Hypertherm®

XPR300™

Instruction Manual

809480 – REVISION 3

ENGLISH

Register your new Hypertherm system

Benefits of registration

- ☑ **Safety:** Registration allows us to contact you in the unlikely event a safety or quality notification is required.
- ☑ **Education:** Registration gives you free access to online product training content via the Hypertherm Cutting Institute.
- ☑ **Confirmation of ownership:** Registration can serve as proof of purchase in case of an insurance loss.

Go to **www.hypertherm.com/registration** for easy and fast registration.

If you experience any problems with the product registration process, please contact registration@hypertherm.com.

For your records

Serial number: ____

Purchase date: ____

Distributor: ____

____

____

Maintenance notes: ____

____

____

____

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Environmental stewardship is one of Hypertherm's core values, and it is critical to our success and our customers' success. We are striving to reduce the environmental impact of everything we do. For more information: www.hypertherm.com/environment.

XPR300

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REVISION 3

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Original instructions

October 2019

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For training and education resources, go to the Hypertherm Cutting Institute (HCI) online at www.hypertherm.com/hci.

Contents

List of Tables

1 Specifications

Terminology

XPR cutting system – The plasma power supply, gas connect console, torch connect console, and torch.

Cutting system or cutting machine – The XPR cutting system, CNC, torch lifter, cutting table, and other components.

Wet process – Any process that uses water as a shield fluid.

Dry process – Any process that does not use water as a shield fluid.

Ferrous – Mild steel

Non-ferrous – Stainless steel and aluminum

Gases – Hydrogen (H_2), argon (Ar), nitrogen (N_2), oxygen (O_2), water (H_2O), F5 (95% nitrogen, 5% hydrogen)

Mixed-fuel gas – A mixture of H_2-Ar-N_2 created in the OptiMix gas connect console.

XPR cutting system description

General

XPR cutting systems are designed for indoor use with correct ventilation to cut a wide range of thicknesses of mild steel, stainless steel, and aluminum.

Plasma power supply

The plasma power supply is a 300 A, 210 VDC constant-current supply. It contains a heat exchanger, fans, and a pump to cool the torch and other electronic components. The plasma power supply supports EtherCAT®, wireless, RS-422 serial, and discrete communication protocols to communicate with a CNC or wireless device.

The power-indicator LED on the plasma power supply indicates power status:

- It illuminates amber when the plasma power supply is receiving electric power and the remote on-off switch is in the OFF position.
- It illuminates green when the plasma power supply is receiving electric power and the remote on-off switch is in the ON position.

Gas connect consoles

There are 3 types of gas connect consoles: Core™, VWI™ (vented water injection), and OptiMix™. Each type provides a different set of gas connection capabilities, which provide selecting and metering functions for the gas control system. The gas connect console has 2 printed circuit boards (PCBs): a control PCB and an ignition PCB. If your XPR cutting system is equipped with an OptiMix gas connect console, there is also a gas mixer that has its own control board. A green power LED illuminates when power is supplied to the console.

For some cutting systems, a remote on-off switch controls the power that goes to the console.

TorchConnect console

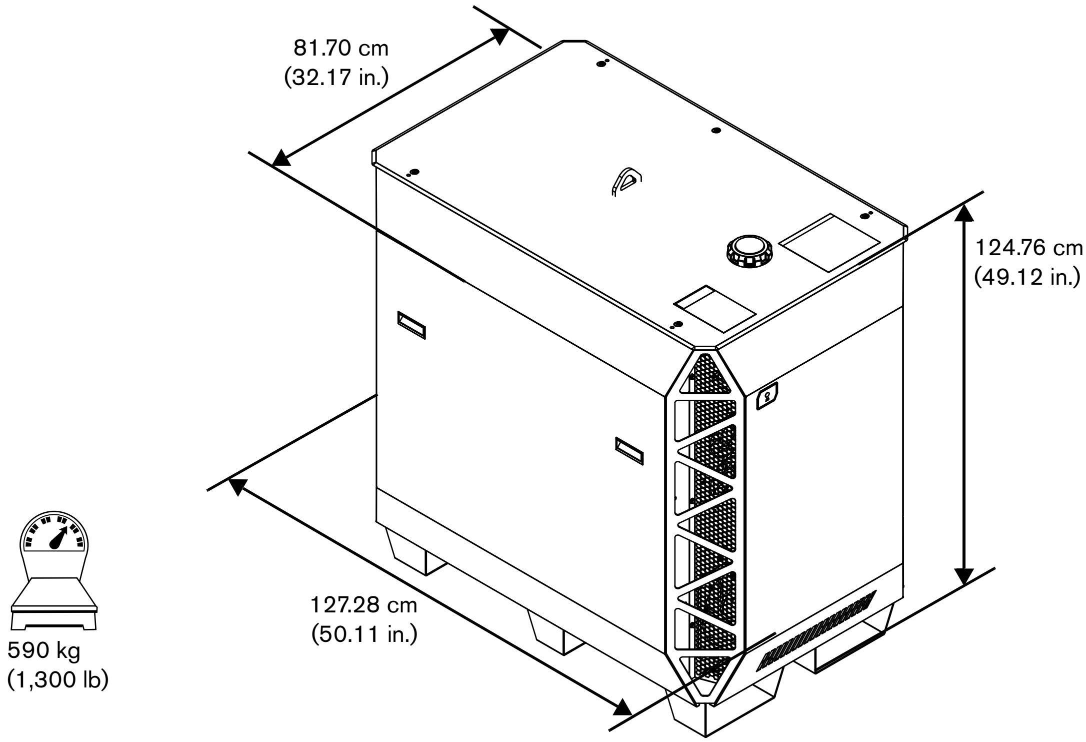
The TorchConnect™ console has proportional valves, solenoid valves, and pressure transducers. The TorchConnect console also has 2 PCBs, a control PCB, and an ohmic contact PCB. The TorchConnect console provides all power, gas, and cooling connections for connection to the torch. A power-indicator LED illuminates when power is supplied to the console.

For some cutting systems, a remote on-off switch controls the power that goes to the console.

Torch

The torch assembly consists of a torch mount sleeve, torch receptacle, torch, and water tube. The torch receptacle contains a solenoid valve. Consumables are installed on the torch.

Plasma power supply (part number varies)



The part number and specifications can differ for your plasma power supply. (See *Table 1* on page 22 and *Table 2* on page 22 for part numbers and specifications.)

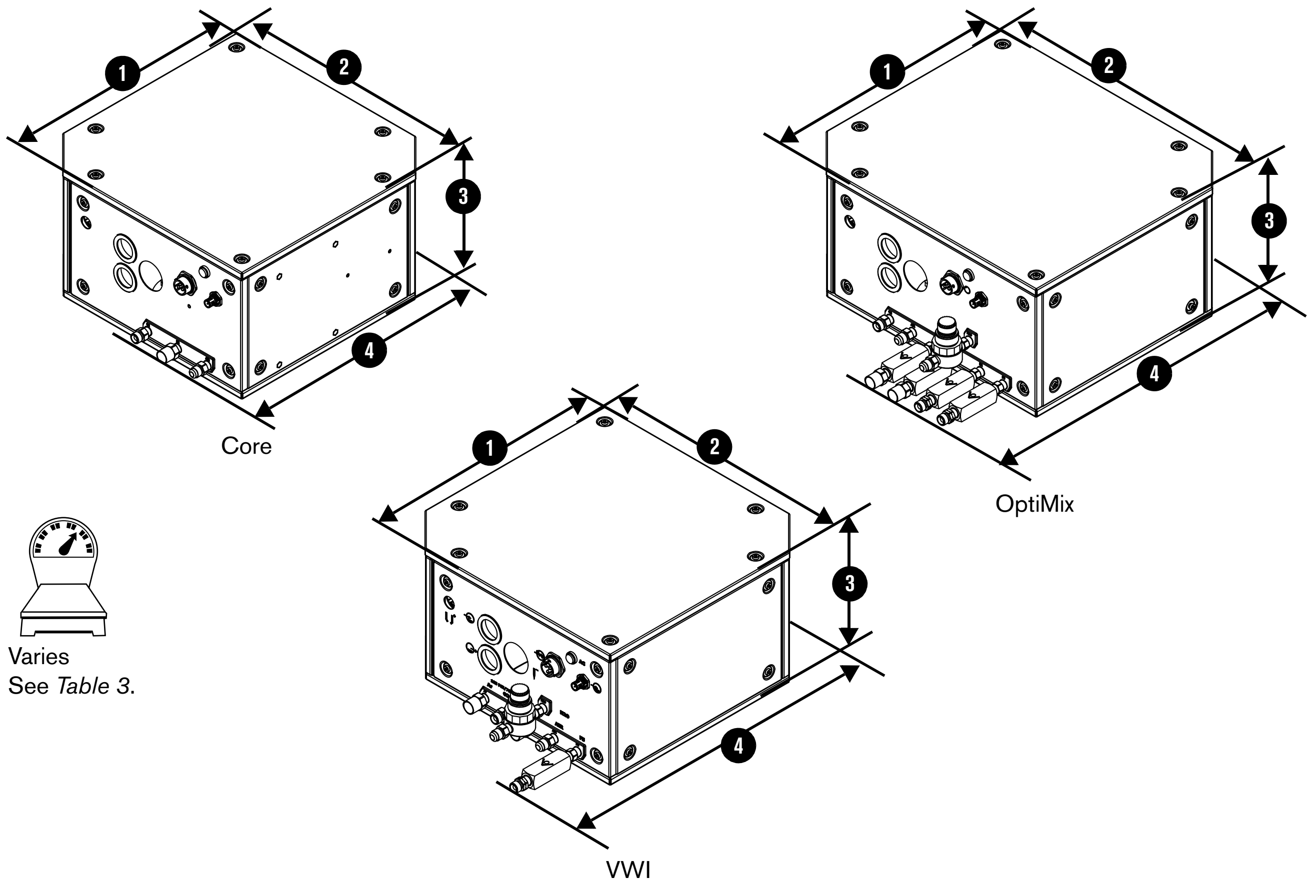
Table 1 – Plasma power supply general specifications

Maximum open-circuit voltage (U_0)	360 VDC
Maximum output current (I_2)	300 A
Output voltage (U_2)	50 VDC – 210 VDC
Duty cycle rating (X)	100% at 63 kW, 40°C (104°F)
Operational ambient temperature range	>0°C – 40°C (>32°F – 104°F) – Applies only to cutting systems that use water as a shield fluid. -10 °C – 40°C (14°F – 104°F) – Applies only to cutting systems that do not use water as a shield fluid. **Note**: Only VWI- and OptiMix-equipped cutting systems can use water as a shield fluid.
Power factor (cosθ)	0.98 at 63 kW
Cooling	Forced air (Class F)
Insulation	Class H
EMC emissions classification (CE models only)	Class A
Lift points	Top lift eye Bottom lift truck slots
Lift eye weight rating	680 kg (1,500 lb)

Table 2 – Plasma power supply part numbers and specifications

<table>
<tr><th>Part number</th><th>Voltage (VAC) (U_1)</th><th>Phase</th><th>Frequency (Hz)</th><th>Rated input current at 66.5 kW output (A) (I_1)</th><th>Regulatory approval
Safety/EMC</th><th>Power (kVA) (± 10%)
(U_1 X I_1 X1.73)</th></tr>
<tr><td>078620</td><td>200</td><td rowspan="10">3</td><td>50 – 60</td><td>206</td><td>cCSAus</td><td rowspan="10">71.43</td></tr>
<tr><td>078621</td><td>208</td><td>60</td><td>198</td><td>cCSAus</td></tr>
<tr><td>078622</td><td>220</td><td>50 – 60</td><td>188</td><td>cCSAus</td></tr>
<tr><td>078623</td><td>240</td><td>60</td><td>172</td><td>cCSAus</td></tr>
<tr><td>078624</td><td>380</td><td>50 – 60</td><td>109</td><td>CCC</td></tr>
<tr><td>078625</td><td>400</td><td>50 – 60</td><td>103</td><td>CE, RCM, EAC, UKr, and AAA</td></tr>
<tr><td>078626</td><td>415</td><td>50</td><td>99</td><td>CE, RCM, EAC, UKr, and AAA</td></tr>
<tr><td>078627</td><td>440</td><td>60</td><td>94</td><td>cCSAus</td></tr>
<tr><td>078628</td><td>480</td><td>60</td><td>86</td><td>cCSAus</td></tr>
<tr><td>078629</td><td>600</td><td>60</td><td>69</td><td>cCSAus</td></tr>
</table>

Gas connect console (part number varies)



Varies
See *Table 3*.

The part number and some specifications differ by gas connect console type (Core, VWI, or OptiMix). (See *Table 3*.)

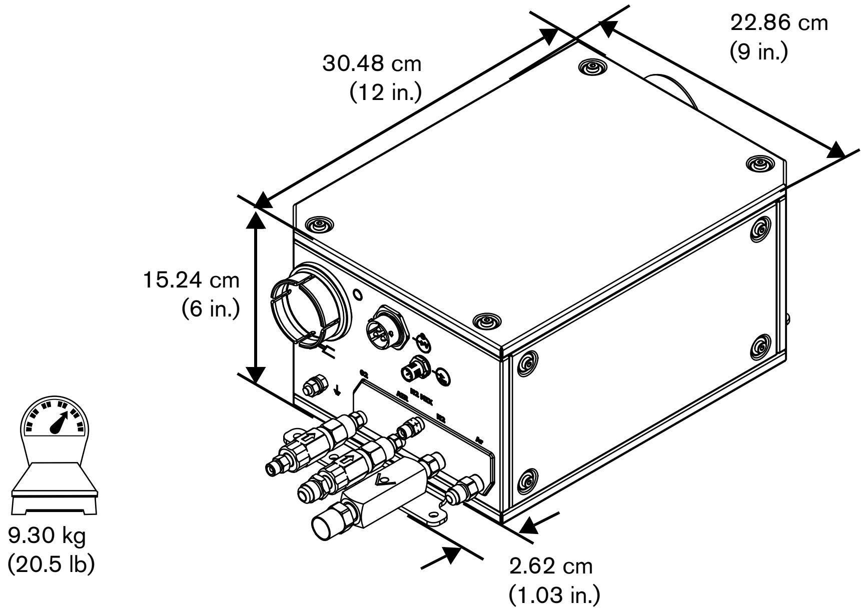
Do not remove the inlet check valves from the gas connect consoles.

Table 3 – Gas connect console part numbers and dimensions

<table>
<tr><th>Gas connect console</th><th>Part number</th><th>Dimension 1</th><th>Dimension 2</th><th>Dimension 3</th><th>Dimension 4 (with fittings)</th><th>Weight</th></tr>
<tr><td>Core</td><td>078631</td><td rowspan="3">374.65 mm
(14.75 in.)</td><td rowspan="2">383.80 mm
(15.11 in.)</td><td rowspan="3">205.99 mm
(8.12 in.)</td><td>431.80 mm
(17.00 in.)</td><td>16.24 kg
35.80 lb</td></tr>
<tr><td>VWI</td><td>078632</td><td>522.22 mm
(20.56 in.)</td><td>19.12 kg
42.15 lb</td></tr>
<tr><td>OptiMix</td><td>078633</td><td>434.59 mm
(17.11 in.)</td><td>524.00 mm
(20.63 in.)</td><td>24.36 kg
53.70 lb</td></tr>
</table>

For mounting dimensions, see *Position and mount the gas connect consoles* on page 77.

TorchConnect console (078618)



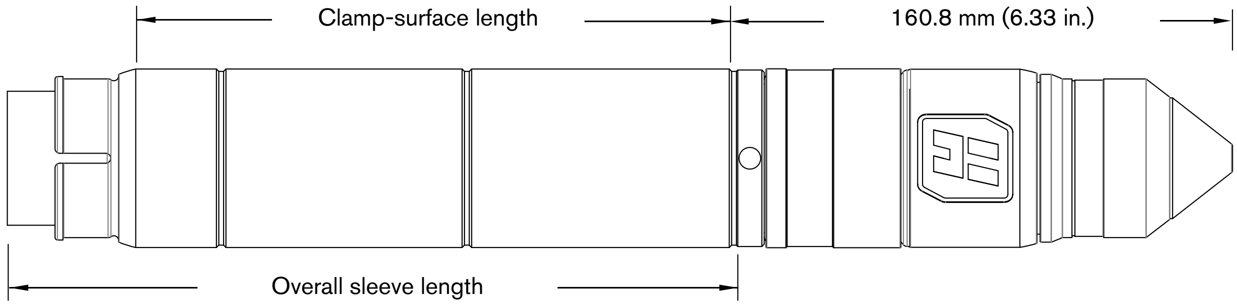
The TorchConnect console (078618) goes with the 3 types of gas connect consoles (Core, VWI, and OptiMix).

Do not remove the inlet check valves from the torch connect console.

The factory location for the mounting brackets is on the bottom of the torch connect console. However, you can move the mounting brackets to either side. Console placement with the torch lead connection on the bottom can minimize the risk of leaked water or coolant collecting inside of the console. Water or coolant collection inside of the TorchConnect console can damage internal electrical components.

For mounting dimensions, see *Position and mount the TorchConnect console* on page 80.

Torch (part number varies)



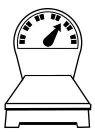


Table 4 – Length and weight by sleeve type

Sleeve type	Clamp-surface length	Overall sleeve length	Combined weight (torch head, receptacle, consumables)	Combined weight with sleeve
Short	111.7 mm (4.4 in.)	155 mm (6.1 in.)	1.4 kg (3 lb)	1.5 kg (3.3 lb)
Standard	189.6 mm (4.5 in.)	233 mm (9.2 in.)		1.6 kg (3.6 lb)
Extended	268.1 mm (10.6 in.)	311 mm (12.3 in.)		1.7 kg (3.9 lb)

The part number and some specifications for your torch can change because of torch sleeve dimensions and other features. (See *Torch assembly* on page 378 of the *Parts List*.)

Table 5 – General torch specifications

Rated arc striking voltage	15.3 kV
Maximum gas pressure at inlet	7.9 bar, 792 kPa (115 psi)
Minimum gas pressure at inlet	7.2 bar, 723 kPa (105 psi)
Maximum torch-side and torch-front force	22.5 kg (50 lb)

Symbols and marks

Safety and EMC symbols and marks

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

S mark

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

CSA mark

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 UL or TÜV.

CE mark

The CE marking signifies the manufacturer's declaration of conformity to applicable European directives and standards. Only those versions of products with a CE marking located on or near the data plate comply with European Directives. Applicable directives may include the European Low Voltage Directive, the European Electromagnetic Compatibility (EMC) Directive, the Radio Equipment Directive (RED), and the Restriction of Hazardous Substances (RoHS) Directive. See the European CE Declaration of Conformity for details.

Eurasian Customs Union (CU) mark

CE versions of products that include an EAC mark of conformity meet the product safety and EMC requirements for export to Russia, Belarus, and Kazakhstan.

GOST-TR mark

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

RCM mark

CE versions of products with a RCM mark comply with the EMC and safety 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.

UkrSEPRO mark

The CE versions of products that include a UkrSEPRO mark of conformity meet the product safety and EMC requirements for export to the Ukraine.

Serbian AAA mark

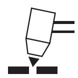
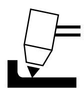
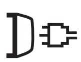
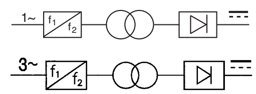
CE versions of products that include a AAA Serbian mark meet the product safety and EMC requirements for export to Serbia.

RoHS mark

The RoHS mark indicates that the product meets the requirements of the European Restriction of Hazardous Substances (RoHS) Directive.

IEC symbols

The following symbols can appear on the data plate, control labels, and switches.

	Direct current (DC)
	Alternating current (AC)
	Plasma torch cutting
	Gouging
	AC input power connection
	The terminal for the external protective (earth) (PE) conductor
I	Power is ON
O	Power is OFF
	A 1-phase or 3-phase inverter-based power source
	Volt/amperage curve, “drooping” characteristic

2 Qualifications and Requirements

Document requirements

This manual refers to several other documents. These documents include:

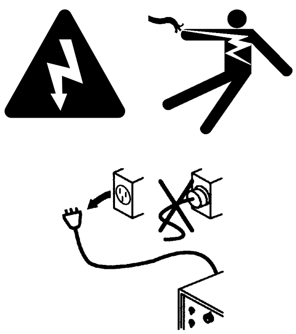
- *XPR Cut Charts Instruction Manual* (809830)
- *CNC Communication Protocol Application Notes for the XPR Cutting System* (809810)
- *XPR Preventive Maintenance Program Instruction Manual* (809490)
- *XPR Firmware Updates Field Service Bulletin* (809820)

You can find these documents on the USB memory stick that came with your plasma power supply. If you do not have these documents, technical documentation is available at www.hypertherm.com/docs.

Technical documentation is current as of the date of its release. Subsequent revisions are possible. Refer to www.hypertherm.com/docs for the most recent revisions of released documents.

Operator qualifications

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

A person is considered qualified to operate the cutting system if he or she is trained and knowledgeable about cutting system equipment construction, operation, and work methods, and about how to recognize and avoid hazards that can be present with certain cutting system equipment or work methods.

For your safety and for the best results:

- **Never** operate the cutting system unless you are qualified to do so.
- Follow NFPA70E Section 85 in North America.
- Follow IEC 60364 series outside of North America.
- Follow OSHA Section1910.331-335 in North America for 600 volts or less.
- Follow all local and national electrical safety requirements for both operator and service personnel.
- **Always** read, understand, and follow all of the safety instructions in this manual, the *Safety and Compliance Manual* (80669C), and on the labels that are on the cutting system.
- Get adequate operator training from a knowledgeable source **before** operation. Adequate training topics include (but are not limited to) the following:
  - How to start and stop the cutting system during routine operation and in an emergency.
  - Conditions and actions that can cause injuries to people or damage cutting system equipment.
  - How to operate all controls.
  - How to identify and respond to fault conditions.
  - How to do maintenance.
  - A copy of the instruction manual.

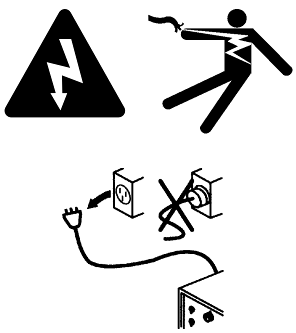
Additional qualifications apply for personnel who do maintenance and troubleshooting (*Qualifications of service personnel* on page 31).

- Do **not** operate the cutting system if you cannot follow all of the safety instructions or if you cannot satisfy the minimum operator qualifications. (See the *Safety and Compliance Manual* [80669C], *Radio Frequency Warning Manual* [80945C], and *Safety instructions related to installation* on page 69.)

  Additional qualifications apply for personnel who do maintenance and troubleshooting (*Qualifications of service personnel* on page 31).

Qualifications of service personnel

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

It can be hazardous to do service and maintenance on industrial cutting systems and equipment.

For your safety and for the best results:

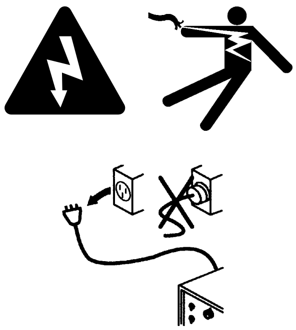
- **Always** read, understand, and follow all of the safety instructions in this manual, the *Safety and Compliance Manual* (80669C), and on the labels that are on the cutting system.
- Get adequate training from a knowledgeable source **before** you do any service or maintenance on the cutting system or equipment.

  The entity responsible for workplace safety where your XPR300 cutting system is used must do a risk assessment and establish the criteria for service personnel training and qualifications.

- Do not do any service or maintenance on the cutting system or equipment if you cannot follow all of the safety instructions (See the *Safety and Compliance Manual* [80669C], *Radio Frequency Warning Manual* [80945C], and *Safety instructions related to installation* on page 69.) or if you cannot satisfy the minimum service personnel qualifications set by workplace safety at your organization.
- Contact a professional repair person who has a license.

System electrical requirements

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

Code conformity

- Follow all local and national electrical safety requirements, including requirements for correct electrical system design and installation.
- Always read, understand, and follow all of the safety instructions in this manual, the *Safety and Compliance Manual* (80669C), and on the labels that are on the cutting system.
- Contact a licensed electrician for information about the codes in your location.

Input power requirements

General input power requirements

As an installer or user, you are responsible for supplying all of the switches, time-delay fuses, and power cords necessary for cutting system installation and operation at the installation site. The switches, fuses, and cords that you supply must satisfy all applicable national and local electrical codes and requirements, and be installed by a licensed electrician.

General input power requirements appear in *Table 6*. For specific requirements for switches, fuses, and cords, refer to *Line-disconnect switch requirements* on page 33, *Circuit breaker and fuse requirements* on page 34, and *Main power cord requirements* on page 34.

Table 6 – Input power requirements

<table>
<tr><th>Part number</th><th>Input voltage (VAC)</th><th>Phase</th><th>Rated input current at 66.5 kW output (A)</th><th>Recommended time-delay fuse size (A)</th><th>Recommended size for the main power cord 90°C (194°F) (mm^2 [AWG*])</th><th>Power (kVA)</th></tr>
<tr><td>078620</td><td>200</td><td rowspan="10">3</td><td>218</td><td>250</td><td>141.3 (4/0)</td><td rowspan="10">75.4</td></tr>
<tr><td>078621</td><td>208</td><td>209</td><td>250</td><td>141.3 (4/0)</td></tr>
<tr><td>078622</td><td>220</td><td>198</td><td>250</td><td>141.3 (4/0)</td></tr>
<tr><td>078623</td><td>240</td><td>181</td><td>225</td><td>111.9 (3/0)</td></tr>
<tr><td>078624</td><td>380</td><td>115</td><td>150</td><td>53.5 (1/0)**</td></tr>
<tr><td>078625</td><td>400</td><td>109</td><td>150</td><td>70.5 (1/0)**</td></tr>
<tr><td>078626</td><td>415</td><td>105</td><td>125</td><td>43.2 (2)</td></tr>
<tr><td>078627</td><td>440</td><td>99</td><td>125</td><td>43.2 (2)</td></tr>
<tr><td>078628</td><td>480</td><td>91</td><td>110</td><td>34.3 (3)</td></tr>
<tr><td>078629</td><td>600</td><td>73</td><td>90</td><td>27.3 (4)</td></tr>
</table>

* AWG requirements must comply with the latest version of the US National Electric Code (in North America) or the latest electric wiring and installation requirements (based on the codes in your location). *Table 6* is for reference only; the requirements for your location can be different. Follow all local and national electrical codes in your location.

** Differences in cross-sectional diameters depend on the strand variations of each cable.

The strain relief for the input power cord that comes with the plasma power supply is sized properly (see *Table 6*). Contact a licensed electrician to make sure that your main power cord size and length meet the codes in your location.

Plasma power supply

As an installer or user, you must connect the plasma power supply to one of the branch-feed circuits. Use a separate, primary line-disconnect switch for the plasma power supply. (See *Line-disconnect switch requirements* on page 33.)

Always follow the local and national electrical safety requirements for your location, including requirements for correct electrical system design and installation. Contact a licensed electrician for more information about the codes in your location.

Line-disconnect switch requirements

As an installer or user, you must supply a separate, line-disconnect switch for the plasma power supply. A means for disconnecting the cutting system shall be provided according to the installation, safety, and emergency requirements for the local codes and regulations, taking into account the input power requirements. Hypertherm does not supply this means of disconnection.

Circuit breaker and fuse requirements

For main feed protection, choose a circuit breaker or fuse that is large enough to withstand all branch-feed loads for both inrush and steady-state current. See *Table 6* on page 33 for the recommended time-delay fuse sizes.

As an installer or user, you must choose time-delay fuses and circuit breakers that can withstand inrush current that is up to 15 times the rated input current for 0.01 seconds and up to 10 times the rated input current for 0.1 seconds.

The size requirements for breakers or fuses at your site can change because of the following:

- Local line conditions (such as source and line impedance and voltage fluctuations)
- Product inrush characteristics
- Regulatory requirements

Always follow the local and national electrical safety requirements for your location, including requirements for correct electrical system design and installation. Contact a licensed electrician for more information about the codes in your location.

If time-delay, high-inrush fuses are not permitted at your site because of national or local codes, use a motor-start circuit breaker or equivalent.

Main power cord requirements

As an installer or user, you must supply the main power cord for your cutting system. See *Table 6* on page 33 for recommended main power cord size.

The recommended main power cord sizes in *Table 6* are based on Table 310.15 of the US National Electric Code (2017 Handbook). *Table 6* shows stranded-flexible cord rates for 90°C (194°F). The size requirement for the main power cord at your site can change because of the following conditions:

- Wires with lower temperature ratings
- Wires with different insulation types
- Different distances between the line-disconnect switch/receptacle and the plasma power supply
- Local codes and regulations

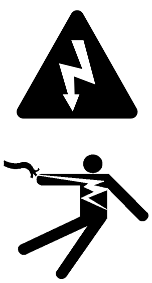
Always follow the local and national electrical safety requirements for your location, including requirements for correct electrical system design and installation. Contact a licensed electrician for more information about the codes in your location.

Input power requirements for CE units

The XPR cutting system is intended for use only in sites that have a service current capacity that is greater than (or equal to) 100 A per phase and supplied from a distribution network that has a nominal voltage of 400/230 V. The installer or user is responsible for verifying that the service current capacity for the installation site satisfies this requirement.

Remote on-off switch

WARNING



ELECTRIC SHOCK CAN KILL

When the remote on-off switch is set to OFF, power remains active to the following components in the system:

- Control board
- Control transformer input and output
- 48 V power supply
- 24 V power supply
- 120 VAC and 220 VAC on the power distribution board
- Input side of the contactors
- Input side of the pump relay
- Power-indicator LED on the front of the plasma power supply

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

You must supply the remote on-off switch (or switches) for your cutting system.

A remote on-off switch lets you supply electric power to or remove electric power from the gas connect console, torch connect console, and some parts of the plasma power supply from a location that is remote from the main power source. A convenient location for a remote on-off switch is near the CNC.

For information about how to do this, see *How to install a remote on-off switch* on page 190.

Process gas requirements (Core, VWI, and OptiMix gas connect consoles)

As an installer or user, you must supply the process gases and supply gas plumbing for your cutting system. See *Table 7* on page 36 for supply gas quality, pressure, and flow requirements.

Process gas requirements include the following:

- Nitrogen is required for all processes.
- Air is required for H_2 mix and F5 processes.
- Water can be used as a shield fluid for plasma power supplies that have a VWI or OptiMix gas connect console. See *Shield water requirements (VWI and OptiMix)* on page 41 for the specifications and requirements for water that is used for shield purposes.

Table 7 – Gas quality, pressure, and flow requirements

Gas	Quality	System inlet pressure (during gas flow*)	Flow rate
O_2 (oxygen)	99.5% pure, clean, dry, oil-free	Core, VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 7.9 bar ± 0.4 (115 psi ± 5)	71 slpm (150 scfh)
N_2 (nitrogen)	99.99% pure, clean, dry, oil-free	Core, VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 8.3 bar ± 0.4 (120 psi ± 5)	181 slpm (380 scfh)
Air**	Clean, dry, oil free consistent with 8573-1:2010 Class 1.4.2	Core, VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 7.9 bar ± 0.4 (115 psi ± 5)	118 slpm (250 scfh)
H_2 (hydrogen)	99.995% pure	OptiMix: 8.3 bar ± 0.4 (120 psi ± 5)	50 slpm (105 scfh)
Ar (argon)	99.99% pure; clean, dry, oil-free	VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 8.3 bar ± 0.4 (120 psi ± 5)	118 slpm (250 scfh)
F5 (95% nitrogen, 5% hydrogen)	99.98% pure	VWI: 7.5 bar ± 0.4 (110 psi ± 5) OptiMix: 7.9 bar ± 0.4 (115 psi ± 5)	40 slpm (85 scfh)

* When there is **no** gas flow, make sure that the pressure at the gas inlet connection is less than 8.6 bar (125 psi) to avoid system alerts.

** Any air compressors that supply air to the cutting system must remove oil prior to air delivery.

Hypertherm recommends that air compressors supply air that obey the following requirements of ISO Standard 8573-1:2010 Class 1.4.2:

Maximum particle count in 1.0m3:	▪ 20,000 at 0.1 microns – 0.5 microns ▪ 400 at 0.5 microns – 1.0 microns ▪ 10 at 1.0 microns – 5.0 microns
Maximum water vapor pressure dew point:	3°C (37°F)
Maximum oil concentration:	0.1 mg/m³ (for aerosol, liquid, and vapor)

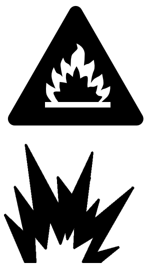
Speak to your air compressor manufacturer if you operate the cutting system in temperatures colder than 3°C (37°F) or if you are unsure that the air compressor can obey the ISO standard for air quality.

Code conformity

- All installer or user-supplied equipment must meet applicable national and local codes for supply gas and supply gas plumbing. Contact a licensed plumber for more information about the codes in your location.
- Any installation, modification, or repair of supply gas equipment or plumbing systems must be done by a licensed plumber.

Plumbing for supply gases

WARNING

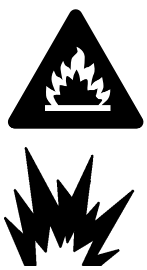


If you use oxygen as the plasma gas for cutting, it can cause a potential fire hazard due to the oxygen-enriched atmosphere that collects.

Hypertherm recommends that you install an exhaust ventilation system to remove the oxygen-enriched atmosphere that can collect when oxygen is used as the plasma gas for cutting.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the flashback arrestors for your cutting system. You can get them from your cutting machine supplier.



Hydrogen is a flammable gas that presents an explosion hazard. Keep flames away from cylinders and hoses that contain hydrogen. Keep flames and sparks away from the torch when using hydrogen as a plasma gas.

Consult your local safety, fire, and building code requirements for the storage and use of hydrogen.

Hypertherm recommends that you install an exhaust ventilation system to remove the hydrogen-enriched atmosphere that can collect when hydrogen is used as the plasma gas for cutting.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

As an installer or user, you must install the supply gases and supply gas plumbing for your cutting system.

- You can use flexible hoses that are designed to carry the appropriate gas and are rated for the correct pressure. Other hoses can crack and leak.
- For the best results, use the recommended torque specifications for plumbing and hose fittings. (See *Table 11* on page 42.)
- You can use rigid copper pipes.
- Do not use steel or aluminum.

Supply-gas hoses are available from Hypertherm. (See *Supply hoses* on page 392.)

All installer or user-supplied equipment must meet applicable national and local codes for supply gas and supply gas plumbing. Contact a licensed plumber for more information about the codes in your location.

Hypertherm recommends an internal diameter of 10 mm (0.375 inch) for supply-gas hoses that are 76 m (250 feet) or less. *Table 8* on page 39 describes the recommended sizes for gas fittings.

Table 8 – Recommended sizes for gas fittings

Fitting type	Size
N_2 / Ar	5/8 inch – 18 RH, internal (inert gas) "B"
Air	9/16 inch – 19, JIC #6
F5 / H_2	9/16 inch – 18, LH (fuel gas) "B"
O_2	9/16 inch – RH (oxygen)

The location of regulators and the number of elbow fittings can have an effect on inlet pressure. If the inlet pressure for your cutting system is not within recommended specifications, contact your cutting machine supplier or regional Hypertherm Technical Service team.

NOTICE

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

CAUTION

All hoses, hose connections, and hose fittings used for supply gas plumbing must be designed for use with the appropriate gas and pressure rating. Other hoses, hose connections, or hose fittings can crack or leak.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Any replacement hose, connection, or fitting must satisfy all applicable regulations and codes.

Non-compliant hoses, hose connections, or hose fittings can crack or leak.

If you replace any fittings on the consoles, or if you use the wrong fittings, it can cause the internal valves to malfunction because contaminants can get into the valves.

NOTICE

Some air compressors use synthetic lubricants that contain esters. Esters will damage the polycarbonates in the air filter bowl.

Regulators for supply gases

CAUTION

Do not use low-quality gas regulators. They do not provide consistent supply gas pressure. Low-quality gas regulators can also cause problems with system performance and decrease cut quality.

NOTICE

Some air compressors use synthetic lubricants that contain esters. Esters will damage the polycarbonates in the air filter bowl.

The installer or user must supply the gas regulator (regulators) for the cutting system.

It is important to choose the correct gas regulator (regulators) for the conditions at the installation site. A gas regulator must be compatible with the gases used and appropriate for the environmental conditions. For example, certain regulators are recommended for specific temperature ranges. The type of gas (cylinder gas, line gas, or liquefied gas), and the gas-delivery pressure and flow, can also influence regulator selection.

Single-stage gas regulation

- Reduces source gas pressure to the necessary delivery pressure in 1 step.
- Delivery pressure is **not** tightly controlled with this type of gas regulation.
- Good choice for generic applications and where fluctuations in source gas pressure are small.

Dual-stage gas regulations

- Reduces source gas pressure to the necessary delivery pressure in 2 steps. Dual-stage regulation uses 2 single-stage regulators. The first regulator reduces the pressure to approximately 3 times the maximum delivery pressure. The second regulator reduces pressure to the necessary delivery pressure.
- Good choice for applications that require consistent delivery pressure and where fluctuations in source gas pressure are large.

Your gas supplier can recommend the best gas regulator (regulators) for the conditions at your site.

Local regulations and the type of gas that is used can influence the recommended inlet gas fittings for your gas connect console. (See *Table 8 – Recommended sizes for gas fittings* on page 39.)

Shield water requirements (VWI and OptiMix)

If you use water as a shield fluid, see *Table 9* for water pressure and flow requirements and *Table 10* for water-purity guidelines.

If using shield water, the temperature range for cutting system operation and storage is reduced to above 0°C to 40°C (32°F to 104°F).

Table 9 – Quality, pressure, and flow requirements for shield water

Quality*	Minimum and maximum pressure	Flow rate required
Deionized water is **not** recommended to use as shield water. Deionized water will react with the copper components in the system and result in decreased life of components and consumables. Hypertherm recommends that you contact a water-quality expert for guidance. Shield water treatments are available: ▪ A water softener if the water has high particulate or mineral content (see *Table 10* on page 41). A water-softener comes with the shield-fluid treatment kit (428920) that is available from Hypertherm. ▪ Treatment of incoming shield water with a filter rated to 50 microns or less. A filter comes with the shield-fluid treatment kit (428920) that is available from Hypertherm. The filter alone (428810) is also available.	2.76 bar (40 psi) minimum 8.27 bar (120 psi) maximum	35 L/h (9.4 US gal/h)

Table 10 – Purity requirements for shield water

Particulate type	Purity requirement
Total dissolved solids	< 61 PPM
Calcium + magnesium	< 40 PPM
Silica	< 5 PPM
pH	6.5 – 8.0

A TDS meter indicates the Total Dissolved Solids (TDS) of a solution. Dissolved ionized solids (such as salts and minerals) increase the electrical conductivity of a solution. Total dissolved solids can be tested with a TDS meter (Hypertherm Waterjet part number 1-13897) available from Hypertherm.

The following accessories are available from Hypertherm

* Water that does not meet minimum purity specifications can cause excessive deposits on the torch nozzle and shield. These deposits can alter the water flow and produce an unstable arc. See *Shield water requirements (VWI and OptiMix)* on page 41.

Plumbing and hose requirements for shield water

The installer or user must supply the plumbing and hoses for the shield water.

- You can use flexible hoses that are designed to carry water.
- For the best results, use the recommended torque specifications for plumbing and hose fittings. (See *Table 11* on page 42.)
- You can use rigid copper pipes.
- Do not use steel or aluminum pipes.

Install the plumbing and hoses consistent with all local and national codes. After installation, pressurize the entire system and test it for leaks.

To decrease the risk of leaks in the cutting system, make sure to tighten all connections to the recommended torque specifications in *Table 11* on page 42.

Hoses are available from Hypertherm. (See *Water (optional shield fluid) (blue)* on page 393 of the *Parts List*.)

Additional regulator requirement for shield water (optional)

Water pressure regulators are built into the VWI and OptiMix gas connect consoles. Additional water pressure regulators are only required when the water pressure is above 7.92 bar (115 psi).

Torque requirements for gas or water plumbing and hose connections

For the best results, use the recommended torque specifications for plumbing and hose fittings.

Table 11 – Torque specifications

	Torque Specifications			
	**Gas or water hose size**	**N·m**	**in·lbf**	**ft·lbf**
	Up to 10 mm (3/8 inch)	8.5 – 9.5	75 – 84	6.25 – 7
	12 mm (1/2 inch)	16.3 – 19.0	144 – 168	12 – 14
	25 mm (1 inch)	54.2 – 88.1	480 – 780	40 – 65

Requirements for shield water removal for freezing-ambient temperatures

If your XPR cutting system uses shield water and is stored in ambient temperatures at or below 0°C (32°F), Hypertherm recommends shield water removal.

Follow these steps to remove shield water from the gas connect console (VWI or OptiMix):

1. Remove the shield water supply line to the gas connect console.

2. Access a source of compressed air that is clean and dry. Use a regulator to adjust the compressed air to 5.52 bar (80 psi).

3. Connect the compressed air hose to the water inlet on the gas connect console.

   The air hose needs to adapt to a JIC 6 male fitting on the gas connect console.

4. Use the XPR web interface or CNC to select a process ID for a water process (such as 2028).

5. Select **Preflow** from the Plasma Process Selection menu.

   During preflow, water mist will exit the torch nozzle for approximately 45 – 50 seconds.

6. Repeat *step 5* until shield water mist is no longer visible exiting the torch nozzle.

   It can take 7 – 10 preflow cycles for the shield water mist to stop.

Coolant requirements

The cutting system ships **without** coolant in the reservoir. Before you operate the cutting system, you must fill it with coolant. The capacity of the coolant system is between 22.7 liters – 45 liters (6 US gallons – 12 US gallons).

Lead length has an effect on the total coolant volume needed. A cutting system with long leads needs more coolant than a cutting system with short leads.

Before you fill the coolant reservoir (see *Coolant Installation* on page 193), choose the best coolant for your operating conditions. The ambient temperature range where your cutting system operates affects the coolant that you choose.

NOTICE

Never operate the cutting system if you get a low coolant level notice.

There is a risk of serious damage to the cutting system and to the coolant pump if you operate the cutting system with no coolant or with low coolant.

If your coolant pump is damaged, it may need to be replaced.

NOTICE

Never use automotive antifreeze in place of Hypertherm coolant. Antifreeze contains chemicals that damage the torch coolant system.

Make sure to read and follow the warning and cautions below. See the Material Safety Data Sheets (MSDS) and Safety Data Sheets (SDS) for safety data and information about how to handle and store coolant, propylene glycol, and benzotriazole. You can find the MSDS and SDS online. Technical documentation is available at www.hypertherm.com/docs.

WARNING

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. When you come into contact, flush skin or eyes with water. If swallowed, seek immediate medical attention.

Coolant requirements for operation between -10°C – 40°C (14°F – 104°F)

Use Hypertherm premixed coolant (028872) when operating in a temperature range of -10°C to 40°C (14°F to 104°F).

If using shield water, the temperature range for cutting system operation and storage is reduced to above 0°C to 40°C (32°F to 104°F).

If it is possible for the temperature to go below -10°C (14°F) when the cutting system is not in use, adjust coolant propylene glycol concentration to 50% to prevent damage to cooling system components.

Operating your XPR system below -10°C (14°F) is not recommended due to reduced consumable life and performance.

To increase the coolant propylene glycol percentage, add 100% propylene glycol (028873) to the premixed Hypertherm coolant (028872) according to the calculation below. The maximum percentage of propylene glycol should never exceed 50%.

Total system coolant volume (in liters)*	X	0.4	=	Total volume in liters of 100% propylene glycol to add
Total system coolant volume (in US gallons)*	X	1.514	=	Total volume in US gallons of 100% propylene glycol to add

* See *Estimate the total coolant volume for your cutting system* on page 248.

Coolant requirements for operation in temperatures above 40°C (104°F)

For operating temperatures above 40°C (104°F) and that can never go at or below 0°C (32°F) use treated water with no propylene glycol as coolant.

For operations in very warm temperatures, treated water provides the best cooling properties.

Treated water is a mixture of purified water that meets the *Purity requirements for coolant water* on page 54 and 1 part benzotriazole (128020) to 300 parts of water. Benzotriazole acts as a corrosion inhibitor for the copper coolant system inside of the cutting system.

Flow requirements for coolant

- The maximum coolant flow rate is 11.36 liters per minute (3.0 US gallons per minute).
- The minimum coolant flow rate is 3.79 liters per minute (1 US gallon per minute).

The cutting systems stops automatically if the flow rate reaches this maximum or minimum flow rate. Automatic, low-flow shut-off protects the coolant pump from damage from low-flow or no-flow conditions. Automatic, high-flow shut-off protects the torch and leads from damage from a blow-out event.

For information about how to diagnose and troubleshoot coolant flow issues, see:

- *Low coolant flow codes (540 – 542)* on page 312
- *High coolant flow codes (543 – 544)* on page 314

Purity requirements for coolant water

Always use water that meets the specifications in *Table 12* on page 46 when using a custom coolant mix.

Water that is too pure can also cause problems. Deionized water can cause corrosion in the coolant system. After deionization, add benzotriazole (128020).

Use water purified by any method (deionization, reverse osmosis, sand filters, water softeners, etc.) as long as the water purity meets the specifications in the table below. Contact a water specialist for advice in choosing a water filtration system.

Table 12 – Purity measurement methods for coolant water

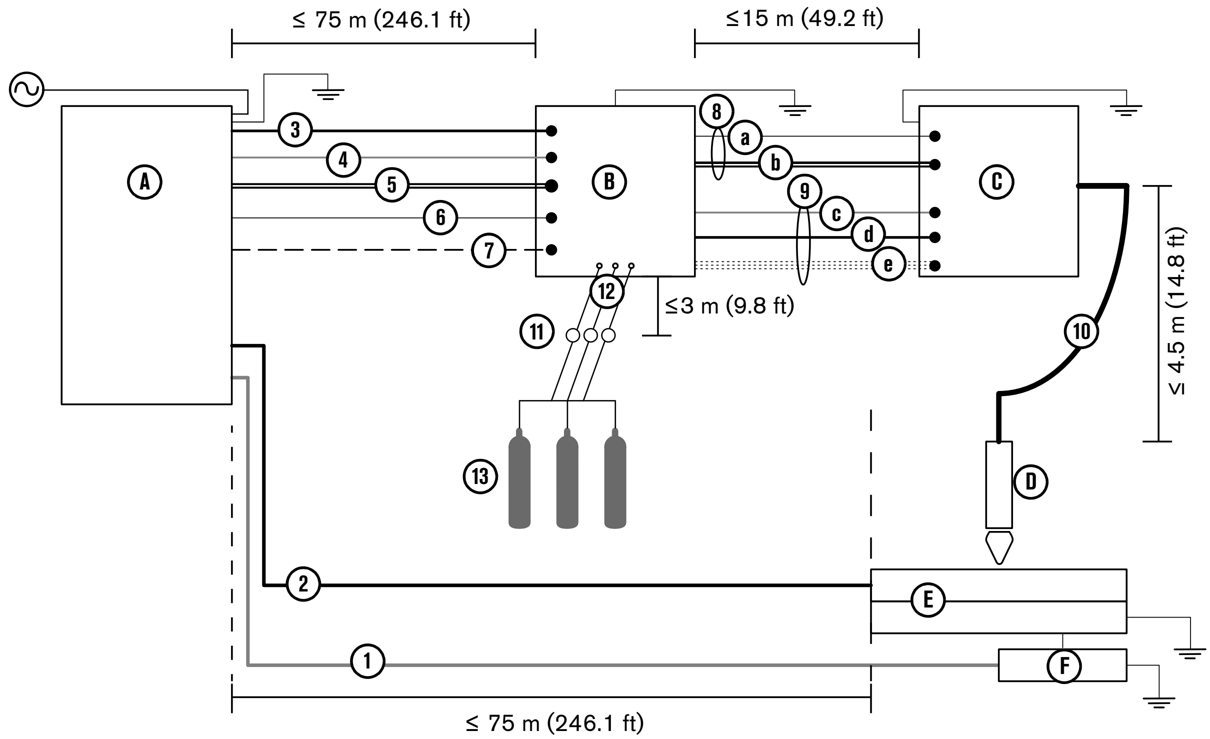
Methods to measure water purity				
Water purity level	Conductivity µS/cm at 25°C (77°F)	Resistivity mΩ·cm at 25°C (77°F)	Dissolved solids or hardness (ppm of NaCl)	Grains per gallon (gpg of $CaCO_2$)
Pure water (For reference only. Do not use.)	0.055	18.3	0	0
Maximum purity	0.5	2	0.206	0.010
Minimum purity	18	0.054	8.5	0.43
Maximum potable water (For reference only. Do not use.)	1000	0.001	495	25

Requirements to position system components

When you plan where to position the plasma power supply, gas connect console, torch connect console, and torch, use the following limitations and requirements:

- *Site requirements* on page 50
- *Length requirements for hoses, cables, and leads* on page 50
- *Bend radius requirements for hoses, cables, and leads* on page 51
- *Distance requirements between high-frequency leads and control cables* on page 51
- *Distance requirements for ventilation and access* on page 51
- *Distance requirements for communications* on page 52

Recommended configuration with the Core gas connect console



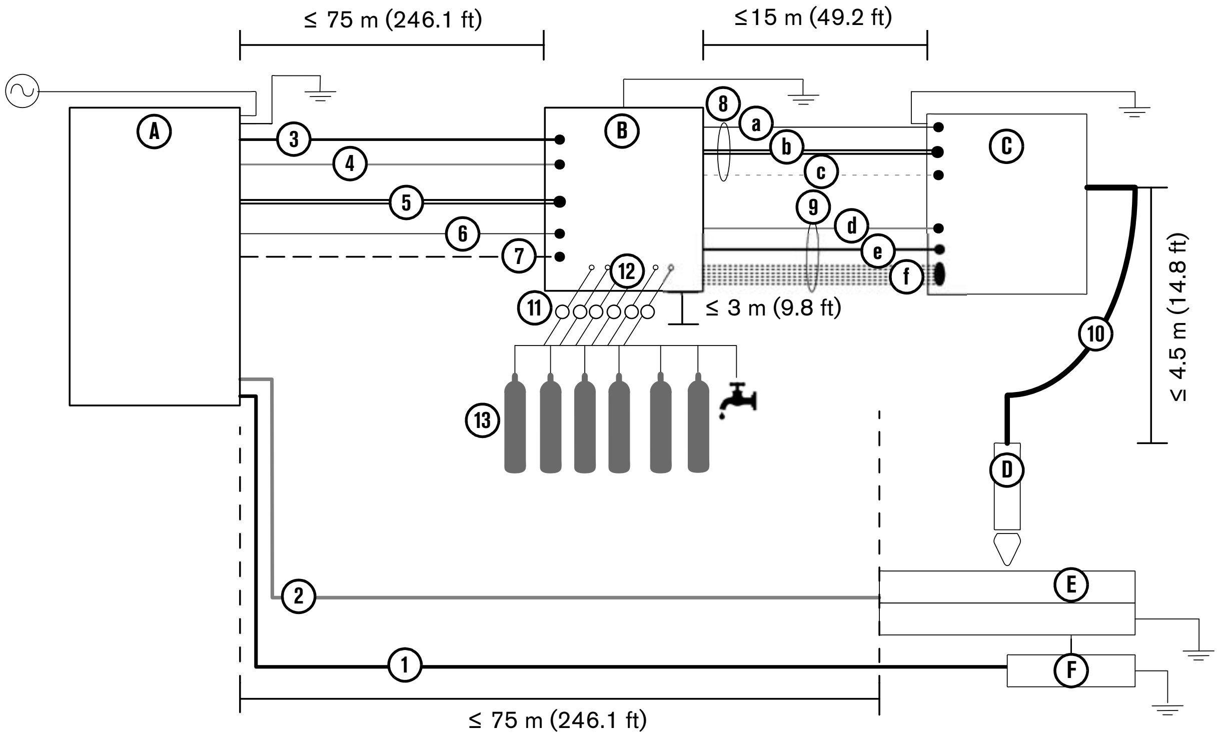
A Plasma power supply
B Gas connect console (Core)
C Torch connect console
D Torch
E Cutting table
F Computerized numeric control (CNC)

1 Computerized numeric control (CNC) lead
2 Work lead
3 Controller area network (CAN) cable
4 Power cable (120 VAC)
5 Coolant hoses (1 supply, 1 return)
6 Pilot arc lead
7 Negative lead
8 Pilot arc and coolant hose set assembly
- **a** Pilot arc lead
- **b** Coolant hose set (1 supply, 1 return)

9 Power, CAN, 3-gas assembly
- **c** Power cable (120 VAC)
- **d** CAN cable
- **e** 3 gas hoses (Core)

10 Torch lead
11 Gas regulators (For the best results, position a gas regulator within 3 meters (10 feet) of the gas connect console)
12 Hoses for supply gases
13 Gases Core: O_2, N_2, and air

Recommended configuration with the VWI or OptiMix gas connect console



- **A** Plasma power supply
- **B** Gas connect console (VWI or OptiMix)
- **C** Torch connect console
- **D** Torch
- **E** Cutting table
- **F** Computerized numeric control (CNC) lead

1. Computerized numeric control (CNC) lead
2. Work lead
3. Controller area network (CAN) cable
4. Power cable (120 VAC)
5. Coolant hoses (1 supply, 1 return)
6. Pilot arc lead
7. Negative lead
8. Pilot arc, coolant hose set, shield water assembly
   - **a** Pilot arc lead
   - **b** Coolant hose set (1 supply, 1 return)
   - **c** Shield water hose (VWI or OptiMix)
9. Power, CAN, 5-gas assembly
   - **d** Power cable (120 VAC)
   - **e** CAN cable
   - **f** 5 gas hoses (VWI or OptiMix)
10. Torch lead
11. Gas regulators (For the best results, position a gas regulator within 3 meters (10 feet) of the gas connect console)
12. Hoses for supply gases
13. Gases and water
    VWI: O_2, air, N_2, Ar, F5, and water
    OptiMix: O_2, air, N_2, Ar, F5, water, H_2

Site requirements

Table 13 – Recommendations for where to position system components

Plasma power supply	▪ Level surface (less than 10° incline) ▪ Clean and dry area ▪ Able to support at least 680 kg (1,500 lb)
Gas connect console*	▪ Level surface (less than 10° incline) ▪ Clean and dry area ▪ Able to support the weight of your gas connect console (weight varies with type, see *Specifications* on page 19)
Torch connect console*	▪ Clean and dry area ▪ Able to support at least 9.3 kg (20.5 lb)

* The same recommendations are applicable for mezzanine locations.

Length requirements for hoses, cables, and leads

The distances between the plasma power supply, gas connect console, torch connect console, torch, and cutting table are limited by the lengths of the interconnect hoses, cables, and leads that connect them.

Table 14 – Length ranges for interconnect hoses, cables, and leads

From this component…	to this component…	…the length can range from:
Plasma power supply	Gas connect console (Core, VWI, OptiMix)	3 m (9.8 ft) – 75 m (246.1 ft)*
Gas connect console	Torch connect console	3 m (9.8 ft) – 15 m (49.2 ft)*
Torch connect console	Torch or cutting table	2 m (6.6 ft) – 4.5 m (14.8 ft)*

* See *Recommended configuration with the Core gas connect console* on page 48 and *Recommended configuration with the VWI or OptiMix gas connect console* on page 49 for visual distance requirements.

For a complete list of hoses, cables, and leads see *Parts List* on page 353.

Make sure to install hoses, cables, and leads that are the correct length.

- Hoses, cables, or leads that are too short can cause restriction of mechanical movement.
- Cables and leads that are too long can cause electromagnetic interference (EMI).

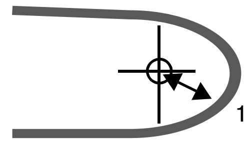
EMI can have a negative effect on cut quality.

Contact your cutting machine supplier for recommendations about the best lead lengths for your cutting system.

Bend radius requirements for hoses, cables, and leads

The following hoses, cables, and leads cannot bend beyond a minimum bend radius of 15.25 cm (6 inches):

- Torch lead
- Pilot arc lead
- Coolant hose set
- Power cable
- CAN cable
- 3-gas hose bundle for the **Core** gas connect console
- 5-gas hose bundle for the **VWI or OptiMix gas** connect console
- Gas supply hoses



Distance requirements between high-frequency leads and control cables

Electromagnetic interference (EMI) can occur if high-frequency leads (such as the pilot arc and negative leads) are too close to control cables (such as the 120 VAC power, CAN, and EtherCAT® cables).

If possible, use a separate track to isolate each lead and cable.

If separate tracks are not possible, Hypertherm recommends a minimum separation distance 150 mm (6 inches) between the high-frequency leads and control cables. Separate the pilot arc lead, negative lead, or any power cables that have a voltage higher than 120 VAC from the following:

- CAN cable
- Power cable (120 VAC)
- CNC lead (EtherCAT, serial RS-422, or discrete lead)

Distance requirements for ventilation and access

- Ventilation
  - Do not block the ventilation louvers on the corners or bottom panels of the front and back of the plasma power supply. A separation distance of least 1 m (3.3 feet) is required for ventilation.
  - Do not block the ventilation louvers on the gas connect console. A separation distance of least 1.27 cm (0.50 inch) is required for ventilation.
  - Do not block the ventilation louvers on the torch connect console. You must use the mounting brackets to allow space between the console and mounting surface.
- Service and maintenance access – Hypertherm recommends a minimum distance of 1 meter (3.3 feet) between the plasma power supply and other system components, or between the plasma power supply and an obstacle.

Distance requirements for communications

Table 15 – Maximum distance between the plasma power supply and controlling device

Communication type	Distance
Wireless	Unobstructed maximum radius of 30.5 m (100 ft)*
EtherCAT**	Maximum 75 m (246.1 ft)
Discrete**	Maximum 75 m (246.1 ft)
Serial RS-422**	Maximum 75 m (246.1 ft)

* Obstructions or distances greater than 30.5 meters (100 feet) can have an effect on communication between the plasma power supply and wireless device.

** See *Recommended configuration with the Core gas connect console* on page 48 and *Recommended configuration with the VWI or OptiMix gas connect console* on page 49 for visual distance requirements.

Wireless compliance

Wireless devices use radio frequencies that may be regulated, but regulations differ from country to country. Wireless devices that conform to IEEE standards 802.11a, 802.11b, 802.11g, 802.11n, 802.16e, and others, are designed for, or certified for use in, specific countries. Certificates of Radio Frequency (RF) Compliance from wireless device manufacturers for wireless devices integrated into Hypertherm products can be found in the “Downloads library” at www.hypertherm.com.

The user of Hypertherm products that have integrated wireless devices is responsible for ensuring that each wireless device has been certified for the country of use and configured with the correct selection of frequency and channel for the country of use. Wireless devices that are integrated into Hypertherm products are not allowed to be operated in countries where regulations for wireless device certification have not been satisfied. Any wireless device or antennae modification or deviation from the permissible configuration, markings, power, frequency settings, and other local regulations on radio frequency wireless device for the country of use can be an infringement of national law.

See the *XPR Wireless Compliance Manual* (80992C) for more information.

Torch mounting bracket requirements

You must supply the torch mounting bracket for your cutting system. Choose one that does the following:

- Holds a torch diameter that is 57.15 mm (2.25 inches)
- Holds the torch perpendicular (at a 90° angle) to the workpiece (for non-bevel cutting)
- Does not interfere with the torch lifter

The XPR torch mounting sleeve is larger than the torch mounting sleeve for HPR torches. Modification or replacement of previous mounting hardware is necessary for XPR torches.

Mounting brackets are available from Hypertherm. (See *Torch bracket* on page 379 of the *Parts List*.)

Torch lifter requirements

Choose a lifter that has a weight capacity of at least 11.3 kg (25 lb). This includes the weight of a torch rotational sleeve, if used.

See your torch lifter instruction manual for more information.

CNC requirements

Remote on-off switch

The CNC must have a remote on-off switch

Adjustable settings

The CNC must allow the adjustment of the following settings:

- Current setpoint
- Plasma cutflow
- Shield cutflow
- Gas mixing setpoints

Display settings

The CNC must show the following data:

- Plasma gas type
- Shield gas type
- Process ID selected
- System diagnostic codes
- Gas connect console firmware version
- Plasma power supply firmware version

The CNC must show the following data in real time to troubleshoot and diagnose system operation:

- Chopper current
- Work lead current
- System status codes
- Chopper temperature
- Transformer temperature
- Coolant temperature
- Coolant flow
- Process gas pressures
- Fan speeds

Diagnostics and troubleshooting

The CNC must be able to execute the following commands to diagnose and troubleshoot system operation:

- Test preflow gases
- Test pierceflow gases
- Test cutflow gases
- Test for gas system leaks

For more information on CNC commands, see the *CNC Communication Protocol for the XPR Cutting System* (809810).

Recommended grounding and shielding

Introduction

This section describes practices for grounding and shielding a plasma cutting system to minimize its susceptibility to electromagnetic interference (EMI) (also known as **noise**). It also describes the service ground, protective earth (PE) ground, and DC power ground. The diagram at the end of this section shows these types of grounds in a plasma cutting system.

The grounding practices in this section have been used on many installations with excellent results, and Hypertherm recommends 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. However, due to the variation in equipment and installations, these grounding practices may not succeed in every case to eliminate EMI problems. Hypertherm recommends that you consult your local and national electrical codes to make sure that the grounding and shielding practices that you use satisfy the requirements for your location.

Types of grounding

Service ground (also known as safety ground) 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 cutting table. It includes the service ground coming into the plasma system and other systems, such as the CNC and the motor drives, as well as the supplemental ground rod connected to the cutting table. In the plasma circuits, the ground is carried from the plasma system chassis to the chassis of each separate console through the interconnecting cables.

Protective earth (PE) ground is the grounding system inside the electrical equipment. The PE ground, which connects to the service ground, provides electrical continuity between the equipment and the AC service.

DC power ground (also known as cutting current ground or work) is the grounding system that completes the path of the cutting current from the torch back to the plasma system. It requires that the positive lead from the plasma system be firmly connected to the cutting table ground bus with a properly sized cable. It also requires that the slats, on which the workpiece rests, make firm contact with the table and the workpiece.

EMI grounding and shielding is the grounding system that limits the amount of EMI emitted by the plasma and motor drive systems. It also limits the amount of EMI that is received by the CNC and other control and measurement circuits. The grounding practices described in this section mainly target EMI grounding and shielding.

Grounding practices

1. Unless noted, use cables with a minimum gauge of 21.2 mm^2 (4 AWG) (047031) for the EMI ground cables shown in the *Example grounding diagram* on page 60.

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 motor as possible. If there are motors at each end of the gantry, run a separate EMI ground cable from the far motor to the gantry bus bar. The gantry bus bar should have a separate, heavy EMI ground cable 21.2 mm^2 (4 AWG; 047031) to the table bus bar. The EMI ground cables for the torch lifter and the RHF or combined ignition/gas connect console must each run separately to the table ground bus.

3. Inadequate grounding not only exposes operators to dangerous voltages, but inadequate grounding also increases the risk of equipment failure and unnecessary downtime. Ideally a ground should be zero ohms resistance, but field experience indicates under 1 ohm resistance is satisfactory for most applications. Hypertherm recommends that you consult your local and national electrical codes to make sure that the grounding and shielding practices that you use satisfy the requirements for your location.

4. A ground rod (a PE ground) that meets all applicable local and national electric codes must be installed within 6 m (20 ft) of the cutting table. The PE ground must be connected to the cutting table ground bus bar using a minimum 21.2 mm^2 (4 AWG) grounding cable (047031). Consult an electrician in your location to make sure that your grounding meets all local and national electric codes.

5. For the most effective shielding, use the Hypertherm CNC interface cables for I/O signals, serial communication signals, between plasma systems in multi-drop connections, and for interconnections between all parts of the Hypertherm system.

6. All hardware used in the ground system must be brass or copper. While you can use steel studs welded to the cutting table for mounting the ground bus, no other aluminum or steel hardware can be used in the ground system.

7. AC power, PE, and service grounds must be connected to all equipment according to local and national codes.

8. For a system with a remote high frequency (RHF) console or combined ignition/gas connect console, 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 be run parallel to other wires or cables only if they are separated by at least 150 mm (6 inches). If possible, run power and signal cables in separate cable tracks.

9. For a system with a RHF console or combined ignition/gas connect console, Hypertherm recommends that you mount this console as close as possible to the torch. This console also must have a separate ground cable that connects directly to the cutting table ground bus bar.

10. 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) ground on the table. This includes the ignition/gas connect console, whether it is bolted to the plasma system or to the cutting table.

11. The coupler on the pilot arc and coolant hose set assembly must be connected firmly to the gas connect console and torch connect console collars. Make sure to tighten the clamp. The collar on the torch lead must be connected firmly to the torch sleeve. Make sure to tighten the clamp. Connect a ground lead (10 AWG) to the flat terminal on the torch mounting sleeve.

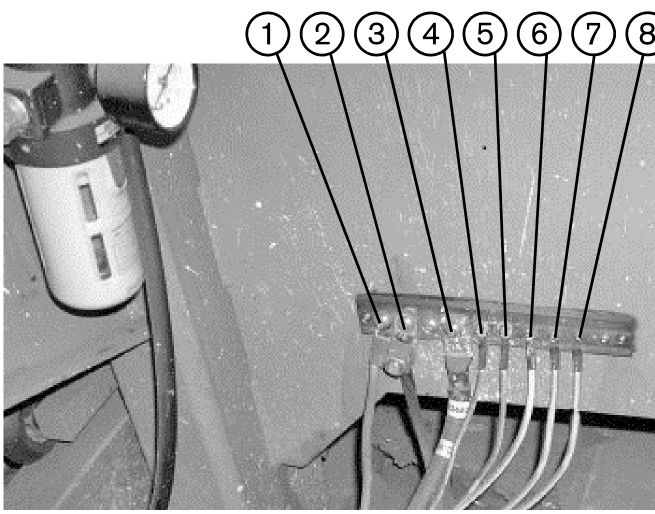
12. The torch holder and the torch breakaway mechanism – the part mounted to the lifter, not the part mounted to the torch – must be connected to the stationary part of the lifter with copper braid at least 12.7 mm (0.5 inches) wide. A separate cable must run from the lifter to the gantry ground bus bar. The valve assembly should also have a separate ground connection to the gantry ground bus bar.

13. If the gantry runs on rails that are not welded to the table, then each rail must be connected with a ground cable from the end of the rail to the table. The rail ground cables connect directly to the table and do not need to connect to the table ground bus bar.

14. If you are installing a voltage divider board, mount it as closely as possible to where the arc voltage is sampled. One recommended location is inside the plasma system enclosure. If a 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 1800F or equivalent). Use a cable with a braided shield, not a foil shield. Connect the shield to the chassis of the plasma system and leave it unconnected at the other end.

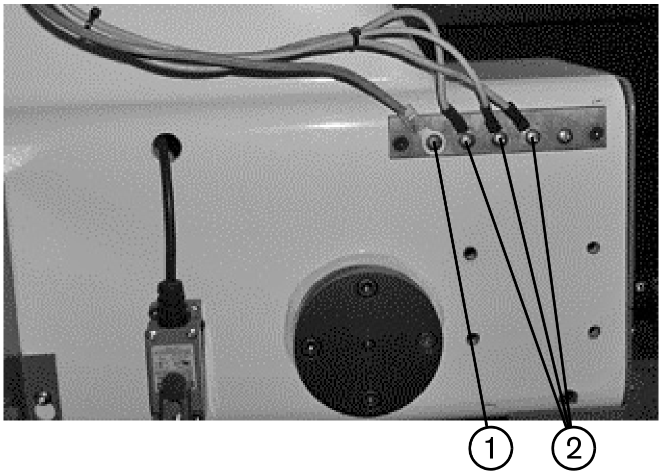
15. All other signals (analog, digital, serial, and encoder) should run in twisted pairs inside a shielded cable. Connectors on these cables should have a metal housing. The shield, not the drain, should be connected to the metal housing of the connector at each end of the cable. Never run the shield or the drain through the connector on any of the pins.

The following picture shows an example of a cutting table ground bus. The components shown here may differ from your system.



1 Gantry ground bus
2 Ground rod
3 Plasma system lead (+)
4 Gas connect console
5 CNC enclosure
6 Torch holder
7 Plasma system chassis
8 Torch connect console

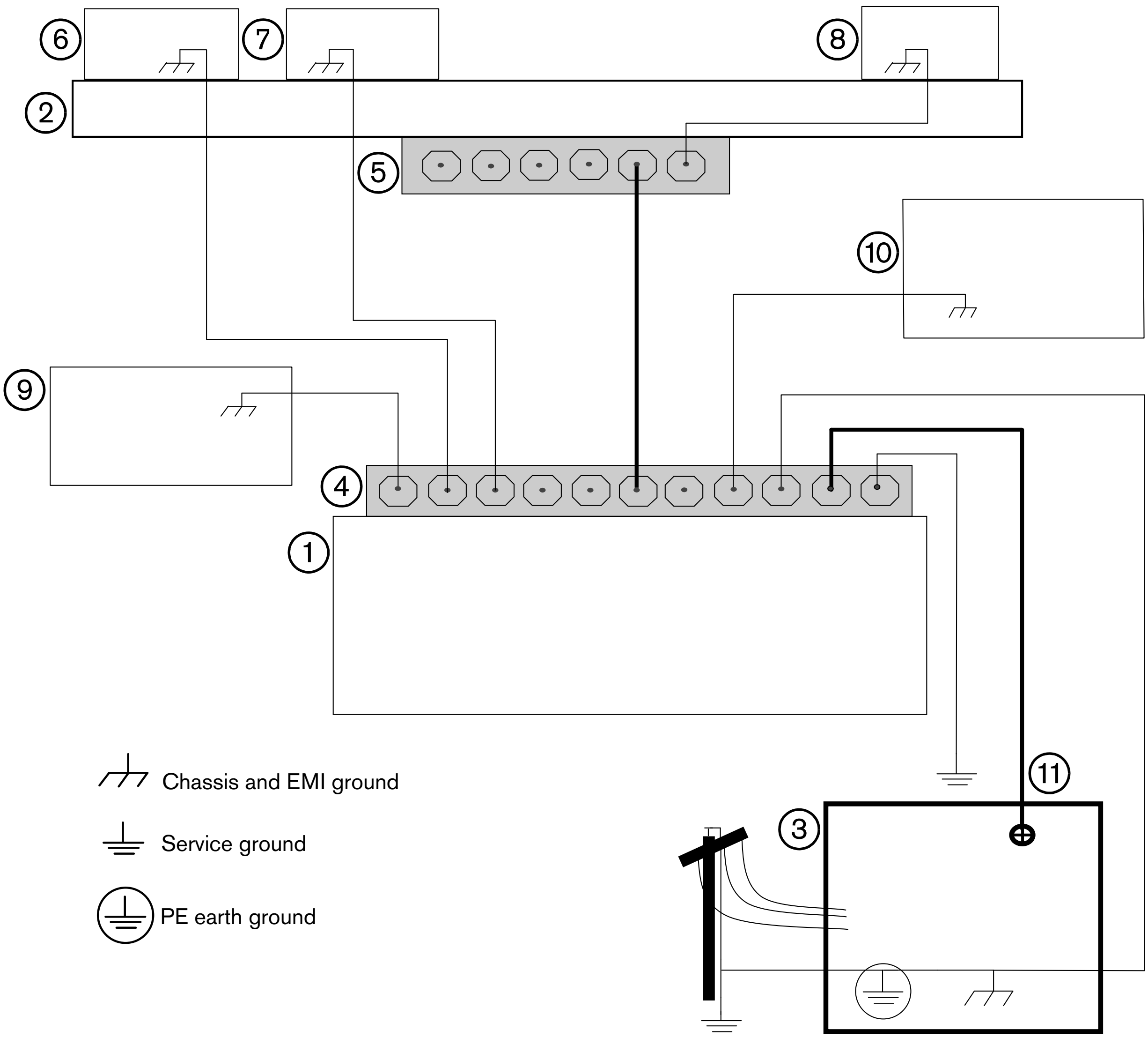
The following picture shows an example of a gantry ground bus. It is bolted to the gantry, close to the motor. All of the individual ground cables from the components mounted on the gantry connect to the bus. A single heavy cable then connects the gantry ground bus to the table ground bus.



1 Cable to the cutting table ground bus

2 Ground cables from components on the gantry

Example grounding diagram



1 Cutting table
2 Gantry
3 Plasma system
4 Table ground bus bar
5 Gantry ground bus bar
6 Torch height control lifter
7 Torch connect console
8 CNC controller
9 Torch height control module
10 Gas connect console. Connect to table ground bus bar.*
11 DC power ground (work)

* The ignition console is integrated into the gas connect console for XPR cutting systems.

This example is based on practices in North America. Other regions can have different local or national electrical codes. Hypertherm recommends that you consult your local and national electrical codes to make sure that the grounding and shielding practices that you use satisfy the requirements for your location.

3 Installation

Before you begin

- As an installer or user, make sure to read, understand, and follow all safety instructions related to installation before you start installation. (See *Safety instructions related to installation* on page 69.)
- Make sure that you have all of the documents that you need. (See *Document requirements* on page 29.)

Upon receipt

- Make sure that you received all items on your order in good condition. Contact your cutting machine supplier if any parts are damaged or missing.
- Inspect the items for damage that may have occurred during shipment. If you find evidence of damage, see *Claims* below. All communications regarding this equipment must include the model number and serial number.
- Record your product information and register your product's serial number at www.hypertherm.com.
- Before you set up this equipment, read the safety information included with your equipment. Failure to follow safety instructions can result in personal injury or in damage to equipment.

Claims

- Claims for damage during shipment – If your equipment was damaged during shipment, file a claim with the carrier. You can contact Hypertherm for a copy of the bill of lading. If you need additional assistance, call the nearest Hypertherm office listed in the front of this manual.
- Claims for defective or missing merchandise – If any component is missing or defective, contact your Hypertherm cutting machine supplier. If you need additional assistance, call the nearest Hypertherm office listed in the front of this manual.

Acoustical noise

This plasma system can make more than the permitted acoustical noise levels as defined by national and local codes. Always put on correct ear protection when cutting or gouging. Any acoustical noise measurements taken are related to the specific environment in which the system is used. Refer to *Noise can damage hearing* in the *Safety and Compliance Manual* (80669C).

In addition, you can find an *Acoustical Noise Data Sheet* for your system at www.hypertherm.com/docs. In the search box, enter **data sheet**.

Proper handling and safe use of chemicals

Material Safety Data Sheets (MSDS) and Safety Data Sheets (SDS) are part of a hazard communication plan that supplies detailed information about hazardous chemicals. The information includes the chemical's toxicity and reactivity, first aid for exposure, approved storage and disposal, recommended protective equipment, and spill-handling procedures.

The Occupational Safety and Health Administration (OSHA) has presented new hazardous chemical labeling requirements as a part of its recent revision of the Hazard Communication Standard (29 CFR 1910.1200), to align with the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (GHS). The GHS is an international system for standardizing chemical classification and labeling.

Chemical regulations in the USA, Europe, and other locations require that Material Safety Data Sheets (MSDS) and Safety Data Sheets (SDS) be made available for chemicals that are supplied with the product and chemicals used in or on the product. This list of chemicals is supplied by Hypertherm.

See the MSDS and SDS online. Technical documentation is available at www.hypertherm.com/docs.

Installation requirements

All installation and service of the electrical systems must obey national and local electrical codes. A qualified person must do this work.

Contact the nearest Hypertherm Technical Service team listed in the front of this manual or your authorized Hypertherm cutting machine supplier with any technical questions.

Installation overview

These are the general steps to install the cutting system. It is important to be familiar with these steps before installation begins.

1. Position the system components. See *How to position the system components* on page 75.
2. Ground the system components. See *How to ground the system components* on page 83.
3. Remove the rear panel of the plasma power supply. Remove the top and side panels from the consoles. See *How to remove the external panels from the system components* on page 86.
4. Connect the plasma power supply to the gas connect console. See *How to connect the plasma power supply and gas connect console (Core, VWI, or OptiMix)* on page 93.
5. Connect the work lead to the plasma power supply and the cutting table. See *How to connect the work lead to the plasma power supply and cutting table* on page 98.
6. Connect the gas connect console to the torch connect console. See *How to connect the gas connect console to the torch connect console* on page 103.
7. Install and connect the supply gas plumbing and water. See *How to install and connect the supply gases* on page 111.
8. Connect the torch receptacle to the torch connect console. See *How to connect the torch receptacle to the TorchConnect console* on page 121.
9. Install the torch onto a lifter. See *How to install the torch in the torch mounting bracket* on page 127.
10. Install the consumables. See *How to install the consumables* on page 129.
11. Install the torch in the torch receptacle. See *How to install the torch into the torch receptacle* on page 131.
12. Connect the cutting system to power. See *How to connect electric power to the cutting system* on page 133.

You can use the included checklist to verify system requirements and the completion of major installation steps. (See *Installation checklist* on page 64.)

Installation checklist

Verify system requirements

Electrical	
See *System electrical requirements* on page 32.	
☐	Make sure that the electrical system conforms to all applicable codes.
☐	Make sure that the input power meets requirements. See *Input power requirements* on page 32.
☐	Make sure that the circuit breaker or fuse meets requirements. See *Circuit breaker and fuse requirements* on page 34.
☐	Make sure that the main power cord is the correct size and correctly installed. See *Main power cord requirements* on page 34. As an installer or user, you must supply the main power cord for your cutting system.
☐	Make sure that there is a separate line-disconnect switch for the plasma power supply. See *Line-disconnect switch requirements* on page 33. As an installer or user, you must supply the line-disconnect switch for your cutting system.
☐	Make sure that the emergency-stop switches are correctly installed. As an installer or user, you must supply the emergency-stop switches for your cutting system.
☐	Make sure that the remote on-off switch is correctly installed. See *Remote on-off switch* on page 35. As an installer or user, you must supply the remote on-off switch for your cutting system.

Process gas and plumbing		
See *Process gas requirements (Core, VWI, and OptiMix gas connect consoles)* on page 36. You must supply the process gases and supply gas plumbing for your cutting system.		
☐	Make sure that the gas quality meets requirements.	
☐	Make sure that the gas pressure meets requirements.	
☐	Make sure that the gas flow meets requirements.	
☐	Make sure that the gas plumbing and hoses meet requirements. See *Plumbing for supply gases* on page 38. The cutting system comes with the hoses that connect the plasma power supply components. As an installer or user, you must supply the plumbing for the process gases.	
	☐	Make sure that the plumbing is the correct type and correctly installed. As an installer or user, you must supply flashback arrestors for your cutting system if you use oxygen as the plasma gas.
	☐	Make sure that the hoses are the correct type and length, and that they are correctly installed.
	☐	Make sure that the regulators are the correct type, installed in the correct locations, and correctly installed. See *Regulators for supply gases* on page 40. As an installer or user, you must supply the gas regulators for your cutting system.
	☐	Make sure that the plumbing conforms to all applicable codes.

Shield water (VWI and OptiMix)

See *Shield water requirements (VWI and OptiMix)* on page 41. You must supply the shield water for your cutting system.

- ☐ Make sure that the water quality meets requirements.
- ☐ Make sure that the water pressure meets requirements.
- ☐ Make sure that the water flow meets requirements.
- ☐ Make sure that the water plumbing and hoses meet requirements. See *Plumbing and hose requirements for shield water* on page 42.

  As an installer or user, you must supply the plumbing and hoses for shield water.
  - ☐ Make sure that the plumbing is the correct type and correctly installed.
  - ☐ Make sure that the hoses are the correct type and length, and that they are correctly installed.
  - ☐ Additional water pressure regulators are only required when the water pressure is above 7.92 bar (115 psi). See *Additional regulator requirement for shield water (optional)* on page 42.

Configuration

See *Requirements to position system components* on page 47.

- ☐ Make sure that the configuration of system components is correct. See *Recommended configuration with the Core gas connect console* on page 48 and *Configuration with VWI or OptiMix gas connect console* on page 74.
- ☐ Make sure that the spacing and ventilation for the plasma power supply meets requirements. See *Distance requirements for ventilation and access* on page 51.

  Hypertherm recommends a minimum distance of 1 meter (3.3 feet) between the plasma power supply and other system components, or between the plasma power supply and an obstacle.
- ☐ Make sure that the surfaces that hold system components are flat, dry, clean, and can support the weight. See *Site requirements* on page 50.
  - ☐ Make sure that the table ventilation meets requirements (if applicable) (check table type).
    - ☐ Water table
    - ☐ Downdraft table
    - ☐ Other (specify)

Hoses, cables, and leads

Do not bend the following hoses, cables, and leads beyond a minimum bend radius of 15.25 cm (6 inches): Torch lead, pilot arc lead, coolant hose set, power cable, CAN cable, 3-gas hose bundle (for the Core gas connect console), 5-gas hose bundle (for the VWI or OptiMix gas connect console), and gas supply hoses.

The cutting system comes with the cables and leads that connect system components. See the following sections in the *Parts List* for part numbers and descriptions:

- *Plasma power supply to gas connect console connections* on page 385.
- *Gas connect console to torch connect console connections* on page 387.
- *Plasma power supply to CNC connections* on page 389.
- *Plasma power supply to cutting table connection* on page 390.
- *Torch connect console to torch receptacle connection* on page 391.

- ☐ Make sure that the hoses, cables and leads are the correct type. See *How to identify and prepare the hoses, cables, and leads* on page 90.
- ☐ Make sure that the hoses, cables, and leads are the correct length. See *Length requirements for hoses, cables, and leads* on page 50.

Grounding

- ☐ Make sure that the grounding meets requirements. See *Recommended grounding and shielding* on page 56.
  - ☐ Plasma power supply
  - ☐ Gas connect console
  - ☐ Torch connect console
  - ☐ Cutting table
  - ☐ CNC
  - ☐ Torch lead collar

Verify installation steps

Connections

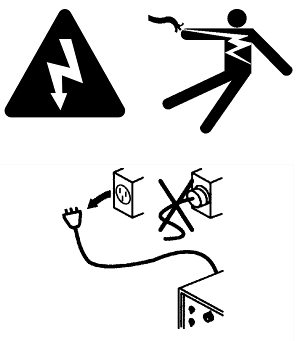
- ☐ Make sure that the connections between the plasma power supply and the gas connect console are correctly installed. See *How to connect the plasma power supply and gas connect console (Core, VWI, or OptiMix)* on page 93.
  - ☐ Coolant hose set
  - ☐ Power cable
  - ☐ CAN cable
  - ☐ Negative lead (-)
  - ☐ Pilot arc lead
- ☐ Make sure that the work lead (+) connection between the plasma power supply and the cutting table is correctly installed. See *How to connect the work lead to the plasma power supply and cutting table* on page 98.
- ☐ Make sure that the connections between the gas connect console and torch connect console are correctly installed. See *How to connect the gas connect console to the torch connect console* on page 103.
  - ☐ Core — See *Connect the gas connect console (Core) to the TorchConnect console* on page 103.
    - ☐ Pilot arc and coolant hose set assembly. See *Connect the pilot arc and coolant hose set assembly* on page 103.
    - ☐ Power, CAN, and 3-gas assembly (Core only). See *Connect the power, CAN, and 3-gas assembly (Core)* on page 106.
  - ☐ VWI / OptiMix — See *Connect the gas connect console (VWI or OptiMix) to the TorchConnect console* on page 107.
    - ☐ Pilot arc, coolant hose set, and water assembly. See *Connect the pilot arc, coolant hose set, and shield water assembly* on page 107.
    - ☐ Power, CAN, and 5-gas assembly. See *Connect the power, CAN, and 5-gas assembly* on page 110.
- ☐ Make sure that the connection between the torch receptacle and torch connect console is installed correctly. See *How to connect the torch receptacle to the TorchConnect console* on page 121.
  - ☐ Make sure that the hoses, cables, and leads are correctly installed.
    - ☐ Make sure that the connections are the correct type and correctly installed.
    - ☐ Make sure that there is no damage or kinks.
    - ☐ Make sure that there are no coils in the cables that can create EMI problems.
    - ☐ Make sure that the distance between high-frequency leads and control cables meets requirements. See *Distance requirements between high-frequency leads and control cables* on page 51.
    - ☐ Make sure that the distance for communication meets requirements. See *Distance requirements for communications* on page 52.

Installation steps		
☐	Make sure that the consumables are the correct type and correctly installed. A loose or overtightened electrode can cause torch damage. Hypertherm recommends between 2.3 N·m – 2.8 N·m (20 in·lbf – 25 in·lbf) torque to tighten an electrode. See *How to install the consumables* on page 129. The torch head that comes with the XPR torch assembly kit (428488) has 300 A mild steel consumables pre-installed.	
☐	Make sure that the torch is correctly installed.	
	☐	Make sure that the torch mounting bracket is correctly installed. See *Torch mounting bracket requirements* on page 53. As an installer or user, you must supply the torch mounting bracket for your cutting system.
	☐	Make sure that the torch is correctly installed into the torch receptacle. See *How to install the torch into the torch receptacle* on page 131.
	☐	Make sure that the torch is correctly installed into the lifter. See *Torch lifter requirements* on page 53. As an installer or user, you must supply the motorized torch lifter for your cutting system.
☐	Electrical power – Make sure that electrical power is supplied to the cutting system. See *How to connect electric power to the cutting system* on page 133.	
☐	CNC interface – Make sure that the communication method is installed correctly. See *Connect for Communication* on page 143.	
	☐	EtherCAT
	☐	Wireless (XPR web interface) and discrete
	☐	Serial RS-422 and discrete
☐	Coolant – Make sure that the coolant is installed correctly. See *Coolant Installation* on page 193.	
	☐	Make sure that the coolant type is correct. See *Coolant requirements* on page 44.
	☐	Make sure that the coolant reservoir is full. See *How to fill the cutting system with coolant* on page 194.

Safety instructions related to installation

Before you start installation, make sure to read, understand, and follow all of the safety instructions that are in this manual, the *Safety and Compliance Manual* (80669C) and *Radio Frequency Warning Manual* (80945C), and affixed to the cutting system.

WARNING



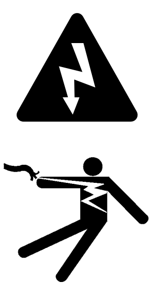
ELECTRIC SHOCK CAN KILL

Disconnect all electric power from the plasma power supply before you move the plasma power supply or put it into position.

If you move or position the plasma power supply while it is connected to electric power, you can be injured or killed and the plasma power supply can be damaged.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

WARNING



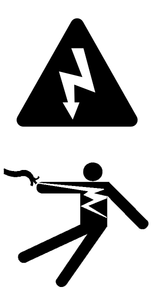
ELECTRIC SHOCK CAN KILL

The line-disconnect switch must be in the OFF position before you connect the power cord to the cutting system.

The line-disconnect switch must REMAIN in the OFF position until all installation steps are complete.

In the United States, use a “lock out/tag out” procedure until installation is complete. In other countries, follow the appropriate national and local safety procedures.

WARNING



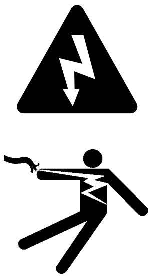
ELECTRIC SHOCK CAN KILL

When the line-disconnect switch is in the ON position, there is line voltage throughout the cutting system.

Voltages present throughout the cutting system can cause injury or death.

Use extreme caution if you do diagnosis or maintenance tasks when the line-disconnect switch is in the ON position.

WARNING



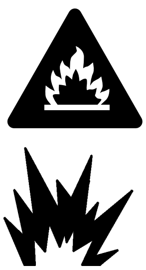
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING

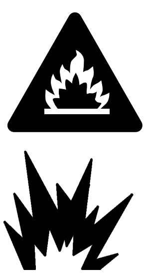


If you use oxygen as the plasma gas for cutting, it can cause a potential fire hazard due to the oxygen-enriched atmosphere that collects.

Hypertherm recommends that you install an exhaust ventilation system to remove the oxygen-enriched atmosphere that can collect when oxygen is used as the plasma gas for cutting.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the flashback arrestors for your cutting system. You can get them from your cutting machine supplier.



Hydrogen is a flammable gas that presents an explosion hazard. Keep flames away from cylinders and hoses that contain hydrogen. Keep flames and sparks away from the torch when using hydrogen as a plasma gas.

Consult your local safety, fire, and building code requirements for the storage and use of hydrogen.

Hypertherm recommends that you install an exhaust ventilation system to remove the hydrogen-enriched atmosphere that can collect when hydrogen is used as the plasma gas for cutting.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

WARNING

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. When you come into contact, flush skin or eyes with water. If swallowed, seek immediate medical attention.

NOTICE

Never use automotive antifreeze in place of Hypertherm coolant. Antifreeze contains chemicals that damage the torch coolant system.

CAUTION

If you use the wrong coolant, it can cause damage to the cutting system. See *Coolant requirements* on page 44.

NOTICE

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

NOTICE

Some air compressors use synthetic lubricants that contain esters. Esters will damage the polycarbonates in the air filter bowl.

⚠ CAUTION

All hoses, hose connections, and hose fittings used for supply gas plumbing must be designed for use with the appropriate gas and pressure rating. Other hoses, hose connections, or hose fittings can crack or leak.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Any replacement hose, connection, or fitting must satisfy all applicable regulations and codes.

Non-compliant hoses, hose connections, or hose fittings can crack or leak.

If you replace any fittings on the consoles, or if you use the wrong fittings, it can cause the internal valves to malfunction because contaminants can get into the valves.

⚠ NOTICE

The manufactured lengths of torch and console leads are critical for system performance.

Never alter the lengths of any leads.

Cut quality and the lifespan of consumables will be decreased if you alter the leads.

⚠ NOTICE

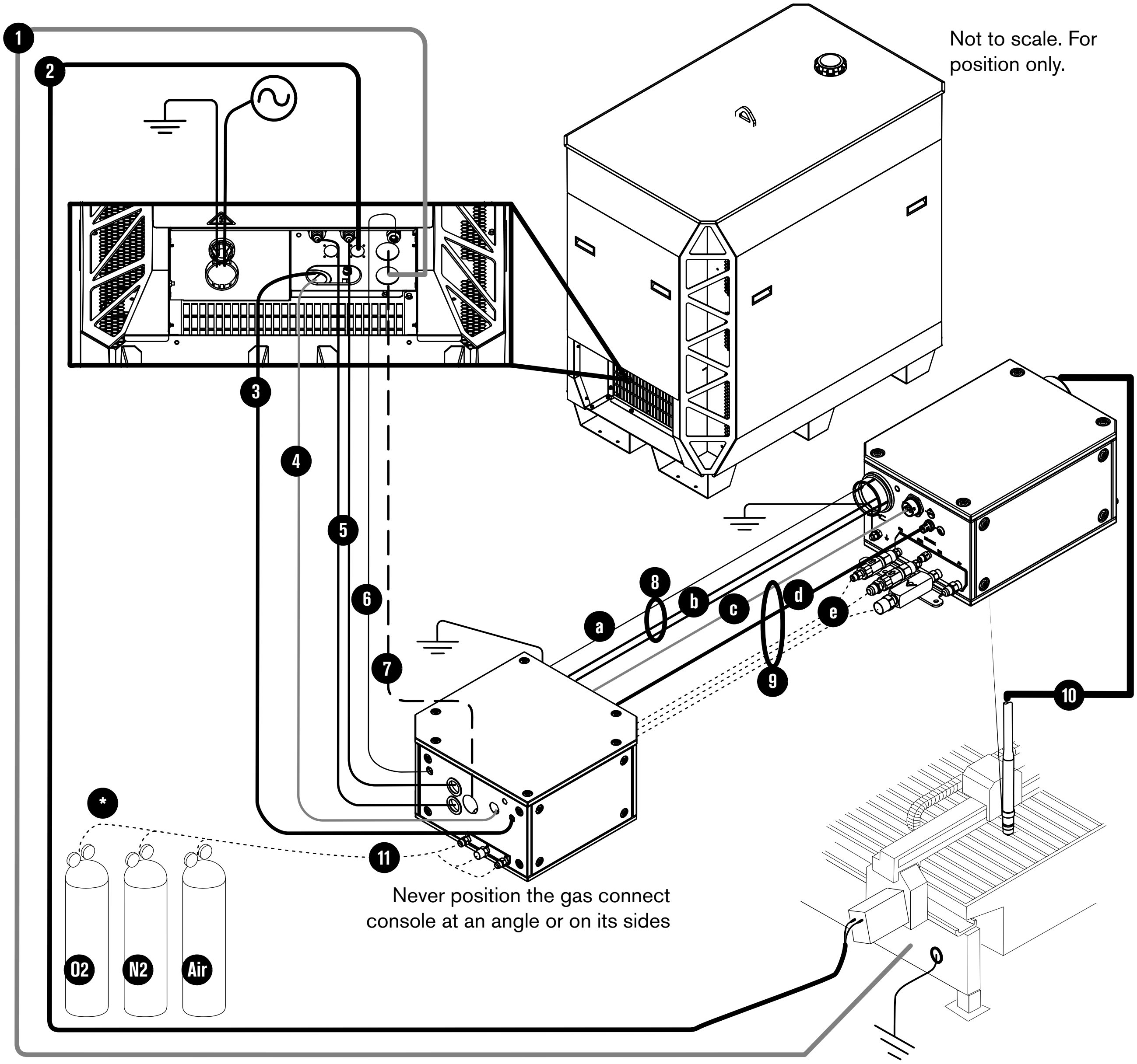
Gas leaks or pressure and flow rates that are outside of recommended ranges can:

- Cause problems with system performance
- Result in bad cut quality
- Shorten the life of consumables

If the quality of the gas is bad or if the pressure setting is incorrect, it can decrease:

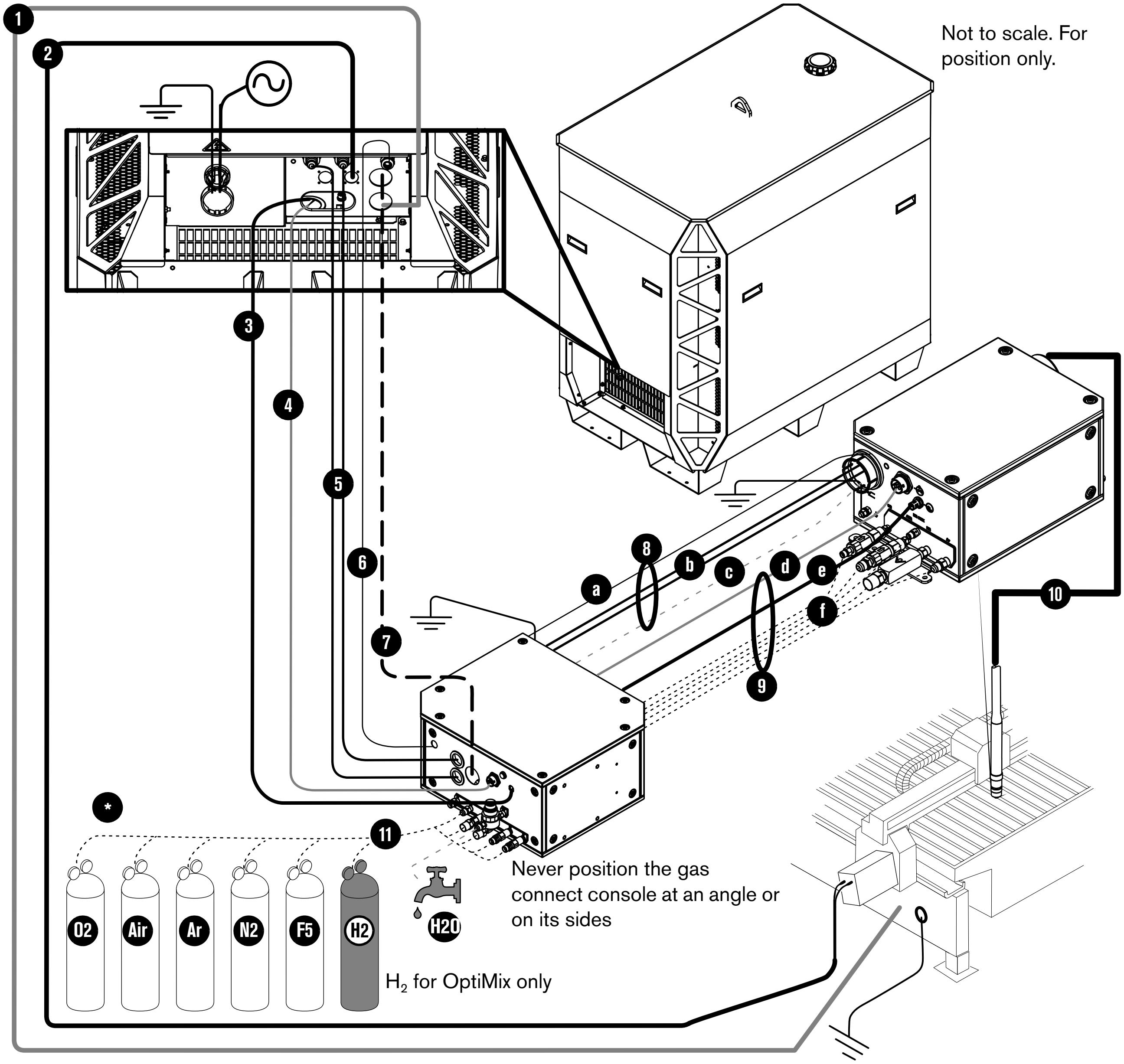
- Cut quality
- Cut speed
- Cut thickness capabilities

Configuration with Core gas connect console



- **1** Work lead
- **2** CNC connection cable (EtherCAT shown)
- **3** Controller area network (CAN) cable
- **4** Power cable (120 VAC)
- **5** Coolant hose set (1 supply, 1 return)
- **6** Pilot arc lead
- **7** Negative lead (2/0 or 4/0)
- **8** Pilot arc and coolant hose set assembly
  - **a** Pilot arc lead
  - **b** Coolant hose set (1 supply, 1 return)
- **9** Power, CAN, 3-gas assembly
  - **c** Power cable (120 VAC)
  - **d** CAN cable
  - **e** 3 gas hoses (Core)
- **10** Torch lead
- **11** Hoses for supply gases
- ***** Regulator (For the best results, position a gas regulator within 3 meters (10 feet) of the gas connect console)

Configuration with VWI or OptiMix gas connect console



- **1** Work lead
- **2** CNC connection cable (EtherCAT shown)
- **3** CAN cable
- **4** Power cable (120 VAC)
- **5** Coolant hose set (1 supply, 1 return)
- **6** Pilot arc lead
- **7** Negative lead (2/0 or 4/0)
- **8** Pilot arc, coolant hose set, shield water assembly
  - **a** Pilot arc lead
  - **b** Coolant hose set (1 supply, 1 return)
  - **c** Shield water hose (VWI or OptiMix)
- **9** Power, CAN, 5-gas assembly
  - **d** Power cable (120 VAC)
  - **e** CAN cable
  - **f** 5 gas hoses (VWI or OptiMix)
- **10** Torch lead
- **11** Hoses for supply gases/shield water
- ***** Regulator (For the best results, position a gas regulator within 3 meters (10 feet) of the gas connect console)

How to position the system components

Put all system components into position prior to making connections.

Plan where to position system components

When you plan where to position system components, use the following:

- *Site requirements* on page 50
- *Length requirements for hoses, cables, and leads* on page 50
- *Bend radius requirements for hoses, cables, and leads* on page 51
- *Distance requirements between high-frequency leads and control cables* on page 51
- *Distance requirements for ventilation and access* on page 51
- *Distance requirements for communications* on page 52

Position system components

Position the plasma power supply

WARNING

HEAVY EQUIPMENT CAN CAUSE SERIOUS INJURY IF DROPPED – LIFT CAREFULLY

When lifting or moving the plasma power supply:

- Clear the area of all cables, wires, and other potential obstacles that can get caught on the plasma power supply while you are moving it.
- Only use equipment with sufficient capability to safely lift and support the plasma power supply.
- If you use the lift eye to lift the plasma power supply, make sure that you lift only the plasma power supply so that you do not exceed the maximum lift eye rating. See *Table 1* on page 22.
- If you use a lift truck to lift the plasma power supply, use one whose forks extend along the entire bottom of the plasma power supply. Use the lift truck slots located on the bottom of the plasma power supply.
- Make sure that the area is clear before setting the plasma power supply down.
- Set the plasma power supply down gently. Do not drop it from any height.

The XPR300 plasma power supply weighs 590 kg (1,300 lbs). You must use a lift truck or other lift equipment to position the plasma power supply. See *Table 16*.

Table 16 – Equipment to lift or move the plasma power supply

Lift truck	You can use a lift truck to move the plasma power supply into position. The lift truck forks must be: 1) long enough to fully support and extend along the entire bottom of the plasma power supply, and 2) rated to hold the weight of the plasma power supply.
Lift eye	A lift eye is built into the top of the plasma power supply. Make sure that the lift equipment that you use is rated to hold the weight of the plasma power supply.

To protect the plasma power supply from drops and damage, make sure to balance the plasma power supply evenly between the lift truck forks or lift equipment and to use slow speeds.

Position and mount the gas connect consoles

Before you mount the gas connect console, make sure that you have done the following:

- Planned where to position the system components. (See *Plan where to position system components* on page 75.)

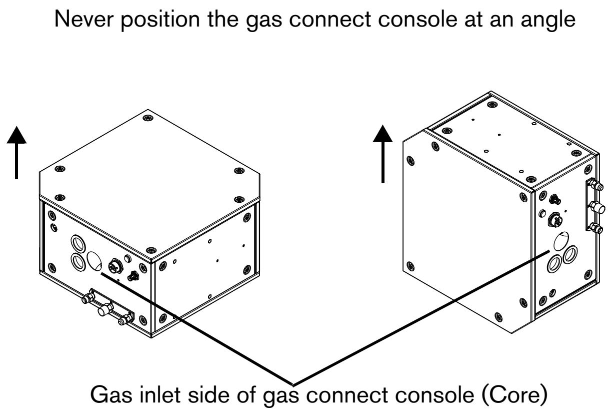
  The gas connect console has 2 orientation options: bottom and 1 side, as shown in *Figure 1* and *Figure 2*.

- Followed the requirements in *Requirements to position system components* on page 47.

All 3 gas connect consoles (Core, VWI, and OptiMix) have 3 mounting holes on the bottom panel. For mounting dimensions, see *Figure 1* on page 78 and *Figure 2* on page 79.

If you have questions about when or how to use the mounting holes to mount your gas connect console, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Figure 1 – Mounting dimensions for the Core and VWI gas connect consoles



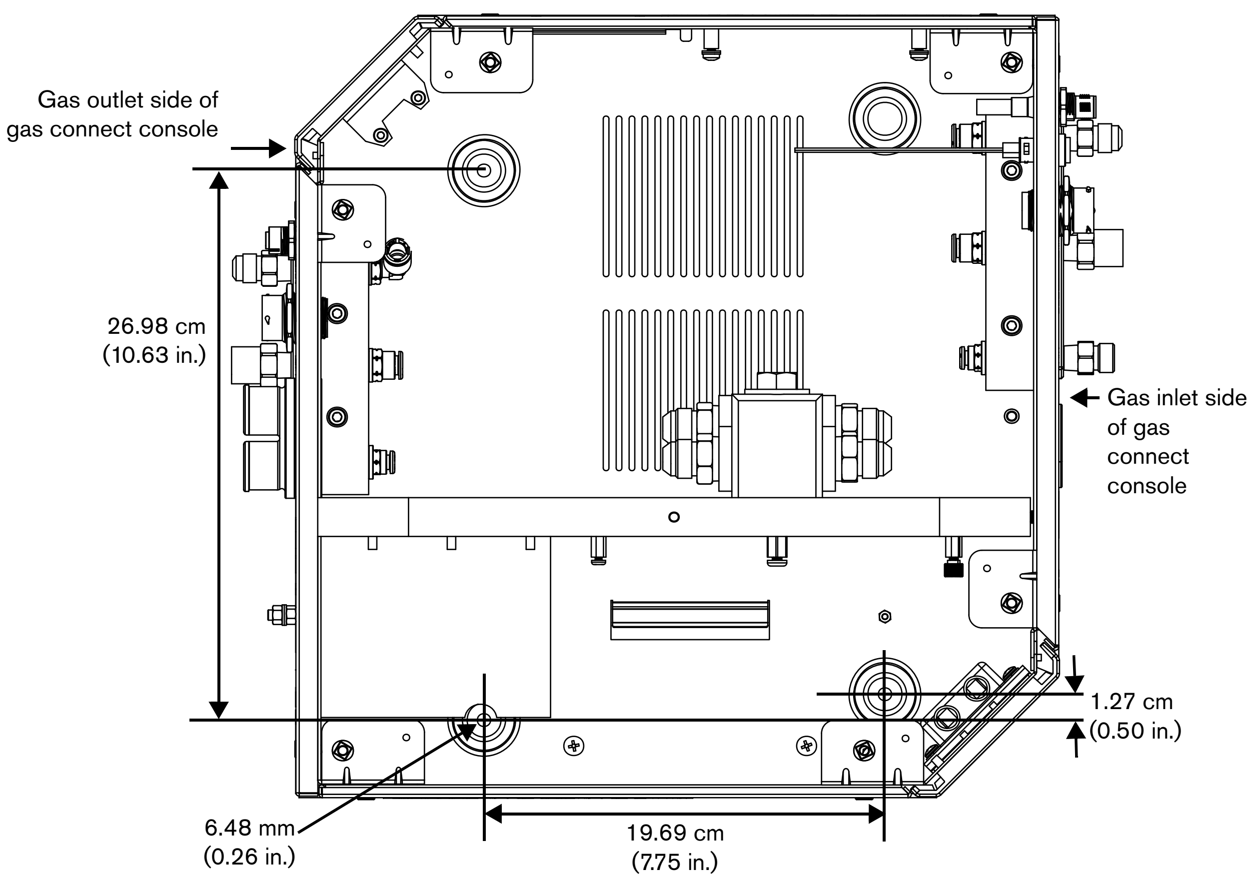
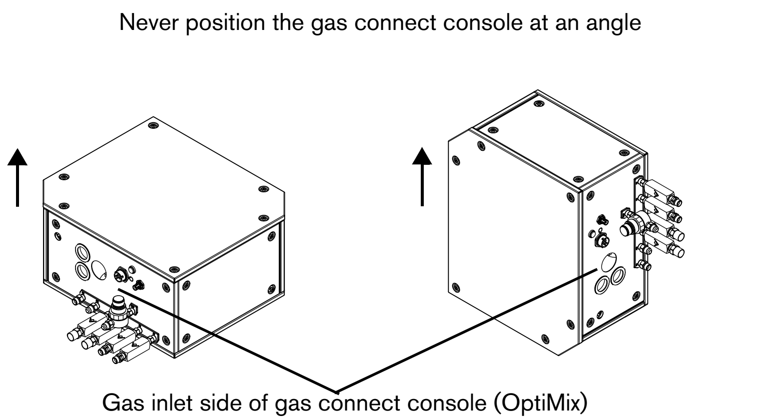
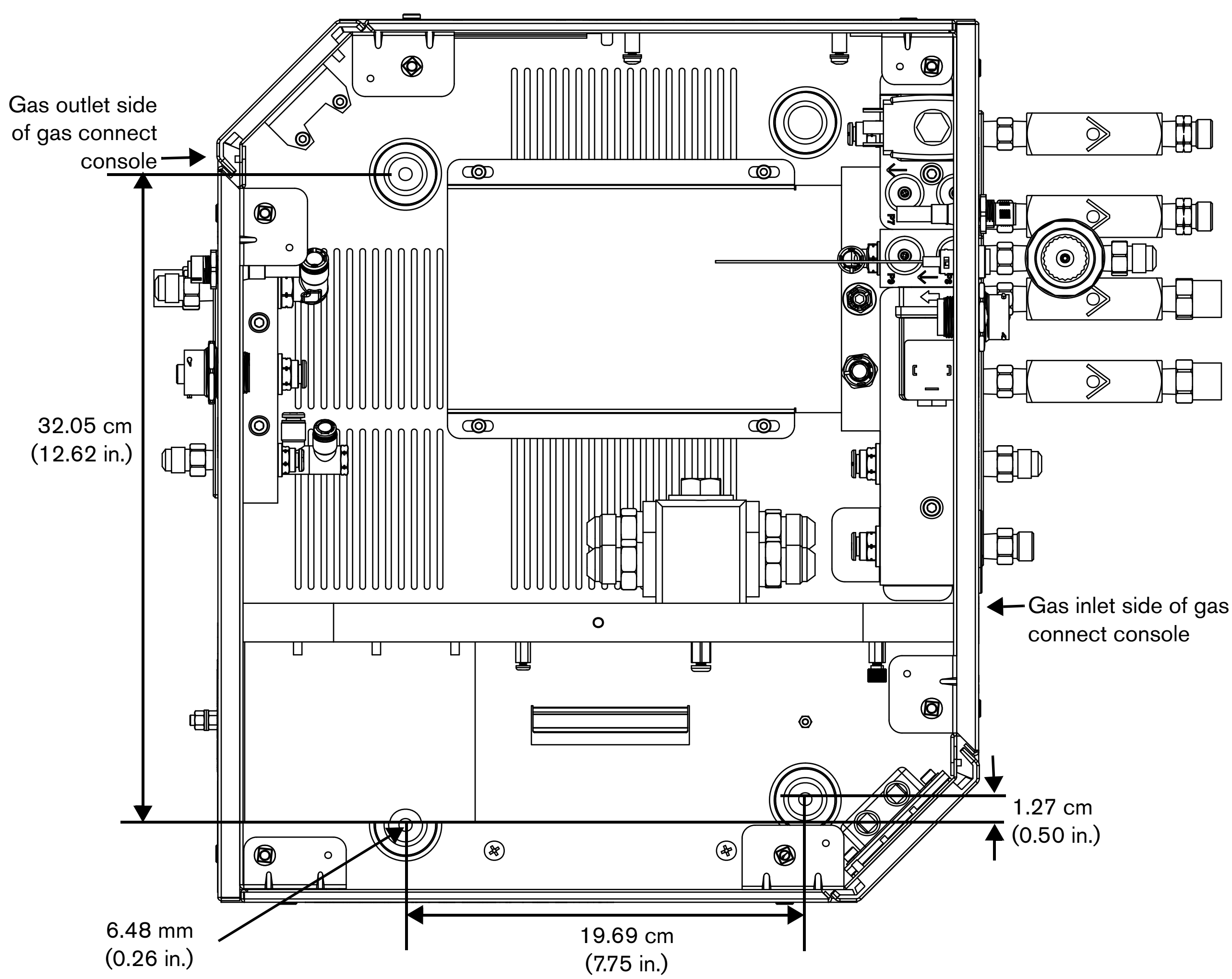


Figure 2 – Mounting dimensions for the OptiMix gas connect console





Position and mount the TorchConnect console

Before you mount the TorchConnect console, make sure that you have done the following:

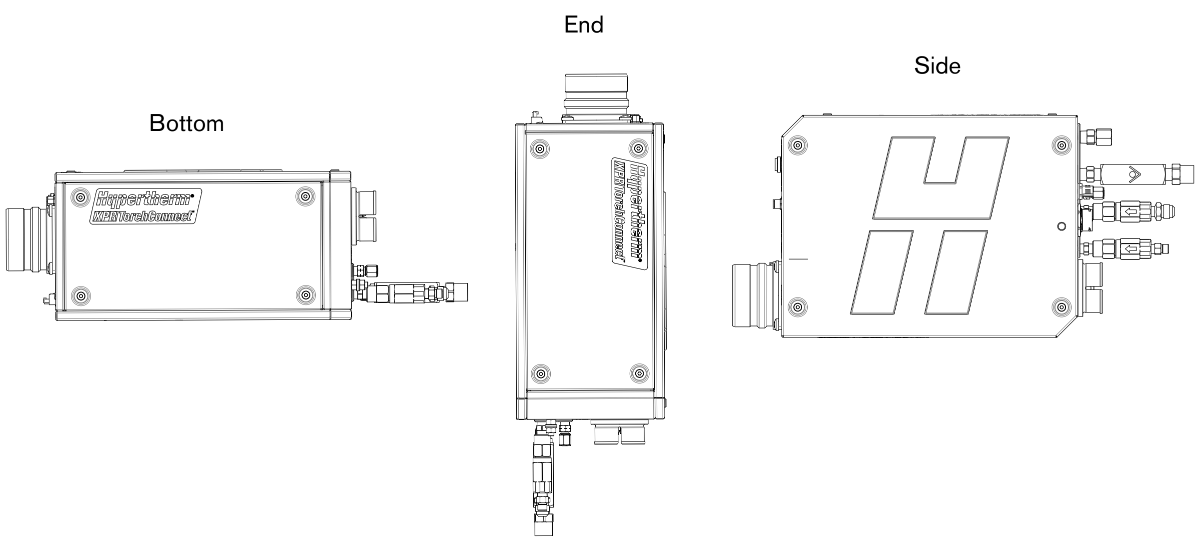
- Planned where to position the system components. (See *Plan where to position system components* on page 75.)
- Followed the requirements in *Requirements to position system components* on page 47.

The factory location for the mounting brackets is on the bottom of the TorchConnect console. However, you can reposition the mounting brackets from the bottom of the console to one of the side covers. There are 3 mounting orientations, 1 bottom, 1 end, and 1 side. Console orientation with the torch lead connection on the bottom will minimize the risk of leaked water or coolant collecting inside of the console, which can damage internal electrical components.

For mounting dimensions, see *Figure 4* on page 81.

If you have questions about when or how to use the mounting brackets to mount your TorchConnect console, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Figure 3 – Recommended orientations for the TorchConnect console



If you position the torch connect console with the EasyConnect pointed up, make sure to support the torch lead to maintain the minimum 15.25 cm (6 in.) bend radius.

Figure 4 – Side mount orientation and mounting dimensions for the torch connect console

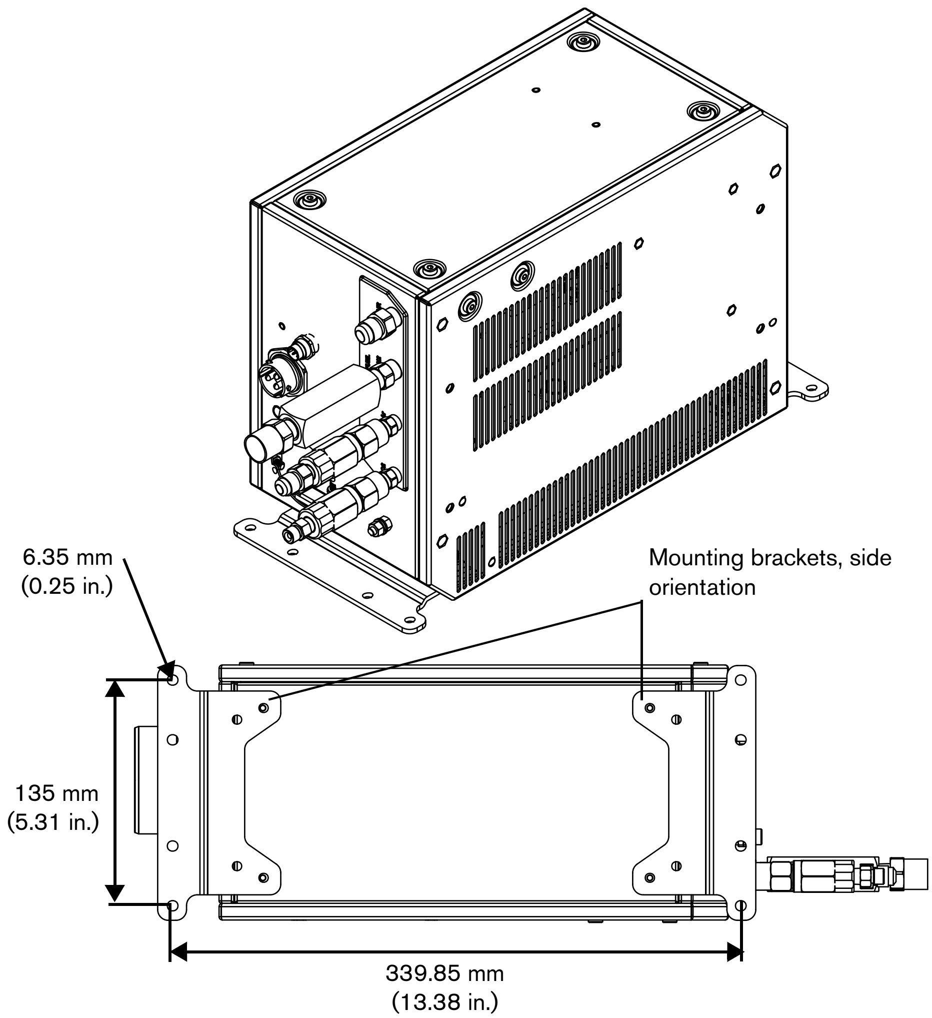
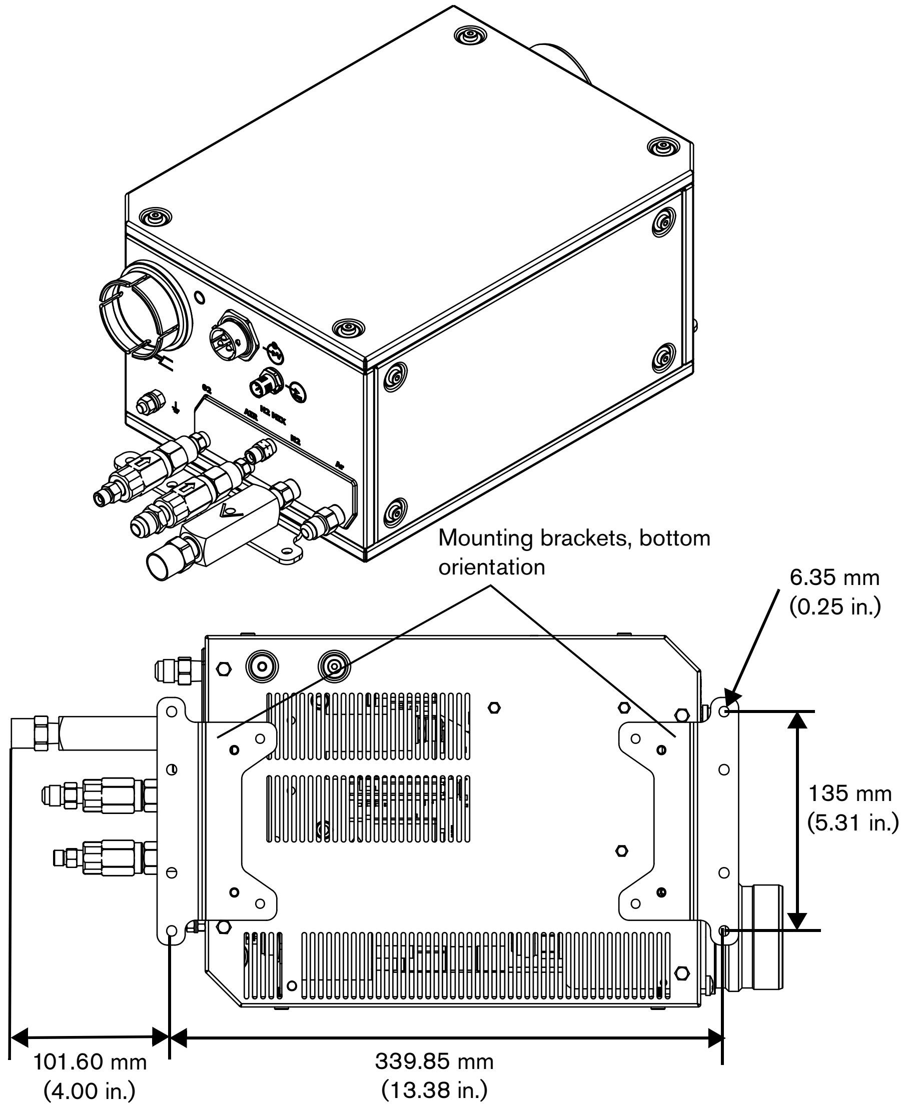


Figure 5 – Bottom mounting for the torch connect console



How to ground the system components

It is important to follow all grounding and shielding recommendations See *Recommended grounding and shielding* on page 56.

Ground system components after you position them and before you connect the hoses, cables, and leads.

Figure 6 – Plasma power supply grounding (detail)

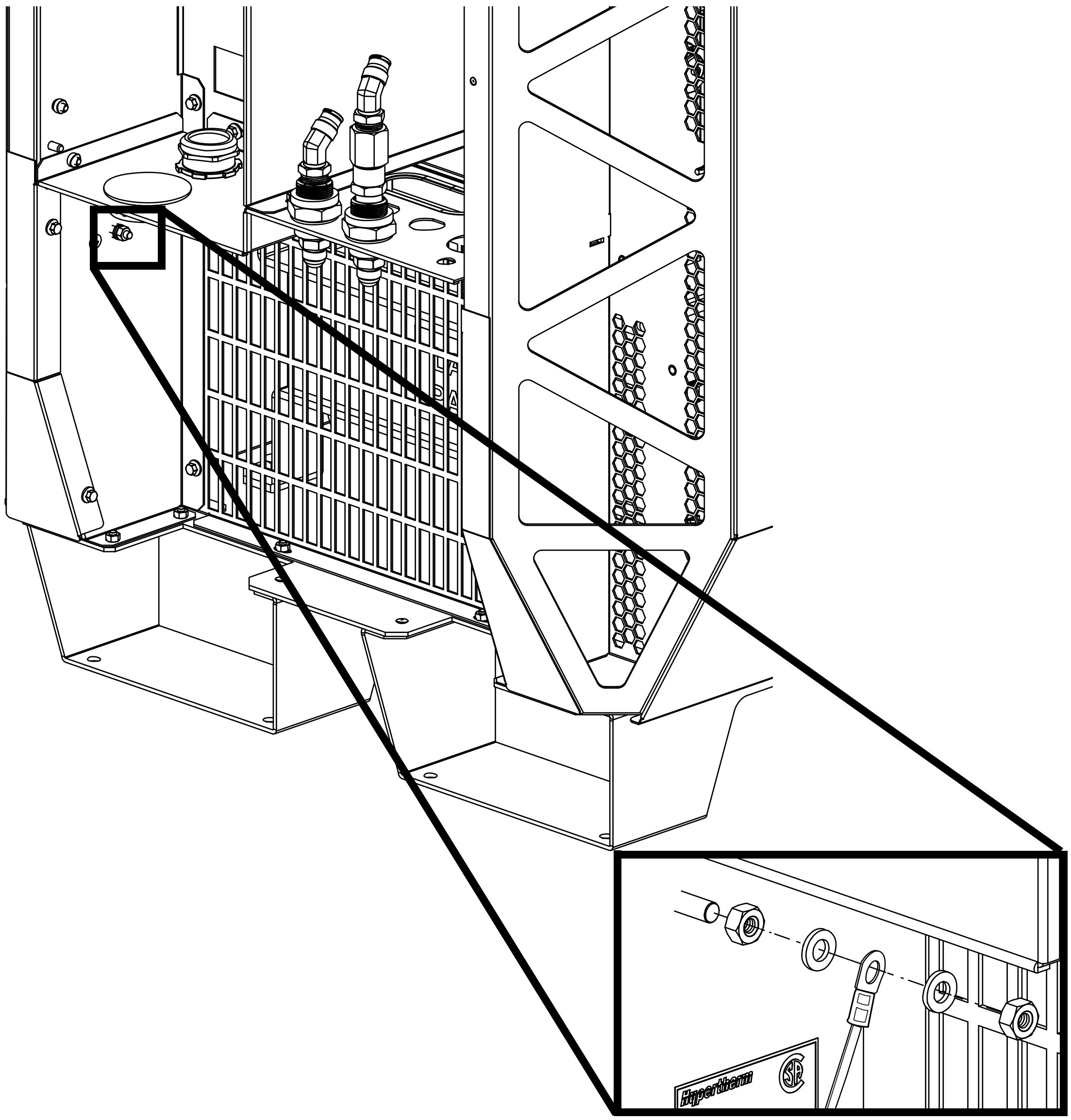


Figure 7 – Gas connect consoles grounding (detail)

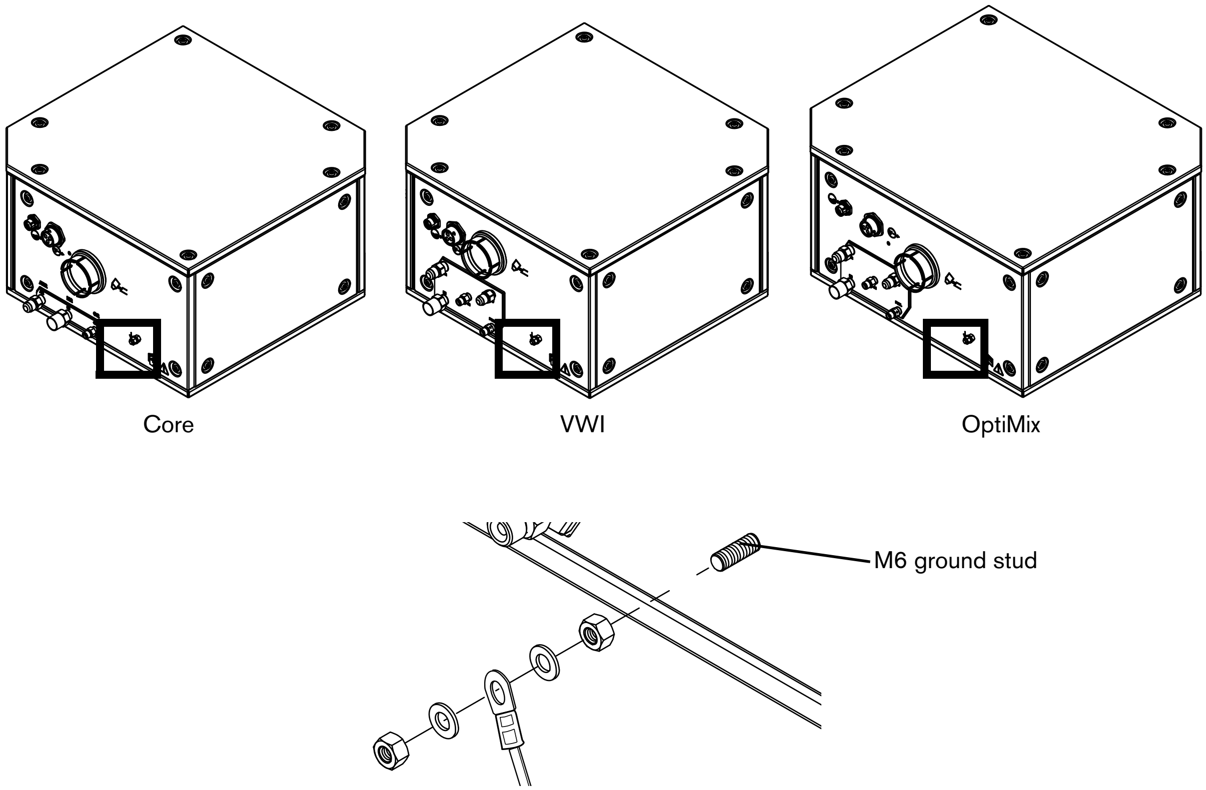


Figure 8 – Torch connect console grounding (detail)

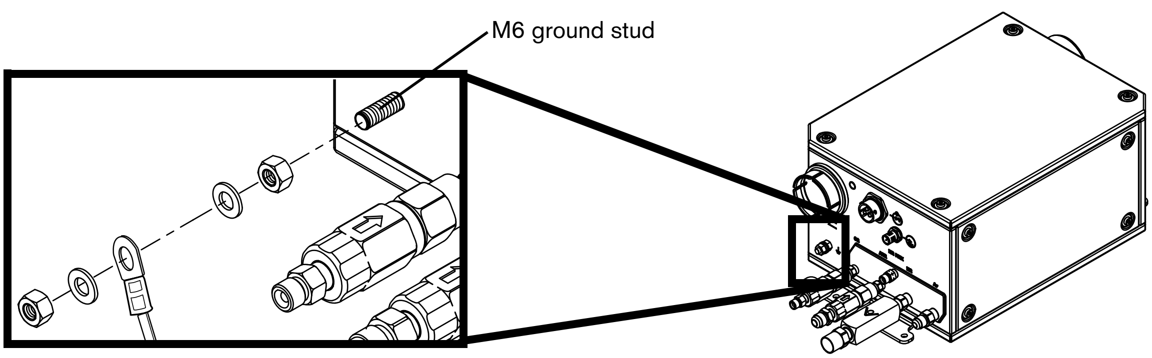
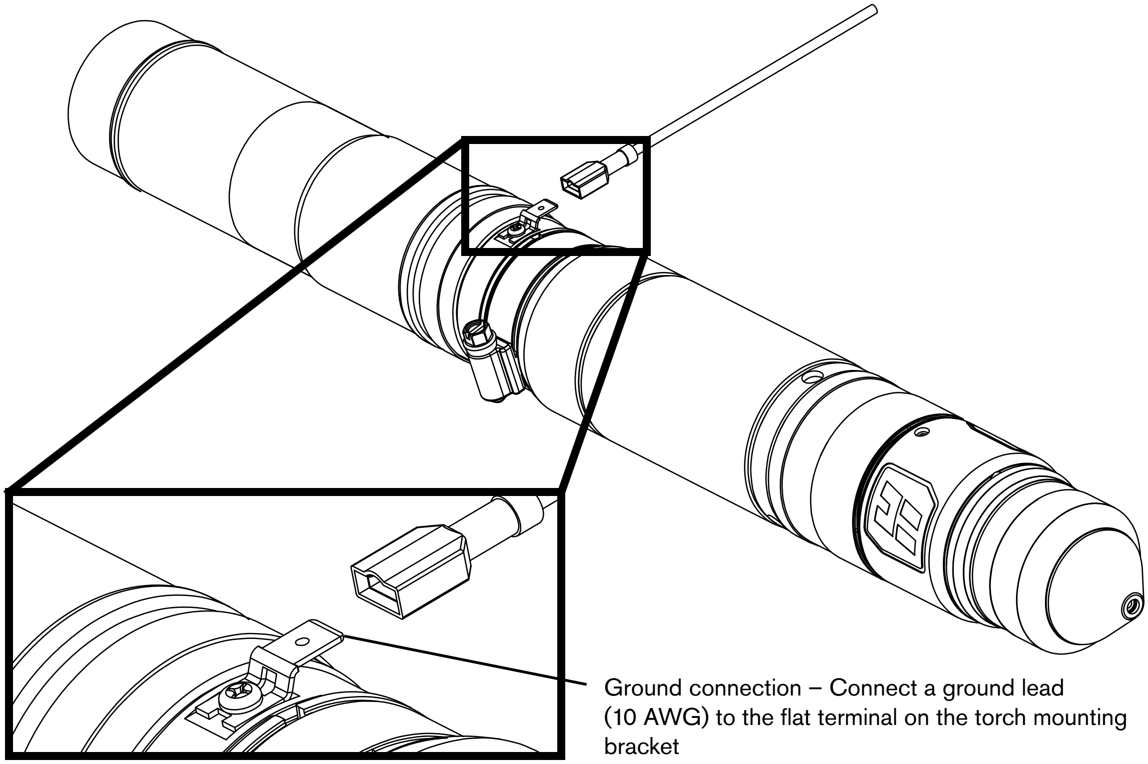
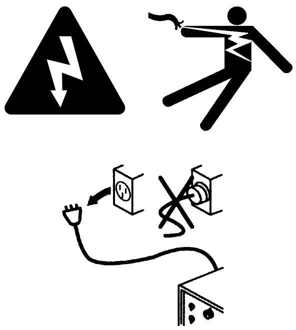


Figure 9 – Torch lead collar grounding (detail)



How to remove the external panels from the system components

WARNING



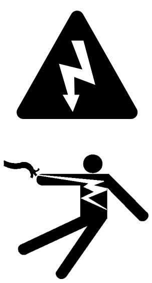
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

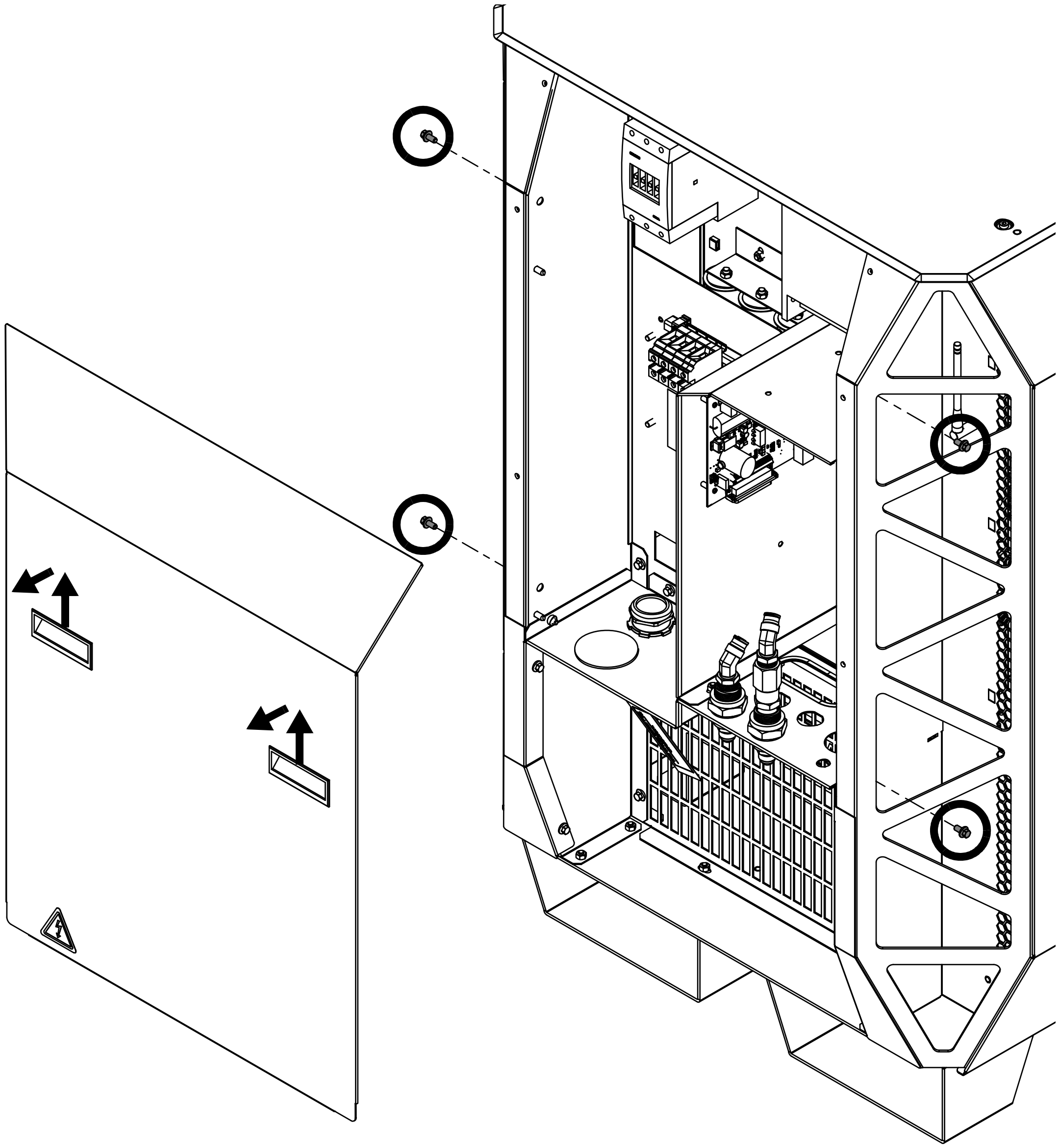
Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

Before you remove any panels:

- Make sure that all electric power is removed from the cutting system.

  Even if power is removed from the plasma power supply, you can still get a serious electric shock if the cutting system remains connected to an electric power source. Make sure that all electric power is removed before you start installation.

Figure 10 – Remove the rear panel from the plasma power supply



Removal of the rear panel is usually all that is necessary to complete the installation steps.

Figure 11 – Remove panels from the gas connect console

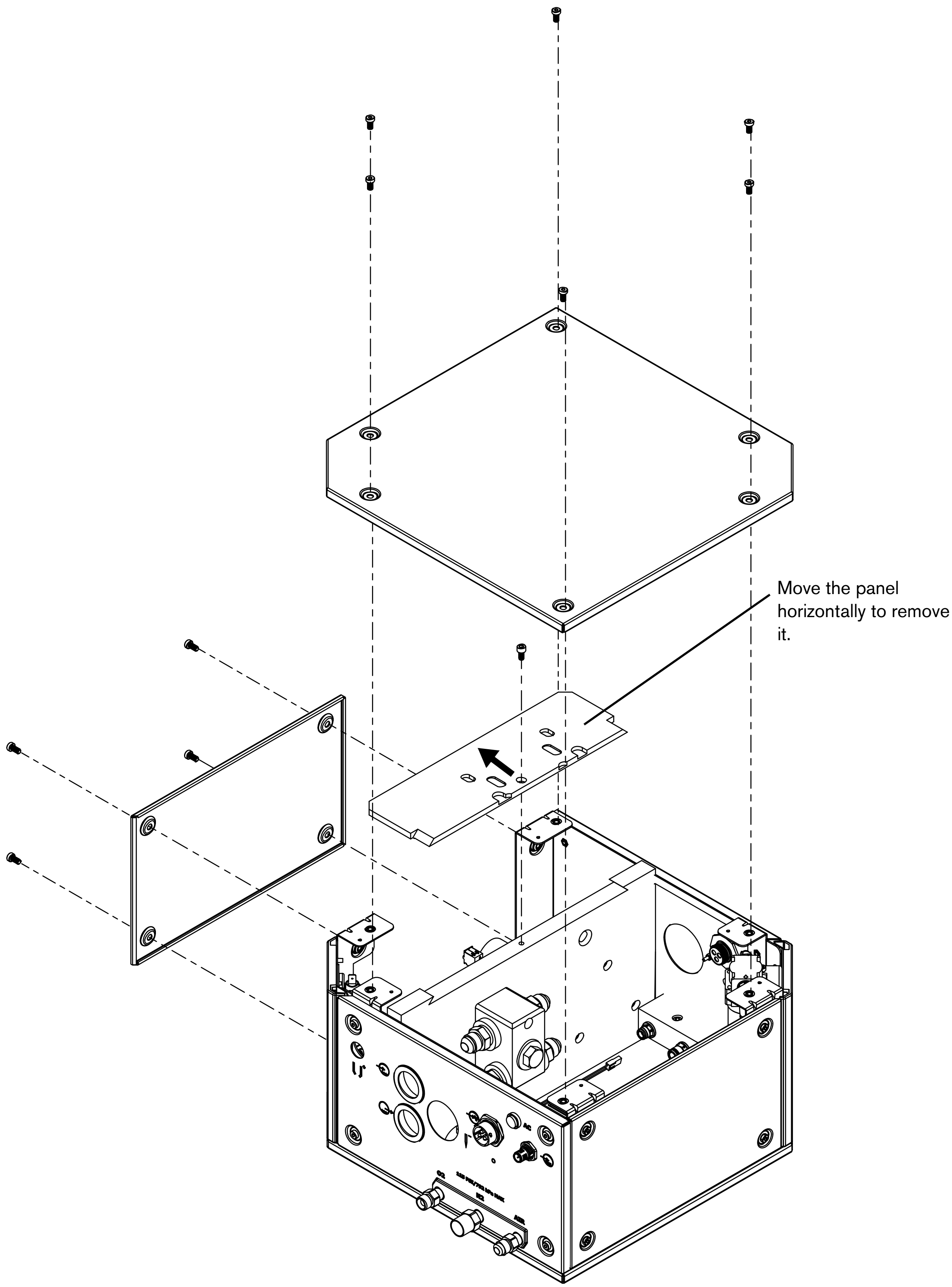
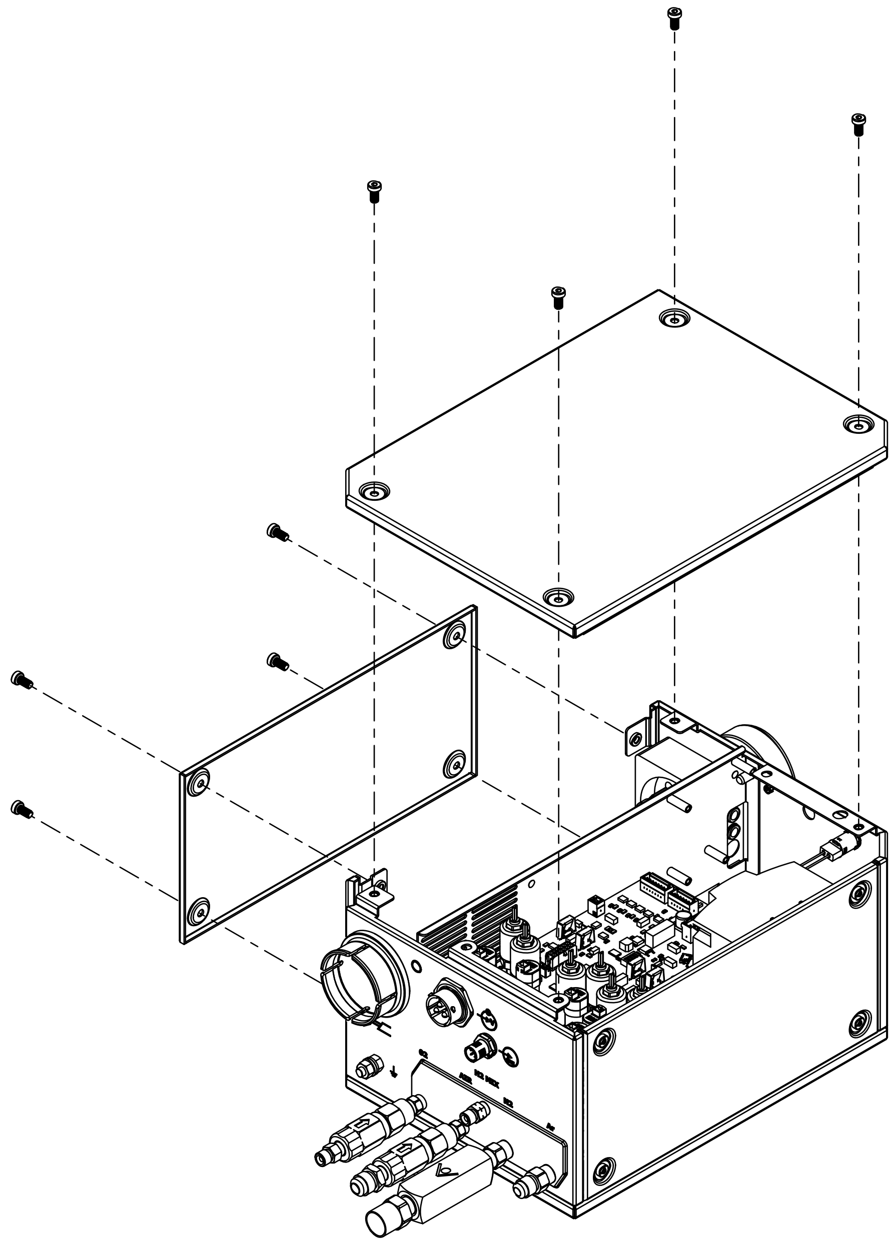


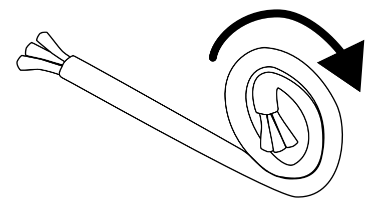
Figure 12 – Remove top and side panel from the torch connect console



How to identify and prepare the hoses, cables, and leads

Use the following drawings of hoses, cables, and leads to confirm their appearance.

- Use a hand-over-hand motion to uncoil the hoses, cables, and leads. As you uncoil each hose or lead, position the flat portion on the floor. Do **not** pull from one end to uncoil it. Pulling from one end to uncoil it can damage the hose, cable, or lead.



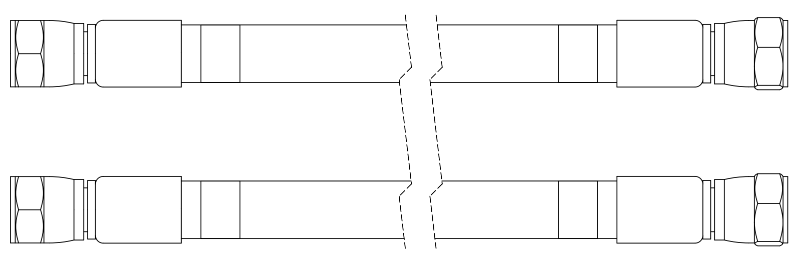
For more information about how to uncoil the hoses and leads, refer to the field service bulletin that accompanies them.

- Make sure that you have all of the necessary hoses, cables, and leads. New hoses, cables, and leads ship with a tag or label that has a part number.

Do **not** order or use cables or leads that are longer than necessary. If you coil a cable or lead because it is too long, electrical interference or EMI problems can occur. Electrical interference or EMI problems can have a negative effect on system performance.

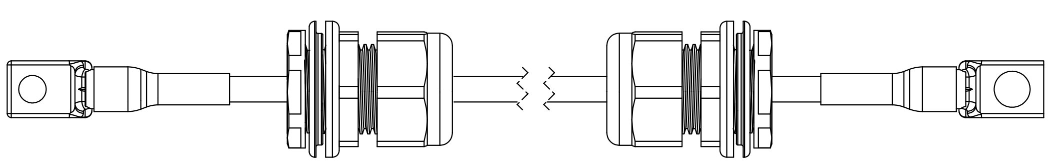
For part numbers and specifications, see the *Parts List* on page 353.

Coolant hose set

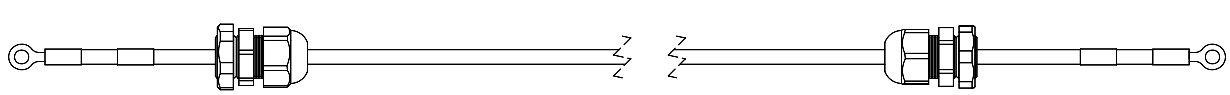


The coolant hose set includes 1 supply hose with green bands and 1 return hose with red bands.

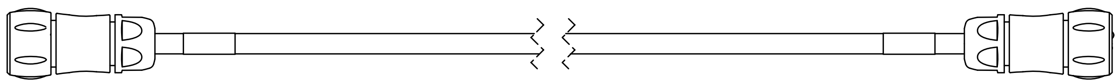
Negative lead with strain relief



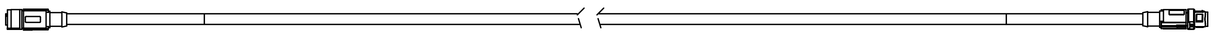
Pilot arc lead with strain relief



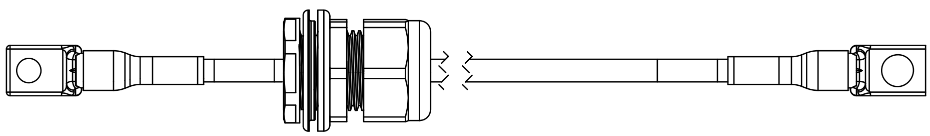
Power cable



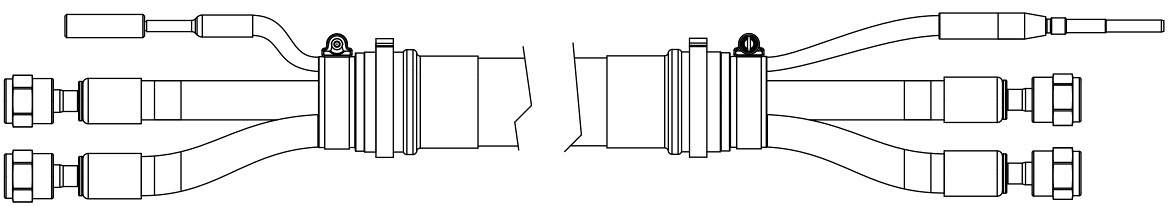
CAN cable



Work lead

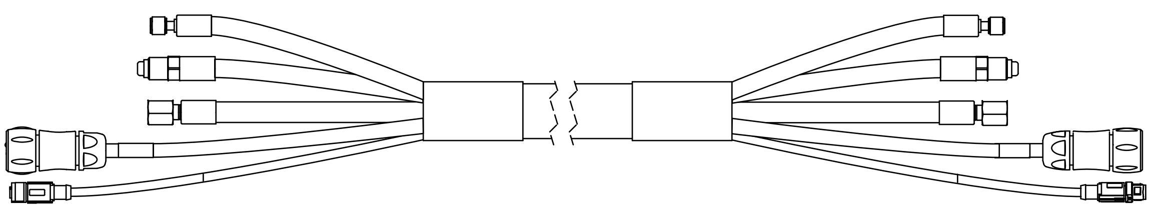


Pilot arc and coolant hose set assembly

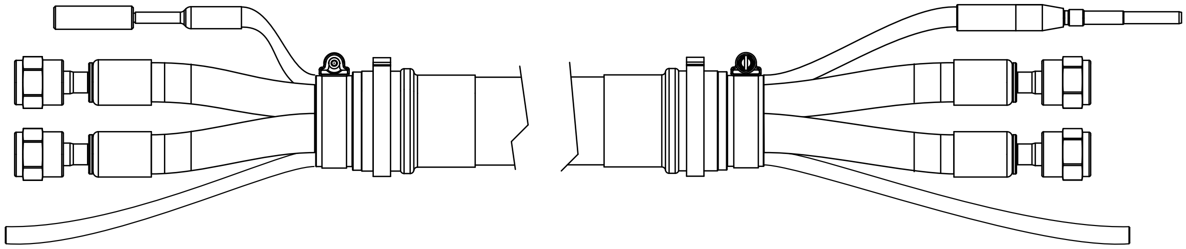


The coolant hose set includes 1 supply hose with green bands and 1 return hose with red bands.

Power, CAN, 3-gas assembly (only for Core)

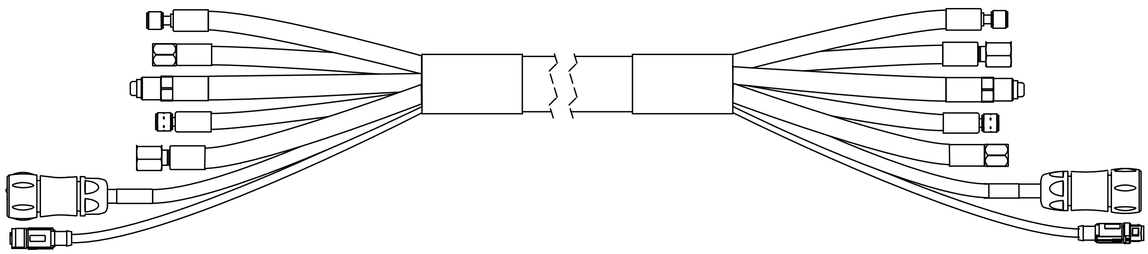


Pilot arc, coolant hose set, and shield water assembly (only for VWI and OptiMix)

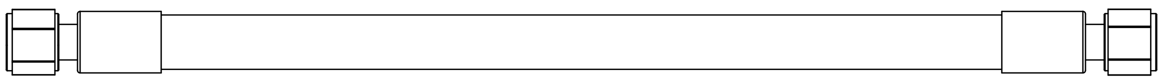


The coolant hose set includes 1 supply hose with green bands and 1 return hose with red bands.

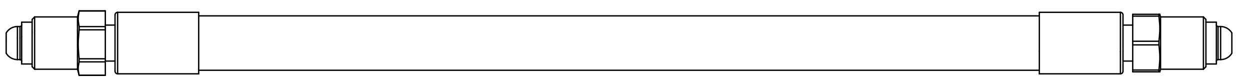
Power, CAN, and 5-gas assembly (only for VWI and OptiMix)



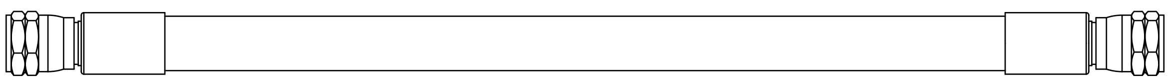
Oxygen hose (blue)



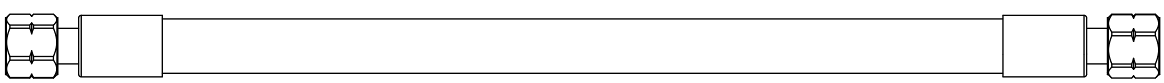
Nitrogen hose (black)



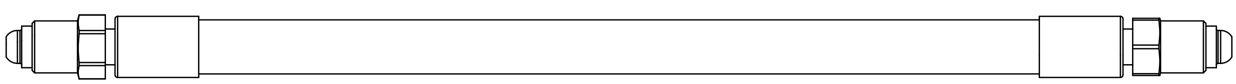
Air hose (black)



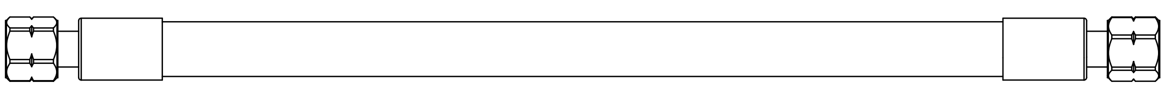
Hydrogen (OptiMix only) (red)



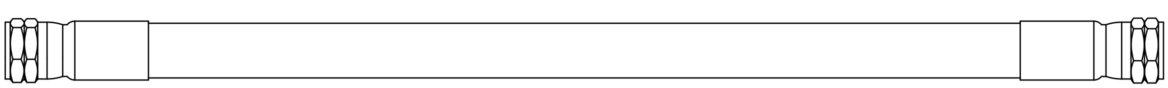
Argon (VWI or OptiMix only) (black)



F5 (VWI or OptiMix only) (red)



Shield water (VWI or OptiMix only) (blue)



How to connect the plasma power supply and gas connect console (Core, VWI, or OptiMix)

Label in the plasma power supply

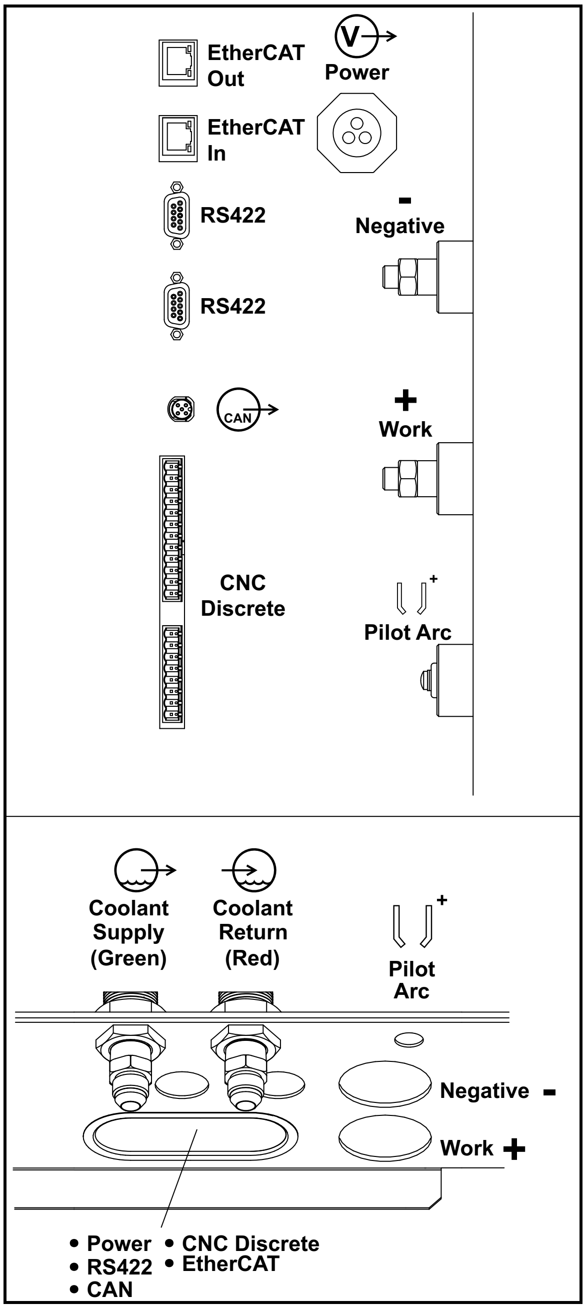
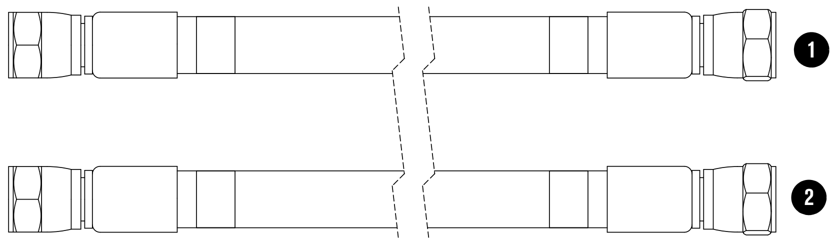


Table 17 – Definitions of symbols on the label

CAN	CAN
V	Power
-	Negative
+	Work
+	Pilot arc
	Coolant supply
	Coolant return

Connect the coolant hose set

Figure 13 – Coolant hose set



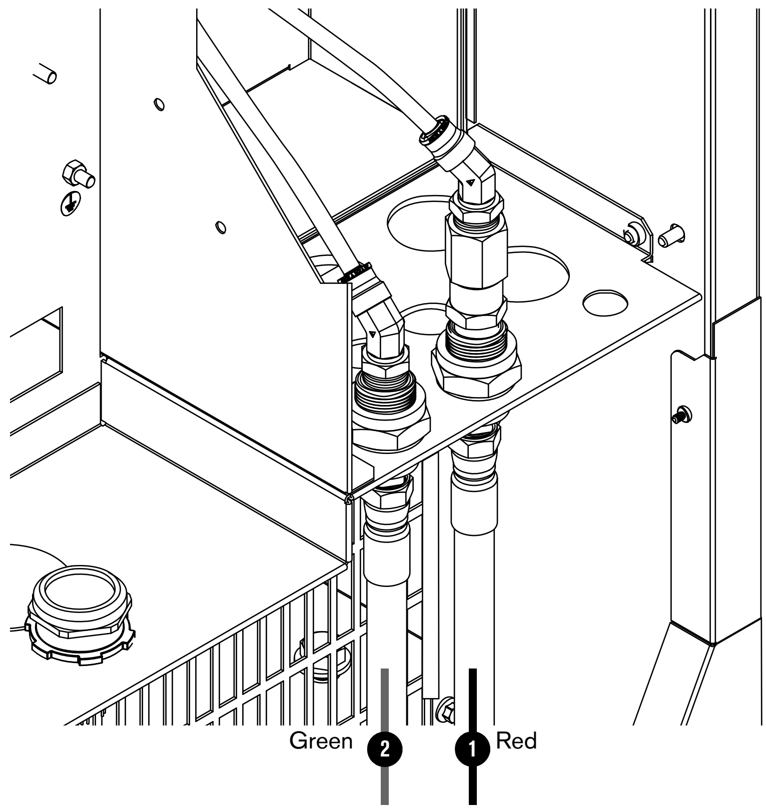
1 Coolant return hose (red band)

2 Coolant supply hose (green band)

For lengths, see *Coolant hose set* on page 386 of the *Parts List*.

Connect the coolant hose set to the plasma power supply:

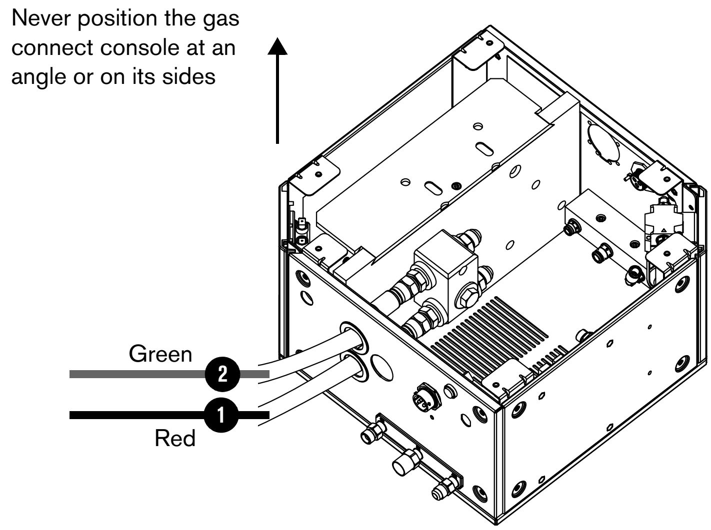
1. Connect the coolant return hose (red) to the coolant return fitting (red).
2. Connect the coolant supply hose (green) to the coolant supply fitting (green).



Connect the coolant hose set to the gas connect console:

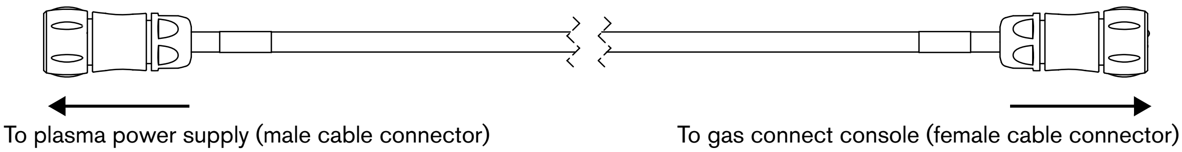
1. Connect the coolant return hose (red) to the coolant return fitting (red, bottom).

2. Connect the coolant supply hose (green) to the coolant supply fitting (green, top).



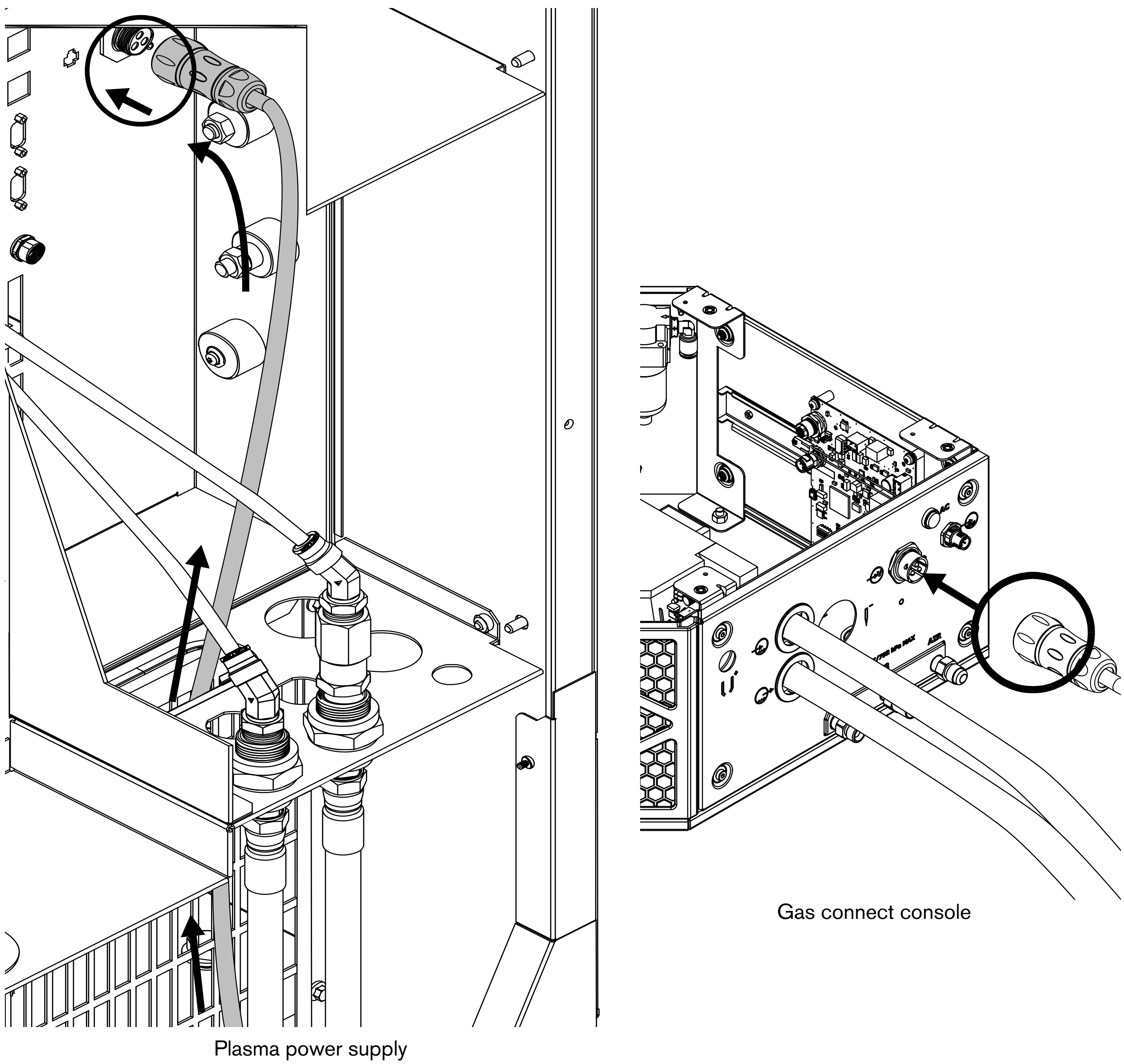
Connect the power cable

Figure 14 – Power cable



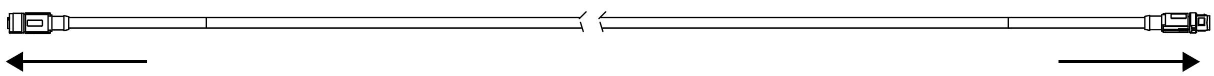
For lengths, see *Power cable* on page 386 of the *Parts List*.

Figure 15 – Connect the power cable



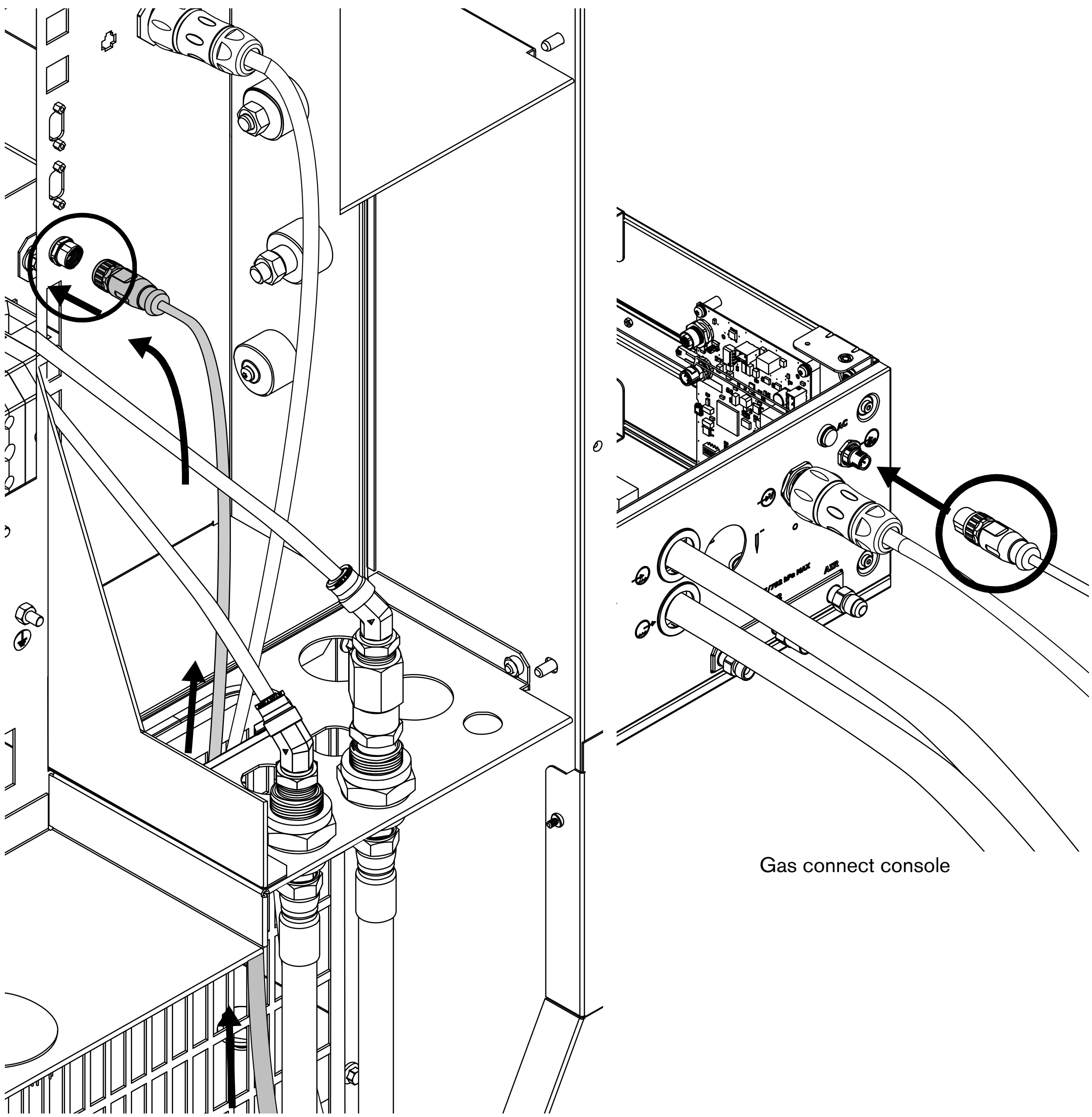
Connect the CAN cable

Figure 16 – CAN cable



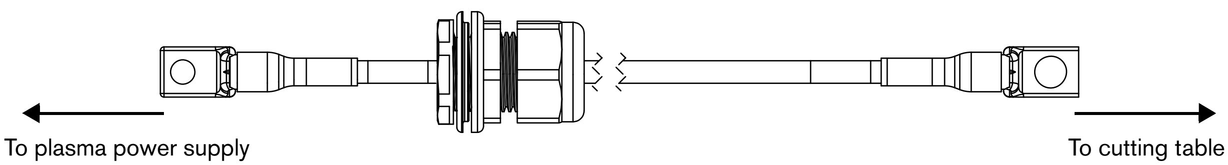
For lengths, see *CAN cable* on page 387 of the *Parts List*.

Figure 17 – Connect the CAN cable and finger-tighten



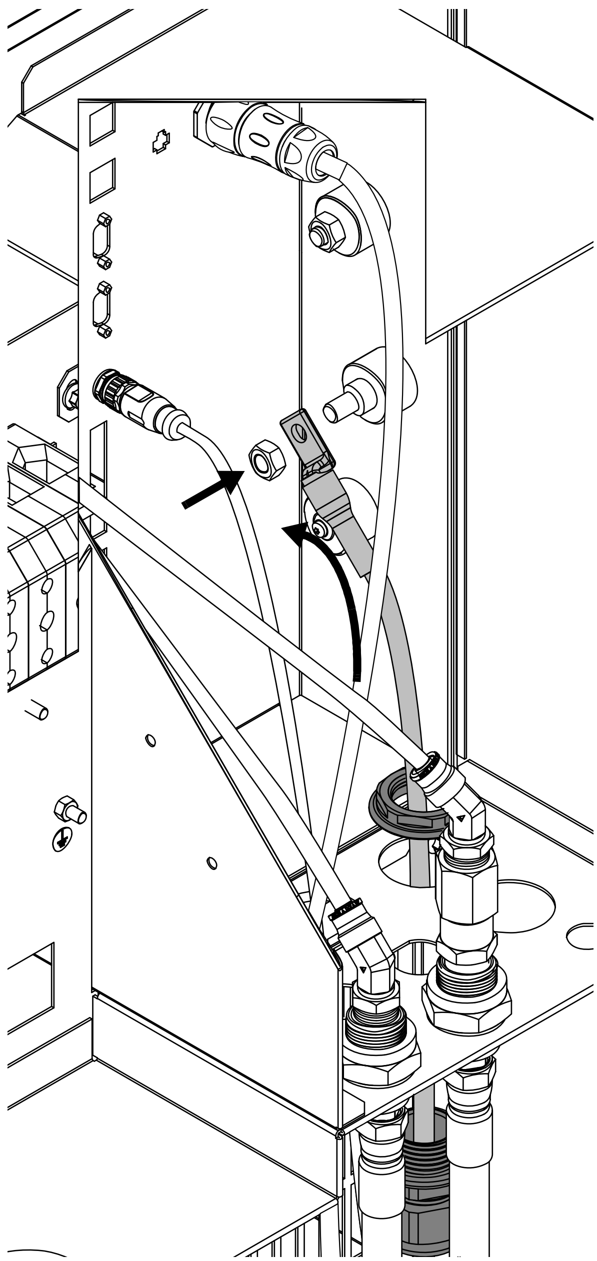
How to connect the work lead to the plasma power supply and cutting table

Figure 18 – Work lead



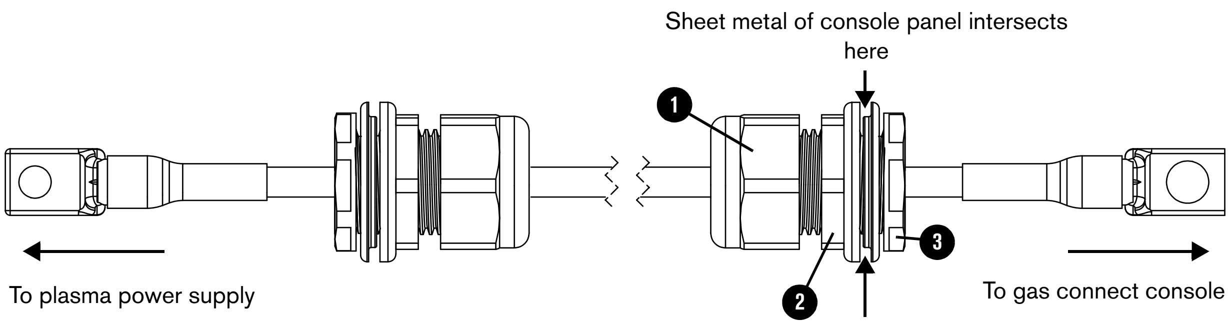
For lengths, see *Work lead* on page 390 of the *Parts List*.

Figure 19 – Connect the work lead to the plasma power supply (shown) and cutting table



Connect the negative lead with strain relief

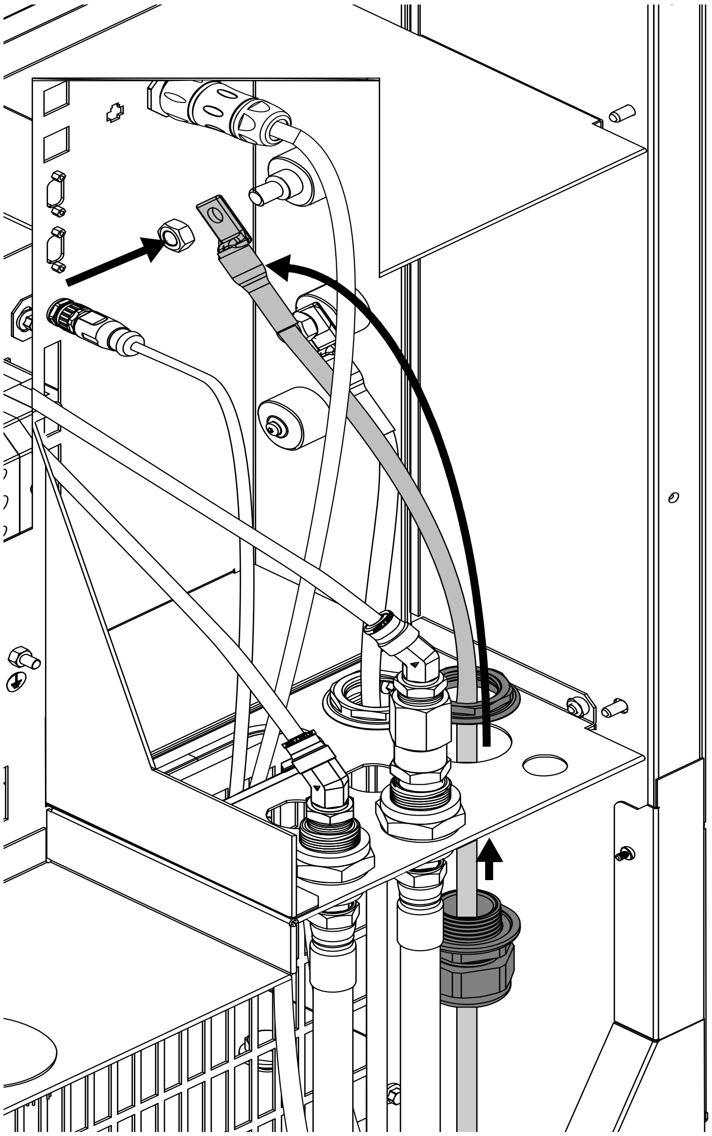
Figure 20 – Negative lead with strain relief



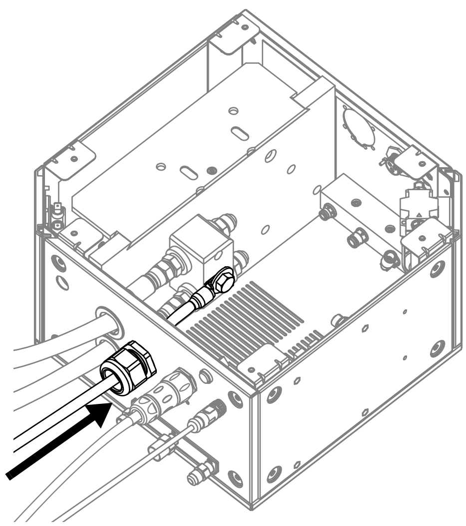
1. Put the outer nut ❶ and strain relief nut ❷ onto the negative lead.
2. Put the negative lead and strain relief nut through the hole in the gas connect console or plasma power supply.
3. Put the inner nut ❸ over the end of the lead.
4. Connect the gas connect console end of the lead to the coolant block, or connect the plasma power supply end of the lead to the negative (-) connector.
5. Tighten the inner nut ❸ onto the strain relief nut ❷.

For lengths, see *Negative lead with strain relief* on page 385 of the *Parts List*.

Figure 21 – Connect the negative lead with strain relief



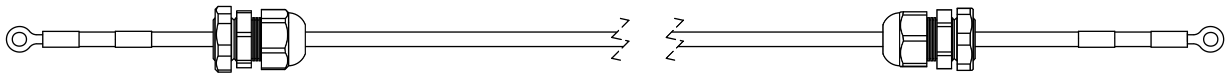
Plasma power supply



Gas connect console

Connect the pilot arc lead with strain relief

Figure 22 – Pilot arc lead with strain relief



For lengths, see *Pilot arc lead with strain relief* on page 385 of the *Parts List*.

Figure 23 – Connect the pilot arc lead with strain relief to the plasma power supply

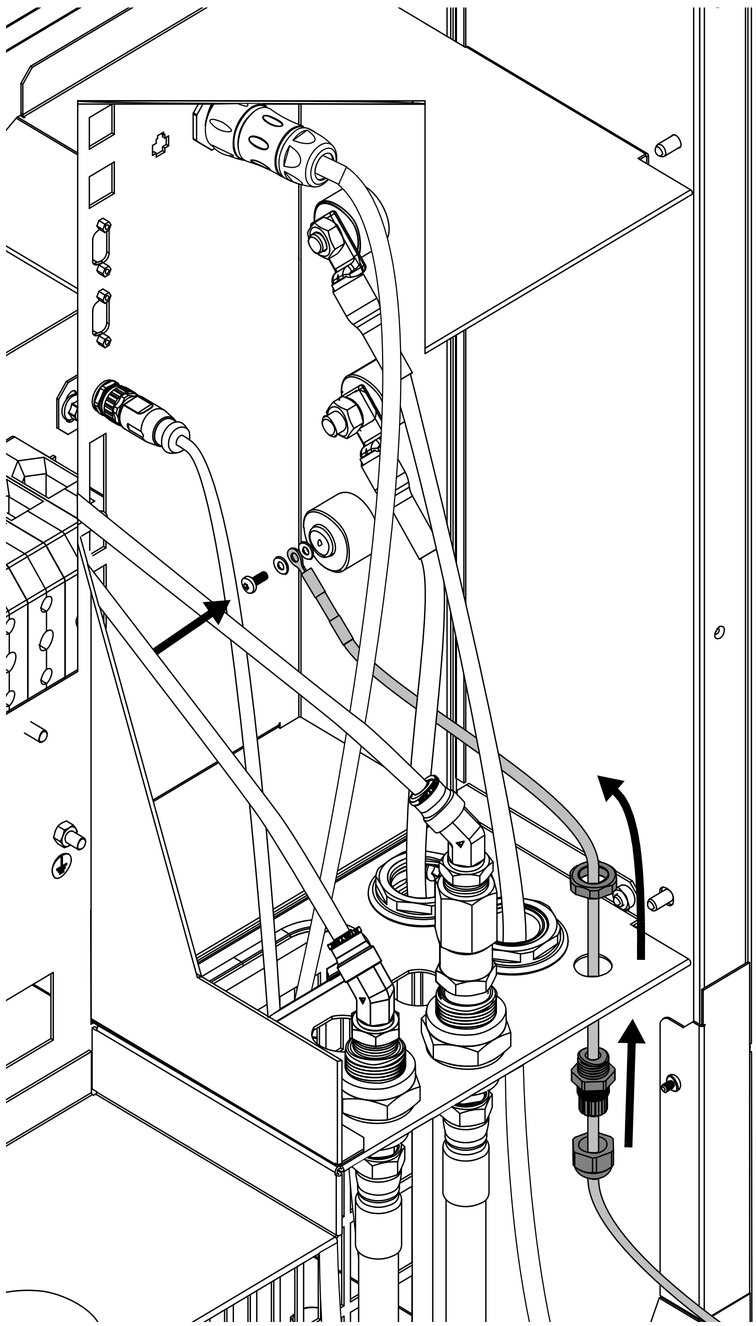
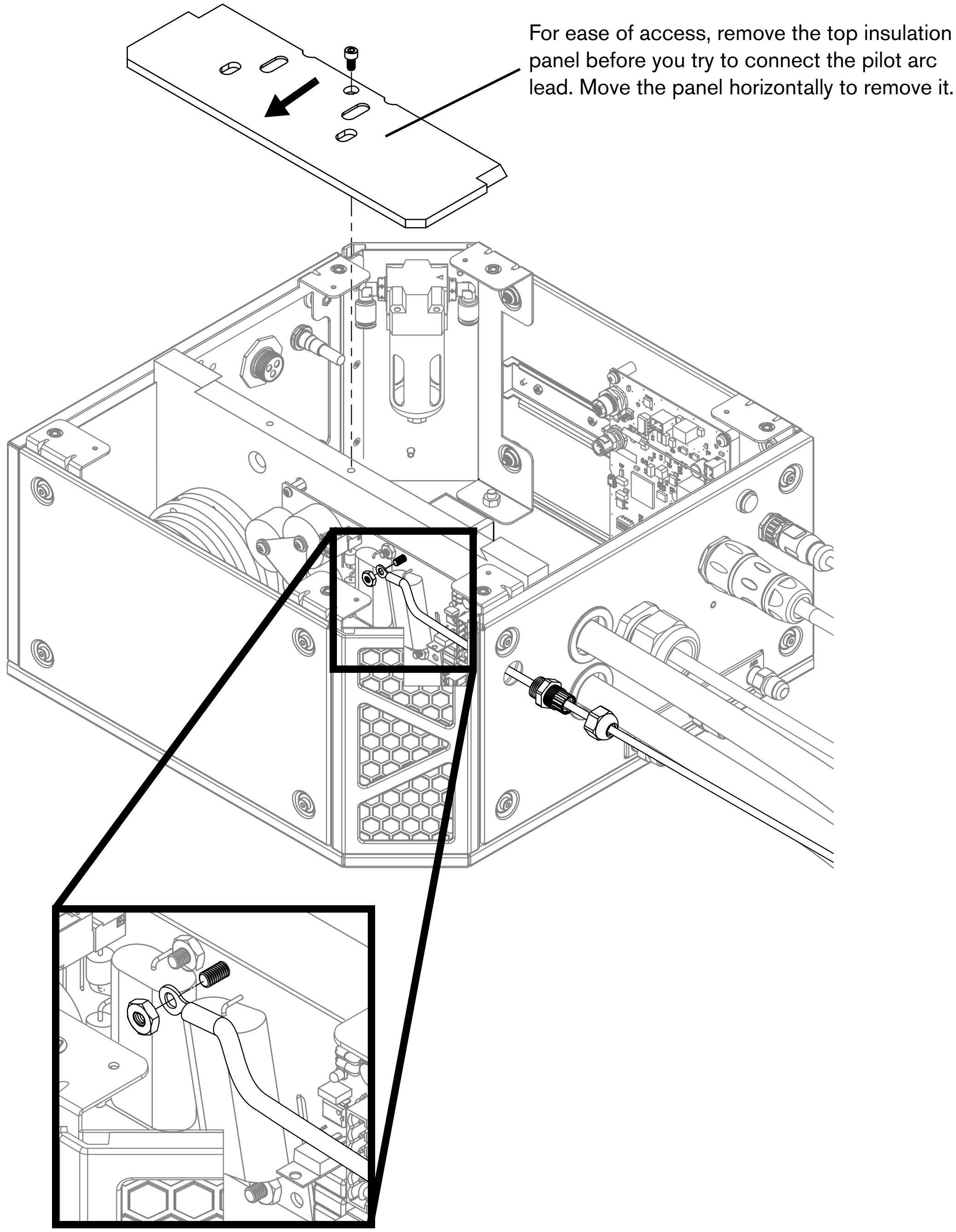


Figure 24 – Connect the pilot arc lead with strain relief to the gas connect console (Core, VWI, or OptiMix)



You do not need the strain relief nut. Remove the nut from the lead and tighten the strain relief into the panel on the gas connect console.

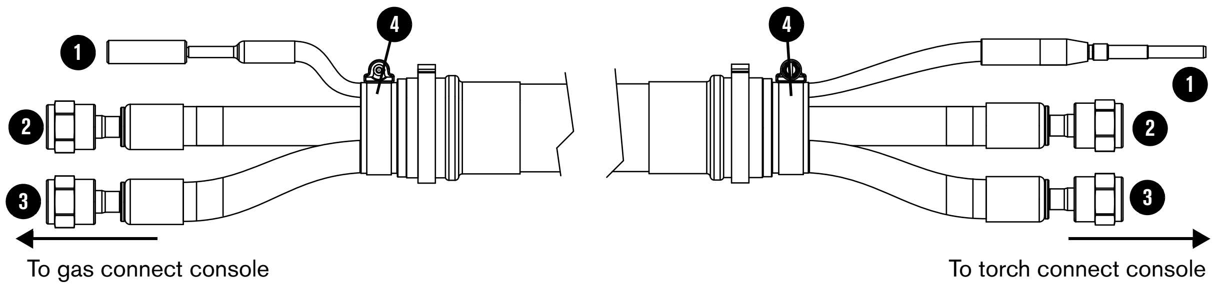
How to connect the gas connect console to the torch connect console

Connect the gas connect console (Core) to the TorchConnect console

- These installation steps are for the **Core** gas connect console.
- If you have a VWI or OptiMix gas connect console, see *Connect the gas connect console (VWI or OptiMix) to the TorchConnect console* on page 107.

Connect the pilot arc and coolant hose set assembly

Figure 25 – Pilot arc and coolant hose set assembly

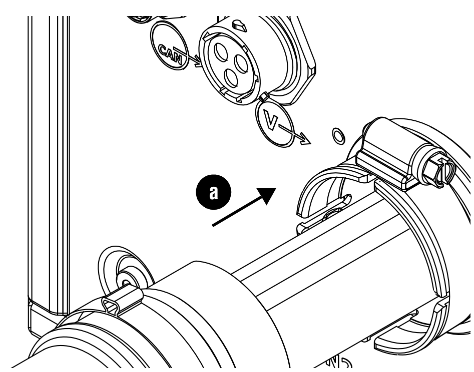


1 Pilot arc lead (yellow)
2 Coolant return hose (red band)
3 Coolant supply hose (green band)
4 Lead coupler

For lengths, see *Pilot arc and coolant hose set assembly (Core)* on page 387 of the *Parts List*.

1. Connect the lead assembly to the gas connect console:
   a. Put the hoses and lead through the hole in the gas connect console.

   These installation steps are for the **Core** gas connect console.



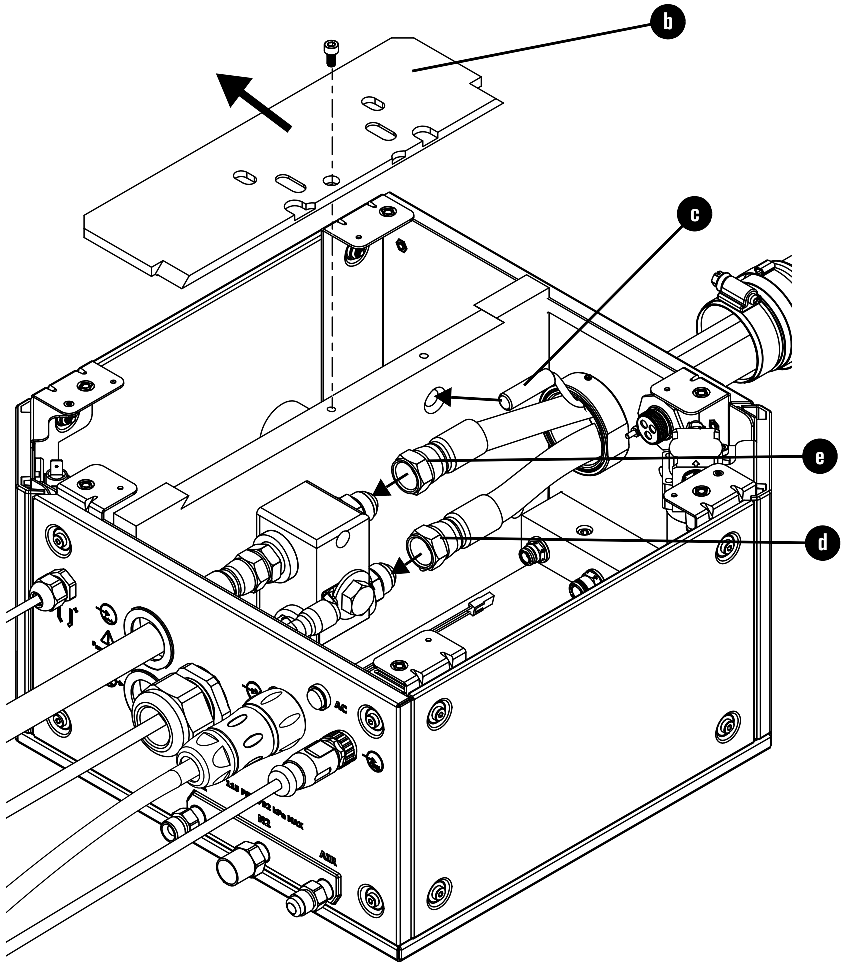
b. Remove the insulator panel.

> Move the panel horizontally to remove it.

c. Connect the pilot arc lead.

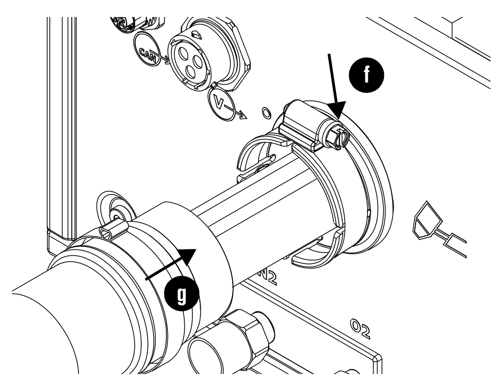
d. Connect the coolant return hose (red) to the coolant return fitting (red).

e. Connect the coolant supply hose (green) to the coolant supply fitting (green).



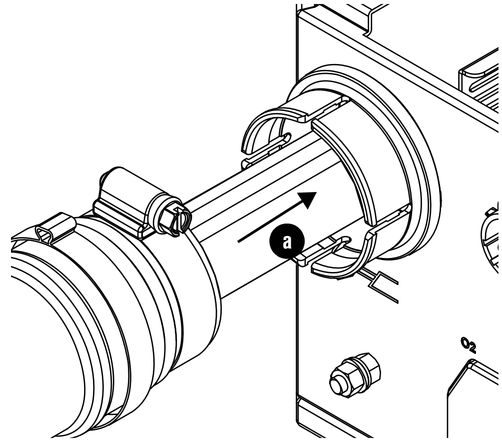
f. Remove the hose clamp from the lead and position it into the groove on the console collar.

g. Push the coupler into the console collar and tighten the clamp.



2. Connect the console-to-console coolant lead to the TorchConnect console:

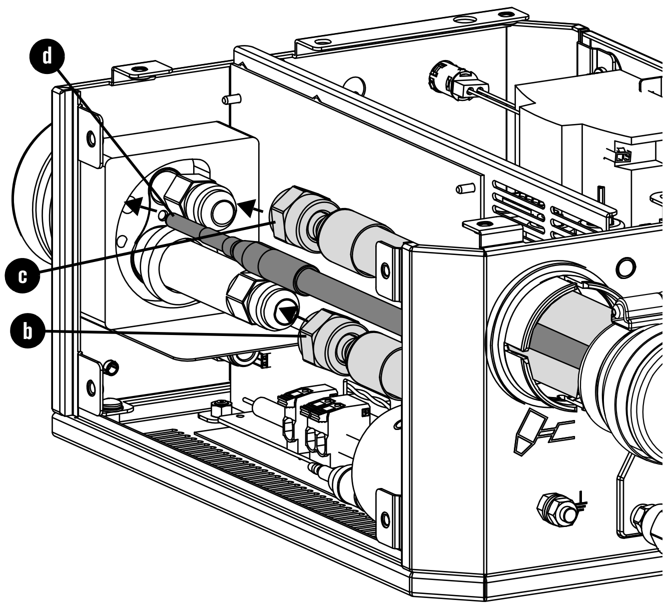
a. Put the hoses and lead through the hole in the TorchConnect console.



b. Connect the coolant return hose (red) to the coolant return fitting (red).

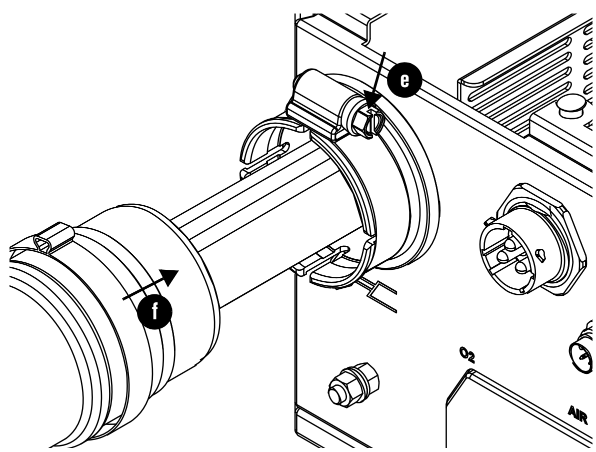
c. Connect the coolant supply hose (green) to the coolant supply fitting (green).

d. Connect the pilot arc lead.



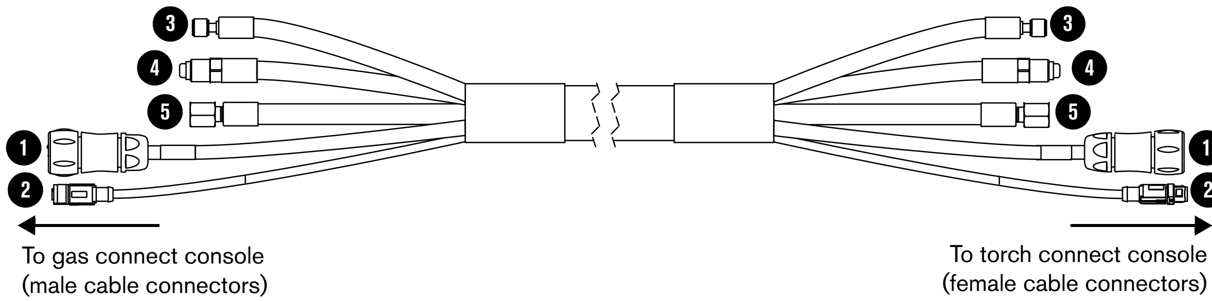
e. Remove the hose clamp from the lead and position it into the groove on the console collar.

f. Push the coupler into the console collar and tighten the clamp.



Connect the power, CAN, and 3-gas assembly (Core)

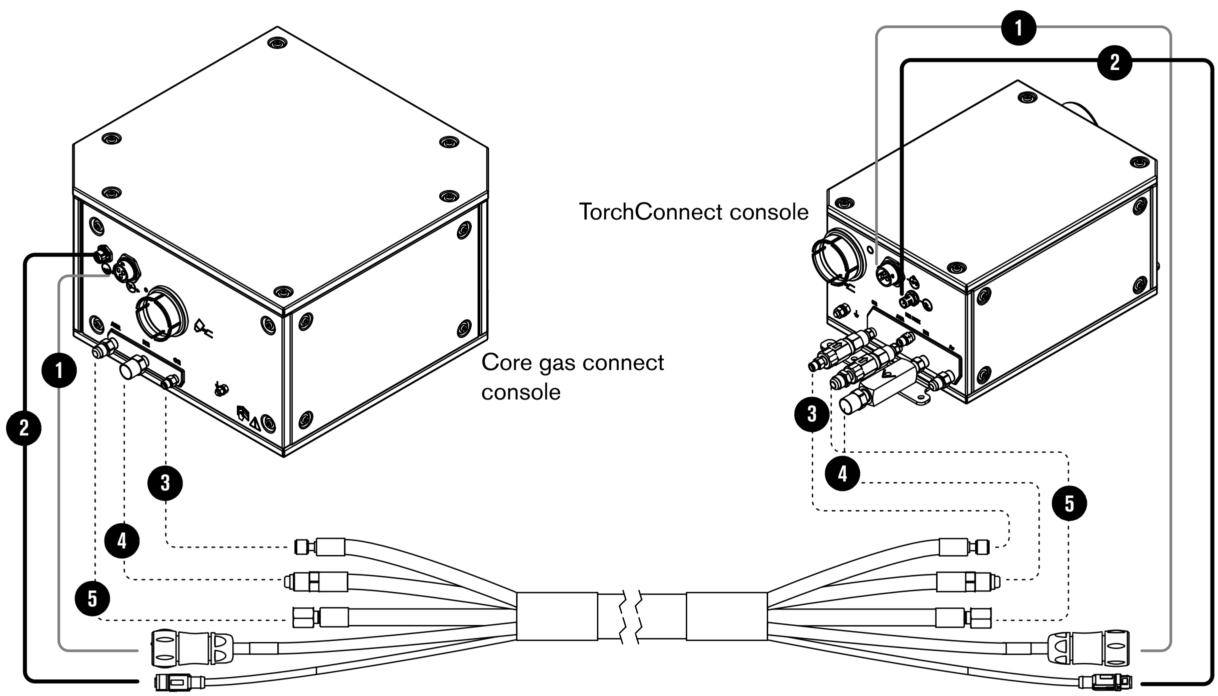
Figure 26 – Power cable, CAN cable, and 3-gas hose assembly



1 Power cable
2 CAN cable
3 Oxygen hose (blue)
4 Nitrogen hose (black)
5 Air hose (black)

For lengths, see *Power, CAN, and 3-gas assembly (Core)* on page 387 of the *Parts List*.

Figure 27

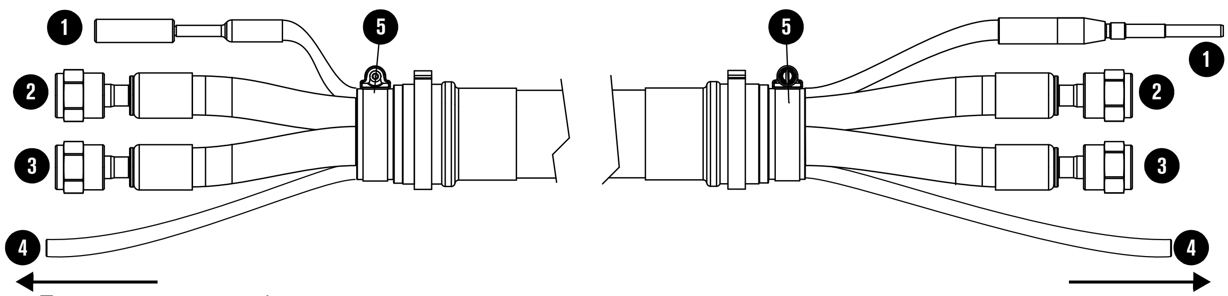


Connect the gas connect console (VWI or OptiMix) to the TorchConnect console

- These installation steps are for the **VWI or OptiMix** gas connect console.
- If you have a Core gas connect console, see *Connect the gas connect console (Core) to the TorchConnect console* on page 103.

Connect the pilot arc, coolant hose set, and shield water assembly

Figure 28 – Pilot arc, coolant hose set, and shield water assembly



1 Pilot arc lead (yellow)

2 Coolant return hose (red band)

3 Coolant supply hose (green band)

4 Shield water hose

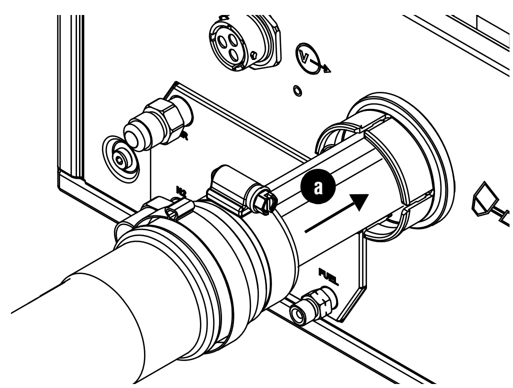
5 Lead coupler

For lengths, see *Pilot arc, coolant hose set, and shield water assembly (VWI or OptiMix)* on page 388 of the *Parts List*.

1. Connect the lead assembly to the gas connect console:

   a. Put the hoses and lead through the hole in the gas connect console.

   These installation steps are for the **VWI or OptiMix** gas connect console.



b. Remove the insulator panel.

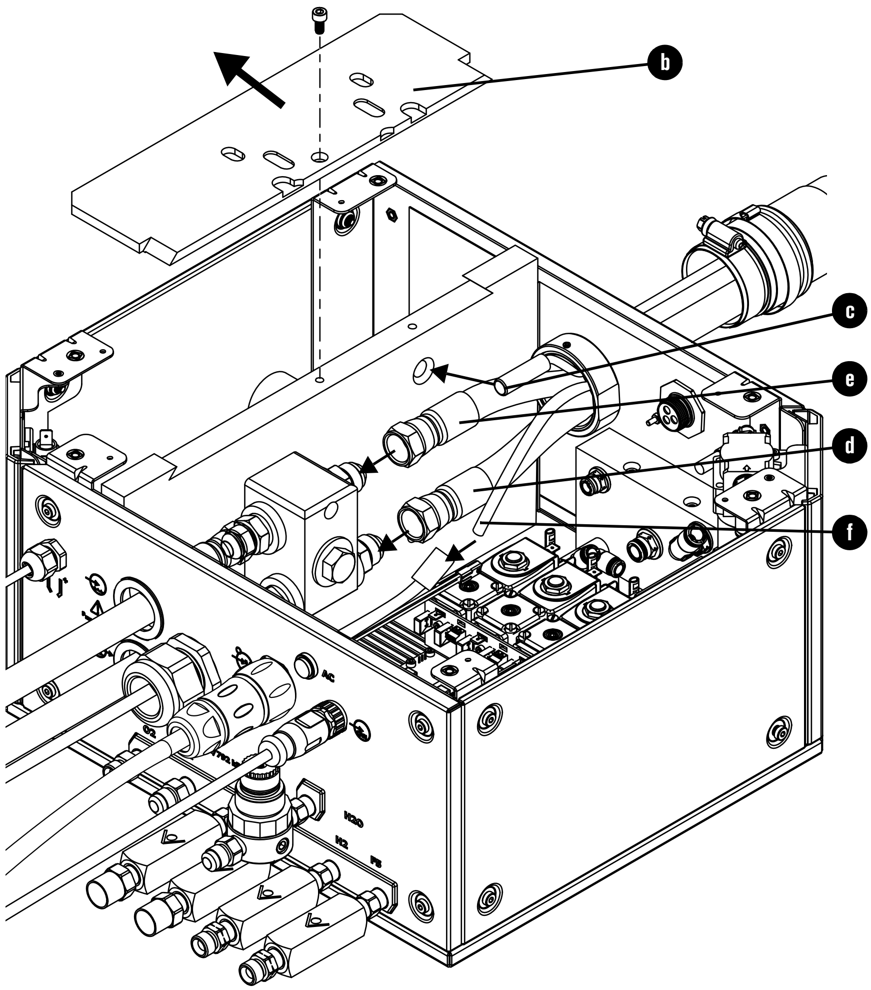
> Move the panel horizontally to remove it.

c. Connect the pilot arc lead.

d. Connect the coolant return hose (red) to the coolant return fitting (red).

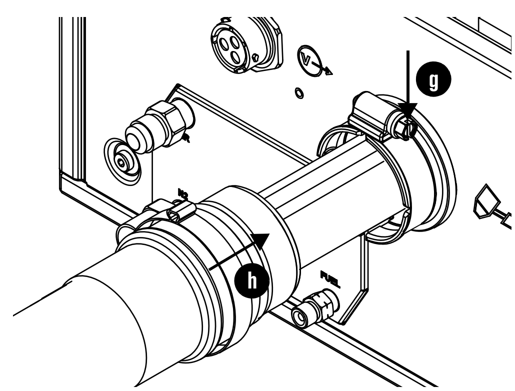
e. Connect the coolant supply hose (green) to the coolant supply fitting (green).

f. Connect the water hose inside of the VWI or OptiMix console.



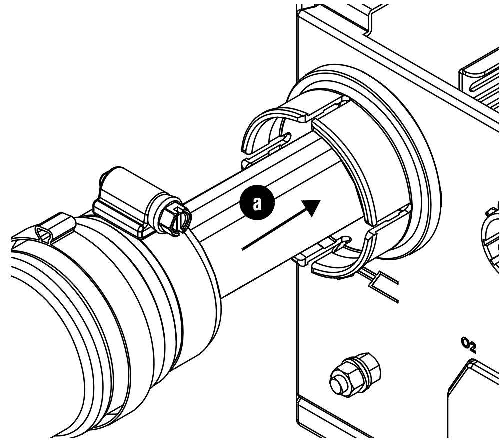
g. Remove the hose clamp from the lead and position it into the groove on the console collar.

h. Push the coupler into the console collar and tighten the clamp.



2. Connect the lead assembly to the TorchConnect console:

   a. Put the hoses and lead through the hole in the TorchConnect console.

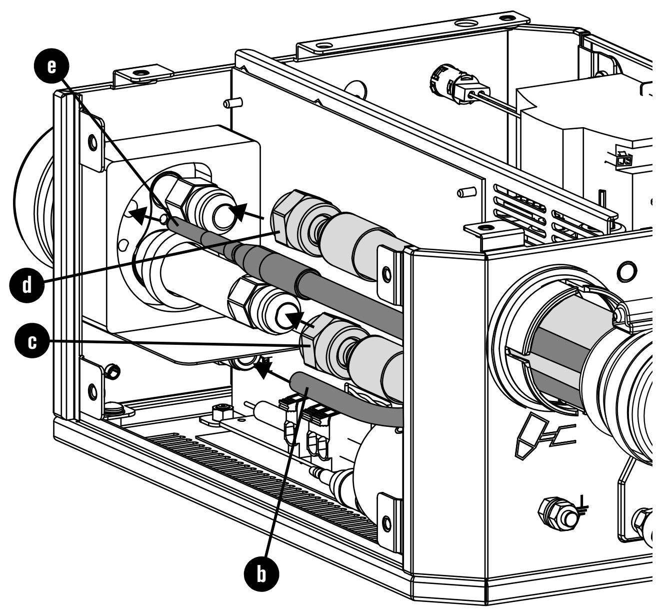


   b. Push the water hose into the connector until it stops, approximately 13 mm (0.5 inch).

   c. Connect the coolant return hose (red) to the coolant return fitting (red).

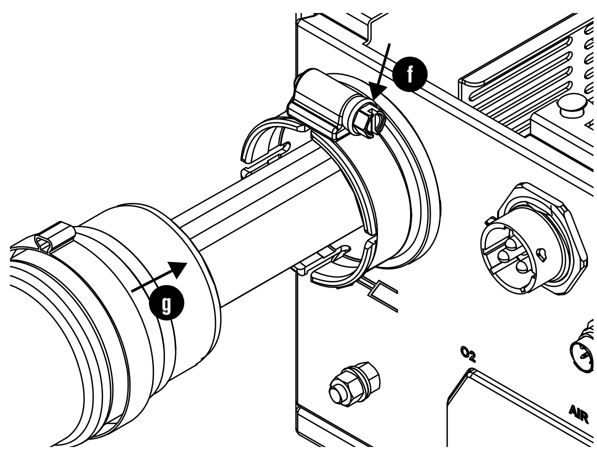
   d. Connect the coolant supply hose (green) to the coolant supply fitting (green).

   e. Connect the pilot arc lead.



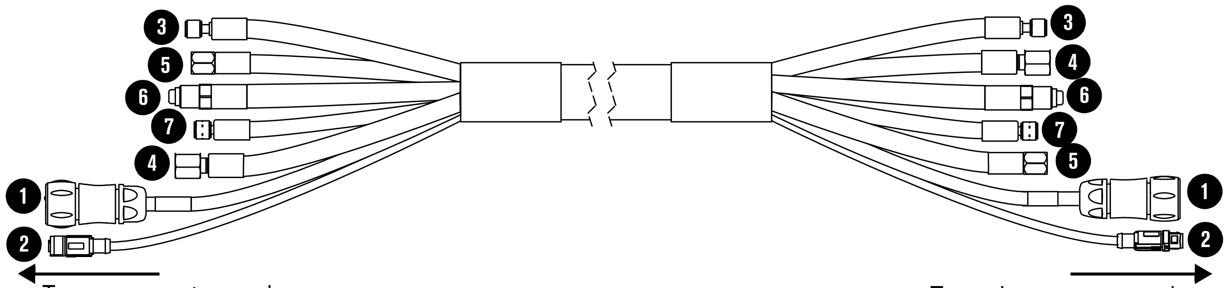
   f. Remove the hose clamp from the lead and position it into the groove on the console collar.

   g. Push the coupler into the console collar and tighten the clamp.



Connect the power, CAN, and 5-gas assembly

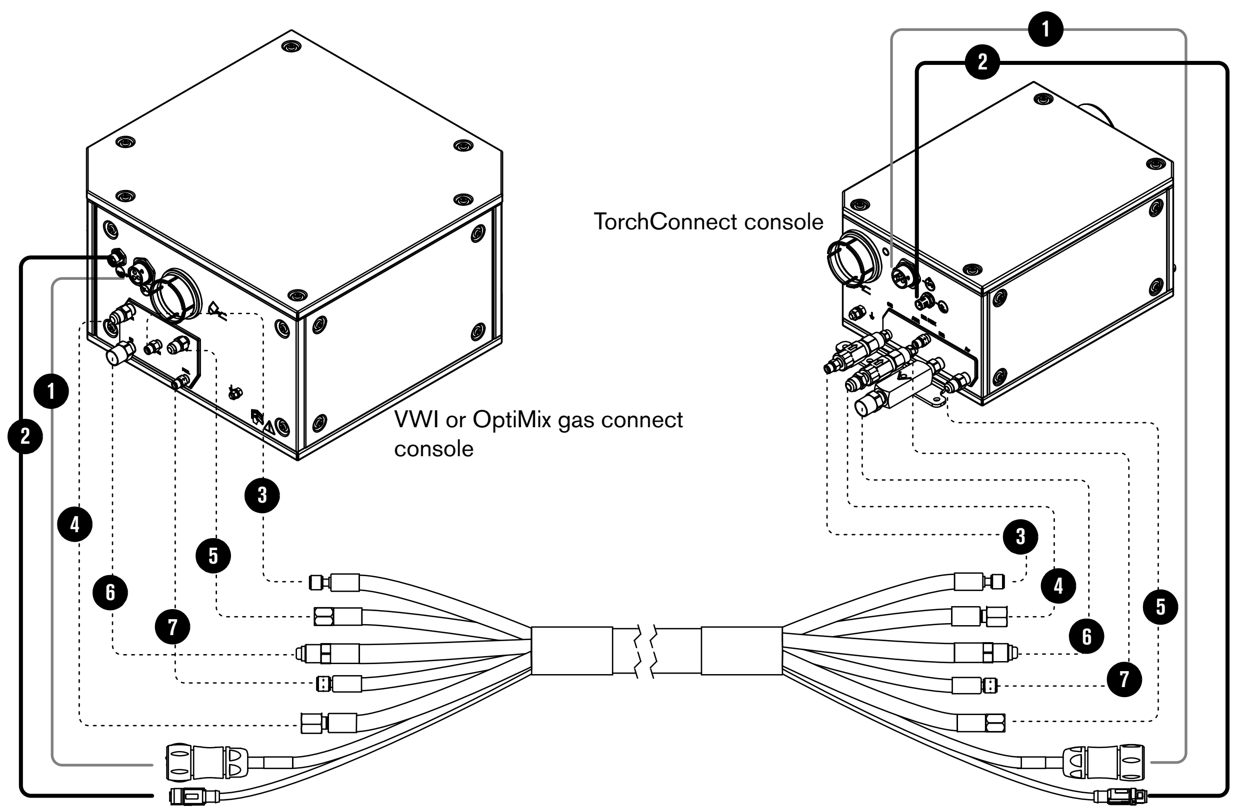
Figure 29 – Power cable, CAN cable, and 5-gas hose assembly



1 Power cable
2 CAN cable
3 Oxygen (blue)
4 Air hose (black)
5 Argon hose (black)
6 Nitrogen hose (black)
7 H_2-mix or F5 hose (red)

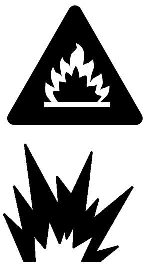
For lengths, see *Power, CAN, and 5-gas assembly (VWI or OptiMix)* on page 388 of the *Parts List*.

Figure 30



How to install and connect the supply gases

WARNING

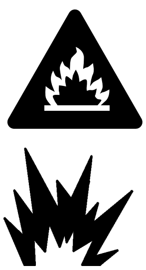


If you use oxygen as the plasma gas for cutting, it can cause a potential fire hazard due to the oxygen-enriched atmosphere that collects.

Hypertherm recommends that you install an exhaust ventilation system to remove the oxygen-enriched atmosphere that can collect when oxygen is used as the plasma gas for cutting.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the flashback arrestors for your cutting system. You can get them from your cutting machine supplier.



Hydrogen is a flammable gas that presents an explosion hazard. Keep flames away from cylinders and hoses that contain hydrogen. Keep flames and sparks away from the torch when using hydrogen as a plasma gas.

Consult your local safety, fire, and building code requirements for the storage and use of hydrogen.

Hypertherm recommends that you install an exhaust ventilation system to remove the hydrogen-enriched atmosphere that can collect when hydrogen is used as the plasma gas for cutting.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

CAUTION

All hoses, hose connections, and hose fittings used for supply gas plumbing must be designed for use with the appropriate gas and pressure rating. Other hoses, hose connections, or hose fittings can crack or leak.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Any replacement hose, connection, or fitting must satisfy all applicable regulations and codes.

Non-compliant hoses, hose connections, or hose fittings can crack or leak.

If you replace any fittings on the consoles, or if you use the wrong fittings, it can cause the internal valves to malfunction because contaminants can get into the valves.

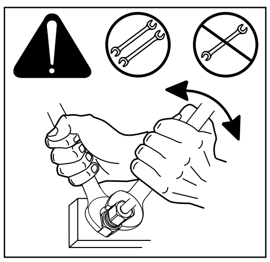
You must supply the following items for your cutting system:

- High-quality gas regulators (See *Regulators for supply gases* on page 40 and *Figure 31* on page 116.)
- Supply gas plumbing (See *Plumbing for supply gases* on page 38.)
- Supply gases (See *Process gas requirements (Core, VWI, and OptiMix gas connect consoles)* on page 36.)

Make sure that the gas regulators, supply gas plumbing, and supply gases that you choose satisfy all minimum requirements. (See *Process gas requirements (Core, VWI, and OptiMix gas connect consoles)* on page 36.)

Use the torque specifications in *Table 18* when you tighten any gas supply fittings.

Table 18 – Torque specifications

	**Torque Specifications**			
	Gas or water hose size	**N∙m**	**in∙lbf**	**ft∙lbf**
	Up to 10 mm (3/8 inch)	8.5 – 9.5	75 – 84	6.25 – 7
	12 mm (1/2 inch)	16.3 – 19.0	144 – 168	12 – 14
	25 mm (1 inch)	54.2 – 88.1	480 – 780	40 – 65

Install gas regulators

You must install the gas regulators **before** the supply gas plumbing. For installation steps, see the instruction manual that came with the gas regulator.

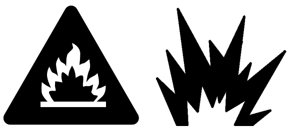
For the best results, position a gas regulator within 3 meters (10 feet) of the gas connect console. If your supply gas is positioned more than 3 meters (10 feet) from the gas connect console, Hypertherm recommends a 2-stage gas regulator configuration.

See *Regulators for supply gases* on page 40 for guidance about how to choose the best gas regulator (regulators) for your cutting system.

After installation is complete, pressurize the entire system and look for gas leaks. Your system installer or a licensed plumber can do this for you.

Connect supply gases to the gas connect console (Core)

WARNING



Never remove a check valve.

An explosion can occur if the cutting system is operated without check valves.

NOTICE

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

CAUTION

All hoses, hose connections, and hose fittings used for supply gas plumbing must be designed for use with the appropriate gas and pressure rating. Other hoses, hose connections, or hose fittings can crack or leak.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Any replacement hose, connection, or fitting must satisfy all applicable regulations and codes.

Non-compliant hoses, hose connections, or hose fittings can crack or leak.

If you replace any fittings on the consoles, or if you use the wrong fittings, it can cause the internal valves to malfunction because contaminants can get into the valves.

CAUTION

Do not alter or replace the supply gas fittings on the gas connect console.

If you alter or replace the fittings, it can cause the internal valves to malfunction if particulates get into the valves.

NOTICE

Some air compressors use synthetic lubricants that contain esters. Esters will damage the polycarbonates in the air filter bowl.

⚠ NOTICE

Gas leaks or pressure and flow rates that are outside of recommended ranges can:

- Cause problems with system performance
- Result in bad cut quality
- Shorten the life of consumables

If the quality of the gas is bad or if the pressure setting is incorrect, it can decrease:

- Cut quality
- Cut speed
- Cut thickness capabilities

- These installation steps are for the **Core** gas connect console.
- If you have a VWI or OptiMix gas connect console, see *Connect supply gases and shield water to the gas connect console (VWI or OptiMix)* on page 117.

Hypertherm recommends an internal diameter of 10 mm (0.375 inch) for supply gas hoses that are 76 m (250 feet) or less. Make sure that you have the correct supply gas hoses before you connect them. See *How to identify and prepare the hoses, cables, and leads* on page 90. *Table 19* describes the recommended sizes for gas fittings.

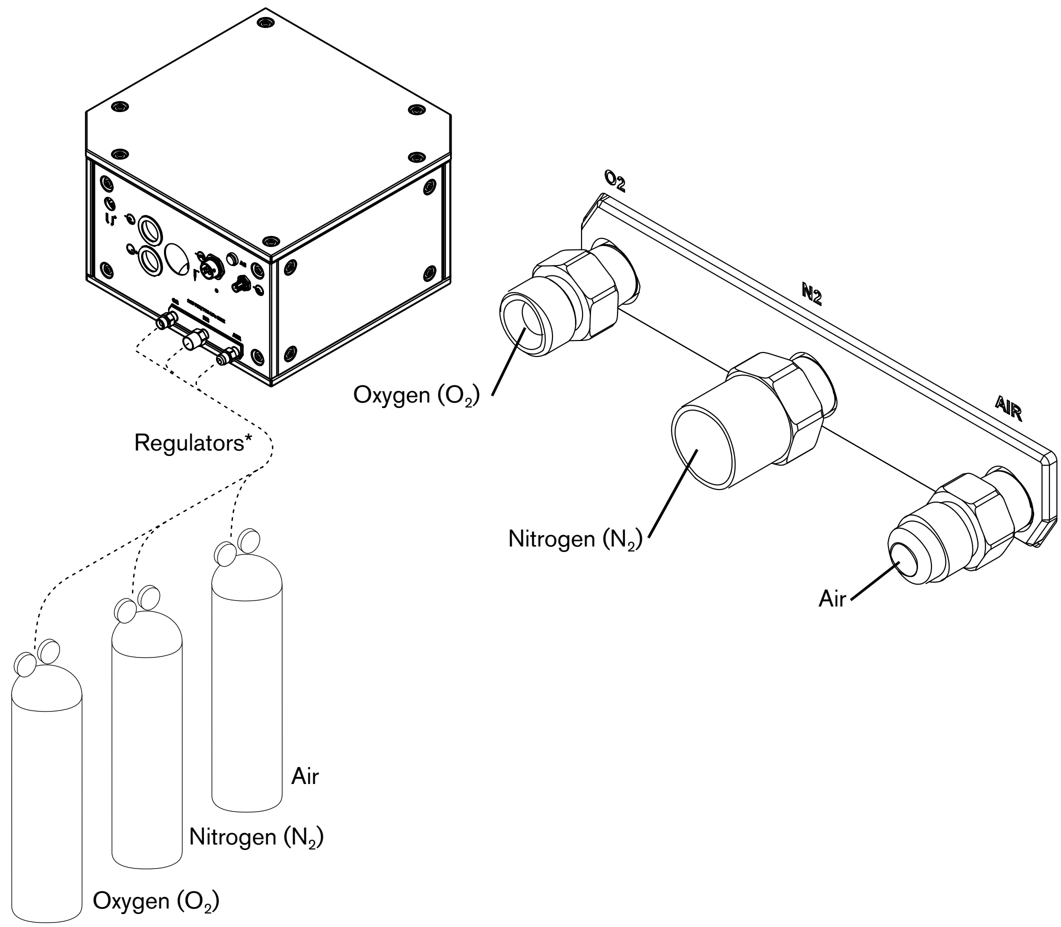
Table 19 – Recommended sizes for gas fittings

Fitting type	Size
N_2 / Ar	5/8 inch – 18 RH, internal (inert gas) “B”
Air	9/16 inch – 19, JIC #6
F5 / H_2	9/16 inch – 18, LH (fuel gas) “B”
O_2	9/16 inch – RH (oxygen)

To decrease the risk of leaks in the system, make sure to tighten all connections to the torque specifications in *Table 18* on page 112.

After installation is complete, pressurize the entire system and look for gas leaks. A licensed plumber can do this for you.

Figure 31 – Connect the supply gas plumbing and gases to the Core gas connect console



* For the best results, position a gas regulator within 3 meters (10 feet) of the gas connect console. If your supply gas is positioned more than 3 meters (10 feet) away from the gas connect console, Hypertherm recommends a 2-stage configuration: 1) Use single-stage regulator for high pressure at the source and 2) use a second regulator for normal pressure at the 3 meter (10 feet) location.

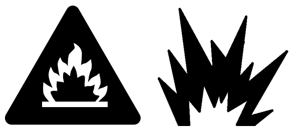
CAUTION

Cutting system performance can be bad if a supply gas hose is connected to the wrong port on a gas connect console.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Connect supply gases and shield water to the gas connect console (VWI or OptiMix)

WARNING



Never remove a check valve.

An explosion can occur if the cutting system is operated without check valves.

NOTICE

Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

CAUTION

All hoses, hose connections, and hose fittings used for supply gas plumbing must be designed for use with the appropriate gas and pressure rating. Other hoses, hose connections, or hose fittings can crack or leak.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Any replacement hose, connection, or fitting must satisfy all applicable regulations and codes.

Non-compliant hoses, hose connections, or hose fittings can crack or leak.

If you replace any fittings on the consoles, or if you use the wrong fittings, it can cause the internal valves to malfunction because contaminants can get into the valves.

CAUTION

Do not alter or replace the supply gas fittings on the gas connect console.

If you alter or replace the fittings, it can cause the internal valves to malfunction if particulates get into the valves.

NOTICE

Some air compressors use synthetic lubricants that contain esters. Esters will damage the polycarbonates in the air filter bowl.

⚠ NOTICE

Gas leaks or pressure and flow rates that are outside of recommended ranges can:

- Cause problems with system performance
- Result in bad cut quality
- Shorten the life of consumables

If the quality of the gas is bad or if the pressure setting is incorrect, it can decrease:

- Cut quality
- Cut speed
- Cut thickness capabilities

- These installation steps are for the **VWI or OptiMix** gas connect console.
- If you have a Core gas connect console, see *Connect supply gases to the gas connect console (Core)* on page 114.

Hypertherm recommends an internal diameter of 10 mm (0.375 inch) for supply gas hoses that are 76 m (250 feet) or less. Make sure that you have the correct supply gas hoses before you connect them. See *How to identify and prepare the hoses, cables, and leads* on page 90. *Table 20* describes the recommended sizes for gas fittings.

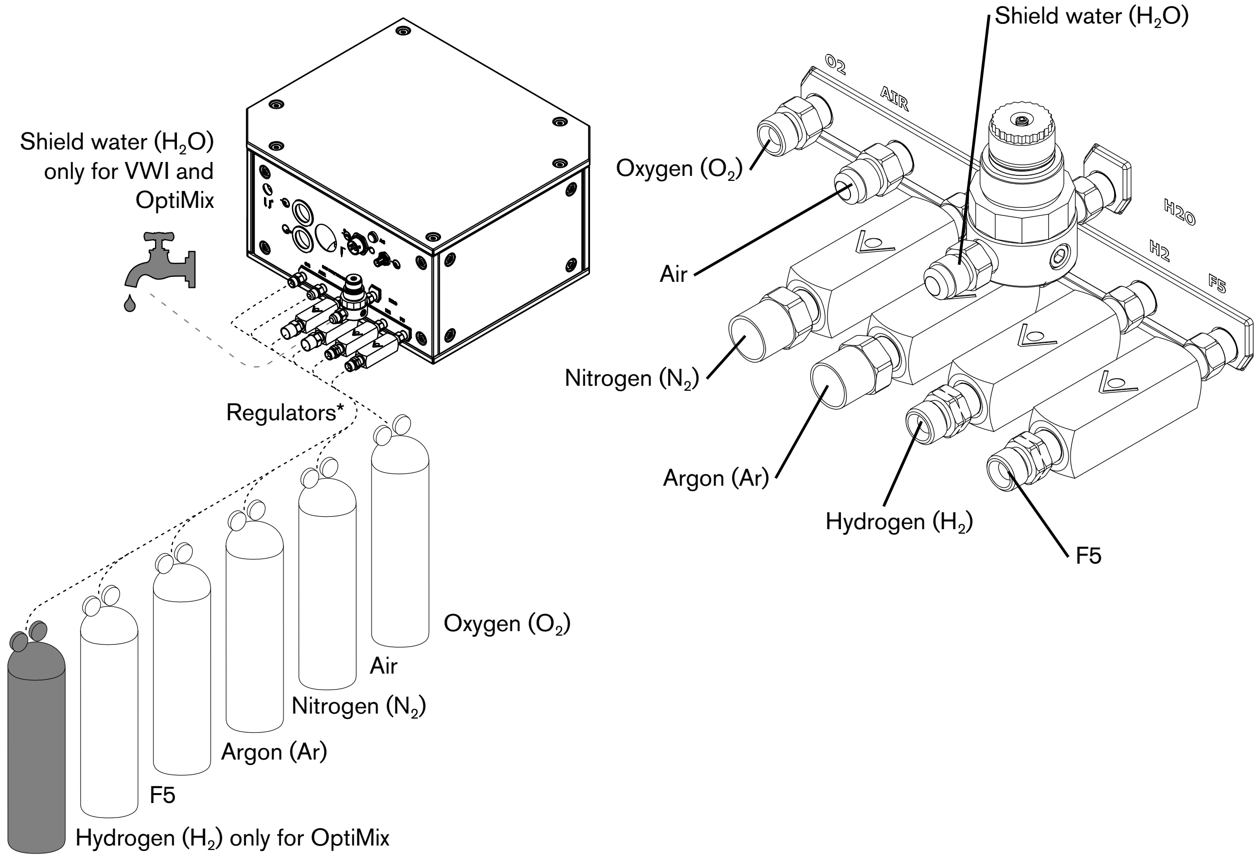
Table 20 – Recommended sizes for gas fittings

Fitting type	Size
N_2 / Ar	5/8 inch – 18 RH, internal (inert gas) “B”
Air	9/16 inch – 19, JIC #6
F5 / H_2	9/16 inch – 18, LH (fuel gas) “B”
O_2	9/16 inch – RH (oxygen)

To decrease the risk of leaks in the system, make sure to tighten all connections to the torque specifications in *Table 18* on page 112.

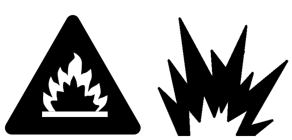
After installation is complete, pressurize the entire system and look for gas leaks. A licensed plumber can do this for you.

Figure 32 – Connect the supply gas plumbing, gases, and optional shield water to the VWI or OptiMix gas connect console



* For the best results, position a gas regulator within 3 meters (10 feet) of the gas connect console. If your supply gas is positioned more than 3 meters (10 feet) away from the gas connect console, Hypertherm recommends a 2-stage configuration: 1) Use single-stage regulator for high pressure at the source and 2) use a second regulator for normal pressure at the 3 meter (10 feet) location.

WARNING



An explosion can occur if a supply gas hose is connected to the wrong port on a VWI or OptiMix gas connect console.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

CAUTION

Cutting system performance can be bad if a supply gas hose is connected to the wrong port on a gas connect console.

NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure.

Connect shield water to the gas connect console (VWI or OptiMix)

Shield water is available with the **VWI or OptiMix** gas connect console.

- If you have a Core gas connect console, see *Connect supply gases to the gas connect console (Core)* on page 114.
- If you have a VWI or OptiMix gas connect console, but choose to not use shield water, you can ignore this installation step.
- Make sure to follow *Shield water requirements (VWI and OptiMix)* on page 41 if you do use shield water.
- If using shield water, the temperature range for cutting system operation is reduced to above 0°C to 40°C (32°F to 104°F).

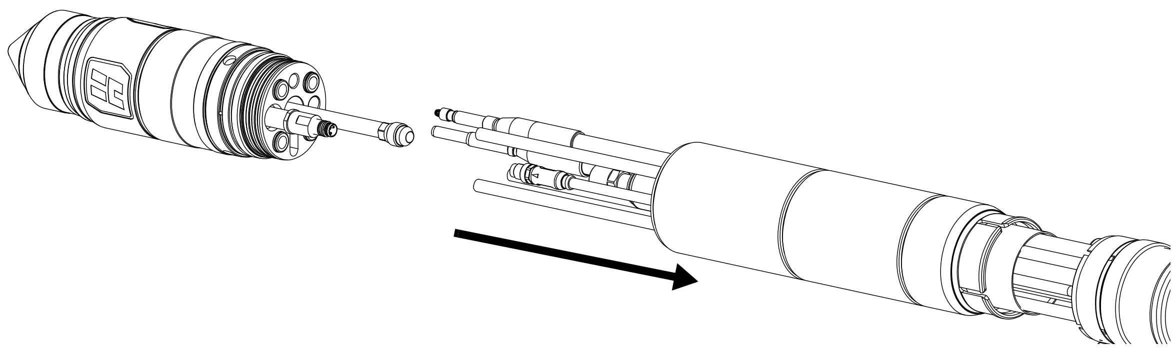
How to connect the torch receptacle to the TorchConnect console

Connect the EasyConnect torch lead assembly to the torch receptacle

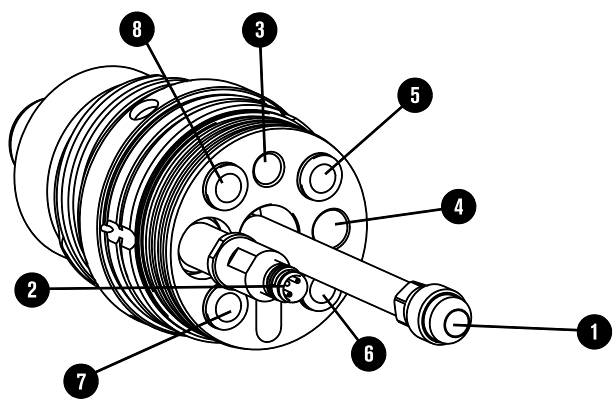
1. Uncoil approximately 2 meters (6.5 feet) of the torch-end of the torch lead assembly.

2. Position the torch collar onto the connector-end of the torch.

3. Slide the torch mounting sleeve onto the torch-end of the torch lead assembly. Make sure to position the mounting sleeve away from the connector ends, so that the ends are not covered. This lets you access the connector ends.



4. Align the color-coded leads in the torch lead assembly with the corresponding connectors in the torch receptacle.



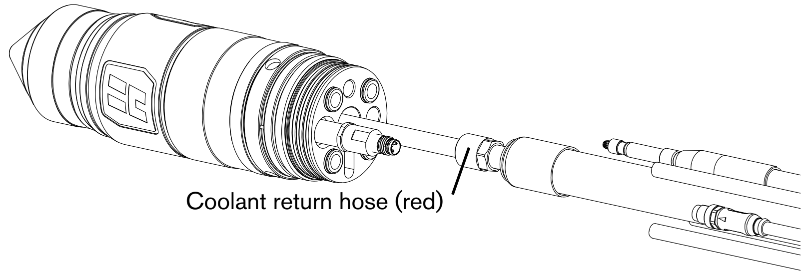
1	Coolant return (red)	5	Coolant supply (green)
2	Plasma valve	6	Shield gas (blue)
3	Pilot arc (yellow)	7	Plasma gas 2 (yellow)
4	Ohmic (orange)	8	Plasma gas 1 (black)

Good alignment minimizes twisted leads. Twisted leads can cause gas or coolant restrictions that shorten the life of consumables or result in bad cut quality.

5. Connect the torch leads and connectors in the following order:

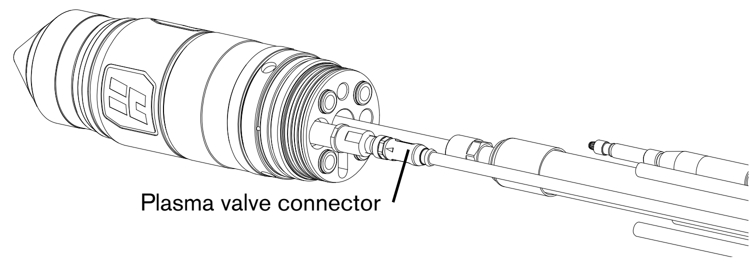
   a. Use 2 wrenches to install the coolant return hose (red) onto the coolant return fitting (red) and tighten to 16.3 N·m – 19.0 N·m (144 in·lbf – 168 in·lbf).

      Do not tighten too much.



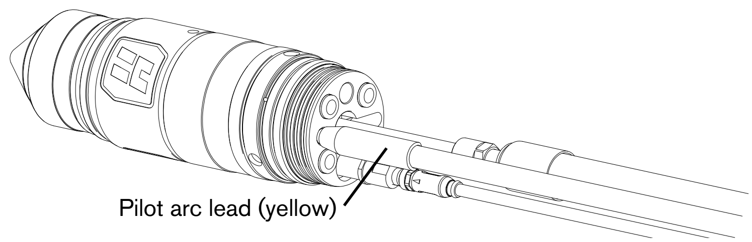
   b. Insert the plasma valve connector and finger-tighten.

      Do not use tools.



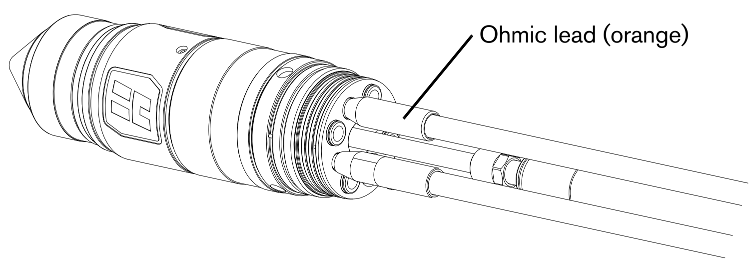
   c. Connect the pilot arc lead (yellow) and finger-tighten.

      Do not use tools.



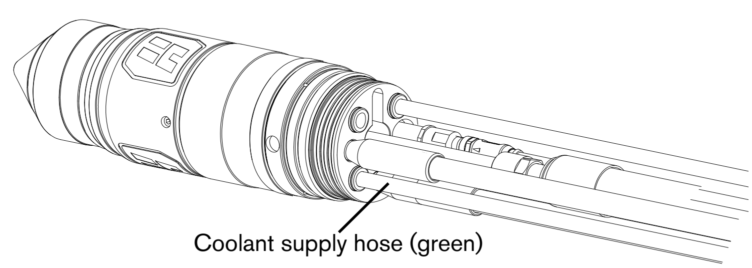
   d. Connect the ohmic lead (orange) and finger-tighten.

      Do not use tools.



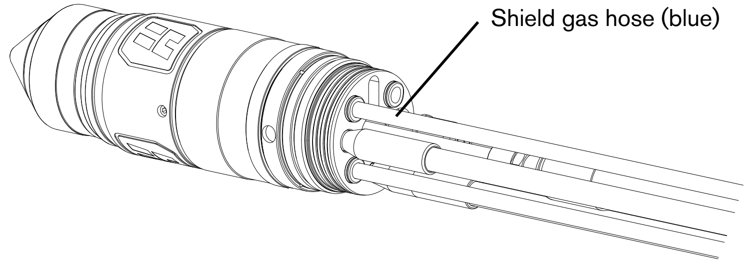
   e. Connect the coolant supply hose (green). Push the hose into the connector until it stops, approximately 13 mm (0.5 inch).

      This is a push-to-connect fitting.



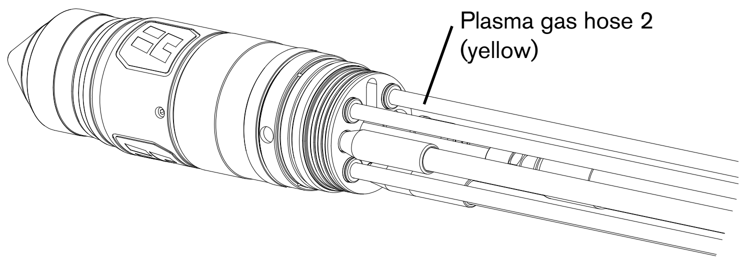
f. Connect the shield gas hose (blue). Push the hose into the connector until it stops, approximately 13 mm (0.5 inch).

> This is a push-to-connect fitting.



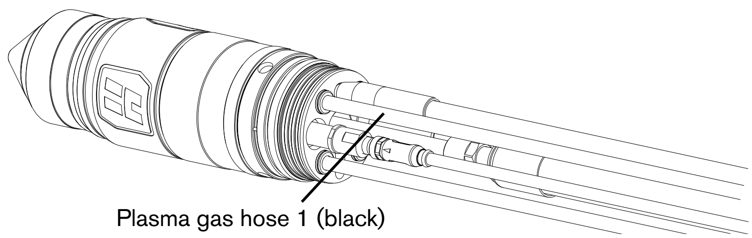
g. Connect plasma gas hose 2 (yellow). Push the hose into the connector until it stops, approximately 13 mm (0.5 inch).

> This is a push-to-connect fitting.



h. Connect plasma gas hose 1 (black). Push the hose into the connector until it stops, approximately 13 mm (0.5 inch).

> This is a push-to-connect fitting.

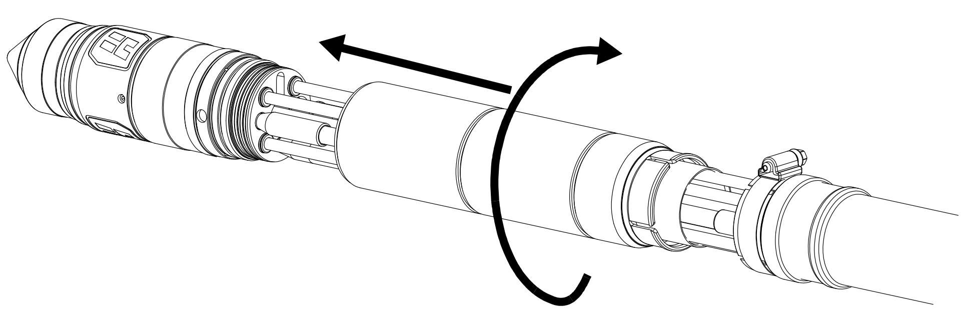


6. Install the torch mounting sleeve:

a. Slide the torch mounting sleeve towards the torch.

b. Hand-tighten the torch mounting sleeve.

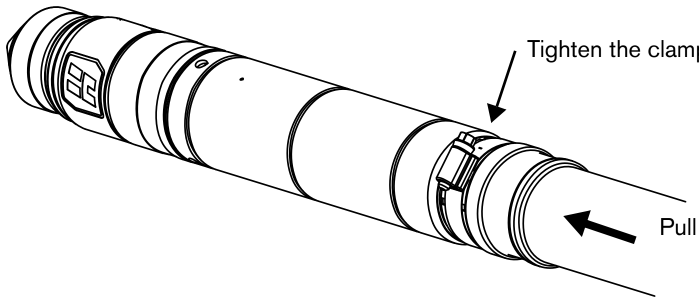
> A spanner wrench (104879) comes with all 4 of the consumable parts kits (428616, 428617, 428618, 428619). Do **not** over tighten the torch mounting sleeve if you use the spanner wrench to stabilize the torch during mounting sleeve installation.



7. Reposition the collar on the torch-end of the torch lead:

a. Pull the collar towards the torch-end of the torch lead assembly.

b. Tighten the hose clamp that holds the collar in position.



Connect the EasyConnect™ torch lead assembly to the TorchConnect console

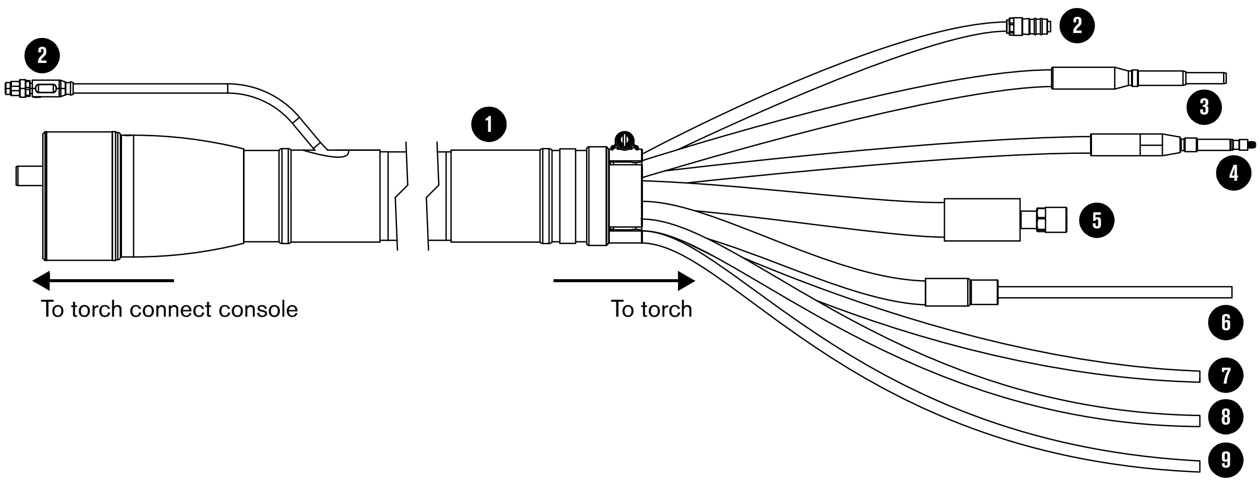
NOTICE

The manufactured lengths of torch and console leads are critical for system performance.

Never alter the lengths of any leads.

Cut quality and the lifespan of consumables will be decreased if you alter the leads.

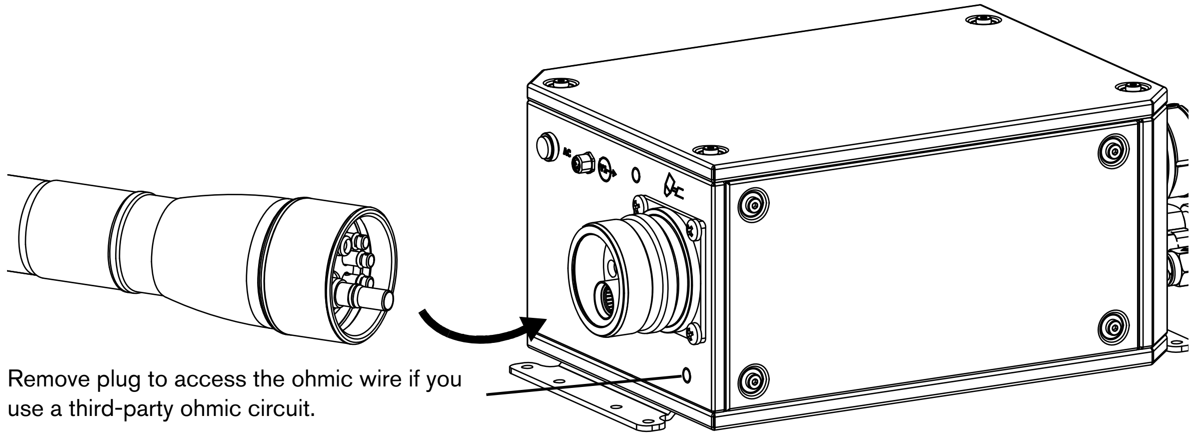
Figure 33 – Torch lead assembly



- **1** Protective sleeve
- **2** Plasma valve cable
- **3** Ohmic lead
- **4** Pilot arc lead
- **5** Coolant return hose (red)
- **6** Coolant supply hose (green)
- **7** Shield gas hose
- **8** Plasma gas hose A
- **9** Plasma gas hose B

For lengths, see *Torch lead* on page 391 of the *Parts List*.

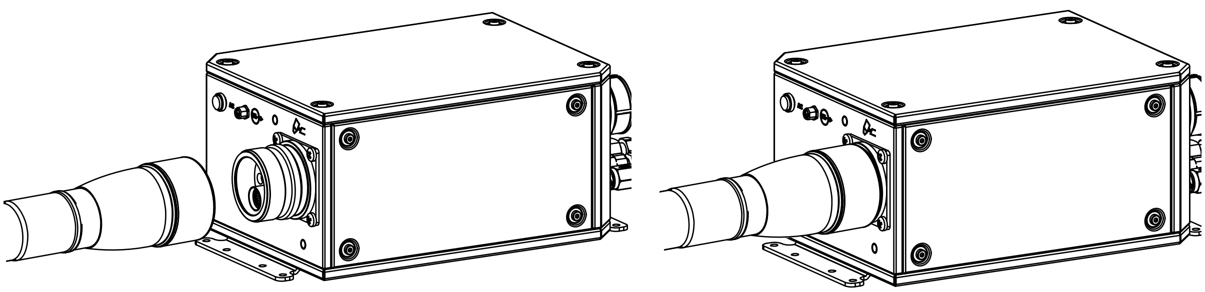
1. Align the connectors in the torch lead assembly with the corresponding receptacles in the TorchConnect console.



2. Connect the torch lead assembly to the TorchConnect console:

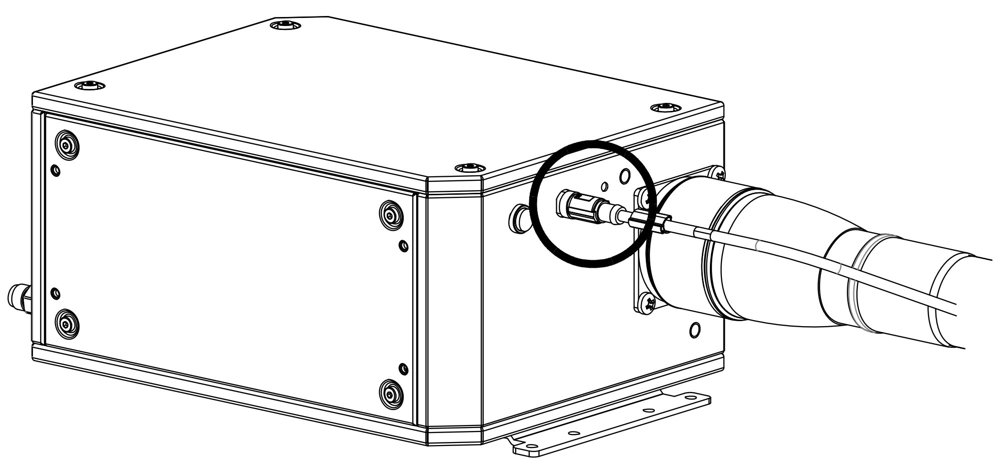
   a. Hand-tighten the coupler of the torch lead assembly.

      Do not use tools.



   b. Connect the plasma valve cable to its connector, then finger-tighten.

      Do not use tools.



How to install the torch in the torch mounting bracket

Before you install the torch in the torch mounting bracket, you must attach the torch lead assembly to the torch receptacle. (See *Connect the EasyConnect torch lead assembly to the torch receptacle* on page 121.)

As the installer or user, you must supply the torch mounting bracket for your cutting system. Choose one that meets the requirements in *Torch mounting bracket requirements* on page 53. Mounting brackets are available from Hypertherm. (See *Torch bracket* on page 379 of the *Parts List*).

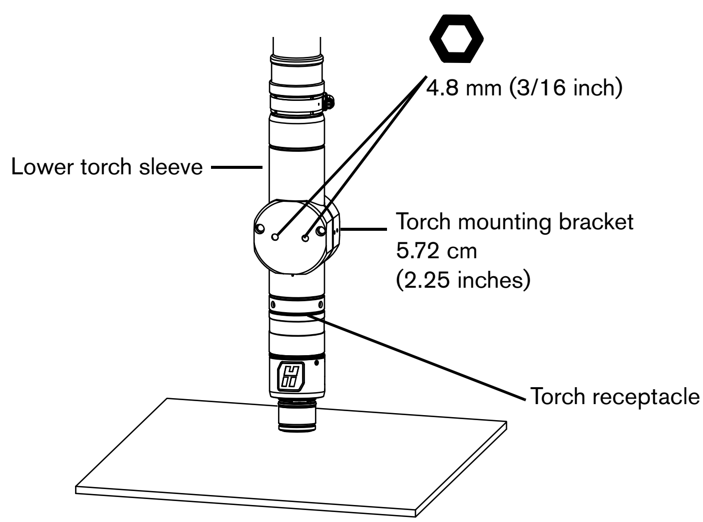
> The XPR torch mounting sleeve is larger than the torch mounting sleeve for HPR torches. Modification or replacement of previous mounting hardware is necessary for XPR torches.

1. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED is not illuminated on the plasma power supply, gas connect console, or torch connect console.
2. Install the torch mounting bracket onto the torch lifter.

   > See the instruction manual that came with the torch lifter for information about how to install the torch mounting bracket in the torch lifter.

3. Insert the torch (with attached torch lead assembly) into the torch mounting bracket. See *Figure 34*.

Figure 34 – Torch in mounting bracket



4. Position the torch below the torch mounting bracket. The mounting bracket:
   - Must go around the lower portion of the torch sleeve
   - Must **not touch** the torch receptacle

   To minimize vibration at the torch tip, position the torch mounting bracket as low as possible on the torch sleeve, without touching the torch receptacle.

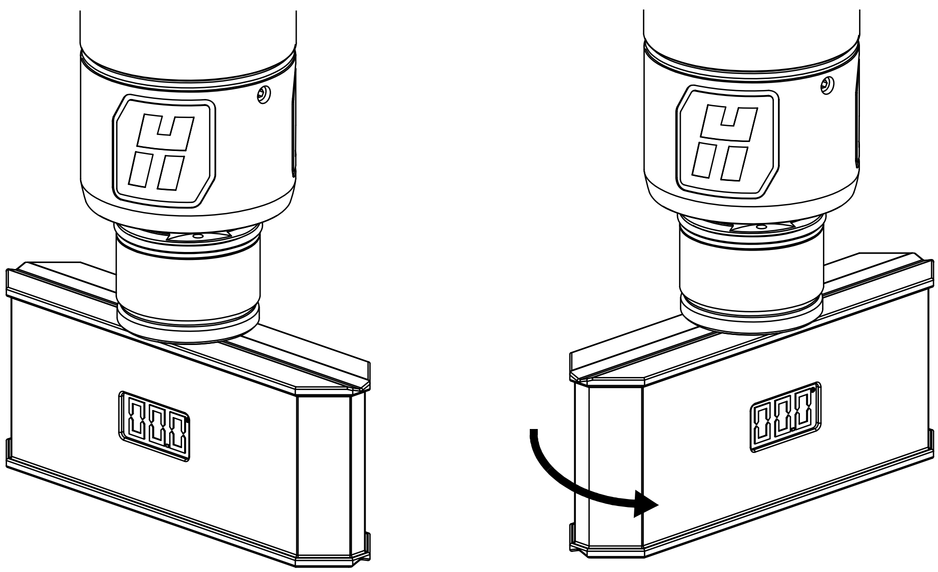
5. Make sure that the torch is level (at a 0° angle) in all directions as shown in *Figure 35* on page 128.

   Remove the consumables, including the water tube, from the torch.

   You can use a digital level to measure alignment for standard-position cutting, marking, and piercing.

   During bevel cutting, the torch is at an angle (not perpendicular) to the workpiece. The torch position for XPR torches can range from 0° – 52°. For information on bevel cutting, see *Bevel cutting* on page 212.

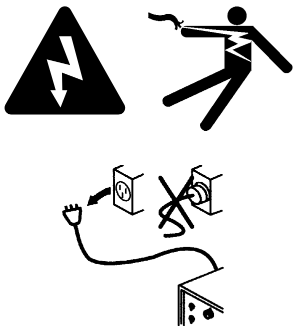
Figure 35 – Level the torch



6. Tighten the screws on the torch mounting bracket.

How to install the consumables

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

The line-disconnect switch must REMAIN in the OFF position until all installation or maintenance steps are complete.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

The torch head that comes with the XPR torch assembly kit (428488) has 300 A mild steel consumable parts pre-installed.

For guidance about how to choose the best consumables for your cutting or marking needs, see the *XPR Cut Charts Instruction Manual* (809830). If you need to change the consumable parts, follow this procedure.

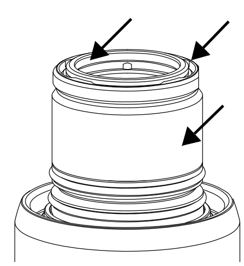
See *Sample configurations for consumables* on page 135.

If you need to exchange consumable parts, follow these steps.

1. Remove the power from the cutting system:
    a. Set the line-disconnect switch to the OFF position.
    b. Make sure that the power-indicator LED is not illuminated on the plasma power supply, gas connect console, or torch connect console.
2. If you have not already done so, choose the best consumables for your cutting or marking needs.
3. Apply a thin film of silicone lubricant (027055) to each O-ring on every consumable.

    The O-rings should look shiny. Too much lubricant can prevent gas flow.
    Remove excess lubricant if found.

4. Use a clean, lint-free cloth to wipe the internal and external surfaces of the torch.



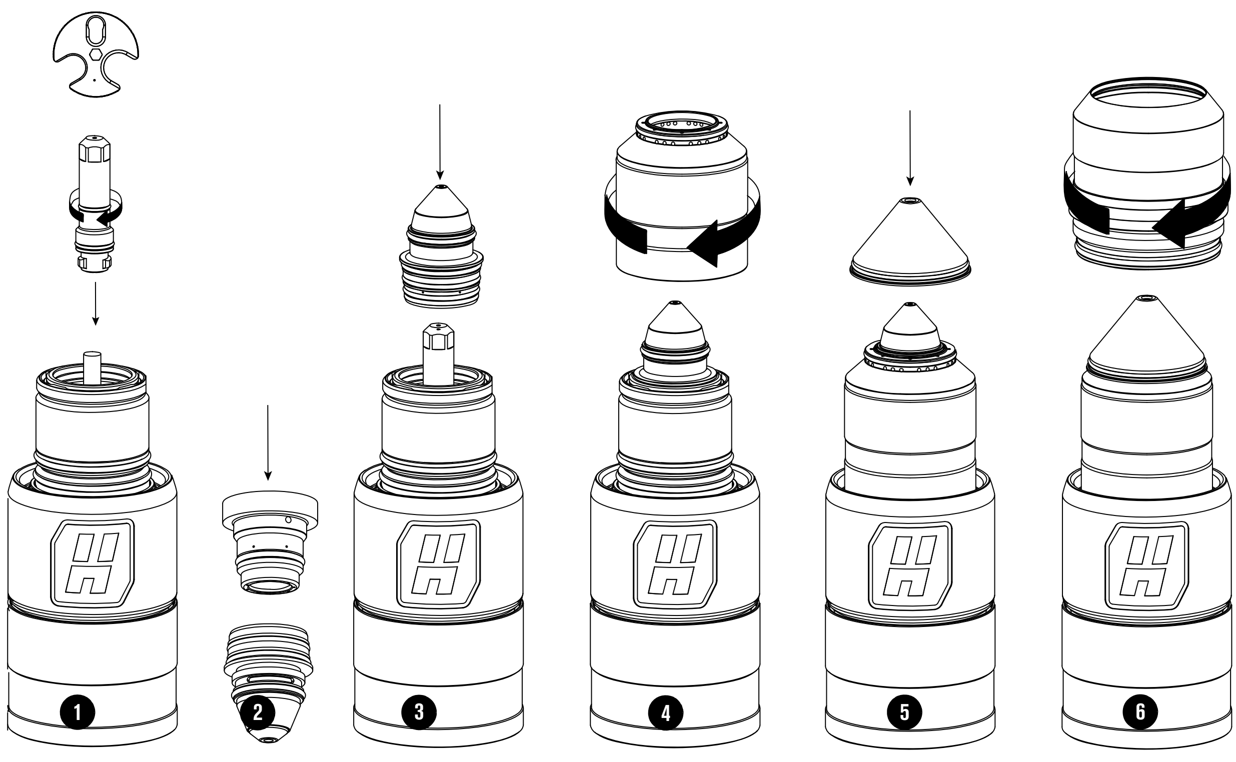
5. Install the consumables on the torch as shown in *Figure 36*:
   a. Make sure that the water tube is installed.
   b. Install the electrode ❶. Use a consumable tool (104119) to tighten the electrode to between 2.3 N·m – 2.8 N·m (20 in·lbf – 25 in·lbf) torque.

      A loose or overtightened electrode can cause torch damage. Hypertherm recommends between 2.3 N·m – 2.8 N·m (20 in·lbf – 25 in·lbf) torque to tighten an electrode.

      Hypertherm offers an electrode torque tool (429013) for tightening XPR torch components. It is pre-calibrated at 2.5 N·m (22.1 in·lbf).

   c. Install the swirl ring ❷ into the nozzle.
   d. Install the nozzle and swirl ring assembly ❸.
   e. Install the nozzle retaining cap ❹.
   f. Install the shield ❺.
   g. Install the shield cap ❻.

Figure 36 – Install the consumables on the torch



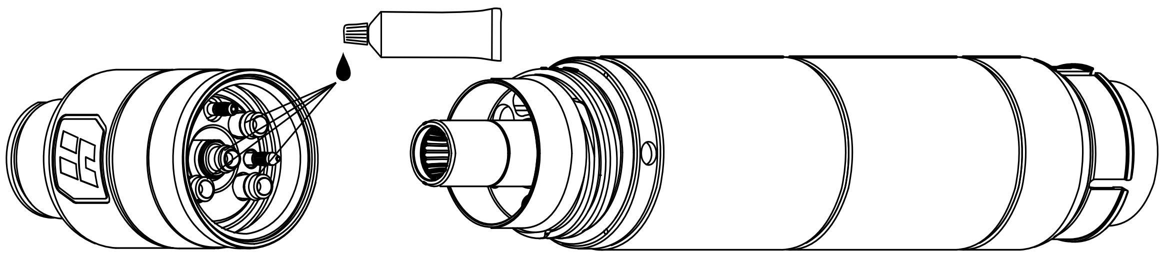
6. Install the torch in the torch receptacle. (See *How to install the torch into the torch receptacle* on page 131.)

7. Install the torch and attached receptacle in the torch mounting bracket. (See *How to install the torch in the torch mounting bracket* on page 127.)

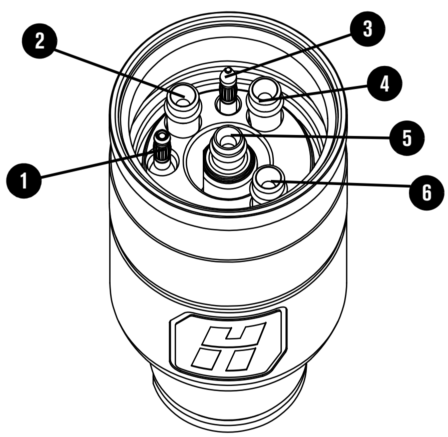
How to install the torch into the torch receptacle

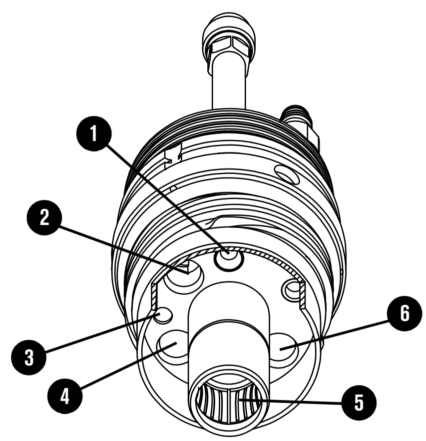
1. Apply a thin film of silicone lubricant (027055) to each of the 4 O-rings inside of the torch body.

   Do **not** apply silicone to the brass electrical connectors.



   The O-rings should look shiny. Too much lubricant can prevent gas flow.
   Remove excess lubricant if found.



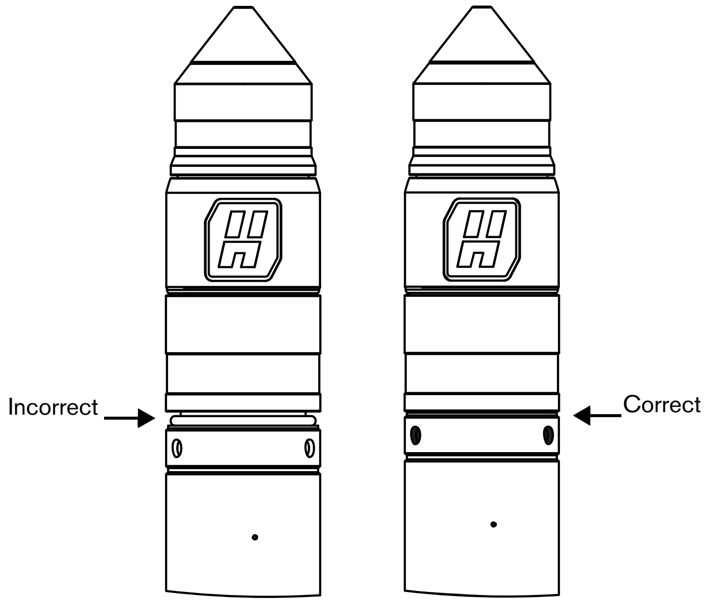


1 Pilot arc
2 Coolant return
3 Ohmic
4 Shield gas
5 Coolant supply
6 Plasma gas

2. Put the torch body into the torch receptacle and hand-tighten:
   a. Rotate the torch body with slight upward force until you feel it engage into position in the receptacle.
   b. Hand tighten the torch-coupler nut until the coupler nut no longer rotates.

   Hand tighten only. Do not use tools.

3. Make sure that the torch body is fully inserted into the torch receptacle. There should be no space between the torch body and torch receptacle.



How to connect electric power to the cutting system

CAUTION

Any installation, modification, or repair of electrical equipment or electrical systems must be done by a licensed electrician.

WARNING

ELECTRIC SHOCK CAN KILL

The line-disconnect switch must be in the OFF position before you connect the power cord to the cutting system.

The line-disconnect switch must REMAIN in the OFF position until all installation steps are complete.

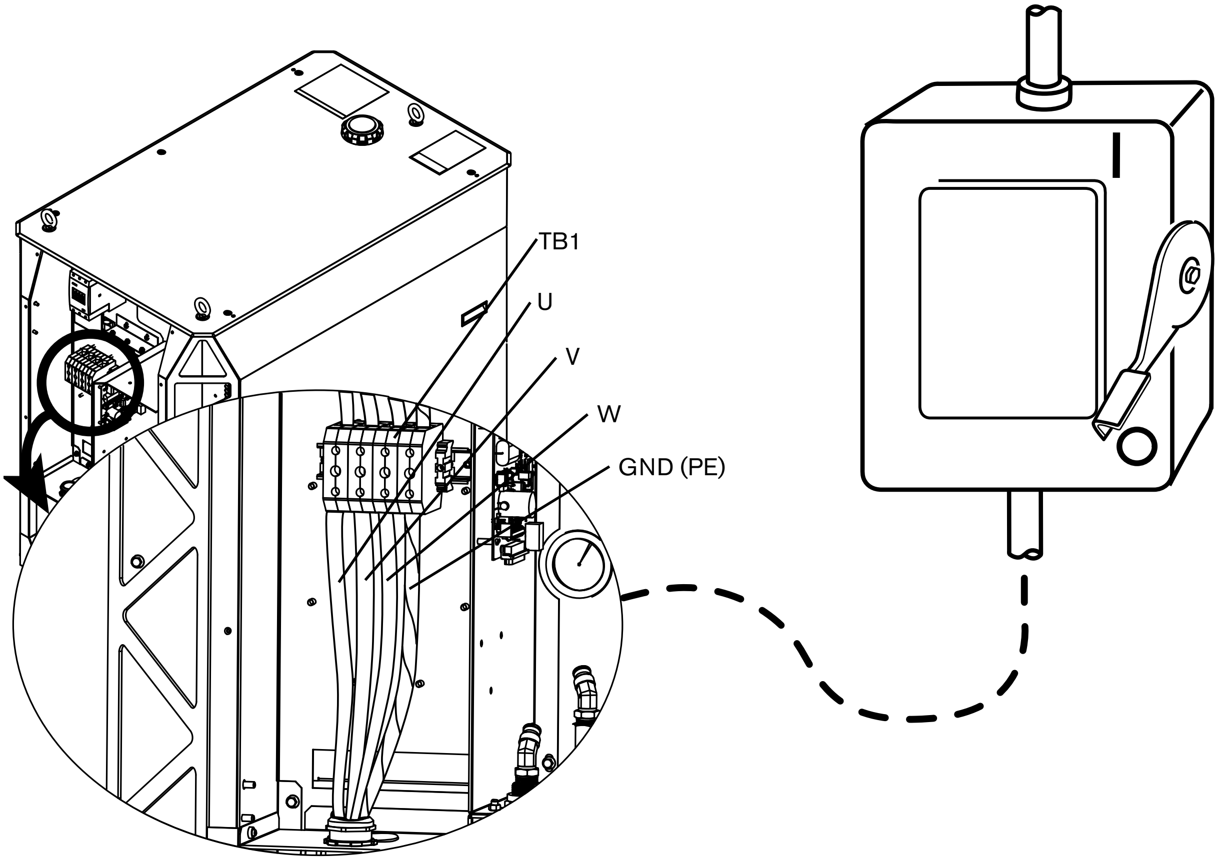
In the United States, use a "lock out/tag out" procedure until installation is complete. In other countries, follow the appropriate national and local safety procedures.

You must supply the main power cord for your cutting system. Choose a main power cord that satisfies local codes and regulations and that meets the input power requirements. (See *Input power requirements* on page 32.) For information about the codes in your location, contact a licensed electrician.

The size requirements for the main power cord at your site can vary based on the distance of the receptacle from the main box and on local codes and regulations.

1. Make sure that the line-disconnect switch is in the OFF position and remains in the OFF position until all installation steps are complete.
2. Connect the main power cord to the plasma power supply (*Figure 37* on page 134):
   a. Connect the ground lead (PE) from the main power cord to the ground terminal (⏚) of TB1.
   b. Connect the W, V, and U leads from the main power cord to the corresponding TB1 terminals.

Figure 37 – Connect the main power cord to the plasma power supply



3. Follow national and local electrical codes to connect the W, V, and U power leads from the main power cord to the line-disconnect switch (*Table 21* on page 134).

Table 21 – Color codes for main power cord wires

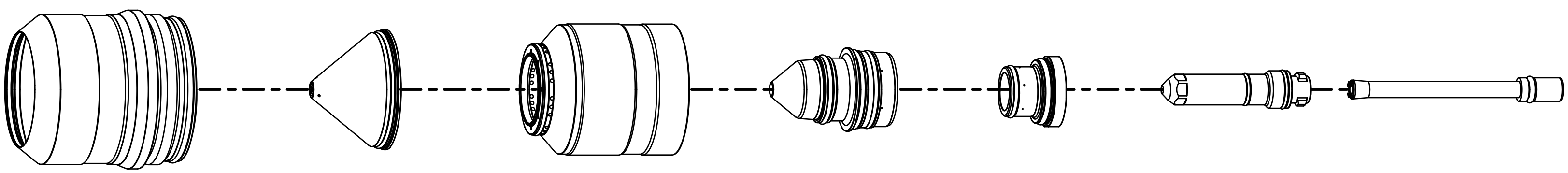
Wire color codes for North America	Wire color codes for Europe, Asia, and most locations outside of North America
U = Black	U = Black
V = White	V = Blue
W = Red	W = Brown
PE (earth ground) = Green/yellow	PE (earth ground) = Green/yellow

Sample configurations for consumables

Worn or damaged consumables can have a negative effect on cut quality. Examine the installed consumables at least once daily, **before** system operation. For information about how to do this, see *Examine the consumable parts* on page 237 in the *Maintenance* section of this manual.

Ferrous (mild steel) sample configurations

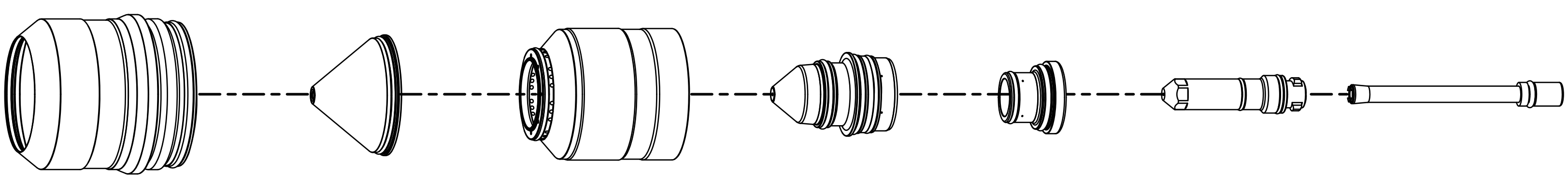
Mild steel – 30 A – O_2/O_2



Shield retaining cap	Shield	Nozzle retaining cap	Nozzle	Swirl ring	Electrode	Water tube
420200	**420228** 420619*	**420365**	**420225**	**420407** 420620*	**420222**	**420368**

* Consumables for mirror cutting only.

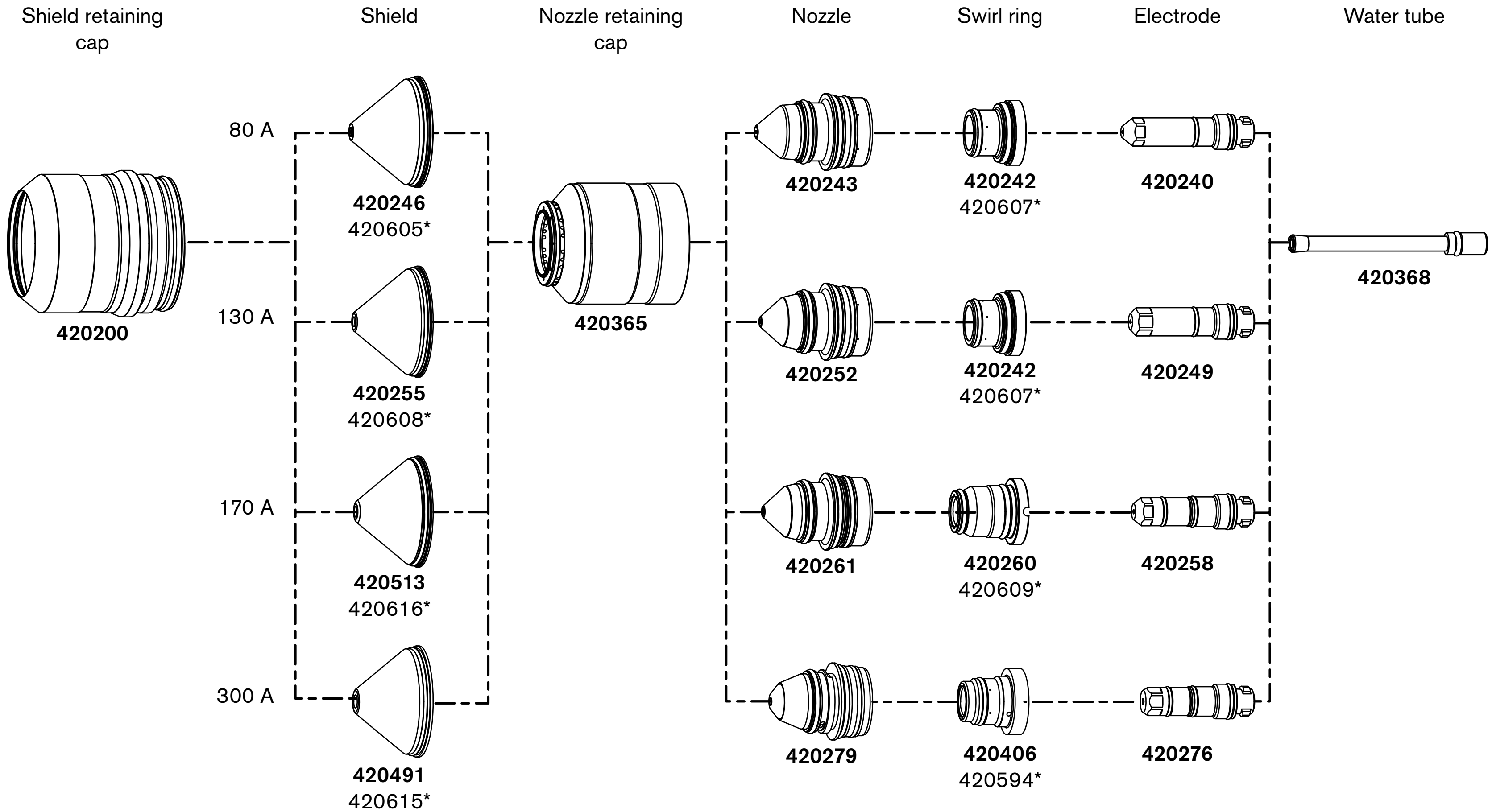
Mild steel – 50 A – O_2/Air



Shield retaining cap	Shield	Nozzle retaining cap	Nozzle	Swirl ring	Electrode	Water tube
420200	**420237** 420767*	**420365**	**420234**	**420233** 420768*	**420231**	**420368**

* Consumables for mirror cutting only.

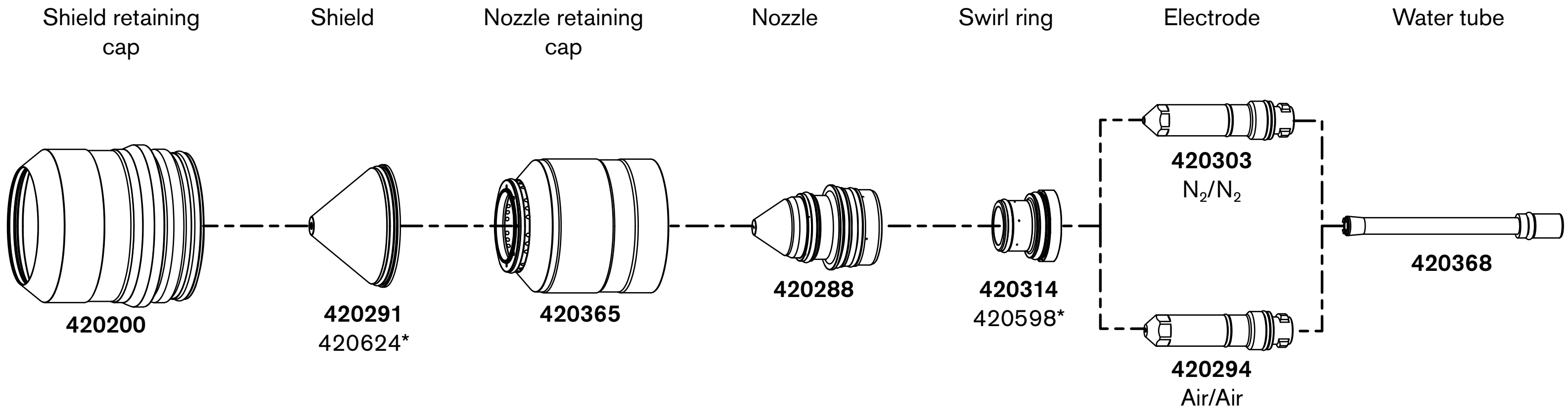
Mild steel – 80 A, 130 A, 170 A, and 300 A – O_2/Air



* Consumables for mirror cutting only.

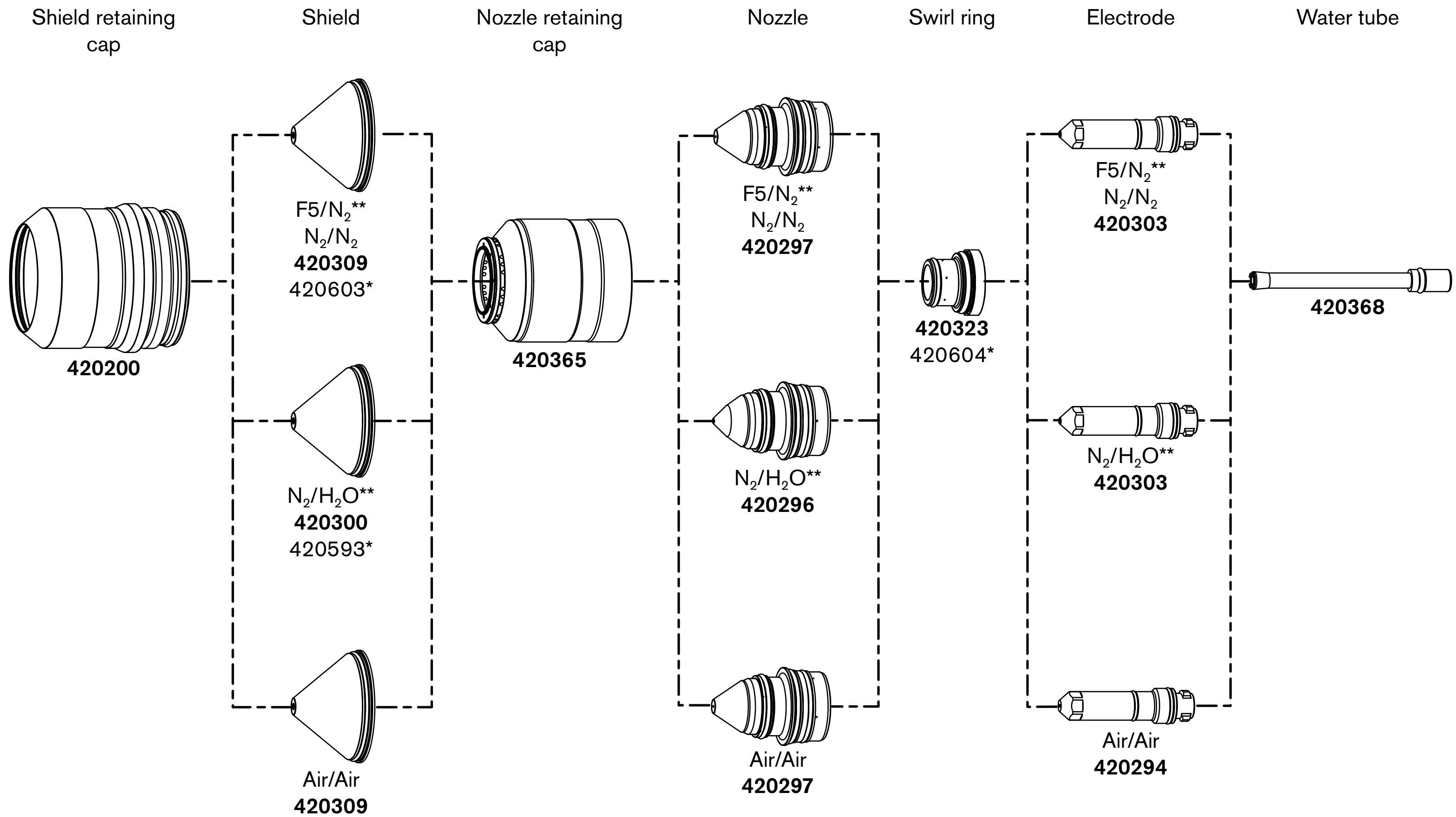
Non-ferrous (stainless steel and aluminum) sample configurations

Non-ferrous – 40 A – N_2/N_2 and Air/Air



* Consumables for mirror cutting only.

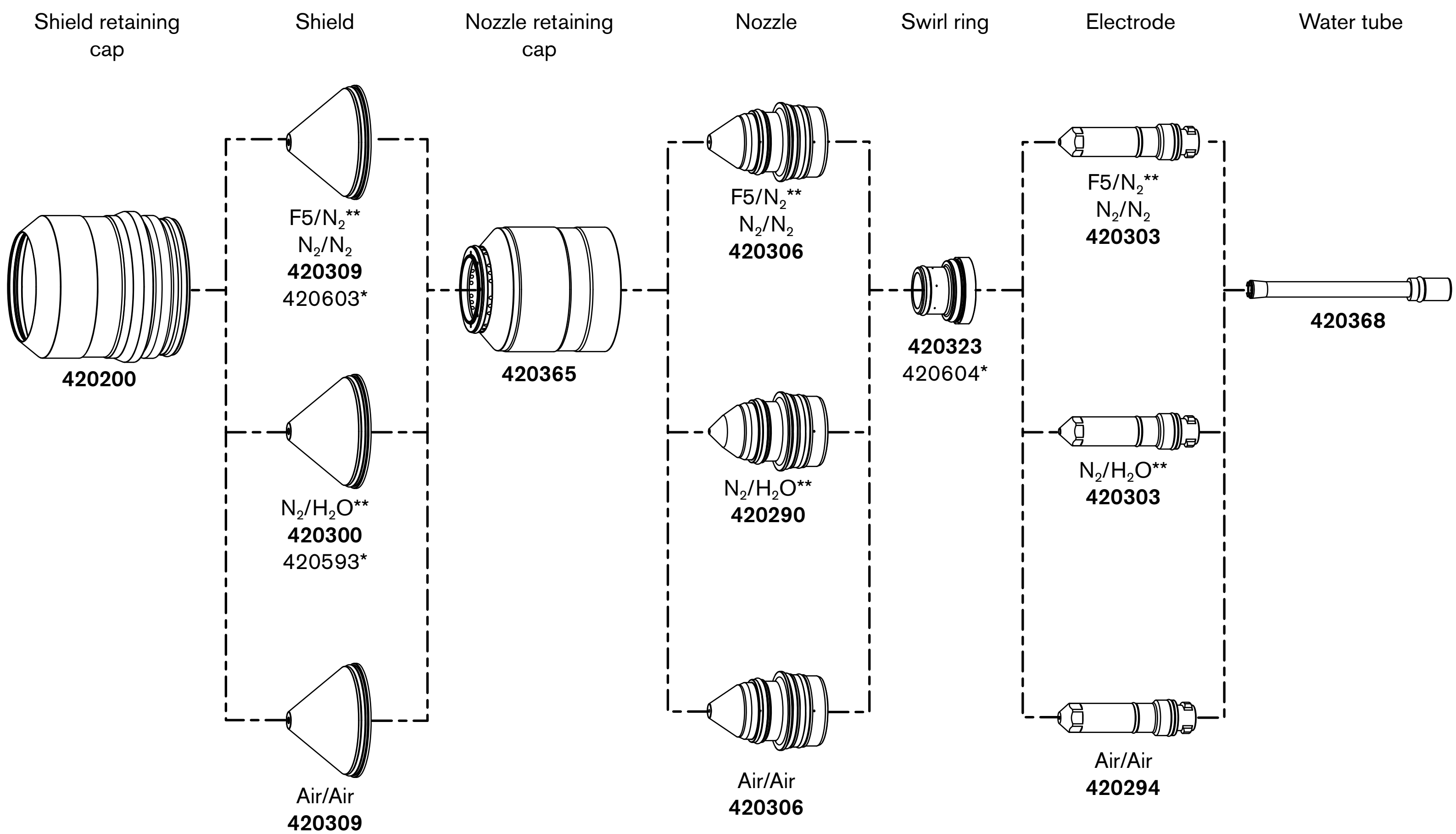
Non-ferrous – 60 A – $F5/N_2$**, N_2/N_2, N_2/H_2O**, and Air/Air



* Consumables for mirror cutting only.

** $F5/N_2$ and N_2/H_2O can only be used with VWI or OptiMix consoles.

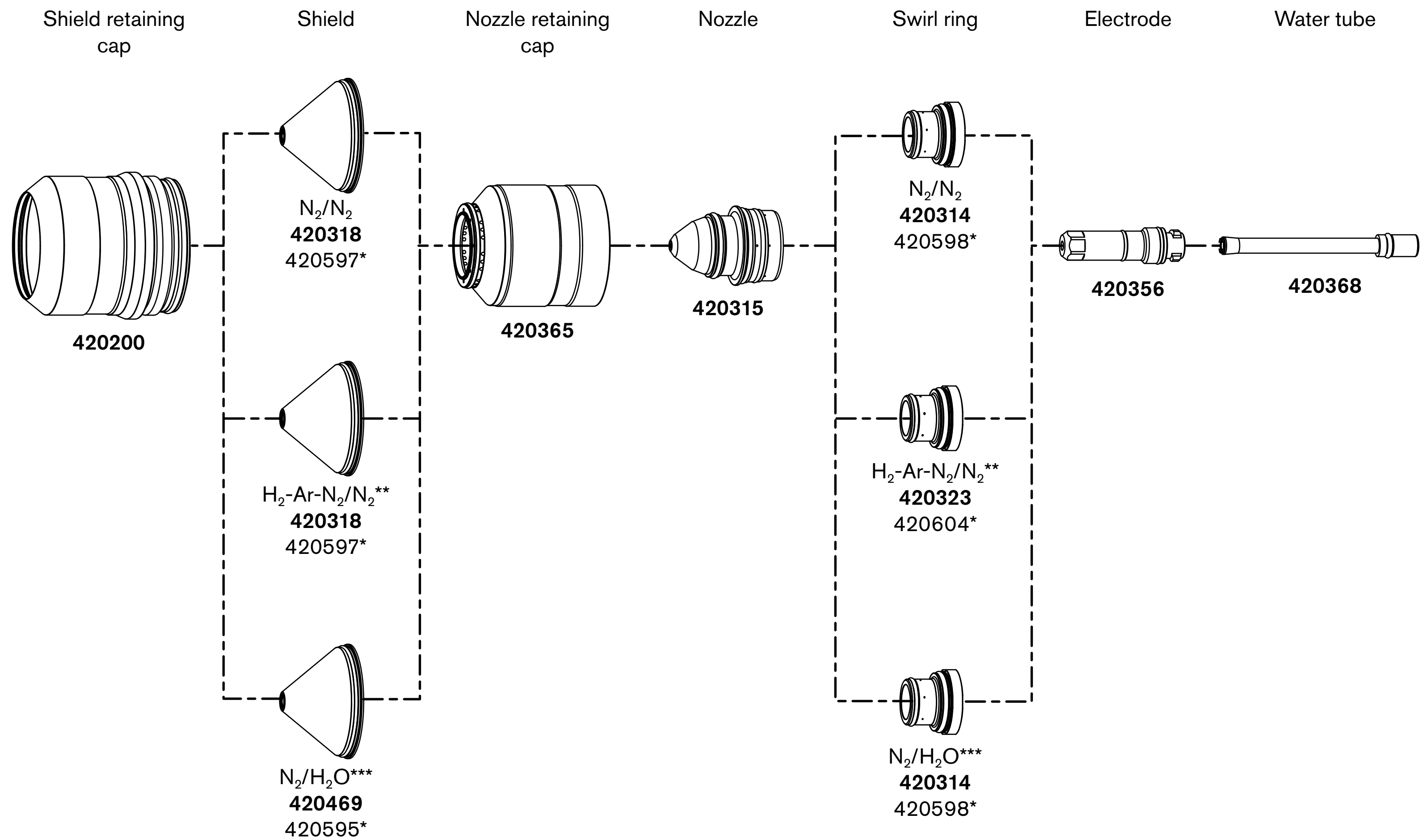
Non-ferrous – 80 A – $F5/N_2$**, N_2/N_2, N_2/H_2O**, Air/Air



* Consumables for mirror cutting only.

** $F5/N_2$ and N_2/H_2O can only be used with VWI or OptiMix consoles.

Non-ferrous – 130 A – N_2/N_2, H_2-Ar-N_2/N_2**, N_2/H_2O***

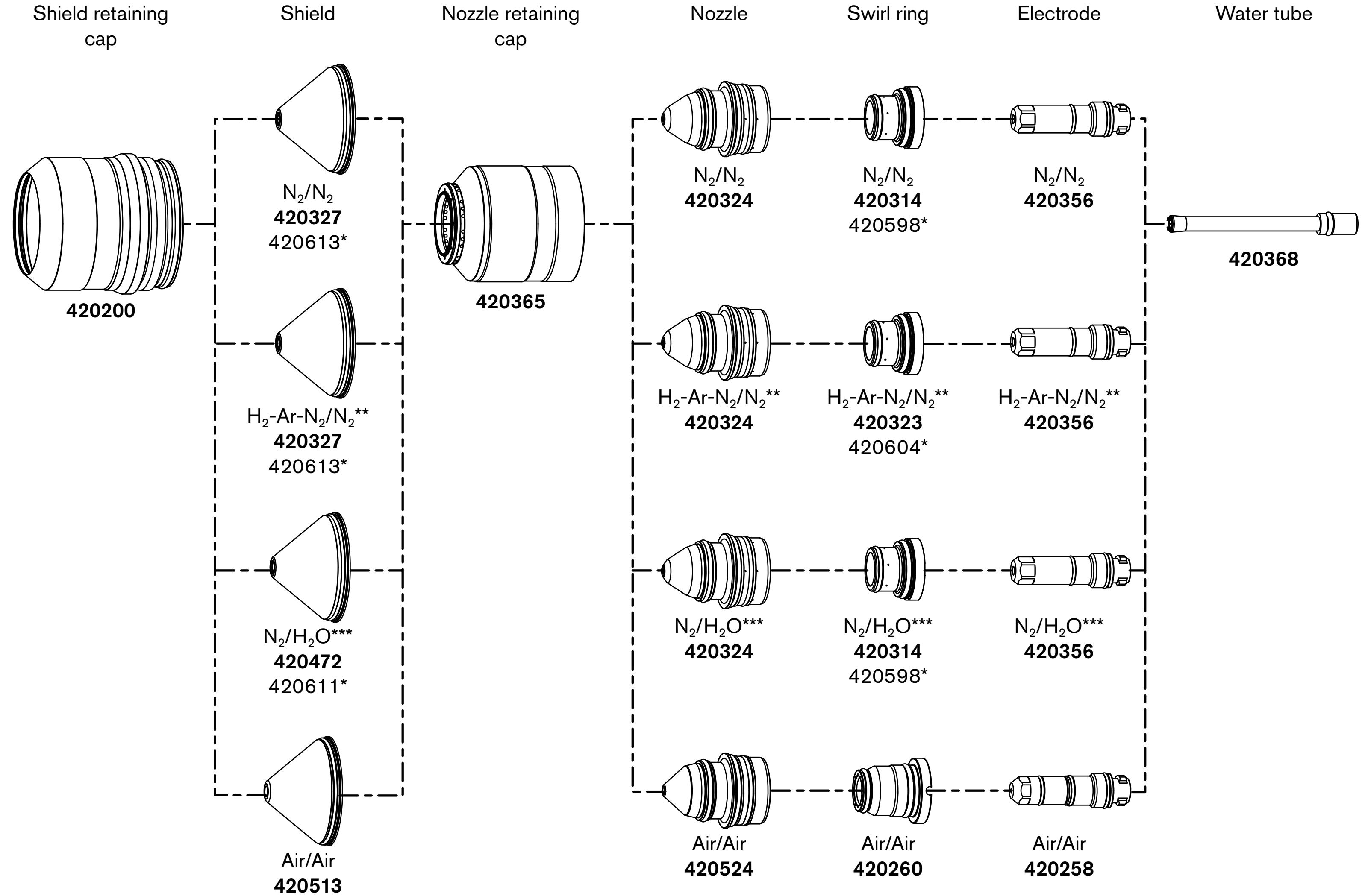


* Consumables for mirror cutting only.

** H_2-Ar-N_2/N_2 and N_2/H_2O can be used with OptiMix consoles.

*** N_2/H_2O can be used with VWI or OptiMix consoles.

Non-ferrous – 170 A – N_2/N_2, H_2-Ar-N_2/N_2**, N_2/H_2O***, Air/Air

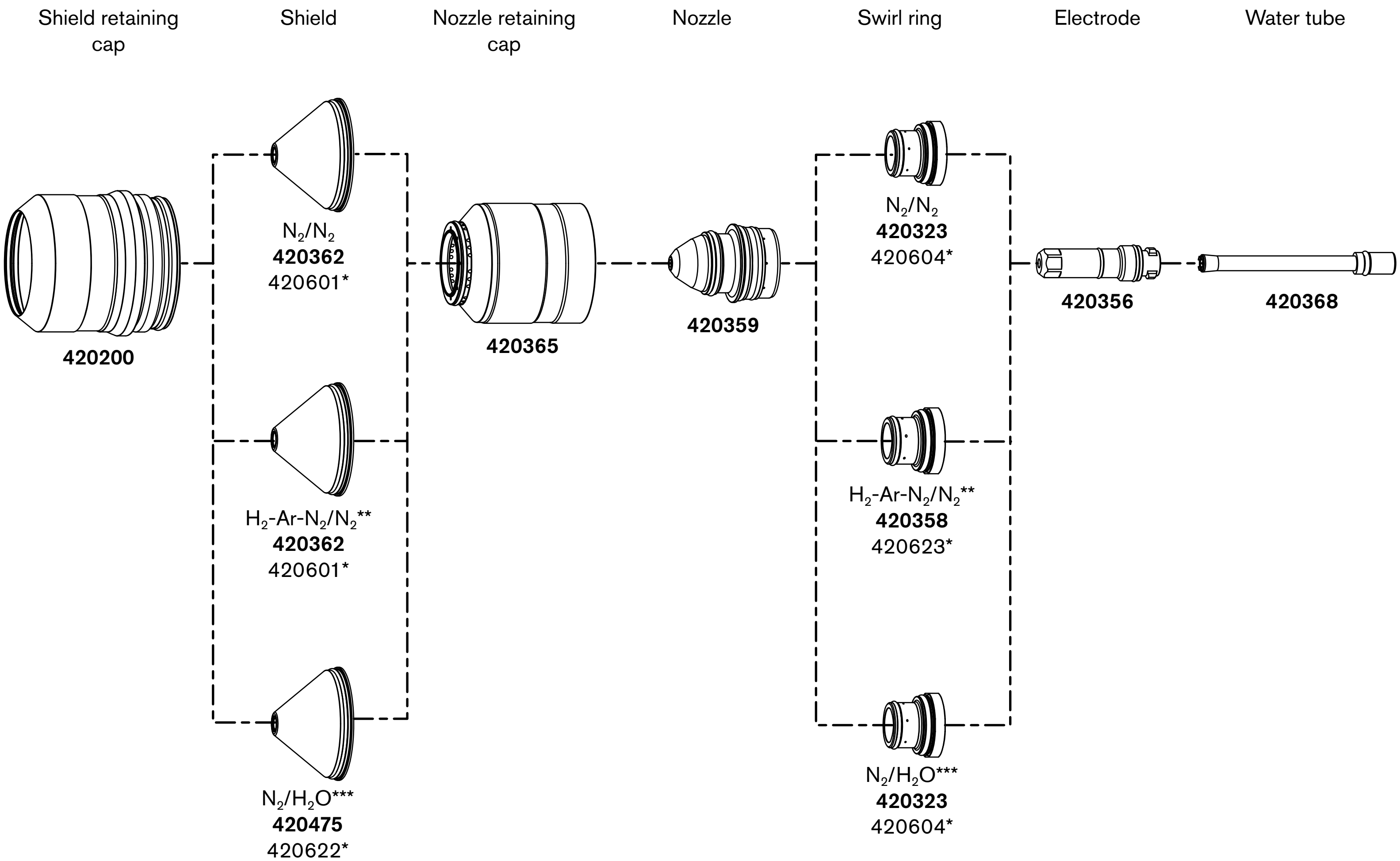


* Consumables for mirror cutting only.

** H_2-Ar-N_2/N_2 can be used with OptiMix consoles.

*** N_2/H_2O can be used with VWI or OptiMix consoles

Non-ferrous – 300 A – N_2/N_2, H_2-Ar-N_2/N_2**, N_2/H_2O***



* Consumables for mirror cutting only.

** H_2-Ar-N_2/N_2 and N_2/H_2O can be used on OptiMix consoles.

*** N_2/H_2O can be used with VWI or OptiMix consoles.

4 Connect for Communication

Choose the communication method that is best for your cutting system. There are 3 communication methods to fully operate the cutting system:

- **EtherCAT** – Use this method with an EtherCAT-compatible controller. See *How to connect to the plasma power supply with EtherCAT* on page 145.

  If you use EtherCAT, **do not** use discrete. You can fully operate the cutting system with EtherCAT. See *Table 22* on page 144.

- **Serial RS-422 and discrete –** Use this method with a serial RS-422 and discrete-compatible controller.
  - See *How to connect to the plasma power supply with serial RS-422* on page 147.
  - See *How to connect to the plasma power supply with discrete* on page 150.

  If you use serial RS-422, you must also use discrete to fully operate the cutting system. See *Table 22* on page 144.

- **Wireless (XPR Web Interface) and discrete** – Use this method with a wireless-enabled device and discrete-compatible controller.
  - See *How to connect to the plasma power supply with the XPR web interface* on page 162.
  - See *How to connect to the plasma power supply with discrete* on page 150.

  If you use wireless, you must also use discrete to fully operate the cutting system. See *Table 22* on page 144.

For information on signals and protocols, see the *CNC Communication Protocol for the XPR Cutting System* (809810).

Table 22 – Communication requirements and options

Set process with…*	To fully operate the cutting system…	Monitor with…		
	Discrete	EtherCAT	XPR web interface	RS-422
EtherCAT	Can be required**	Preferred	Alternative	Alternative
XPR web interface	Required	Alternative	Preferred	Alternative
RS-422	Required	Alternative	Alternative	Preferred

* **The device that first sets a process controls the plasma power supply.** For information on how to change the device that has control of the plasma power supply, see *How to change the device that has control* on page 186.

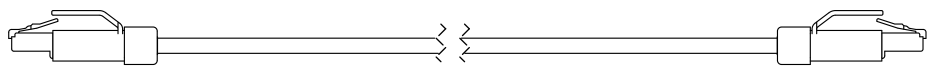
** Discrete inputs are ignored when a process ID is set over EtherCAT to a cutting system that uses the factory-default configuration. Contact your cutting machine supplier or Hypertherm Technical Services team with questions.

Example: If you use EtherCAT to set the process, the preferred method to monitor is EtherCAT. However, you can use RS-422 or the XPR web interface to monitor.

How to connect to the plasma power supply with EtherCAT

- For an example of a system diagram, see *EtherCAT multi-system interface (Sheet 16 of 22)* on page 424.
- For information on signals and protocols, see *EtherCAT communications* and *Serial RS-422 and EtherCAT commands* in the *CNC Communication Protocol for the XPR Cutting System* (809810).

Figure 38 – EtherCAT cable



Hypertherm sells EtherCAT cables that have been tested with our cutting system. See *EtherCAT CNC interface cable* on page 389 in the *Parts List*.

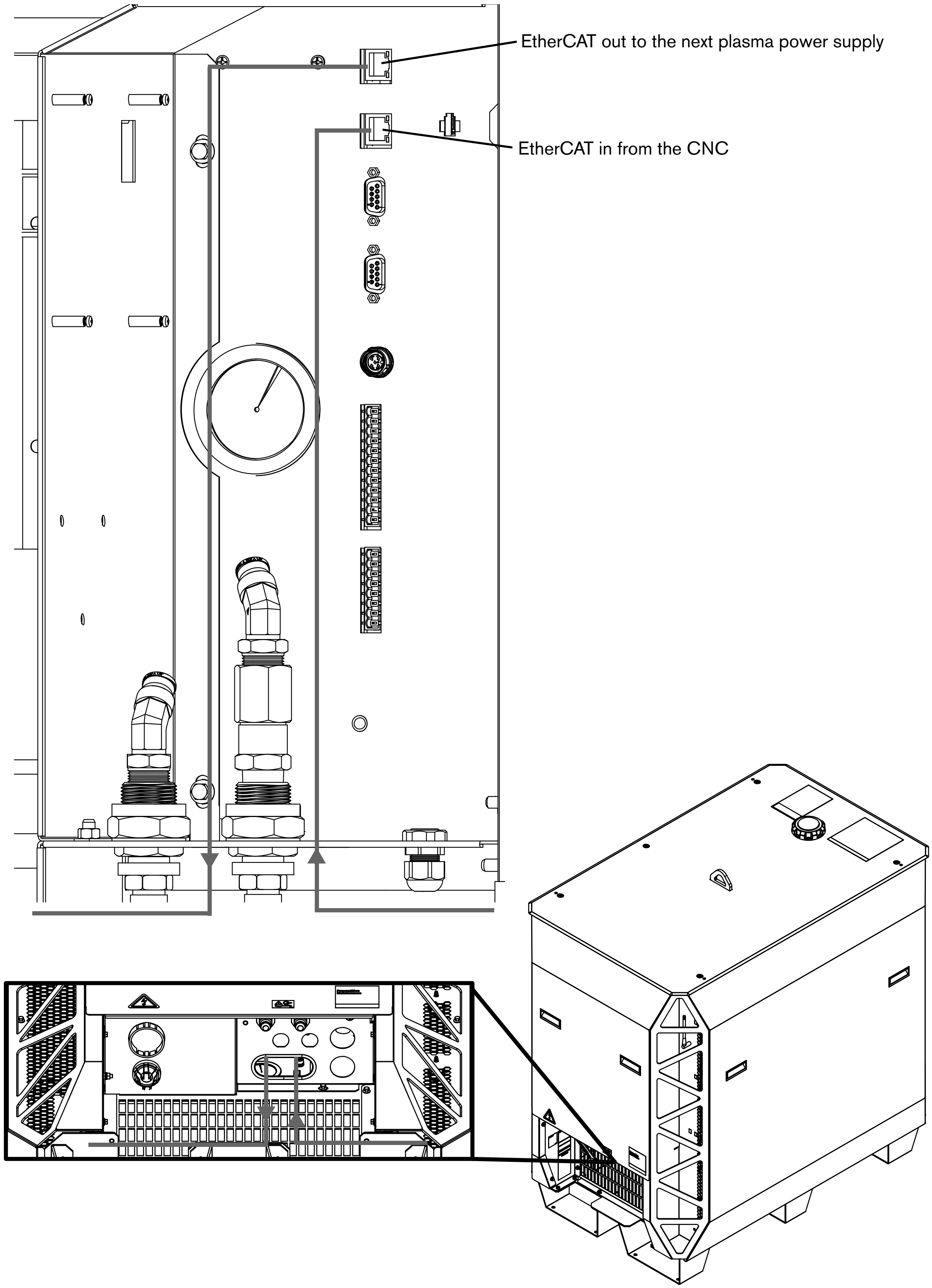
If you supply your own cables, choose EtherCAT cables that follow the Beckhoff® specification.

Type	Cat5e, 2-pair, 4-wire, double-shielded (overall foil and braid shield)
Wire	Construction: Stranded tinned wire Diameter: 0.75 mm (7 X 0.25 mm), 22 AWG Insulation: Polyethylene, 1.5 mm (0.06 inch) diameter
Core	Construction: Filler as central element Layer 1: 4 wires, 2 pair in star-quad configuration Sequence of colors: White, yellow, blue, orange Layer 2: Plastic tape overlapped Inner jacket: Thermoplastic copolymer, 3.9 mm (0.04 inch) diameter Aluminum laminated foil overlapped Shield: Braided, tinned copper wires, 0.13 mm (0.005 inch) diameter, coverage about 85%, 4.7 mm (0.19 inch) diameter
Jacket	Material: Polyurethane Wall thickness: 0.9 mm (0.04 inch) Outer diameter: 6.5 mm (0.26 inch) ± 0.2 mm (0.008 inch)
Maximum length	61 m (200 ft)

Use the following recommendations to avoid electromagnetic interference (EMI) problems with your cutting system:

- Separate the EtherCAT cable from the pilot arc lead, negative lead, or any power cables that have a voltage higher than 120 VAC. See *Distance requirements between high-frequency leads and control cables* on page 51.
- Do not route the EtherCAT cable close to the gas connect console.

Figure 39 – Connect EtherCAT cables to plasma power supply



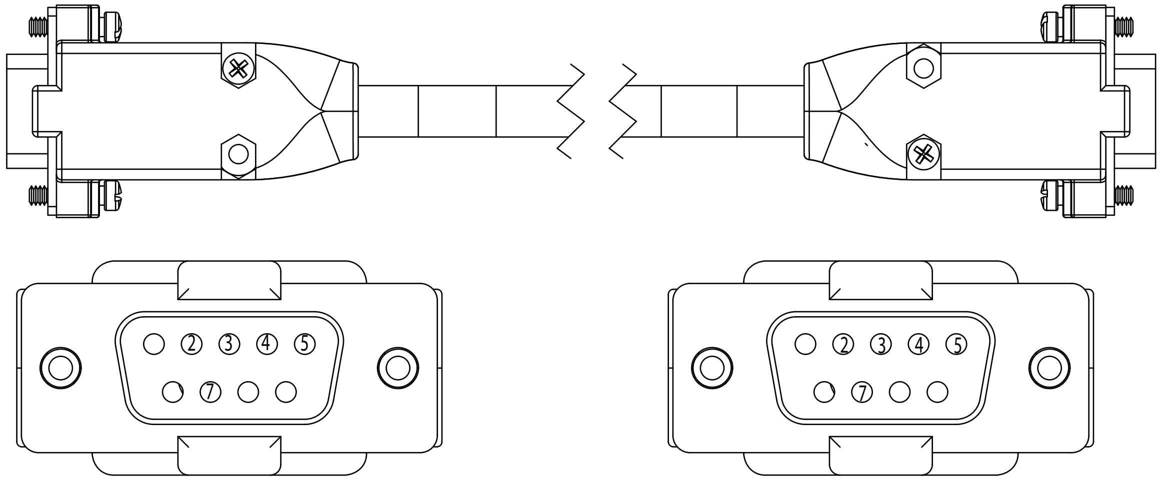
How to connect to the plasma power supply with serial RS-422

- For an example of a system diagram, see *Serial RS-422 and discrete multi-system interface (Sheet 17 of 22)* on page 425.
- For serial RS-422 multi-drop (multi-system) addressing, see *XPR serial RS-422 multi-drop (multi-system) addressing* in the *CNC Communication Protocol for the XPR Cutting System* (809810).
- For information on signals and protocols, see *XPR serial RS-422 communications* and *Serial RS-422 and EtherCAT commands* in the *CNC Communication Protocol for the XPR Cutting System* (809810).

To use arc voltage control (AVC) with a serial RS-422 cutting system, you must install an additional PCB inside the plasma power supply. For information about how to install this board, see *VDC3 board installation (for AVC with RS-422 and discrete-only)* on page 154.

1. Remove the rear panel of the plasma power supply. See *How to remove the external panels from the system components* on page 86.
2. Put End A (*Figure 40*) of the serial RS-422 cable through the hole in the bottom of the rear compartment in the plasma power supply. See *Figure 41* on page 149.
3. Connect End A of the serial RS-422 cable to the correct connector on the control board in the plasma power supply:
    - For systems with multiple plasma power supplies, use the top connector (J12) for the CNC. Use the bottom connector (J13) to connect to the next plasma power supply.
    - For systems with only one plasma power supply, you can use either connector to connect to the CNC.
4. Connect the End B (*Figure 40*) of the cable to the CNC.
5. If you are only monitoring with RS-422 serial, you are done. If you want to operate the cutting system, go to *step 6*.
6. You must connect to the plasma power supply with discrete. See *How to connect to the plasma power supply with discrete* on page 150.

Figure 40 – Serial RS-422 cable



End A
To the plasma power supply (top serial connector, J12)

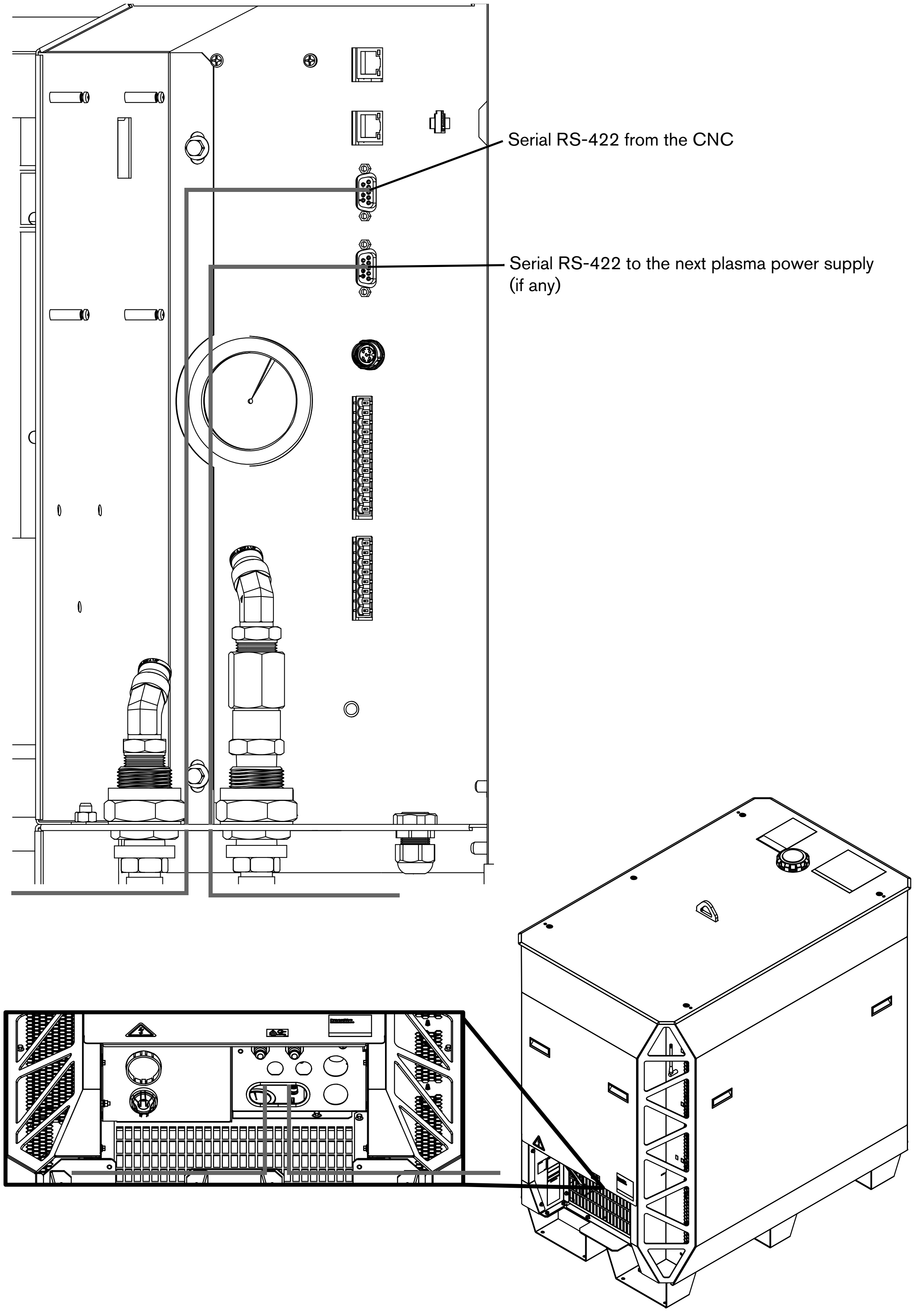
End B
To the CNC

For lengths, see *Serial CNC interface cable* on page 390 in the *Parts List*.

Table 23 – Pinout for serial RS-422 interface cable

End A		Wire color	End B		Wire type
Signal	**Pin number**		**Pin number**	**Signal**	
TxD +	4	Red	7	RxD +	Pair
TxD -	2	Black	3	RxD -	
RxD +	7	White	4	TxD +	Pair
RxD -	3	Black	2	TxD -	
GND	5	Green	5	GND	Pair
–	Cut	Black	Cut	–	

Figure 41 – Connect the serial RS-422 cable to the plasma power supply



How to connect to the plasma power supply with discrete

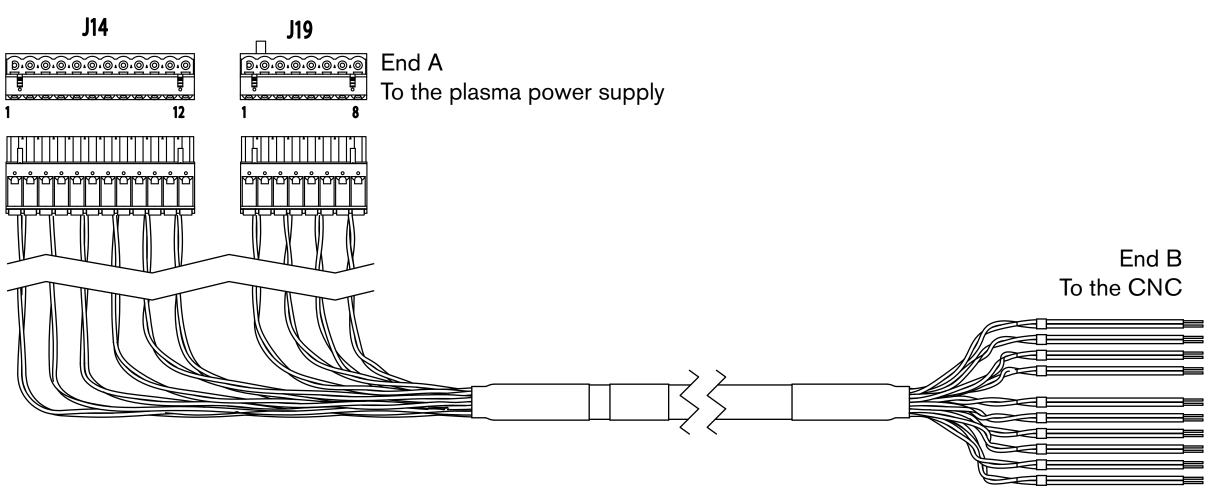
You must use serial RS-422 or the XPR Web Interface with discrete to operate the cutting system.

To use arc voltage control (AVC) with a discrete cutting system, you must install an additional PCB inside the plasma power supply. For information about how to install this board, see *VDC3 board installation (for AVC with RS-422 and discrete-only)* on page 154.

- For an example of a system diagram, see *Discrete multi-system interface (Sheet 18 of 22)* on page 426.
- For information on signals and protocols, see *XPR discrete communication* in the *CNC Communication Protocol for the XPR Cutting System* (809810).

1. Remove the rear panel of the plasma power supply. See *How to remove the external panels from the system components* on page 86.
2. Put End A (*Figure 42*) of the discrete cable through the hole in the bottom of the rear compartment in the plasma power supply. See *Figure 43* on page 153.
3. Connect J14 and J19 to their respective connectors on the control board in the plasma power supply.
4. Connect the End B (*Figure 42*) of the cable to the CNC. See *Table 24* on page 151 and *Table 25* on page 152 for pinouts.

Figure 42 – Discrete cable



For lengths, see *Discrete CNC interface cable* on page 389 in the *Parts List*.

Table 24 – Pinout for J14 on the discrete cable

End A (*Figure 42* on page 150)				
J14 pin	**Input/ Output**	**Signal**	**Function**	**Wire color**
1	Input[1]	Remote on/off +	When the input is closed, the plasma power supply is enabled. When open, the power to the consoles and the contactors is disabled.	Red
2		Remote on/off -		Black
3	Input[2]	Plasma start +	The CNC initiates preflow. If the hold input is not active, the CNC continues with the plasma arc. The plasma power supply stays in preflow as long as the hold input remains active.	White
4		Plasma start -		Black
5	Output[2]	Motion +	Notifies the CNC that an arc transfer has occurred and to begin machine motion once the CNC's pierce delay time elapses.	Green
6		Motion -		Black
7	Input[1, 3]	Hold +	The CNC delays plasma arc initiation. This signal is normally used in combination with the Start signals to synchronize multiple torches. Activate this signal at the same time as the Plasma Start signal. Deactivate this signal to fire the torch.	Blue
8		Hold -		Black
9	Input[1]	Pierce complete +	The CNC notifies the plasma system to maintain the shield preflow until the CNC releases the signal. Activate this signal at the same time as the Plasma Start signal. Deactivate this signal when the pierce time is complete.	Yellow
10		Pierce complete -		Black
11	Output-[4]	F+24V CNC	Available 24 VDC (200 mA maximum)	Brown
12		F PWRGND	Ground	Black

Table 25 – Pinout for J19 on the discrete cable

End A (*Figure 42* on page 150)				
J19 pin	**Input/ Output**	**Signal**	**Function**	**Wire color**
1	Output[2]	Error +	Notifies the CNC that an alert, error, or failure has occurred. This signal is not intended to be used to stop table motion.	Orange
2		Error -		Black
3	Output[2]	Ready for start +	Notifies the CNC that the plasma power supply is ready for the plasma start.	White
4		Ready for start -		Red
5	Output[2]	Auto pierce detect +	Notifies the CNC that the plasma power supply has detected that the system has pierced through the workpiece and is ready to begin motion.	Green
6		Auto pierce detect -		Red
7	Output[5]	Shield ohmic contact +	See notes below for further info.	Blue
8		Shield ohmic contact -		Red

1 Inputs are optically isolated. They require 24 VDC at 12.5 mA or dry-contact closure at 8 mA.

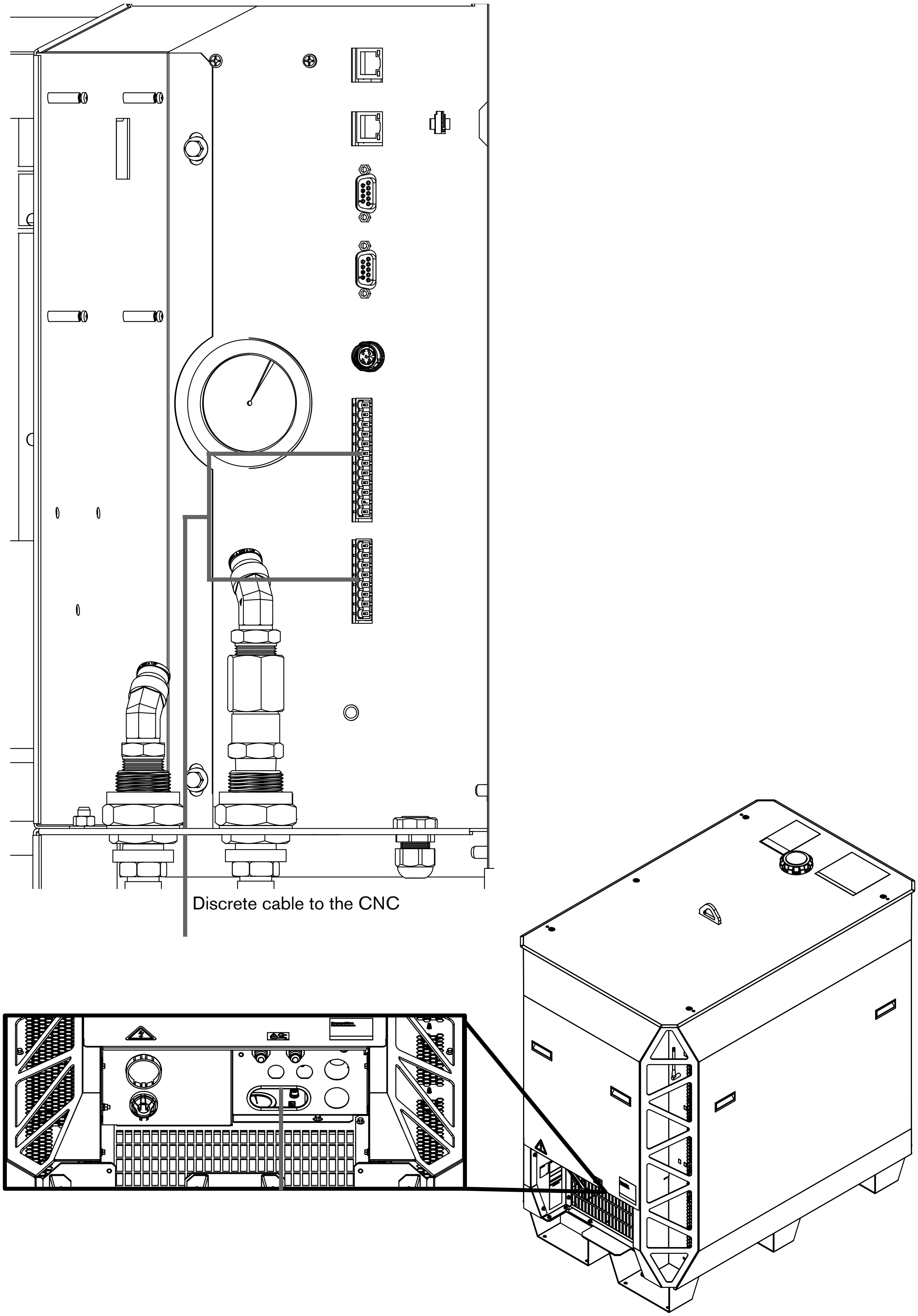
2 Outputs are optically isolated, open-collector transistors. The maximum rating is 24 VDC at 10 mA.

3 Although the plasma power supply has output capability, it is normally used solely as an input.

4 CNC +24 VDC provides 24 VDC at 200 mA maximum. A jumper is required on J17 to use 24 V power.

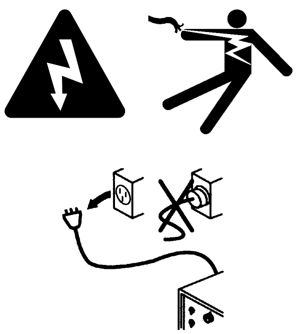
5 Shield ohmic contact is used to interface to plasma interface boards that have their own ohmic contact circuit. (See *How to use ohmic contact sense* on page 187.)

Figure 43 – Connect the discrete cable to the plasma power supply



VDC3 board installation (for AVC with RS-422 and discrete-only)

WARNING



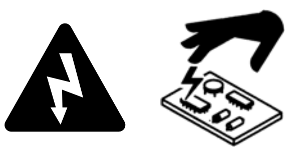
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

CAUTION



Static electricity can damage circuit boards. Use proper precautions when handling printed circuit boards.

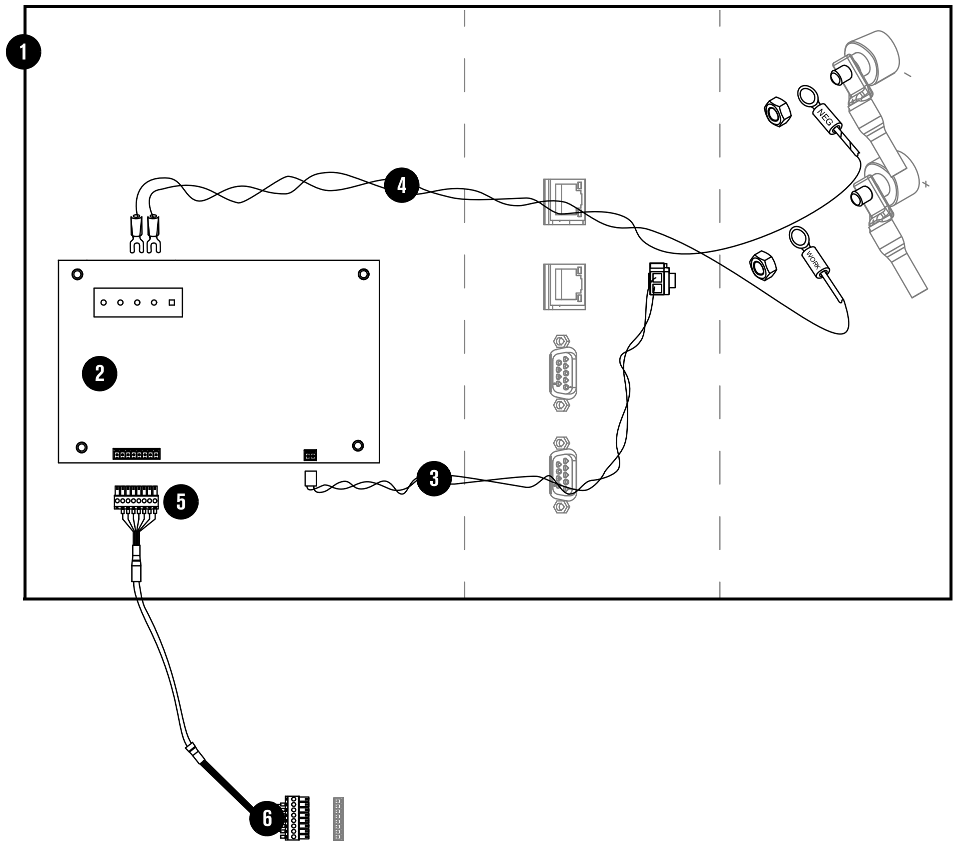
Store PC boards in anti-static containers.

Wear a grounded wrist strap when handling PC boards.

Diagram of board, cable, and wire connections

See *Figure 44* for an overview of the board, cable, and wire connections inside the plasma power supply.

Figure 44 – Connections inside the plasma power supply



1 Plasma power supply

2 Board: VDC3 (141511)

Wire harness in the plasma power supply

- 3 Wires: VDC3 board 120 VAC
- 4 Wires: Arc voltage

5 Male connector to VDC3 board (pre-installed on the VDC3 board)

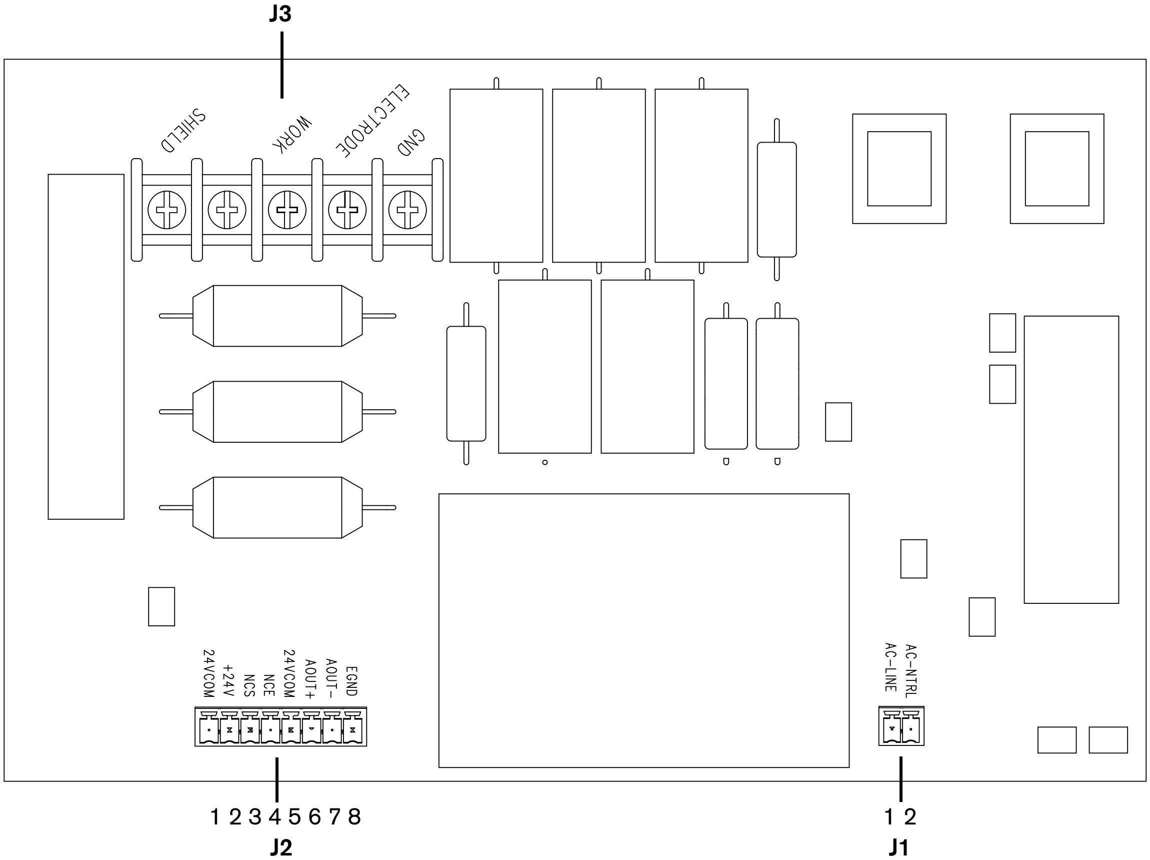
6 Cable and connector to the computer numerical controller (CNC) (customer supplied)

Part numbers are shown for parts included in the kit.

The wire harness to connect the VDC3 board is located in a clip inside of the plasma power supply. The wiring harness includes the arc voltage wires and the power wires.

How to install the VDC3 board (141511)

Figure 45 – VDC3 board



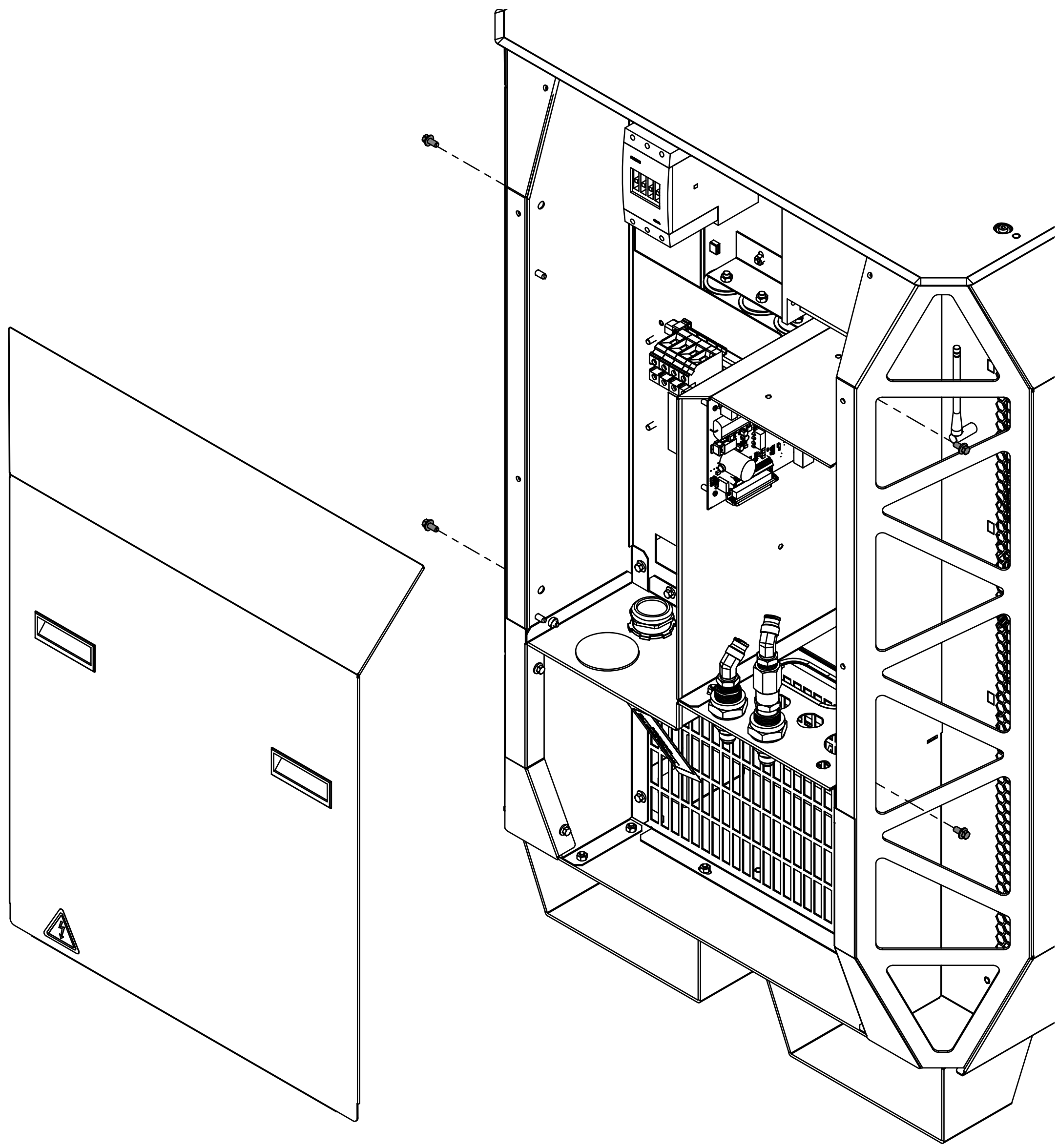
J1 120 VAC wires connector

J2 VDC3 board cable connector

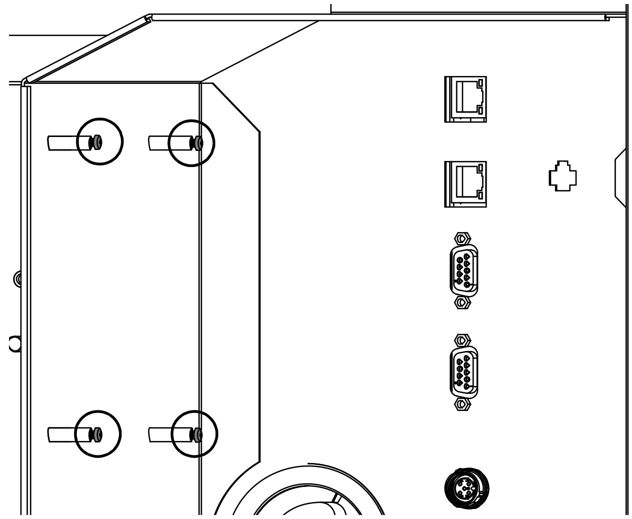
J3 Arc voltage wires connector

1. Use a 10 mm hex socket wrench or nut driver to remove the rear panel of the plasma power supply.

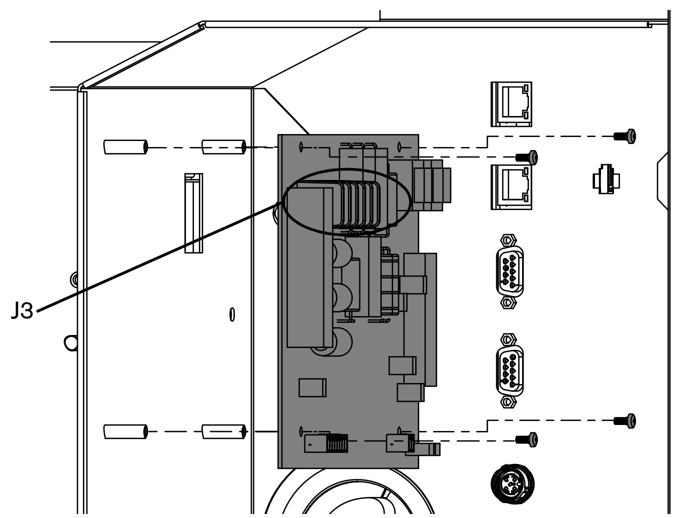
Figure 46



2. Use a #2 Phillips screwdriver to remove the 4 screws from the studs.

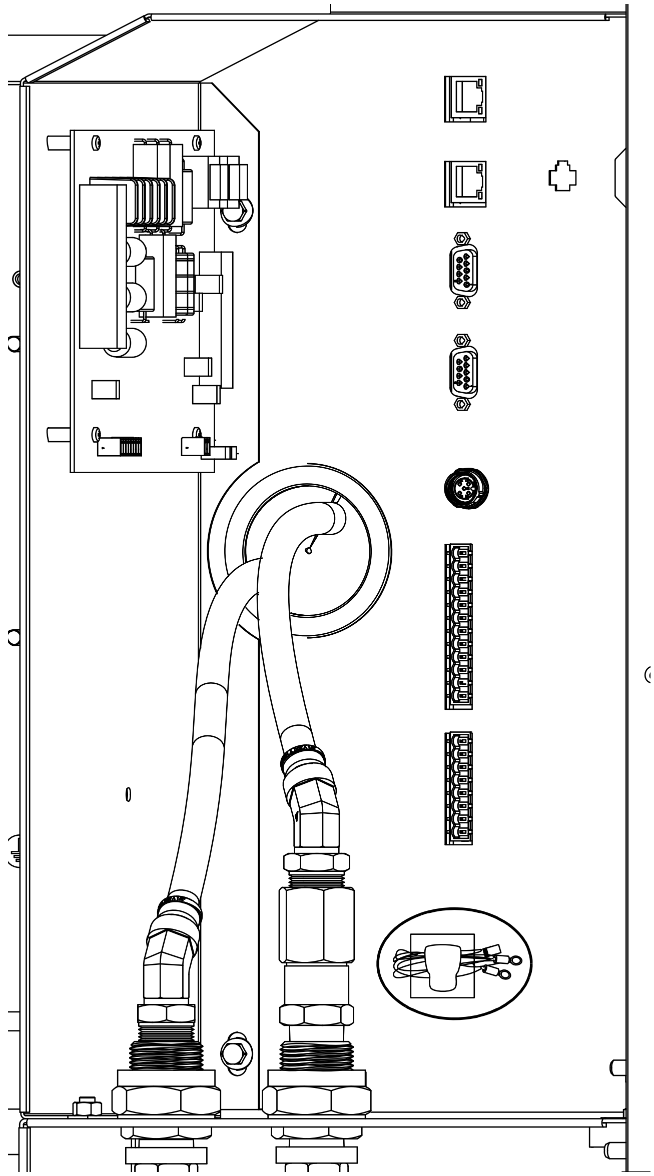


3. With J3 on top, use the 4 screws to install the board on the studs. Tighten the screws to 9.2 kg·cm (8.0 in·lb).



How to connect the VDC3 board (141511)

1. Remove the wire bundle from the wire clip in the plasma power supply.

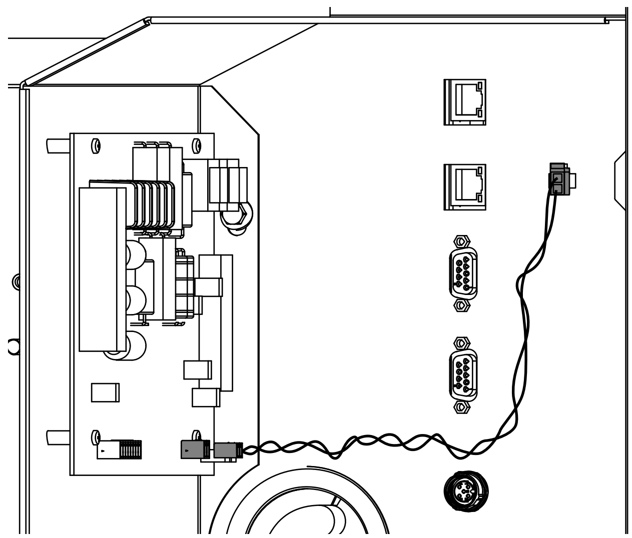


The wire bundle is included in the plasma power supply. The bundle includes the arc voltage wires and power wires.

2. Connect one end of the VDC3 120 VAC harness to J1 of the VDC3 board with the tab on top. See *Figure 47*.

3. Connect the other end of the VDC3 120 VAC harness to the 120 VAC connector.

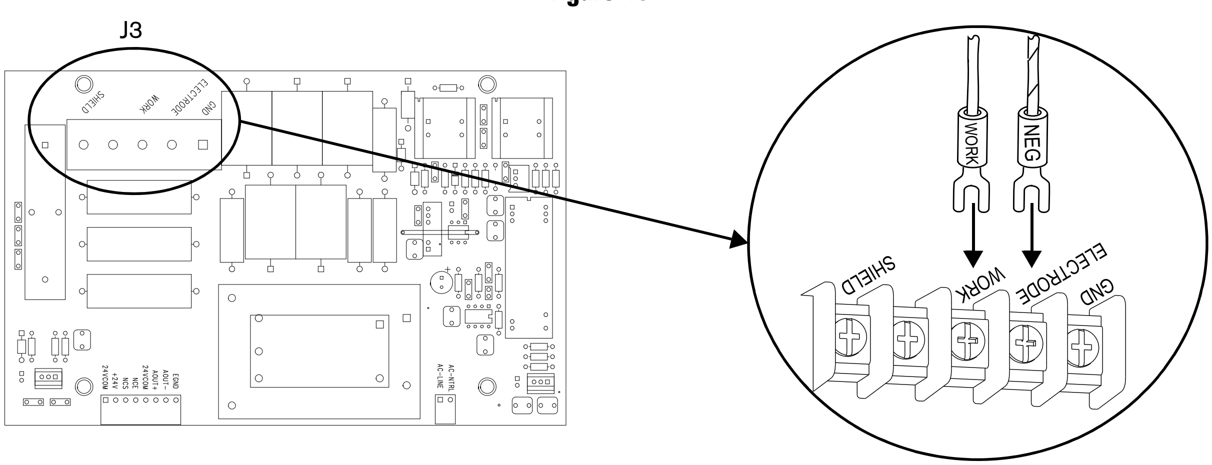
Figure 47



4. Attach the spade connector of the yellow wire (WORK) to the J3-WORK terminal. See *Figure 48*.

5. Attach the spade connector of the yellow/black wire (NEG) to the J3-ELECTRODE terminal.

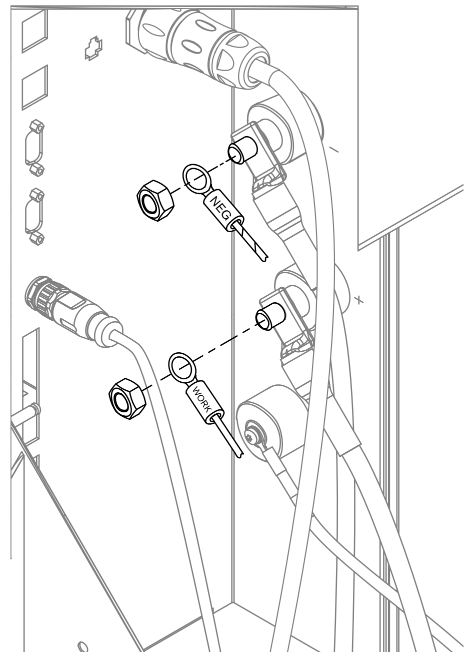
Figure 48



6. Attach the ring connector on the yellow wire (WORK) to the work bolt in the plasma power supply.Tighten the nut to 20 N·m (15 ft·lb).

7. Attach the ring connector on the yellow/black wire (NEG) to the negative bolt in the plasma power supply. Tighten the nut to 20 N·m (15 ft·lb).

   Other wires are already attached to the bolts in the plasma power supply. Attach the arc voltage wires on top of the existing wires.



8. Use NCS (pin 3), NCE (pin 4), Aout+ (pin 6), and Aout- (pin 7) to connect to the CNC. See *Figure 45* on page 156 for the locations of the pins. See *Table 26* for the pinout.

   Use the interface requirements of your CNC for additional connection requirements.

Table 26 – Pinout for J2 on the VDC3 board

J2 on the VDC3 board	
Pin number	**Signal**
1	Not connected
2	+24 VDC (out)
3	Nozzle contact sense (output)
4	Nozzle contact enable (input)
5	24 VDC common
6	+ Analog out (40:1)
7	- Analog out (analog common)
8	EMI chassis ground (cable shield)

9. Install the rear panel of the plasma power supply.

How to connect to the plasma power supply with the XPR web interface

CAUTION

If you use a wireless (Wi-Fi™) network to communicate with your cutting system, Hypertherm recommends the use of a secure Wi-Fi network to minimize the risk of unauthorized cutting system operation or misuse.

Minimum security features can include, but are not limited to, the following:

- Password protection
- WPA2 security for the plasma power supply
- A hidden SSID for the Wi-Fi network
- Operator training about network security

Unauthorized access or misuse of the Wi-Fi network can result in incorrect settings or commands. Bad settings and commands can cause an uncontrollable or unusable system. A negative effect on system performance, shortened consumable life, and torch damage is also possible.

You must use discrete with the XPR web interface to operate the cutting system.

If you go out of range with the device, you cannot communicate with the cutting system. The cutting system continues to operate. For more information on distances for wireless, see *Distance requirements for communications* on page 52.

You can use one of the following options to connect to the XPR web interface:

- Access point (AP) mode (See *Use AP mode to connect* on page 163.)
  - You connect to the plasma power supply's network.
  - AP mode is the default connection option. You connect to a single plasma power supply.
- Network mode (See *Use network mode to connect* on page 165.)
  - You connect the plasma power supply to your network.
  - The advantage of network mode is that you can connect to one network and access multiple plasma power supplies.

Web interface support information

- If you have a problem connecting and you suspect a problem with your device, router, or local network, contact your system administrator.
- If you have a problem connecting and you suspect a problem with the plasma power supply, contact your cutting machine supplier or Hypertherm Technical Service.

Use AP mode to connect

In AP mode, each plasma power supply has its own connection. You can only connect to and control one plasma power supply at a time. You must have a computer-based device with a screen, web browser that supports the latest web standards, and wireless access.

1. Supply power to the cutting system:
   a. Set the line-disconnect switch to the ON position.
   b. Make sure that the power-indicator LED is illuminated on the plasma power supply.
   c. Make sure that the remote on-off switch is set to ON.

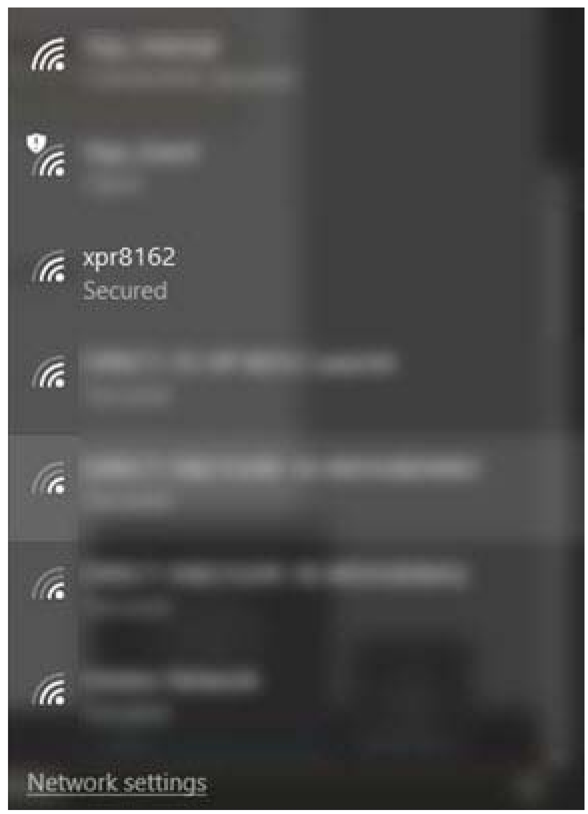
2. On your device, go to the wireless connections menu.

   This menu can be different on different devices.

3. Choose the XPR connection.

   The default connection name is “xpr” + the System ID. The System ID is the last 4 digits of the Media Access Control (MAC) address. For more information on the System ID and MAC address, see *Web interface screen information* on page 180.

   If you want to change the connection name, see *Configure* on page 185.



4. Enter the password, “hypertherm”.

   If you want to change your password, see *Configure* on page 185.

5. Open an Internet browser.

6. Go to http://192.168.1.1/index.html.
   - The plasma power supply is now connected.
   - The information about your plasma power supply and connection are located in the upperleft of the XPR web interface.

   - If the Client ID and the Operator ID are the same on your device, you are in control of the plasma power supply and can set a process.
   - See *Web interface screen information* on page 180 for more information on the interface menus.

7. To fully operate the cutting system, you must also use discrete. See *How to connect to the plasma power supply with discrete* on page 150.

Use network mode to connect

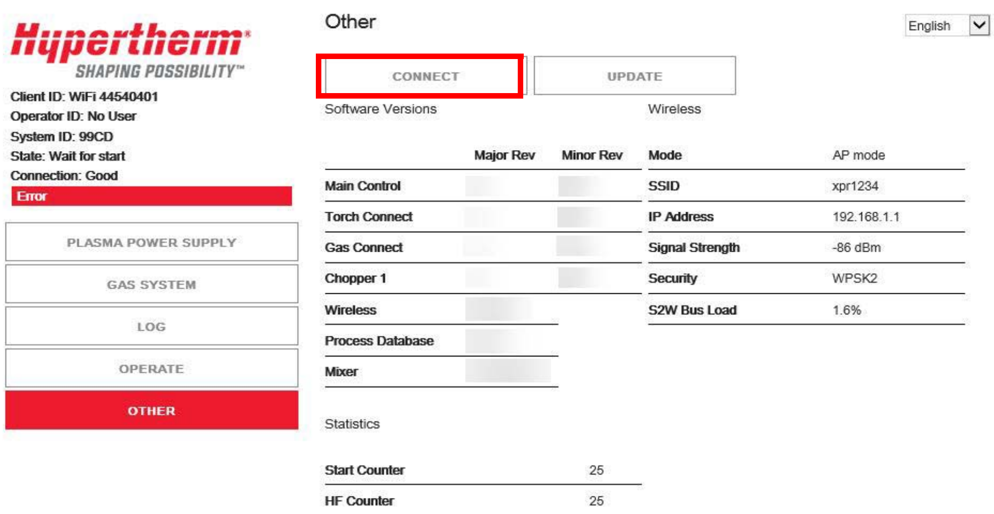
In network mode, multiple plasma power supplies can be connected to a network. You can connect to and control multiple plasma power supplies at the same time.You must have a computer-based device with a screen, web browser that supports the latest web standards, and wireless access.

Before you begin:

- You must set up a router with a local network to access. Follow the router's instructions to do this. If you have problems setting up your router, contact your system administrator.
- You must know the SSID and passphrase for the router.

1. Follow the procedure in *Use AP mode to connect* on page 163 to connect the wireless set-up device to the plasma power supply.

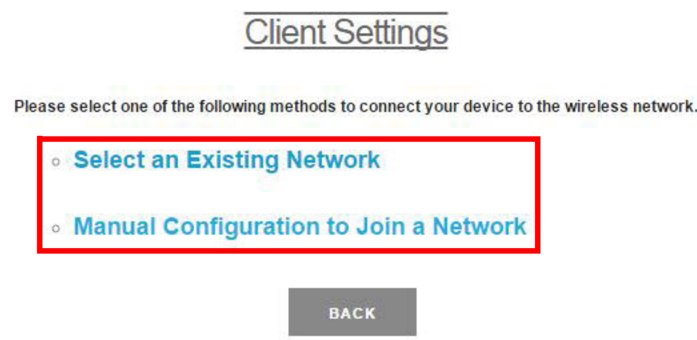
2. Choose **Connect** on the **Other** screen to open the Device Setup page.



The XPR web interface shows different fields for different XPR models. The screen shown is for reference only.

3. Choose **Client Settings**.

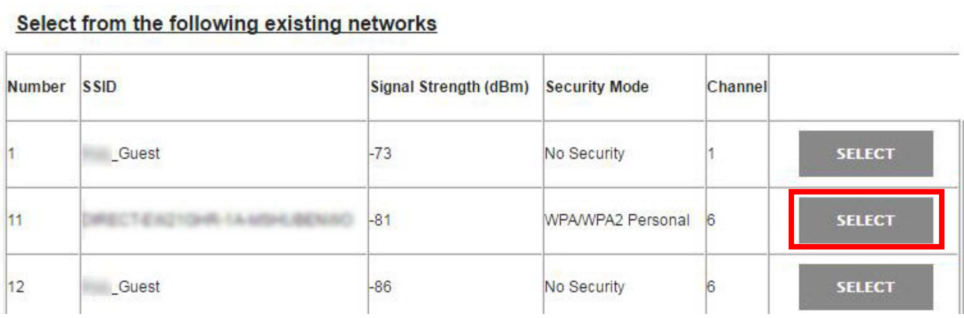
4. Choose an option to connect to wireless networks:
   - *Select an existing network* on page 167.
   - *Set up manually* on page 170.



Select an existing network

When you choose this option, the plasma power supply scans for and shows the available access points.

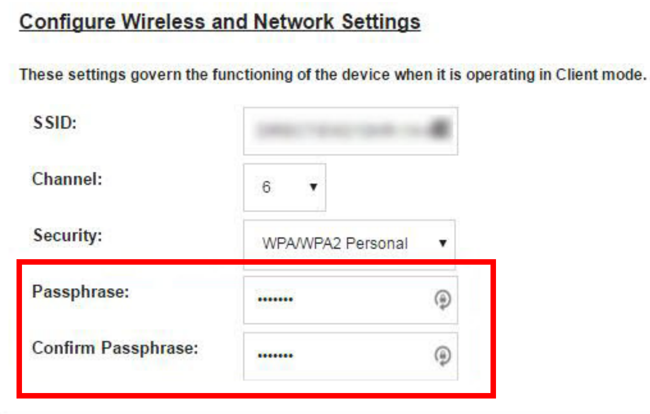
1. Choose **Select** to connect to your router.



Select from the following existing networks

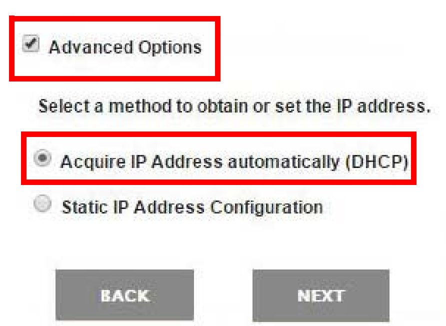
Number	SSID	Signal Strength (dBm)	Security Mode	Channel	
1	_Guest	-73	No Security	1	SELECT
11		-81	WPA/WPA2 Personal	6	SELECT
12	_Guest	-86	No Security	6	SELECT

2. Type the required credentials for the router in **Passphrase**.

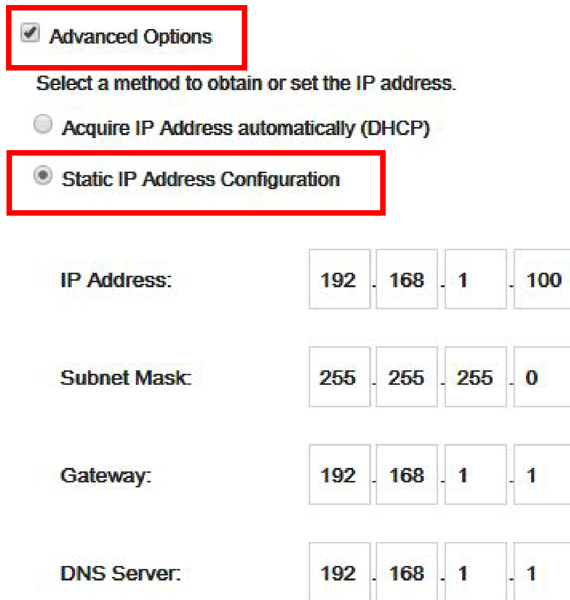


3. If needed, select the **Advanced Options** check box and select a method to get the IP address. If not, go to *step 4*.

   a. Dynamic Host Configuration Protocol (DHCP)

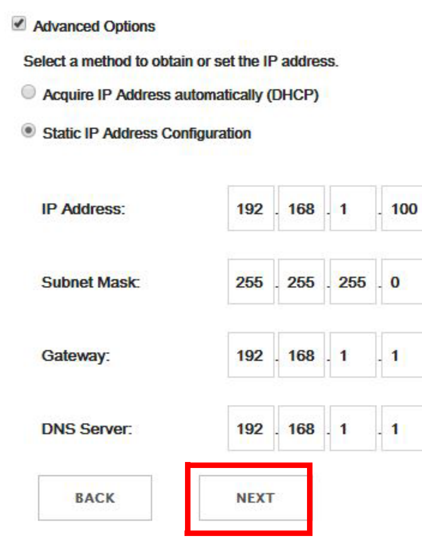


b. Static IP (advanced users only.)



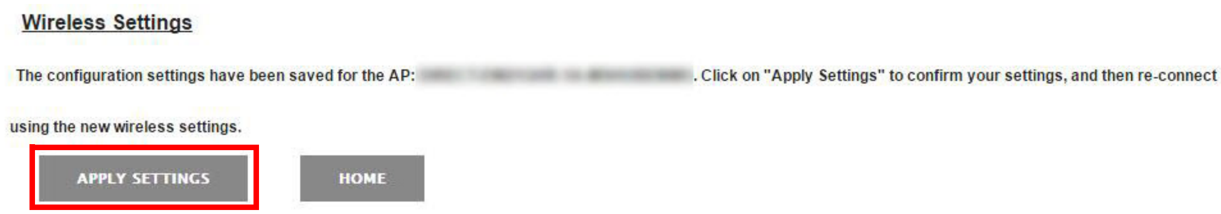
4. Choose **Next** to go to the Wireless Configuration Summary screen.

This page shows information about the **SSID**, **Channel**, and **Security** type.



5. Choose **Save**.

6. This page provides the option to apply the settings. Choose **Apply Settings**.



The selected wireless settings are applied to connect the plasma power supply to the new network. The plasma power supply now resets and connects to the new network.

To access the web interface after setup, see *Access the XPR web interface after setup in network mode* on page 173.

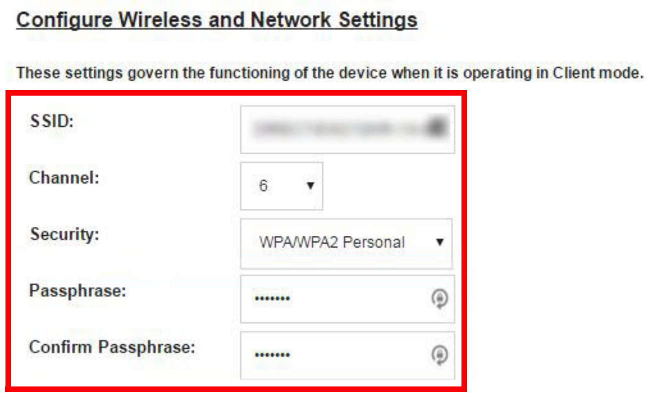
7. If you are only monitoring with the XPR web interface, you are done. If you want to operate the cutting system, go to *step 8*.

8. You must connect to the plasma power supply with discrete. See *How to connect to the plasma power supply with discrete* on page 150.

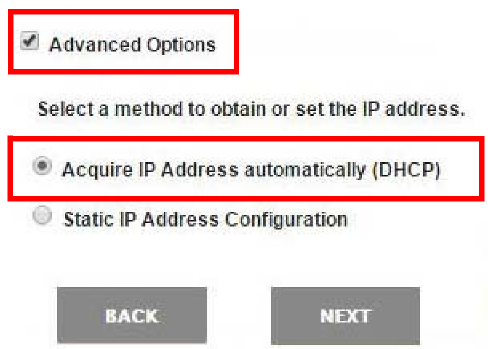
Set up manually

When you choose this option, you manually set up the wireless network.

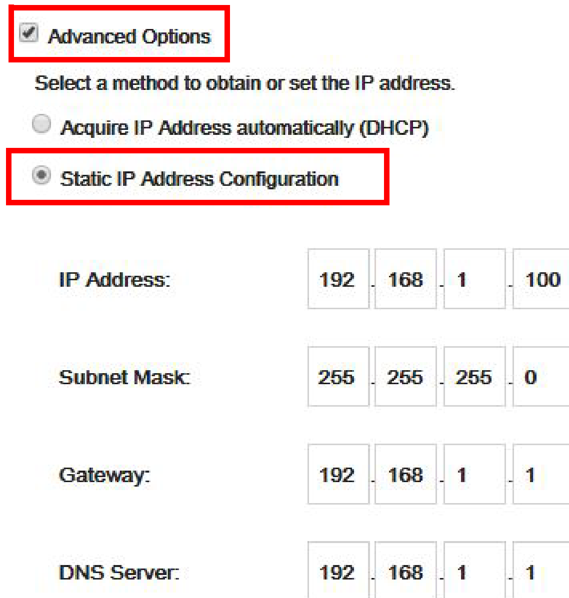
1. Select or type the wireless related settings such as **SSID**, **Channel**, **Security**, and **Passphrase**.



2. If needed, select the **Advanced Options** check box and select a method to get the IP address. If not, go to *step 3*.
   a. Dynamic Host Configuration Protocol (DHCP)

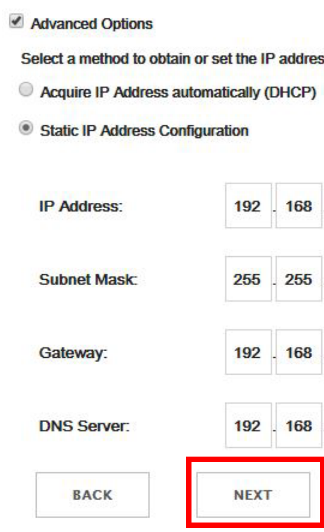


b. Static IP (advanced users only.)



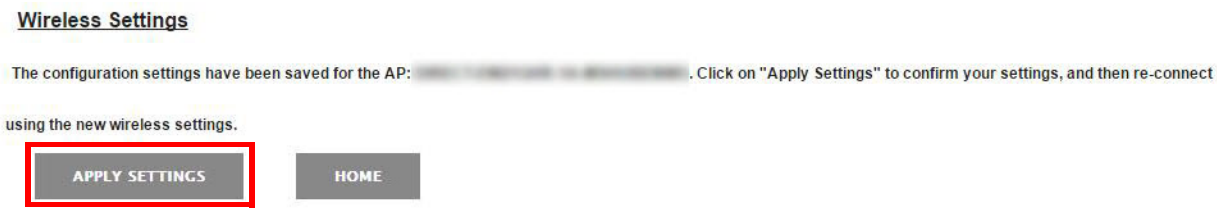
3. Choose **Next** to go to the Wireless Configuration Summary screen.

This page shows information about the **SSID**, **Channel**, **Security** type, **IP Address**, **Subnet Mask**, **Gateway**, and **DNS Server**.



4. Choose **Save**.

5. This page provides an option to apply the settings. Choose **Apply Settings**.



The selected wireless settings are applied to connect the plasma power supply to the new network. The plasma power supply now resets and connects to the new network.

To access the web interface after setup, see *Access the XPR web interface after setup in network mode* on page 173.

6. If you are only monitoring with the XPR web interface, you are done. If you want to operate the cutting system, go to *step 7*.

7. You must connect to the plasma power supply with discrete. See *How to connect to the plasma power supply with discrete* on page 150.

Access the XPR web interface after setup in network mode

Use the IP address of the plasma power supply.

> Hypertherm recommends that you use DHCP reservation if it is available on your router. This allows the plasma power supply to keep the same IP address through power cycles without having to set up the wireless module with the static IP address.

1. Use your router's web interface to find the DHCP client table. (See *Figure 49* for an example.)

Figure 49 – Example DHCP client table

DHCP Clients

Host Name	IP Address	MAC Address	Client Lease Time
DLABRECQUET430	192.168.1.104	xx:xx:xx:xx:30:0C	1 day 00:00:00
GS_188162	192.168.1.133	xx:xx:xx:xx:81:62	1 day 00:00:00

2. Find the IP address of the plasma power supply.

> Your plasma power supply name shows as "GS_" + the last 6 digits of the MAC address.

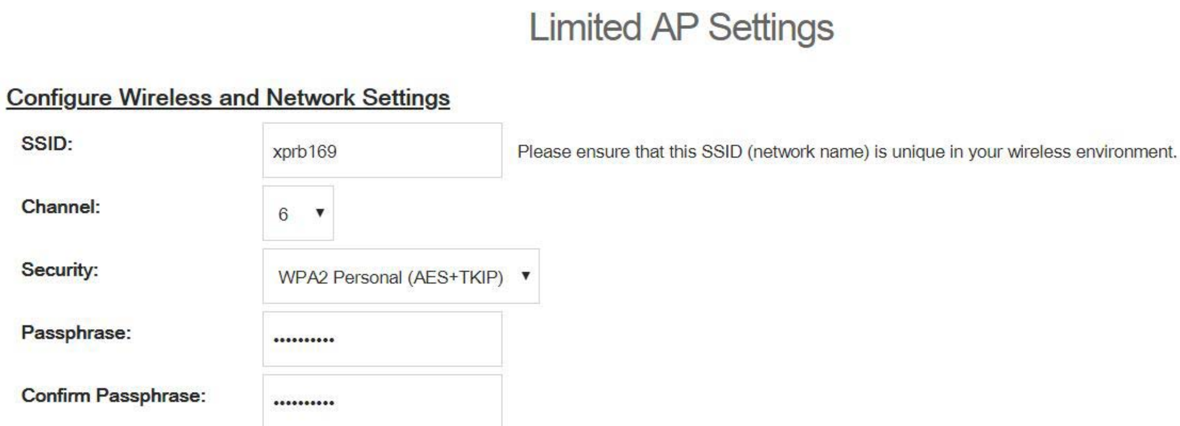
3. Open a web browser.

4. Use the assigned IP address to access the XPR web interface. In the example in *Figure 49* you navigate to http://192.168.1.133/index.html.

Change the limited AP settings

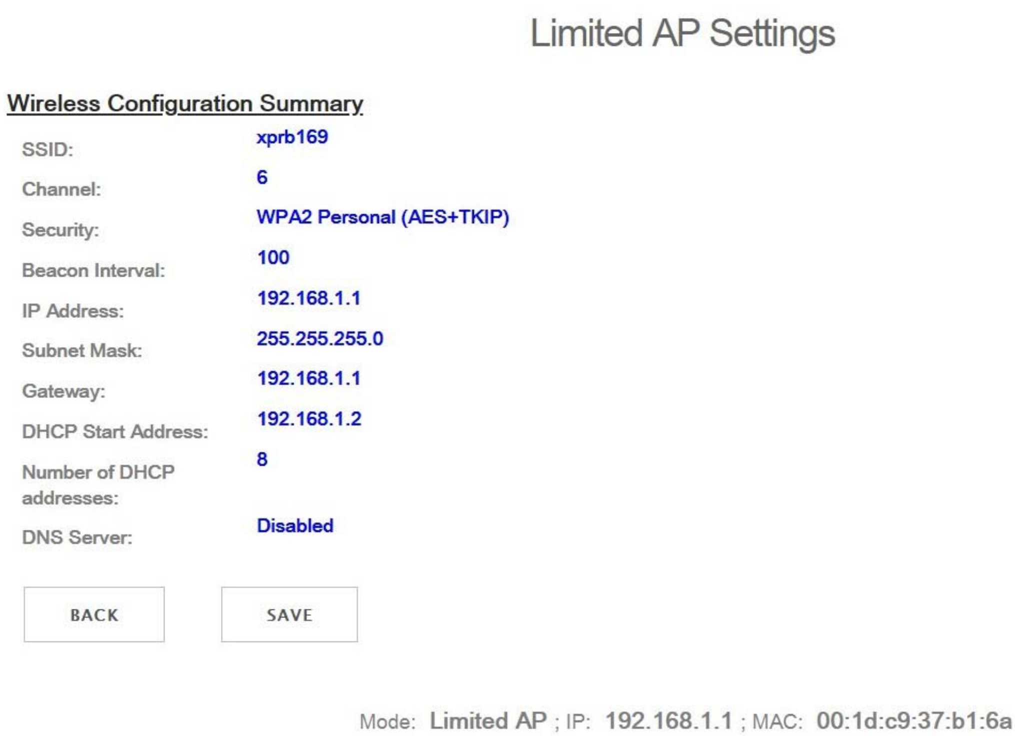
You can change the limited AP SSID, channel, network address, and DHCP settings in the Connect screen.

1. Choose **Other** > **Connect** > **Limited AP Settings**.
2. On the Limited AP Settings screen, select the AP mode settings



3. Choose **Advance Options**, then **Next**.

4. Verify that the settings are correct. Adjust if necessary, otherwise, choose **Save**.



5. Choose **Apply Settings**.

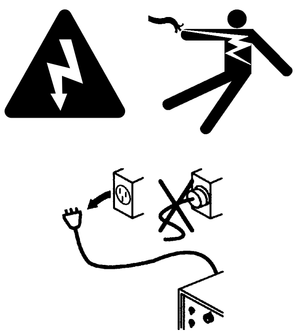
The change takes effect after you cycle the power.

6. Cycle the power to the plasma power supply.

Reset the wireless module

It is possible to make mistakes when you set up the wireless module. Use this procedure to reset your wireless module to its default settings.

WARNING



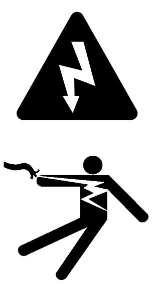
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

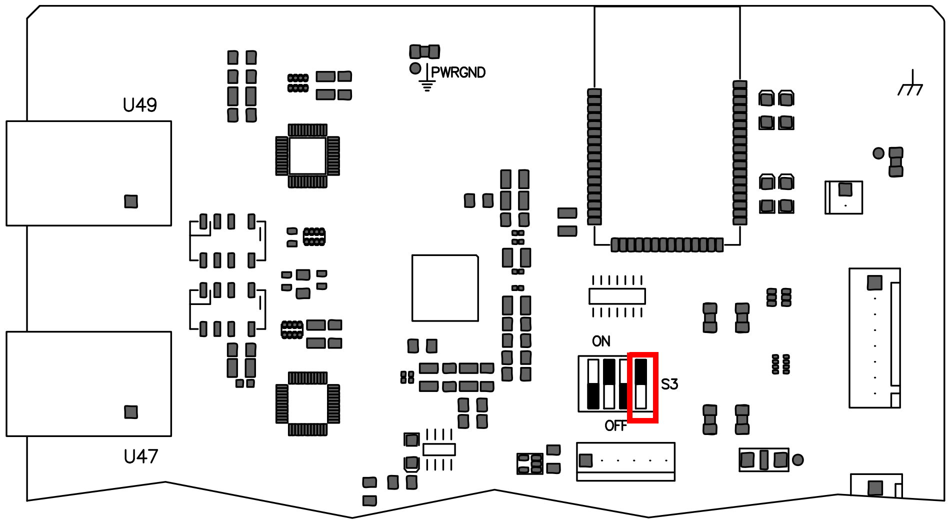
Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

1. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED is not illuminated on the plasma power supply.
2. Remove the side panel of the plasma power supply.

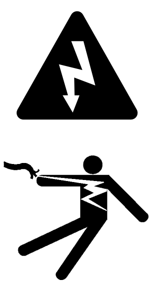
3. On the main control board, set position 4 on DIP switch S3 to the ON position.

   This disables the wireless.



4. Supply power to the cutting system:
   a. Set the line-disconnect switch to the ON position.
   b. Make sure that the power-indicator LED is illuminated on the plasma power supply.

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Use extreme caution if you service a plasma power supply when connected to an electric power source and the outer cover or panels are removed.

5. Wait 30 seconds.

6. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED is not illuminated on the plasma power supply.

7. Set position 4 on DIP switch S3, located on the main control board, to the OFF position.

   This enables the wireless.

8. Install the side panel of the plasma power supply.

9. Supply power to the cutting system:

   a. Set the line-disconnect switch to the ON position.

   b. Make sure that the power-indicator LED is illuminated on the plasma power supply.

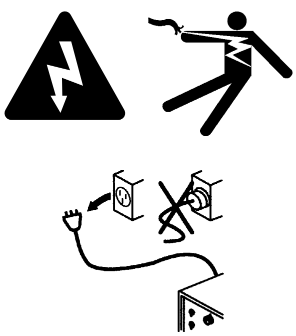
10. Wait 30 seconds.

    The wireless module is now reset to the factory default settings.

How to disable the wireless connection

If you want to completely disable the wireless connection, use this procedure.

WARNING



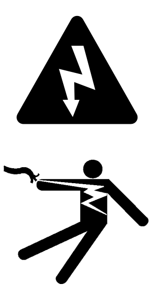
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

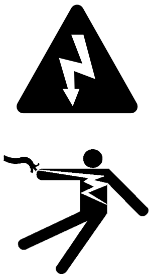
1. Remove the power from the cutting system:

   a. Set the line-disconnect switch to the OFF position.

   b. Make sure that the power-indicator LED is not illuminated on the plasma power supply.

2. Remove the side panel of the plasma power supply.

⚠ WARNING



ELECTRIC SHOCK CAN KILL

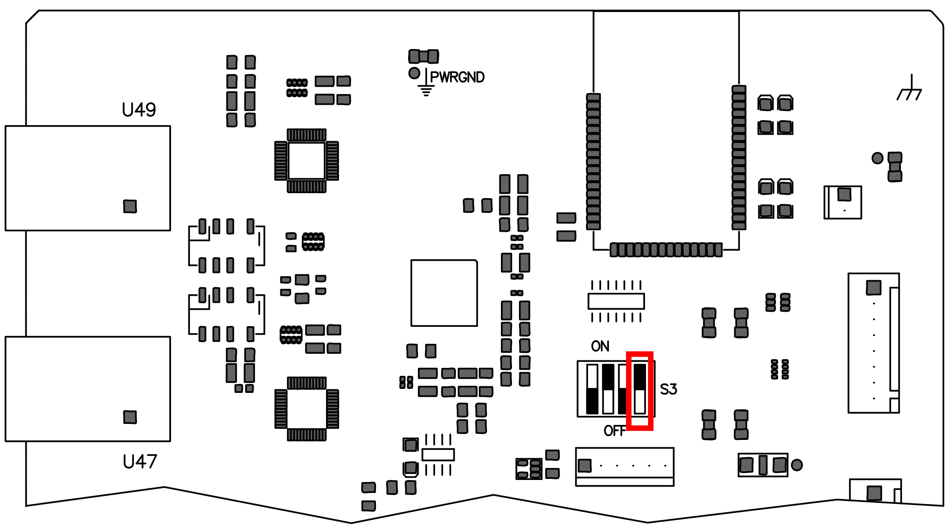
The plasma power supply contains dangerous electric voltages that can cause injury or death.

Use extreme caution if you service a plasma power supply when connected to an electric power source and the outer cover or panels are removed.

3. On the main control board, set position 4 on DIP switch S3 to the ON position.

   This disables the wireless.

Figure 50 – Main control board (note DIP switch S3 location).

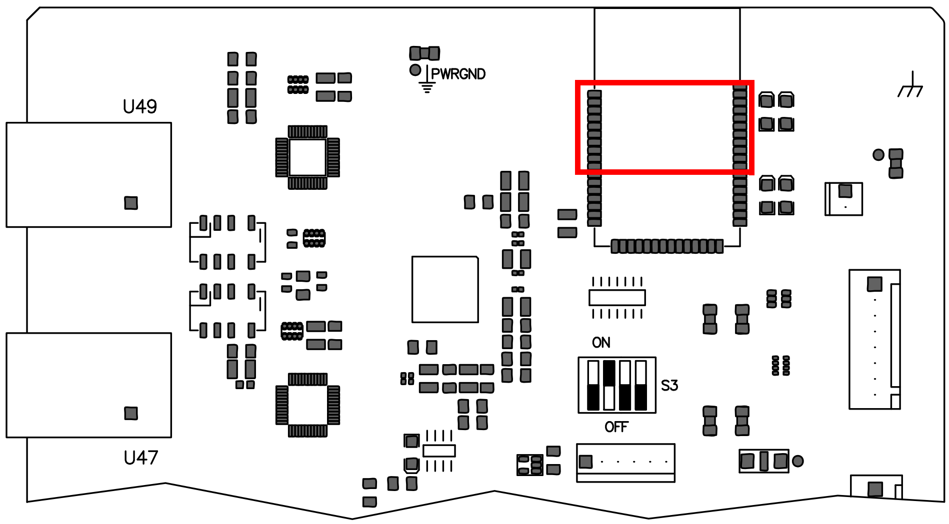


4. Install the side panel of the plasma power supply.
5. Supply power to the cutting system:
   a. Set the line-disconnect switch to the ON position.
   b. Make sure that the power-indicator LED is illuminated on the plasma power supply.

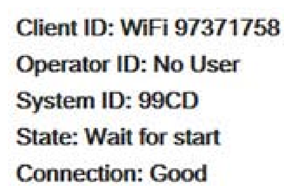
Web interface screen information

If you replace the control PCB, the information stored on the PCB changes. This includes the MAC address, System ID, passwords, and network information.

- **System ID** – This is the identifier for the plasma power supply. It is the last 4 digits of the MAC address. The MAC address is printed on the wireless module on the control PCB.



- **Operator ID** – This is the identifier for the device or client that has control of the plasma power supply. The first part of the Operator ID shows the type of connection that sent a process, **WiFi** for wireless, **Uart 422** for serial RS-422, or **EtherCAT** for EtherCAT.



To change which device has control of the plasma power supply, see *How to change the device that has control* on page 186.

- **Client ID** – This is the identifier for a device that communicates with the plasma power supply. This ID uses the UTC time stamp and is saved in a browser cookie.

If the Client ID and the Operator ID are the same on your device, you are in control of the plasma power supply.

- **Connection** – This is the status of the communication between the device and the plasma power supply. (Good or Error.)

Plasma power supply

On this screen you can monitor the status of the plasma power supply. This screen also lists inputs and outputs. When highlighted red or gray, that input or output is active.

Status

Type	XPR[illegible] OptiMix
State	Wait for start
Log	0
Process	2053 - 130A Mix/N_2
Arc Time	0d 0h 20min 51s
(+) DC	300 A
Coolant Flow	7.96 lpm (2.1 gpm)
Coolant Level	Low

IO

Inputs	Outputs
On Switch	Main Contactor
Start	Coolant Pump
Hold	Coolant Solenoid
Pierce	Magnetics Fans
	Heat Exchanger Fans
	Ready for Start
	Ohmic Contact
	Motion
	Hold
	Error

Fan Speed

Heat Exchanger 1	2950 rpm
Heat Exchanger 2	2951 rpm
Magnetics 1	2952 rpm
Magnetics 2	2953 rpm
Control Side 1	6150 rpm
Control Side 2	6250 rpm

Temperature

Coolant	24.9 °C (77 °F)
Transformer	26 °C (79 °F)
Inductor 1	25.1 °C (77 °F)
Inductor 2	25.2 °C (77 °F)
Inductor 3	25.3 °C (78 °F)
Inductor 4	25.4 °C (78 °F)

Chopper

	Setpoint	DC	Temperature
Chopper 1	150 A	151 A	69 °C (156 °F)
Chopper 2	150 A	149 A	70 °C (158 °F)

Arc Voltage	126 V
Bus Voltage	325.8 V

The XPR web interface shows different fields for different XPR models.
The screen shown is for reference only.

Gas system

On this screen you can monitor the status of the torch connect console and the gas connect console. You can also see which valves are active when the gas is flowing. Active valves are indicated with a gray highlight.

You can do 4 tests from this screen: Test Preflow, Test Cutflow, Test Pierceflow, and Gas Leak Test. The gas leak test is only available on XPR cutting systems equipped with a VWI or OptiMix gas connect console. See *How to do a gas leak test (VWI and OptiMix)* on page 331.

The test starts when you choose the button. The button becomes active, indicated with a red highlight. The active valves are indicated with a gray highlight. The gases shown on Line A, Line B, and shield are different depending on the process ID that you selected. The gases flow for 60 seconds unless you choose the same button or choose another button that interrupts the test.

TEST PREFLOW	TEST PIERCEFLOW
TEST CUTFLOW	GAS LEAK TEST

Torch Connect

	Type	Setpoint	Output	Inlet	PWM
Line A	Mix	0.00 bar (0 psi)	4.21 bar (61 psi)	7.72 bar (112 psi)	0%
Line B	N_2	0.00 bar (0 psi)	0.00 bar (0 psi)	7.58 bar (110 psi)	0%
Shield	Air	2.41 bar (35 psi)	2.48 bar (36 psi)	7.79 bar (113 psi)	28%

Valve States V1 V4 V5 V6 V7 V8 V9 V10 V11 V12

OptiMix

	Setpoint	Output	Inlet	PWM
H_2O	0.00 bar (0 psi)	0.00 bar (0 psi)	2.41 bar (35 psi)	0%
F5	0.00 bar (0 psi)	0.00 bar (0 psi)	7.93 bar (115 psi)	0%
H_2	25 slpm	26 slpm	7.93 bar (115 psi)	75%
Ar	15 slpm	16 slpm	7.58 bar (110 psi)	35%
N_2	35 slpm	36 slpm	8.62 bar (125 psi)	65%

Outlet Pressure 3.79 bar (55 psi)

Log

On this screen you can monitor active diagnostic codes and view diagnostic code history. There are 4 categories of codes: information, alert, error, and failure. See *Diagnostic codes* on page 261 for definitions.

Active

Class	ID	On Time	Description	Details
Failure	513	0d 15h 39min 4s	Main->TCC CAN t/o	N/A
Failure	503	0d 15h 38min 35s	TCC->Main CAN t/o	hf:49677ms
Alert	531	0d 15h 38min 17s	Low psi-Line B	pres:38psi ref:53psi
Alert	770	0d 15h 37min 50s	Gas Inlet - N_2 Line B	p1:79psi ref:80psi
Error	691	0d 15h 37min 7s	Node reset	id:1 rcc:0x2e hf:27999ms
Error	691		Node reset	

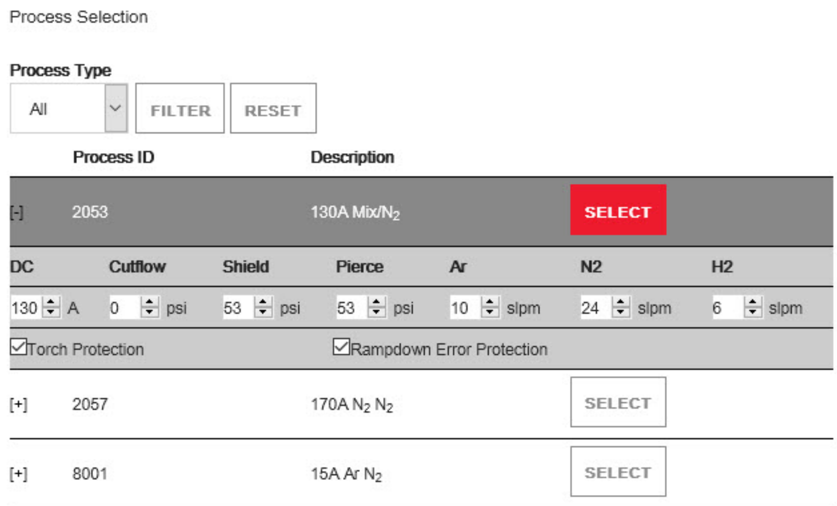
History

Class	ID	On Time	Description	Details
Info	647	0d 15h 37min 7s	Process selected	id:1001
Info	643	0d 15h 36min 43s	No process loaded	N/A
Info	642	0d 15h 36min 41s	System powered	N/A
Error	691	0d 15h 36min 40s	Node reset	id:1 rcc:0x2e hf:999ms

Operate

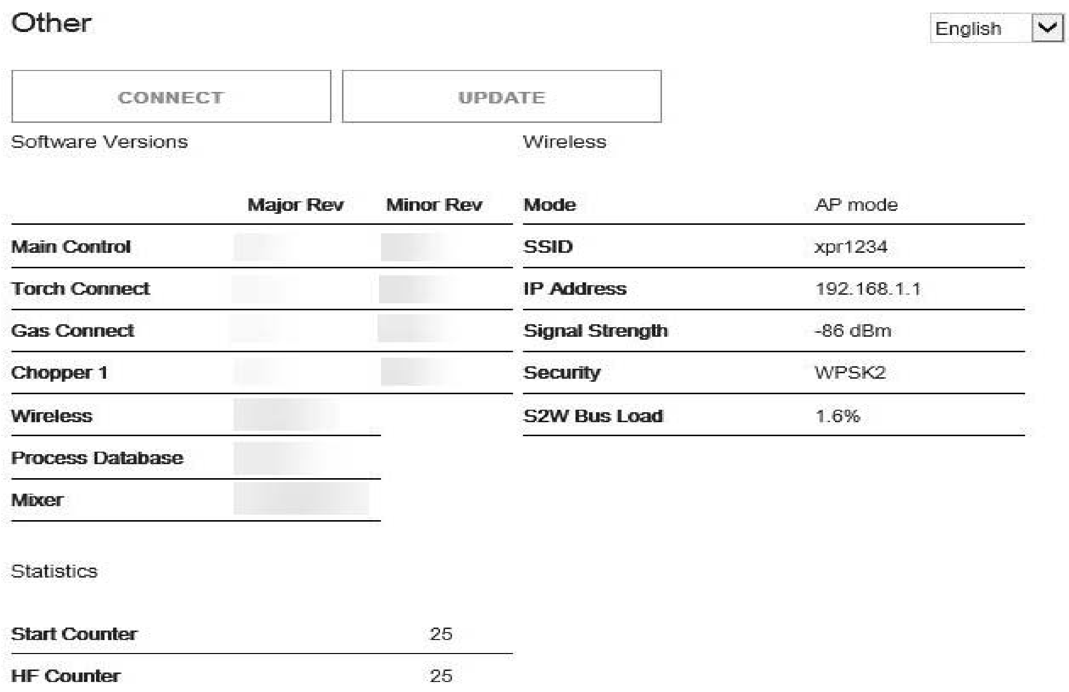
On this screen, if you have the device that is in control of the plasma power supply, you can select a process ID based on material, thickness, and process type.

You can customize some parameters by choosing the + to open the menu. The plasma power supply keeps this customization until the remote on-off switch is set to OFF or the power is removed from the plasma power supply. The customization is also reset when you select a new process.



Other

On this screen you can view the software versions and monitor the status of the wireless connection. From this screen, you can also access the **Configure**, **Connect**, and **Update** commands.



The XPR web interface shows different fields for different XPR models.
The screen shown is for reference only.

Configure – On this screen you can change the connection name, limited AP password, limited AP IP address, or the setup password

- You cannot use special characters in any of the fields on this screen.
- The connection name must be less than 32 characters long.
- Passwords must be between 8 and 20 characters long.
- Passwords are case sensitive.

Connect – On this screen you can change your client settings and connect to other networks. For more information on how to do this, see *Use network mode to connect* on page 165.

Update – On this screen you can update the web interface and firmware.

How to change the device that has control

The device that first sets a process controls the plasma power supply. For example, if the CNC sets the process, all other devices that connect to the plasma power supply after the CNC sets the process can only monitor the data.

If the **Client ID** and the **Operator ID** in the XPR web interface are the same on your device, you are in control of the plasma power supply.

To change the device that has control of the plasma power supply:

1. Remove the power from the cutting system:
    a. Set the line-disconnect switch to the OFF position.
    b. Make sure that the power-indicator LED is not illuminated on the plasma power supply.
2. Supply power to the cutting system:
    a. Set the line-disconnect switch to the ON position.
    b. Make sure that the power-indicator LED is illuminated on the plasma power supply.

How to use ohmic contact sense

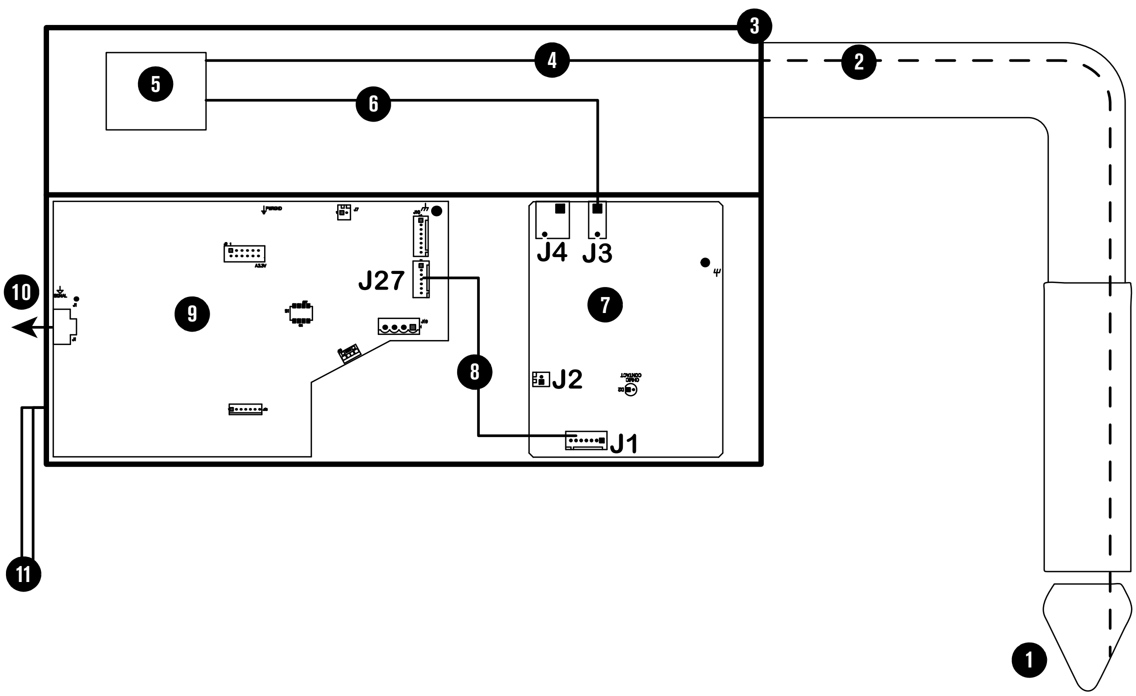
Ohmic relay overview

- The relay is normally open when not powered.
- The relay is closed during operation, except during ignition or cutting with water processes.
- Ohmic contact is disabled when cutting with a water process.
- Ohmic contact is disabled when the remote on-off switch is in the OFF position.

Internal ohmic contact sense

This is the default installation for the torch and torch connect console. No action is required.

Figure 51 – Internal ohmic diagram



1	Torch	**7**	Ohmic PCB
2	Ohmic wire, inside torch and torch lead	**8**	J1 to J27 wires
3	Torch connect console	**9**	Control PCB
4	Ohmic wire, torch receptacle to ohmic relay	**10**	CAN connection
5	Ohmic relay	**11**	2 ground connections (required)
6	Ohmic wire, ohmic relay to J3		

External ohmic contact sense

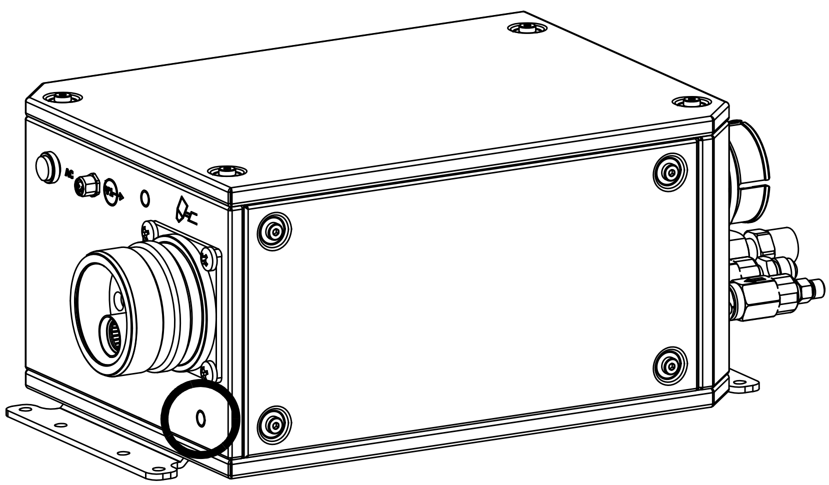
If you plan to use external ohmic contact sense, make the following modification to the ohmic wiring inside of the torch connect console.

The relay is still used to help isolate the ohmic circuit from high voltage.

1. Remove the power from the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Make sure that the power-indicator LED is not illuminated on the torch connect console.
2. Disconnect the ohmic wire from J3 on the ohmic PCB in the torch connect console.
3. Connect the ohmic wire that you removed from J3 to J4 pin1.
4. If you have a third-party ohmic circuit, remove the plug from the sheet metal on the torch connect console to access the ohmic wire inside. Otherwise, skip to *step 5*.

   The plug is located below the torch lead connection (*Figure 52*).

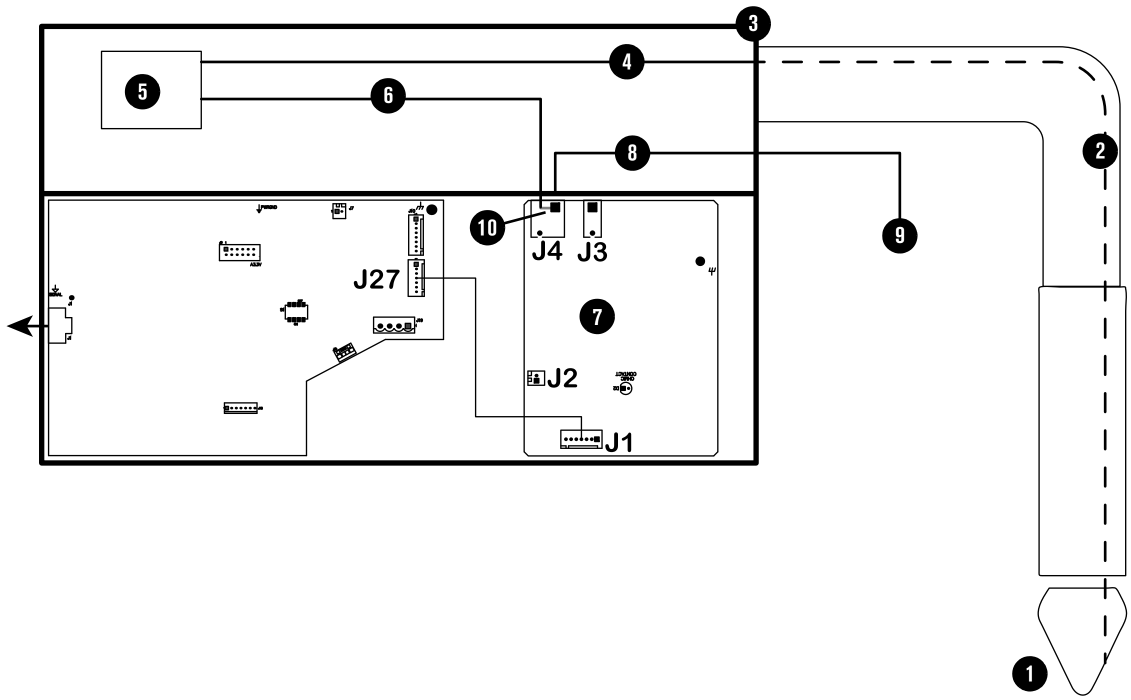
Figure 52 – Remove plug to access the ohmic wire if you use a third-party ohmic circuit



5. Connect the ohmic wire 6 from the ohmic relay to J4 pin 2 on the ohmic PCB in the torch connect console.

6. Connect the ohmic wire 9 to the PCB connection for ohmic inside the lifter.

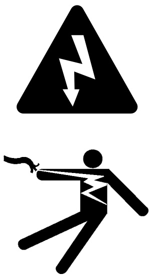
Figure 53 – Example external ohmic diagram



1 Torch
2 Ohmic wire, inside torch and torch lead
3 Torch connect console
4 Ohmic wire, torch receptacle to ohmic relay
5 Ohmic relay
6 Ohmic wire, ohmic relay to J4
7 Ohmic PCB
8 Ohmic wire, J4 to lifter or third party ohmic circuit
9 Torch lifter or third party ohmic circuit
10 Pin 1 and pin 2 on J4 are connected in the ohmic PCB

How to install a remote on-off switch

⚠ WARNING



ELECTRIC SHOCK CAN KILL

When the remote on-off switch is set to OFF, power remains active to the following components in the system:

- Control board
- Control transformer input and output
- 48 V power supply
- 24 V power supply
- 120 VAC and 220 VAC on the power distribution board
- Input side of the contactors
- Input side of the pump relay
- Power-indicator LED on the front of the plasma power supply

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

If you want to use the remote on-off feature, remove the jumper from pin 1 and pin 2 of the J14 connector and install your own interface.

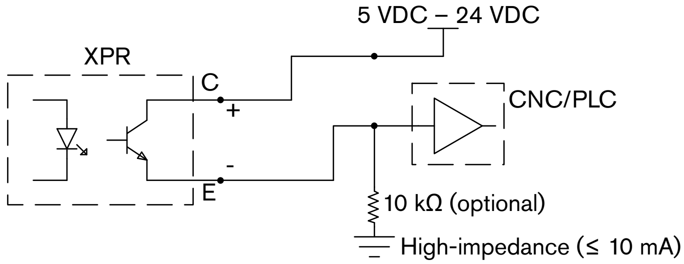
- For the pinout of J14, see *Table 24* on page 151.
- Use the examples in *Examples of output circuits* on page 191 and *Examples of input circuits* on page 192 to design your circuit.

When the remote on-off switch is set to OFF (disabled), power is removed from the following parts:

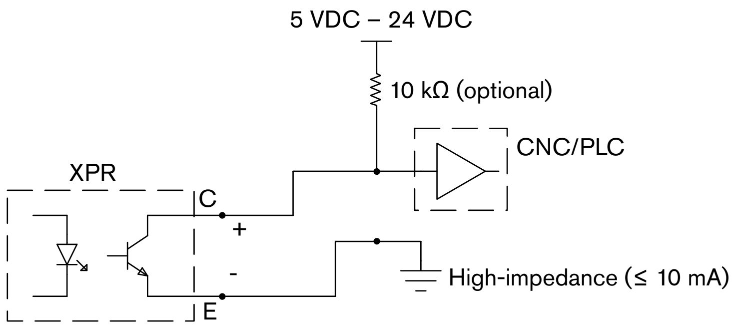
- Gas connect console
- Torch connect console
- Contactor enable
- Pump relay enable
- Fan enable
- CNC outputs

Examples of output circuits

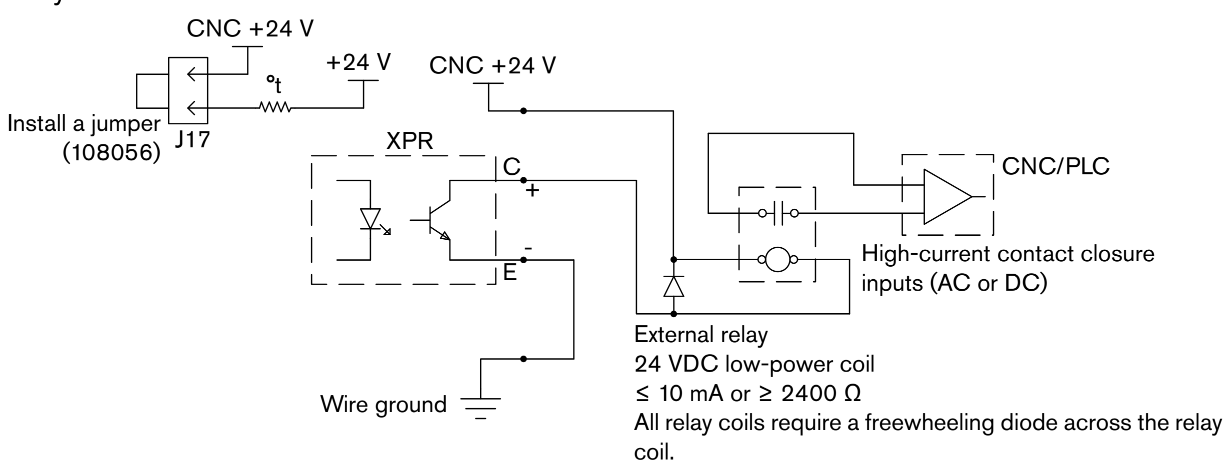
Logic interface, active high



Logic interface, active low



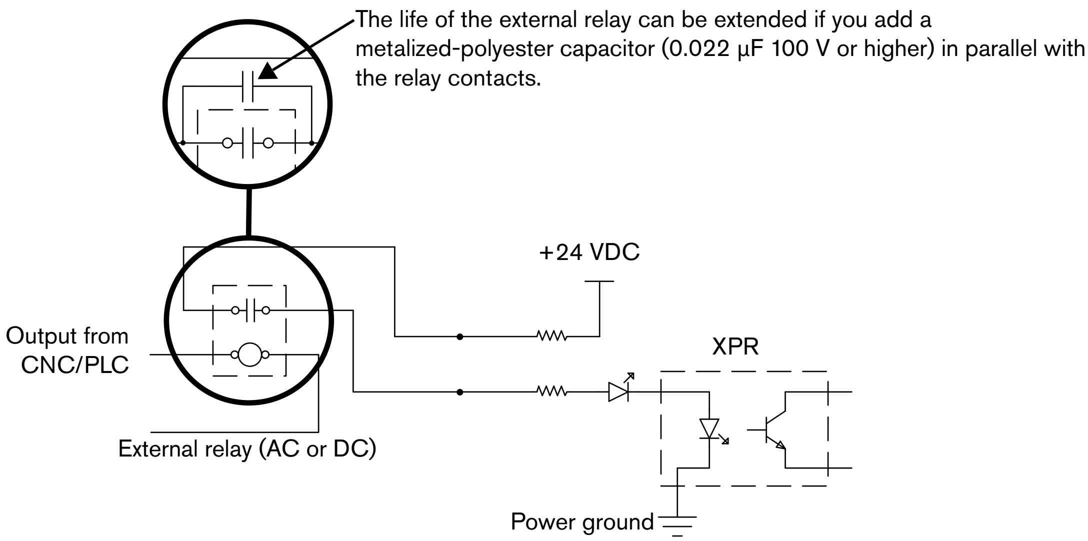
Relay interface



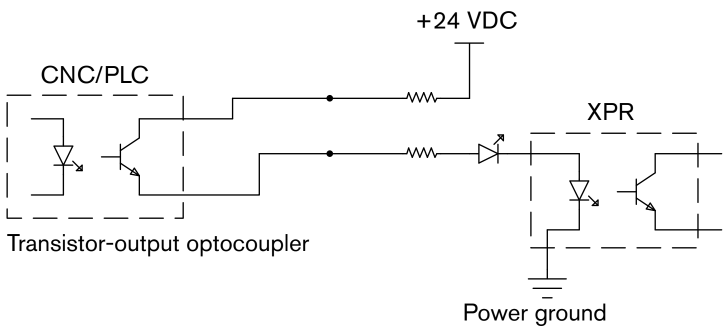
This circuit **VOIDS the warranty**. Do **NOT** use.

Examples of input circuits

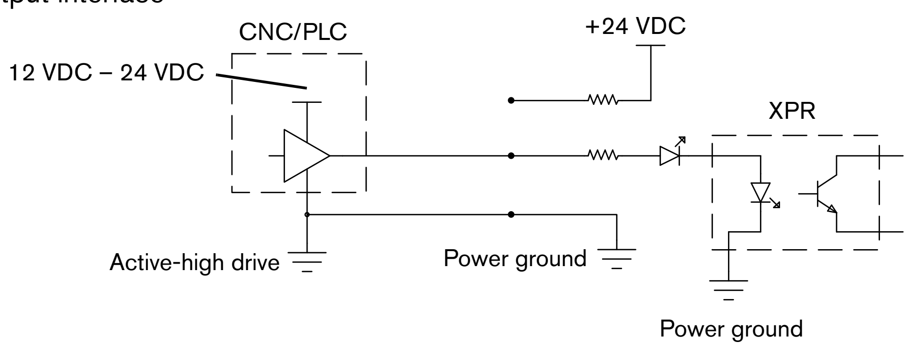
Relay interface



Optocoupler interface



Amplified-output interface



5 Coolant Installation

Overview

The cutting system ships **without** coolant in the reservoir. Before you operate the cutting system, you must fill it with coolant. The coolant capacity for the XPR cutting system is between 22.7 liters – 45.4 liters (6 US gallons – 12 US gallons).

A cutting system with long leads requires more coolant than a cutting system with short leads.

Contact your cutting machine supplier to reorder coolant. For information about how to calculate the approximate total volume of coolant for your cutting system, see *Estimate the total coolant volume for your cutting system* on page 248.

The plasma power supply ships with the coolant filter (027005) and coolant pump screen (127559) installed. Additional coolant filters and screens are available from Hypertherm. See *Coolant system* on page 356.

For information about how to install a replacement coolant filter or coolant pump screen, see the *XPR Preventive Maintenance Program Instruction Manual* (809490).

How to fill the cutting system with coolant

NOTICE

Never operate the cutting system if you get a low coolant level notice.

There is a risk of serious damage to the cutting system and to the coolant pump if you operate the cutting system with no coolant or with low coolant.

If your coolant pump is damaged, it may need to be replaced.

NOTICE

Never use automotive antifreeze in place of Hypertherm coolant. Antifreeze contains chemicals that damage the torch coolant system.

NOTICE

If you use the wrong coolant, it can cause damage to the cutting system. See *Coolant requirements* on page 44.

1. Get the correct coolant mixture for your cutting system.

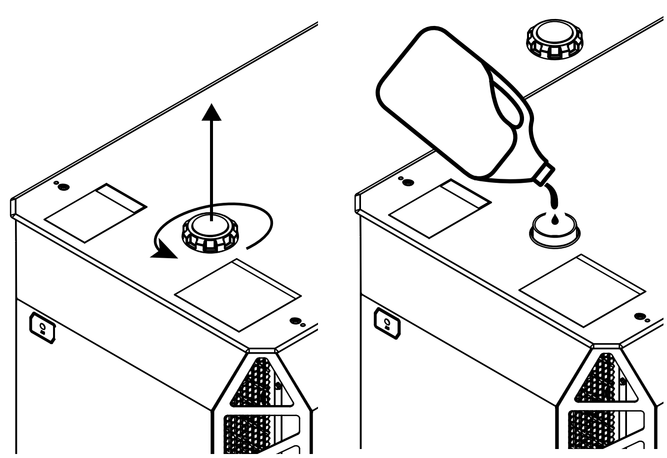
   See *Coolant requirements* on page 44 to determine what percentage of propylene glycol to add in the premixed Hypertherm coolant (028872).

2. Remove the cap from the reservoir fill port inlet that is located on top of the plasma power supply.

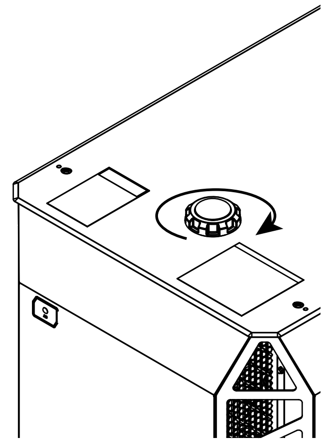
3. Look into the fill port inlet to see into the coolant reservoir.

4. Pour the coolant into the reservoir until the coolant level gets to the base of the fill spout.

   You can see the coolant level from the fill port inlet as you pour the coolant.



5. Install the cap onto the coolant reservoir.

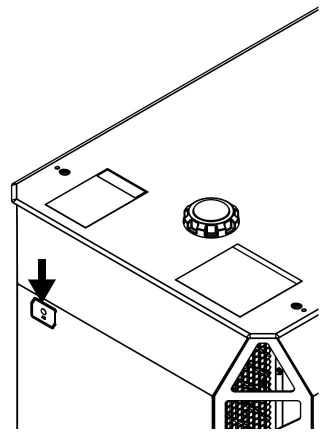


6. Supply the power to the cutting system:

   a. Set the line-disconnect switch to the ON position.

   b. Make sure that the remote on-off switch is enabled.

   c. Make sure that the green power-indicator LED is illuminated on the plasma power supply.



7. Use the CNC or XPR web interface to send a process to the plasma power supply and start the coolant pump.

> When you send a process, the gases start to flow and after a few seconds the coolant pump starts. If the pump stops, it is necessary to purge the air out of the coolant loop. Use the remote on-off switch to start and stop the coolant pump until the pump continues to run.

8. If necessary, add more coolant to fill the reservoir to the base of the fill spout.

WARNING

WET FLOOR

The floor can become slippery when wet.

If you put too much coolant in the reservoir, coolant flows out of the front of the plasma power supply onto the floor.

9. After installation of the coolant, use the CNC or XPR web interface to deselect the process.

6 Operation

Overview

This section of the manual describes the following items that relate to cutting system operation:

- *Controls and indicators* on page 198
- *Sequence of operation* on page 201
- *How to choose the torch positions and process settings you need* on page 211
- *Process selection* on page 219
- *How to use cut charts* on page 221
- *How to select consumables* on page 224
- *Factors of cut quality* on page 224

If you have questions about how to operate your cutting system, contact your cutting machine supplier or regional Hypertherm Technical Service team. You can find contact information for each regional office at www.hypertherm.com on the "Contact us" page.

Controls and indicators

Controls

CNC

A computerized numeric control (CNC) controls cutting system operation. The CNC has the following functions:

- Executes part programs from computer-aided design (CAD) and computer-aided manufacturing (CAM) software.
- Sends commands to the cutting system through a CNC interface cable (or wireless connection) between the CNC (or wireless device) and the plasma power supply.
- Reacts to feedback signals it receives from the cutting system and (or) operator.

Multiple cutting system commands, settings, and displays are visible and controllable from different CNC screens.

CNC screens can include the following:

- Main (control) screen
- Process setup screen
- Diagnostic screen
- Test screen
- Cut chart screen

See the instruction manual that came with your CNC for descriptions of CNC screens.

For information about how to use the Hypertherm CNC to control cutting system operation, see:

- The instruction manual that came with your CNC
- *CNC Communication Protocol for the XPR Cutting System* (809810)

Wireless device

A wireless device can be used to setup and monitor the XPR cutting system. A wireless device with the XPR web interface sends commands to the XPR cutting system through a wireless connection between the wireless device and the plasma power supply.

Multiple cutting system commands, settings, and displays are visible and controllable from different XPR web interface screens. For information on these screens, see *Web interface screen information* on page 180.

For information about how to set up a wireless device with the XPR web interface, see *How to connect to the plasma power supply with the XPR web interface* on page 162.

Indicators

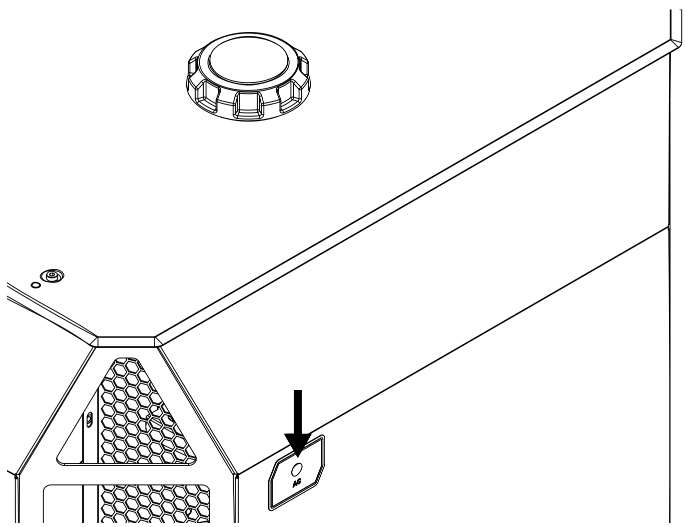
Power-indicator LEDs

Light emitting diodes (LEDs) illuminate to indicate power status.

The power-indicator LED on the plasma power supply (*Figure 54*) uses 2 colors to indicate power status:

- The LED illuminates amber when the plasma power supply is receiving electric power and the remote on-off switch is in the OFF position.
- The LED illuminates green when the plasma power supply is receiving electric power and the remote on-off switch is in the ON position.
- The plasma power supply that came with early XPR300 cutting systems has a green-only power-indicator. A power-indicator LED upgrade kit (428893) is available from Hypertherm if you want a 2-color LED for your plasma power supply.

Figure 54 – Power-indicator LED on the plasma power supply



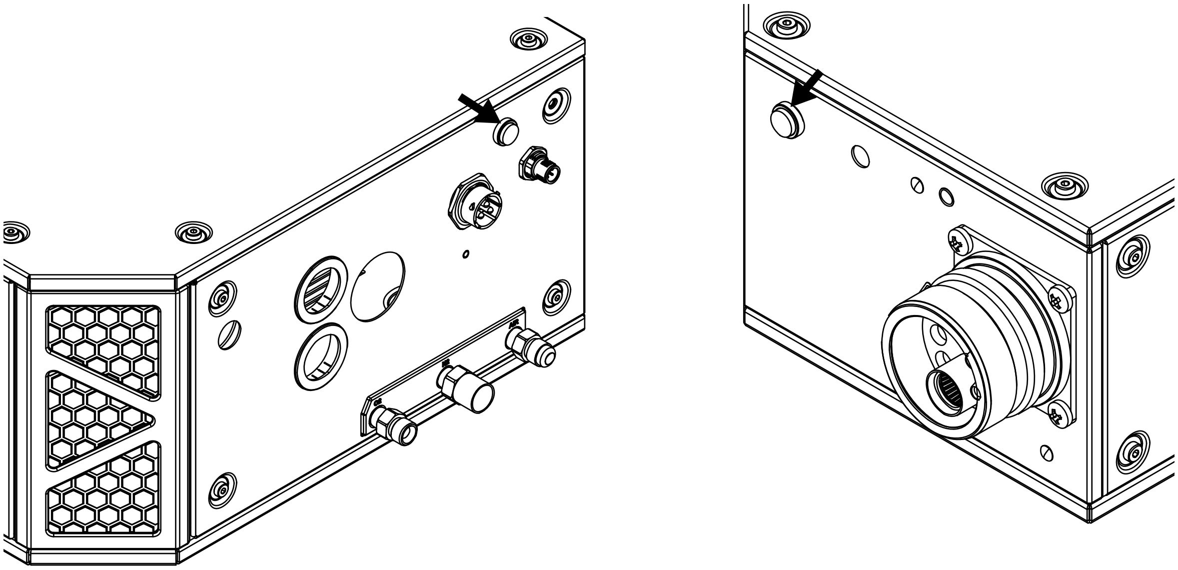
When illuminated, the green power-indicator LED on the gas connect console (*Figure 55* on page 200) and torch connect console (*Figure 55* on page 200) indicate that:

- Power is supplied to the XPR cutting system.
- The line-disconnect switch or breaker for the unit is set to the ON (I) position.
- The unit is ready for use.

> The early XPR300 plasma power supplies use

The power-indicator LED on the plasma power supply of early XPR300 cutting systems use 1 color, green, to indicate power status. You can upgrade your

Figure 55 – Power-indicator LED on the gas connect console (left)
and on the torch connect console (right)



CNC display

Except for the power-indicator LEDs that show power status, all other visual indications of cutting system performance appear on the CNC or XPR web interface.

For CNC screen descriptions, see the instruction manual that came with your CNC.

Sequence of operation

The flowcharts on the following pages show the sequence of operation for the XPR cutting system.

States of operation for the XPR cutting system

Each state of operation is assigned a unique name and number for identification purposes. The type of name you see (name or number) depends on your cutting system settings.

Powerup State (1)

The operator supplies power to the cutting system to start the Powerup State (1).

Power is supplied to the cutting system.
Cutting system operation STARTS.

↓

Make sure that signals are OFF for the following:

- Main contactor
- Coolant pump
- Cooling fans

↓

Establish CAN communication.

↓

Wait for RS-422 serial, EtherCAT, or wireless communication between the plasma power supply and CNC or wireless device.

↓

Determine system configuration (number of choppers and number and type of consoles).

↓

Is Powerup State (1) complete and successful?

No → Diagnose and troubleshoot the problem. (See *Diagnostics and Troubleshooting* on page 253.) Then, start the Powerup State (1) again.

Yes ↓

Continue to *Initial checks State (2)* on page 202

Initial checks State (2)

Search for diagnostic codes.

Is there a diagnostic code?

Yes

Diagnose and troubleshoot the problem. (See *Diagnostics and Troubleshooting* on page 253.) Then, start Initial checks State (2) again.

No

Measure the following:

- Temperatures (main transformers, choppers, coolant)
- Inlet pressures (gas connect console, torch connect console)

Are the measurements within the acceptable range?

No

Diagnose and troubleshoot the problem. (See *Diagnostics and Troubleshooting* on page 253.)

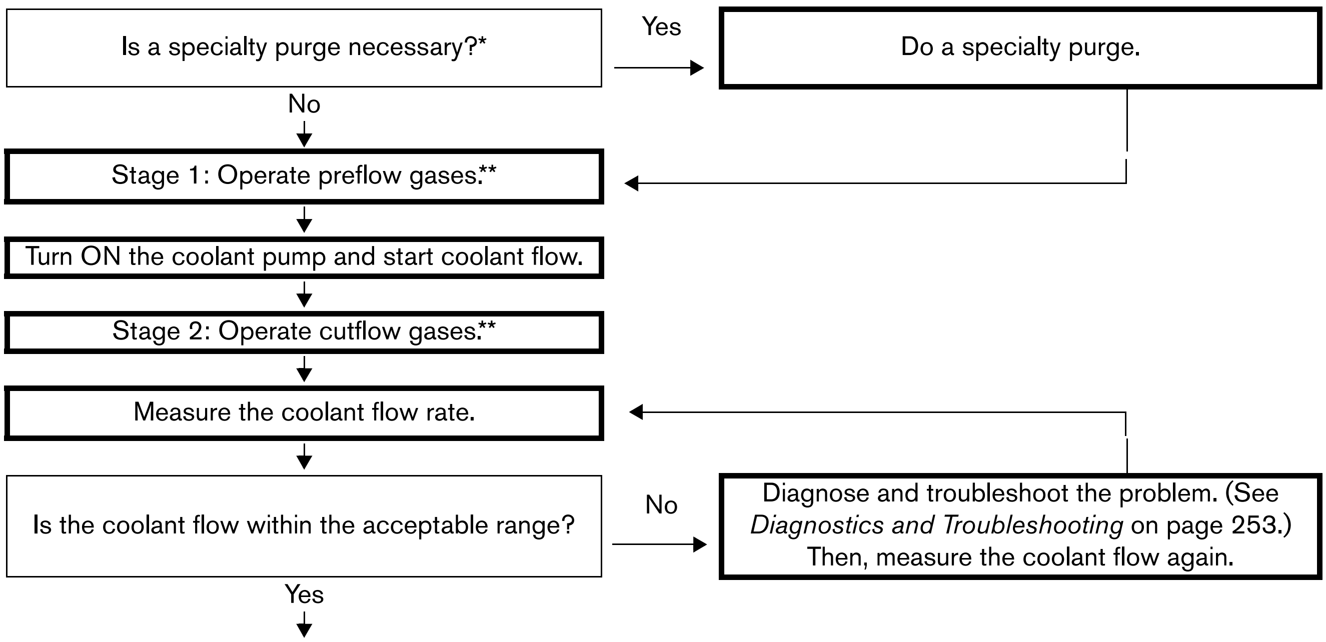
Yes

Wait for process selection by the operator.

Select a process ID.

Continue to *Gas purge/pump on State (3)* on page 203.

Gas purge/pump on State (3)



Continue to *Wait for start State (5)* on page 204.

* A specialty purge (with either N_2 or air) occurs automatically if the process changes from a non mixed-fuel gas to a mixed-fuel gas or F5 process (or the reverse). If the previous process was a water (H_2O) process, then a water purge is added to the gas purge. (See *Automatic purges* on page 209.) If the previous process was not H_2O, or mixed-fuel gas, or F5, skip to the usual 2-stage gas purge.

** The length of time necessary to complete a purge is based on: 1) the type of operator-selected process that the CNC or wireless device sends to the cutting system, 2) if this is the first process sent after the Powerup State (1) starts, and 3) the type of previous operator-selected process.

Wait for start State (5)

Wait for the CNC to send the Plasma Start command to the cutting system.

Wait for a command: select a new process or "Plasma Start" (there is no limit to how long the system waits for input).

↓

Is a new process selected or "Plasma Start" selected?

No → Wait for a command

Yes ↓

For new process selection, continue to *Initial checks State (2)* on page 202.

OR

For a "Plasma Start" command, continue to *Preflow/charge DC State (7)* on page 204.

Preflow/charge DC State (7)

Start preflow gas flow.

↓

Turn ON the inrush contactor and then the main contactor.

↓

Turn ON the chopper.

↓

Turn ON the fans (if not already on).*

↓

Turn ON the coolant pump (if not already on).*

↓

Measure gas pressure.

↓

Make sure that Hold Ignition signal is OFF.

↓

Is the Preflow State complete and successful?

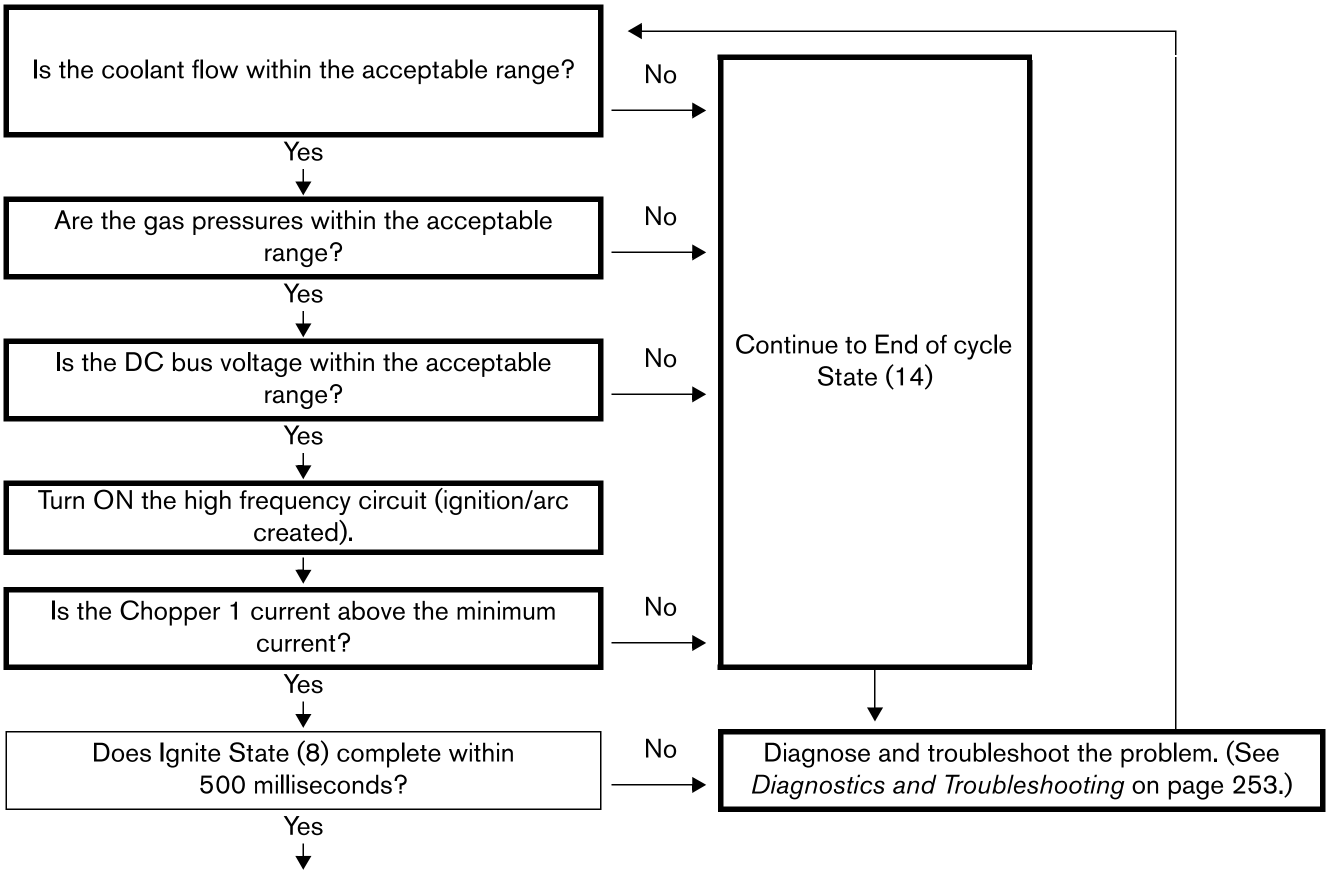
No → Diagnose and troubleshoot the problem. (See *Diagnostics and Troubleshooting* on page 253.) Then, start Preflow/charge DC State (7) again.

Yes ↓

Continue to *Ignite State (8)* on page 205.

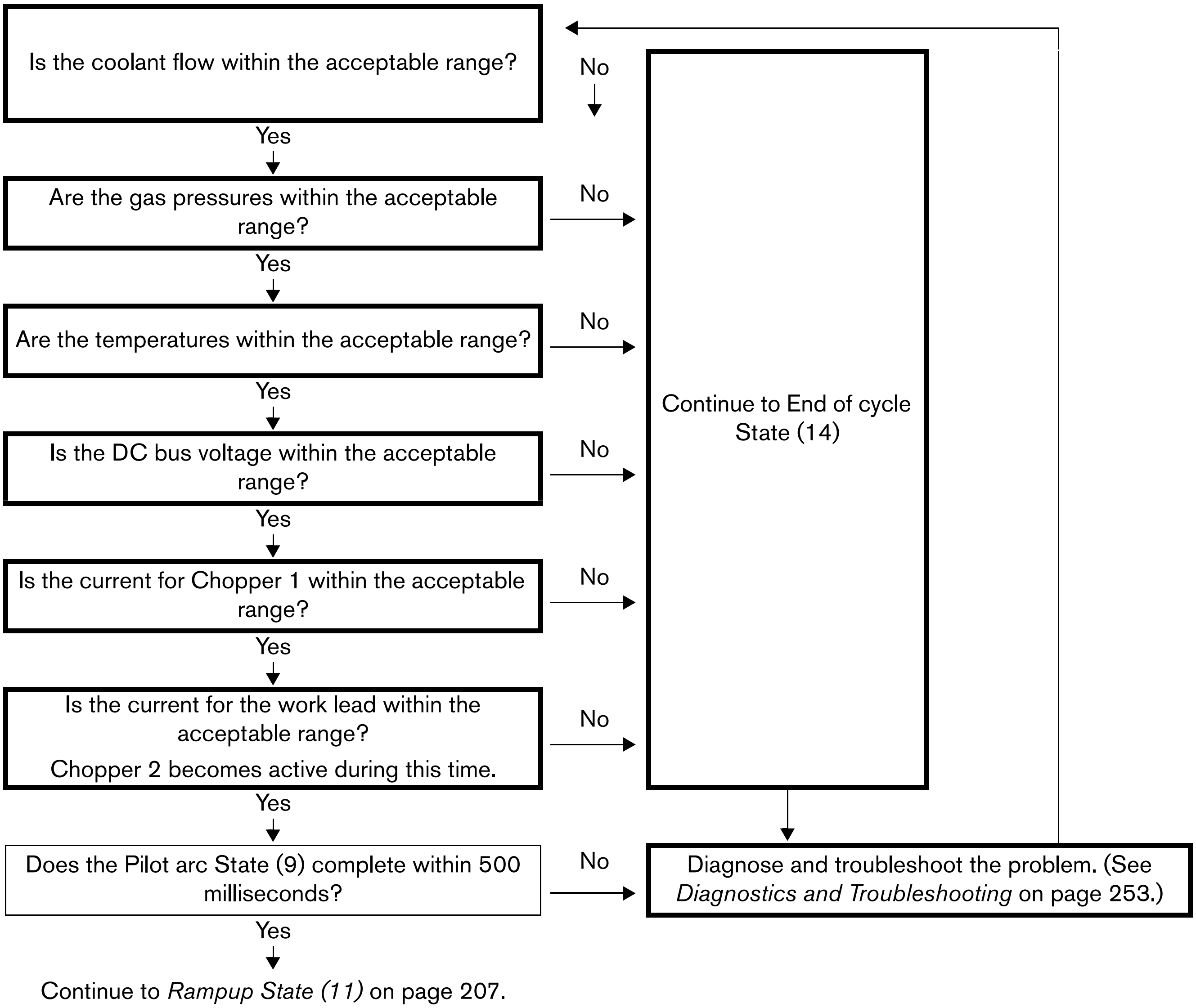
* To conserve energy, the coolant pump and fans stop after the time limit expires without a command.

Ignite State (8)



Continue to *Pilot arc State (9)* on page 206.

Pilot arc State (9)



Rampup State (11)

Increase current and gas flow to the setpoints for this process.

Is the Rampup State (11) complete and successful?

No → Diagnose and troubleshoot the problem. (See *Diagnostics and Troubleshooting* on page 253.)

Yes

Continue to *Steady State (12)* on page 207.

Steady State (12)

During the Steady State (12), the sent process (piercing, marking, or cutting) is active.

Does the coolant flow rate remain within the acceptable range?

No

Yes

Do the gas pressures remain within the acceptable range?

No

Yes

Do the temperatures remain within the acceptable range?

No

Yes

Does the current for Chopper 1 and Chopper 2 remain within the acceptable range? (If the process is less than or equal to 30 A, only Chopper 1 is active).

Note: If the operator-selected process is equal to or greater than 30 A, monitor both choppers.

No

Yes

Is the Plasma Start signal removed?

Yes

Continue to *Rampdown State (13)* on page 208.

Diagnose and troubleshoot the problem. (See *Diagnostics and Troubleshooting* on page 253.)

Rampdown State (13)

Rampdown State (13) begins when the CNC removes the Plasma Start command.

Decrease current to the final setpoint.

↓

Decrease gas flow to the final setpoint.

↓

Is Rampdown State (13) complete and successful?

No → Diagnose and troubleshoot the problem. (See *Diagnostics and Troubleshooting* on page 253.)

Yes ↓

Continue to *End of cycle State (14)* on page 208.

End of cycle State (14)

Turn OFF Chopper 1 and Chopper 2.

↓

Turn OFF gas.

↓

Start post-flow gas flow.

↓

Start timer to turn OFF the contactor.

↓

Start timer to stop the fans.

↓

Start timer to stop the coolant pump.

↓

Cycle ends. Continue to *Wait for start State (5)* on page 204.*

* After the successful completion of an operator-selected process, the cutting system returns to the *Wait for start State (5)* on page 204 to wait for the next command.

High-voltage relay stages (closed or opened) in the ohmic circuit

During a wet process (specifically, N_2/H_2O), water can act as a current path for the ohmic-sense circuit. To prevent any passage of current to the ohmic board, the cutting system automatically opens the high-voltage relay and disables the ohmic-sense circuit.

Ohmic sensing for the N_2/H_2O process is available in cutting systems with firmware that is revision L or later. Stall force is required when the N_2/H_2O process is used underwater.

During a dry process, the cutting system closes the high-voltage relay and enables the ohmic-sense circuit (except during high-frequency starts).

Automatic purges

XPR cutting system purges are automatic. The type of purge is based on the currently-selected process, the previously-selected process, and on the type of gas connect console (OptiMix, VWI, or Core).

- OptiMix and VWI XPR cutting systems do both gas-change and process-setup purges. (See *Gas-change purges for OptiMix or VWI XPR cutting systems* on page 209 and *Process-setup purges for all XPR cutting systems* on page 210.)
- Core XPR cutting systems do only process-setup purges. (See *Process-setup purges for all XPR cutting systems* on page 210.)

The length of time necessary to complete a purge is based on the type of operator-selected process and if the active process is the first process sent after the Powerup State (1). (See *Sequence of operation* on page 201.)

Gas-change purges for OptiMix or VWI XPR cutting systems

If you have an XPR cutting system equipped with an OptiMix or VWI gas connect console, a plasma-gas purge occurs automatically when the cutting system changes from a **non** mixed-fuel gas process to a mixed-fuel gas (H_2-mix) or F5 process or from a mixed-fuel gas (H_2-mix) or F5 to a **non** mixed-fuel gas process.

Core XPR cutting systems skip gas-change purges.

The type of plasma gas used for the purge is based on the type of cutting system configuration (OptiMix or VWI):

- OptiMix XPR cutting systems use a 2-phase gas-change purge that includes N_2.
- VWI XPR cutting systems use a 2-phase gas-change purge that includes air.

Plasma-gas purge

The following steps occur automatically for a plasma-gas purge:

1. Mixed-fuel gas (H_2-mix) or F5 drains from the XPR cutting system through the torch.
2. If you have an OptiMix XPR cutting system, N_2 purges any residual mixed-fuel gas.
3. If you have a VWI XPR cutting system, air purges any residual F5 gas from the torch lead.

Shield-gas/shield-fluid purge

If a process changes from a wet process to a dry process, a shield-fluid purge is used. During a shield-fluid purge, N_2 purges residual water from the shield gas/fluid hose.

A wet process uses water as a shield fluid. A dry process does not use water as a shield fluid.

Core XPR cutting systems skip the gas-change purge. Core XPR cutting systems use only process-setup purges. (See *Process-setup purges for all XPR cutting systems* on page 210.)

Process-setup purges for all XPR cutting systems

If you have a cutting system equipped with an OptiMix or VWI gas connect console, a process-setup purge automatically follows the gas-change purge, and includes preflow and cutflow purges.

If you have a Core XPR cutting system, the gas-change purge is skipped, and only the process-setup purge occurs.

The type of process gas used for a process-setup purge is based on the operator-selected process.

How to choose the torch positions and process settings you need

Perpendicular-position cutting, marking, and piercing

During perpendicular-position cutting, marking, and piercing, the torch remains perpendicular (at a 90° angle) to the workpiece. Many cutting processes and all piercing and marking processes use a perpendicular torch position.

Cutting

Cutting processes use a plasma arc that goes through the full thickness of the metal to create a desired shape. The length and shape of a cut part is based on the path and duration of torch movement.

Marking

Marking processes use argon (Ar) or nitrogen (N_2) to make marks on metal, without piercing or cutting through it. A typical use for marking is to mark a workpiece for secondary operations (such as bending or drilling) or for alpha-numeric part identification.

When you use argon marking, the type of metal, its thickness, and its surface finish have an effect on marking quality. Torch speeds and current levels also have an effect:

- Slower torch speeds and higher currents make deeper marks.
- Faster torch speeds and lower currents make shallower marks.

Make sure to mark and cut individual parts when you use the argon-marking processes. Marking the entire nest prior to cutting can reduce the life of consumables. For better results, alternate cuts and marks.

> Poor quality marking or burn-through can occur with metal that is less than 1.5 mm (0.06 in. or 16 gauge).

Piercing

Piercing processes penetrate the full thickness of the metal. Piercing is also the first action involved in cutting a part.

> Use edge starts when piercing is not possible.

If the torch moves too soon, the plasma arc cannot penetrate the metal. If the movement delays too long, the pierce-hole size can increase, which can result in the loss of the transferred arc. If the torch is too close to the workpiece during piercing, damage can occur to the consumables and the torch.

You can minimize unwanted results, increase the number of pierces, and maximize the life of consumable parts when you use the piercing settings that Hypertherm recommends.

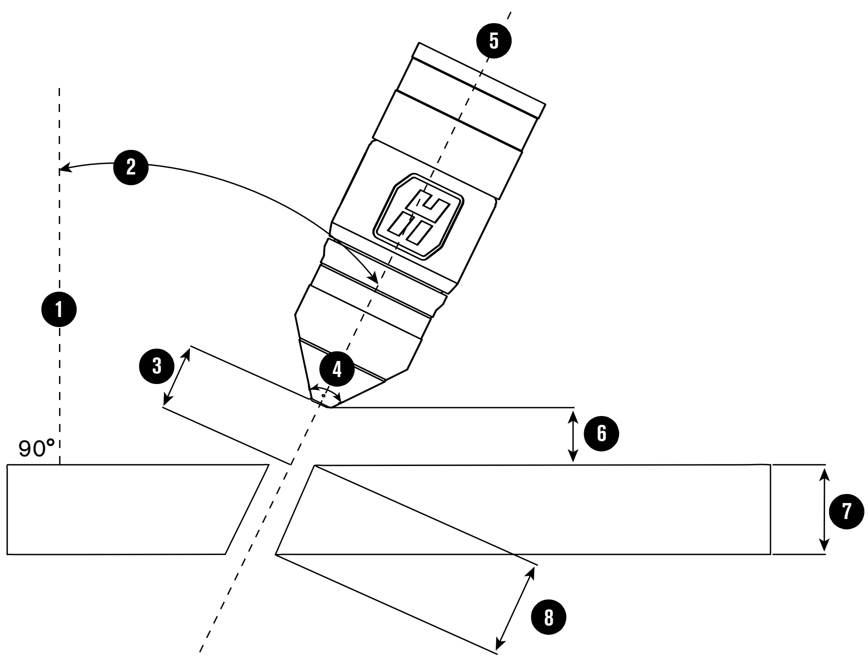
> For information about how to get the best piercing results, see *Recommendations for piercing processes* on page 226.

Bevel cutting

During bevel cutting, the torch is at an angle (**not** perpendicular) to the workpiece. The angle of the torch (relative to the workpiece) has an effect on the bevel cut angle of the metal.

The torch and consumable parts are designed so that the torch position can range from 0° – 52° so that the torch tip remains the closest point to the workpiece. If you need an angle greater than 52°, you can raise the torch to increase the clearance.

Figure 56 – Sample orientation of a torch during bevel cutting



1 **Perpendicular line**: The imaginary line that is perpendicular (at a 90° angle) to the workpiece.

2 **Bevel angle**: The angle between the center line of the torch and an imaginary line that is perpendicular to the workpiece.

3 **Cut height**: The linear distance from the center of the torch to the workpiece surface along the torch center-line. For optimal results, select a cut height that is based on an "effective thickness" value in the cut charts.

If a specific cut height is inconsistent with a clearance requirement, select a slightly higher cut height to prevent torch collisions.

4 **Cone angle**: All XPR torches have a 76° cone angle that makes it possible to tilt or position the torch up to 52°. If you need an angle greater than 52°, you can raise the torch to increase the clearance.

5 **Torch center line**: The imaginary line along the central axis of the torch.

6 **Clearance**: The vertical distance from the lowest point of the torch to the surface of the workpiece. Make sure that the distance is at least 2 mm – 3 mm (0.080 in. – 0.120 in.) to minimize torch contact with any slag on top of the plate.

7 **Nominal thickness**: The vertical thickness of a workpiece. This is the thickness of the metal that the plasma arc cuts, marks, or pierces.

8 **Effective thickness**: The distance that the plasma arc travels through the metal while cutting. This value is equal to the nominal thickness, divided by the cosine of the bevel angle.

Arc voltage settings for bevel cutting depend on the torch position, metal thickness, cut speed, and effective cut height. For this reason, cut charts only include arc voltages for perpendicular-position cutting.

Bevel compensation tables

Hypertherm's TrueBevel™ software has specialized cut charts known as "bevel compensation tables." They can help you get the best results on mild steel with minimal operator intervention.

For information about how to access and use the bevel compensation tables, refer to the instruction manual that came with your Hypertherm CAM software.

Hypertherm's ProNest™ software includes bevel-compensation tables.

For information about CNC compatibility requirements and how to use bevel compensation tables with non-Hypertherm CNCs, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Ferrous (mild steel) processes

Ferrous (mild steel) processes are developed for cutting A36 mild steel. All mild steel processes are available with all 3 XPR gas connect consoles (OptiMix, VWI, and Core). Mild steel processes use O_2/Air in most cases, except for the following:

- Lower-current cutting processes on thinner metals, True Hole, and internal-feature cutting use O_2/O_2.
- The 300 A processes, on some thicknesses, use O_2/N_2.
- Argon-assist technology uses argon (Ar) in the shield to increase pierce capacity.

See the *XPR Cut Charts Instruction Manual* (809830) for information about the gases used for plasma gas and shield gas during different processes.

All mild steel processes use Hypertherm's enhanced LongLife® technology that works together with Arc Response Technology™ to extend the life of consumables by detecting and reacting to rampdown errors before they occur.

HyDefinition vented processes	The XPR300 cutting system offers HyDefinition vented consumables for 30 A – 170 A processes. The processes enable the operator to achieve the following results: ▪ High-quality cuts ▪ Dross-free cutting (metal dependent) ▪ Fast cut speeds
HyDefinition 300 A process	The 300 A process is non-vented and delivers the following cutting options: ▪ High-quality cuts ▪ Excellent consumable part life ▪ Dross-free cutting with most thicknesses (metal dependent) ▪ Consistent cut quality over the lifetime of the consumable parts

The consumable parts for 300 A processes are non-vented and use a liquid-cooled nozzle (in place of a vented, air-cooled nozzle).

Non-ferrous (stainless steel and aluminum) processes

Non-ferrous (stainless steel and aluminum) processes that appear in the XPR cut charts were developed using the following metals:

- 304L and 316L stainless steel
- 6061 aluminum

It is possible, however, to cut other types of stainless steel and aluminum.

Non-ferrous process availability is based on the type of gas connect console that you have (Core, VWI, or OptiMix).

Table 27 – Available non-ferrous processes by gas connect console type and gas type.

Gas connect console	Available stainless steel processes	Available aluminum processes
Core	N_2/N_2	N_2/N_2, Air/Air
VWI	N_2/N_2, N_2/H_2O, $F5/N_2$	N_2/N_2, N_2/H_2O, Air/Air
OptiMix	N_2/N_2, N_2/H_2O, H_2-mix/N_2, $F5/N_2$	N_2/N_2, N_2/H_2O, H_2-mix/N_2, Air/Air

Table 28 – Process recommendations for cut quality, based on metal thickness and type

Metal thickness		Metal type	
Metric (mm)	English (in)	Stainless steel	Aluminum
1	0.036	40 A N_2/N_2	40 A Air/Air
3	0.105		
3.5	0.125	60 A N_2/N_2	60 A Air/Air
5	0.188		60 A N_2/N_2
6	0.250	80 A $F5/N_2$	80 A N_2/H_2O
10	0.375		
12	0.500	130 A H_2-mix/N_2	130 A N_2/H_2O
16	0.625	170 A H_2-mix/N_2	170 A N_2/H_2O
20	0.750	300 A H_2-mix/N_2	
25	1.000		300 A N_2/H_2O
50	2.000		
75	3.000		–

Stainless steel

HyDefinition (HDi) vented processes	The XPR300 cutting system offers HDi vented cutting for all processes that cut stainless steel (up to170 A). HyDefinition vented processes produce high-quality cuts with minimal dross and can be used with either N_2, F5, or mixed-fuel gases. Specifically, HyDefinition vented processes can produce: ▪ A sharp top edge of the cut ▪ A smooth, shiny, or gray cut edge ▪ Excellent cut-edge angularity ▪ Fast cut speed
HyDefinition vented mixed-fuel gas processes	OptiMix-equipped systems let operators use mixed-fuel gas processes for stainless steel cutting. The OptiMix gas connect console has a 3-gas mixer that mixes H_2, Ar, and N_2 so that the operator can tune the cut edge color and angle with a wide variety of gas mixtures. The cutting system chooses an optimized combination of 3 gases or 2 gases (H_2, Ar) based on the thickness of the metal to be cut.
HyDefinition vented water injection processes	VWI processes use a low flow rate of water through the shield line (instead of shield gas). A process that uses water as a shield fluid is sometimes known as a “wet” process. Wet processes deliver an overall good cut quality with low operating cost and a decreased heat-affected zone. Wet processes produce a slightly rougher edge than “dry” processes.
HyDefinition non-vented processes	The 300 A processes (N_2/N_2, mixed-fuel gas/N_2, and N_2/H_2O) are non-vented and deliver the following cutting options: ▪ Dark-colored cut edges with N_2/N_2. ▪ Yellow-orange cut edges with mixed-fuel gas/N_2 on metals with 15 mm – 25 mm (0.59 in. – 1 in.) thicknesses. ▪ Dark, blue-hued cut edges with mixed-fuel gas/N_2 on metals with thicknesses that are greater than 25 mm (1 in.). ▪ Gray cut edges with small heat-affected zone with N_2/H_2O.

Aluminum

HyDefinition (HDi) vented processes	In addition to high-quality stainless steel cuts (See *Stainless steel* on page 215.), the N_2 and mixed-fuel gas HyDefinition consumables can be used to produce high quality cuts on aluminum.
HyDefinition mixed-fuel gas processes	OptiMix-equipped systems let operators use mixed-fuel gas processes for aluminum cutting. The OptiMix gas connect console has a 3-gas mixer that mixes H_2, Ar, N_2. The cutting system chooses an optimized combination of 3 gases or 2 gases (H_2, Ar) based on the thickness of the metal to be cut.
HyDefinition vented water injection processes	VWI processes use a low flow rate of water through the shield line (instead of shield gas). A process that uses water as a shield fluid is sometimes known as a “wet” process. For aluminum, wet processes generally produce a smoother edge than “dry” processes. Additionally, VWI lets operators get: ▪ A sharp top edge of the cut ▪ A smooth cut edge ▪ Excellent cut-edge angularity
HyDefinition non-vented processes	The 300 A processes (N_2/N_2, mixed-fuel/N_2, and N_2/H_2O) are non-vented and deliver good cut quality at fast cutting speeds.

Processes for special applications

Underwater cutting

⚠ WARNING

Underwater cutting with fuel gases or underwater cutting of non-ferrous alloys can create an explosion hazard.

- Do NOT cut under water with fuel gases (H_2-mix) or F5.
- Do NOT cut non-ferrous alloys under water or on a water table, unless you can prevent the accumulation of hydrogen gas.

Doing so can result in an explosion during cutting system operation.

Underwater cutting can suppress the acoustical noise, smoke, and glare that plasma cutting produces. Underwater cutting also decreases the heat-affected zone on the workpiece. On mild steel, it also decreases cutting speeds and produces a rougher cut edge with increased dross.

You can expect the acoustical noise levels to average less than 70 decibels for many processes during underwater cutting of metals that are up to 75 mm (3 inches) below the water surface.

Make sure to satisfy the following conditions before you do underwater cutting:

- Do **not** cut under water with fuel gases (H_2-mix) or F5. An explosion can occur.
- Do **not** cut non-ferrous alloys under water or on a water table, unless you have installed the correct safety equipment from your table manufacturer or cutting machine supplier.
- Consult with your cutting machine supplier, the table manufacturer, and other experts prior to cutting non-ferrous alloys to implement a risk assessment and mitigation plan that eliminates the risk of detonation by preventing hydrogen accumulation.
- Do **not** cut a workpiece that is more than 75 mm (3 inches) below the surface of the water. It can negatively affect cutting system performance.
- Do **not** use True Hole® processes underwater. True Hole processes are not compatible with underwater cutting.

  True Hole cutting on a water table is possible only if the surface of the water is lowered to at least 25 mm (1 inch) **below the bottom surface** of the workpiece. For information about True Hole processes, contact your cutting machine supplier or regional Hypertherm Technical Service team.

- Make sure that the torch is perpendicular (at a 90° angle) to the workpiece.

- Make sure that preflow is turned ON during initial height sense (IHS) for all underwater cutting.

  Use the CNC or XPR web interface to activate the IHS. For information about how to do this, see the instruction manual that came with your CNC.

- Make sure that ohmic contact is disabled for all underwater cutting.

  For information about how to disable ohmic contact, see the instruction manual that came with your CNC.

Underwater cut charts are listed by amperage. They appear with the ferrous and stainless steel cut charts. (See the *XPR Cut Charts Instruction Manual* (809830).)

Underwater cut chart settings are provided for:

- Ferrous processes 80 A and above
- Non-fuel gas stainless steel processes 80 A and above

Mirror cutting

Consumable parts for mirror cutting are available for all processes. They include a special swirl ring and shield that causes the gases to swirl in the opposite direction. The opposite-direction gas swirl makes the “good side” of the cut on the left side, relative to torch motion.

Mirror-cutting consumables are commonly used to cut a “left-handed” version of a “right-handed” part. Mirror-cutting consumables use the same settings as standard consumables.

For part numbers for mirror-cutting consumables, see *Sample configurations for consumables* on page 135.

Process selection

All of the XPR cutting processes have a unique identification number (process ID). Each process ID aligns with a specific set of pre-programmed values in the cut chart database in the plasma power supply control board.

Processes in the database can be selected by:

- Metal type and thickness
- Cutting current
- Plasma and shield gas types
- Process category (See *Process categories* on page 221.)

When you select a process ID from the CNC or the Operate screen in the XPR web interface, the cutting system automatically activates the pre-programmed settings for that process based on the values in the database.

On-screen options let you select, monitor, and control processes directly from the CNC or the Operate screen in the XPR web interface.

Manual selection of settings is not necessary in most cases. However, you can adjust some pre-programmed settings with override or offset commands, within limits. (See *Process ID offsets / overrides* on page 220.)

How to use process IDs to access optimal settings

When you select a process ID from the CNC or XPR web interface, you automatically get the optimized settings that Hypertherm recommends for that process.

The pre-programmed settings come from Hypertherm's extensive laboratory tests. Because of differences in cutting systems, metals, and consumables, it is sometimes necessary to adjust the settings. However, in most cases, you can expect the best results when you use the default settings that come with a process ID.

To automatically get recommended settings, select the process ID for the process that aligns with your needs:

1. Go to the process selection screen on the CNC or the Operate screen on the XPR web interface.

2. Select the process ID:

   a. Examine the list of available processes.

   b. Identify the process that best aligns with your needs. For example, choose process ID 1153 to activate the settings for 170 A, 12 mm (0.5 inch), mild steel, O_2/Air.

   Process selection must occur during the Initial checks State (2) of operation. See *States of operation for the XPR cutting system* on page 201.

3. If none of the processes are satisfactory:
   a. Select the closest available process.
   b. Send the necessary offset command or commands to adjust the setting or settings as necessary. (See *Process ID offsets / overrides* on page 220.)

> If you have an unusual process requirement, contact your cutting machine supplier or regional Hypertherm Technical Service team for guidance.

Process ID offsets / overrides

You can adjust some pre-programmed settings with an offset or override command. An offset/override command is a type of serial RS-422 or EtherCAT signal that lets you change the default value of a setting, within an allowable limit.

For example, if a pre-programmed plasma pressure value is 65, and you want to change it to 70, send an offset command of 5 (65 + 5 = 70). You can also use the web interface to send the desired plasma pressure value (70). See *Web interface screen information* on page 180.)

> Offset settings remain active until you send a new process ID to the cutting system, or until power is removed from the cutting system.

For descriptions of offset commands and the allowable limits for each adjustable setting, see the *CNC Communication Protocol for the XPR Cutting System* (809810).

How to use cut charts

Electronic cut charts are available on the cut chart screen of your CNC or XPR web interface.

For information about how to find electronic cut charts, see the instruction manual that came with your CNC.

Cut charts are available in the *XPR Cut Charts Instruction Manual* (809830).

The cut charts are for reference purposes. Always use the electronic cut charts that appear on your CNC or XPR web interface for the most complete and accurate process-selection information.

Use the cut charts for guidance about process selection, especially if the default process ID settings are not satisfactory for your application.

The pre-programmed settings that come with a process ID are designed to give the best balance between quality and productivity with consumables that are in average condition.

The results that you want from a process can influence process selection. In some cases, cut quality is important. In other cases, speed is important. Often, the best choice balances these requirements.

Process core thickness (PCT)

The cut chart for every cutting process contains a range of possible thicknesses. Process engineers work to optimize a range of thicknesses (usually in the middle of the overall range of thicknesses). This optimized range is known as the process core thickness (PCT). Thicknesses greater and less than the PCT can have varied results relative to cut quality, cut speed, and piercing capability.

Process categories

The XPR cut charts have up to 5 process categories. Each category has a unique process category number (1 – 5) that correlates to the performance that you can expect when you select this process. The process category number for the process that you choose changes the quality-speed balance.

For best results, Hypertherm recommends that you select process category number 1 whenever possible. Category 1 represents an optimized thickness (or PCT) for that cut process with the overall best balance of cut quality and cut speed.

Table 29 on page 222 and *Table 30* on page 223 describe the results that you can expect with different process category numbers.

Table 29 – Process category options and expected quality-speed results for ferrous (mild steel) processes

Process category number	Process category condition	Category description	Quality	Speed
Category 1	Process Core Thickness (PCT)	▪ Best overall balance of productivity and cut quality. ▪ The process is optimized for this thickness. ▪ Expect cut speeds that range from 2,030 mm/min – 3,810 mm/min (80 in/min – 150 in/min). ▪ Dross free, in most cases.	Very good	Very good
Category 2	Thicker than PCT	▪ Good choice when edge quality is more important than speed. ▪ Expect cut speeds that are slower than 2,030 mm/min (80 in/min). ▪ Expect some low-speed dross.	Very good – excellent	Lower
Category 3	Thinner than PCT	▪ Good choice when speed is more important than edge quality. ▪ Expect cut speeds that are faster than 3,810 mm/min (150 in/min). ▪ Dross-free results in most cases.	Lower	Higher
Category 4	Edge Start Only	▪ Edge start is required. ▪ Thick, low-speed dross is likely.	Good	Low
Category 5	Severance	▪ This is the maximum thickness for these processes. ▪ Edge start is required. ▪ Expect cut speeds that are slower than 250 mm/min (10 in/min). ▪ Cut-edge quality can be rough. ▪ Expect significant dross.	Very low	Very low

In general, Hypertherm recommends lower amperage processes for the best cut-edge quality, and higher amperage processes for the best dross-free cutting. When speed is more important than quality, you can use a higher-amperage process. For guidance about process selection, refer to *Table 28 – Process recommendations for cut quality, based on metal thickness and type* on page 214 and the *XPR Cut Charts Instruction Manual* (809830).

Table 30 – Process category options and expected quality-speed results for non-ferrous processes

Process category number	Process category condition	Category description	Quality	Speed
Category 1	Process Core Thickness (PCT)	▪ Whenever possible, select Category 1 for optimal edge quality and speed, with minimal dross. ▪ The process is optimized for this thickness. ▪ Expect cut speeds that range from 1,016 mm/min – 3,048 mm/min (40 in/min – 120 in/min). ▪ Dross free, in most cases.	Very good – excellent	Very good
Category 2	Thicker than PCT	▪ In most situations, you can expect square cut edges with sharp top edges. ▪ Darker edge color is possible with stainless steel. ▪ Expect cut speeds that are slower than 1,016 mm/min (40 in/min). ▪ Expect some dross.	Good – very good	Lower
Category 3	Thinner than PCT	▪ Select Category 3 when speed is more important than edge quality. ▪ Expect cut speeds that are faster than 3,048 mm/min (120 in/min). ▪ Expect some dross.	Lower	Higher
Category 4	Edge Start Only	▪ Edge start is required. ▪ Darker edge color is possible with stainless steel. ▪ Thick dross is likely.	Good	Low
Category 5	Severance	▪ This is the maximum thickness for these processes. ▪ Edge start is required. ▪ Expect cut speeds that are slower than 250 mm/min (10 in/min). ▪ Cut-edge quality can be rough. ▪ Expect significant dross. ▪ Thick-metal cutting techniques can be necessary.	Very low	Very low

In general, Hypertherm recommends dross-free processes. Non-ferrous dross is very difficult to remove. Depending on the gas-connect console, the XPR300 cutting system offers the following non-ferrous cutting processes: Air/Air, N_2/N_2, N_2/H_2O, F5/N_2 and mixed-fuel gas/N_2. For guidance about process selection, refer to *Table 28 – Process recommendations for cut quality, based on metal thickness and type* on page 214 and the *XPR Cut Charts Instruction Manual* (809830).

How to select consumables

The XPR cutting system uses the same consumable parts for perpendicular-position (90° angle) and bevel-cutting processes. This eliminates the need to change consumables when you switch from a perpendicular-position process to bevel cutting or from bevel cutting to a perpendicular-position process. This also eliminates the need to inventory two different sets of consumables (perpendicular and bevel).

For guidance on how to select consumables (including part numbers) by process type and metal and how to install the consumables, see the following:

- *XPR Cut Charts Instruction Manual* (809830)
- *How to install the consumables* on page 129

Factors of cut quality

Dross

- Dross is more likely to occur on a hot workpiece. The first cut in a series often produces the least dross. You can expect more dross with more cuts.
- Changes in shield flow can dramatically influence dross formation on non-ferrous metals.

Problem	Cause*	Solution
On mild steel, low-speed dross is heavier, but easy to remove.	The plasma arc can move ahead of the torch when the torch speed is too slow.	Increase the torch speed.
On mild steel, high-speed dross is finer, but difficult to remove.	The plasma arc can lag behind the torch when the torch speed is too fast.	Decrease the torch speed.

* Worn or damaged consumables can produce intermittent dross.

How to get the results you want

This section of the manual gives general recommendations for how to get the best results for many processes.

For instructions on how to troubleshoot specific performance problems, see *Diagnostics and Troubleshooting* on page 253.

General recommendations for all processes

- Always start with the default settings for the process that you want to use. In most cases, you can expect the best results when you use the default settings that come with a process ID.
- If you decide that it is necessary to adjust a default setting, use offset or override commands to make incremental changes to the original value (values), within limits. (See *Process ID offsets / overrides* on page 220.)
- Do not allow the torch to touch the workpiece during cutting system operation. Contact with the workpiece can damage the torch nozzle and shield. It can also damage the surface of the workpiece.
- Make sure that the torch is perpendicular (at a 90° angle) to the workpiece for perpendicular-position processes.
- Unsteady drive system and rail movement can make torch motion unsteady, which can cause irregular cut patterns. Make sure to do routine service and maintenance to the drive system and rails.

  See the instruction manual that came with your cutting machine or table for information on how to do this.

- Do all cutting system maintenance tasks as scheduled. (See *Maintenance* on page 231.)

Recommendations for perpendicular-position cutting processes

- Always start with the default settings for piercing the thickness of the metal that you want to cut.
- Avoid firing the torch into the air.

  It is acceptable to begin a cut at the edge of the workpiece.

- Avoid lead-outs that move away from the workpiece and stretch the plasma arc.
- Do the following steps to avoid the loss of a transferred plasma arc:
  - End every cut with the plasma arc still attached to the workpiece. (See *Automatic rampdown error protection* on page 229.)
  - Decrease the cutting speed when the end of the cut is near.
  - Stop the plasma arc before the part is completely cut (allow completion of the cut during rampdown).
  - Program the path of the torch into the scrap area for rampdown.

Recommendations for piercing processes

For the best piercing outcomes follow these recommendations:

- Always start with the default settings for piercing the thickness of metal that you want to pierce.
- Allow a lead-in distance that is approximately the same thickness as the metal to be pierced. For example, for 50 mm (2 inch) metal, use a 50 mm (2 inch) lead-in.
- Keep the torch above cut height until it passes over the puddle of molten metal created by the pierce. Puddle avoidance minimizes shield damage.
- Make sure to follow transfer height and pierce height recommendations during piercing processes. (See the *XPR Cut Charts Instruction Manual* (809830.)
- If it is difficult to pierce the workpiece (because of metal type or thickness):
  - Increase the shield pierce flow (if this function is available with your CNC).

    For this to work, the shield pierce signal must be activated. For information about how to activate the shield pierce signal, see the instruction manual that came with your CNC.

  - Use a "moving" or "flying" pierce technique, but only if you are an experienced operator.

    With a "moving" or "flying" pierce technique, torch motion starts immediately after arc transfer and during piercing. **Do not attempt this technique unless you are an experienced operator.** Damage to the torch, lifter, or other system components is possible.

  - Choose an argon-assist process to pierce thicker than 45 mm (1.75 inch) for mild steel.

Hypertherm's pierce control and assist technology can minimize timing and torch height issues that can have a negative effect on piercing processes.

Pierce control* and assist technology	
Pierce delay settings	▪ The operator selects the time (in seconds) necessary to pierce through the full thickness of the metal. ▪ The operator enters this setting from the CNC or XPR web interface. ▪ For recommendations on how to choose the best pierce-delay setting, see the cut charts. See the *XPR Cut Charts Instruction Manual* (809830).
Shield pierce gas signal	▪ This signal enables the shield pierce flow function. ▪ This signal must be activated with the Plasma Start command. (See *Wait for start State (5)* on page 204.) For information about commands and signals, see the *CNC Communication Protocol for the XPR Cutting System* (809810).
Shield pierce flow setting	▪ The shield pierce gas setting is used during pierce operation. ▪ The shield pierce gas setting is active until pierce delay expires. ▪ The shield pierce gas setting can be offset or overridden.

* Also known as "pierce complete."

Recommendations for marking processes

- Alternate between marking and cutting processes. Marking without intermittent cutting can shorten the life of consumables.

Recommendations for bevel-cutting processes

- When possible, pierce with the torch perpendicular to the workpiece and then tilt the torch.
- Limit tilt rotation speed if necessary.
- Maintain 2 mm – 3 mm (0.08 inch – 0.12 inch) of clearance between the torch and the workpiece.
- Use the effective thickness of the workpiece you are cutting to select cut speed.

With True Bevel™ technology, Hypertherm provides you with flexible and adjustable bevel compensation cut charts, or process parameter tables, that automatically compensate key settings such as torch height and cut speed.

How to maximize the life of consumable parts

- LongLife process settings can minimize erosion on the emitter surface of the electrodes. The following steps occur automatically with LongLife electrode protection:
  - Gas and current flow automatically ramp-up at the start of a cut
  - Gas and current flow automatically ramp-down at the end of a cut
- To achieve the full benefits of Hypertherm's LongLife and Arc Response Technology, avoid firing the torch into the air. (See *Arc Response Technology* on page 228.)

  It is acceptable to start a cut at the edge of the workpiece.

- Use the pierce settings in the cut chart database. (See *Piercing* on page 211.)
- To achieve the full benefits of Hypertherm's automatic rampdown error protection (see *Automatic rampdown error protection* on page 229), select processes that have cut speeds of 3,560 mm/min (140 in/min) or less.
- To minimize the risk of catastrophic failure of a consumable part when cutting speeds are greater than 3,560 mm/min (140 in/min), always take the following steps when cutting:
  - Decrease the cutting speed when the end of the cut is near.
  - Program torch movement into the scrap area of the workpiece.

  If possible, use a chain cut so that the path of torch movement leads directly from one cut part into the next. This will minimize multiple plasma arc starts and stops for multi-part cutting that damage electrodes.

Arc Response Technology

The plasma power supply is equipped with choppers that monitor the current and arc voltage load once every 33 microseconds (30 kilohertz), letting the system detect and react nearly instantaneously to events happening at the torch during cutting.

Arc Response Technology lets the XPR cutting system react to certain events at the torch that can lead to decreased consumable life or possible torch damage.

Automatic torch protection

When consumables fail catastrophically (blow out) at high current settings, torch damage can occur. This damage can occur either through arcing damage or from molten copper and/or brass that gets into the coolant paths of the torch.

If catastrophic consumable failure occurs, the choppers can detect the event at the onset through the electromagnetic interference (EMI) or noise signature of the current being delivered to the torch. The choppers respond quickly to stop the cutting system and prevent damage to the torch. The electrode will still blow out and other consumables can also be affected, but catastrophic damage to the torch will not occur.

Automatic rampdown error protection

LongLife technology requires a controlled stop of the current and gas pressure to preserve electrode life for mild steel cut processes. A failure to complete the cut on the workpiece causes most uncontrolled stops (rampdown errors). Failure to complete the cut on the workpiece causes the arc to stretch and then snap out in a rampdown error, which can drastically decrease consumable life. Common causes for a rampdown error are:

- Incorrect hole lead outs
- Running off the edge of the workpiece

The cutting system can detect a rampdown error before the arc snaps out and can respond quickly to do a controlled stop of the current and gas pressure. This can significantly increase the electrode life, especially when cut speeds are less than 3,560 mm/min (140 in/min).

7

Maintenance

Overview

Hypertherm cutting systems can operate in harsh conditions for many years. To maintain cutting system performance, minimize operating costs, and lengthen cutting system life, it is important to follow all maintenance procedures and schedules.

> If you have questions about how to maintain your cutting system, contact your cutting machine supplier or regional Hypertherm Technical Service team. You can find contact information for your regional office at www.hypertherm.com on the “Contact us” page.

This section of the manual describes maintenance steps that you **must do daily, before system operation.**

- For instructions about preventive maintenance (such as weekly, monthly, and yearly tasks) see the *XPR Preventative Maintenance Program (PMP) Instruction Manual* (809490).
- For recommendations about how to diagnose and troubleshoot performance issues, see *Diagnostics and Troubleshooting* on page 253.
- For printed circuit board (PCB) drawings and LED locations, see *PCB information* on page 343.

> See *Table 31* on page 232 for a list of preventive maintenance steps. The *PMP Instruction Manual* (809490) explains how to do them.

> Usually, operators can do the daily, weekly, and bi-monthly tasks. Usually qualified maintenance personnel are needed for monthly, every-6-month, and yearly tasks.

Table 31 – Inspection, preventive maintenance, and cleaning tasks

Maintenance task or activity	Daily	Weekly	Monthly	Every 6 months
Do a test of the inlet pressures	X			
Examine all of the air filters	X			
Do a check of the coolant level and condition	X			
Examine and lubricate O-rings	X			
Examine the water tube and torch	X			
Examine hoses, cables, and leads		X		
Do tests for gas leaks		X		
Do a check of the coolant flow		X		
Clean inside the plasma power supply			X	
Examine the contactors			X	
Examine the pilot arc relay			X	
Examine the coolant system			X	
Do the coolant flow test			X	
Examine the gas line connections			X	
Examine the hoses			X	
Examine the cables			X	
Examine the ground connections			X	
Examine the table-to-workpiece connection			X	
Replace the coolant and coolant filter, and clean and examine the pump screen and coolant check valve				X

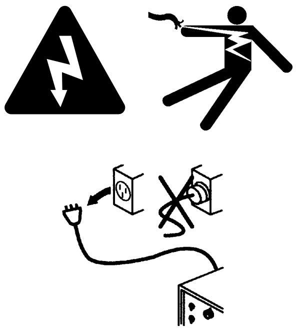
How to do daily inspections

Always do the following at least once daily, **before** system operation:

- *Examine the gas regulators* on page 235
- *Examine the shield water regulator (if applicable)* on page 235
- *Examine the connections and fittings* on page 235
- *Examine the consumable parts, torch, and torch receptacle* on page 236
- *Examine the torch lead* on page 241

Remove the power from the cutting system

WARNING



ELECTRIC SHOCK CAN KILL

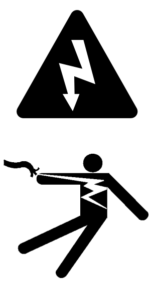
Disconnect electrical power before doing any installation or maintenance.

The line-disconnect switch must REMAIN in the OFF position until all installation or maintenance steps are complete.

In the United States, use a “lock out/tag out” procedure until installation or maintenance is complete. In other countries, follow the appropriate national and local safety procedures.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

WARNING



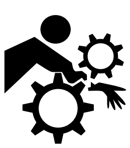
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING



MACHINE MOTION CAN CAUSE INJURY

The end-use customer and the cutting machine supplier are responsible for providing protection against the hazardous moving parts of this cutting system.

Read and follow the instruction manual provided by the cutting machine supplier.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

Many procedures in this section require you to remove the power from the cutting system. To do this safely, use the following procedure.

> Before you remove the power from the cutting system, it can be helpful to move the torch to the edge of the cutting table and raise the torch lifter to its highest point. This provides easier access to the torch and consumable parts.

1. Set the line-disconnect switch to the OFF position.
2. If the cutting system is not hard wired, disconnect the main power from the electric power. If the cutting system is hard wired, you cannot disconnect the main power from the electric power.

   > Even if you remove the power from the cutting system, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source. Use extreme care during service and maintenance when the cutting system is connect to electricity.

3. Make sure that the power-indicator LED is not illuminated on the plasma power supply, gas connect console, or torch connect console.

Examine the gas regulators

Before you start cutting system operation, examine the regulator (regulators) for the supply gases. Make sure that the supply gas pressures and flow rates are within the recommended range. (See *Table* 7 on page 36.) Adjust the regulator (regulators) if necessary.

Examine the shield water regulator (if applicable)

If your cutting system uses water as a shield fluid, examine the shield water settings before you start cutting system operation. Make sure that the water pressure and flow rate is within the recommended range. (See *Table 9* on page 41.) The regulator on the gas connect console cannot be adjusted. If you have a regulator on the water supply, adjust that regulator if necessary.

Examine the connections and fittings

1. Remove the power from the cutting system. See *Remove the power from the cutting system* on page 234.
2. Examine all of the hoses, cables, and leads that connect system components. Look for:
   - Kinks
   - Cracks
   - Cuts
   - Frays
   - Bulges or bubbles

3. Replace any hose, cable, or lead if you find damage or excessive wear.

   See *Installation* on page 61 for information about how to do this.

4. Examine all of the fittings that connect the hoses, cables, and leads:

   a. Tighten loose connections if found, but do not make the connections too tight.

      See *Table 11* on page 42 for torque specifications.

   b. Order a replacement hose, cable, or lead set if you find its fitting has damage or excess wear. Replacement sets are available from Hypertherm.

      Individual fittings for external hoses, cables, and leads are **not** replaceable. If you find a problem with an external fitting, you must order a replacement hose, cable, or lead set (with integrated fitting).

      Some hose fittings **inside** of the plasma power supply are replaceable. For part numbers and specifications, see the *Parts List* on page 353.

5. Make sure that the hoses, cables, and leads do not twist or kink during torch movement and system operation. Adjust them if needed.

6. Before you supply power to the cutting system, always complete all inspection and maintenance tasks.

Examine the consumable parts, torch, and torch receptacle

Remove the torch and consumable parts

1. Remove the power from the cutting system. See *Remove the power from the cutting system* on page 234.

2. Loosen the torch coupler nut to release the torch from the torch receptacle.

   The torch and consumables can be hot. Wear gloves to protect your hands.

3. Put the torch and torch receptacle on a surface that is:

   - Clean
   - Dry
   - Oil-free

4. Turn the shield cap counter-clockwise to release and remove the shield.

5. Turn the nozzle retaining cap counter-clockwise to release and remove the nozzle and swirl ring.

6. Use the consumable tool (104119) to turn the electrode counter-clockwise. Remove the electrode.

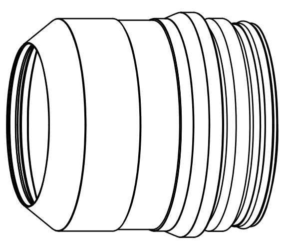
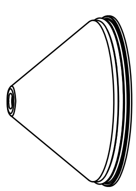
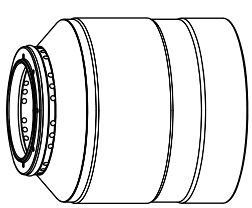
7. Put the used consumables on a surface that is:
   - Clean
   - Dry
   - Oil-free

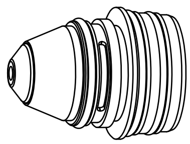
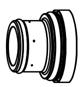
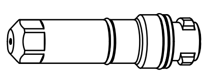
Examine the consumable parts

1. Complete the following procedures before continuing:
   a. *Remove the power from the cutting system* on page 234
   b. *Remove the torch and consumable parts* on page 236

2. Examine the consumable parts for damage and excess wear. (See *Table 32* on page 237 for a list of inspection tasks.)

Table 32 – Inspection tasks for consumables

Inspect	Look for	Action if found
Shield cap 	Erosion or missing material Cracks Melted, eroded, or missing material Damaged O-rings	Replace the shield cap.
	Molten material attached	If there is no damage to the shield cap, you can remove the molten material. If there is damage, replace the shield cap.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
Shield 	A center hole that is not circular Damaged O-rings	Replace the shield.
	Over-lubricated O-rings	Use a clean, lint-free cloth to remove excess lubricant.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
Nozzle retaining cap 	Damage Poor cut quality after replacing other consumables Damaged O-rings	Replace the nozzle retaining cap.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.

Inspect	Look for	Action if found
Nozzle 	Erosion or missing material Blocked gas holes A center hole that is not circular Damaged O-rings	Replace the nozzle.
	Over-lubricated O-rings	Use a clean, lint-free cloth to remove excess silicone lubricant.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
Swirl ring 	Chips or cracks Blocked gas holes Damaged O-rings	Replace the swirl ring.
	Dirt or debris	Use compressed air to remove dirt or debris. Replace the swirl ring if you find damage.
	Over-lubricated O-rings	Use a clean, lint-free cloth to remove excess silicone lubricant.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
Electrode 	Damaged O-rings	Replace the electrode.
	Over-lubricated O-rings	Use a clean, lint-free cloth to remove excess lubricant.
	Dry O-rings	Apply a thin film of silicone lubricant (027055) to O-rings that appear dry.
	Emitter wear For guidance about how to identify emitter wear, refer to *How to identify emitter wear* on page 243.	Replace the electrode and nozzle.

If an electrode needs replacement because of emitter wear, always replace the nozzle at the same time as the electrode.

3. If any consumable part needs replacement, see *How to install the consumables* on page 129 for the installation steps.

4. Clean the consumable parts that do not need replacement:
   a. Use a clean, lint-free cloth to wipe the internal and external surfaces.
   b. Use compressed air to remove debris from internal and external surfaces.

   The nozzle retaining cap can retain debris. Make sure to clean it thoroughly.

c. Use **clean water** if you choose to wash consumables parts in water. Use water from the faucet to soak or rinse them. **Never use the water from a cutting table** to wash consumable parts. Cutting table water has contaminants that will damage consumable parts.

d. Apply a thin film of silicone lubricant (027055) to any O-ring that looks dry.

The O-rings should look shiny. Too much lubricant can prevent gas flow. Remove excess lubricant if found.

5. Before you supply power to the cutting system, install the following components:

- Consumables in the torch. (See *How to install the consumables* on page 129.)
- Torch in the torch receptacle. (See *How to install the torch into the torch receptacle* on page 131.)

Examine the torch

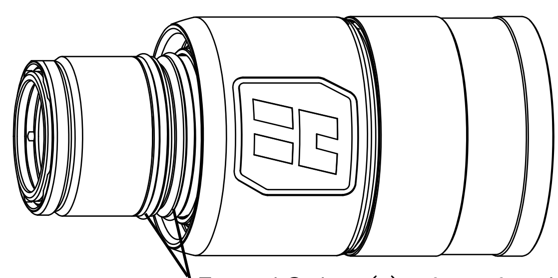
1. Complete the following procedures before continuing:

a. *Remove the power from the cutting system* on page 234

b. *Remove the torch and consumable parts* on page 236

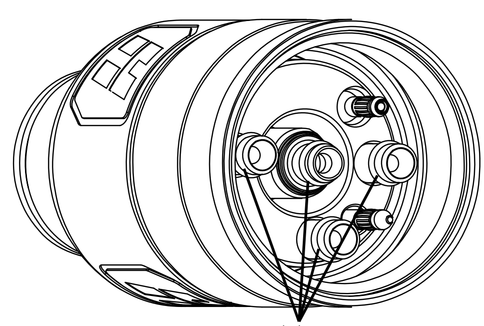
2. Examine the torch for:

- Damage or excess wear on the external O-rings that are on the front of the torch



External O-rings (2) at front of torch

- Damage or excess wear on the internal O-rings that are on the rear of the torch
- Dry O-rings
- Over-lubricated O-rings
- Cracks in the torch main body
- Cracks in the torch insulator



Internal O-rings (4) at rear of torch

3. Replace any O-rings that have damage or excess wear.

Torch rebuild kits are available from Hypertherm. (See *Preventive maintenance kits* on page 393 of the *Parts List*.)

4. If you find cracks in the torch main body or torch insulator, replace the entire torch main body. (See *How to install the torch into the torch receptacle* on page 131.)

5. Replace the torch water tube if you find pitting or bends. (See *How to replace the water tube* on page 242.)

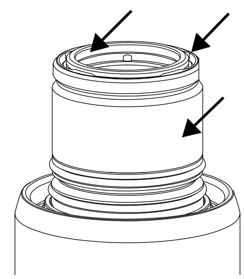
6. Clean and lubricate the torch if it does not need replacement:

   a. Use a clean, lint-free cloth to wipe the internal and external surfaces. (See *Figure 57*.)

   b. Use compressed air to remove debris from the internal and external surfaces.

   A cotton swab can be used for internal surfaces that are difficult to reach. Do not leave cotton fibers inside of the torch.

Figure 57 – Wipe the internal and external surfaces of the torch



   c. Apply a thin film of silicone lubricant (027055) to any O-ring that does not need replacement and that looks dry.

   The O-rings should look shiny. Too much lubricant can prevent gas flow. Remove excess lubricant if found.

7. Before you supply power to the cutting system, install the following components:
   - Consumables in the torch. (See *How to install the consumables* on page 129.)
   - Torch in the torch receptacle. (See *How to install the torch into the torch receptacle* on page 131.)

Examine the torch receptacle

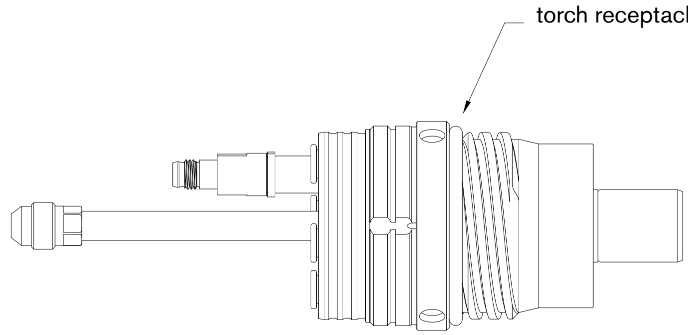
1. Complete the following procedure before continuing:

   a. *Remove the power from the cutting system* on page 234

2. Examine the torch receptacle. Look for:
   - Cuts, nicks, damage or excess wear on the O-ring on the torch receptacle

     The O-ring on the torch receptacle does not require lubricant. The O-ring is for dust protection only.

   - Cracks in the torch receptacle body



3. Replace the O-ring if it has damage or excess wear.

   Torch rebuild kits are available from Hypertherm. (See *Preventive maintenance kits* on page 393 of the *Parts List*.)

4. If you find cracks in the torch main body or torch insulator, replace the entire torch receptacle. (See *Connect the EasyConnect torch lead assembly to the torch receptacle* on page 121.)

5. Clean the torch receptacle if it does not need replacement:

   a. Use a clean, lint-free cloth to wipe the internal and external surfaces.

   b. Use compressed air to remove debris from the internal and external surfaces.

      A cotton swab can be used for internal surfaces that are difficult to reach.
      Do not leave cotton fibers inside the torch receptacle.

6. Before you supply power to the cutting system, make sure that the following components are installed:

   - Consumables in the torch. (See *How to install the consumables* on page 129.)
   - Torch in the torch receptacle. (See *How to install the torch into the torch receptacle* on page 131.)

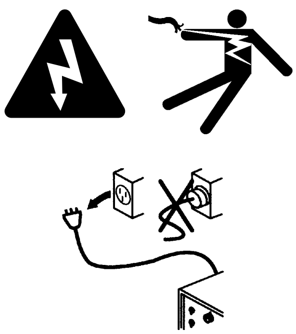
Examine the torch lead

Before cutting system operation, examine the torch lead. Look for damage or wear.

- Look for kinks, cracks, cuts, or excess wear. Replace the torch lead if you find these conditions.
- Make sure that all connections between the torch and torch lead are tight. Tighten loose connections if found, but do not make the connections too tight. Do **not** use tools to tighten these connections.
- If you have a power track that supports hoses, cables, and leads, examine their position on the track. Look for evidence that the hoses, cables, and leads are exceeding bend radius requirements during cutting system operation. (See *Bend radius requirements for hoses, cables, and leads* on page 51.)
- Make adjustments if you find evidence of kinking, bending, or twisting.

How to replace the water tube

WARNING



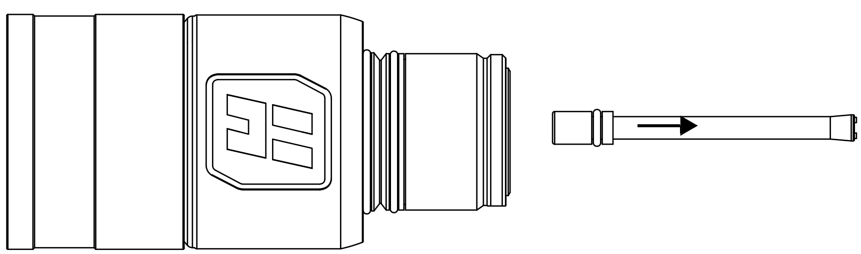
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any installation or maintenance.

The line-disconnect switch must REMAIN in the OFF position until all installation or maintenance steps are complete.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Complete the following procedures before continuing:
   a. *Remove the power from the cutting system* on page 234
   b. *Remove the torch and consumable parts* on page 236
2. Remove the water tube from the torch.



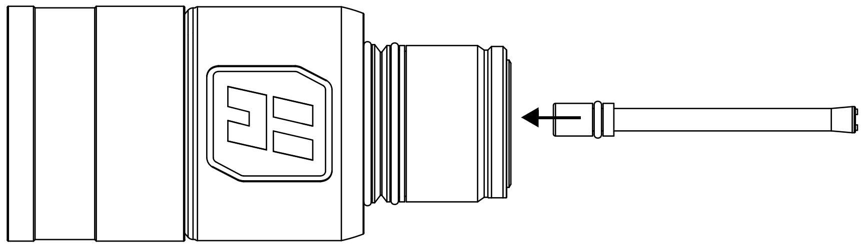
3. Examine the O-ring on the end of the water tube:
   a. Replace the O-ring if you find damage or excess wear.

      Torch rebuild kits are available from Hypertherm. (See *Preventive maintenance kits* on page 393 of the *Parts List*.)

   b. Apply a thin film of silicone lubricant (027055) if the O-ring is dry.

      The O-ring should look shiny. Too much lubricant can restrict water tube motion. Remove excess lubricant if found.

4. Install a water tube in the torch.



When correctly installed, the water tube can seem loose. Any side-to-side looseness will disappear after electrode installation.

5. Before you supply power to the cutting system, install the following components:

- Consumables in the torch. (See *How to install the consumables* on page 129.)
- Torch in the torch receptacle. (See *How to install the torch into the torch receptacle* on page 131.)

How to identify emitter wear

Emitter wear can indicate when to replace the electrode. Emitter wear can be described by the width, depth, and appearance of the electrode pit. The number of starts and the arc-on time can have an effect on emitter wear.

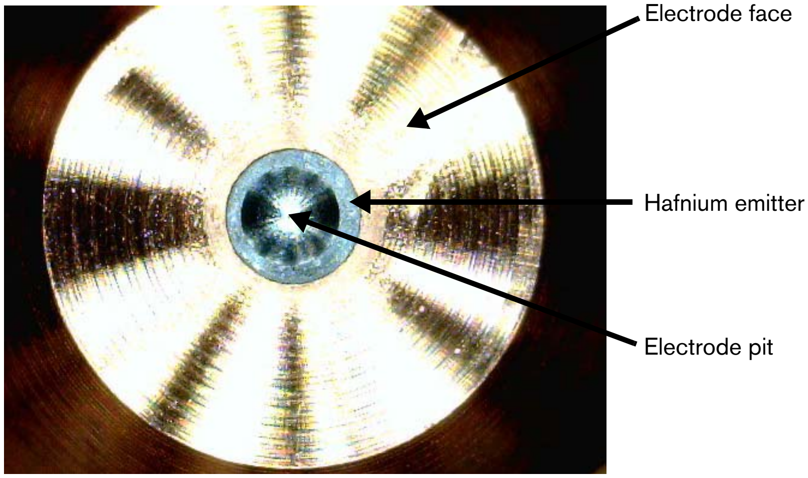
Emitter wear can cause the cut quality to degrade. Your cut quality requirements will indicate when to replace the electrode.

If an electrode needs replacement because of emitter wear, always replace the nozzle at the same time as the electrode.

The following guidelines for how to evaluate emitter wear apply to hafnium-emitter electrodes.

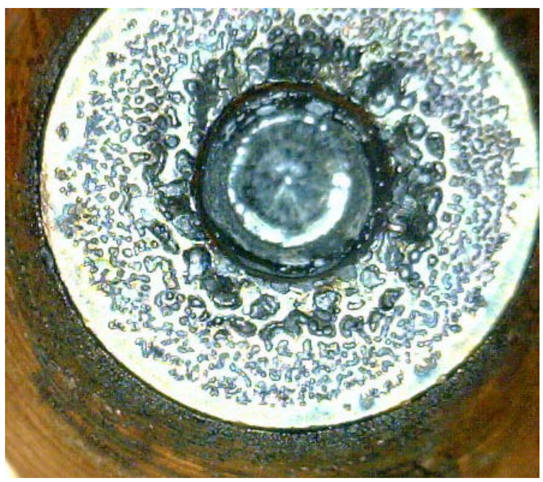
The face of a new electrode looks shiny and smooth (*Figure 58*).

Figure 58 – Face of a new electrode (note hafnium emitter and electrode pit)



If the electrode pit diameter extends beyond the hafnium (*Figure 59*), replace the electrode and nozzle.

Figure 59 – Wide electrode pit that extends beyond the hafnium



In general, if the electrode pit depth exceeds the guidelines below, replace the electrode and nozzle.

Electrode amperage	Replacement pit depth*	Description
< 130 A	≥ 1 mm (0.04 in)	In general, for electrodes less than 130 A, replace the electrode when the pit depth is 1 mm (0.04 in) or greater.
≥ 130 A and < 300 A	≥ 1.25 mm (0.05 in)	In general, for electrodes greater than or equal to 130 A and less than 300 A, replace the electrode when the pit depth is 1.25 mm (0.05 in) or greater.
300 A	≥ 1.5 mm (0.06 in)	In general, for 300 A electrodes, replace the electrode when the pit depth is 1.5 mm (0.06 in) or greater.

* Based on your cut-quality requirements, it can be necessary to replace your electrode at a pit depth that is shallower or deeper than the guidelines above.

For information about how to measure electrode pit depth, see *How to measure the pit depth of an electrode* on page 246.

If you see a non-symmetrical, rough-edged pit and rough-surfaced electrode face (*Figure 60*), replace the electrode and nozzle.

Figure 60 – Non-symmetrical, rough-edged pit and rough-surfaced electrode face

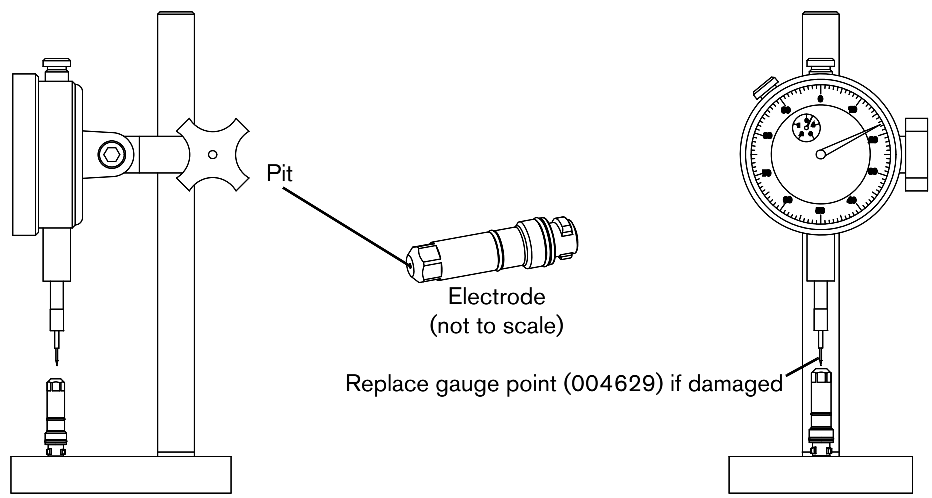
If an electrode needs replacement because of emitter wear, always replace the nozzle at the same time as the electrode.

How to measure the pit depth of an electrode

1. Complete the following procedures before continuing:
   a. *Remove the power from the cutting system* on page 234
   b. *Remove the torch and consumable parts* on page 236
2. Use an electrode pit-depth gauge to measure the pit depth on the electrode. (See *Figure 61* on page 246.)

   A pit-depth gauge (004630) is available from Hypertherm. (See *Other consumable and torch parts* on page 384 of the *Parts List*.)

Figure 61 – Use an electrode pit-depth gauge to measure pit depth



How to do coolant maintenance

If the CNC alerts you that the coolant level is low (see *Low coolant flow codes (540 – 542)* on page 312), remove the power from the cutting system and refill the coolant reservoir **immediately.**

WARNING

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. When you come into contact, flush skin or eyes with water. If swallowed, seek immediate medical attention.

NOTICE

Never operate the cutting system if you get a low coolant level notice.

There is a risk of serious damage to the cutting system and to the coolant pump if you operate the cutting system with no coolant or with low coolant.

If your coolant pump is damaged, it may need to be replaced.

NOTICE

Never use automotive antifreeze in place of Hypertherm coolant. Antifreeze contains chemicals that damage the torch coolant system.

NOTICE

If you use the wrong coolant, it can cause damage to the cutting system. See *Coolant requirements* on page 44.

Estimate the total coolant volume for your cutting system

The capacity of the coolant reservoir for the XPR cutting system is 22.7 liters to 45 liters (6 US gallons to 12 US gallons).

A cutting system with long leads requires more coolant than a cutting system with short leads.

To calculate the estimated total coolant volume necessary for your cutting system, use the calculations below:

For total estimated volume in liters:

26	+	0.2534	X	Length of leads (**in meters**) between the plasma power supply and gas connect console for your cutting system	=	Total estimated volume (in liters)

For total estimated volume in US gallons:

6.8	+	0.0204	X	Length of leads (i**n feet**) between the plasma power supply and gas connect console for your cutting system	=	Total estimated volume (in US gallons)

See *Coolant Installation* on page 193.

Replace all of the coolant

The use of old coolant can decrease coolant flow, which can cause higher torch temperatures that shorten the life of consumable parts.

Hypertherm recommends that you replace all of the coolant at least once every 6 months, as part of routine preventive maintenance. More frequent replacement can be necessary because of environmental conditions including but not limited to contaminants in your coolant or diagnostic codes that indicate coolant problems.

For instructions about preventive maintenance (such as weekly, monthly, and yearly tasks) see the *XPR Preventative Maintenance Program (PMP) Instruction Manual* (809490).

Adding new coolant to the reservoir when the coolant level is low is **not** the same as replacing all of the coolant. **All** of the coolant must be removed in order to flush the coolant system.

The steps below describe how to remove all of the old coolant. Refill the cutting system with new coolant only after you remove all of the old coolant.

For coolant installation steps, see *Coolant Installation* on page 193.

Remove old coolant from the coolant system

1. Remove the power from the cutting system. See *Remove the power from the cutting system* on page 234.

2. Remove the right external panel from the plasma power supply (this is the panel on the right when you look at the front of the unit).

   M6 (10 mm hex) screws hold the panel in position.

3. Remove old coolant from the coolant reservoir:

   a. Connect a 3/8-inch inner diameter tube to the outlet of the valve on the bottom of the reservoir.

   b. Put the other end of the tube into an empty container.

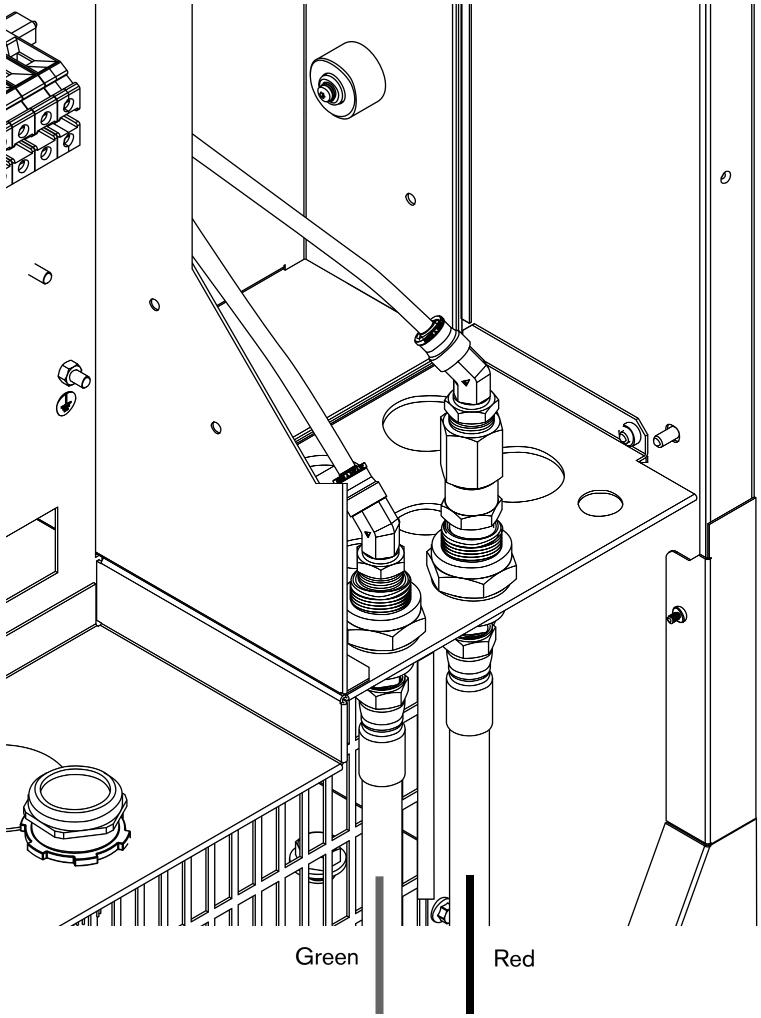
   Use a container that holds the approximate total coolant volume for your cutting system.

   c. Open the valve located on the bottom of the reservoir.

   d. Remove the cap on the reservoir inlet to allow the coolant to flow out of the reservoir.

4. Remove old coolant from the heat exchanger:

   a. Keep the 3/8-inch inner diameter tube connected to the outlet of the valve on the bottom of the reservoir on one end and the other end in the container.



   b. Remove the coolant return hose (red band) from the rear of the plasma power supply.

   c. Attach compressed air (no more than 6.89 bar/100 psi) to the coolant return hose fitting on the rear of the plasma power supply where the return coolant hose (red band) was previously connected.

   d. For no more than 30 seconds, use the compressed air to blow all of the coolant back into to the reservoir and filter housing.

      System components need the coolant to lubricate rotating surfaces. If air flows through the cutting system for longer than 30 seconds, it can eliminate the coolant necessary for lubrication.

   e. Close the valve at the bottom of the reservoir and remove the 3/8-inch inner diameter tubing from the outlet.

      Do not store the 3/8-inch diameter tubing inside of the plasma power supply.

f. Leave the coolant return hose (red band) disconnected from the rear of the plasma power supply.

g. Put a container under the pump plug.

h. Remove the plug and coolant pump screen and set them aside.

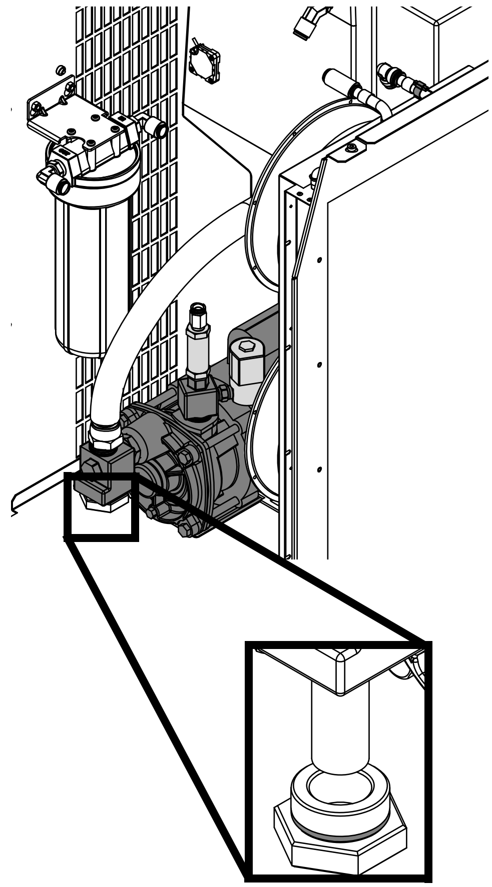
i. Remove the coolant supply hose (green band) from the rear of the plasma power supply.

j. Attach compressed air (no more than 3.45 bar/50 psi) to the coolant supply hose fitting on the rear of the plasma power supply where the coolant supply hose (green band) was previously connected.

k. For no more than 30 seconds, use the compressed air to blow all of the coolant into the container.

l. Leave the coolant supply hose (green band) disconnected.

System components need the coolant to lubricate rotating surfaces. If air flows through the cutting system for longer than 30 seconds, it can eliminate the coolant necessary for lubrication.



5. Clean and, if needed, replace the coolant pump screen:

a. Clean the coolant pump screen. Rinse it with water if you find debris.

b. Examine the coolant pump screen.

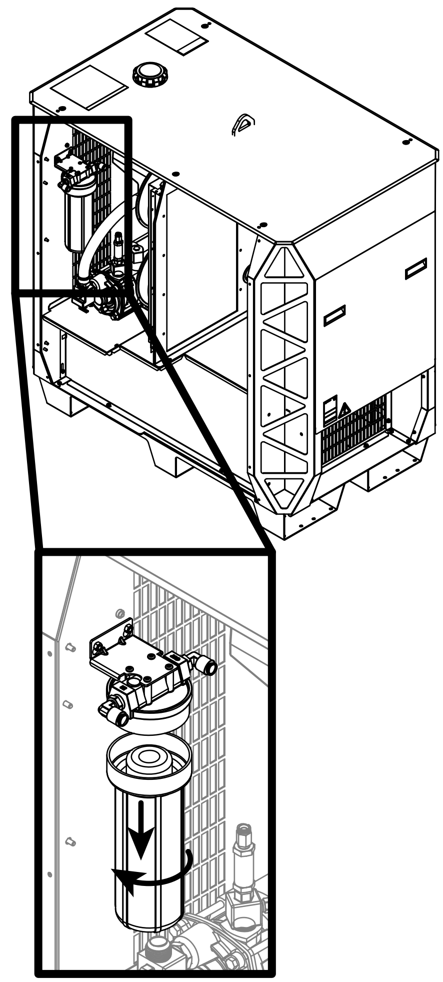
c. If you find damage on the coolant pump screen, replace it (127559).

d. Install the coolant pump screen.

e. Wipe the O-ring on the plug. Make sure that the O-ring is free of debris, cracks, and nicks.

f. Install the plug on the coolant pump housing.

6. Remove old coolant from the filter housing and replace the coolant filter:
   a. Remove the filter housing from inside of the plasma power supply.
   b. Discard all of the coolant from inside of the filter housing.
   c. Remove and discard the coolant filter.
   d. Examine the filter housing for debris. Rinse the filter housing to remove any debris, if found.
   e. Install a new coolant filter (027005).
   f. Install the filter housing.



7. Remove old coolant from hoses and leads:

   Cutting system hoses and leads can hold a large volume of coolant.

   Make sure to remove all of the old coolant from the hoses and leads. If you do not, the new coolant will mix with the old coolant. This will cause the new coolant to degrade faster.

   a. Put the disconnected end of the coolant return hose into an empty container.

      Use a container that holds the approximate total coolant volume for your cutting system.

   b. Attach compressed air (no more than 6.89 bar/100 psi) to the disconnected end of the coolant supply hose (green band).
   c. For approximately 3 minutes, inject compressed air into the coolant supply hose fitting to force coolant out of the coolant return hose (red band) into an empty container.
   d. After 3 minutes, look for coolant flow out of the coolant return hose (red band). Repeat this process until coolant flow from the coolant return hose (red band) stops.
   e. When coolant flow from coolant return hose (red band) stops, connect both hoses to the rear of the plasma power supply.

8 Diagnostics and Troubleshooting

Overview

This section of the manual includes information about how to diagnose and troubleshoot performance issues. It includes the following:

- A list of diagnostic codes and steps to troubleshoot them.
- Drawings for PCBs.

For information about daily inspections and preventive maintenance, see the following:

- *How to do daily inspections* on page 233 of this manual.
- *XPR Preventive Maintenance Program (PMP) Instruction Manual* (809490).

> If you have questions about how to care for your cutting system, contact your cutting machine supplier or regional Hypertherm Technical Service team. You can find contact information for each regional office at www.hypertherm.com on the "Contact us" page.

The cutting system software generates a diagnostic code for most conditions that decrease cutting system performance. Some conditions have multiple diagnostic codes.

Diagnostic codes appear on the XPR web interface and can be queried by the CNC.

> For information about how to view diagnostic codes on your CNC, see the instruction manual that came with your CNC. Codes show on the Log screen of the XPR web interface. See *Log* on page 183.

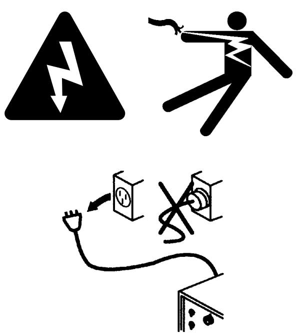
Safety considerations

For maximum safety, follow these safety guidelines when you diagnose or troubleshoot performance issues:

- Before you attempt to diagnose or troubleshoot a problem, make sure to read, understand, and follow all of the safety instructions (in this manual and on the cutting system).
- Unless the instructions tell you otherwise, always remove the power from the cutting system before you attempt to diagnose or troubleshoot a performance issue.
- Use a licensed electrician to install, modify, inspect, or repair any electrical equipment or electrical systems.
- Use a licensed plumber to install, modify, inspect, or repair any plumbing equipment or plumbing systems.

For more information, refer to *Qualifications of service personnel* on page 31 and the *Safety and Compliance Manual* (80669C).

WARNING



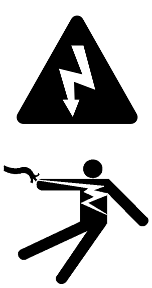
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

Initial inspection steps

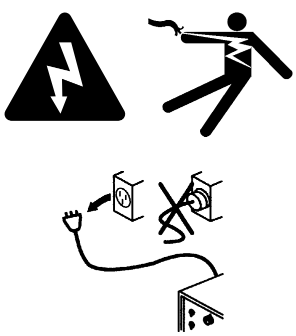
Some conditions do not give a diagnostic code. For example, there are no diagnostic codes (and the cutting system does not work) if electric power is removed from the cutting system.

Before you attempt to find or resolve a performance issue that does not result in a diagnostic code, make sure to first look for obvious problems or damage. Always start with the following inspection steps:

- Make sure that the cutting system is connected to electric power. (See *How to connect electric power to the cutting system* on page 133.)
- Make sure that the line-disconnect switch is set to ON. (See *Line-disconnect switch requirements* on page 33.)
- Examine the PCBs. (See page 257.)
- Use a licensed electrician to measure the line voltage between the terminals that are inside of the plasma power supply. (See page 259.)

Remove the power from the cutting system

WARNING



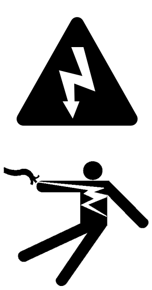
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

WARNING



ELECTRIC SHOCK CAN KILL

The line-disconnect switch must be in the OFF position before you connect the power cord to the cutting system.

The line-disconnect switch must REMAIN in the OFF position until all installation steps are complete.

In the United States, use a “lock out/tag out” procedure until installation is complete. In other countries, follow the appropriate national and local safety procedures.

WARNING

ELECTRIC SHOCK CAN KILL

When the line-disconnect switch is in the ON position, there is line voltage throughout the cutting system.

Voltages present throughout the cutting system can cause injury or death.

Use extreme caution if you do diagnosis or maintenance tasks when the line-disconnect switch is in the ON position.

WARNING

ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING

MACHINE MOTION CAN CAUSE INJURY

The end-use customer and the cutting machine supplier are responsible for providing protection against the hazardous moving parts of this cutting system.

Read and follow the instruction manual provided by the cutting machine supplier.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

Many procedures in this section require you to remove the power from the cutting system. To do this safely, use the following procedure.

Even if you use the remote on-off switch to turn OFF the cutting system, electricity remains inside the cutting system. You can still get a serious electric shock when the cutting system is connected to an electric power source.

Before you remove the power from the cutting system, it can be helpful to move the torch to the edge of the cutting table and raise the torch lifter to its highest point. This provides easier access to the torch and consumable parts.

1. Set the line-disconnect switch to the OFF position.

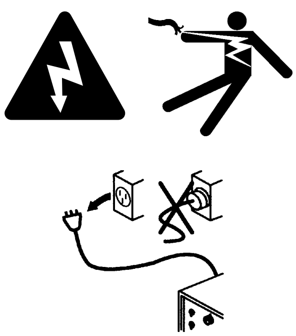
2. If the cutting system is not hard wired, disconnect the main power cord from the electric power. If the cutting system is hard wired, you cannot disconnect the main power cord from the electric power.

   Even if you remove the power from the cutting system, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source. Use extreme care during service and maintenance when the cutting system is connected to electricity.

3. Make sure that the power-indicator LED is not illuminated on the plasma power supply, gas connect console, or torch connect console.

Examine the PCBs

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)

2. Remove the external panel or panels from the system component that has the PCB that you want to examine. (See *Table 33*.)

Table 33 – PCB names and locations

PCB name	Location	See the following drawings to PCB location page
Power distribution PCB	Plasma power supply	See *Control side – view 1* on page 360.
Control PCB	Plasma power supply	See *Control side – view 2* on page 361.
Chopper assembly PCB	Plasma power supply	See *Control side – view 2* on page 361.
Start-circuit assembly PCB	Plasma power supply	See *Control side – view 1* on page 360.
I/O PCB	Plasma power supply	See *Control side – view 2* on page 361.
Fan power distribution PCB	Plasma power supply	See *Fans* on page 355.
Control PCB	Gas connect console	See *Gas connect console manifold side parts* on page 365.
High-frequency, high-voltage ignition PCB	Gas connect console	See *Gas connect console high-voltage side parts* on page 364.
Ohmic contact PCB	Torch connect console	See *Torch connect console manifold side – view 1* on page 375.
Control PCB	Torch connect console	See *Torch connect console manifold side – view 1* on page 375.

3. Examine the PCB. Look for:
   - Loose or disconnected PCB connectors
   - Loose or disconnected PCBs
   - Discoloration
   - Damage
4. If you find a PCB that is loose, reconnect it if possible.
5. If you find a PCB that has damage or discoloration, replace it.

   See *Parts List* on page 353 for part numbers and reorder information.

6. If all PCBs are in good condition, measure the line voltage between the terminals inside of the plasma power supply. (See *Measure the line voltage between the terminals inside the plasma power supply* on page 259.)
7. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Measure the line voltage between the terminals inside the plasma power supply

WARNING

ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

WARNING

ELECTRIC SHOCK CAN KILL

When the line-disconnect switch is in the ON position, there is line voltage at the contactor and the power distribution PCB.

Voltages present at the terminal block and contactors can cause injury or death.

Use extreme caution when you measure the primary power in these areas.

It is necessary for the cutting system to have electric power to measure line voltage. Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains plugged in and the panels on the plasma power supply are removed.

1. Measure the line voltage between the terminals (*Figure 62* on page 260) in the following order:
   - ❑ U to V
   - ❑ U to W
   - ❑ V to W

   Verify each line to ground.

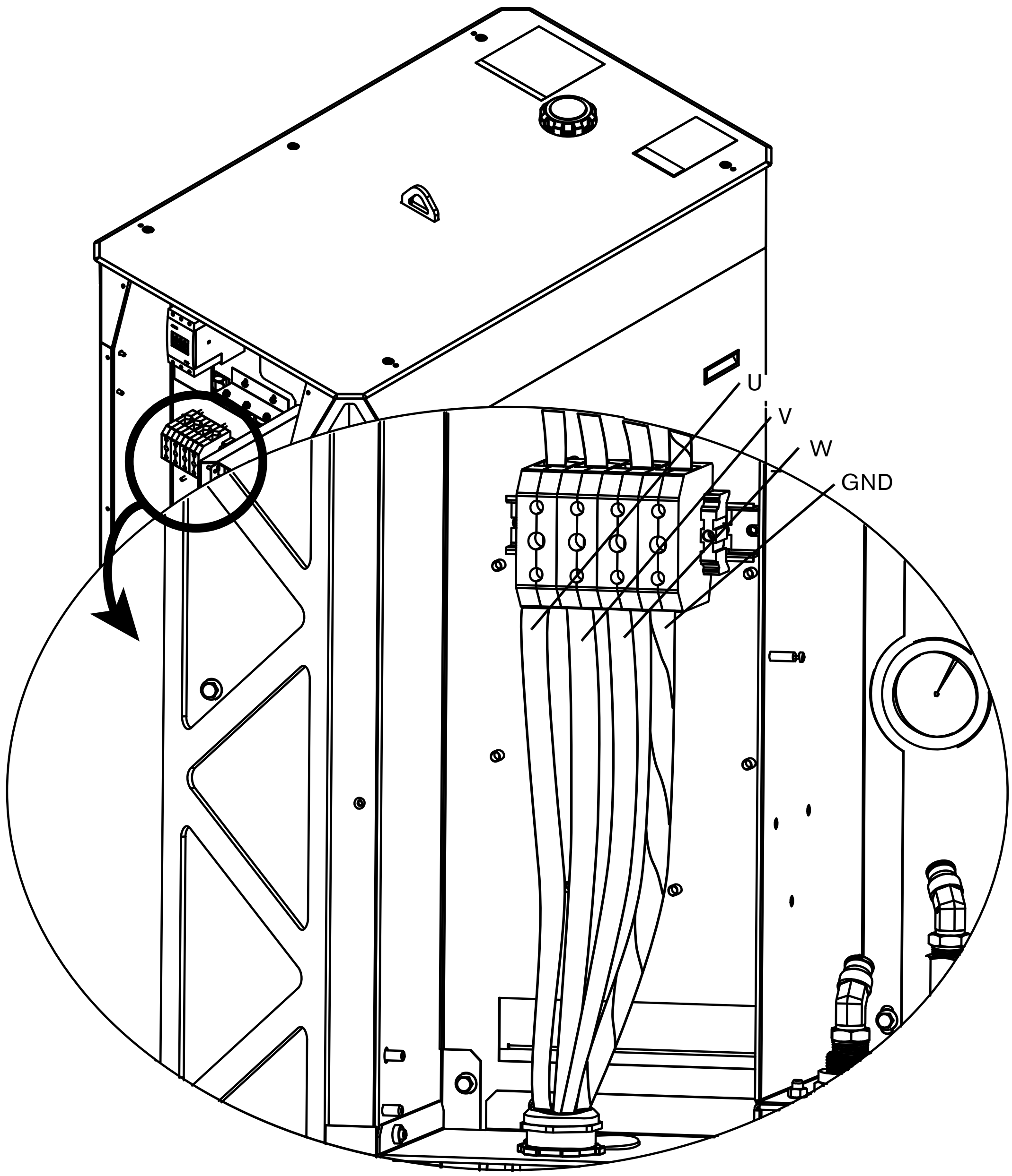
2. Determine if the voltage between any 2 of the 3 lines is equal to the supply voltage.

3. If any 1 line is equal to or 10% greater than the other 2 lines, examine with the incoming electric supply lines.

   If the incoming electric supply lines are good, contact a licensed electrician or the electric company that supplies electricity for more information.

4. If the voltage between any 2 of the 3 lines is less than the supply voltage:
   a. Remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)
   b. Examine the power cord for damage.
   c. Examine the fuses at the line-disconnect switch. Look for continuity.
   d. Repair or replace any damaged or defective parts if found.
5. Repeat these steps until the line voltage between any 2 of the 3 lines is equal to the supply voltage.

Figure 62



Diagnostic codes

How to diagnose and troubleshoot diagnostic codes

Use the Corrective action column of *Table 35* on page 263 to respond to the diagnostic codes that show on the CNC or XPR web interface.

Diagnostic codes can include the following abbreviations:

GCC – Gas connect console

CAN – Controller area network

TCC – Torch connect console

t/o – Time out

HF – High frequency

IGBT – Insulated-gate bipolar transistor

Ch1 – Chopper

Ch2 – Chopper 2

DC – Direct current, current

Ind – Inductor

MagFan – Magnetics fan

HxFan – Heat exchanger fan

Table 34 – Diagnostic codes in the web interface

Type	Description
Information	These codes contain information about the current conditions. In many cases, operator action is not necessary for Information codes. If action is necessary, the steps are usually simple.
Alert	These codes describe conditions that can reduce productivity or quality. Resolve an Alert code as soon as possible.
Error	These codes describe conditions that usually reduce productivity or quality, or cause damage to cutting system components. Resolve an Error code as soon as possible.
Failure	These codes describe conditions where you cannot start the arc until the condition is resolved. Failure mode protects the cutting system and system components from permanent damage.

Certain codes can occur if the cutting system has old firmware. Make sure that you have the most recent XPR firmware. Log into the Xnet at www.hypertherm.com to download it.

If you cannot find or resolve the problem with the corrective actions in *Table 35*, contact your cutting machine supplier or regional Hypertherm Technical Service team listed in the front of this manual.

Table 35 – Diagnostic codes

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
500 Failure	GCC->Main CAN t/o	The gas connect console (Core, VWI, or OptiMix) cannot receive communications (at least once-per-second) from the main control though the CAN.	See *CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)* on page 304.	Shut down	Remote on-off
501 Failure	Mix->Main CAN t/o	The gas connect console (Core, VWI, or OptiMix) cannot receive communications (at least once-per-second) from the main control through the CAN.		Shut down	Remote on-off
503 Failure	TCC->Main CAN t/o	The torch connect console (Core, VWI, or OptiMix) cannot receive communications (at least once-per-second) from the main control through the CAN.		Shut down	Remote on-off
504 Failure	Ch1->Main CAN t/o	Chopper 1 cannot receive communications (at least once-per-second) from the main control through the CAN.		Shut down	Remote on-off
505 Failure	Ch2->Main CAN t/o	Chopper 2 cannot receive communications (at least once-per-second) from the main control trough the CAN.	See *CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)* on page 304.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
507 Failure	Main no CAN	There is a problem with the CAN network when power is supplied to the cutting system.	See *CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)* on page 304.	None	Remote on-off
508 Error	CAN Busy	The CAN bus is overloaded (for 10 milliseconds or more).		None	Remote on-off
510 Failure	Main->GCC CAN t/o	The main control cannot receive communications (at least once-per-second) from the gas connect console (Core, VWI, or OptiMix) through the CAN.		Ramp down	Remote on-off
511 Failure	Main->Mix CAN t/o	The main control cannot receive communications (at least once-per-second) from the gas connect console's mix module through the CAN.		Ramp down	Remote on-off
513 Failure	Main->TCC CAN t/o	The main control cannot receive communications (at least once-per-second) from the torch connect console (Core, VWI, or OptiMix) through the CAN.		Ramp down	Remote on-off
514 Failure	Main->Ch1 CAN t/o	The main control cannot receive communications (at least once-per-second) from Chopper 1 through the CAN.		None	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
515 Failure	Main->Ch2 CAN t/o	The main control cannot receive communications (at least once-per-second) from Chopper 2 through the CAN.	See *CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)* on page 304.	None	Remote on-off
520 Alert	Ignite t/o (no pilot arc)	The sensor in Chopper 1 did not measure current during the 600 millisecond ignite period. No current path completes between the nozzle and electrode for at least 600 milliseconds.	**1.** Make sure that the transfer height is correct and that the torch is not in contact with the workpiece. **2.** Examine the consumables. Replace the consumables that have damage or excess wear. **3.** Make sure that both spark arrestors (also known as spark ignitors) illuminate brightly. **4.** Inspect the main contactor: **5.** Look for black or rough surfaces that are difficult to remove. **6.** Make sure that the contactor closes immediately after the Start command is applied. **7.** If the contactor is bad, replace it. If the contactor is good, examine the pilot arc relay. **8.** Examine the pilot arc relay. Make sure that it closes. **9.** If the pilot arc relay is good, examine the wiring. Make sure that the coil receives 120 VAC. **10.** Inspect the Start circuit/Pilot PCB. If the Start circuit/Pilot PCB is bad, replace it. **11.** Do a torch lead test. (See *How to test continuity between the nozzle and workpiece* on page 335.)	End of cycle	Start or set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
521 Alert	Pilot arc t/o (no arc transfer)	No current detected on the work lead for 500 milliseconds after the pilot arc current is established. The sensor in the work lead is unable to measure current greater than the transfer reference value for a minimum of 3 milliseconds.	**1.** Make sure that the transfer height is correct. **2.** Examine the consumables. Replace the consumables that have damage or excess wear. **3.** Do a torch lead test. (See *How to test continuity between the nozzle and workpiece* on page 335.)	End of cycle	Start or set process; remote on-off
522 Alert	Preflow t/o	The cutting system cannot complete the preflow routine within 30 seconds.	**1.** Review the diagnostic code history for previous gas-related codes. Previous codes can indicate where to look for flow or pressure problems. **2.** Examine the consumables, valves, and inlet hoses. Make sure that they are correct. Replace them if you find damage or excess wear.	End of cycle	Start or set process; remote on-off
523 Error	Preflow purge t/o	The preflow purge cannot get to the setpoint within 45 seconds.		None	Set process; remote on-off
524 Error	Cutflow purge t/o	The preflow purge cannot get to the setpoint within 45 seconds.		None	Set process; remote on-off
525 Error	Inert gas purge t/o	The XPR cutting system is unable to complete the N_2 purge within 45 seconds. The process did not get selected.		None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
530 Alert	Low psi-Line A	▪ The Line A pressure (P5) is less than 75% of the setpoint for 200 milliseconds, for any process; or ▪ P5 is less than 75% of the P21 sensor reading for 4 seconds, for a mixed-fuel gas process; or ▪ P5 is less than 75% of the P7 setpoint for 4 seconds, for a F5 process.	**1.** Review the diagnostic code history for previous pressure-related codes. Previous codes can indicate where to look for flow or pressure problems. **2.** Make sure that the inlet gas pressure for Line A (P2) or Line B (P1) are in the correct range. **3.** If the measurement is too high or too low, use the regulators to adjust the pressure for the Line A/Line B gas or F5 gas to the correct range. **4.** Examine the consumables: ▪ Make sure that the correct consumables are installed. ▪ Make sure that there is no damage or excess wear. **5.** Replace incorrect consumables or consumables that have damage or excess wear. **6.** Use the gas volume monitors located near the pressure transducers to look for gas leaks.	Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
531 Alert	Low psi-Line B	For a minimum of 200 milliseconds, Line B pressure is less than 75% of setpoint.	**1.** Review the diagnostic code history for previous pressure-related codes. Previous codes can indicate where to look for flow or pressure problems. **2.** Make sure that the inlet gas pressure for Line A (P2) or Line B (P1) are in the correct range. **3.** If the measurement is too high or too low, use the regulators to adjust the pressure for the Line A/Line B gas or F5 gas to the correct range. **4.** Examine the consumables: ▪ Make sure that the correct consumables are installed. ▪ Make sure that there is no damage or excess wear. **5.** Replace incorrect consumables or consumables that have damage or excess wear. **6.** Use the gas volume monitors located near the pressure transducers to look for gas leaks.	Ramp down	Set process; remote on-off
532 Alert	Low psi-H_2O	For a minimum of 200 milliseconds, the shield water pressure (P9) is less than 50% of the setpoint (2.7 bar/39 psi) and the setpoint is greater than 0.	See *Low shield water pressure code (532)* on page 310.	Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
533 Alert	Low psi-F5	For a minimum of 200 milliseconds, the F5 pressure sensor (P7) is less than 75% of setpoint.	**1.** Review the diagnostic code history for previous pressure-related codes. Previous codes can indicate where to look for flow or pressure problems. **2.** Make sure that the inlet gas pressure for Line A (P2) or Line B (P1) are in the correct range. **3.** If the measurement is too high or too low, use the regulators to adjust the pressure for the Line A/Line B gas or F5 gas to the correct range. **4.** Examine the consumables: ▪ Make sure that the correct consumables are installed. ▪ Make sure that there is no damage or excess wear. **5.** Replace incorrect consumables or consumables that have damage or excess wear. **6.** Use the gas volume monitors located near the pressure transducers to look for gas leaks.	Ramp down	Set process; remote on-off
534 Alert	Low psi-Shield	For a minimum of 600 milliseconds, the shield gas pressure is less than 75% of the setpoint, and the setpoint is more than 0.	See *Low shield gas pressure code (534)* on page 311.	Ramp down	Set process; remote on-off
540 Error	Low flow 1-Coolant	For a minimum of 40 seconds after the Plasma Start switch is turned ON, the coolant flow rate is less than 1.9 L/min (0.5 gal/min).	See *Low coolant flow codes (540 – 542)* on page 312.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
541 Error	Low flow 2-Coolant	For a minimum of 10 seconds after the coolant flow rate gets to 1.9 L/min (0.5 gal/min), the flow rate stays less than 3.03 L/min (0.8 gal/min).	See *Low coolant flow codes (540 – 542)* on page 312.	Shut down	Remote on-off
542 Failure	Low flow-Coolant	The coolant flow is less than 3.79 L/min (1 gal/min) for a minimum of 1 second.		Shut down	Remote on-off
543 Error	High flow 1-Coolant	The coolant flow is more than 3.03 L/min (0.8 gal/min) for a minimum of 5 seconds after the coolant pump stops.	See *High coolant flow codes (543 – 544)* on page 314.	Shut down	Set process; remote on-off
544 Failure	High flow-Coolant	The coolant flow rate is more than 11.36 L/min (3.0 gal/min), for a minimum of 1 second. This error can also occur when air is in the line or when there is a torch blow out.		Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
550 Alert	No plasma arc	For a minimum of 10 milliseconds during a Steady State, the total electric current decreases 50% below the electric current setpoint, and the setpoint is more than the setpoint for that process (setpoints vary by process type).	**1.** Examine the consumables. Replace consumables that have damage or excess wear. **2.** Do a test for gas leaks. Replace leaking components if found. **3.** Examine contactors. Replace damaged components if found. **4.** Look for DC bus errors. **5.** Exchange the choppers. See if the code follows the change. ▪ If yes, it confirms the bad chopper. Replace it. ▪ If no, go to *step 6*. **6.** Examine the following components: ▪ Choppers ▪ Inductors **7.** Replace damaged choppers or inductors if found. **8.** Make sure that the arc remains on workpiece during XPR cutting system operation. **9.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Start or set process; remote on-off
552 Alert	DC below limit-Ch1	The Chopper 1 current decreases below 50% of the setpoint for 50 milliseconds and the setpoint is more than 10 A.		End of cycle	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
553 Alert	DC below limit-Ch2	The Chopper 2 current decreases below 50% of the setpoint for 50 milliseconds and the setpoint is more than 10 A.	**1.** Examine the consumables. Replace consumables that have damage or excess wear. **2.** Do a test for gas leaks. Replace leaking components if found. **3.** Examine contactors. Replace damaged components if found. **4.** Look for DC bus errors. **5.** Exchange the choppers. See if the code follows the change. ▪ If yes, it confirms the bad chopper. Replace it. ▪ If no, go to *step 6*. **6.** Examine the following components: ▪ Choppers ▪ Inductors **7.** Replace damaged choppers or inductors if found. **8.** Make sure that the arc remains on workpiece during XPR cutting system operation. **9.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
555 Failure	DC exceeds limit-Ch1	For at least 10 milliseconds, the electric current for Chopper 1 is more than 170 A.	**1.** Examine the consumables. Replace consumables that have damage or excess wear. **2.** Do a test for gas leaks. Replace leaking components if found. **3.** Examine contactors. Replace damaged components if found. **4.** Look for DC bus errors. **5.** Exchange the choppers. See if the code follows the change. ▪ If yes, it confirms the bad chopper. Replace it. ▪ If no, go to *step 6*. **6.** Examine the following components: ▪ Choppers ▪ Inductors **7.** Replace damaged choppers or inductors if found. **8.** Make sure that the arc remains on workpiece during XPR cutting system operation. **9.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
556 Failure	DC exceeds limit-Ch2	For a minimum of 10 milliseconds, the electric current for Chopper 2 is more than 170 A.	**1.** Examine the consumables. Replace consumables that have damage or excess wear. **2.** Do a test for gas leaks. Replace leaking components if found. **3.** Examine contactors. Replace damaged components if found. **4.** Look for DC bus errors. **5.** Exchange the choppers. See if the code follows the change. ▪ If yes, it confirms the bad chopper. Replace it. ▪ If no, go to *step 6*. **6.** Examine the following components: ▪ Choppers ▪ Inductors **7.** Replace damaged choppers or inductors if found. **8.** Make sure that the arc remains on workpiece during XPR cutting system operation. **9.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off
560 Error	Over temp-Ch1	The insulated-gate bipolar transistor (IGBT) temperature sensor for Chopper 1 measured more than 75°C (167°F).	See *Over temp diagnostic codes – Choppers (560 – 561) and Coolant (587)* on page 315.	Ramp down	–
561 Error	Over temp-Ch2	The insulated-gate bipolar transistor (IGBT) temperature sensor for Chopper 2 measured more than 75°C (167°F).	See *Over temp diagnostic codes – Choppers (560 – 561) and Coolant (587)* on page 315.	Ramp down	–

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
570 Alert	Start on Powerup	The Plasma Start switch is turned ON before the cutting systems goes into Powerup State.	See *Start switch diagnostic codes (570 – 577)* on page 318.	None	Start or set process; remote on-off
571 Alert	Start on wait-start	The plasma start switch is turned ON before the cutting system enters a Wait-for-Start State.		None	Start or set process; remote on-off
574 Info	Start removed preflow	The plasma start switch goes OFF during Preflow State.	See *Start switch diagnostic codes (570 – 577)* on page 318.	End of cycle	Start or set process; remote on-off
575 Info	Start removed ignite	The Plasma Start switch goes OFF during Ignite State.		End of cycle	Start or set process; remote on-off
576 Info	Start removed pilot	The Plasma Start switch goes OFF during Pilot arc state.		End of cycle	Start or set process; remote on-off
577 Info	Start removed rampup	The Plasma Start switch goes OFF during a Ramp-Up State.		End of cycle	Start or set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
580 Error	Over temp-Ind1	The temperature for Inductor 1(1A)or 2 (1B) is more than 160°C (320°F). When conditions are normal, it takes approximately 10 minutes for the XPR cutting system to cool. Over-temp error codes can occur when cooling takes more than 10 minutes. A high ambient temperature can have an effect on cooling time.	See *Over temp diagnostic codes – Inductors (580 – 583), Transformers (586)* on page 320.	Ramp down	—
581 Error	Over temp-Ind2			Ramp down	—
582 Error	Over temp-Ind3	The temperature for Inductor 3 (2A) or 4 (2B) is more than 160°C (320°F). When conditions are normal, it takes approximately 10 minutes for the XPR cutting system to cool. Over-temp error codes can occur when cooling takes more than 10 minutes. A high ambient temperature can have an effect on cooling time.	See *Over temp diagnostic codes – Inductors (580 – 583), Transformers (586)* on page 320.	Ramp down	—
583 Error	Over temp-Ind4			Ramp down	—
586 Error	Over temp-Xfmr	The temperature for the transformer is more than 160°C (320°F) for a minimum of 5 seconds.	See *Over temp diagnostic codes – Inductors (580 – 583), Transformers (586)* on page 320.	Ramp down	—
587 Error	Over temp-Coolant	The coolant temperature is more than 85°C (185°F).	See *Over temp diagnostic codes – Choppers (560 – 561) and Coolant (587)* on page 315.	Ramp down	—

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
588 Failure	Fan timeout	Fan timeout error codes can occur when cooling takes more than 1 hour. A high ambient temperature can have an effect on cooling time.	**1.** Identify the over-temp diagnostic codes that appear on the XPR web interface. **2.** Follow the troubleshooting steps for the codes.	Shut down	—
600 Error	No TCC found	The torch connect console does not identify itself to the main control PCB through the CAN for a minimum of 30 seconds after power is supplied to the cutting system.	See *CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)* on page 304.	Shut down	Remote on-off
601 Error	No chopper found	Chopper 1 does not identify itself to the main control PCB through the CAN for a minimum of 30 seconds after power is supplied to the cutting system.	**1.** Confirm that the chopper ID connector is connected to J8. **2.** Connect the connectors if necessary. **3.** If connected, see *CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)* on page 304.	Shut down	Remote on-off
602 Error	No GCC found	The gas connect console (Core, VWI, or, OptiMix) does not identify itself to the main control PCB for a minimum of 30 seconds after power is supplied to the cutting system.	See *CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)* on page 304.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
604 Alert	No Chopper 2 found	The inductor thermocouples for Chopper 2 were detected, but Chopper 2 was not detected.	**1.** Make sure that the connector (J8) on Chopper 2 is fully engaged. **2.** Make sure that the connector (J2) on Chopper 2 is fully engaged. **3.** If connected, see *CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)* on page 304.	None	Start or set process; remote on-off
610 Failure	Ch1 Torch Protect ChA	A catastrophic failure of a consumable part is found on the Channel A Chopper 1 current signature.	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, see *How to install the consumables* on page 129.	Ramp down	Remote on-off
611 Failure	Ch1 Torch Protect ChB	A catastrophic failure of a consumable part is found on the Channel B Chopper 1 current signature.		Ramp down	Remote on-off
612 Failure	Ch2 Torch Protect ChA	A catastrophic failure of a consumable part is found on the Channel A Chopper 2 current signature.	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, see *How to install the consumables* on page 129,	Ramp down	Remote on-off
613 Failure	Ch2 Torch Protect ChB	A catastrophic failure of a consumable part is found on the Channel B Chopper 2 current signature.		Ramp down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
620 Alert	Rampdown error (arc stretch) detected	The chopper duty cycle exceeds the programmed limit. A rampdown error can be the cause. During a ramp-down error, the arc distance between the torch and workpiece increases rapidly. Rampdown errors can decrease consumable life. The XPR cutting system can detect and react to rampdown errors. This helps extend the life of consumable parts. (See *Automatic rampdown error protection* on page 229.)	Make sure that you are following correct cutting techniques: ▪ Use a workpiece that is large enough for the selected parts or nesting program. ▪ Use the correct parts or nesting program. Rampdown errors can occur when crossing large kerfs or cutting at incorrect heights. ▪ End every cut with the plasma arc still attached to the workpiece. ▪ Decrease the cutting speed when the end of the cut is near. ▪ Stop the plasma arc before the part is completely cut (allow completion of the cut during rampdown). ▪ Program the path of the torch into the scrap area for rampdown.	Ramp down	Start or set process; remote on-off
621 Failure	Over voltage-DC bus	The DC bus voltage is more than 414 V.	**1.** Confirm the input-line voltage is within+/-14% of nominal (see *Input power requirements* on page 32). **2.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
622 Failure	Under voltage DC bus	The DC bus voltage is less than 280 V.	**1.** Confirm the input-line voltage is within+/-14% of nominal (see *Input power requirements* on page 32). **2.** Remove the power from the cutting system. **3.** Remove the cover from the contactor. **4.** Inspect the contacts for excess wear. Replace the contactor, if excess wear is found. **5.** Inspect the following contactor components for loose connections: ▪ Contactor ▪ Input to chopper ▪ Power cord **6.** Tighten loose connections if found. **7.** Examine the connections from the control PCB on J6. Look for loose or bad connections on pins 5 and 6. Tighten loose connections or replace bad connections. **8.** Make sure that LED D1 on the power distribution board (141425) is illuminated. **9.** If not illuminated, examine the power distribution board. Look for: ▪ 120 VAC at the input (J1 pins 5 – 6) ▪ Continuity on fuse FH2 (with power OFF) ▪ 120 VAC at the output (J5 pins 7 – 8 and pins 9 – 10) **10.** If 120 VAC is not present on the J5 contactor output pins, inspect J4 and K1 Relay connections for damage. **11.** If K1 is bad, replace either the power distribution board (141425) or the K1 relay (003257). **12.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
623 Error	Ch1 DC at Idle	Chopper 1 is in idle state and the chopper current is more than 10 A.	**1.** Look for 24 VDC from the power sources (J2 pins 1 – 3). **2.** If you find 24 VDC from the power sources, the chopper is bad. **3.** Replace the chopper if necessary.	None	Remote on-off
624 Error	Ch2 DC at Idle	Chopper 2 is in idle state and the chopper current is more than 10 A.	**1.** Look for 24 VDC from the power sources (J2 pins 1 – 3). **2.** If you find 24 VDC from the power sources, the chopper is bad. **3.** Replace the chopper if necessary.	None	Remote on-off
626 Error	No DC output-Ch1	Chopper 1 does not make current for a minimum of 250 milliseconds after Arc-On State starts. Pilot arc was established but then lost prior to transfer.	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, see *How to install the consumables* on page 129. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Remote on-off
627 Error	No DC output-Ch2	No current produced within 250 milliseconds after Arc-On State starts	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, see *How to install the consumables* on page 129. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Remote on-off
631 Failure	DC at wait-start	The current in the work lead is more than 5 A while the XPR cutting system is in the Wait-for-Start State.	See *Current sensor diagnostic codes (631)* on page 323.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
640 Info	No error	For your information: There are no active faults.	No operator action necessary.	None	—
642 Info	System powered	For your information: Power is supplied to the XPR cutting system and the customer-supplied, remote on-off switch is in the ON position (enabled).		None	Start or set process; remote on-off
643 Info	No process loaded	For your information: Power is supplied to the XPR cutting system and no process is selected.	It is necessary to select a process to end the Initial checks (2) State of operation and start the Gas purge State (there is no limit for how long the system waits for input). (See *Sequence of operation* on page 201.)	None	Start or set process; remote on-off
645 Info	System is off	For your information: Power is supplied to the cutting system and the customer-supplied, remote on-off switch is in the OFF position (disabled).	No operator action necessary. XPR cutting system operation continues when the remote on-off switch is set to the ON position. (See *Sequence of operation* on page 201.)	None	Start or set process; remote on-off
646 Info	System turned off	For your information: Power is removed from the XPR cutting system.		Shut down	Start or set process; remote on-off
647 Info	Process selected	Shows the operator-selected process.	No operator action necessary.	None	Start or set process; remote on-off
654 Alert	CH1ArcOnTimeout	During Ignite State, Chopper 1 does not enter Arc-On State for at least 100 milliseconds.	**1.** Remove the power from the cutting system. **2.** Restore electrical power to the cutting system. **3.** Send a process command to the cutting system. **4.** If the code continues, contact your cutting system supplier or regional Hypertherm Technical Service team.	End of cycle	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
655 Alert	Current (DC) preflow	During Preflow State, a chopper finds current.	**1.** Inspect the consumable parts for damage and excess wear. **2.** If any consumable part needs replacement, see *How to install the consumables* on page 129. **3.** Examine the torch lead. Look for a short or open line condition.	Shut down	Start or set process; remote on-off
660 Error	Thermistor Fault-Ind 1	The main control finds a shorted temperature sensor in Inductor 1A.	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Shut down	Remote on-off
661 Error	Thermistor Fault-Ind 2	The main control finds a shorted temperature sensor in Inductor 1B.		Shut down	Remote on-off
662 Error	Thermistor Fault-Ind 3	The main control finds a shorted temperature sensor in Inductor 2A.	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Shut down	Remote on-off
663 Error	Thermistor Fault-Ind 4	The main controls finds a shorted temperature sensor in Inductor 2B.		Shut down	Remote on-off
666 Error	Thermistor Fault-Xfmr	The main control finds a shorted temperature sensor in the transformer.	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Shut down	Remote on-off
667 Error	Thermistor Fault-Ch1	Chopper 1 finds a shorted temperature sensor near the insulated-gate bipolar transistor (IGBT).		Ramp down	Remote on-off
668 Error	Thermistor Fault-Ch2	Chopper 2 finds a shorted temperature sensor near the IGBT.	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Ramp down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
670 Error	Thermistor Fault-Coolant	The main control finds a shorted coolant temperature sensor.	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Shut down	Remote on-off
671 Error	No Thermistor-Ind 1	The main control finds an open circuit in Inductor 1 (1A).		Shut down	Remote on-off
672 Error	No Thermistor-Ind 2	The main control finds an open circuit in Inductor 2 (1B).		Shut down	Remote on-off
673 Error	No Thermistor-Ind 3	The main control finds an open circuit in Inductor 3 (2A).	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Shut down	Remote on-off
674 Error	No Thermistor-Ind 4	The main control finds an open circuit in Inductor 4 (2B).	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Shut down	Remote on-off
677 Error	No Thermistor-Xfmr	The main control finds an open circuit in the transformer.	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Shut down	Remote on-off
678 Error	No Thermistor-Ch1	The XPR cutting system cannot detect the temperature sensor for Chopper 1.	**1.** Make sure that the 2 wires for J9 are fully engaged. **2.** Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Ramp down	Remote on-off
679 Error	No Thermistor-Ch2	The XPR cutting system cannot detect the temperature sensor for Chopper 2.	**1.** Make sure that the 2 wires for J9 are fully engaged. **2.** Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 336.)	Ramp down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
681 Error	No Thermistor-Coolant	The main control detects an open circuit in the coolant sensor.	Use a digital multimeter to measure the resistance from the thermistor. (See *How to measure resistance from thermistors* on page 338.)	Shut down	Remote on-off
691 Error	Node reset	The main control receives a "console reset" message after power is supplied to the XPR cutting system.	**1.** Inspect the grounding for the cutting system. High frequency electromagnetic interference (also known as noise) can reset the CAN node. **2.** Make sure that the green (power-indicator) LED on the gas connect console and torch connect console is illuminated. **3.** If the LEDs are not illuminated, examine the power distribution board (141425). Look for: ▪ Loose and poorly-connected connectors and CAN cables. ▪ Evidence of 120 V (D1 illuminated). **4.** If D1 is illuminated, examine the plasma power supply control PCB (141322). Make sure that the remote on-off switch is in the ON position (enabled) (D89 illuminated). Re-set the switch if necessary. **5.** Contact your cutting machine supplier or regional Hypertherm Technical Service team. Make sure that you have the Record ID associated with the error.	Shut down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
695 Alert (OptiMix only)	Low Inlet H_2-Mix	The hydrogen (H_2) inlet pressure (P10) for the mixing module in the gas connect console (only for OptiMix) is less than 8.3 bar ± 0.4 (120 psi ± 5).	See *Low inlet pressure for H_2, Ar, N_2, and H_2O diagnostic codes (695 – 697, 700, 701)* on page 324.	None	Set process; remote on-off
696 Alert (OptiMix only)	Low Inlet Ar-Mix	The argon (Ar) inlet pressure (P11) for the mixing module in the gas connect console (only for OptiMix) is less than 8.3 bar ± 0.4 (120 psi ± 5).			
697 Alert (OptiMix only)	Low Inlet N_2-Mix	The nitrogen (N_2) inlet pressure (P12) for the mixing module in the gas connect console (only for OptiMix) is less than 8.3 bar ± 0.4 (120 psi ± 5).		None	Set process; remote on-off
699 Error	Mix Fault	The main control finds a mixing-module fault in the gas connect console (OptiMix only).	No operator action necessary.	Ramp down	Set process; remote on-off
700 Alert	Gas Inlet F5-GCC	The F5 inlet pressure (P6) in the gas connect console (only for VWI or OptiMix) is less than 5.52 bar (80 psi) or more than 8.61 bar (105 psi).	See *Low inlet pressure for H_2, Ar, N_2, and H_2O diagnostic codes (695 – 697, 700, 701)* on page 324.	None	Set process; remote on-off
701 Alert	Low Inlet H_2O GCC	The water (H_2O) inlet pressure (P8) in the gas connect console (only for VWI and OptiMix) is less than 2.07 bar (30 psi).		None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
702 Alert	Shield Gas Inlet N_2 TCC	For a minimum of 200 milliseconds, the nitrogen (N_2) inlet pressure (P4) in the torch connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (125 psi).	If you have a cutting system equipped with a Core or VWI gas connect console, refer to *Gas inlet pressure codes (768 – 771)* on page 330. If you have a cutting system equipped with a OptiMix gas connect console, refer to *Process-gas inlet pressure in the torch connect console diagnostic codes (702, 705, 769, 770) for OptiMix-equipped cutting systems* on page 327.	None	Set process; remote on-off
703 Alert	Shield Gas Inlet O_2 TCC	For a minimum of 200 milliseconds, the oxygen (O_2) inlet gas pressure (P4) in the torch connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (125 psi).		None	Set process; remote on-off
704 Alert	Shield Gas Inlet Air TCC	For a minimum of 200 milliseconds, the air inlet pressure (P4) in the torch connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (125 psi)		None	Set process; remote on-off
705 Alert	Shield Gas Inlet Ar-TCC	For a minimum of 200 milliseconds, the argon (Ar) inlet pressure (P4) in the torch connect console is less than 5.52 bar (80 psi) or more than 8.61 bar (125 psi) for at least 200 milliseconds.		None	Set process; remote on-off
706 Error	No sensor P1-TCC	The P1 pressure sensor in the torch connect console is not detected.	See *Pressure transducer diagnostic codes (706 – 715)* on page 329.	Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
707 Error	No sensor P2-TCC	The P2 pressure sensor in the torch connect console is not detected.	See *Pressure transducer diagnostic codes (706 – 715)* on page 329.	Ramp down	Set process; remote on-off
708 Error	No sensor P3-TCC	The P3 pressure sensor in the torch connect console is not detected.		Ramp down	Set process; remote on-off
709 Error	No sensor P4-TCC	The P4 pressure sensor in the torch connect console is not detected.		Ramp down	Set process; remote on-off
710 Error	No sensor P5-TCC	The P5 pressure sensor in the torch connect console is not detected.		Ramp down	Set process; remote on-off
711 Error	No sensor P14-TCC	The P14 pressure sensor in the torch connect console is not detected.		Ramp down	Set process; remote on-off
712 Error (VWI and OptiMix only)	No sensor P6-GCC	The P6 pressure sensor in the gas connect console is not detected.		Ramp down	Set process; remote on-off
713 Error (VWI and OptiMix only)	No sensor P7-GCC	The P7 pressure sensor in the gas connect console is not detected.		Ramp down	Set process; remote on-off
714 Error (VWI and OptiMix only)	No sensor P8-GCC	The P8 pressure sensor in the gas connect console is not detected.		Ramp down	Set process; remote on-off
715 Error	No sensor P9-GCC	The P9 pressure sensor in the gas connect console is not detected.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
716 Error	Process Invalid	The operator-selected process is not supported by this XPR cutting system. **Smart-fault data values**:	Refer to the smart-fault data value (number) that accompanies the diagnostic code in the XPR web interface to identify the unsupported process and best corrective action for each:	None	Set process; remote on-off
		1: invalid id Process ID = 0	Refer to the *XPR Cut Charts Instruction Manual* (809830) for guidance about how to select the process ID for a supported process.	None	Set process; remote on-off
		2: invalid user Another interface has control of the cutting system. **Note**: Only 1 communication method (Serial, EtherCAT or Wireless) at a time can send a process ID to the XPR cutting system.	Refer to the *Connect for Communication* on page 143 and *How to change the device that has control* on page 186 for guidance about how to select or change the interface that controls the cutting system.	None	Set process; remote on-off
		3: invalid user source Another interface has control of the cutting system. **Note**: Only 1 wireless interface at a time can send a process ID to the XPR cutting system.		None	Set process; remote on-off
		4: invalid process Incorrect process ID was sent.	Refer to the *XPR Cut Charts Instruction Manual* (809830) for guidance about how to select the process ID for a supported process.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
716 Error	Process Invalid	**5: not allowed or system not ready** The cutting system is not ready for a new process ID. It can only accept a process ID during the following states: "Initial Checks (2)," "Inert Gas Purge (4)," "Wait for Start (5)," "Manual Leak Test (20)" or "End of Cycle (14)" states.	Wait until gas purge or cutting is complete. The cutting system cannot accept a new process ID during gas purge or cutting. If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service Team.	None	Set process; remote on-off
		6: not supported **Note**: The 3 XPR gas connect consoles (OptiMix, VWI, Core) can have different capabilities. For example, argon assist and argon marking for mild steel are available for cutting systems equipped with OptiMix or VWI gas connect consoles, but not with Core.	See *How to choose the torch positions and process settings you need* on page 211 for information about different process capabilities.	None	Set process; remote on-off
717 Alert	Low voltage-mix	The supply voltage for the gas mixer in the gas connect console is less than 21 V.	Confirm the output voltage of the 24 VDC power source in the gas connect console (only for OptiMix). The output voltage should be 24 VDC.	Ramp down	Set process; remote on-off
718 Alert	High voltage-mix	The supply voltage for the gas mixer in the gas connect console is more than 27 V.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
719 Alert	Mix pwm 100%	100% duty is reached on H_2, Ar, or N_2 proportional valve supply voltage. Total flow is decreased to keep the mix percentage of the other gases accurate. Because the mixer tries to deliver a flow, the outlet pressure can continue to rise.	**1.** Make sure that the consumables are correct. **2.** Make sure that the inlet pressures for N_2, Ar, and H_2 are consistently within acceptable range. **3.** Make sure that you have the most recent XPR firmware. Log into the Xnet at www.hypertherm.com to download it.	None	Start or set process; remote on-off
720 Alert	Mix Pout>Pin	Pressure out (P21) is more than one of the pressures on the inlet side of the mixer (P10 – P12) by at least 0.069 bar (1 psi). When this occurs, the mixer reduces flow to prevent backflow, which can affect cut quality.	**1.** Make sure that the consumables are correct. **2.** Increase N_2, Ar, and H_2 pressure during test cutflow within acceptable range. **3.** Make sure that you have the most recent XPR firmware. Log into the Xnet at www.hypertherm.com to download it.	None	
721 Error	Mix param checksum	There was a failure of the mixing parameter checksum.	**1.** Use the remote on-off switch to turn OFF and then turn ON the cutting system. **2.** If the code continues, replace the gas connect console.	Ramp down	Set process; remote on-off
722 Error	Mix flow cal	There was a failure of the mixing flow calibration.		Ramp down	Set process; remote on-off
723 Error	Mix pressure cal	There was a failure of the mixing pressure calibration.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
724 Error	Mix I2C1	There is a mixing communication error on I2C1.	**1.** Examine the cable used to ground the gas connect console. Connect a disconnected cable or repair a damaged cable if found. **2.** Make sure that all external panels for all system components are correctly installed. Install loose or missing panels if found. **3.** Make sure that all hardware that holds the external panels is in position and is tight. Tighten loose connections if found.	Ramp down	Set process; remote on-off
725 Error	Mix I2C2	There is a mixing communication error on I2C2.		Ramp down	Set process; remote on-off
726 Error	Mix system clock	There is a problem with the mixing system clock.	**1.** Use the remote on-off switch to turn OFF and then turn ON the cutting system. **2.** If the code continues, replace the gas connect console.	Ramp down	Set process; remote on-off
730 Alert	Solenoid error V1	There is an over-current condition for receptacle valve V1 at the PCB in the torch connect console.	**1.** Inspect the valve driver cable connections for the valve receptacle in the torch connect console. **2.** Replace the torch V1 valve if you find damage or excess wear.	Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
733 Alert	Solenoid error V4	There is an over-current condition for receptacle valve V4 at the PCB in the torch connect console.	**1.** Examine the wiring for the valve. **2.** Connect the valve wire to another valve. If the error goes away, the valve is bad. **3.** Replace the bad valve.	Ramp down	Set process; remote on-off
734 Alert	Solenoid error V5	There is an over-current condition for receptacle valve V5 at the PCB in the torch connect console.		Ramp down	Set process; remote on-off
735 Alert	Solenoid error V6	There is an over-current condition for receptacle valve V6 at the PCB in the torch connect console.		Ramp down	Set process; remote on-off
736 Alert	Solenoid error V7	There is an over-current condition for receptacle valve V7 at the PCB in the torch connect console.		Ramp down	Set process; remote on-off
737 Alert	Solenoid error V8	There is an over-current condition for receptacle valve V8 at the PCB in the torch connect console.		Ramp down	Set process; remote on-off
738 Alert	Solenoid error V9	There is an over-current condition for receptacle valve V9 at the PCB in the torch connect console.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
739 Alert	Solenoid error V10	There is an over-current condition for receptacle valve V10 at the PCB in the torch connect console.	**1.** Examine the wiring for the valve. **2.** Connect the valve wire to another valve. If the error goes away, the valve is bad. **3.** Replace the bad valve.	Ramp down	Set process; remote on-off
740 Alert	Solenoid error V11	There is an over-current condition for receptacle valve V11 at the PCB in the torch connect console.		Ramp down	Set process; remote on-off
741 Alert	Solenoid error V12	There is an over-current condition for receptacle valve V12at the PCB in the torch connect console.		Ramp down	Set process; remote on-off
742 Alert	Mix I2C1 Alert	There is a mixing alert for I2C1.	**1.** Examine the cable used to ground the gas connect console. Connect any disconnected cable or repair a damaged cable if found. **2.** Make sure that all external panels for all system components are correctly installed. Install loose or missing panels if found. **3.** Make sure that all hardware that holds the external panels is in position and is tight.	Ramp down	Set process; remote on-off
743 Alert	Mix I2C2 Alert	There is a mixing alert for I2C2.		Ramp down	Set process; remote on-off
744 Alert	Low Speed- MagFan 1	The fan tach feedback is below the minimum.	**1.** Examine the fan. Make sure that the following fan connections are good: **2.** The fan connector. **3.** The wiring to J2 and J5 on the fan power distribution PCB. **4.** The wiring to J7 on the Control PCB 1. **5.** Tighten loose connections if found. **6.** Verify 48 VDC power source output. If not correct, replace the 48 VDC power source. **7.** If you do not find any loose connections and the 48 VDC power source is good, replace the fan.	None	Set process; remote on-off
745 Alert	Low Speed- MagFan 2	The fan tach feedback is below the minimum.		None	Set process; remote on-off
748 Alert	Low Speed- HxFan 1	The fan tach feedback is below the minimum.		None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
749 Alert	Low Speed- HxFan 2	The fan tach feedback is below the minimum.	**1.** Examine the fan. Make sure that the following fan connections are good: ▪ The fan connector. ▪ The wiring to J2 and J3 (HxFan1) and to J4 (HxFan2) on the fan power distribution PCB. ▪ The wiring to J7 on the Control PCB 1. **2.** Tighten loose connections if found. **3.** Verify 48 VDC power source output. If not correct, replace the 48 VDC power source. **4.** If you do not find any loose connections and the 48 VDC power source is good, replace the fan.	None	Set process; remote on-off
750 Alert	Low speed CAB FAN1 (Control Side) Fan 1	Fan speed is below the minimum acceptable RPM value.	**1.** Examine the fan. Make sure that the following fan connections are good: ▪ The fan connector. ▪ The wiring to J7 Low speed CAB FAN1 (Control Side) Fan 1 on the fan power distribution PCB. ▪ The wiring to J7 on the Control PCB 1. **2.** Tighten loose connections if found. **3.** Verify 48 VDC power source output. If not correct, replace the 48 VDC power source. **4.** If you do not find any loose connections and the 48 VDC power source is good, replace the fan.	None	Set process; remote on-off
751 Alert	Low speed CAB FAN1 (Control Side) Fan 2	Fan speed is below the minimum acceptable RPM value.	**1.** Examine the fan. Make sure that the following fan connections are good: ▪ The fan connector. ▪ The wiring to J8 Low speed CAB FAN2 (Control Side) Fan 2 on the fan power distribution PCB. ▪ The wiring to J8 on the Control PCB 1. **2.** Tighten loose connections if found. **3.** Verify 48 VDC power source output. If not correct, replace the 48 VDC power source. **4.** If you do not find any loose connections and the 48 VDC power source is good, replace the fan.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
752 Error	Phase Fault Ch1	There is a 3-phase error in Chopper 1.	**1.** Confirm the input-line voltage is within+/-14% of nominal (see *Input power requirements* on page 32). **2.** Remove the power from the cutting system. **3.** Remove the cover from the contactor. **4.** Inspect the contacts for excess wear. Replace the contactor, if excess wear is found. Otherwise, continue with the following steps. **5.** Inspect the following contactor components for loose connections: ▪ Contactor ▪ Input to chopper ▪ Power cord **6.** Tighten loose connections if found. Otherwise, continue with the following steps. **7.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
753 Error	Phase Fault Ch2	There is a 3-phase error in Chopper 2.	**1.** Confirm the input-line voltage is within+/-14% of nominal (see *Input power requirements* on page 32). **2.** Remove the power from the cutting system. **3.** Remove the cover from the contactor. **4.** Inspect the contacts for excess wear. Replace the contactor, if excess wear is found. Otherwise, continue with the following steps. **5.** Inspect the following contactor components for loose connections: ▪ Contactor ▪ Input to chopper ▪ Power cord **6.** Tighten loose connections if found. Otherwise, continue with the following steps. **7.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	Shut down	Remote on-off
755 Alert	Low level-Coolant	The coolant level is low.	Fill the coolant reservoir with coolant. (See *Coolant Installation* on page 193.)	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
756 Info	Leak test results	Reports the result of a gas leak test: 0: leak in v1 v12 or hose 1: leak in b1 2: leak in v1 or b1 3: leak in v1 Vv0 or hose 4: leak in b3); break; 5: leak in v10 or b3 6: manual leak test failed 7: manual leak test passed 8: leak in v4 v5 v6 or v7 9: leak in b2 10: leak in v10 or hose 11: no n2 inlet or v5 12: leak in p7 volume 13: leak in line A or v1 14: auto leak test failed 15: auto leak test passed 16: timeout	See *How to do a gas leak test (VWI and OptiMix)* on page 331.	None	Start or set process; remote on-off
757 Error	DC work exceeds limits	The work lead current exceeds the setpoint by 5 A.	Make sure that you have the most recent XPR firmware. If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	End of cycle	Remote on-off
758 Alert	Main 24 V dip	The 24 V DC bus decreases to less than 20 V on the main control.	Make sure that you have the most recent XPR firmware. If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remote on-off
759 Alert	Main 24 V bus low	The 24 V bus decreases to less than 20 V on the gas connect console.		Ramp down	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
763 Alert	Coolant solenoid fault	The coolant solenoid driver finds an over-current condition.	**1.** Inspect the coolant solenoid and wiring. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log in to the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remote on-off
764 Alert	Main contactor fault	The main contactor driver finds an over-current condition.	**1.** Inspect the main contactor and wiring. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log in to the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remote on-off
765 Alert	Inrush contactor fault	The inrush contactor driver finds an over-current condition.	**1.** Inspect the inrush contactor, inrush contactor relay, and wiring for damage. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log in to the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remove on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
766 Alert	Pump enable fault	The pump enable driver finds an over-current condition.	**1.** Inspect the pump solid state relay for damage. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log in to the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.	None	Set process; remote on-off
767 Alert	Remote relay fault	The remote on-off relay driver finds an over-current condition.	**1.** Inspect the pump solid state relay for damage. Replace them if you find damage or excess wear. **2.** Make sure that you have the most recent XPR firmware. You can log in to the Xnet at www.hypertherm.com to download it. **3.** If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team	None	Set process; remote on-off
768 Alert	Gas inlet – O_2 Line A	Line A O_2 inlet pressure (P2) is below 5.52 bar (80 psi) or above 8.62 bar (125 psi).	See *Gas inlet pressure codes (768 – 771)* on page 330.	None	Set process; remote on-off
769 Alert	Gas Inlet – Argon Line B	Line B Argon inlet pressure (P1) is below 5.52 bar (80 psi) or above 8.62 bar (125 psi).	If you have a cutting system equipped with a Core or VWI gas connect console, refer to *Gas inlet pressure codes (768 – 771)* on page 330. If you have a cutting system equipped with a OptiMix gas connect console, refer to *Process-gas inlet pressure in the torch connect console diagnostic codes (702, 705, 769, 770) for OptiMix-equipped cutting systems* on page 327.	None	Set process; remote on-off
770 Alert	Gas Inlet – N_2 Line B	Line B N_2 inlet pressure (P1) is below 5.52 bar (80 psi) or above 8.62 bar (125 psi).		None	Set process; remote on-off
771 Alert	Gas Inlet – Air Line A	Line A Air inlet pressure (P2) is below 5.52 bar (80 psi) or above 8.62 bar (125 psi).	See *Gas inlet pressure codes (768 – 771)* on page 330.	None	Set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
772 Alert	High Inlet – Line A	Line A inlet pressure (P2) is more than 9.99 bar (145 psi).	Lower the air or O_2 inlet pressure.	Ramp down	Set process; remote on-off
774 Alert	P5 >=P2	Line A (H_2-mix) outlet pressure (P5) exceeds air inlet pressure (P2) and Line A type is “mix.” The system will automatically stop cutting system operation.	Increase air inlet pressure.	Ramp down	Set process; remote on-off
775 Alert	Node update	Informs the status of the node update. The alert occurs when the PCB updates via wireless connection.	Refer to the *XPR Firmware Updates Field Service Bulletin* (809820).	None	Start or set process; remote on-off
776 Alert	Wifi reset	The GS2011 wireless module has been reset.	Reduce wireless connections to the XPR cutting system.	None	Start or set process; remote on-off
777 Alert	Pilot relay fault	The pilot relay driver detects an over current condition.	**1.** Remove the power for the XPR cutting system. **2.** Remove the control-side panel from the plasma power supply. **3.** Examine the control PCB (PCB 1). **4.** Remove J6 from the control PCB. **5.** Remove the cover from the pilot arc relay. **6.** Use an ohmmeter to measure the coil resistance across wires 21 and 22. You can expect a resistance of approximately 280 ohms. **7.** If the ohms value is more than 10% above or below 280 ohms, replace the pilot arc relay. **8.** If the ohms value is within acceptable range, make sure that the most-recently released XPR firmware is installed. Install the most recent firmware, if necessary.	None	Set process; remote on-off

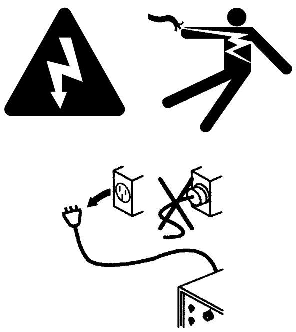
Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
778 Alert This code occurs only with cutting systems that have firmware at Rev J or earlier	Hv relay fault	The high-voltage relay driver detects an over current condition.	**1.** Remove the power for the XPR cutting system. **2.** Remove the top and side panels from the torch connect console. **3.** Examine the ohmic PCB inside the torch connect console. **4.** Remove J2 from the ohmic PCB. **5.** Use an ohmmeter and needle probes to measure the coil resistance across the 2 sockets (J2, 2 female connector). You can expect a resistance of approximately 126 ohms. **6.** If the ohms value is more than 10% above or below 126 ohms, replace the ohmic relay (Hv relay). **7.** If the ohms value is within acceptable range, make sure that you have the most recent XPR firmware. Log into the Xnet at www.hypertherm.com to download it.	None	Set process; remote on-off
779 Alert	Ch1 15V bus	The Chopper 1 15 V bus is out of range (below 13 V or above 17 V).	**1.** Verify the 24 VDC on the connector J2, pins 1 and 2 on the Chopper 1 assembly. **2.** If the 24 VDC is absent, examine the wiring on J2 of Chopper 1. Look for loose connections. **3.** If you measure 24 VDC, replace the Chopper 1 assembly.	None	Set process; remote on-off
780 Alert	Ch2 15V bus	The Chopper 2 15 V bus is out of range (below 13 V or above 17 V).	**1.** Verify the 24 VDC on the connector J2, pins 1 and 2 on the Chopper 1 assembly. **2.** If the 24 VDC is absent, examine the wiring on J2 of Chopper 2. Look for loose connections. **3.** If you measure 24 VDC, replace the Chopper 2 assembly.	None	Start or set process; remote on-off

Diagnostic code number and category	Diagnostic code name	Description	Corrective action	XPR action	Code cancels with
782 Alert	Mix low psi-P2	The Air inlet pressure (P2) in the torch connect console is less than 7.58 bar (110 psi) during a mix gas process (OptiMix only).	Increase air pressure	None	Clears with start, set process, and remote ON-OFF

See *Sequence of operation* on page 201 for descriptions of XPR cutting system operation.

CAN codes (500 – 503, 510 – 513 for gas connect console, 504 – 505, 514 – 515 for CAN cable and jumper block, 507 – 508 for CAN network and bus, 600 – 602 for no CAN communication)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

Multiple codes at the same time can indicate a problem with the CAN cable. If there is only one code, the problem is more likely to be caused by what the code says (not the CAN cable).

1. Remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)
2. For **chopper-related codes**, make sure that the chopper ID cable connector is fully engaged in J8 on Chopper 1 and Chopper 2. If the chopper ID cable connection is good, continue with the following steps:
   a. For code 504 alone:
      - Examine the CAN cable connection between Chopper 1 and Chopper 2. Look for loose connections, bent pins, and bent sockets.
      - Tighten loose connections if found.
      - If you find bent sockets, order a new cable.
      - If you find a bent pin, try to straighten it. If this does not work, order a new cable.
   b. For code 503 and 504 together:
      - Examine the CAN cable connection between Chopper 2 and the control board (PCB 1) on the plasma power supply. Look for loose connections, bent pins, and bent sockets.
      - Tighten loose connections if found.
      - If you find bent sockets, order a new cable.
      - If you find a bent pin, try to straighten it. If this does not work, order a new cable.
   c. If the CAN cable connections are good, examine the PCB for Chopper 1/PCB 2 and Chopper 2/PCB 3. Make sure that the following green LEDS are illuminated on each PCB:
      - D22 (+18/-5 VDC)
      - D14 (+5 VDC)
      - D21 (+3.3 VDC)

These LEDs indicate power to the chopper control boards (PCB 2 and PCB 3).

d. If any LEDs are not illuminated, continue with the following steps:

- If **all** of the LEDs are **not** illuminated, make sure that the power connector for J2 is fully engaged.
  - If the connector for J2 is fully engaged, make sure that the wiring to the connector is good.
  - Check for 24 V DC, Chopper 1 J2, Pins 1 and 3.Chopper 2, Pins 2 and 4
  - If the wiring is good and the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.
- If **only** 1 or 2 LEDs are **not** illuminated, PCB replacement can be necessary. Contact your cutting machine supplier or regional Hypertherm Technical Service team.

e. If the green LEDs on both boards are illuminated, examine the PCB 2 and PCB 3 chopper boards:

- Make sure that LED D3 and D4 on PCB 2 and PCB 3 are blinking once-per-second (indicates the microprocessor on the control board is functional).
- Make sure that the DIP switches on S2 are in the following positions:
  - 1 – OFF
  - 2 – OFF
  - 3 – OFF
  - 4 – OFF
- Make sure that the CAN cable connector is fully engaged in J7.

f. If the LEDs are **not** functioning as described above, contact your cutting machine supplier or regional Hypertherm Technical Service team.

g. If LEDs are functioning as described above, examine LEDs D33 and D34. Flickering indicates the communications on the CAN cable is functional.

h. If LED D33 and D34 are not flickering, contact your cutting machine supplier or regional Hypertherm Technical Service team.

i. If the CAN cable connectors and microprocessor are good and the LEDs appear functional, but the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service team.

3. If the code is for the **Core or VWI** gas connect console (GCC), go to *step 6*.

4. If the code is for the **OptiMix** GCC, go to *step* 7.

5. If the code is for the torch connect console (TCC), go to *step 8*.

6. **For Core and VWI GCC codes**, examine the CAN cable connections between the plasma power supply and gas connect console:

a. Look for loose connections. Tighten loose connections if found.

b. If the connections are good, make sure that the control board inside of the gas connect console is tightly mounted to the chassis. Tighten loose connections if found.

c. Examine control board (141375) inside of the gas connect console. Make sure that the following LEDs are illuminated:

- D16 (+5 VDC)
- D18 (+3.3 VDC)

> These LEDs indicate power to the PCB. See *PCB information* on page 343.

d. If the LEDs are illuminated, examine LEDs D30 and D31. Look for once-per-second blinking (indicates the microprocessor on the PCB is functional).

e. If LED D30 and D31 are blinking once-per-second, examine LEDs D24 and D25. Flickering indicates the microprocessor on the PCB is functional.

f. If LED D24 and D25 are flickering and you have codes 600 and 602, make sure that the connection between the main power supply and gas connect console is good:

- ❑ Make sure that the CAN cable between the plasma power supply and gas connect console is connected.
- ❑ Disconnect the CAN cable connection between the gas connect console and torch connect console.

g. If D24 and D25 stop flickering, one of the following conditions can be the problem:

- ❑ There is a bad connection between the plasma power supply and the gas connect console. Reconnect or replace the CAN cable if necessary.
- ❑ There is a bad connection between the small CAN jumper cable for the gas connect console control board (141375) and the sheet metal (located inside of the gas connect console). Reconnect or replace the CAN cable if necessary.

h. If the control board is functional and the code continues, there is a problem with either the CAN cable between the gas connect console and torch connect console or with the small CAN jumper cable for the gas connect console control board (141375) and the sheet metal (located inside of the gas connect console). Continue with the following steps to identify the problem cable:

- ❑ Disconnect and examine each cable. Look for look loose connections, bent pins, and bent sockets.
- ❑ Tighten loose connections if found.
- ❑ If you find bent sockets, order a new cable.
- ❑ If you find a bent pin, try to straighten it. If this does not work, order a new cable.

i. If D24 and D25 are not illuminated and not flickering, the CAN cable to the plasma power supply is disconnected. Reconnect the CAN cable if necessary.

j. If D24 is not illuminated and D25 is flickering, examine the control board for shorts. Look for a shorting block across pins 1 and 2 of J16.

k. If there is a shorting block, remove it and restart the cutting system.

l. If J16 is open, replace the control board (141375).

7. **For OptiMix GCC codes**, examine the CAN cable connections between the plasma power supply and gas connect console:

   a. Look for loose connections. Tighten loose connections if found.

   b. Make sure that the control board (141375) inside of the gas connect console is tightly mounted to the chassis. Tighten loose connections if found.

   c. Examine the control board inside of the gas connect console. Make sure that the following LEDs are illuminated on the control board:

      - D16 (+5 VDC)
      - D18 (+3.3 VDC)

   These LEDs indicate power to the PCB. See *PCB information* on page 343.

   d. If the LEDs are illuminated, examine LEDs D30 and D31. Look for once-per-second blinking (indicates the microprocessor on the PCB is functional).

   e. If LED D30 and D31 are blinking once-per-second, examine LEDs D24 and D25. Flickering indicates the microprocessor on the PCB is functional.

   f. If LED D24 and D25 are flickering and you have codes 600 and 602, make sure that the connection between the main power supply and gas connect console is good:

      - ❑ Make sure that the CAN cable between the plasma power supply and gas connect console is connected.
      - ❑ Disconnect the CAN cable connection between the gas connect control board (141375) and the mixer in the same console.

   The gas connect console, mixer, and torch connect consoles *can appear* to communicate, even when the CAN cable between them is disconnected.

   g. If D24 and D25 stop flickering, the CAN cable is bad. One of the following conditions can be the problem:

      - ❑ The CAN cable is damaged. Use a Ohm meter to verify the continuity at the end of each connector of the CAN cable. Verify pin-by-pin and in the same order as the CAN connectors. For example, Pin_1 on End A corresponds to Pin_1 on End B of the cable. Replace the cable if no continuity is found.

      - ❑ There is a bad connection between the plasma power supply and the gas connect console. Reconnect or replace the CAN cable if necessary.
      - ❑ There is a bad connection between the small CAN jumper cable for the gas connect console control board (141375) and the sheet metal (located inside of the gas connect console). Reconnect or replace the CAN cable if necessary.

h. If the control board is functional and the code continues, continue with the following steps:

- ❑ Replace the CAN cable between the control board (141375) and the mixer.
- ❑ Disconnect the CAN cable between the gas connect console and torch connect console.
- ❑ Make sure that the green LEDs on the mixer are functional, and that the XPR web interface or CNC screen indicates that the cutting system is equipped with a OptiMix gas connect console.

i. If D24 and D25 are not illuminated and not flickering, the CAN cable to the plasma power supply is disconnected. Reconnect the CAN cable if necessary.

j. If D24 is not illuminated and D25 is flickering, examine the control board for shorts. Look for a shorting block across pins 1 and 2 of J16.

k. If there is a shorting block, remove it and restart the cutting system.

l. Look for CAN problems with the mixer inside of the OptiMix gas connect console. There are 3 LEDs located side-by-side. Look for the green LED. Examine the green LED on the board of the mixer:

- ❑ If the green LED is blinking once-per-second and the yellow LED is flickering, the CAN cable is good and the cutting system is ready for use.
- ❑ If the green LED is blinking once-per-second and the yellow LED is **not** illuminated, a CAN communication failure can be the problem. Examine the CAN cable between the control board (141375) and the mixer. Look for a loose connection or bent pins.
- ❑ If the green LED is blinking once-per-second and the red LED is illuminated (steady, no flickering), the mixer in the gas connect console can be the problem. Contact your cutting machine supplier or regional Hypertherm Technical Services team. Technical Services can help you decide if it is necessary to replace the gas connect console.

8. **For TCC codes**, examine the CAN cable connections between the gas connect console and the torch connect console:

a. Look for loose connections. Tighten loose connections if found.

b. Examine the control board (141334) inside of the torch connect console. Make sure that the following LEDs are illuminated on the control board:

- ❑ D43 (+5 VDC)
- ❑ D46 (+3.3 VDC)

c. If D43 and D46 are not illuminated, use a digital volt meter to measure the power output for PS1.

- ❑ If there is no 24 VDC output, examine the 120 VAC input to PS1. If there is no 120 VAC, examine the power cable connection to the torch connect console and the 120 VAC-out connection from the gas connect console. Tighten loose connections if found.

d. If D43 and D46 are illuminated, make sure that 120 VAC-out from the gas connect console is connected, then verify that the Activity LED (D88) and Status LED (D87) are blinking. Look for once-per-second blinking (indicates the microprocessor on the PCB is functional).

- ❑ If the LEDs are **not** blinking once-per-second, replace the control board. If replacement is necessary, contact your cutting machine supplier or Hypertherm Technical Service team.

e. If the power LEDs are good, examine CAN TX LED (D35) and RX LED (D34). Flickering indicates the microprocessor on the PCB is functional.

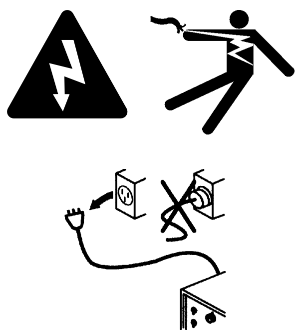
f. If the RX LED (D34) is **not** flickering, the CAN cable between the gas connect console and torch connect console is disconnected. Reconnect the CAN cable, if necessary.

g. If the RX LED is flickering and the CAN TX LED (D35) is **not** flickering, replace the control board (141334) inside of the torch connect console. If replacement is necessary, contact your cutting machine supplier or regional Hypertherm Technical Service team.

9. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Low shield water pressure code (532)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Make sure that the shield water pressure supplied to the cutting system is between 2.76 bar – 7.93 bar (40 psi – 115 psi).

   If the pressure is less than 2.76 bar (40 psi), then a “booster” water pump can be necessary to avoid system shut down or bad cut quality. See *Shield water requirements (VWI and OptiMix)* on page 41.

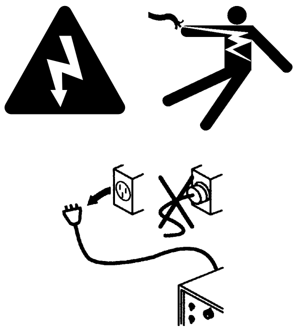
2. Examine all water hoses and water hose inlet fittings. Look for:
   - Damage or kinks that can restrict flow.
   - Leaks that can decrease pressure.
3. Replace any hoses with damage or kinks.
4. Reposition the hoses if you find fixable kinks.
5. Replace any fitting that has damage.
6. Tighten loose connections if found.
7. Examine water regulators. Look for debris that can block the flow path.
8. Adjust the inlet water pressures to at least 2.77 bar (40 psi) when cutting, if necessary.

   The Hypertherm-supplied regulator that is connected to the gas connect console is pre-set at the factory. Do **not** adjust this regulator.

9. If you cannot find or fix the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Low shield gas pressure code (534)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Make sure that the consumables are correct for the operator-selected process.
2. Examine gas hoses and fittings. Look for:
   - Damage and kinks that can restrict flow.
   - Leaks that can decrease pressure.
3. If the hoses and fittings are good, look at the CNC or XPR web interface to identify the shield gas pressure.

   For information about the recommended shield gas pressure by process type, see the cut charts. See the *XPR Cut Charts Instruction Manual* (809830).

4. Send a command to test preflow. Make sure that the pressure is within the correct range for the active process.

   For information about how to do this, see the instruction manual that came with your CNC.

5. Send a command to test cutflow and continue with the following steps:

   Make sure that the pressure on P14 is achieved. An error occurs only if the value is less than 75% of the setpoint for at least 600 milliseconds.

   a. If the pressure is too high or too low, use the optional external shield gas regulator to decrease or increase the pressure.
   b. Examine voltage going to J21.1 and J21.2 for B2 and J7 for V11 (See *Valve states during operation* on page 402 to identify if V11 is enabled). Look for voltage between 5 VDC – 24 VDC.
   c. If B2 and V11 do not have the correct voltage, examine the connections between the control board (141334) and the valves. Make sure that the connections are fully engaged.

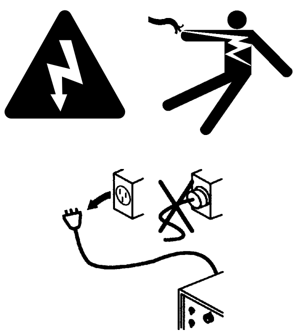
If the connections are fully engaged but the code continues, replace the control board.

6. If you cannot get the recommended pressure, or if pressure is within range but the code continues, exchange B2 with B1 or B3, or exchange P14 with a different transducer, to see if the code follows the exchange. If yes, replace B2 or P14, as needed.

7. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Low coolant flow codes (540 – 542)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Make sure that the coolant level in the coolant reservoir is acceptable.

   You can see the coolant level from the fill port inlet located on the top of the plasma power supply. You also can see coolant levels on the CNC screen or XPR web interface.

2. If the coolant reservoir is not full, fill it with coolant. (See *Coolant Installation* on page 193.)

3. If the coolant reservoir level is acceptable, but the code continues:
   a. Make sure that the coolant pump is ON and the gauge is spinning.
   b. Make sure that the bypass is working.
   c. Examine the coolant hoses. Look for restrictions or blockages.
   d. Examine the consumables. Make sure they are correct for the operator-selected process.
   e. Examine the coolant filter. Replace it if necessary. (See *Table 31 – Inspection, preventive maintenance, and cleaning tasks* on page 232.)
   f. Examine the coolant pump screen. Replace it if you find damage. Clean it if you find debris.

4. If coolant filter or coolant pump screen replacement is not necessary, do a coolant flow test to identify the source of a coolant leak or obstruction. (See *How to measure coolant flow* on page 333.)

5. Send a process command to start the coolant pump.

   The coolant pump starts automatically any time a process command is sent. (See *Sequence of operation* on page 201.)

6. If the coolant flow test value (see *step 4*) is equal to or greater than 3.78 L/min (1.0 gal/min), but the XPR web interface shows a lower value, complete the following steps:

   a. Examine the control PCB. Look for +15 VDC on J8 pin 1 and pin 2.

      If there is no voltage on J8 pin 1 and pin 2, examine the wiring harness that connects to J8. Look for a short. If no short is found, replace the control PCB.

   b. If the voltage on J8 pin 1 and pin 2 is +15 VDC, examine the flow sensor output (in frequency) at the control PCB. Measure the frequency on J8 pin 3 (pulse) and pin 2 (ground).

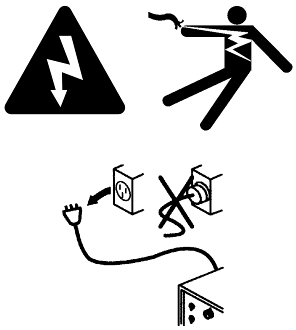
Flow rate		Frequency (Hz)
Liters per minute (L/min)	**US gallons per minute (gal/min)**	
1.89 L/min	0.5 gal/min	15 Hz
3.78 L/min	1.0 gal/min	34 Hz
5.67 L/min	1.5 gal/min	54 Hz

      If the value differs more than 0.8 L/min (0.2 gal/min), or if there are no pulses (0 Hz), replace the flow sensor.

7. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

High coolant flow codes (543 – 544)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

A failed coolant pump can cause a high coolant flow diagnostic code (543). To make sure that the coolant pump is operational:

1. Look at the CNC or XPR web interface to make sure that the coolant pump is operational.
2. For diagnostic code **543**, examine the coolant hoses. Make sure that you have Hypertherm-supplied coolant hoses. Replace the bad hoses with Hypertherm-supplied coolant hoses, if necessary.
3. For diagnostic code **544**, do the following steps to re-set the cutting system:
   a. Set the line-disconnect switch to the OFF position.
   b. Examine the torch. Missing or severely damaged consumables can cause the flow meter to give a higher flow value.

      A missing water tube can have an effect on coolant flow.

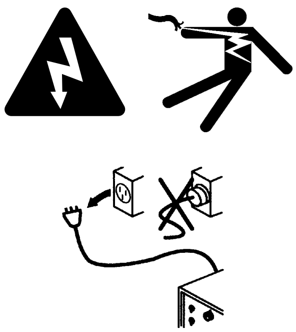
   c. Set the line-disconnect switch to the ON position.
   d. Use the CNC or XPR web interface to send a process command to the cutting system.

      The coolant pump starts automatically any time a process command is sent.

   e. If the code continues:
      - Examine the flow meter. Look for air bubbles in the sight glass. Air bubbles can cause the flow meter to give a higher flow value.
      - Make sure the coolant level is slightly above the level switch.
      - Examine the hoses and hose fittings. Look for damage or loose connections.
4. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Over temp diagnostic codes – Choppers (560 – 561) and Coolant (587)

WARNING



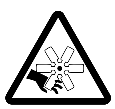
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

CAUTION



MOVING BLADES CAN CAUSE INJURY

Keep your hands away from moving parts.

1. Make sure that the clearance around the plasma power supply is adequate.

   For adequate ventilation, Hypertherm recommends a minimum separation distance of 1 meter (3.3 feet) between the plasma power supply and any other objects or equipment.

2. Make sure that the ambient temperature where the plasma power supply is located is within the acceptable temperature range for cutting system operation (See *Table 1*.)

   If the temperature where your plasma power supply is located is above the temperature limit, you can see reduced performance and over-temp diagnostic codes.

3. While all of the fans continue to operate, allow the cutting system to cool.

4. Reference the XPR web interface. Make sure that the heat-exchanger fan speed is within the acceptable range (heat-exchanger fan 1; heat-exchanger fan 2).

Fan type	Acceptable range of speed
Large fans (254 mm / 10 inch)	2,800 RPM – 3,400 RPM
Small fans (120 mm / 4.7 inch)	5,600 RPM – 6,400 RPM

5. If the fan speed is within acceptable range, remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)

6. Remove the pump-side and front panels of the plasma power supply.

7. If you find obstructions, debris, or dust, use compressed air to remove the obstruction, debris, or dust from the fans and heat-exchanger area.

   The heat-exchanger area can retain large amounts of dust or debris. Multiple uses of compressed air is often necessary to clear this area. Consider the use of personal protective equipment to protect yourself from airborne particulates and debris.

   Make sure to minimize fan rotation during compressed air use. You can use a gloved hand to hold a fan in position, if necessary.

8. Make sure that the heat-exchanger fans have no obvious obstruction, dust, or debris:

   a. Disconnect the connector for the choppers or remove the coolant thermistor wires from the connector. This makes it easier to measure only the resistance for the thermistors.

   b. Use a digital multimeter to measure the resistance from each thermistor wire, based on the following codes and connector-pin locations:

Diagnostic code	Thermistor location	Location of thermistor wires / connector	Pins	
587, 670, 681	Heat exchanger, top	PCB 1	J1.2 pin 7	J1.2 pin 8
560, 667, 678	Chopper 1 (cold plate)	PCB 2	J9 pin 1	J9 pin 2
561, 668, 679	Chopper 2 (cold plate)	PCB 3	J9 pin 1	J9 pin 2

   c. Look for a resistance value that is outside of the minimum or maximum in *Table 36*:

85	750	1250
95	600	1000
105	400	800
115	300	600
125	200	500
135	150	400
145	150	250
155	125	225
165	100	175

Table 36 – Minimum and maximum ohmic resistance values for thermistors

Thermistor temperature	Minimum resistance (Ohms)	Maximum resistance (Ohms)
25°C (77°F)	9,000	11,000
35°C (95°F)	5,000	7,000
45°C (113°F)	3,900	4,900
55°C (131°F)	2,500	3,500
65°C (149°F)	1,500	2,500
75°C (167°F)	1,000	2,000
85°C (185°F)	750	1,250
95°C (203°F)	600	1,000
105°C (221°F)	400	800
115°C (239°F)	300	600
125°C (257°F)	200	500
135°C (275°F)	150	400
145°C (293°F)	150	250
155°C (311°F)	125	225
165°C (329°F)	100	175

At approximately 25°C (77°F), you can expect a resistance of approximately 10,000 ohms.

d. If the resistance value is outside the minimum or maximum value in *Table 36* on page 317, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you to decide if there is a wiring fault or if thermistor replacement is necessary.

e. If the resistance value is at or very near 0 ohms:

- Inspect the wiring between each thermistor and its connector pins.
- Look for shorts between wires or to the ground.

f. If the resistance value is above 100 ohms and below the minimum:

- Remove the electrical power from the cutting system. (See *Remove the power from the cutting system* on page 255.)
- Allow the coolant to reach 85°C (185°F) or below.

It can take a long time for the coolant to reach 85°C (185°F) if the ambient temperature is high. Contact your cutting machine supplier or regional Hypertherm Technical Service team for guidance about how to cool the cutting system, if necessary.

- Restore electrical power to the cutting system.
- Repeat *step 8*.

g. If the resistance remains below the minimum ohmic value or does not change after you allow the coolant to reach 85°C (185°F) or below, do one or more of the following steps, based on the diagnostic code(s):
   - Replace chopper 1 (PCB 2) for error code 560 (over temp-Ch1).
   - Replace chopper 2 (PCB 3) for error code 561 (over temp-Ch2).
   - Replace copper pipe thermistor assembly for error code 587 (Over temp-Coolant).

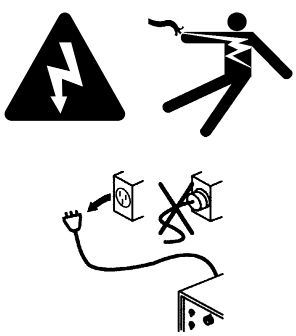
h. If the resistance is within range, continue cutting system operation.

i. If the thermistor resistance is within range when the thermistor is disconnected from the control PCB and the code continues when the thermistor is reconnected to the control PCB, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you decide if control PCB replacement is necessary. (See *Plasma power supply control PCB (141322)* on page 344 or *Plasma power supply chopper PCB (141319)* on page 347.)

9. If the code continues, or if you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Start switch diagnostic codes (570 – 577)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Use the CNC or XPR web interface to verify the status of the cutting system. Make sure that a cutting sequence is **not** active.

2. Remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)

3. Remove the control-side panel from the plasma power supply.

4. Supply power to the cutting system.

5. If the code continues after you supply power to the cutting system, examine LED D50 on PCB 1. Look for illumination.

6. If the LED is not illuminated, there is a CNC problem.

See the instruction manual that came with your CNC for troubleshooting recommendations.

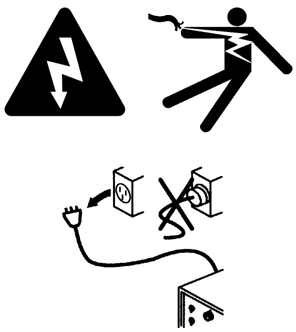
7. If LED D50 is illuminated:
   a. Remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)
   b. Remove the connector from J14 on the rear of the plasma power supply.
   c. Supply power to the cutting system.
   d. Examine the LED D50 on PCB 1. Look for illumination.
8. If LED D50 is illuminated (when the discrete cable remains disconnected), examine the PCB for dust or other contaminants. Use compressed air to remove any dust, debris, or obstruction if found.
9. If LED D50 is still illuminated after the wire is removed, there is a problem with the board. Contact your cutting machine supplier.
10. If the LED is not illuminated, skip to *step 12*.
11. If the code stops and LED D50 is not illuminated with the discrete cable still disconnected, examine the discrete cable for damage. Look for:
    - Shorts across the line
    - Damaged cable
    - Bad relays
    - Loose connections

    Replace the discrete cable if you find damage. (See *Discrete CNC interface cable* on page 389 in *Parts List*.)
12. If you do not find visible damage to the discrete cable, remove the discrete cable from PCB 1. Look for an open circuit between pins 3 and 4 of J14.
13. If the cable is good, make sure that the CNC output is set to OFF.
14. If there is a short circuit, make sure that the discrete cable is not shorted and that the CNC start signal output is set to OFF.

    A closed circuit can indicate that the CNC sent a plasma-start signal or damage on the discrete cable.
15. If you cannot find or resolve the issue with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Over temp diagnostic codes – Inductors (580 – 583), Transformers (586)

WARNING



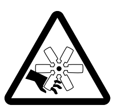
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

CAUTION



MOVING BLADES CAN CAUSE INJURY

Keep your hands away from moving parts.

1. Make sure that the clearance around the plasma power supply is adequate.

> For adequate ventilation, Hypertherm recommends a minimum separation distance of 1 meter (3.3 feet) between the plasma power supply and any other objects or equipment.

2. Make sure that the ambient temperature where the plasma power supply is located is within the acceptable temperature range for cutting system operation (See *Table 1* on page 22.)

> If the temperature where your plasma power supply is located is above the temperature limit, you can experience reduced performance and over-temp diagnostic codes.

3. While all of the fans continue to operate, allow the cutting system to cool.

> Before you continue with the next step, make sure that the magnetics reach a temperature of 160°C (320°F) or below.

4. **Without removing the external side panel** on the plasma power supply, look through the ventilation trusses on the plasma power supply to examine both magnetic fans inside.

> Look through the ventilation trusses on the front of the plasma power supply to locate the 2 magnetic (254 mm / 10 inch) fans inside. It is **not** necessary to remove the external panels to view the magnetics fans. Magnetic fans are near the front and bottom.

5. Examine the XPR web interface. Make sure that the speed for each magnetics fan is within the acceptable range (magnetics fan 1; magnetics fan 2).

Fan type	Acceptable range of speed
Large fans (254 mm / 10 inches)	2,800 RPM – 3,400 RPM
Small fans (120 mm / 4.7 inches)	5,600 RPM – 6,400 RPM

During normal operation, it is usually difficult to see individual blades because of the fast speed of the fan rotation). If you can easily see individual blades without the use of a strobe lamp, the rotation speed is probably too slow.

6. If the speed of the fans is below the acceptable range (see table above), remove the electrical power from the cutting system. (See *Remove the power from the cutting system* on page 255.)

7. Remove the front panel of the plasma power supply.

8. If you find obstructions, debris, or dust, use compressed air to remove the obstruction, debris, or dust from the fans and magnetics area.

The magnetics area can retain large amounts of dust or debris. Multiple uses of compressed air is often necessary to clear this area. Consider the use of personal protective equipment to protect yourself from airborne particulates and debris.

Make sure to minimize fan rotation during compressed air use. You can use a gloved hand to hold a fan in position, if necessary.

9. If both magnetics fans have no obvious obstruction, dust, or debris:
   a. Disconnect the connector from the control board PCB 1 (for the magnetics).
   b. Use a digital multimeter to measure the resistance from each thermistor wire, based on the following connector-pin locations:

Diagnostic code	Thermistor location	Location of thermistor wires/connector	1st connector pin	2nd connector pin
580, 660, 671	Inductor 1A	PCB 1	J1.4 pin 3	J1.4 pin 4
581, 661, 672	Inductor 1B	PCB 1	J1.4 pin 5	J1.4 pin 6
582, 662, 673	Inductor 2A	PCB 1	J1.4 pin 7	J1.4 pin 8
583, 663, 674	Inductor 2B	PCB 1	J1.2 pin 1	J1.2 pin 2
586, 666, 677	Transformer	PCB 1	J1.4 pin 1	J1.4 pin 2

Thermistors are located on the magnetics.

c. Look for a resistance value from each thermistor wire that is outside of the minimum or maximum in *Table 37*:

Table 37 – Minimum and maximum ohmic resistance values for thermistors

Thermistor temperature	Minimum resistance (Ohms)	Maximum resistance (Ohms)
25°C (77°F)	9,000	11,000
35°C (95°F)	5,000	7,000
45°C (113°F)	3,900	4,900
55°C (131°F)	2,500	3,500
65°C (149°F)	1,500	2,500
75°C (167°F)	1,000	2,000
85°C (185°F)	750	1,250
95°C (203°F)	600	1,000
105°C (221°F)	400	800
115°C (239°F)	300	600
125°C (257°F)	200	500
135°C (275°F)	150	400
145°C (293°F)	150	250
155°C (311°F)	125	225
165°C (329°F)	100	175

At approximately 25°C (77°F), you can expect a resistance of approximately 10,000 ohms.

d. If the ohmic resistance is outside of the minimum or maximum value in *Table 37* on page 322, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you to decide if there is a wiring fault or if thermistor replacement is necessary.

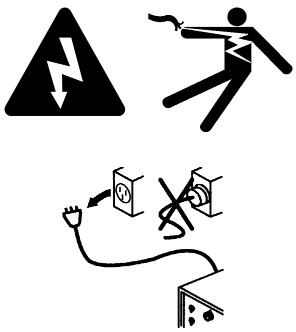
e. If the resistance is at or very near 0 ohms:

- ❑ Inspect the wiring between each thermistor and its connector pins.
- ❑ Look for shorts between wires or to the ground.

10. If the thermistor resistance is within range when the thermistor is disconnected from the control PCB and the code continues when the thermistor is reconnected to the control PCB, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you decide if control PCB replacement is necessary. (See *Plasma power supply control PCB (141322)* on page 344.)

Current sensor diagnostic codes (631)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

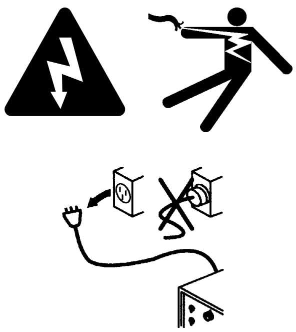
All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)
2. Examine J1.8 on PCB 1 (control PCB) and the work lead sensor located on the I/O panel on PCB5 (I/O PCB).
3. Look for:
   - Damage
   - Loose connections
4. If the connections are good and the code continues, replace PCB5 (I/O PCB).
5. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Low inlet pressure for H_2, Ar, N_2, and H_2O diagnostic codes (695 – 697, 700, 701)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. During test cutflow and test preflow, look at the CNC or XPR web interface to identify the gas or water inlet pressure in the mixing module inside the gas connect console. Look at:
   - The H_2 inlet pressure (P10) for code 695.
   - The Ar inlet pressure (P11) for code 696.
   - The N_2 inlet pressure (P12) for code 697.
   - The H_2O inlet pressure (P8) for code 701.

2. If you have a Core, VWI, or OptiMix gas connect console, make sure that the gas inlet pressures inside the gas connect console are acceptable:

Gas connect console	Acceptable gas inlet pressures in the gas connect console		
	H_2	N_2	Ar
Core	–	7.5 bar ± 0.4 (110 psi ± 5)	–
VWI	–	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)
OptiMix	8.3 bar ± 0.4 (120 psi ± 5)	8.3 bar ± 0.4 (120 psi ± 5)	8.3 bar ± 0.4 (120 psi ± 5)

3. If you have a VWI or OptiMix gas connect console, make sure that the water inlet pressure is at least 2.07 bar (40 psi).

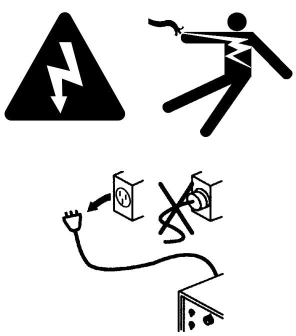
4. When gas flow is less than the pressure range, use the regulators to increase the pressure, if necessary. Do **not** exceed the recommended pressures.

5. If the pressure remains too low, examine the gas hoses and gas inlet fittings. Look for:
   - Damage or kinks that can restrict flow.
   - Leaks that can decrease pressure.

6. Replace the hoses if you find damage or kinks.
7. Reposition the hoses if you find fixable kinks.
8. Replace any fitting that has damage.
9. Tighten loose connections if found.
10. If you have an XPR cutting system equipped with a VWI or OptiMix gas connect console, make sure that the shield water quality is good [See *Shield water requirements (VWI and OptiMix)* on page 41.]. Bad quality can have a negative effect on the shield water regulator. This can cause diagnostic codes for low inlet pressure.
11. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Shield gas inlet pressure in the torch connect console diagnostic codes (702 – 705)

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Look at the CNC screen or XPR web interface to identify the inlet pressure inside the torch connect console. Look at:
   - The N_2 inlet pressure (P4) for code 702.
   - The O_2 inlet pressure (P4) for code 703.
   - The air inlet pressure (P4) for code 704.
   - The Ar inlet pressure (P4) for code 705.

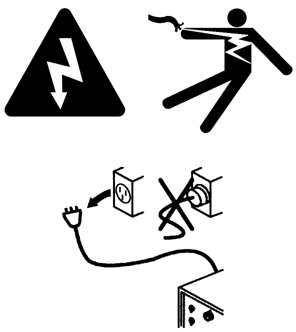
2. Make sure that the gas inlet pressures inside the torch connect console are acceptable:

Gas connect console	Acceptable gas inlet pressures in the torch connect console			
	N_2	O_2	Air	Ar
Core	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	–
VWI	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)	7.5 bar ± 0.4 (110 psi ± 5)
OptiMix	8.3 bar ± 0.4 (100 psi ± 5)	8.3 bar ± 0.4 (115 psi ± 5)	7.9 bar ± 0.4 (115 psi ± 5)	8.3 bar ± 0.4 (100 psi ± 5)

3. Use the regulators to increase or decrease the inlet pressure.
4. If the pressure remains too low, examine gas hoses and gas inlet fittings. Look for:
   - Damage or kinks that can restrict flow.
   - Leaks that can decrease pressure.
5. Replace the hoses if you find damage or kinks.
6. Reposition the hoses if you find fixable kinks.
7. Replace any fitting that has damage.
8. Tighten loose connections if found.
9. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Process-gas inlet pressure in the torch connect console diagnostic codes (702, 705, 769, 770) for OptiMix-equipped cutting systems

WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

The N_2 and Ar gas regulators inside the OptiMix gas connect console (078633) are set at Hypertherm. They are set when the process gas is flowing with 7.9 bar – 8.6 bar (115 psi – 125 psi) pressure on the gas inlet and 6.9 bar (100 psi) on the gas outlet. A downstream 1.6 mm (0.063 inch) orifice is part of both regulator configurations.

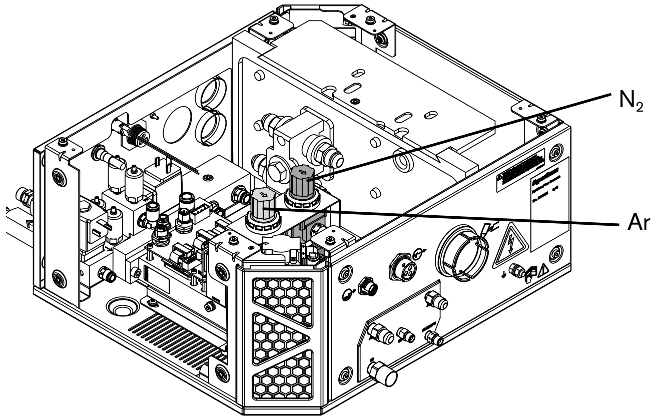
It can be necessary to adjust the regulators, if the following conditions occur:

- N_2 shield inlet (P4) pressure is above 7.5 bar (110 psi) or below 6.2 bar (90 psi)
- Ar shield inlet (P4) pressure is above 7.5 bar (110 psi) or below 6.2 bar (90 psi)

Follow these steps to adjust the N_2 regulator

1. Install 1 of the following sets of consumables:
   - 300 A O_2/Air
   - 300 A N_2/N_2
   - 300 A Mix/N_2
   - 170 A O_2/Air
   - 170 A N_2/N_2
   - 170 A Mix/N_2
2. Use the XPR web interface to choose 1 of the following processes:
   - 2100 for 300 A N_2/N_2 aluminum or stainless steel
   - 2057 for 170 A N_2/N_2 aluminum or stainless steel
3. Remove the cover from OptiMix gas connect console.

4. Pull up the N_2 regulator knob so the orange indicator is visible.



5. Go to **Gas System** in the XPR web interface.

6. Choose **TEST PREFLOW**.

7. While the gas flows, adjust the regulator until the shield inlet sensor (P4) on the XPR web interface is 6.9 bar (100 psi).

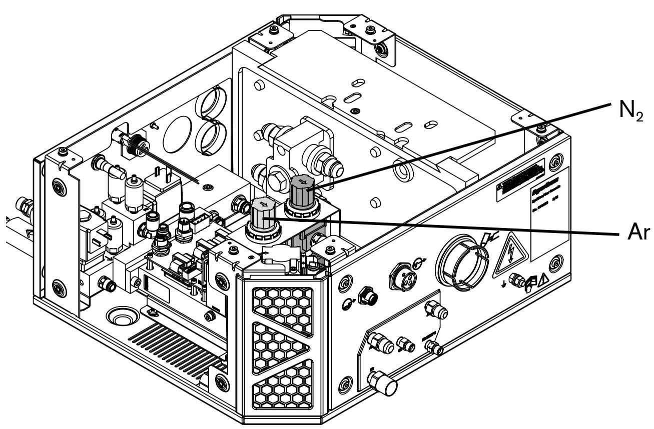
Follow these steps to adjust the Ar regulator

1. Install 1 of the following sets of consumables:
   - 300 A O_2/Air
   - 170 A O_2/Air

2. Use the XPR web interface to choose 1 of the following processes:
   - 1205 for O_2/N_2 mild steel
   - 1157 for O_2/Air (Ar pierce assist) mild steel

3. Remove the cover for OptiMix gas connect console.

4. Pull up the Ar regulator knob so the orange indicator is visible.



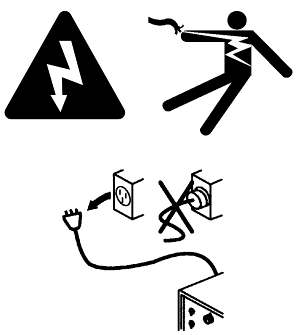
5. Go to **Gas System** in the XPR web interface.

6. Choose **TEST PIERCEFLOW**.

7. While the gas flows, adjust the regulator until the shield inlet sensor (P4) on the web interface is 6.9 bar (100 psi).

Pressure transducer diagnostic codes (706 – 715)

⚠ WARNING



ELECTRIC SHOCK CAN KILL

Disconnect electrical power before doing any troubleshooting or diagnostic work.

All work requiring removal of the plasma power supply outer cover or panels must be done by a qualified technician.

See the *Safety and Compliance Manual* (80669C) for more safety precautions.

1. Remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)

2. Examine the pressure transducer that is referenced in the diagnostic code. For example, if the code references “P1-TCC,” examine the P1 pressure transducer for the torch connect console, or if the code references “P6-GCC,” examine the P6 pressure transducer for the gas connect console.

3. Make sure that the pressure transducer is plugged in correctly on the following PCBs:
   - Torch connect console control PCB
   - Gas connect console control PCB

4. Re-install the pressure transducer if any incorrect connections are found.

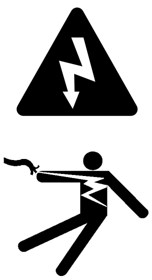
5. If you find damage, replace the damaged control PCB.

6. Replace the pressure transducer.

7. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

Gas inlet pressure codes (768 – 771)

⚠ WARNING



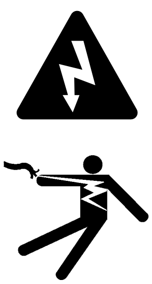
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

⚠ WARNING



ELECTRIC SHOCK CAN KILL

When the line-disconnect switch is in the ON position, there is line voltage at the contactor and the power distribution PCB.

Voltages present at the terminal block and contactors can cause injury or death.

Use extreme caution when you measure the primary power in these areas.

It is necessary for the cutting system to have electric power to verify gas inlet pressures. **Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to electricity and the panels on the plasma power supply are removed.**

Gas pressure drops are more likely to occur if the supply gas hoses are long. For the best results position a gas regulator within 3 meters (10 feet) of the gas connect console (See *Configuration with Core gas connect console* on page 73 and *Configuration with VWI or OptiMix gas connect console* on page 74.)

1. Use the CNC or XPR web interface to select Test Cutflow to start the gas flow.

2. Make sure that the gas inlet pressures are within the acceptable range (*Process gas requirements (Core, VWI, and OptiMix gas connect consoles)* on page 36).

3. If the gas inlet pressure is not within the acceptable range, adjust it
   - **a.** Use a 2-stage regulator that can delivery the necessary gas flow and can maintain consistent gas pressure with high-pressure gas cylinders.

b. Review the diagnostic code history for previous pressure-related codes that can indicate where to look for flow or pressure problems.

c. If you identify a code for a pressure transducer (P1 or P2), exchange the transducers. See if the code follows the transducer change. Replace the bad transducer if necessary. For instructions, refer to “Replace a pressure transducer” in the *XPR Replacement Parts Procedures Field Service Bulletin* (809970),

4. If you have a cutting system equipped with a OptiMix gas connect console, refer to *Process-gas inlet pressure in the torch connect console diagnostic codes (702, 705, 769, 770) for OptiMix-equipped cutting systems* on page 327.

5. If you have a Core or VWI gas connect console, or if the code continues, or if you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

How to do a gas leak test (VWI and OptiMix)

NOTICE

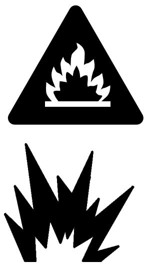
Gas leaks or pressure and flow rates that are outside of recommended ranges can:

- Cause problems with system performance
- Result in bad cut quality
- Shorten the life of consumables

If the quality of the gas is bad or if the pressure setting is incorrect, it can decrease:

- Cut quality
- Cut speed
- Cut thickness capabilities

WARNING

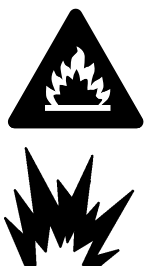


If you use oxygen as the plasma gas for cutting, it can cause a potential fire hazard due to the oxygen-enriched atmosphere that collects.

Hypertherm recommends that you install an exhaust ventilation system to remove the oxygen-enriched atmosphere that can collect when oxygen is used as the plasma gas for cutting.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the flashback arrestors for your cutting system. You can get them from your cutting machine supplier.



Hydrogen is a flammable gas that presents an explosion hazard. Keep flames away from cylinders and hoses that contain hydrogen. Keep flames and sparks away from the torch when using hydrogen as a plasma gas.

Consult your local safety, fire, and building code requirements for the storage and use of hydrogen.

Hypertherm recommends that you install an exhaust ventilation system to remove the hydrogen-enriched atmosphere that can collect when hydrogen is used as the plasma gas for cutting.

Flashback arrestors are REQUIRED to stop the spread of fire to the supply gases (unless a flashback arrestor is not available for a specific gas or pressure).

As an installer or user, you must supply the flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

See *Table 7* on page 36 for the recommended pressure and flow rates.

If you suspect a cutting system gas leak:

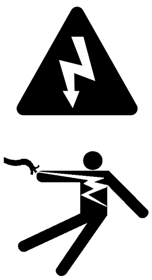
1. Use the CNC screen or XPR web interface to select the command to do an automated gas leak test. Test results and information will appear in the error log.

   For information about how to do this, see the instruction manual that came with your CNC.

2. See the error log for information and guidance about how to diagnose or troubleshoot a possible gas leak.

How to measure coolant flow

WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can cause injury or death.

Even if the plasma power supply is turned OFF, you can still get a serious electric shock if the plasma power supply remains connected to an electric power source.

Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to an electric power source and the outer cover or panels are removed.

It is necessary for power to be supplied to the cutting system to measure coolant flow. **Use extreme caution if you do diagnosis or maintenance tasks when the plasma power supply remains connected to electric power.**

Use the CNC or XPR web interface

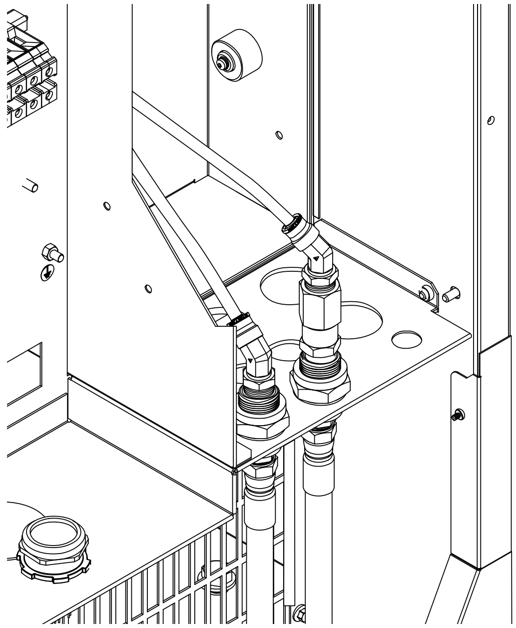
1. Look at the CNC or XPR web interface to identify the coolant flow rate.
2. Make sure that the coolant flow rate is above 3.79 L/min (1 gal/min).

   If the flow rate is outside of the correct range, an internal obstruction or leak can be the cause.

Do a container test

1. Obtain an empty container that has a capacity of at least 3.79 liters (1 US gallon) and volume measurements, if possible.
2. Remove the power from the cutting system. (Refer to *Remove the power from the cutting system* on page 255.)

3. Disconnect the coolant return hose (red) from the coolant return fitting (red) inside the rear of the plasma power supply. Use the container to catch coolant leaks if needed, but empty it before you start the test



4. Put the end of the coolant return hose into the container.
5. Restore electrical power to the cutting system.
6. Send a process to the cutting system.
7. When you hear the coolant pump turn ON, begin a 30-second count while coolant flows into the container.
8. After 30 seconds look at the amount of coolant in the container. It should be at least 1.89 liters (0.5 US gallon).
9. If the flow rate is outside of the correct range, an internal obstruction or leak can be the cause.
10. If you find obstructions, remove them. Replace damaged parts if found.
11. If coolant flow remains slow, and it has been more than 6 months since the last coolant replacement, replace the coolant. (See *Replace all of the coolant* on page 248.)

    Hypertherm recommends coolant replacement every 6 months. For complete preventative maintenance information, see the *XPR Preventative Maintenance Program (PMP) Instruction Manual* (809490).

12. If coolant flow remains slow after replacement, verify that the following function and components are good:
    - Bypass is working
    - Coolant pump motor

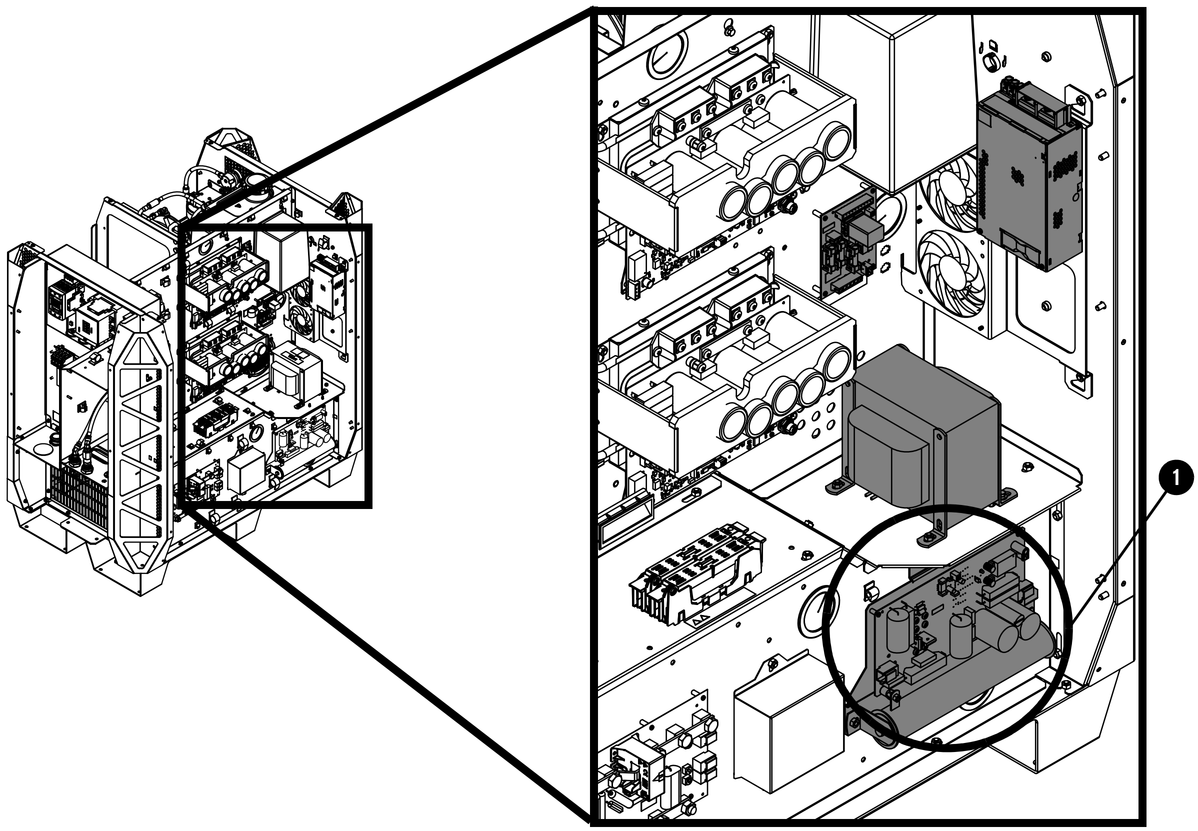
- Consumables and torch
- Coolant check valve

13. If you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

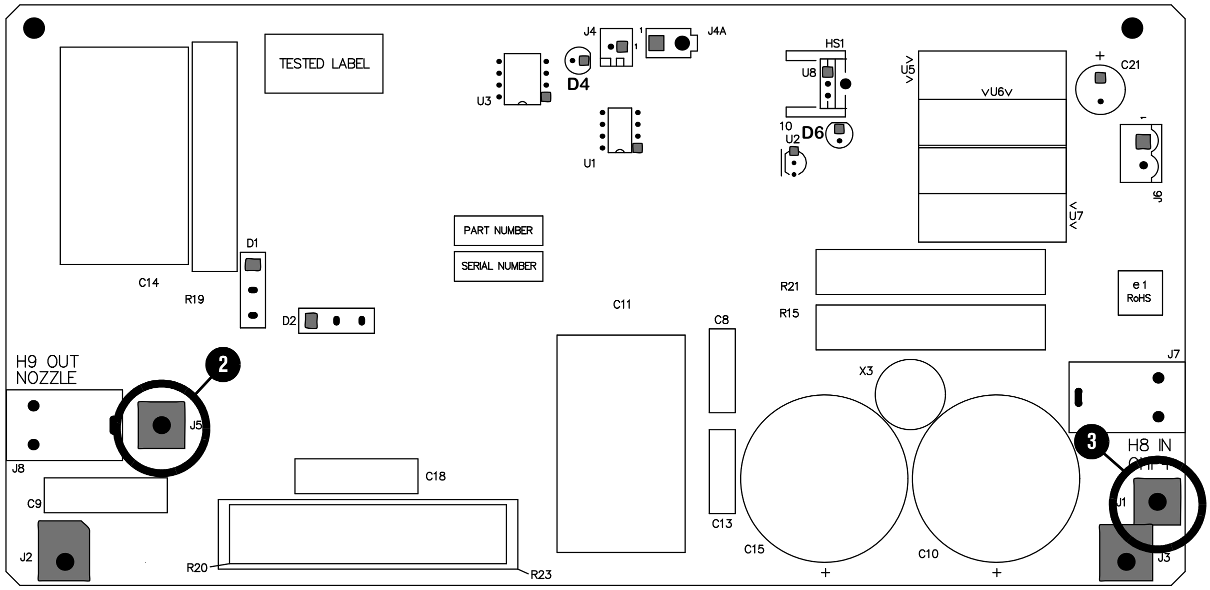
How to test continuity between the nozzle and workpiece

1. Remove the power from the cutting system. (See *Remove the power from the cutting system* on page 255.)

2. Locate the start-circuit assembly PCB 4 ❶.



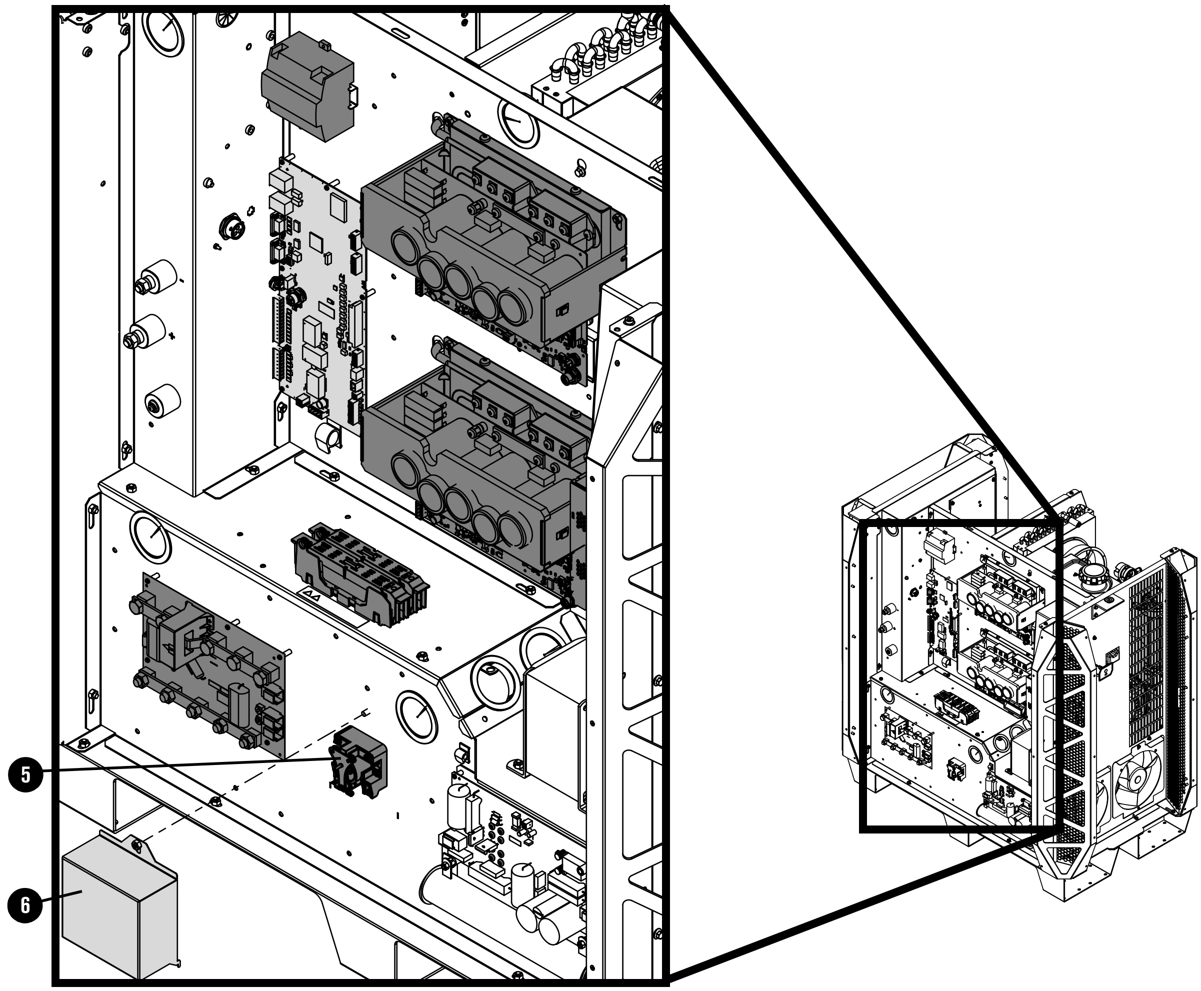
3. Install a temporary jumper wire between J5 (nozzle) ❷ and J1 (work) ❸ on the start circuit PCB 4 (141360).



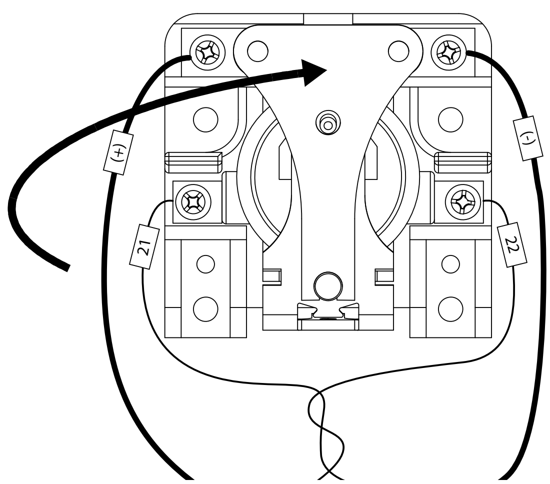
⚠ NOTICE

Never fire an arc when a temporary jumper wire is installed on the PCB. Sparking and damage to the PCB can occur.

4. Locate the pilot arc relay (CR 1) ❹ and remove the dust cover ❺.



5. Have a second person close (push in) the contact on the pilot arc relay.



6. Measure the ohms between the nozzle and the workpiece. Less than 3 ohms is good. A value greater than 3 ohms indicates a faulty connection between the torch and ignition console, or between the ignition console and the power supply, or between the power supply work lead and workpiece.

7. Examine the work lead. Replace it if you find damage or excess wear.

8. Examine the pilot arc circuit (plasma power supply to gas connect console, to torch connect console, to torch receptacle).
   a. If the pilot arc wire is damaged, replace the damaged item.
   b. If the pilot arc wire is not damaged, replace the torch and receptacle.

9. Release the pilot arc relay and measure the ohms between the nozzle and workpiece. The acceptable range is 9,000 – 11,000 ohms. If the ohms value is low (approximately 5,000 ohms or less), examine the pilot arc circuit (power supply to gas connect console, to torch connect console, to torch receptacle). Look for insulation damage and short circuits to ground.

How to measure resistance from thermistors

1. Use a digital multimeter to measure the resistance from each thermistor wire, based on the following connector-pin locations:

Thermistor location	Location of thermistor wires/connector	1st connector pin	2nd connector pin
Inductor 1A	PCB 1	J1.4 pin 3	J1.4 pin 4
Inductor 1B	PCB 1	J1.4 pin 5	J1.4 pin 6
Inductor 2A	PCB 1	J1.4 pin 7	J1.4 pin 8
Inductor 2B	PCB 1	J1.2 pin 1	J1.2 pin 2
Transformer	PCB 1	J1.4 pin 1	J1.4 pin 2
Chopper 1	PCB 2	J9 pin 1	J9 pin 2
Chopper 2	PCB 3	J9 pin 1	J9 pin 2
Coolant temperature	PCB 1	J1.2 pin 7	J1.2 pin 8

2. Look for a resistance value that is outside of the minimum or maximum in *Table 38*:

Table 38 – Minimum and maximum ohmic resistance values for thermistors

Thermistor temperature	Minimum resistance (Ohms)	Maximum resistance (Ohms)
25°C (77°F)	9,000	11,000
35°C (95°F)	5,000	7,000
45°C (113°F)	3,900	4,900
55°C (131°F)	2,500	3,500
65°C (149°F)	1,500	2,500
75°C (167°F)	1,000	2,000
85°C (185°F)	750	1,250
95°C (203°F)	600	1,000
105°C (221°F)	400	800
115°C (239°F)	300	600
125°C (257°F)	200	500
135°C (275°F)	150	400
145°C (293°F)	150	250
155°C (311°F)	125	225
165°C (329°F)	100	175

At approximately 25°C (77°F), you can expect a resistance of approximately 10,000 ohms.

3. If the resistance is above the maximum value, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you to decide if there is a wiring fault or if thermistor replacement is necessary.

4. If the resistance is at or near 0 ohms:
   a. Inspect the wiring between each thermistor and its connector pins.
   b. Look for shorts between wires or to the ground.

5. If the resistance is within range, continue cutting system operation.

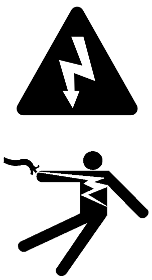
6. If the resistance remains below the minimum ohmic value or does not change after you allow the coolant to reach 85°C (185°F) or below, contact your cutting machine supplier or Hypertherm Technical Service team.

7. If the thermistor resistance is within range when the thermistor is disconnected from the control PCB and the code continues when the thermistor is reconnected to the control PCB, contact your cutting machine supplier or regional Hypertherm Technical Service team. They can help you decide if control PCB replacement is necessary. (See *Plasma power supply control PCB (141322)* on page 344.)

8. If the code continues, or if you cannot find or resolve the problem with these corrective actions, contact your cutting machine supplier or regional Hypertherm Technical Service team.

How to do an ohmic-contact test

WARNING



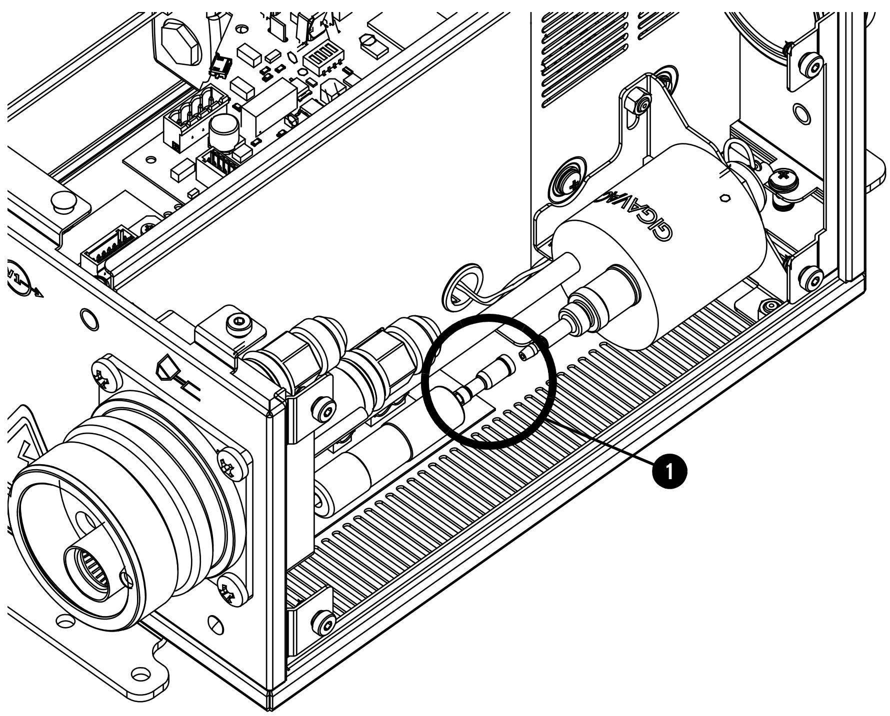
ELECTRIC SHOCK CAN KILL

When the line-disconnect switch is in the ON position, there is line voltage throughout the cutting system.

Voltages present throughout the cutting system can cause injury or death.

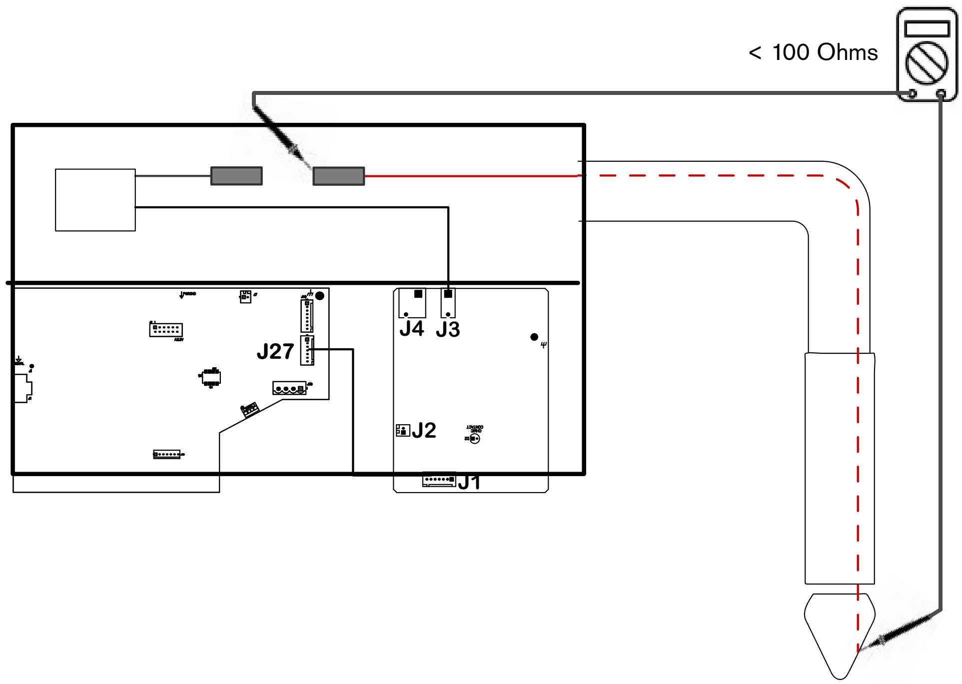
Use extreme caution if you do diagnosis or maintenance tasks when the line-disconnect switch is in the ON position.

1. Remove the power from the cutting system. See *Remove the power from the cutting system* on page 255.
2. Examine the J2 connector on the ohmic contact PCB. Make sure that the ohmic relay coil is connected. Reconnect or tighten the ohmic relay coil if needed.
3. Disconnect the ohmic relay connector to access the bullet connector ❶ on the torch receptacle block-side located inside the torch connect console.



4. Use a digital multimeter to measure the resistance from the torch tip to the ohmic relay. See *Figure 63* on page 341.

Figure 63 – Measure the resistance from the torch tip to the ohmic relay



a. If the resistance is infinite (open), replace the torch lead.

b. If the resistance is less than 100 Ohms, continue with step *step 5*.

5. Reconnect the ohmic relay connector.

6. Examine the ohmic contact PCB. See *Torch connect console ohmic PCB (141368)* on page 351.

   a. If configured for internal ohmic, make sure that the ohmic wire from the ohmic relay is connected to J3.

   b. If configured for external ohmic, make sure that the ohmic wire from the ohmic relay is connected to J4 pin 2 and that the ohmic wire from the lifter is connected to J4 pin 1.

   c. Adjust or tighten connections, if needed, then continue with *step* 7.

7. Supply electrical power to the cutting system.

8. Make sure that the torch is **not** touching the workpiece.

9. Use a digital multimeter to look for 24 VDC between the workpiece, or chassis ground, and the torch tip (J3 or J4).

10. If there is no 24 VDC, examine the wiring to the ohmic PCB (141368). Make sure that the J3 or J4 connector is not clamped onto the wire insulation and that the connection between the J2 or J2A connector and the relay coil is good.

    If the connections are good but there is no 24 VDC, contact your cutting machine supplier or regional Hypertherm Technical Service Team.

11. If you find 24 VDC, continue with the following steps:
    a. Make sure that both the workpiece and the torch connect console are grounded in the same location.
    b. Touch the torch tip to the workpiece or attach a jumper wire between the torch tip and the chassis ground.
    c. Examine LED D2 on the ohmic contact PCB. See *Torch connect console ohmic PCB (141368)* on page 351.
    d. Examine LED D15 on the control PCB. See *Torch connect console control PCB (141334)* on page 352.
    e. Make sure that LED D2 and D15 both illuminate.
    f. If both LEDs illuminate, make sure that the CNC is receiving ohmic contact signals from the cutting system or torch height controller.

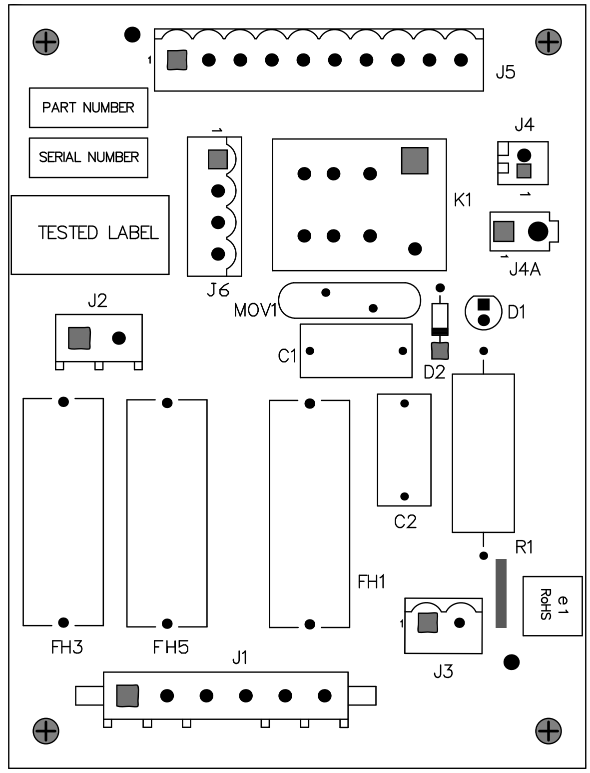
       If receiving ohmic contact signals, refer to the instruction manual that came with your CNC for troubleshooting recommendations.

    g. If LED D2 is not illuminated, replace the ohmic contact board (141368).
    h. If LED D2 is illuminated and D15 is not, examine the wiring harness between both boards. Look for loose wiring.
12. If the code continues, contact your cutting machine supplier or regional Hypertherm Technical Service Team.

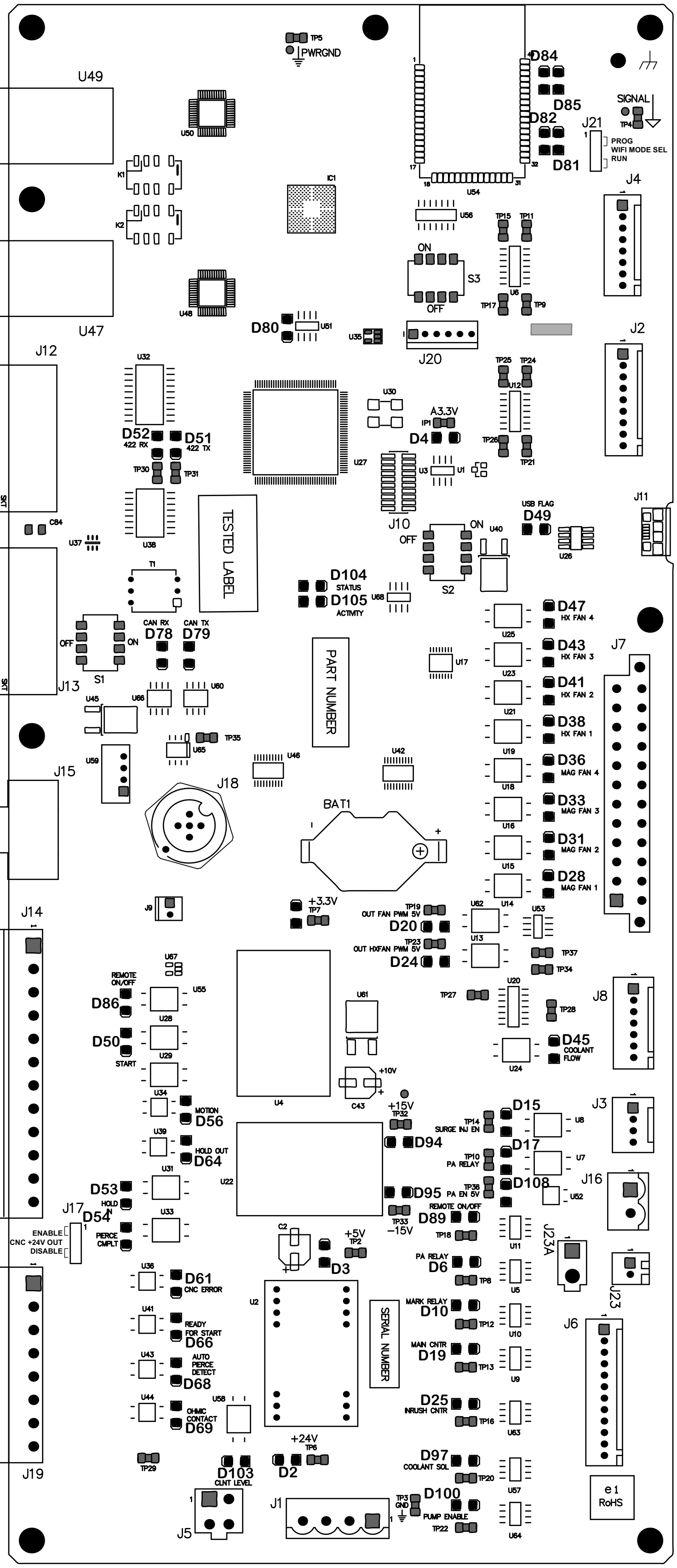
PCB information

Plasma power supply power distribution PCB (141425)

LED	Signal
D1	120 VAC



Plasma power supply control PCB (141322)



LED	Signal
D84	WiFi LED 1
D85	WiFi LED 2
D82	WiFi RX
D81	WiFi TX
D80	EtherCAT EEProm
D52	RS-422 RX
D51	RS-422 TX
D4	A3.3 V
D49	USB FLAG
D104	STATUS
D105	ACTIVITY
D78	CAN RX
D79	CAN TX
D47	CONTROL-SIDE FAN 2 FEEDBACK
D43	CONTROL-SIDE FAN 1 FEEDBACK
D41	HX FAN 2 FEEDBACK
D38	HX FAN 1 FEEDBACK
D31	MAG FAN 2 FEEDBACK
D28	MAG FAN 1 FEEDBACK
D5	+3.3 V
D20	MAGNETIC FANS ENABLE
D24	HEAT EXCHANGER FAN ENABLE
D45	COOLANT FLOW
D86	REMOTE ON-OFF

LED	Signal
D50	PLASMA START
D56	MOTION
D64	HOLD OUT
D53	HOLD IN
D54	PIERCE COMPLETE
D61	CNC ERROR
D66	READY FOR START
D68	AUTO PIERCE DETECT
D69	OHMIC CONTACT OUTPUT
D15	SURGE INJ EN (UNUSED IN THIS SYSTEM)
D108	PILOT ARC ENABLE
D89	REMOTE ON-OFF RELAY ENABLE
D6	PILOT ARC RELAY
D10	MARK RELAY
D19	MAIN CONTACTOR
D25	INRUSH CONTACTOR
D97	COOLANT SOLENOID
D100	PUMP ENABLE
D94	+15 V
D95	-15 V
D3	+5 V
D2	+24 V
D103	COOLANT LEVEL

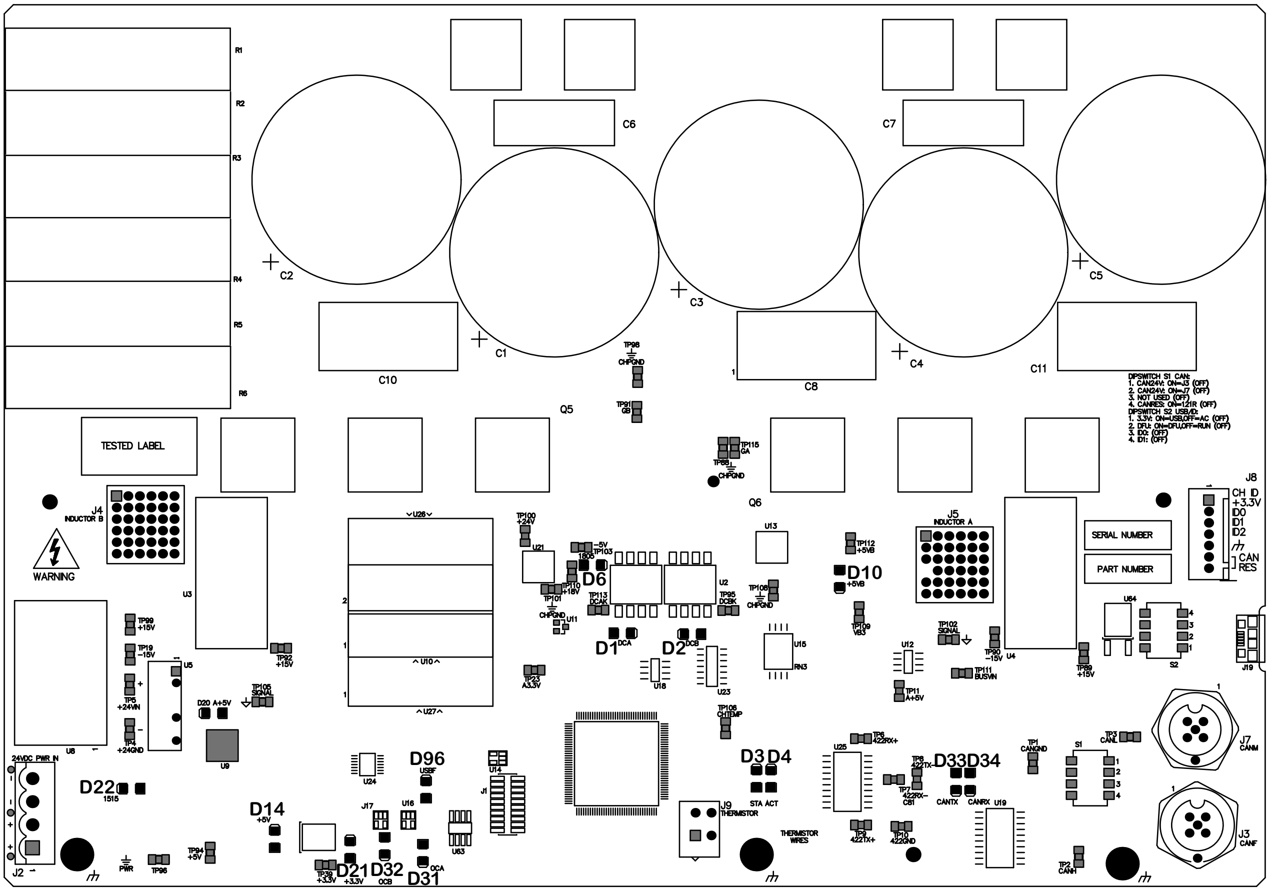
DIP switch positions

DIP switch 1 positions			
1	RS-422 RX termination	–	Default is ON
2	RS-422 TX termination	–	Default is OFF
3	Not used	–	Default is ON
4	CAN termination resistor	ON = 121 Ohms OFF = Open	Default is ON

DIP switch 2 positions			
1	Micro-controller DFU programming mode	ON = DFU OFF = Run	Default is OFF
2	3.3V logic power	ON = USB OTG OFF = Internal power supply	Default is OFF
3	RS-422 Serial ID0	–	Default is OFF
4	RS-422 Serial ID1	–	Default is OFF

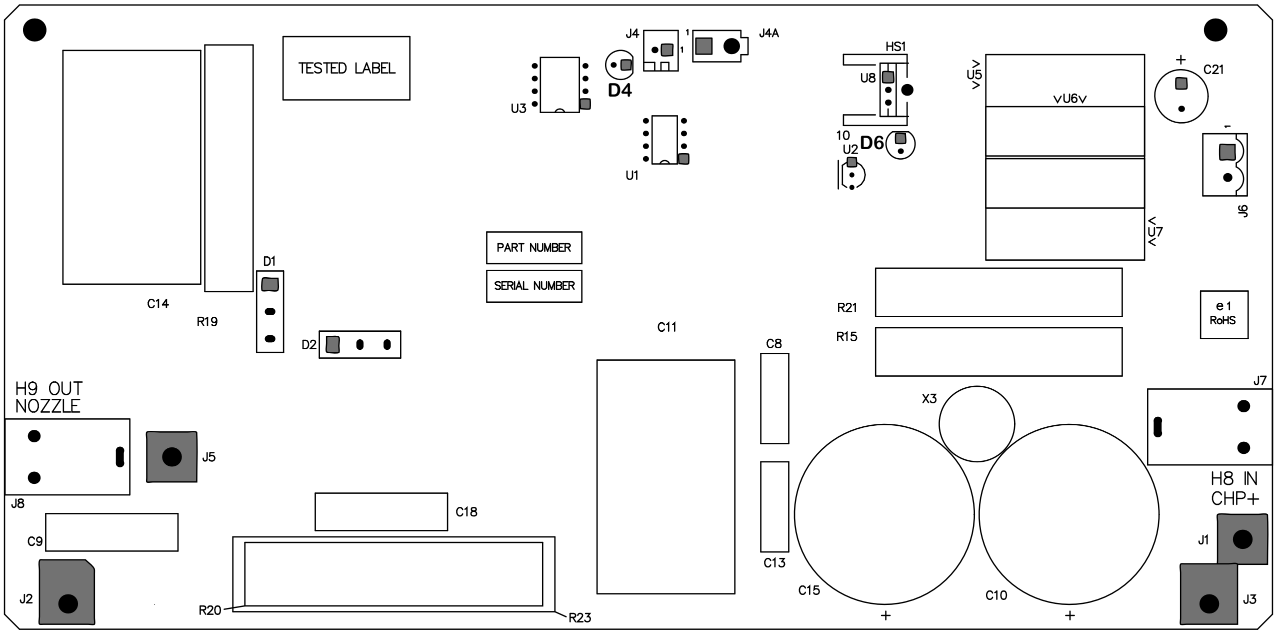
DIP switch 3 positions			
1	Wireless module programming	ON = Enabled OFF = Disabled	Default is OFF
2	Wireless module transmit:	ON = From micro-controller OFF = Disabled	Default is ON
3	Wireless module transmit	ON = From J20 programming connector OFF = Disabled	Default is OFF
4	Wireless enable	ON = Wireless disabled OFF = Wireless enabled	Default is OFF

Plasma power supply chopper PCB (141319)



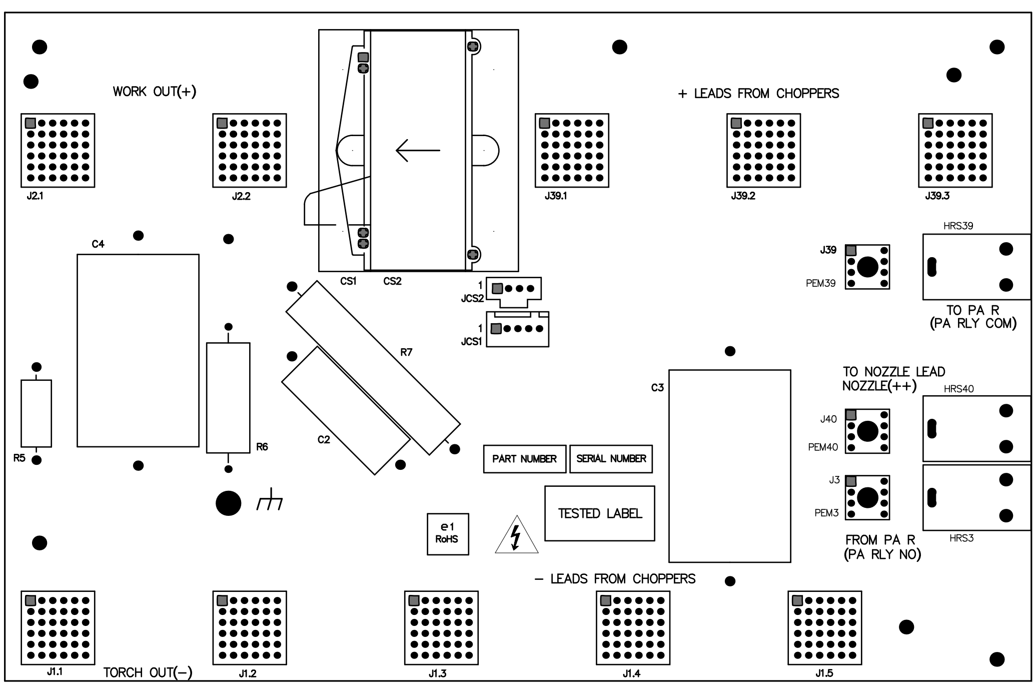
LED	Signal	LED	Signal
D22	+15V AND -15V POWER	D1	DCA
D14	+5 V	D2	DCB
D21	+3.3 V	D3	STATUS
D32	OVER CURRENT CHANNEL B	D4	ACTIVITY
D31	OVER CURRENT CHANNEL A	D10	+5VB
D96	USBFLAG	D33	CAN TX
D6	+18V AND -5V POWER	D34	CAN RX

Plasma power supply start circuit PCB (141360)

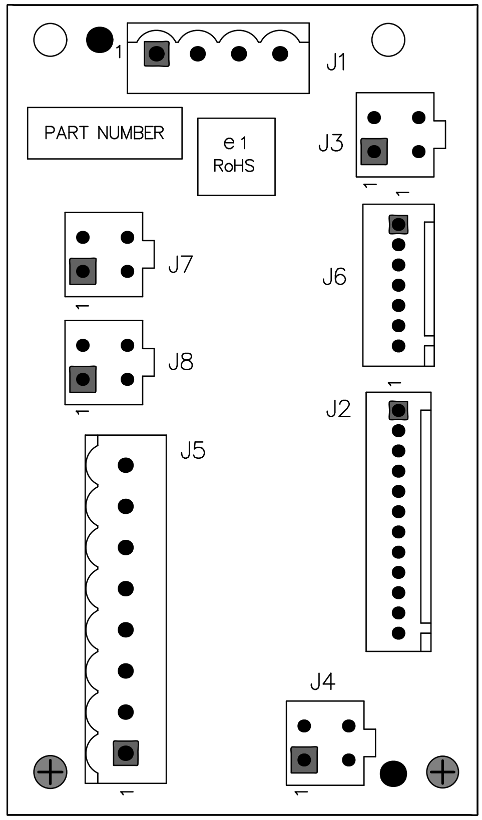


LED	Signal	LED	Signal
D4	PILOT ARC ENABLE	D6	+18V AND -5V POWER

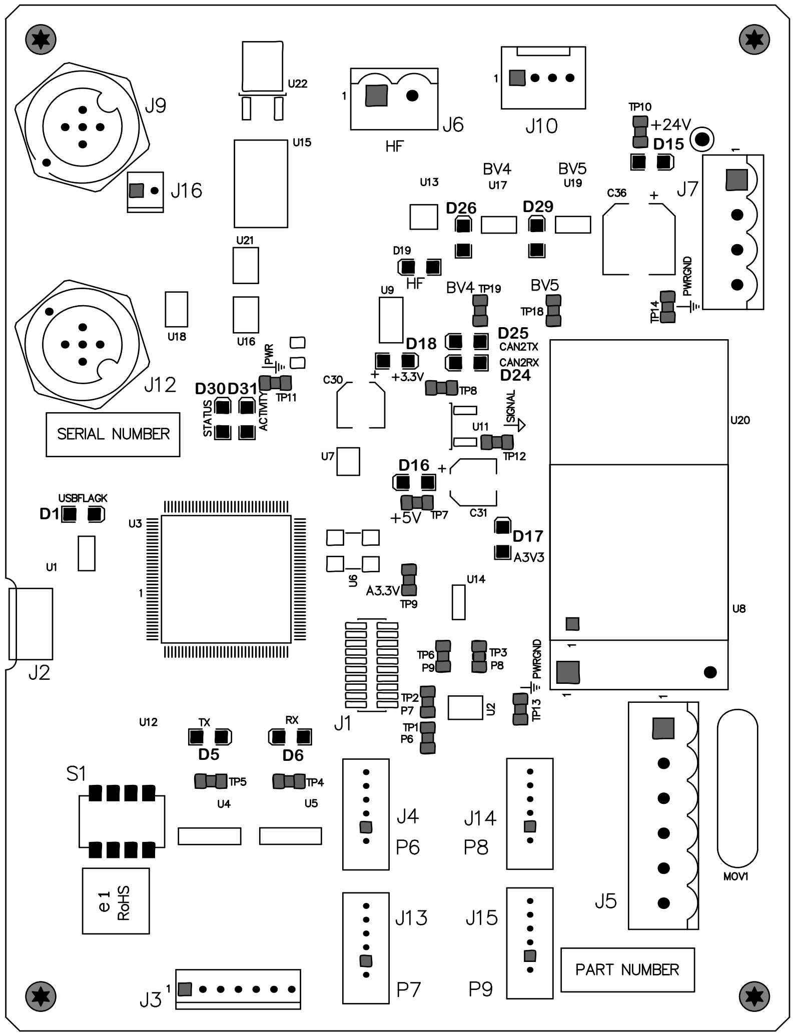
Plasma power supply I/O PCB (141371)



Plasma power supply fan power distribution PCB (141384)

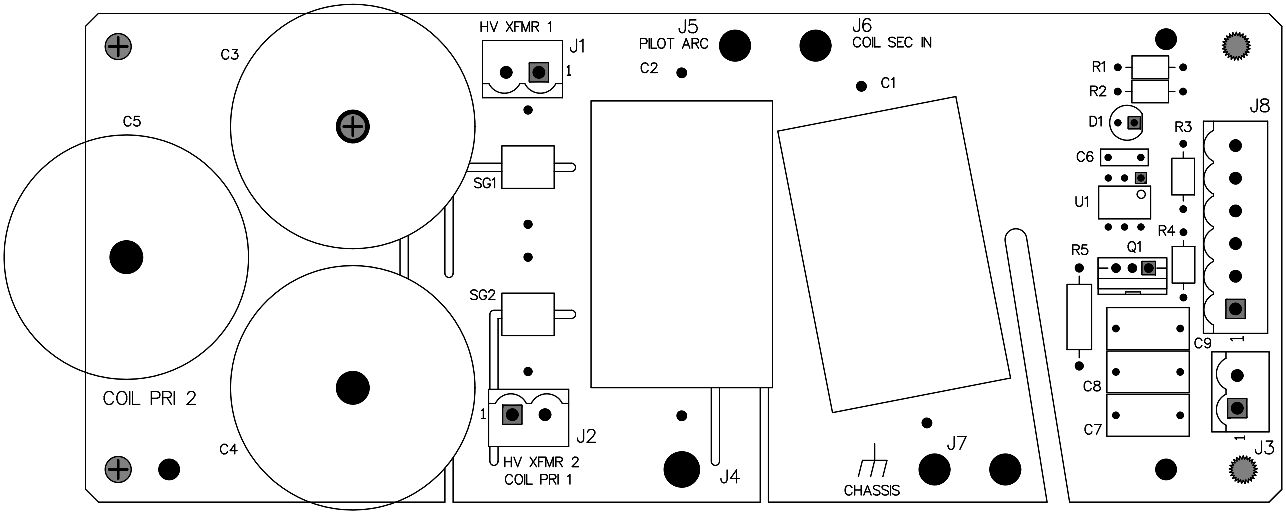


Gas connect console control PCB (141375)



LED	Signal	LED	Signal
D15	+24 V	D24	CAN RX
D29	B5	D30	Status
D26	B4	D31	Activity
D19	HF	D1	USBFLAG
D18	+3.3 V	D16	+5 V
D25	CAN TX	D17	A3.3

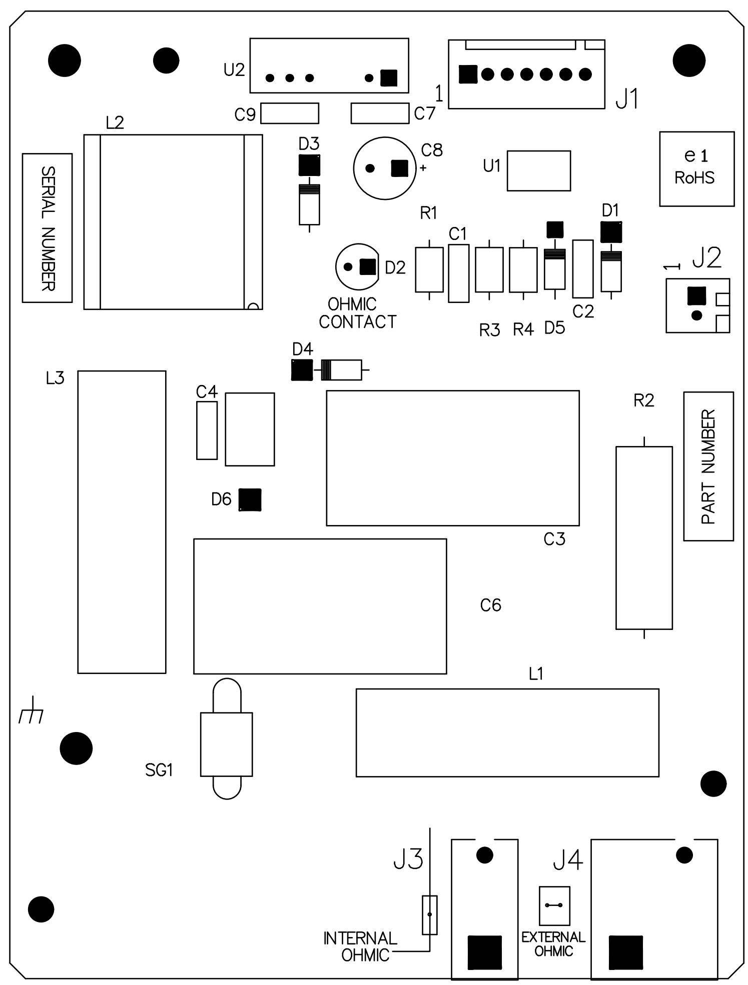
Gas connect console high frequency PCB (141354)



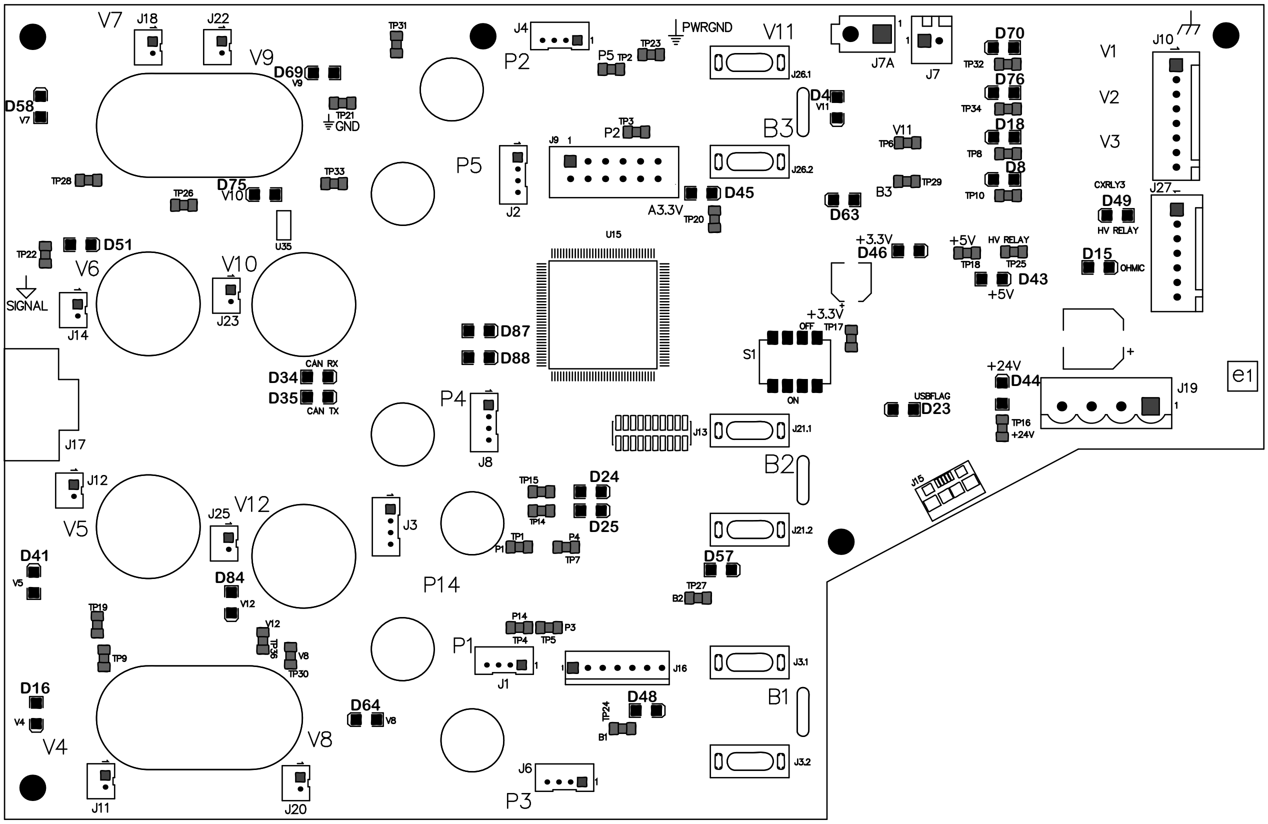
LED	Signal
D1	HIGH FREQUENCY ENABLE

Torch connect console ohmic PCB (141368)

LED	Signal
D2	Ohmic contact



Torch connect console control PCB (141334)

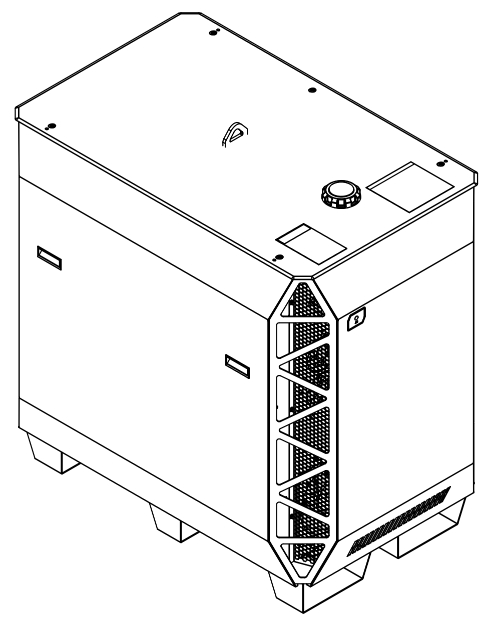


LED	Signal	LED	Signal
D58	V7	D87	STATUS LED
D69	V9	D88	ACTIVITY LED
D75	V10	D45	A3.3 V
D51	V6	D4	V11
D41	V5	D63	B3
D84	V12	D46	+3.3 V
D16	V4	D23	USB FLAG
D64	V8	D43	+5 V
D34	CAN RX	D44	+24 V
D35	CAN TX	D70	V1 TORCH VALVE
D48	B1	D76	V2 (NOT USED IN THIS SYSTEM)
D57	B2	D18	V3 (NOT USED IN THIS SYSTEM)
D49	HV RELAY	D8	(NOT USED IN THIS SYSTEM)
D15	OHMIC CONTACT		

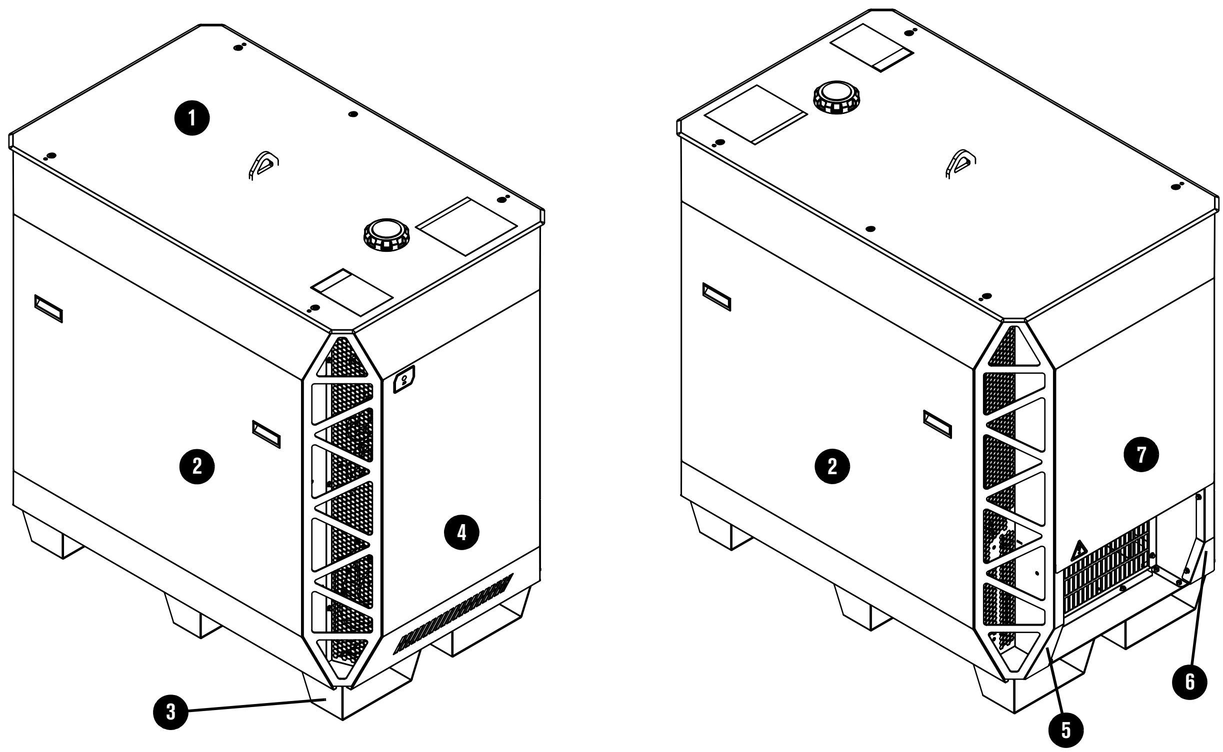
9 Parts List

Plasma power supply

Part number	Voltage (AC)
078620	200
078621	208
078622	220
078623	240
078624	380
078625	400
078626	415
078627	440
078628	480
078629	600

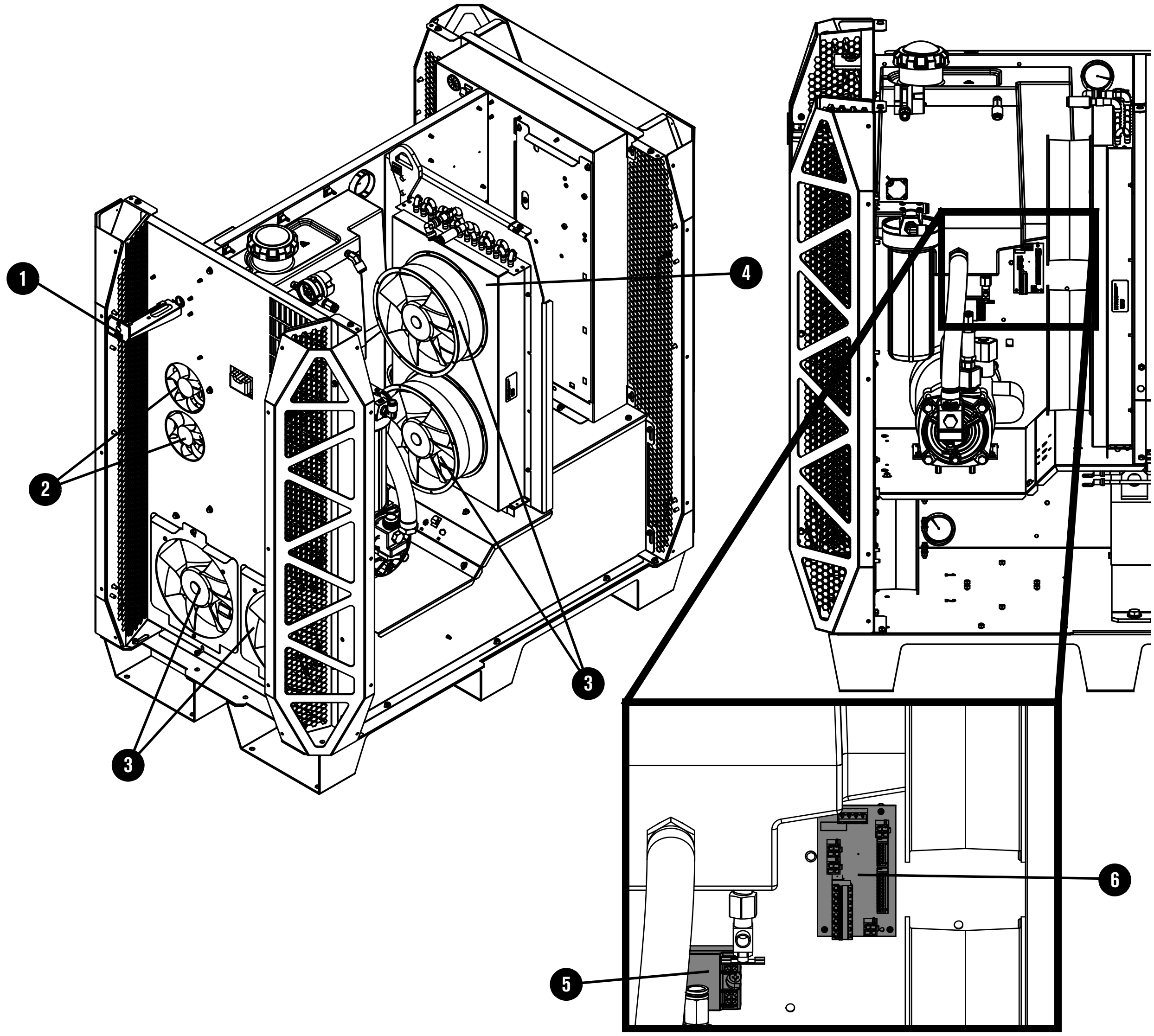


Outer panels



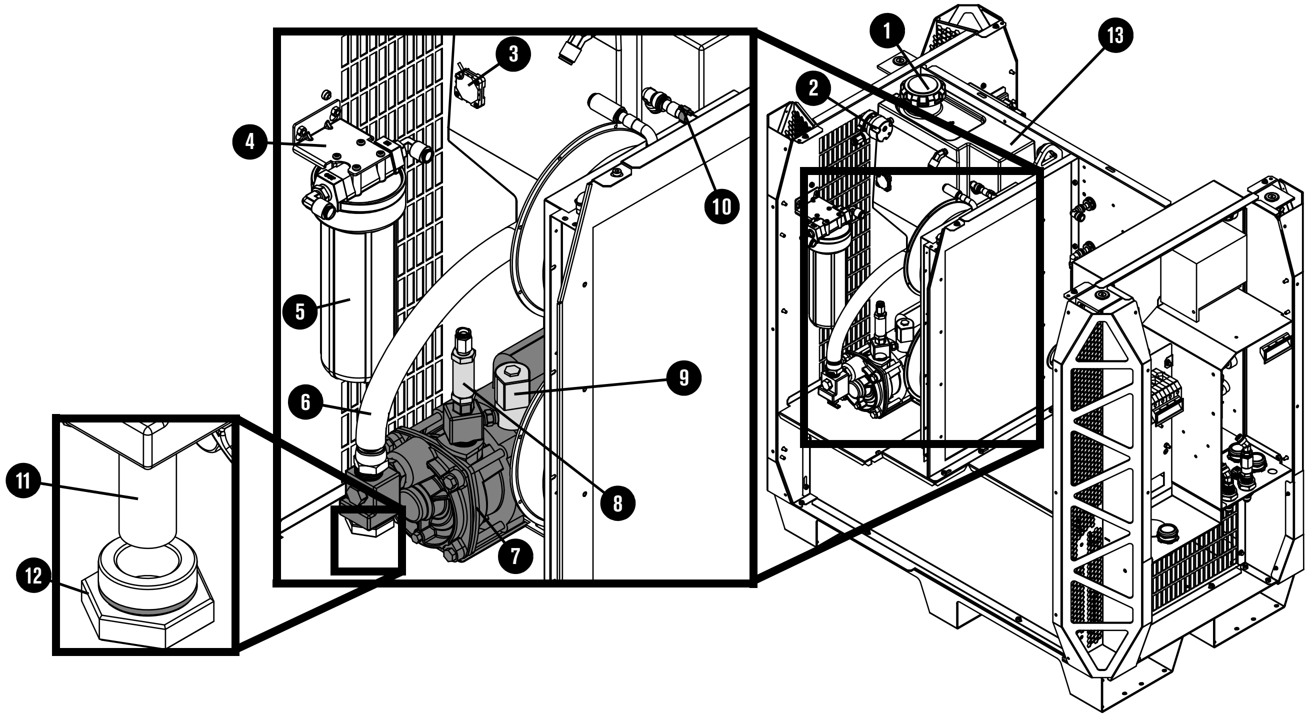
	Part number	Description	Quantity
1	428728	Top panel with labels	1
2	428727	Side panel with labels and handles	2
3	101300	Base	1
4	428725	Front panel with “H” (not shown) and power-indicator LED label	1
5	101314	Lower right (liquid-cooling) rear corner panel	1
6	101307	Lower left (control) rear corner panel	1
7	428726	Rear panel with label and handles	1

Fans



	Part number	Description	Designator	Quantity
1	429002	Power-indicator LED	–	1
2	229821	Fan: 292 cfm, 48 VDC,120 mm (4.7 inch) diameter	CAB FAN3, CAB FAN4	2
3	229822	Fan: 890 cfm, 48 VDC, 254 mm (10 inch) diameter	HX FAN1, HX FAN2, MAG FAN1, MAG FAN2	4
4	229717	Heat-exchanger only	–	1
5	003266	Solid state relay	–	1
6	141384	Fan power distribution PCB	PCB6	1

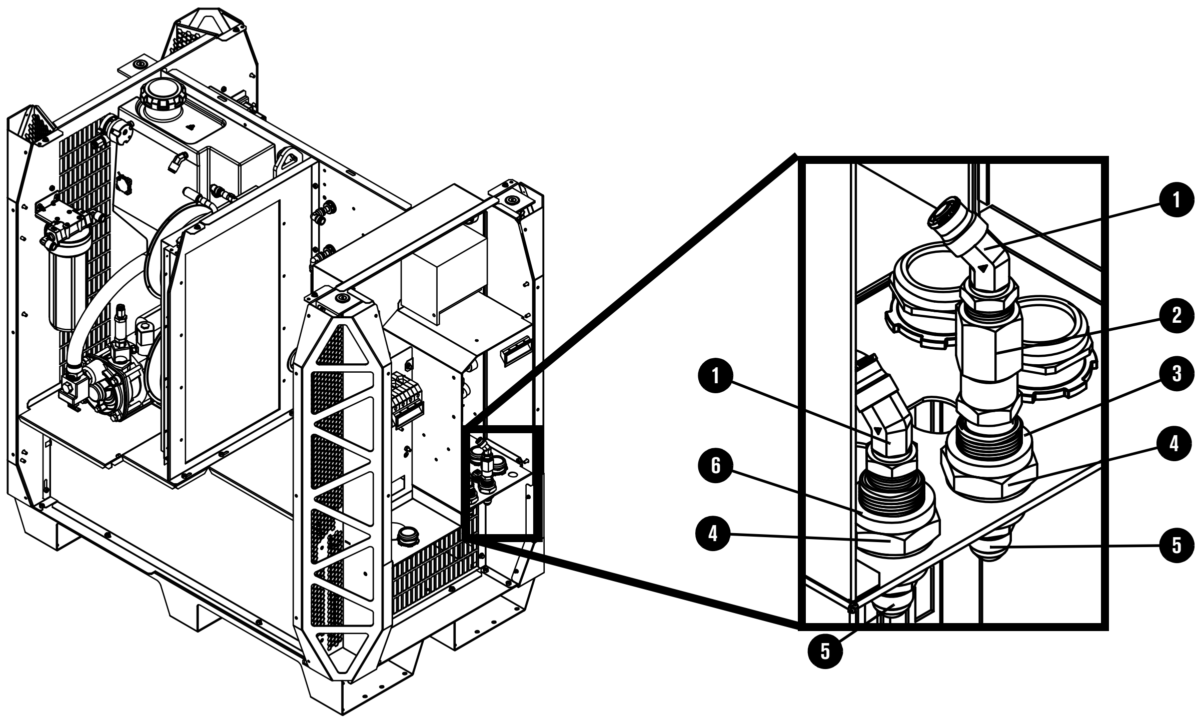
Coolant system



	Part number	Description	Quantity
1	127014	Coolant reservoir cap	1
2	229741	Flow meter	1
3	229775	Coolant level sensor	1
4	101281	Coolant filter bracket	1
5	127344	Coolant filter housing	1
	027005	Coolant filter (fine)	1
6	229777	Coolant hose (1 inch)	1
7	428729	Coolant pump and motor assembly: Adapter: 1-5/8 inch UNF X 1 inch NPT X #16 JIC Plug with O-ring Coolant pump screen (coarse) Pump and motor Adapter: 1 inch MNPT X 1 inch MNPT hexagonal collar Adapter: 1 inch MNPT X 3/8 inch FNPT X 1/4 inch FNPT Adapter: 3/8 inch hexagonal Coolant solenoid valve assembly	1
8	006132	Coolant bypass check valve	1
9	229721	Coolant solenoid valve assembly	1
10	229654	Thermistor: Copper pipe clip with electrical connector	1
11	127559	Coolant pump screen (coarse)	1

	Part number	Description	Quantity
12	229843	Plug and O-ring	1
13	002561	Coolant reservoir	1
	428330	Kit: Tubing (1 inch hose not included)	1

Coolant adapters in the rear compartment

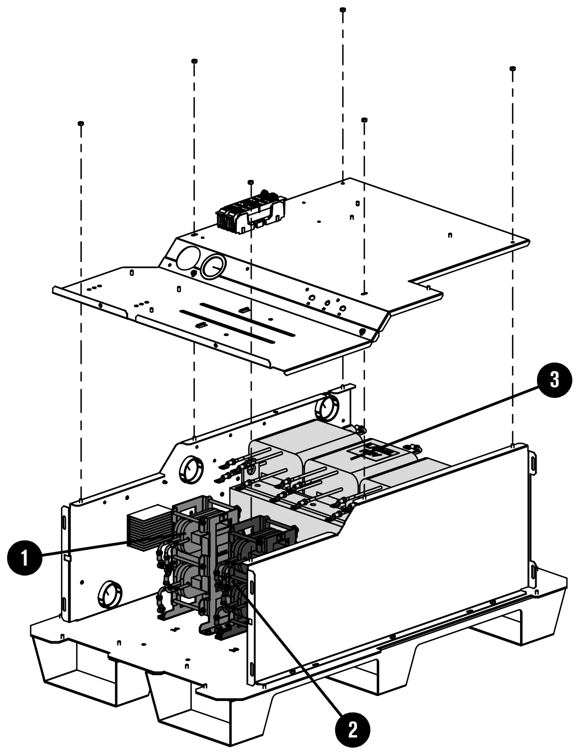


	Part number	Description	Quantity
1	015889	Elbow adapter: 1/2 inch NPT X 1/2 inch tube, 45° swivel	2
2	006154	Coolant check valve	1
3	015903	Red ring: 1.13 inches inner diameter	1
4	015888	Adapter: 1/2 inch FNPT X 1-1/2 inch length bulkhead	2
	015899	Red ring: 0.87 inch inner diameter (not shown)	1
5	015029	Adapter: 1/2 inch NPT X #8 male	2
	015898	Green ring: 0.87 inch inner diameter (not shown)	1
6	015902	Green ring: 1.13 inch inner diameter	1

Other adapters not shown

Part number	Description	Location	Quantity
015669	Male adapter: 3/8 inch NPT X 1/2 inch tube	in coolant solenoid valve	1
006099	Coolant drain valve: 1/4 inch NPT X 3/8 inch tube	in the bottom of the coolant reservoir	1
015073	Adapter: 1/4 inch NPT X 1/4 FPT	in the bottom of the coolant reservoir	1
015738	Elbow adapter: 1/4 inch NPT X 1/2 inch tube, 45° swivel	in the top of the coolant reservoir	1
015510	Adapter: 1/4 inch X hexagonal collar	between the flow meter and coolant reservoir	1
015663	Adapter: 1/4 inch NPT X 1/2 inch tube	in the flow meter and coolant bypass check valve	2
015668	Elbow adapter: 1/2 inch NPT X 1/2 inch tube, 90°	in the coolant filter (fine) assembly	2
104807	Nut for chopper fitting	on the back of choppers	4
015815	Elbow fitting: 1/2 inch tube X 1/2 inch tube, 90°	on the back of the choppers (4) and the heat-exchanger inlet (1)	5
015820	Fitting: 1/2 inch tube X 1/2 inch tube	heat-exchanger outlet	1

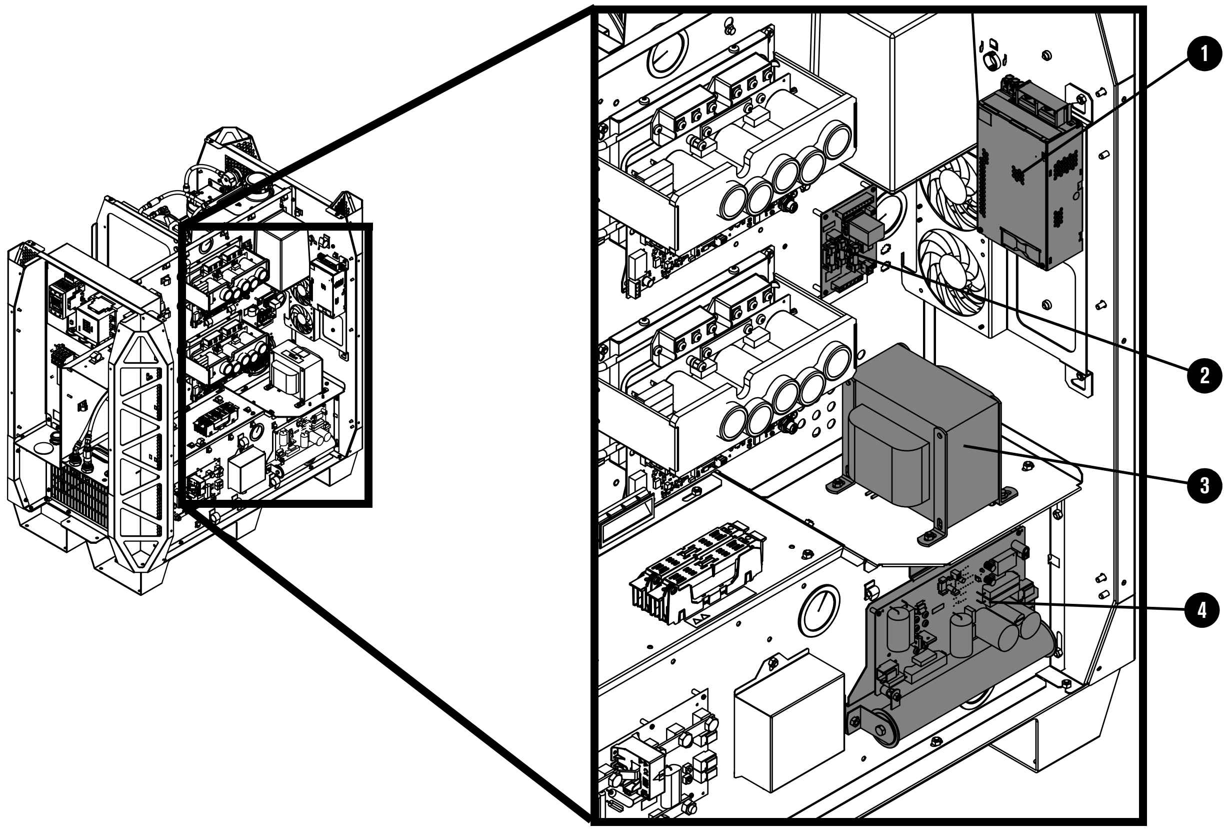
Transformers and inductors



	Part number	Description	Designator	Quantity
1	428844	Kit: Inductor 1A (top)/1B (bottom)	L1	1
2	428845	Kit: Inductor 2A (top)/2B (bottom)	L2	1
3	Transformer, horizontal, 63 kW, 3-phase*			
	–	200 V, 50 Hz – 60 Hz	T2	1
	–	208 V, 60 Hz		
	–	220 V, 50 Hz – 60 Hz		
	–	240 V, 60 Hz		
	–	380 V, 50 Hz – 60 Hz		
	–	400 V, 50 Hz		
	–	415 V, 50 Hz		
	–	440 V, 50 Hz – 60 Hz		
	–	480 V, 60 Hz		
	–	600 V, 60 Hz		

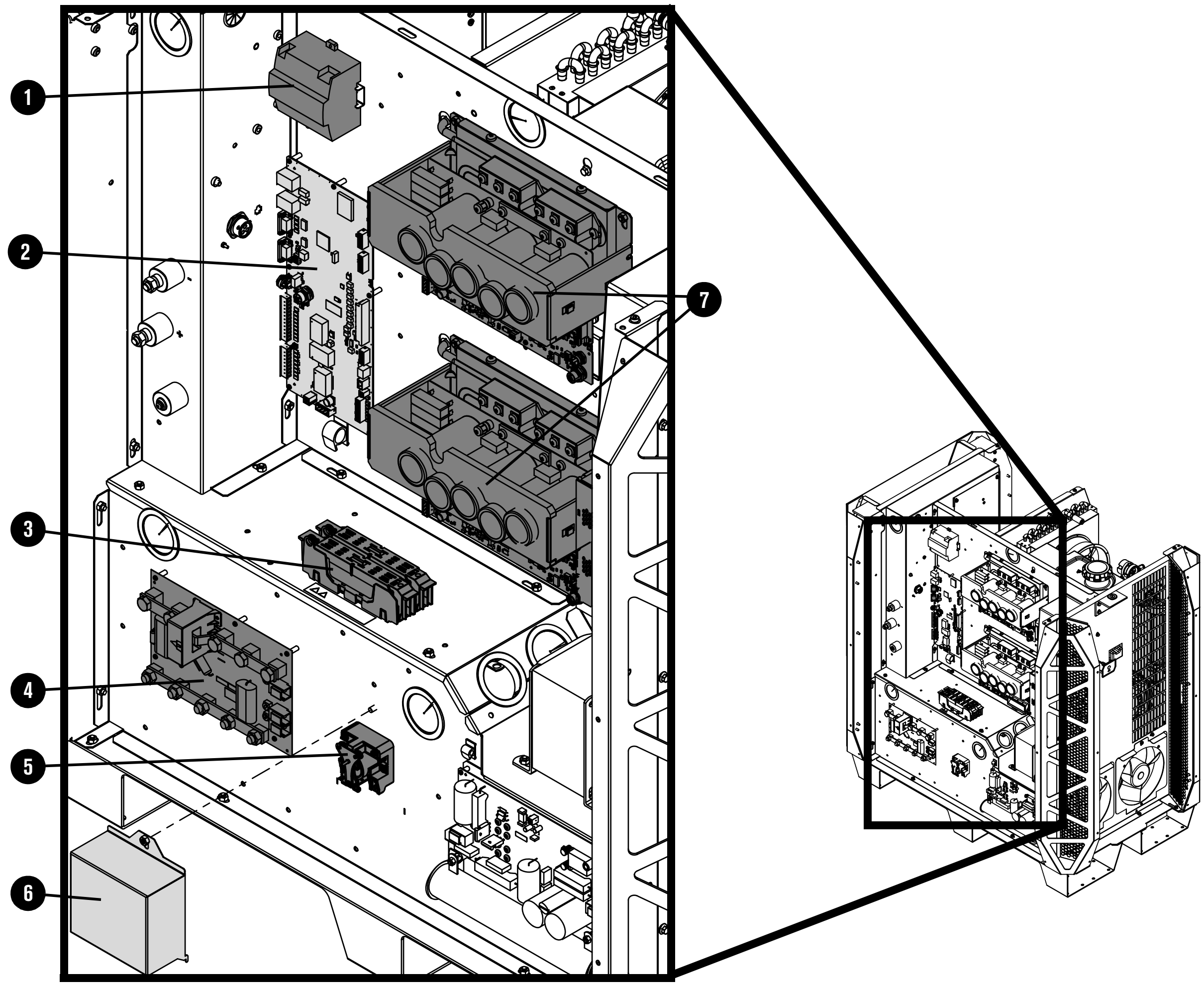
* You cannot purchase this part. Shown for reference only.

Control side – view 1



	Part number	Description	Designator	Quantity
1	229671	Power source: 88 VAC – 264 VAC to 48 VDC, 600 W	PS2	1
2	141425	Power distribution PCB	PCB7	1
	108709	Fuse: 10 A, 250 VAC, time delay (on PCB7)	F3, F4, F5	3
3	**Control transformer assembly, 3 kVA**			
	229809	200 V, 50 Hz – 60 Hz	T1	1
	229810	208 V, 60 Hz, 3 kVA		
	229811	220 V, 50 Hz – 60 Hz		
	229812	240 V, 60 Hz		
	229813	380 V, 50 Hz		
	229814	400 V, 50 Hz		
	229815	415 V, 50 Hz		
	229816	440 V, 50 Hz – 60 Hz		
	229794	480 V, 60 Hz		
	229817	600 V, 60 Hz		
4	229678	Start circuit assembly	PCB4	1

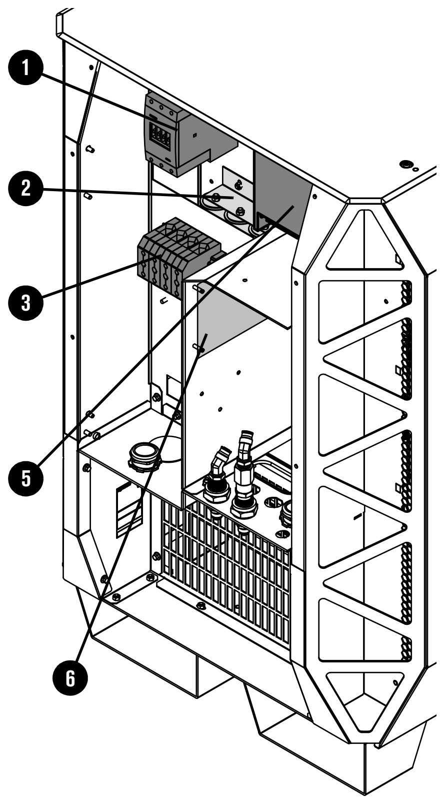
Control side – view 2



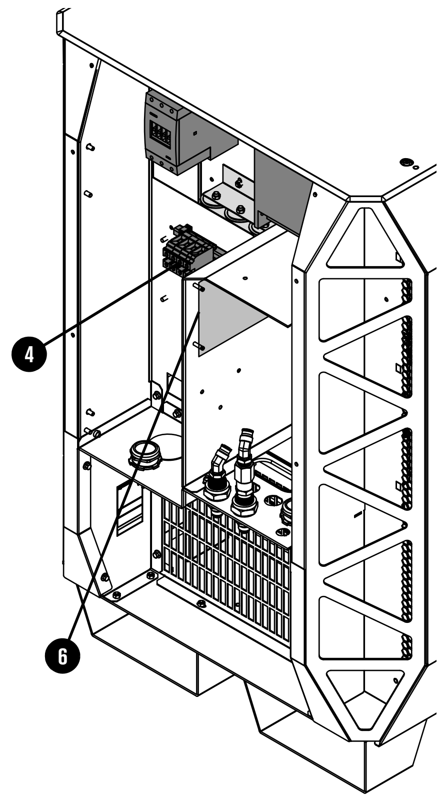
	Part number	Description	Designator	Quantity
1	229640	Power source: 88 VAC – 264 VAC to 24 VDC	PS1	1
2	428750	Control PCB	PCB1	1
3	208394	Fuse holder: 2P, 30 A, 600 V	–	1
	208395	Fuse: 8 A, 600 V, Class R (used in 380 V, 400 V, 415 V, 440 V, 480 V, 600 V)	F1, F2	2
	208397	Fuse: 15 A, 600 V, Class R (used in 200 V, 208 V, 220 V, 240 V)		
4	141371	I/O PCB	PCB5	1
5	003277	Pilot arc relay: 24 VDC, coil, 60 A 28 VDC contacts	CR1	1
6	101316	Pilot arc relay cover	–	1

	Part number	Description	Designator	Quantity
7	229679	Chopper assembly	Chopper 1, Chopper 2	2
	229956	XPR170 wire harness	–	1
	229711	XPR300 wire harness	–	1

Rear compartment of the plasma power supply



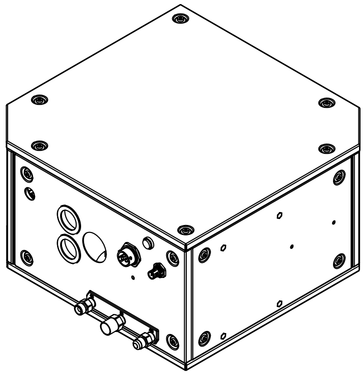
200 V, 208 V, 220 V, 240 V plasma power supplies



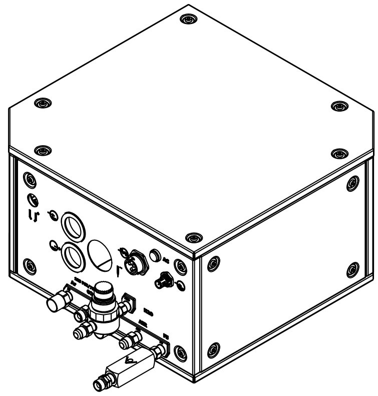
380 V, 400 V, 415 V, 440 V, 480 V, 600 V plasma power supplies

	Part number	Description	Designator	Quantity
1	229697	Inrush contactor assembly: 80 A, IEC AC-3, 3-phase, 120 VAC	IR_CON	1
2	209274	Inrush resistor assembly, 2 Ω X 3	–	1
3	229033	Terminal block 600 V, 200 A (200 V, 208 V, 220 V, 240 V, 380 V, 400 V, 415 V)	TB1	1
4	029316	Terminal block 600 V, 140 A (380 V, 440 V, 480 V, 600 V)		
5	003276	Main contactor (200 V, 208 V, 220 V, 240 V)	M_CON	1
	429060	Main contactor assembly (380 V, 400 V, 415 V, 440 V, 480 V, 600 V)		
6	141511	VDC3 PCB (Optional, for use with RS-422 and discrete cutting systems)	–	1

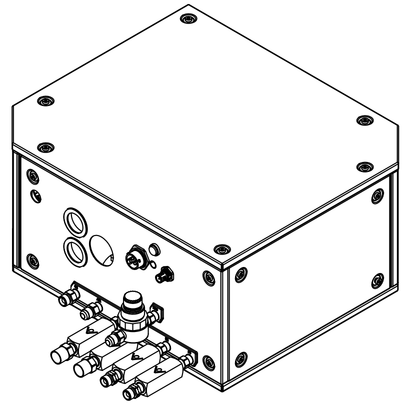
Gas connect consoles



Core



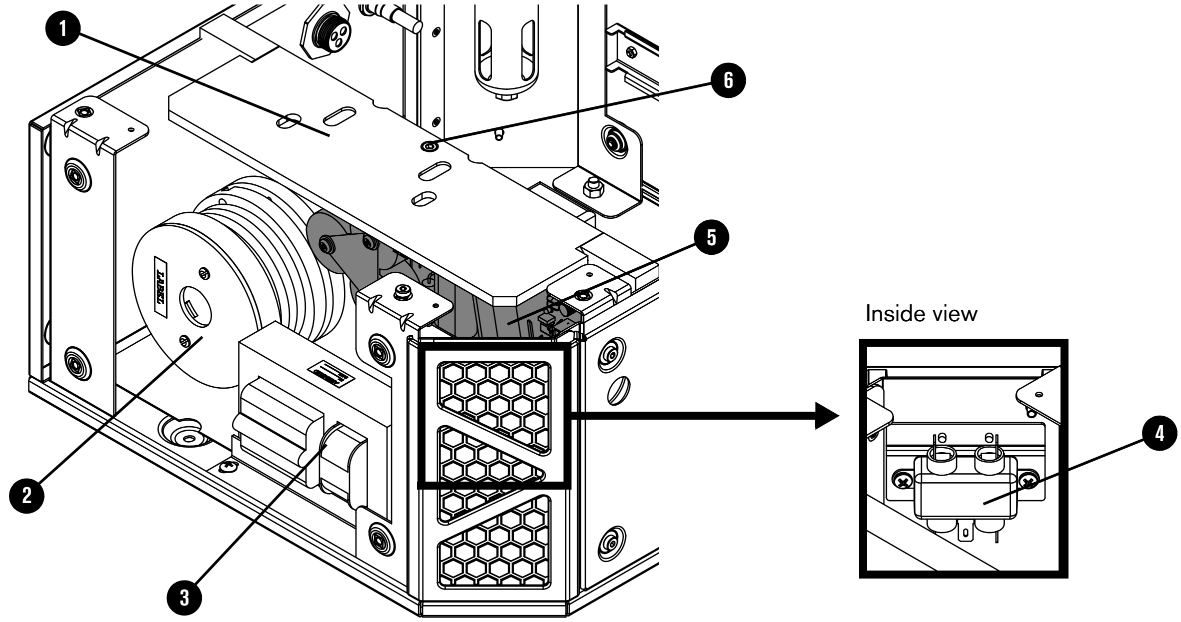
VWI



OptiMix

Part number	Description
078631	Core gas connect console
078632	VWI gas connect console
078633	OptiMix gas connect console

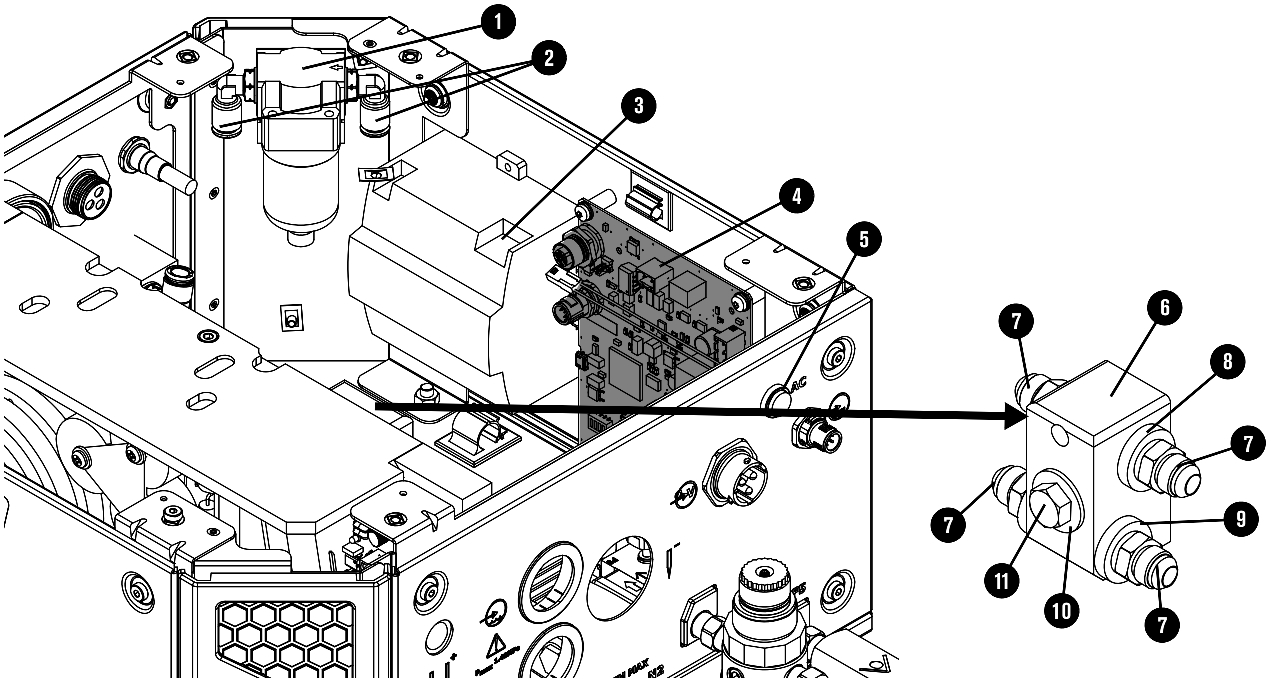
Gas connect console high-voltage side parts



	Part number	Description	Console	Designator	Quantity
1	002570	Insulator	Core, VWI, OptiMix	–	1
2	229837	Coil assembly	Core, VWI, OptiMix	T2	1
3	229838	High-frequency, high-voltage transformer	Core, VWI, OptiMix	T1	1
4	009045	EMI filter	Core, VWI, OptiMix	–	1
5	141354	High-frequency, high-voltage ignition PCB	Core, VWI, OptiMix	PCB2	1
6	075678	Socket head cap screw: M5 – 0.8 X 10 mm hexagonal	Core, VWI, OptiMix	–	1

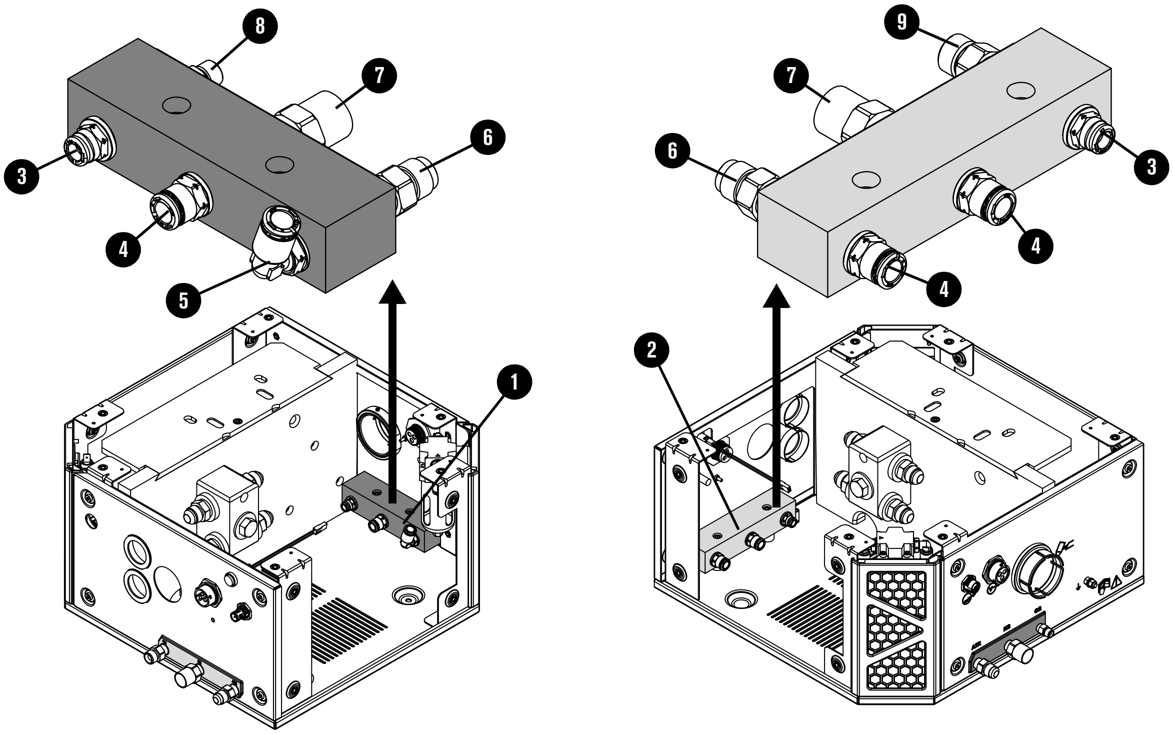
Gas connect console manifold side parts

Core, VWI, and OptiMix gas connect console manifold side



	Part number	Description	Console	Designator	Quantity
1	011151	Air filter assembly	Core, VWI, OptiMix	–	1
	011110	Air filter element	Core, VWI, OptiMix	–	1
2	015853	Male elbow adapter: 1/4 inch NPT X 5/16 inch tube	Core, VWI, OptiMix	–	2
3	229640	Power source: 88 VAC – 264 VAC to 24 VDC	VWI, OptiMix only	–	1
4	141375	Control PCB	Core, VWI, OptiMix	PCB1	1
5	229825	Green power-indicator LED assembly	Core, VWI, OptiMix	–	1
6	104757	Coolant manifold	Core, VWI, OptiMix	–	1
7	015029	Adapter: 1/2 inch NPT X #8 male	Core, VWI, OptiMix	–	4
8	015898	Green ring: 0.87 inches inner diameter	Core, VWI, OptiMix	–	2
9	015899	Red ring: 0.87 inches inner diameter	Core, VWI, OptiMix	–	2
10	075218	Washer	Core, VWI, OptiMix	–	1
11	075140	Bolt	Core, VWI, OptiMix	–	1

Core gas connect console manifolds and adapters



	Part number	Description	Quantity
1	104806	Manifold: Gas output (no adapters)	1
2	104802	Manifold: Gas input (no adapters)	1
	Push-to-connect adapters		
3	015876	1/4 inch NPT X 1/4 inch tube	2
4	015811	1/4 inch NPT X 8 mm tube	3
5	015853	Male elbow: 1/4 inch NPT X 5/16 inch tube	1
	Threaded adapters with thread sealant applied		
6	015012	1/4 inch NPT X #6 male (air output and input)	2
7	015103	1/4 inch NPT X RH ‘B’ inert female (nitrogen output and input)	2
8	015116	1/8 inch NPT X RH ‘A’ male (oxygen output)	1
9	015009	1/4 inch NPT X RH ‘B’ male (oxygen input)	1

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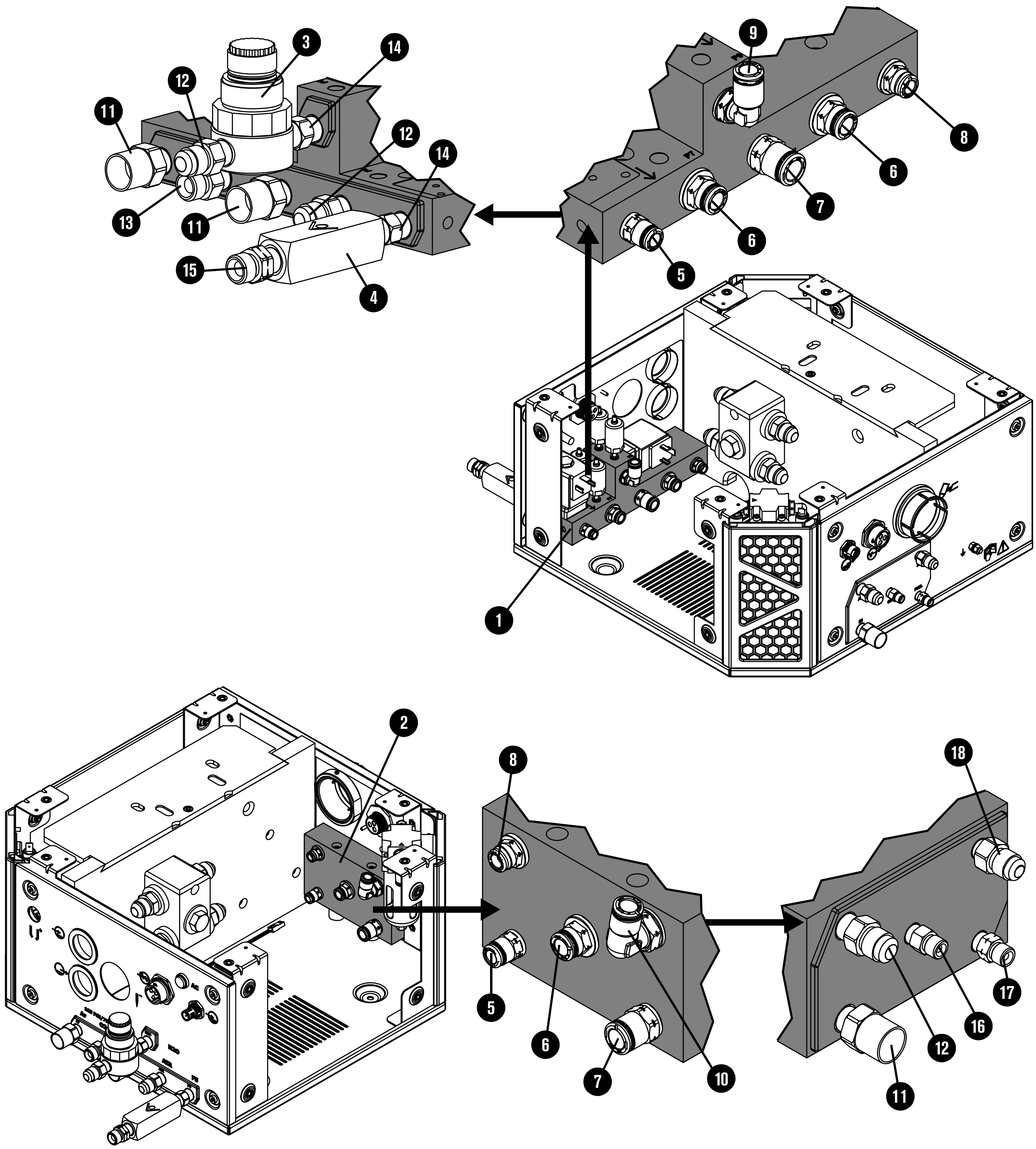
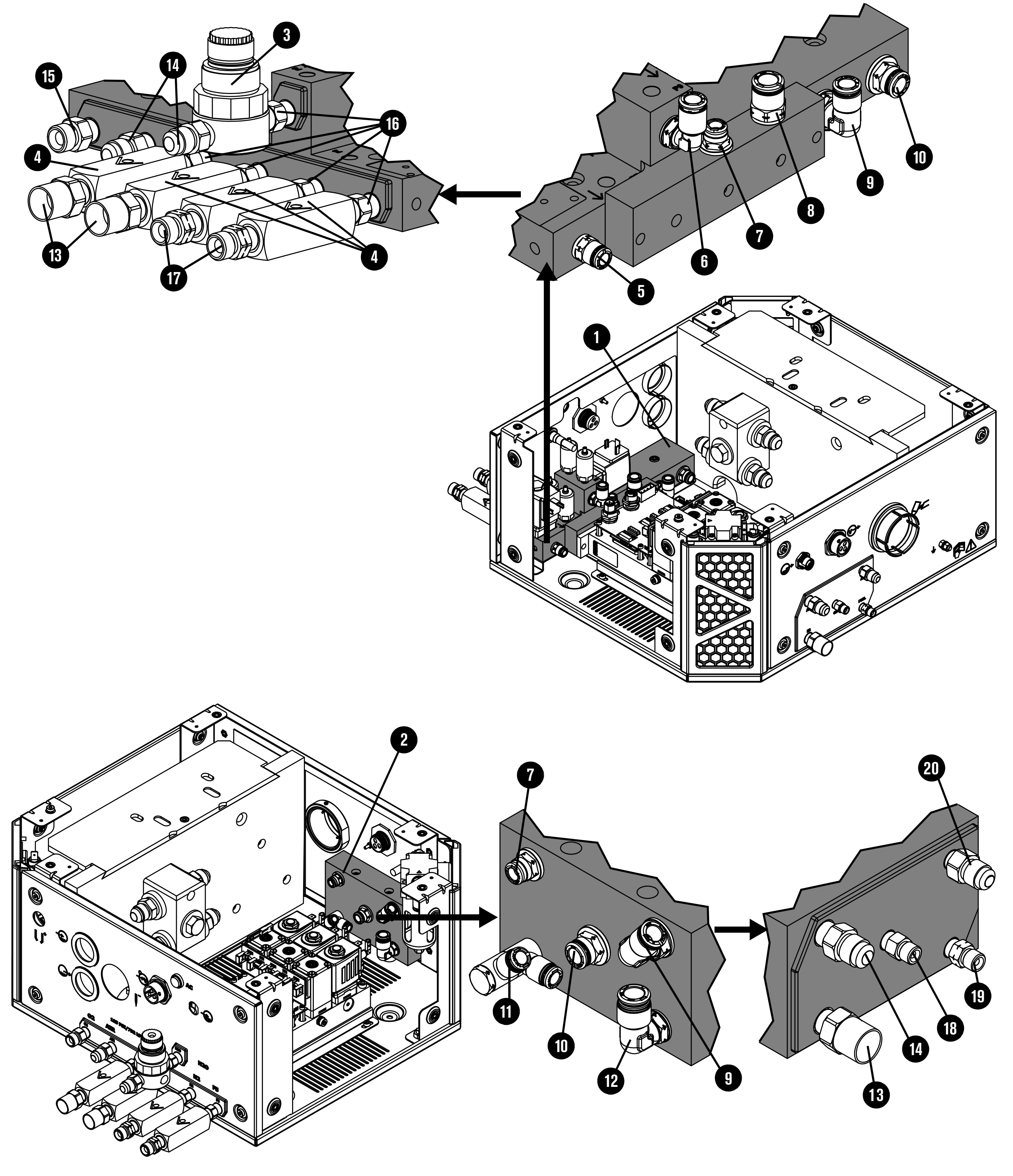
VWI gas connect console input and output manifolds and adapters



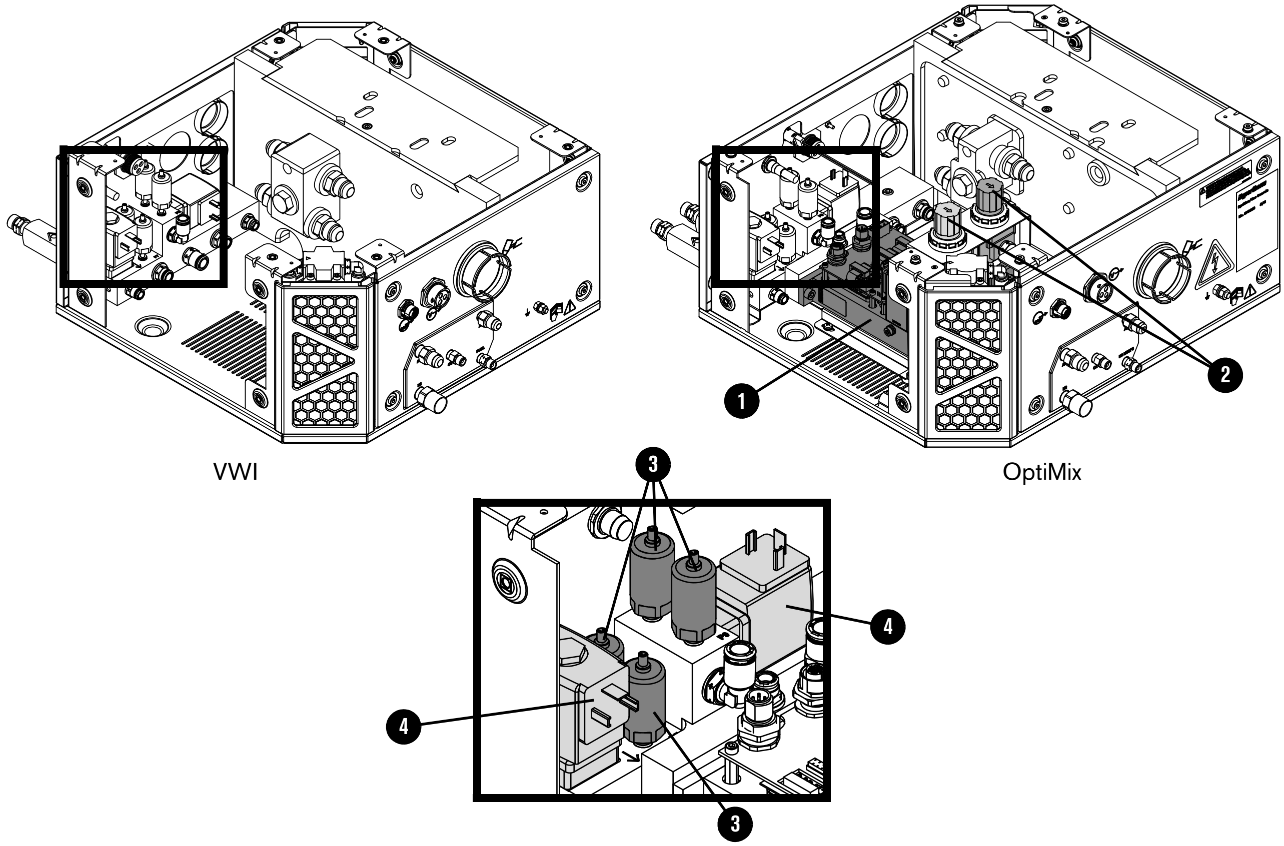
	Part number	Description	Quantity
1	229792	Manifold: Gas input (no adapters)	1
2	104843	Manifold: Gas output (no adapters)	1
3	229844	Water regulator	1
4	006157	Check valve	1
	Push-to-connect adapters		
5	015905	1/8 inch NPT X 1/4 inch tube	2
6	015910	3/8 inch NPT X 5/16 inch tube	2
7	015907	1/4 inch NPT X 3/8 inch tube	1
8	015876	1/4 inch NPT X 1/4 inch tube	1
9	015853	Elbow: 1/4 inch NPT X 5/16 inch tube, 90°	1
10	015909	Elbow: 3/8 inch NPT X 5/16 inch tube, 90°	–
	Threaded adapters with thread sealant applied		
11	015103	1/4 inch NPT X RH ‘B’ inert female	3
12	015012	1/4 inch NPT X #6 male	3
13	015009	1/4 inch NPT X RH ‘B’ male	1
14	015922	1/4 inch X hexagonal collar	2
15	015230	1/4 inch NPT X LH ‘B’	1
16	015116	Adapter: 1/8 inch NPT X RH ‘A’ (oxygen outlet)	1
17	015210	Adapter: 1/8 inch NPT X LH ‘A’ male (hydrogen mix outlet)	1
18	015197	Adapter: 1/8 inch NPT X #5 male (argon outlet)	1

OptiMix gas connect console input and output manifolds and adapters



	Part number	Description	Quantity
1	229793	Manifold: Gas input (no adapters)	1
2	104843	Manifold: Gas output (no adapters)	1
3	229844	Water regulator	1
4	006157	Check valve	4
	Push-to-connect adapters		
5	015905	1/8 inch NPT X 1/4 inch tube	1
6	015853	Elbow: 1/4 inch NPT X 5/16 inch tube	1
7	015876	1/4 inch NPT X 1/4 inch tube	1
8	015907	1/4 inch NPT X 3/8 inch tube	1
9	015909	Elbow: 3/8 inch NPT X 5/16 inch tube	1
10	015910	3/8 inch NPT X 5/16 inch tube	1
11	015906	Dual connection: 1/8 inch NPT X 1/4 inch tube	1
12	015908	Elbow: 1/4 inch NPT X 3/8 inch tube	1
	Threaded adapters with thread sealant applied		
13	015103	1/4 inch NPT X RH ‘B’ inert female	3
14	015012	1/4 inch NPT X #6 male	3
15	015009	1/4 inch NPT X RH ‘B’ male	1
16	015922	1/4 inch X hexagonal collar	5
17	015230	1/4 inch NPT X LH ‘B’	1
18	015116	1/8 inch NPT X RH ‘A’	1
19	015210	1/8 inch NPT X LH ‘A’	1
20	015197	1/8 inch NPT X #5	1

VWI and OptiMix gas connect console mixer, transducers, and valves

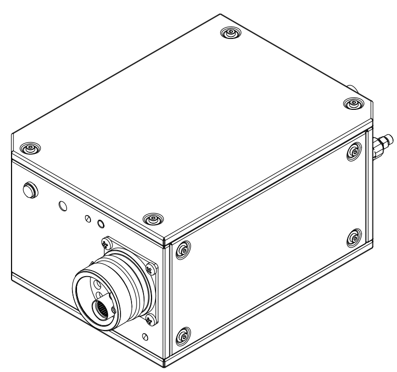


	Part number	Description	Console	Designator	Quantity
1	–	Mixer (You cannot purchase this part. Shown for reference only.)	OptiMix	–	1
2	011101	Regulator	OptiMix	–	2
3	223398	Pressure transducer	VWI and OptiMix	P6 – P9	4
4	006167	Solenoid valve	VWI and OptiMix	B4, B5	2

Gas connect console wire harness, hose kit, and CAN cables

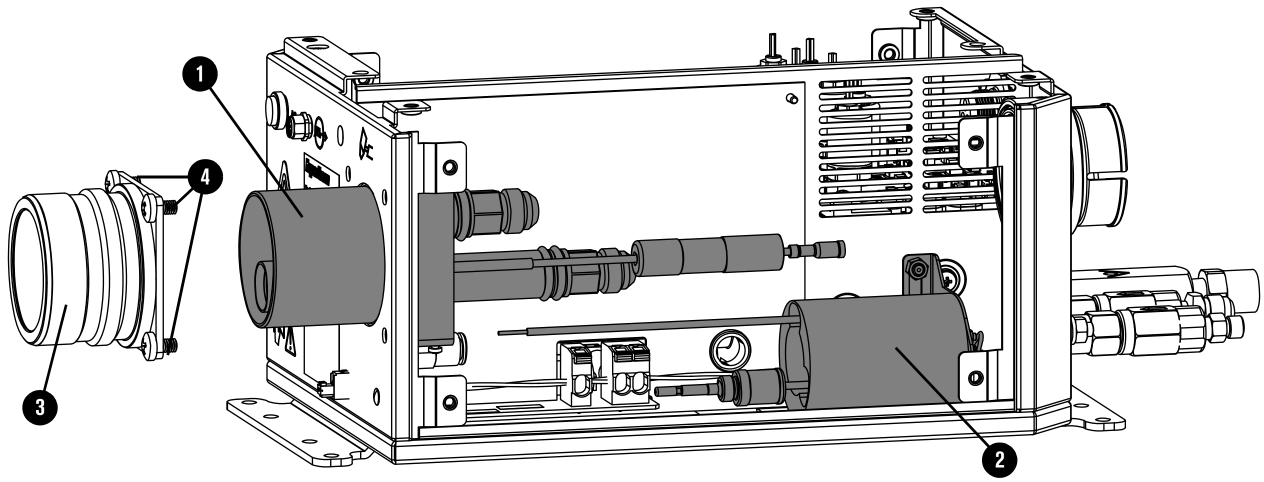
Part number	Description	Console	Quantity
229718	Wire harness	Core	
229719	Wire harness	VWI	1
229720	Wire harness	OptiMix	
428490	Kit: Tubing	Core	
428491	Kit: Tubing	VWI	1
428492	Kit: Tubing	OptiMix	
223709	CAN cable 0.38 m (1.2 ft) to external connector	Core, VWI, OptiMix	1
223710	CAN cable 0.48 m (1.6 ft) male-female	Core, VWI	1
223711	CAN cable 0.5 m (1.6 ft) male-female	OptiMix	1
223712	CAN cable 0.39 m (1.3 ft) male-female	OptiMix	1

Torch connect console



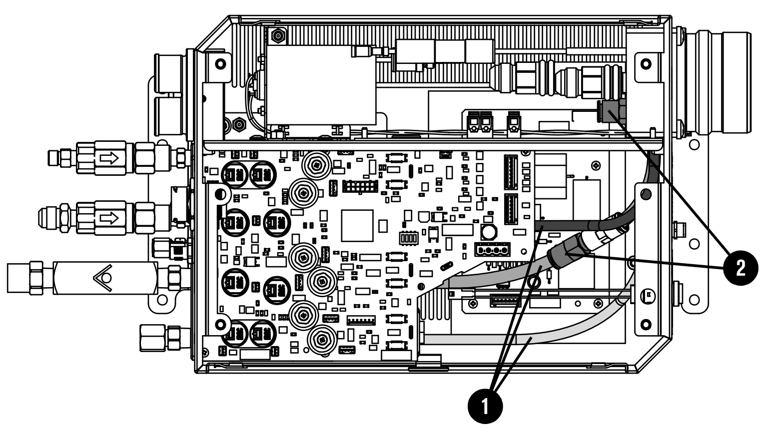
Part number	Description
078618	Torch connect console

Torch connect console Easy Connect side



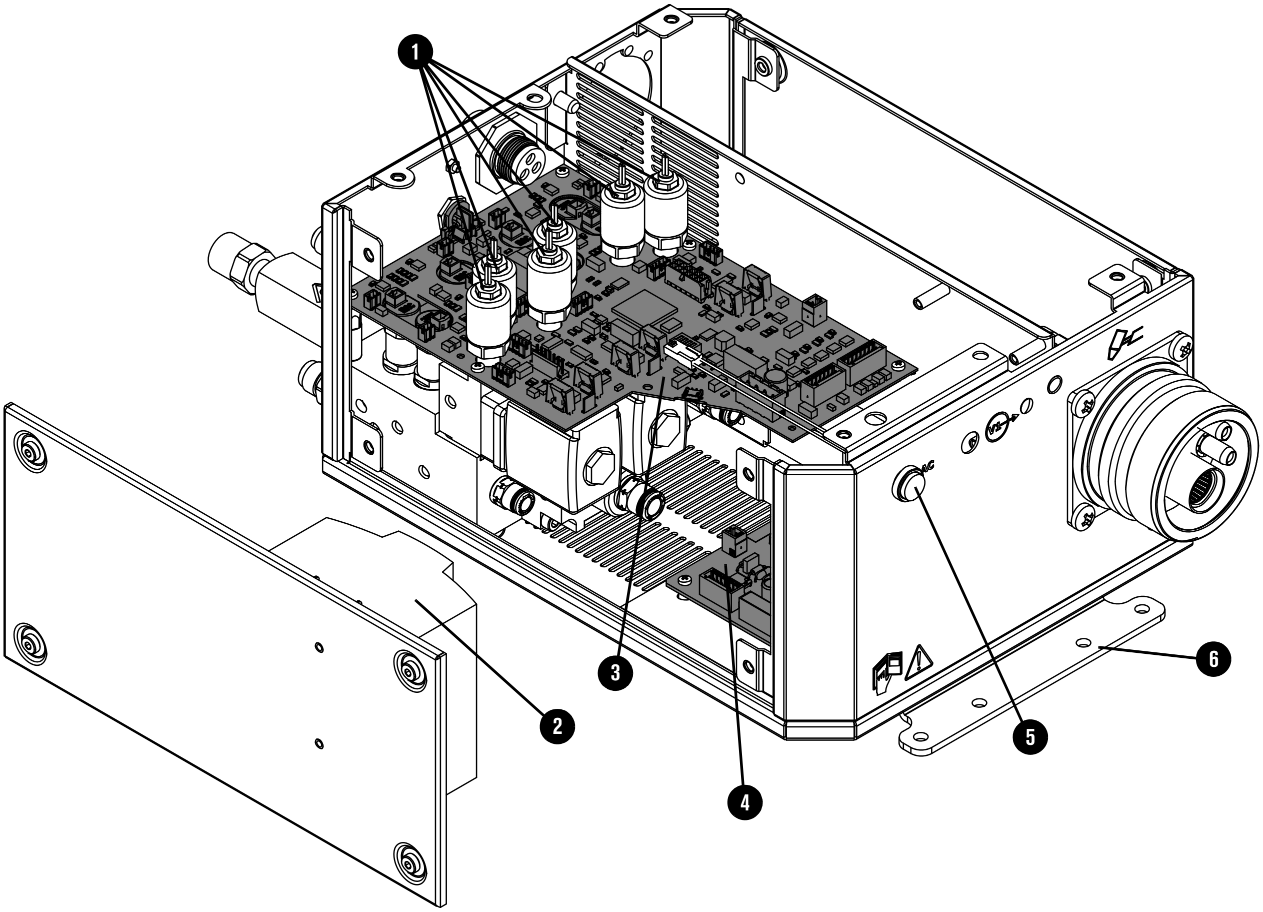
	Part number	Description	Designator	Quantity
1	428730	Torch receptacle block	–	1
2	229882	Ohmic relay and bracket	–	1
3	420376	Torch lead connector	–	1
4	075544	Machine screw: M6 X 10 mm Phillips, pan head	–	4 (3 shown)

Torch connect console – top



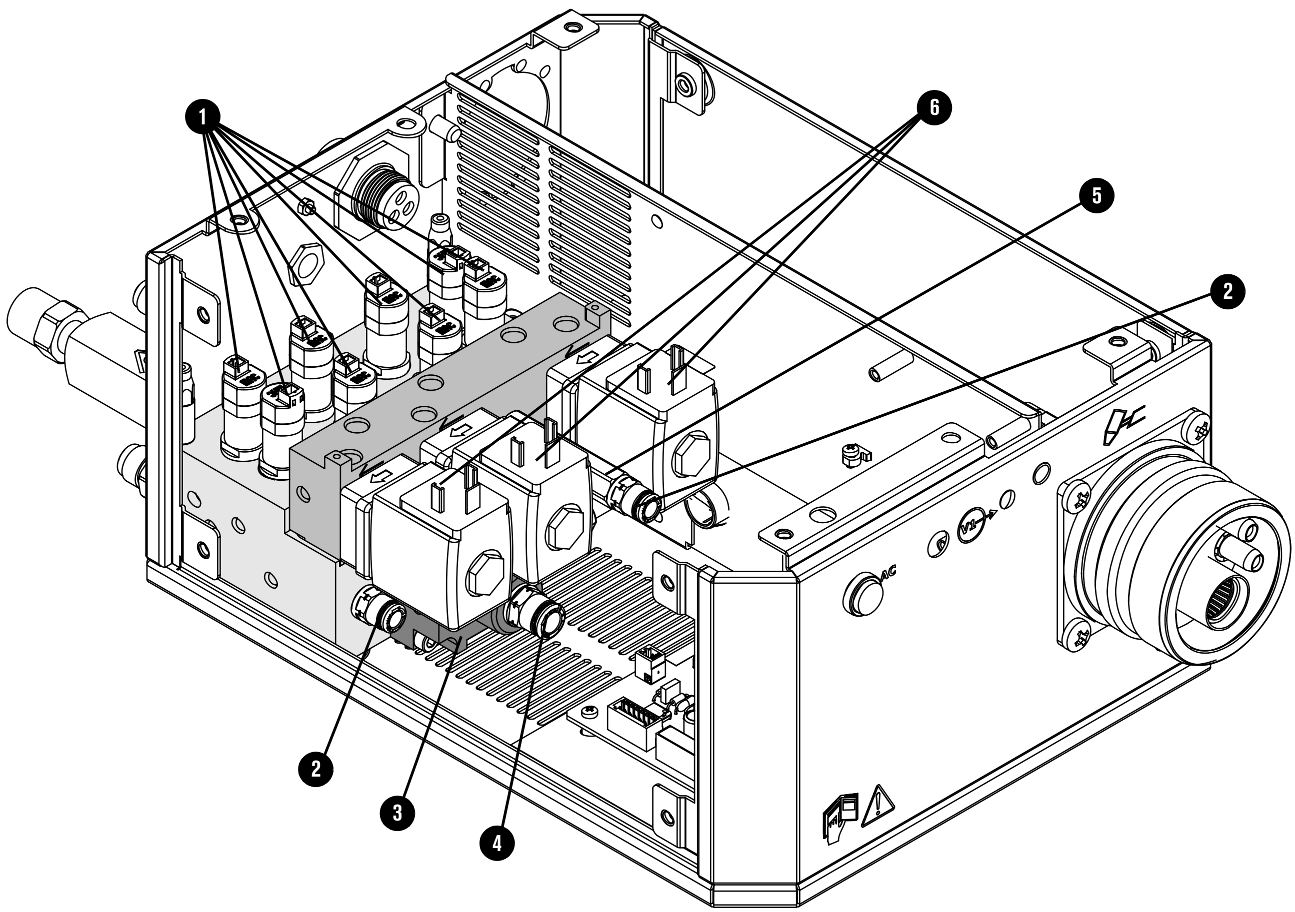
	Part number	Description	Designator	Quantity
1	428338	Kit: Tubing	–	1
2	006152	Check valve	–	2

Torch connect console manifold side – view 1



	Part number	Description	Designator	Quantity
1	223477	Pressure transducer with wire and connector	P1 – P5, P14	6
2	229640	Power source: 88 VAC – 264 VAC to 24 VDC	PS1	1
3	141334	Control PCB	PCB1	1
4	141368	Ohmic contact PCB	PCB2	1
5	229825	Green power-indicator LED assembly	–	1
6	101366	Bracket	–	2 (1 shown)
	229780	Valve cable 40 mm (1.6 inches)	–	8
	229800	Valve cable 279.4 mm (11 inches)	–	1
	229655	Wire harness	–	1

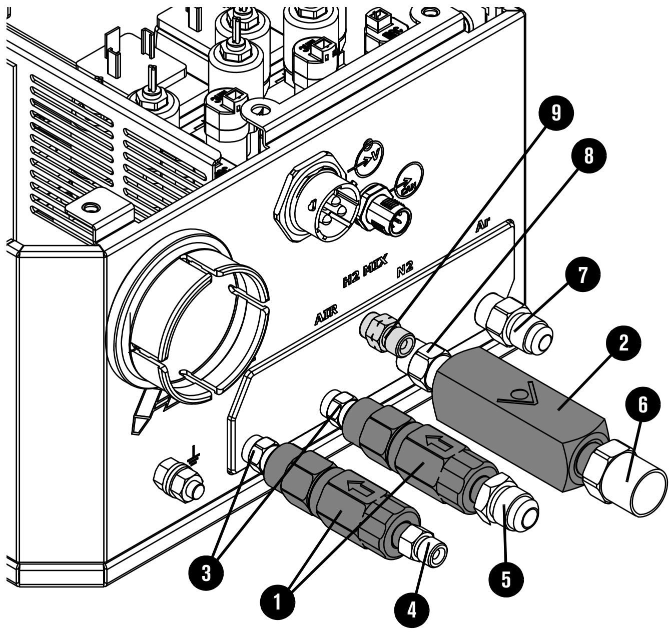
Torch connect console manifold side – view 2



	Part number	Description	Designator	Quantity
	229895	Manifold assembly: ▪ Solenoid valves ▪ Proportional valves ▪ All manifolds ▪ All fittings	–	1
1	229965	Solenoid valve	V4 – V12	9 (8 shown)
	229917	Solenoid valve (229965) tool	–	
2	015905	Adapter: 1/8 inch NPT O-ring seal X 1/4 inch tube	–	2
3	428756	Bottom manifold assembly: ▪ Bottom manifold ▪ Adapter ▪ Critical orifice ▪ Solenoid valve	–	1
4	015811	Adapter: 1/4 inch NPT O-ring seal X 8 mm tube	–	1

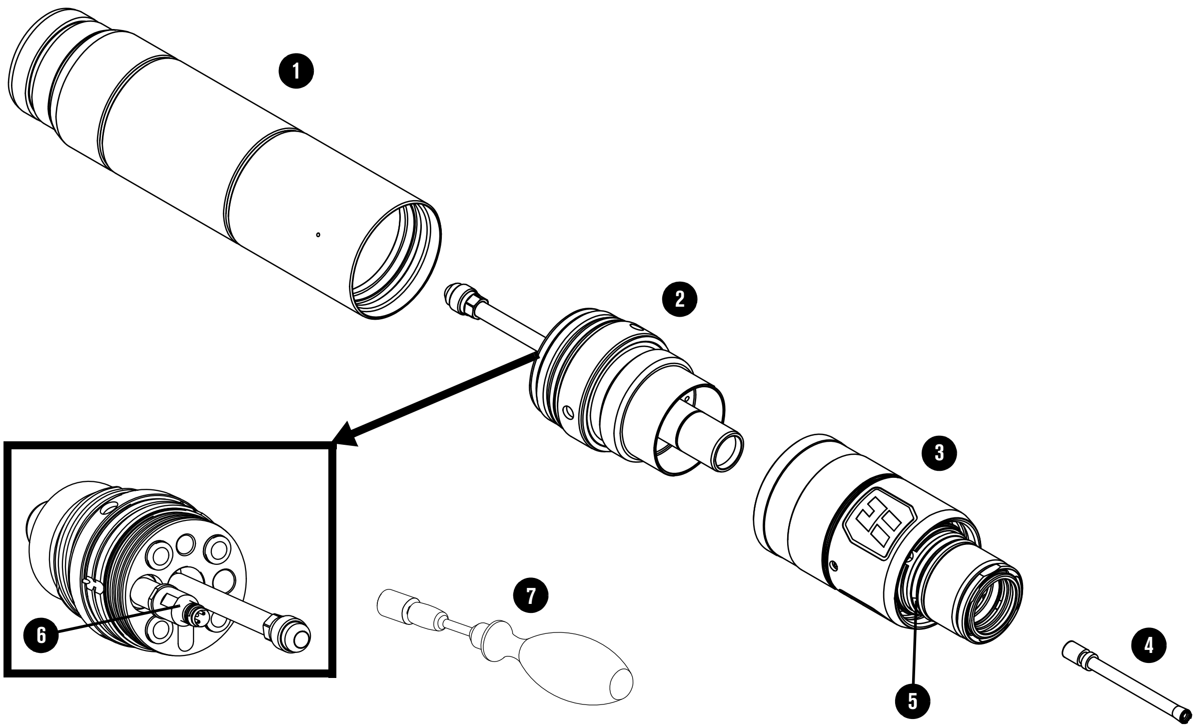
	Part number	Description	Designator	Quantity
5	104406	Adapter: 1/8 inch FPT X1/8 inch NPT X1-5/8 inch	–	1
6	006167	Proportional valve	B1 – B3	3
	044508	O-ring		7

Front adapters and valves



	Part number	Description	Designator	Quantity
1	006077	Check valve: 1/8 inch FPT	–	2
2	006157	Check valve: 1/4 inch NPT female	–	1
	Threaded adapters with thread sealant applied			
3	015517	1/8 inch hexagonal collar	–	2
4	015116	1/8 inch NPT X RH ‘A’	–	1
5	015226	1/8 inch NPT X #6 male	–	1
6	015103	1/4 inch NPT X RH ‘B’ inert female	–	1
7	015007	1/4 inch NPT X #5 male	–	1
8	015922	1/4 inch hexagonal collar	–	1
9	015210	1/8 inch NPT X LH ‘A’ male	–	1

Torch assembly



	Part number	Description
1	420500	Torch mount sleeve assembly: Standard
	420501	Torch mount sleeve assembly: Short
	420502	Torch mount sleeve assembly: Extended
2	420220	Quick-disconnect/torch receptacle
3	420221	Quick-disconnect torch
4	420368	Water tube
5	044028	O-ring for quick-disconnect torch (Refer to *Preventive maintenance kits* on page 393.)
6	006155	Torch solenoid valve (V1)
7	229918	Torch solenoid valve (V1) tool
	006169	Torch solenoid valve connector
	428488	Torch assembly, 300 A mild steel consumables
	104879	2.25 inch spanner wrench

Torch bracket

Part number	Description
428646	Torch lifter bracket: 2.25 inch diameter sleeve

Consumable starter kits

See *Sample configurations for consumables* on page 135 or the *XPR Cut Charts Instruction Manual* (809830) for specific applications.

Mild steel consumable starter kit (428616)

Part number	Description	Quantity
420240	Electrode: 80 A	2
420243	Nozzle: 80 A	2
420246	Shield: 80 A	2
420242	Swirl ring: 80 A – 130 A	2
420249	Electrode: 130 A	3
420252	Nozzle: 130 A	3
420255	Shield: 130 A	2
420261	Nozzle: 170 A	3
420258	Electrode: 170 A	3
420513	Shield: 170 A	2
420260	Swirl ring: 170 A	1
420276	Electrode: 300 A	3
420279	Nozzle: 300 A	3
420491	Shield: 300 A	2
420406	Swirl ring: 300 A	1
420368	Water tube	1
420200	Shield retaining cap	1
420365	Nozzle retaining cap	1
104879	2.25 inch spanner wrench	1
104119	Consumable tool	1
027055	Silicone lubricant, 1/4 ounce	1

Stainless steel and aluminum consumable starter kit (428617)

Part number	Description	Quantity
420288	Nozzle: 40 A	3
420291	Shield: 40 A	2
420297	Nozzle: 60 A	1
420296	Nozzle: 60 A H_2O	1
420306	Nozzle: 80 A	2
420290	Nozzle: 80 A H_2O	2
420469	Shield: 130 A H_2O	1
420356	Electrode: 130 A – 300 A	4
420315	Nozzle: 130 A	2
420318	Shield: 130 A	1
420472	Shield: 170 A H_2O	1
420324	Nozzle: 170 A	3
420327	Shield: 170 A	1
420358	Swirl ring: 300 A fuel	1
420475	Shield: 300 A H_2O	1
420359	Nozzle: 300 A	2
420362	Shield: 300 A	2
420303	Electrode: 40 A – 80 A	3
420309	Shield: 60 A – 80 A	2
420294	Electrode: 40 A – 80 A aluminum air/air	1
420300	Shield: 60 A – 80 A H_2O	1
420314	Swirl ring: 40 A – 170 A multiple processes	1
420323	Swirl ring: 60 A – 300 A multiple processes	1
420368	Water tube	1
420200	Shield retaining cap	1
420365	Nozzle retaining cap	1
104879	2.25 inch spanner wrench	1
104119	Consumable tool	1
027055	Silicone lubricant, 1/4 ounce	1

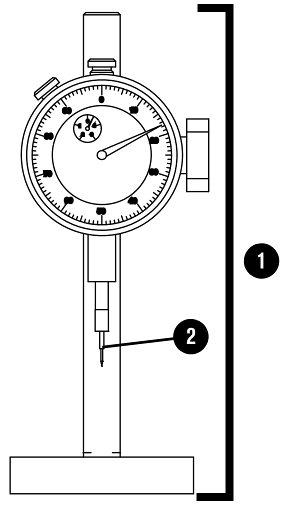
Mild steel consumable starter kit with torch (428618)

Part number	Description	Quantity
420221	Quick-disconnect torch head	1
420240	Electrode: 80 A	2
420243	Nozzle: 80 A	2
420246	Shield: 80 A	2
420242	Swirl ring: 80 A – 130 A	2
420249	Electrode: 130 A	3
420252	Nozzle: 130 A	3
420255	Shield: 130 A	2
420261	Nozzle: 170 A	3
420258	Electrode: 170 A	3
420513	Shield: 170 A	2
420260	Swirl ring: 170 A	1
420276	Electrode: 300 A	3
420279	Nozzle: 300 A	3
420491	Shield: 300 A	2
420406	Swirl ring: 300 A	1
420368	Water tube	2
420200	Shield retaining cap	2
420365	Nozzle retaining cap	2
104879	2.25 inch spanner wrench	1
104119	Consumable tool	1
027055	Silicone lubricant, 1/4 ounce	1

Stainless steel and aluminum consumable starter kit with torch (428619)

Part number	Description	Quantity
420221	Quick-disconnect torch head	1
420288	Nozzle: 40 A	3
420291	Shield: 40 A	2
420297	Nozzle: 60 A	1
420296	Nozzle: 60 A H_2O	1
420306	Nozzle: 80 A	2
420290	Nozzle: 80 A H_2O	2
420469	Shield: 130 A H_2O	1
420356	Electrode: 130 A – 300 A	4
420315	Nozzle: 130 A	2
420318	Shield: 130 A	1
420472	Shield: 170 A H_2O	1
420324	Nozzle: 170 A	3
420327	Shield: 170 A	1
420358	Swirl ring: 300 A fuel	1
420475	Shield: 300 A H_2O	1
420359	Nozzle: 300 A	2
420362	Shield: 300 A	2
420303	Electrode: 40 A – 80 A	3
420309	Shield: 60 A – 80 A	2
420294	Electrode: 40 A – 80 A aluminum air/air	1
420300	Shield: 60 A – 80 A H_2O	1
420314	Swirl ring: 40 A – 170 A multiple processes	1
420323	Swirl ring: 60 A – 300 A multiple processes	1
420368	Water tube	2
420200	Shield retaining cap	2
420365	Nozzle retaining cap	2
104879	2.25 inch spanner wrench	1
104119	Consumable tool	1
027055	Silicone lubricant, 1/4 ounce	1

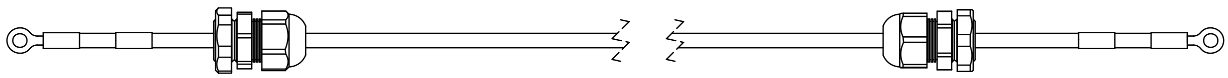
Other consumable and torch parts



	Part number	Description
1	004630	Pit depth gauge
2	004629	Gauge point
	027055	Silicone lubricant, 1/4 ounce
	104119	Consumable tool
	428764	XPR robotic torch teach accessory
	429013	XPR electrode torque tool

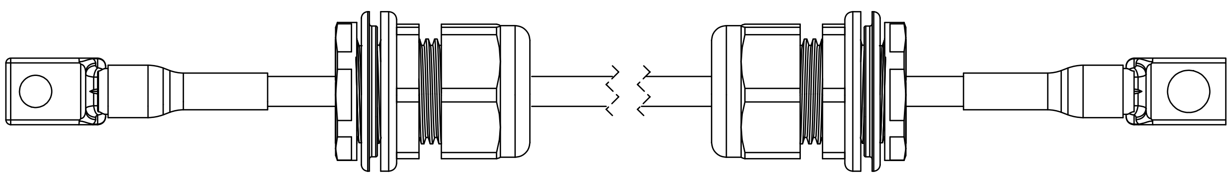
Plasma power supply to gas connect console connections

Pilot arc lead with strain relief



Part number	Length	Part number	Length
223529	3 m (9.8 feet)	223535	25 m (82 feet)
223530	4.5 m (14.8 feet)	223536	35 m (114.8 feet)
223531	7.5 m (24.6 feet)	223537	45 m (147.6 feet)
223532	10 m (32.8 feet)	223538	60 m (196.9 feet)
223533	15 m (49.2 feet)	223539	75 m (246.1 feet)
223534	20 m (65.6 feet)	–	–

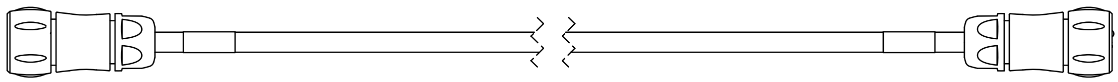
Negative lead with strain relief



Part number	Type	Length	Part number	Type	Length
223573	2/0	3 m (9.8 feet)	223527	4/0	60 m (196.9 feet)
223574	2/0	4.5 m (14.8 feet)	223528	4/0	75 m (246.1 feet)
223575	2/0	7.5 m (24.6 feet)	223551*	2/0	3 m (9.8 feet)
223576	2/0	10 m (32.8 feet)	223552*	2/0	4.5 m (14.8 feet)
223577	2/0	15 m (49.2 feet)	223553*	2/0	7.5 m (24.6 feet)
223578	2/0	20 m (65.6 feet)	223554*	2/0	10 m (32.8 feet)
223579	2/0	25 m (82 feet)	223555*	2/0	15 m (49. 2 feet)
223525	4/0	35 m (114.8 feet)	223556*	2/0	20 m (65.6 feet)
223526	4/0	45 m (147.6 feet)	223557*	2/0	25 m (82 feet)

* Leads labeled with CCC mark only. CCC is defined in *Symbols and marks* on page 26.

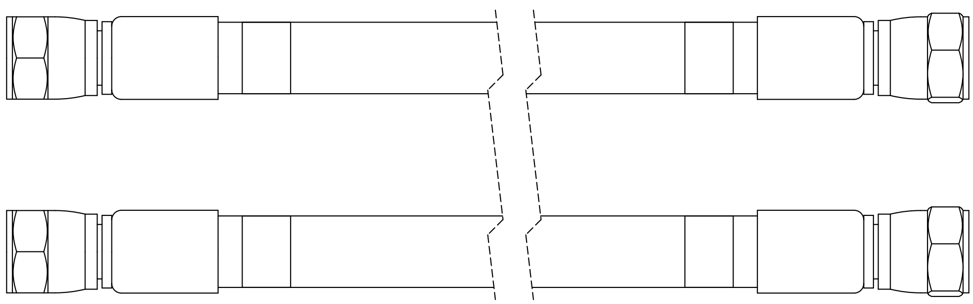
Power cable



Description: 3-position, male-female

Part number	Length	Part number	Length
223436	3 m (9.8 feet)	223446	25 m (82 feet)
223437	4.5 m (14.8 feet)	223447	35 m (114.8 feet)
223439	7.5 m (24.6 feet)	223448	45 m (147.6 feet)
223441	10 m (32.8 feet)	223449	60 m (196.9 feet)
223444	15 m (49.2 feet)	223450	75 m (246.1 feet)
223445	20 m (65.6 feet)	–	–

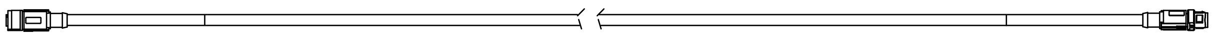
Coolant hose set



Description: 1.27 cm (0.50 inch) internal diameter

Part number	Length	Part number	Length
428475	3 m (9.8 feet)	428481	25 m (82 feet)
428476	4.5 m (14.8 feet)	428482	35 m (114.8 feet)
428477	7.5 m (24.6 feet)	428483	45 m (147.6 feet)
428478	10 m (32.8 feet)	428484	60 m (196.9 feet)
428479	15 m (49.2 feet)	428485	75 m (246.1 feet)
428480	20 m (65.6 feet)	–	–

CAN cable

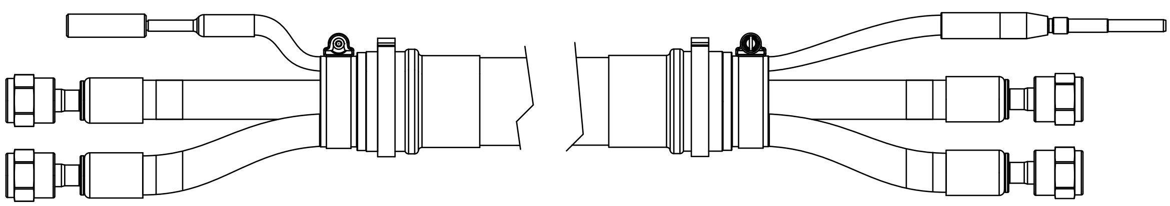


Description: 5-position, male-female

Part number	Length	Part number	Length
223417	3 m (9.8 feet)	223427	25 m (82 feet)
223418	4.5 m (14.8 feet)	223428	35 m (114.8 feet)
223420	7.5 m (24.6 feet)	223429	45 m (147.6 feet)
223422	10 m (32.8 feet)	223430	60 m (196.9 feet)
223425	15 m (49.2 feet)	223431	75 m (246.1 feet)
223426	20 m (65.6 feet)	–	–

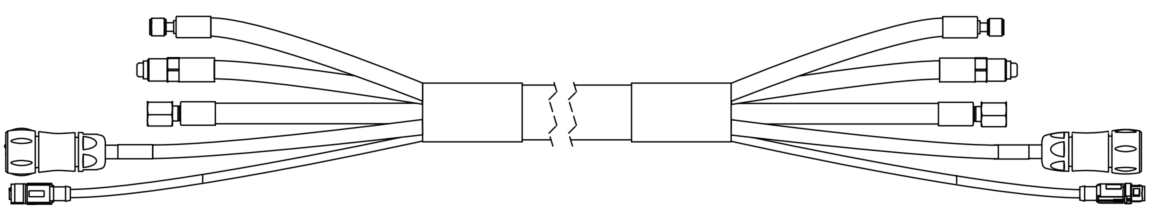
Gas connect console to torch connect console connections

Pilot arc and coolant hose set assembly (Core)



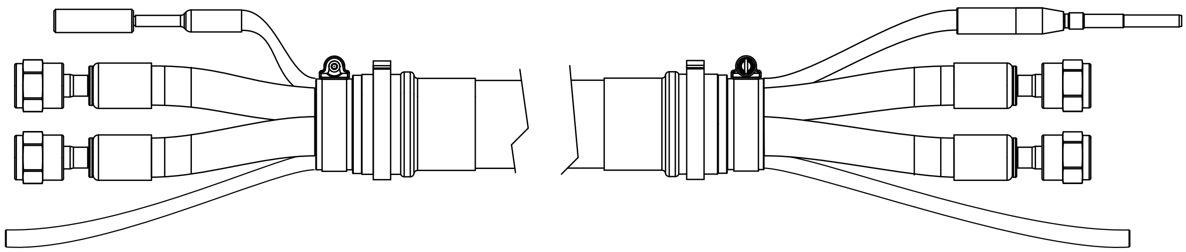
Part number	Length	Part number	Length
428454	3 m (9.8 feet)	428457	7.5 m (24.6 feet)
428455	4.5 m (14.8 feet)	428458	10 m (32.8 feet)
428456	6 m (19.7 feet)	428459	15 m (49.2 feet)

Power, CAN, and 3-gas assembly (Core)



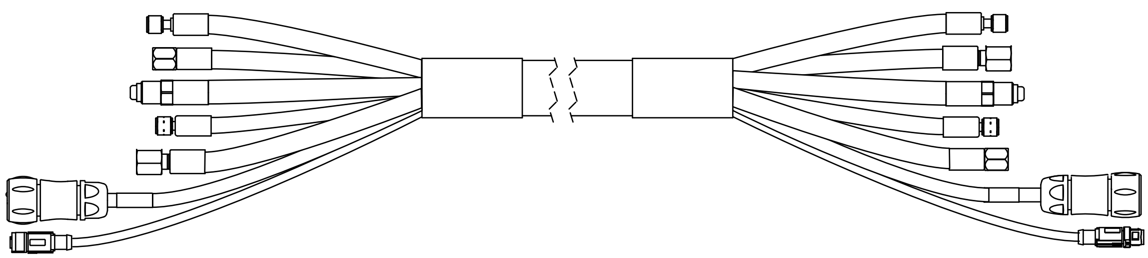
Part number	Length	Part number	Length
428464	3 m (9.8 feet)	428467	7.5 m (24.6 feet)
428465	4.5 m (14.8 feet)	428468	10 m (32.8 feet)
428466	6 m (19.7 feet)	428469	15 m (49.2 feet)

Pilot arc, coolant hose set, and shield water assembly (VWI or OptiMix)



Part number	Length	Part number	Length
428353	3 m (9.8 feet)	428356	7.5 m (24.6 feet)
428354	4.5 m (14.8 feet)	428357	10 m (32.8 feet)
428355	6 m (19.7 feet)	428358	15 m (49.2 feet)

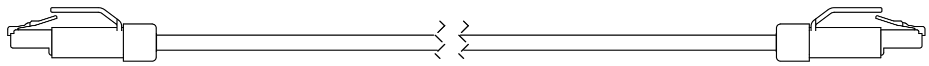
Power, CAN, and 5-gas assembly (VWI or OptiMix)



Part number	Length	Part number	Length
428363	3 m (9.8 feet)	428366	7.5 m (24.6 feet)
428364	4.5 m (14.8 feet)	428367	10 m (32.8 feet)
428365	6 m (19.7 feet)	428368	15 m (49.2 feet)

Plasma power supply to CNC connections

EtherCAT CNC interface cable

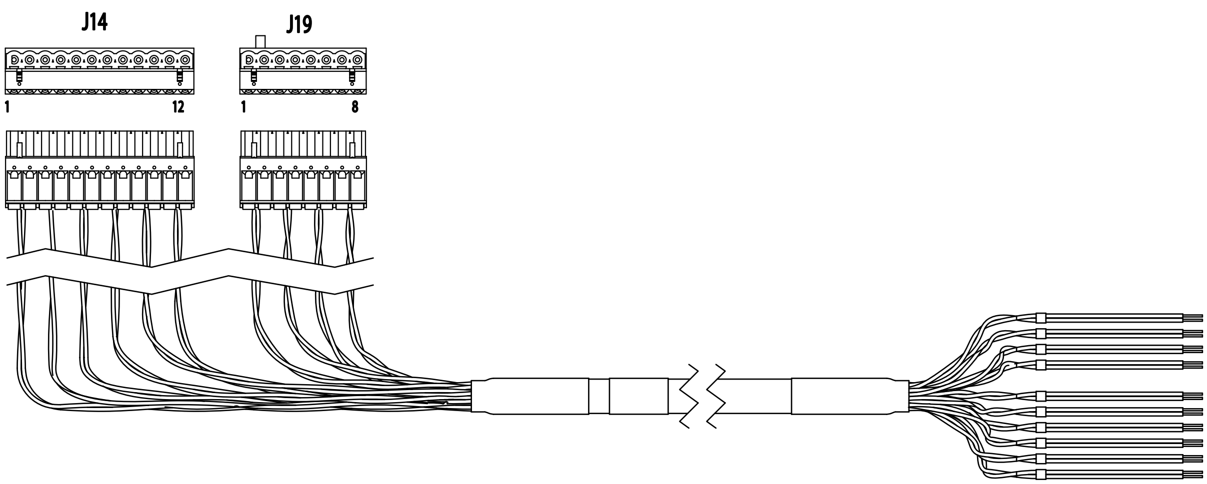


Description: RJ-45 connector, male-male, SF/UTP shield, 2 twisted pairs, 22 AWG

For more information on EtherCAT cable specifications, see *How to connect to the plasma power supply with EtherCAT* on page 145.

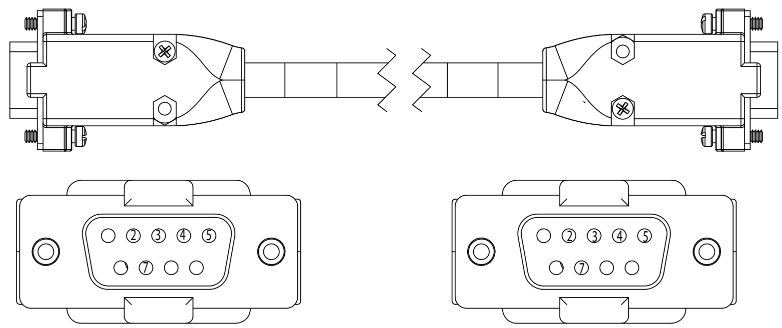
Part number	Length	Part number	Length
223506	0.3 m (1 foot)	223512	10 m (32.8 feet)
223507	0.6 m (2 feet)	223513	15 m (49.2 feet)
223508	1.5 m (4.9 feet)	223514	22.5 m (73.8 feet)
223672	2.5 m (8.2 feet)	223515	30 m (98.4 feet)
223509	3 m (9.8 feet)	223516	45 m (147.6 feet)
223510	6 m (19.7 feet)	223517	60 m (196.9 feet)
223511	7.5 m (24.6 feet)	223714	75 m (246.1 feet)

Discrete CNC interface cable



Part number	Length	Part number	Length
223691	3 m (9.8 feet)	223700	20 m (65.6 feet)
223692	4.5 m (14.8 feet)	223701	22.5 m (73.8 feet)
223693	6 m (19.7 feet)	223702	25 m (82 feet)
223694	7.5 m (24.6 feet)	223703	30 m (98.4 feet)
223695	10 m (32.8 feet)	223704	35 m (114.8 feet)
223696	12 m (39.4 feet)	223705	37.5 m (123 feet)
223697	13.5 m (44.3 feet)	223706	45 m (147.6 feet)
223698	15 m (49.2 feet)	223707	60 m (196.9 feet)
223699	16.5 m (54.1 feet)	223708	75 m (246.1 feet)

Serial CNC interface cable

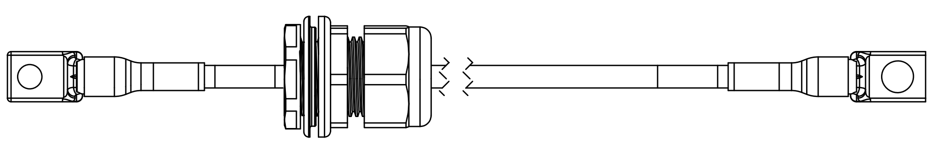


Description: 9-position, D-subminiature (D-sub) connector, male-male, RS-422

Part number	Length	Part number	Length
223673	3 m (9.8 feet)	223682	20 m (65.6 feet)
223674	4.5 m (14.8 feet)	223683	22.5 m (73.8 feet)
223675	6 m (19.7 feet)	223684	25 m (82.0 feet)
223676	7.5 m (24.6 feet)	223685	30 m (98.4 feet)
223677	10 m (32.8 feet)	223686	35 m (114.8 feet)
223678	12 m (39.4 feet)	223687	37.5 m (123 feet)
223679	13.5 m (44.3 feet)	223688	45 m (147.6 feet)
223680	15 m (49.2 feet)	223689	60 m (196.9 feet)
223681	16.5 m (54.1 feet)	223690	75 m (246.1 feet)

Plasma power supply to cutting table connection

Work lead

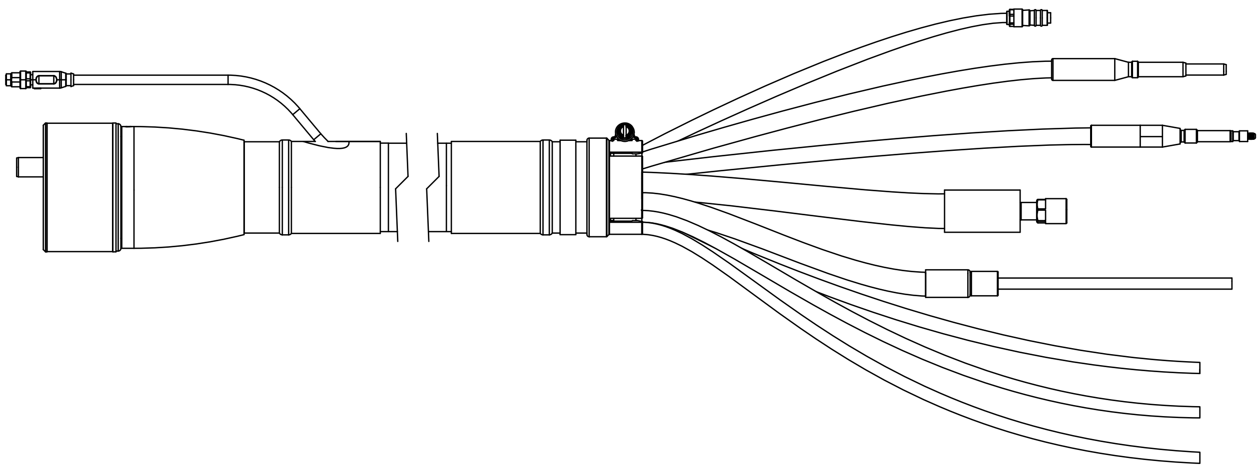


Part number	Type	Length	Part number	Type	Length
223628	2/0	3 m (9.8 feet)	223648	4/0	60 m (196.9 feet)
223629	2/0	4.5 m (14.8 feet)	223649	4/0	75 m (246.1 feet)
223630	2/0	7.5 m (24.6 feet)	223661*	2/0	3 m (9.8 feet)
223631	2/0	10 m (32.8 feet)	223662*	2/0	4.5 m (14.8 feet)
223632	2/0	15 m (49.2 feet)	223663*	2/0	7.5 m (24.6 feet)
223633	2/0	20 m (65.6 feet)	223664*	2/0	10 m (32.8 feet)
223634	2/0	25 m (82 feet)	223665*	2/0	15 m (49.2 feet)
223646	4/0	35 m (114.8 feet)	223666*	2/0	20 m (65.6 feet)
223647	4/0	45 m (147.6 feet)	223667*	2/0	25 m (82 feet)

* Leads labeled with CCC mark only. CCC is defined in *Symbols and marks* on page 26.

Torch connect console to torch receptacle connection

Torch lead



Part number	Length	Part number	Length
428383	2 m (6.6 feet)	428386	3.5 m (11.5 feet)
428384	2.5 m (8.2 feet)	428387	4.5 m (14.8 feet)
428385	3 m (9.8 feet)	–	–

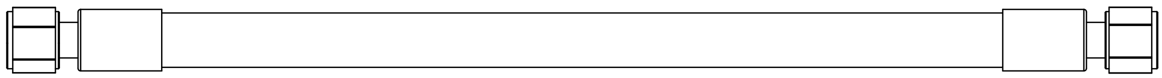
Bevel torch lead

Part number	Lead length	Strain relief length	Part number	Lead length	Strain relief length
428825	2 m (6.6 feet)	0.5 m (20 inches)	428831	2 m (6.6 feet)	1.2 m (48 inches)
428826	2.5 m (8.2 feet)		428832	2.5 m (8.2 feet)	
428827	3 m (9.8 feet)		428833	3 m (9.8 feet)	
428828	3.5 m (11.5 feet)		428834	3.5 m (11.5 feet)	
428830	4.5 m (14.8 feet)		428836	4.5 m (14.8 feet)	

Supply hoses

Oxygen hose (blue)

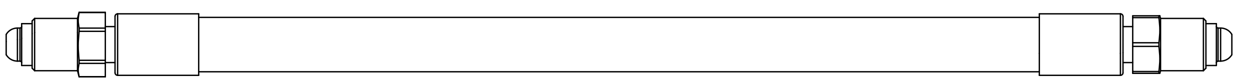
Fittings: RH type “B” female



Part number	Length	Part number	Length
124003	3 m (9.8 feet)	124009	25 m (82 feet)
124004	4.5 m (14.8 feet)	124107	30 m (98.4 feet)
124005	7.5 m (24.6 feet)	124010	35 m (114.8 feet)
124006	10 m (32.8 feet)	124011	45 m (147.6 feet)
124007	15 m (49.2 feet)	124012	60 m (196.9 feet)
124008	20 m (65.6 feet)	124013	75 m (246.1 feet)

Nitrogen or Argon hose (black)

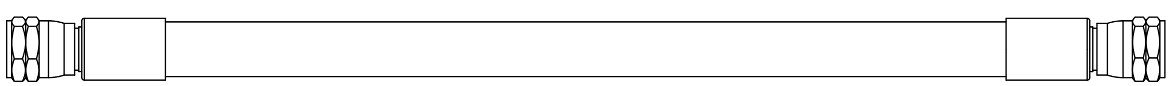
Fittings: RH type “B” male



Part number	Length	Part number	Length
124014	3 m (9.8 feet)	124020	25 m (82 feet)
124015	4.5 m (14.8 feet)	124108	30 m (98.4 feet)
124016	7.5 m (24.6 feet)	124021	35 m (114.8 feet)
124017	10 m (32.8 feet)	124022	45 m (147.6 feet)
124018	15 m (49.2 feet)	124023	60 m (196.9 feet)
124019	20 m (65.6 feet)	124024	75 m (246.1 feet)

Air hose (black)

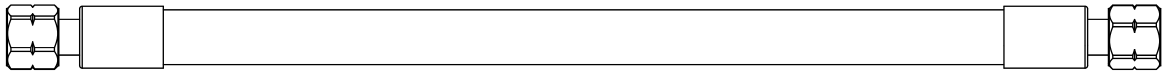
Fittings: JIC-6 female



Part number	Length	Part number	Length
124025	3 m (9.8 feet)	124031	25 m (82 feet)
124026	4.5 m (14.8 feet)	124109	30 m (98.4 feet)
124027	7.5 m (24.6 feet)	124032	35 m (114.8 feet)
124028	10 m (32.8 feet)	124033	45 m (147.6 feet)
124029	15 m (49.2 feet)	124034	60 m (196.9 feet)
124030	20 m (65.6 feet)	124035	75 m (246.1 feet)

Hydrogen or nitrogen-hydrogen (F5) (red)

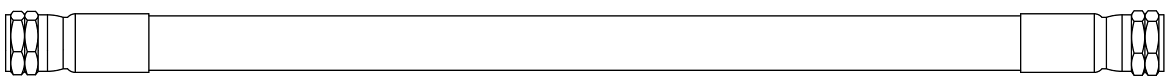
Fittings: LH type “B” female



Part number	Length	Part number	Length
124036	3 m (9.8 feet)	124042	25 m (82 feet)
124037	4.5 m (14.8 feet)	124110	30 m (98.4 feet)
124038	7.5 m (24.6 feet)	124043	35 m (114.8 feet)
124039	10 m (32.8 feet)	124044	45 m (147.6 feet)
124040	15 m (49.2 feet)	124045	60 m (196.9 feet)
124041	20 m (65.6 feet)	124046	75 m (246.1 feet)

Water (optional shield fluid) (blue)

Fittings: JIC-6 female



Part number	Length	Part number	Length
124047	3 m (9.8 feet)	124053	25 m (82 feet)
124048	4.5 m (14.8 feet)	124111	30 m (98.4 feet)
124049	7.5 m (24.6 feet)	124054	35 m (114.8 feet)
124050	10 m (32.8 feet)	124055	45 m (147.6 feet)
124051	15 m (49.2 feet)	124056	60 m (196.9 feet)
124052	20 m (65.6 feet)	124057	75 m (246.1 feet)

Preventive maintenance kits

Part number	Length
428639	Kit: Filter, torch rebuild without coolant
428640	Kit: Filter, torch rebuild with coolant
428920	Kit: Shield-fluid treatment
428878	Kit: Electronics (200 V – 240 V)
428641	Kit: Electronics (200 V – 240 V)
428879	Kit: Electronics (380 V – 600 V)
428642	Kit: Electronics (380 V – 600 V)

Tools

Part number	Length
229917	Torch connect console solenoid valve tool
229918	Torch solenoid valve tool
104879	2.25 inch spanner wrench
004629	Pit depth gauge
104119	Consumable tool
1-13897 (Hypertherm Waterjet part number)	TDS meter

Recommended spare parts

Plasma power supply – recommended spare parts

Part number	Description	Designator	Quantity
428810	Shield-fluid treatment filter	–	1
027005	Coolant filter (fine)	–	1
006154	Coolant check valve	–	1
229640	Power source: 88 VAC – 264 VAC to 24 VDC	PS1	1
229671	Power source: 88 VAC – 264 VAC to 48 VDC, 600 W	PS2	1
229679	Chopper assembly	Chopper 1	1
141322	Control PCB	PCB1	1
141371	I/O PCB	PCB5	1
141384	Fan power distribution PCB	PCB6	1
141425	Power distribution PCB	PCB7	1
108709	Fuse:10 A, 250 VAC, time delay (on PCB7)	F3, F4, F5	2
208397*	Fuse: 15 A, 600 V, Class R (used in 200 V, 208 V, 220 V, 240 V)	F1, F2	2
208395*	Fuse: 8 A, 600 V, Class R (used in 380 V, 400 V, 415 V, 440 V, 480 V, 600 V)	F1, F2	2
003277	Pilot arc relay	CR1	1
229697	Inrush contactor assembly: 80 A, IEC AC-3, 3-phase, 120 VAC	IR_CON	1
003276*	Main contactor (200 V, 208 V, 220 V, 240 V)	M_CON	1
003268*	Main contactor (380 V, 400 V, 415 V, 440 V, 480 V, 600 V)	M_CON	1

* Voltage dependent - Select accordingly

Gas connect consoles – recommended spare parts

Part number	Description	Designator	Quantity
011110	Air filter element	–	1
223398	Pressure transducer (VWI and OptiMix only)	P6 – P9	1
006128	Solenoid valve (VWI and OptiMix only)	B4 – B5	1
141354	High-frequency, high-voltage ignition PCB	PCB2	1

Torch connect console – recommended spare parts

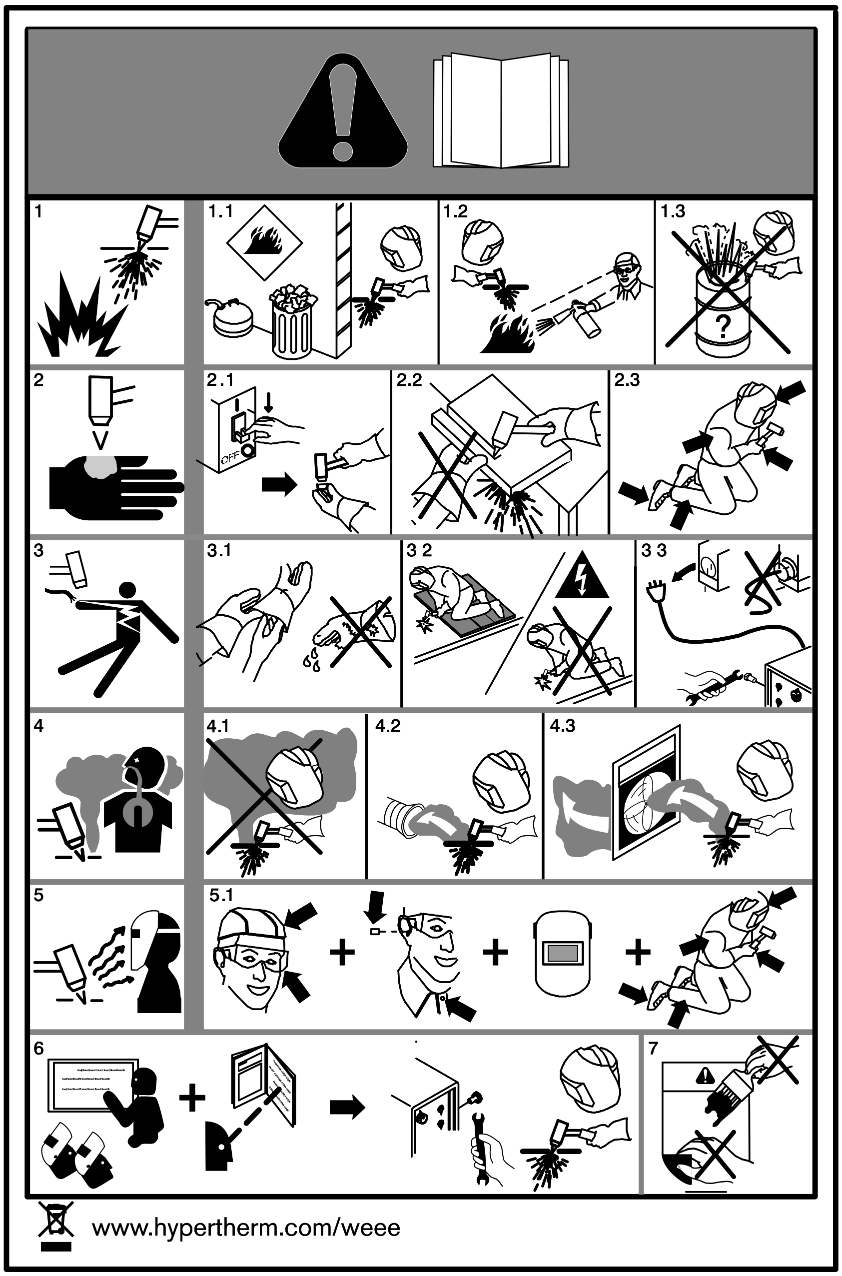
Part number	Description	Designator	Quantity
141368	Ohmic contact PCB	PCB2	1
223477	Pressure transducer with wire and connector	P1 – P5, P14	1

Torch – recommended spare parts

Part number	Description	Designator	Quantity
420220	Quick-disconnect/torch receptacle	–	1
420221	Quick-disconnect torch	–	1
420368	Water tube	–	1
006155	Torch solenoid valve	–	1

Descriptions of warning label icons

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.

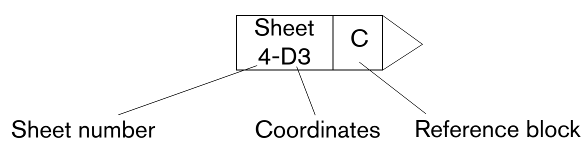


1. Cutting sparks can cause explosion or fire.
1.1 Do not cut near flammables.
1.2 Have a fire extinguisher nearby and ready to use.
1.3 Do not use a drum or other closed container as a cutting table.
2. Plasma arc can injure and burn; point the nozzle away from yourself. Arc starts instantly when triggered.
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.

10 Wiring Diagrams

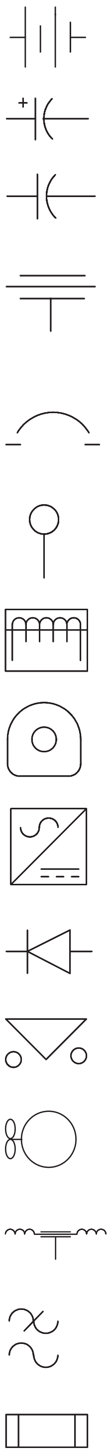
This section contains the wiring diagrams for the system. When you trace a signal path, or reference the *Parts List* or *Troubleshooting* sections, the following conventions will help you understand the organization of the wiring diagrams:

- Sheet numbers are located in the lower, right-hand corner of each page.
- References to other pages use the following connection symbol:

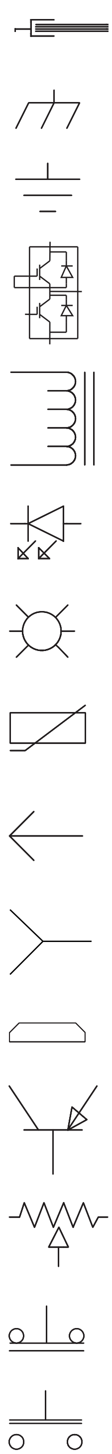


Use the sheet number to find the reference sheet. Line up the coordinates A–D on the Y axis and numbers 1–4 on the X axis of each sheet to find the reference blocks (similar to a road map).

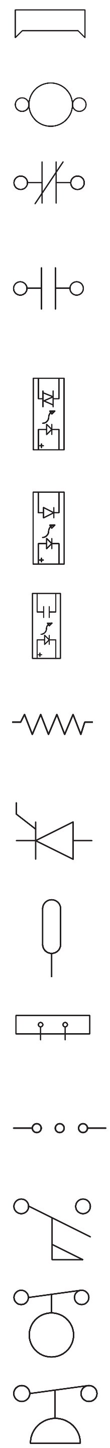
Wiring diagram symbols



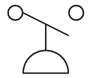
Battery
Cap, polarized
Cap, not polarized
Cap, feed-through
Circuit breaker
Coax shield
Current sensor
Current sensor
DC supply
Diode
Door interlock
Fan
Feed-through LC
Filter, AC
Fuse



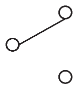
Ground clamp
Ground, chassis
Ground, earth
IGBT
Inductor
LED
Lamp
MOV
Pin
Socket
Plug
PNP transistor
Potentiometer
Push button, normally closed
Push button, normally open

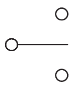


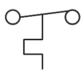
Receptacle
Relay, coil
Relay, normally closed
Relay, normally open
Relay, solid state, AC
Relay, solid state, DC
Relay, solid state
Resistor
SCR
Shield
Shunt
Spark gap
Switch, flow
Switch, level, normally closed
Switch, pressure, normally closed

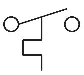

Switch, pressure, normally open

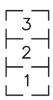

Switch, 1 pole, 1 throw


Switch, 1 pole, 2 throw

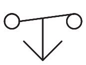

Switch, 1 pole, 2 throw, center off

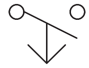

Switch, temperature, normally closed

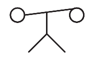

Switch, temperature, normally open

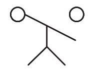


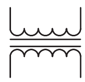
Terminal block

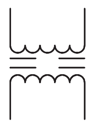

Time delay closed, NC/off


Time delay open, NO/off

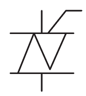

Time delay open, NC/on

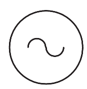

Time delay closed, NO/off


Transformer

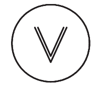

Transformer, air core

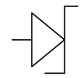

Transformer, coil


Triac

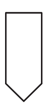

VAC source

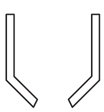

Valve, solenoid

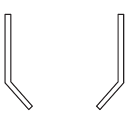

Voltage source

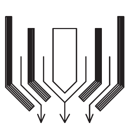

Zener diode

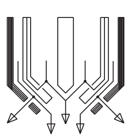
Torch symbols


Electrode


Nozzle


Shield


Torch


Torch, HyDefinition®

Valve states during operation

During each stage of cutting system operation, different valves are active (ON) or inactive (OFF). The type of gas connect console and the type and timing of the active process changes the valves that are active or inactive.

Refer to the CNC or XPR web interface to see the most current information about the state (ON-OFF) of each valve.

- For information about how to view valve states on the CNC, refer to the instruction manual that came with your CNC.
- The following steps describe how to view valve states on the XPR web interface:
  - Use the XPR web interface to select the process you want to view.
  - Go to the Gas System screen. (See *Gas system* on page 182.)

  On this screen you can see which valves are active when the gas is flowing. Active valves are indicated with a gray highlight.

  - On the Gas System screen, enable the desired mode (Test Preflow, Test Pierceflow, or Test Cutflow) for the process you want to view.

  Active valves are indicated with a gray highlight.

Valve states by process ID

Process IDs: 1001, 1002, 1003, 1152, 1153, 1155, 1004, 1005, 1151, 1156											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**

Process IDs: 7001, 7004, 7005, 7007, 7008, 7009, 7010, 7011, 7012, 7013, 7018											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/O_2	**On**	Off	Off	Off	**On**	Off	**On**	Off	**On**	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**

Process ID: 8001											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	Off	Off
Cutflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	**On**	Off
Piercing	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	Off	Off

Process IDs: 9001, 9010, 9018											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	**On**	Off
Cutflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	**On**	Off
Piercing	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	**On**	Off

Process IDs: 2051, 2054, 2057, 2100, 8004, 8005, 8006											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off
Cutflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off
Piercing	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off

Process IDs: 2010, 2011, 2028, 2052, 2055, 2058											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/H_2O	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Cutflow	N_2/H_2O	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Piercing	N_2/H_2O	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off

Process IDs: 2053, 2056, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off
Cutflow	Mix/N_2	**On**	Off	**On**	Off	Off	Off	Off	**On**	Off	Off
Piercing	Mix/N_2	**On**	Off	**On**	Off	Off	Off	Off	**On**	Off	Off

Process IDs: 1201, 1203, 1206											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**

Process IDs: 1051, 7014, 7015											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/O_2	Off	Off	Off	Off	**On**	Off	**On**	Off	Off	Off
Cutflow	O_2/O_2	**On**	Off	Off	Off	**On**	Off	**On**	Off	**On**	**On**
Piercing	O_2/O_2	**On**	Off	Off	Off	**On**	Off	**On**	Off	Off	**On**

Process IDs: 1102, 1101											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	Off
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	Off

Process IDs: 1103, 1104, 1105, 1106, 1107											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	Off
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	Off

Process IDs: 7002, 7003, 7006											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/O_2	**On**	Off	Off	Off	**On**	Off	**On**	Off	**On**	Off
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	Off	Off

Process IDs: 2001, 2002, 2003, 2004, 2005											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	**On**	Off	Off
Cutflow	$F5/N_2$	**On**	Off	**On**	Off	Off	Off	Off	**On**	**On**	Off
Piercing	$F5/N_2$	**On**	Off	**On**	Off	Off	Off	Off	**On**	**On**	Off

Process IDs: 2006, 2007, 2012, 2013, 2014, 2015, 2024, 2025, 2026											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	Off	Off
Cutflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off
Piercing	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off

Process IDs: 2008, 2009											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Of	Off	**On**	Off	Off	Off	Off	Off	Off
Cutflow	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	**On**	Off
Piercing	Air/N_2	**On**	Off	**On**	Off	Off	Off	Off	Off	**On**	Off

Process IDs: 2016, 2017, 2018, 2019											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	Off	Off	Off	Off
Cutflow	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	**On**	Off
Piercing	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	**On**	Off

Process IDs: 2020, 2021, 2022, 2023											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	**On**	Off	Off
Cutflow	$F5/N_2$	**On**	Off	**On**	Off	Off	Off	Off	**On**	Off	Off
Piercing	$F5/N_2$	**On**	Off	**On**	Off	Off	Off	Off	**On**	Off	Off

Process IDs: 9004, 9005, 9006, 9014, 9015, 9016, 9017											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	Off	Off
Cutflow	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	Off	Off
Piercing	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	Off	Off

Process ID: 8007											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Piercing	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off

Process ID: 9007											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	**On**	Off	**On**	Off
Cutflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	**On**	Off	**On**	Off
Piercing	Ar/Air	Off	Off	Off	**On**	Off	**On**	**On**	Off	**On**	Off

Process ID: 9008											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	Off	Off
Cutflow	Ar/Air	Off	Off	Off	**On**	Off	**On**	Off	Off	Off	Off
Piercing	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	Off	Off

Process IDs: 9002, 9003, 9009											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**	Off
Cutflow	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**	Off
Piercing	Ar/N_2	Off	Off	**On**	Off	Off	**On**	Off	Off	**On**	Off

Process IDs: 1202, 1204, 1207											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/N_2	**On**	Off	**On**	Off	Off	Off	**On**	Off	Off	**On**
Piercing	O_2/N_2	**On**	Off	**On**	Off	Off	Off	**On**	Off	Off	**On**

Process IDs: 2027, 2101											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	Off	Off	Off	Off
Cutflow	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	**On**	Off
Piercing	Air/Air	**On**	Off	Off	**On**	Off	Off	Off	Off	Off	Off

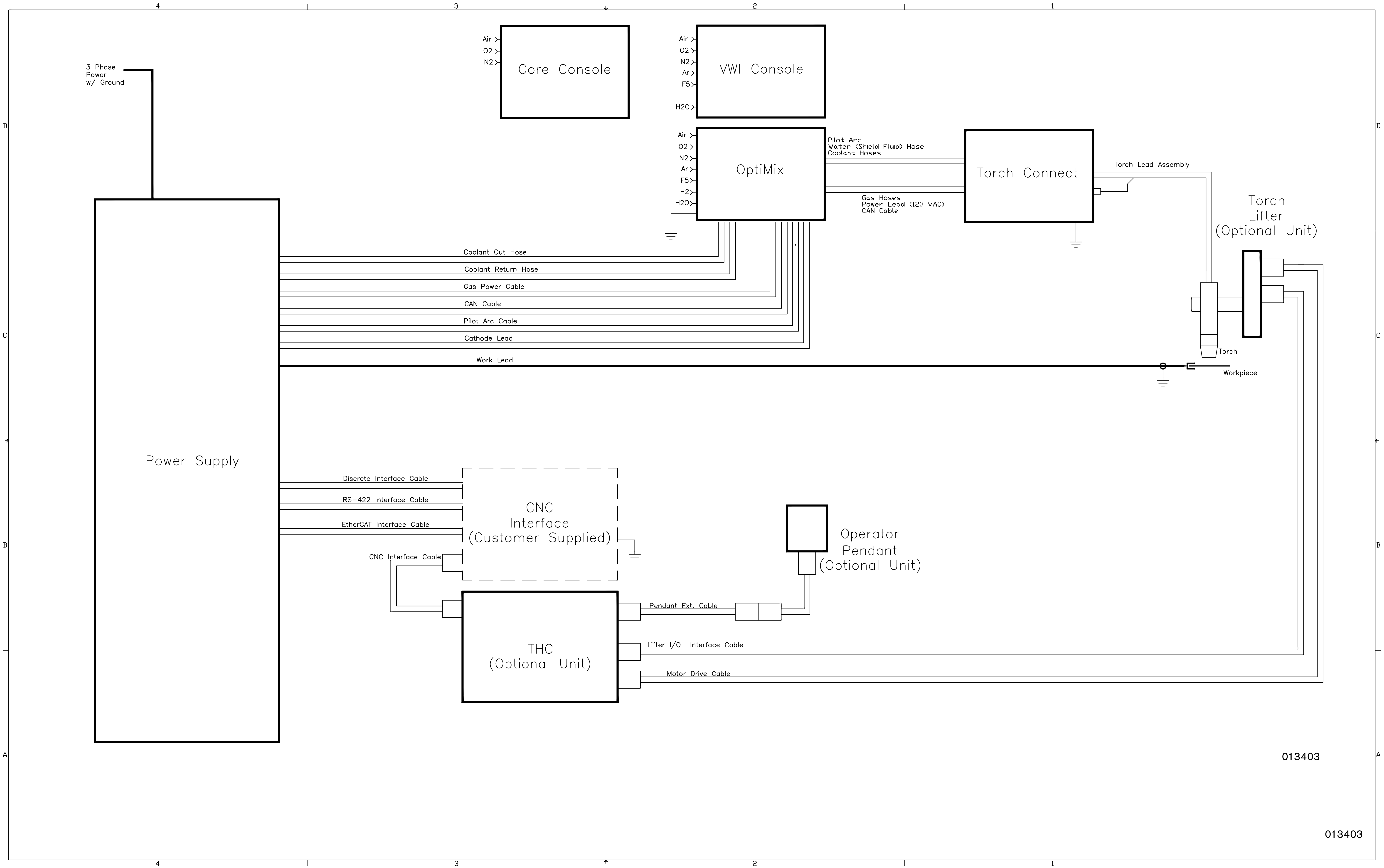
Process ID: 8002											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off
Cutflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off
Piercing	N_2/N_2	Off	Off	**On**	Off	Off	Off	Off	Off	**On**	Off

Process ID: 1205											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/N_2	Off	Off	**On**	Off	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/N_2	**On**	Off	**On**	Off	Off	Off	**On**	Off	Off	**On**
Piercing	O_2/Ar	**On**	**On**	Off	Off	Off	Off	**On**	Off	Off	**On**

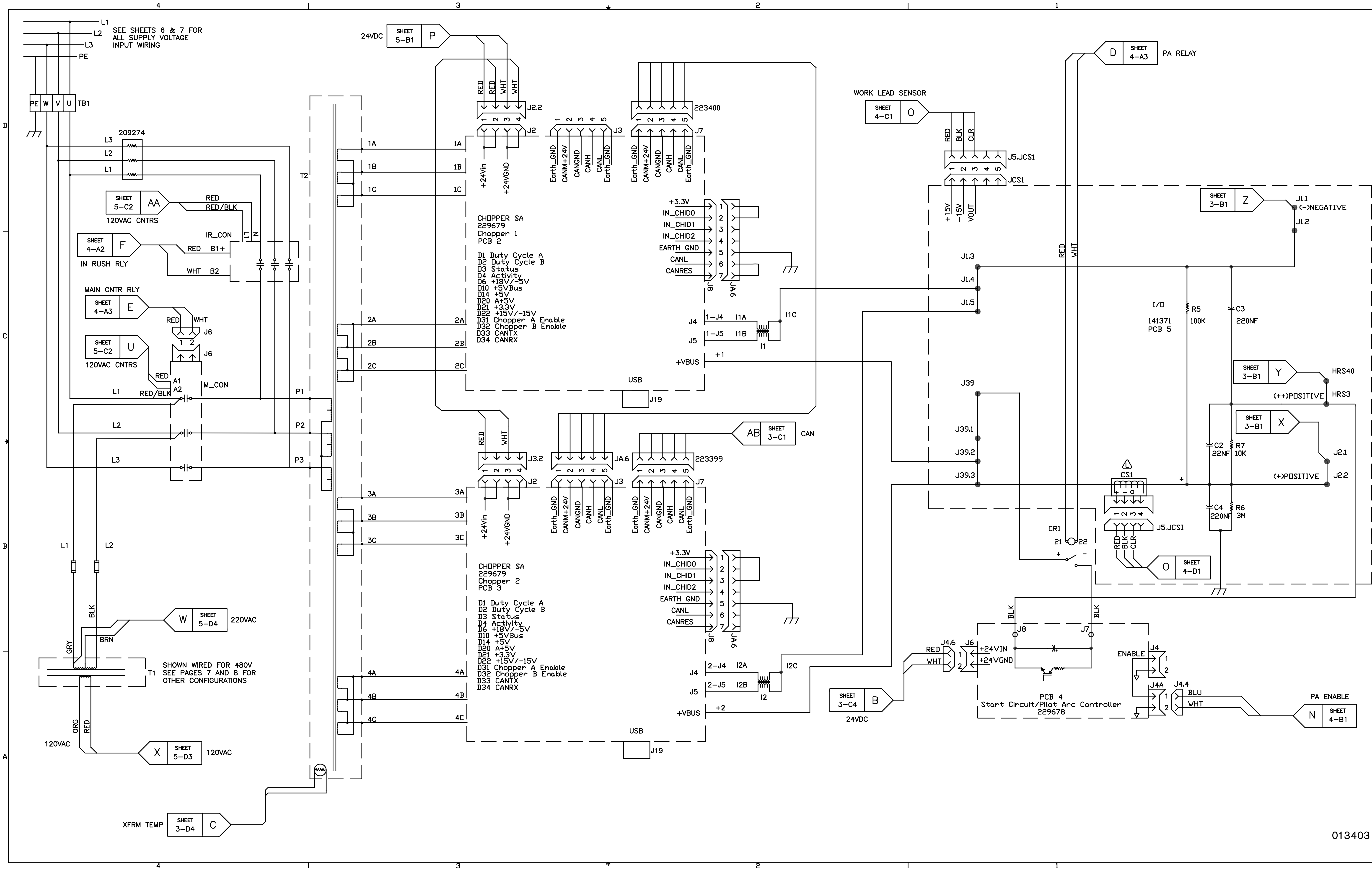
Process IDs: 9011, 9012, 9013											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	Ar/N_2	Off	On	**On**	Off	Off	**On**	Off	Off	**On**	Off
Cutflow	Ar/N_2	Off	On	**On**	Off	Off	**On**	Off	Off	Off	Off
Piercing	Ar/N_2	Off	On	**On**	Off	Off	**On**	Off	Off	Off	Off

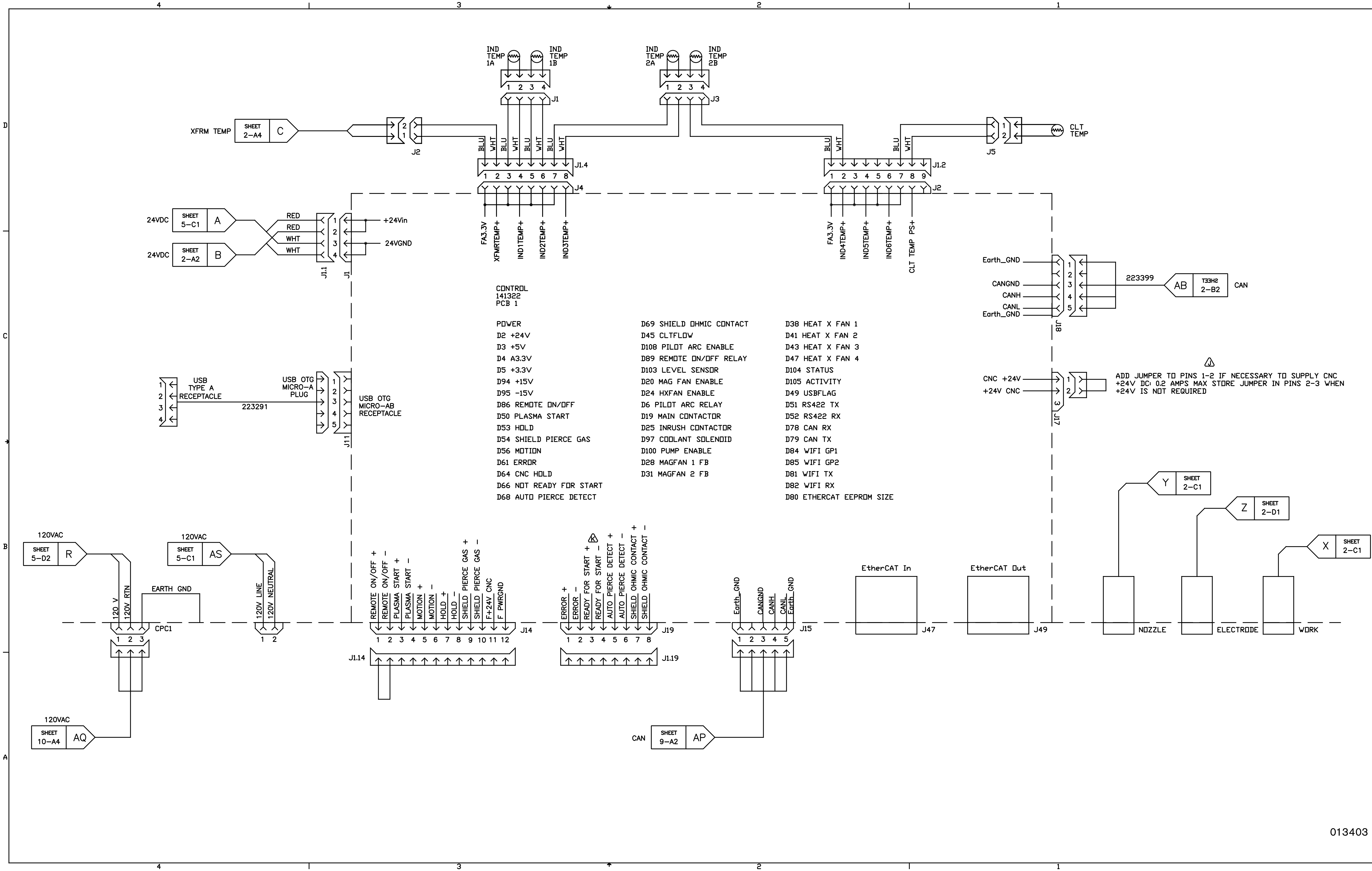
Process IDs: 1060, 1061, 7016, 7017											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	**On**	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	**On**
Piercing	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	**On**

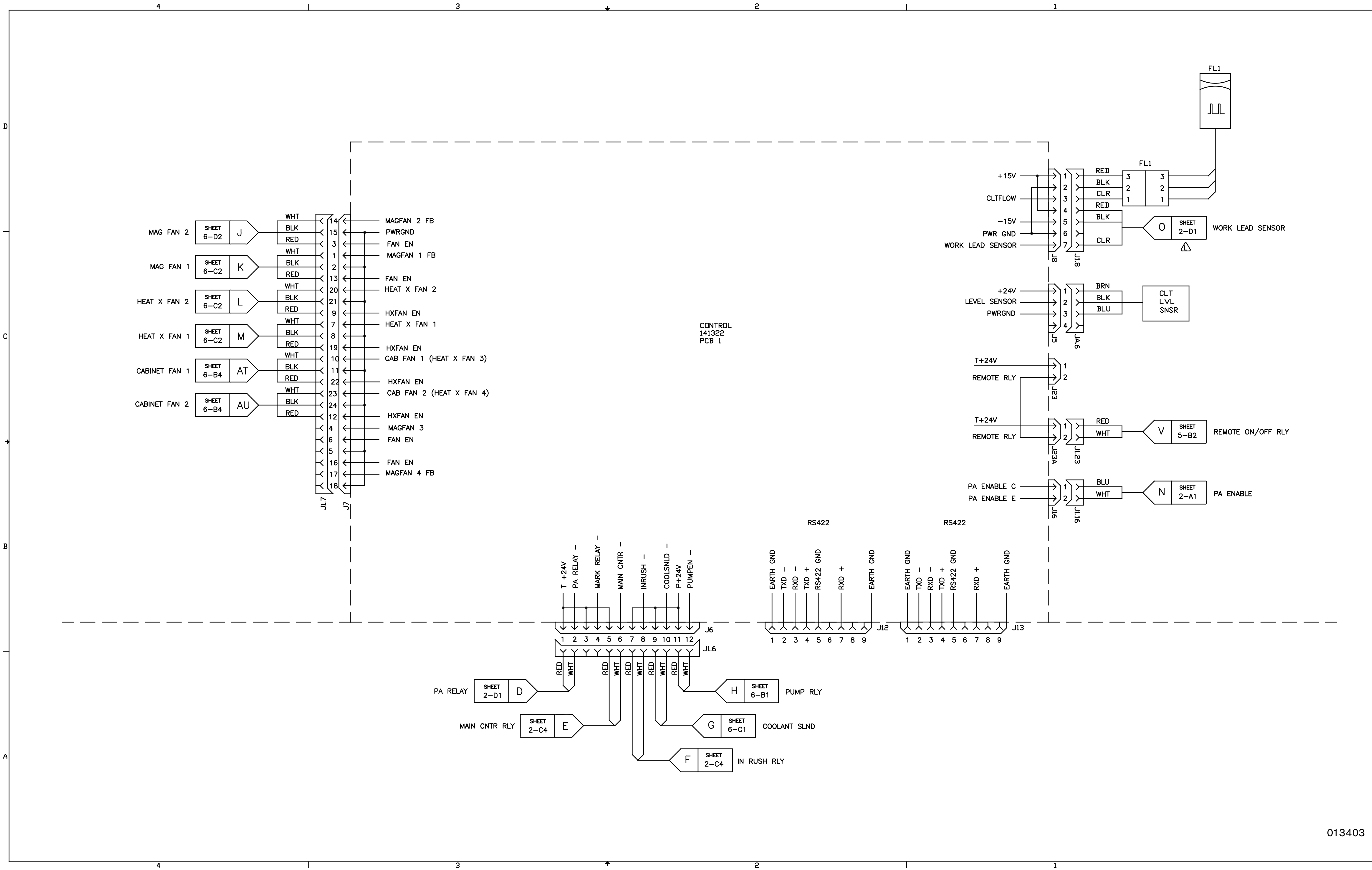
Process ID: 1157											
Block type	**Gas**	**V1**	**V4**	**V5**	**V6**	**V7**	**V8**	**V9**	**V10**	**V11**	**V12**
Preflow	N_2/Air	Off	Off	Off	**On**	Off	Off	**On**	Off	Off	Off
Cutflow	O_2/Air	**On**	Off	Off	**On**	Off	Off	**On**	Off	**On**	**On**
Piercing	O_2/Ar	**On**	**On**	Off	Off	Off	Off	**On**	Off	Off	**On**



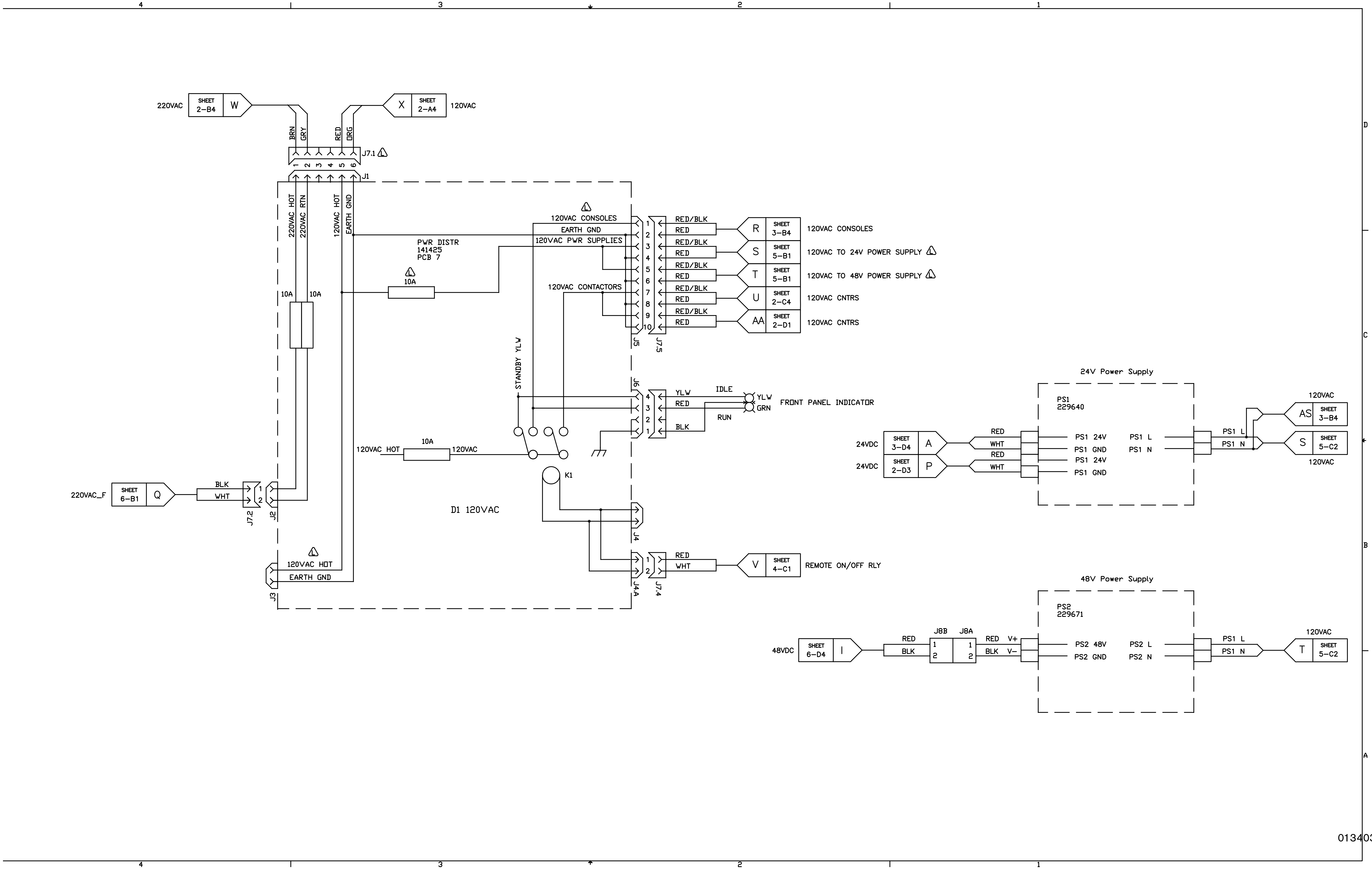
3 Phase Power w/ Ground
Core Console
Air
O2
N2
VWI Console
Air
O2
N2
Ar
F5
H2O
OptiMix
Air
O2
N2
Ar
F5
H2
H2O
Pilot Arc
Water (Shield Fluid) Hose
Coolant Hoses
Gas Hoses
Power Lead (120 VAC)
CAN Cable
Torch Connect
Torch Lead Assembly
Torch Lifter (Optional Unit)
Torch
Workpiece
Power Supply
Coolant Out Hose
Coolant Return Hose
Gas Power Cable
CAN Cable
Pilot Arc Cable
Cathode Lead
Work Lead
Discrete Interface Cable
RS-422 Interface Cable
EtherCAT Interface Cable
CNC Interface (Customer Supplied)
CNC Interface Cable
Operator Pendant (Optional Unit)
Pendant Ext. Cable
THC (Optional Unit)
Lifter I/O Interface Cable
Motor Drive Cable
013403
013403

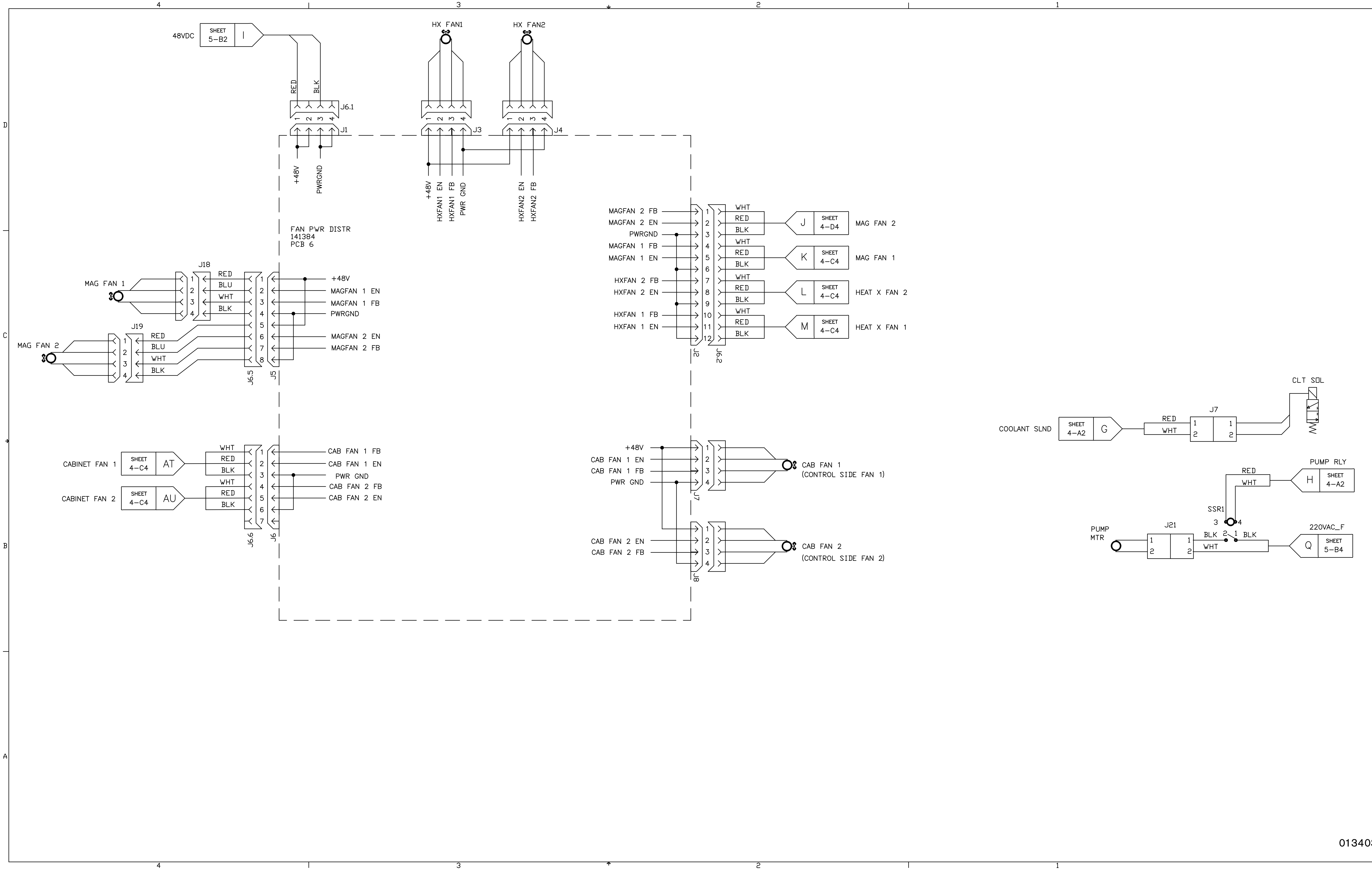

SEE SHEETS 6 & 7 FOR ALL SUPPLY VOLTAGE INPUT WIRING
TB1
209274
120VAC CNTRS
IN RUSH RLY
MAIN CNTR RLY
M_CON
IR_CON
T2
CHOPPER SA
229679
Chopper 1
PCB 2
D1 Duty Cycle A
D2 Duty Cycle B
D3 Status
D4 Activity
D6 +18V/-5V
D10 +5VBus
D14 +5V
D20 A+5V
D21 +3.3V
D22 +15V/-15V
D31 Chopper A Enable
D32 Chopper B Enable
D33 CANTX
D34 CANRX
CHOPPER SA
229679
Chopper 2
PCB 3
24VDC
WORK LEAD SENSOR
PA RELAY
I/O
141371
PCB 5
(-)NEGATIVE
(++)POSITIVE
(+)POSITIVE
PCB 4
Start Circuit/Pilot Arc Controller
229678
PA ENABLE
SHOWN WIRED FOR 480V
SEE PAGES 7 AND 8 FOR OTHER CONFIGURATIONS
220VAC
120VAC
XFRM TEMP
013403

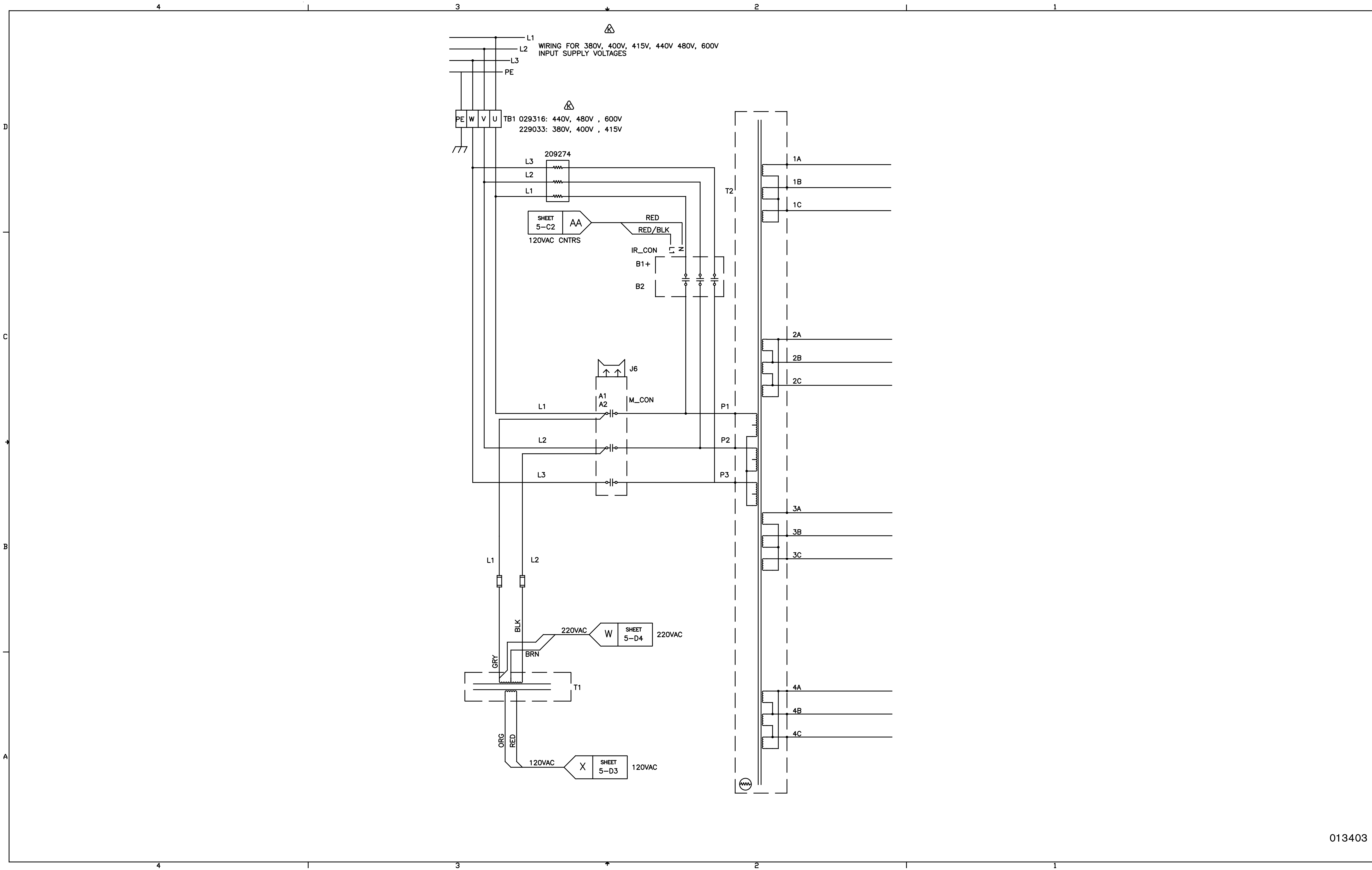

XFRM TEMP
IND TEMP 1A
IND TEMP 1B
IND TEMP 2A
IND TEMP 2B
CLT TEMP
24VDC SHEET 5–C1 A
24VDC SHEET 2–A2 B
+24Vin
24VGND
CONTROL
141322
PCB 1
POWER
D2 +24V
D3 +5V
D4 A3.3V
D5 +3.3V
D94 +15V
D95 -15V
D86 REMOTE ON/OFF
D50 PLASMA START
D53 HOLD
D54 SHIELD PIERCE GAS
D56 MOTION
D61 ERROR
D64 CNC HOLD
D66 NOT READY FOR START
D68 AUTO PIERCE DETECT
D69 SHIELD OHMIC CONTACT
D45 CLTFLOW
D108 PILOT ARC ENABLE
D89 REMOTE ON/OFF RELAY
D103 LEVEL SENSOR
D20 MAG FAN ENABLE
D24 HXFAN ENABLE
D6 PILOT ARC RELAY
D19 MAIN CONTACTOR
D25 INRUSH CONTACTOR
D97 COOLANT SOLENOID
D100 PUMP ENABLE
D28 MAGFAN 1 FB
D31 MAGFAN 2 FB
D38 HEAT X FAN 1
D41 HEAT X FAN 2
D43 HEAT X FAN 3
D47 HEAT X FAN 4
D104 STATUS
D105 ACTIVITY
D49 USBFLAG
D51 RS422 TX
D52 RS422 RX
D78 CAN RX
D79 CAN TX
D84 WIFI GP1
D85 WIFI GP2
D81 WIFI TX
D82 WIFI RX
D80 ETHERCAT EEPROM SIZE
USB TYPE A RECEPTACLE
223291
USB OTG MICRO–A PLUG
USB OTG MICRO–AB RECEPTACLE
Earth_GND
CANGND
CANH
CANL
223399
CAN
CNC +24V
+24V CNC
ADD JUMPER TO PINS 1–2 IF NECESSARY TO SUPPLY CNC +24V DC, 0.2 AMPS MAX STORE JUMPER IN PINS 2–3 WHEN +24V IS NOT REQUIRED
120VAC
EARTH GND
REMOTE ON/OFF
PLASMA START
MOTION
HOLD
SHIELD PIERCE GAS
F+24V CNC
F PWRGND
ERROR
READY FOR START
AUTO PIERCE DETECT
SHIELD OHMIC CONTACT
EtherCAT In
EtherCAT Out
NOZZLE
ELECTRODE
WORK
013403

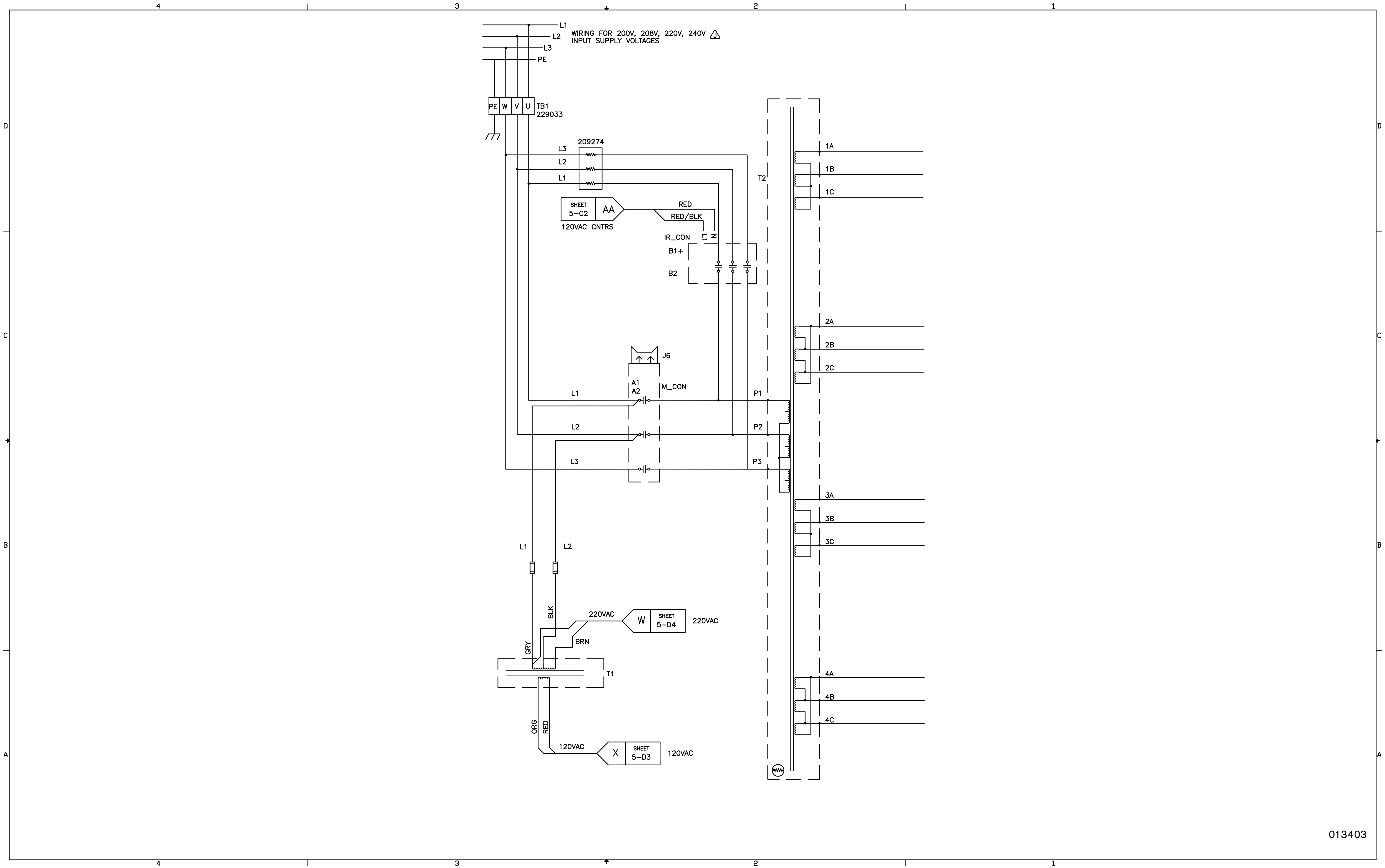

CONTROL
141322
PCB 1
MAG FAN 2
MAG FAN 1
HEAT X FAN 2
HEAT X FAN 1
CABINET FAN 1
CABINET FAN 2
MAGFAN 2 FB
PWRGND
FAN EN
MAGFAN 1 FB
HEAT X FAN 2
HXFAN EN
HEAT X FAN 1
CAB FAN 1 (HEAT X FAN 3)
CAB FAN 2 (HEAT X FAN 4)
MAGFAN 3
MAGFAN 4 FB
+15V
CLTFLOW
-15V
PWR GND
WORK LEAD SENSOR
+24V
LEVEL SENSOR
PWRGND
CLT
LVL
SNSR
T+24V
REMOTE RLY
REMOTE ON/OFF RLY
PA ENABLE C
PA ENABLE E
PA ENABLE
RS422
T +24V
PA RELAY -
MARK RELAY -
MAIN CNTR -
INRUSH -
COOLSNLD -
P+24V
PUMPEN -
EARTH GND
TXD -
RXD -
TXD +
RS422 GND
RXD +
PA RELAY
MAIN CNTR RLY
IN RUSH RLY
COOLANT SLND
PUMP RLY
FL1
013403

Plasma power supply 4 (Sheet 5 of 22)

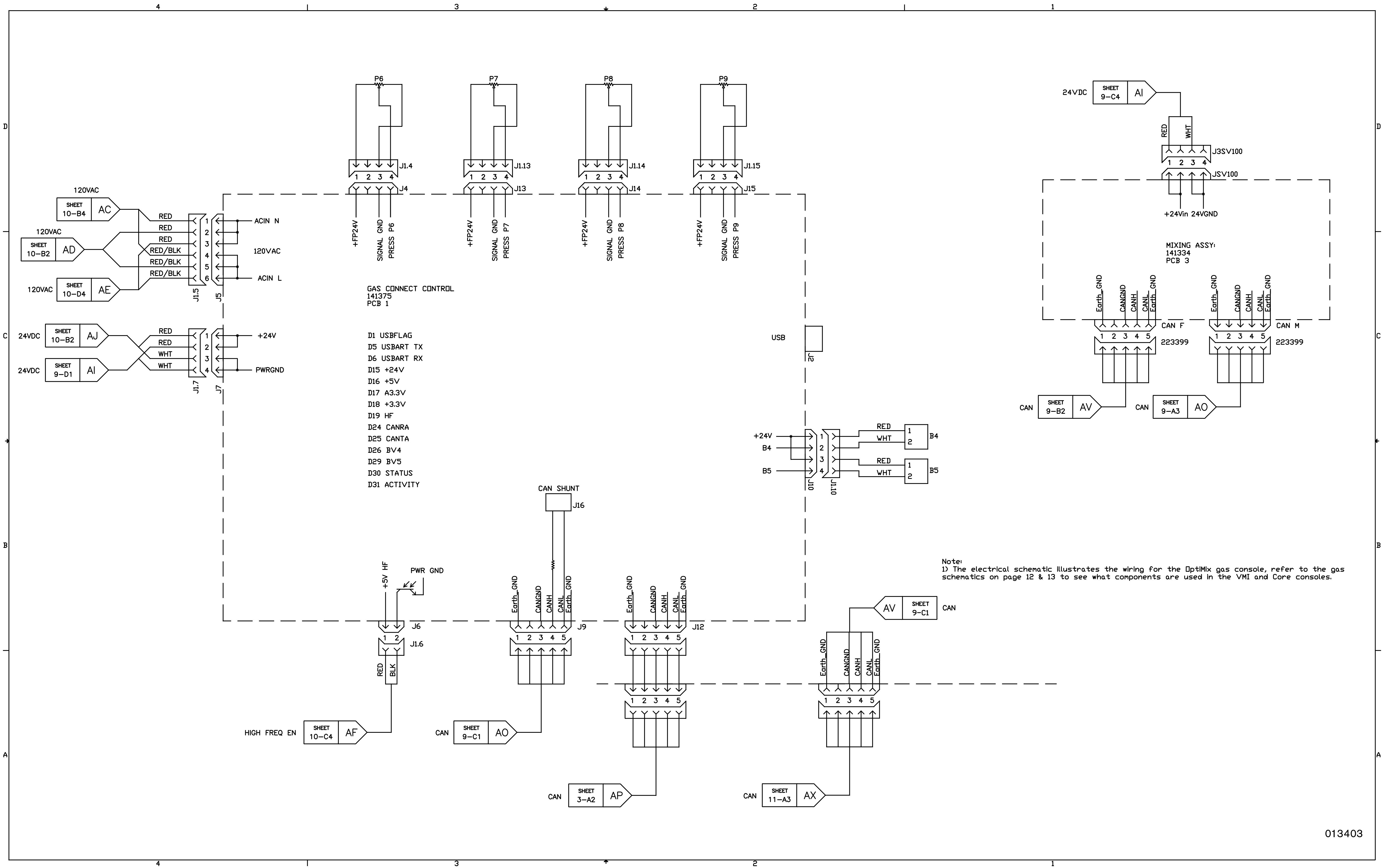


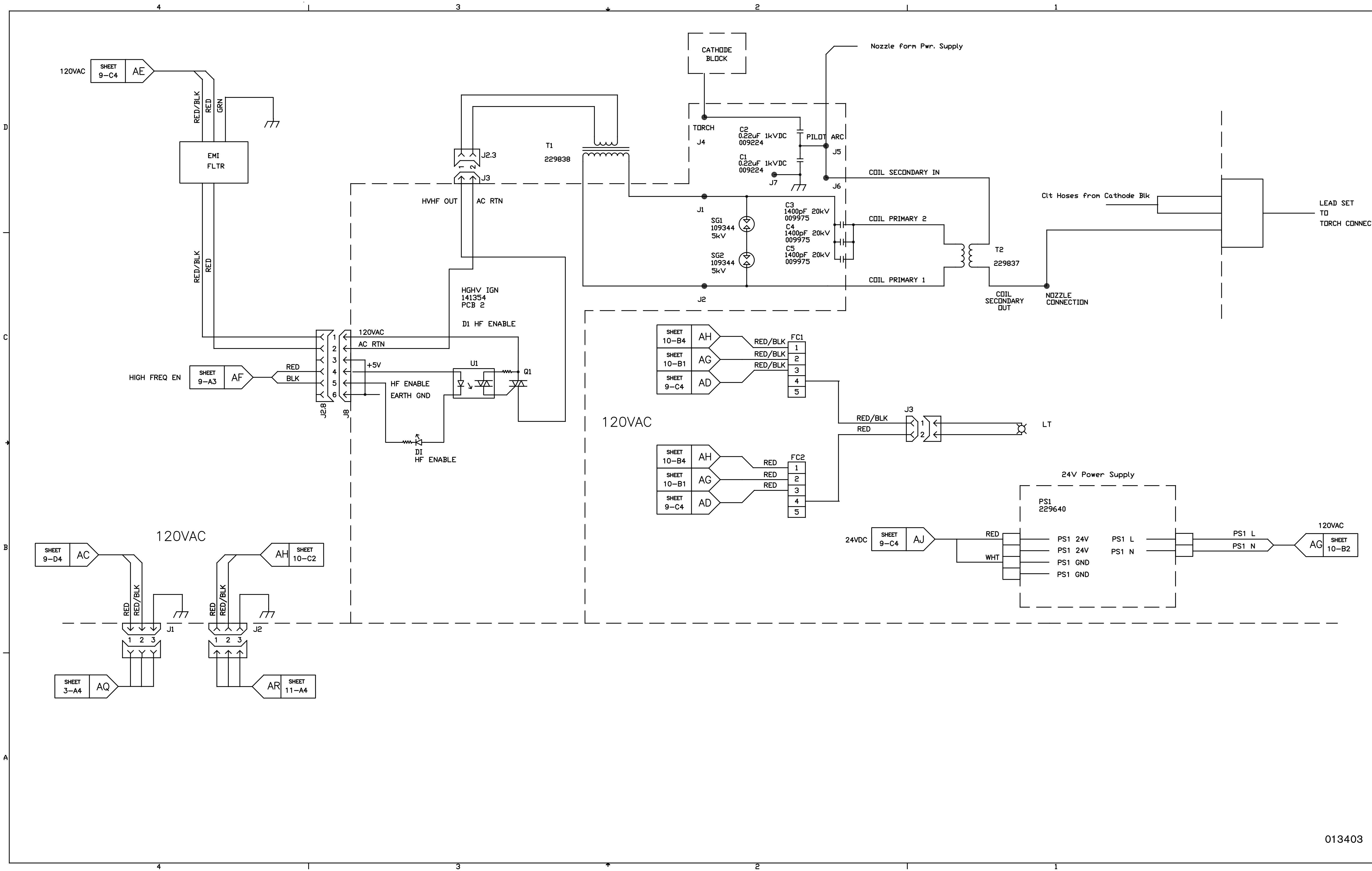

48VDC
SHEET 5-B2 I
RED
BLK
J6.1
J1
+48V
PWRGND
HX FAN1
HX FAN2
J3
J4
+48V
HXFAN1 EN
HXFAN1 FB
PWR GND
HXFAN2 EN
HXFAN2 FB
FAN PWR DISTR
141384
PCB 6
MAG FAN 1
J18
RED
BLU
WHT
BLK
MAG FAN 2
J19
RED
BLU
WHT
BLK
J6.5
J5
+48V
MAGFAN 1 EN
MAGFAN 1 FB
PWRGND
MAGFAN 2 EN
MAGFAN 2 FB
MAGFAN 2 FB
MAGFAN 2 EN
PWRGND
MAGFAN 1 FB
MAGFAN 1 EN
HXFAN 2 FB
HXFAN 2 EN
HXFAN 1 FB
HXFAN 1 EN
J2
J6.2
WHT
RED
BLK
SHEET 4-D4 J
MAG FAN 2
SHEET 4-C4 K
MAG FAN 1
SHEET 4-C4 L
HEAT X FAN 2
SHEET 4-C4 M
HEAT X FAN 1
CABINET FAN 1
SHEET 4-C4 AT
CABINET FAN 2
SHEET 4-C4 AU
WHT
RED
BLK
J6.6
J6
CAB FAN 1 FB
CAB FAN 1 EN
PWR GND
CAB FAN 2 FB
CAB FAN 2 EN
+48V
CAB FAN 1 EN
CAB FAN 1 FB
PWR GND
J7
CAB FAN 1
(CONTROL SIDE FAN 1)
CAB FAN 2 EN
CAB FAN 2 FB
J8
CAB FAN 2
(CONTROL SIDE FAN 2)
CLT SOL
COOLANT SLND
SHEET 4-A2 G
RED
WHT
J7
PUMP RLY
RED
WHT
SHEET 4-A2 H
SSR1
PUMP
MTR
J21
BLK
BLK
WHT
220VAC_F
SHEET 5-B4 Q
013403


L1
L2
L3
PE
WIRING FOR 380V, 400V, 415V, 440V 480V, 600V
INPUT SUPPLY VOLTAGES
PE W V U
TB1 029316: 440V, 480V , 600V
229033: 380V, 400V , 415V
209274
SHEET 5-C2
AA
120VAC CNTRS
RED
RED/BLK
IR_CON
B1+
B2
T2
1A
1B
1C
2A
2B
2C
3A
3B
3C
4A
4B
4C
J6
A1
A2
M_CON
P1
P2
P3
BLK
GRY
BRN
220VAC
W
SHEET 5-D4
T1
ORG
RED
120VAC
X
SHEET 5-D3
013403

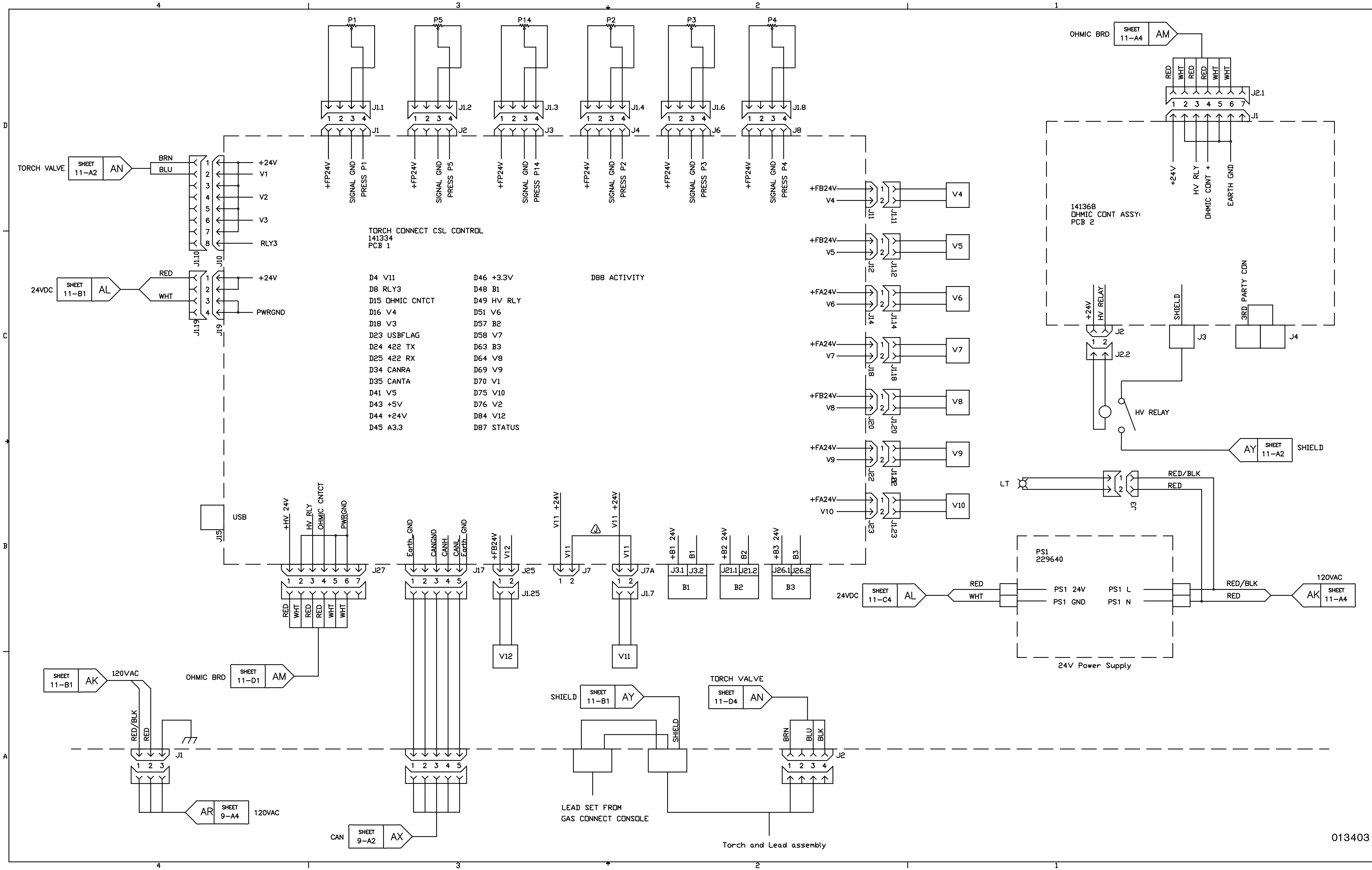


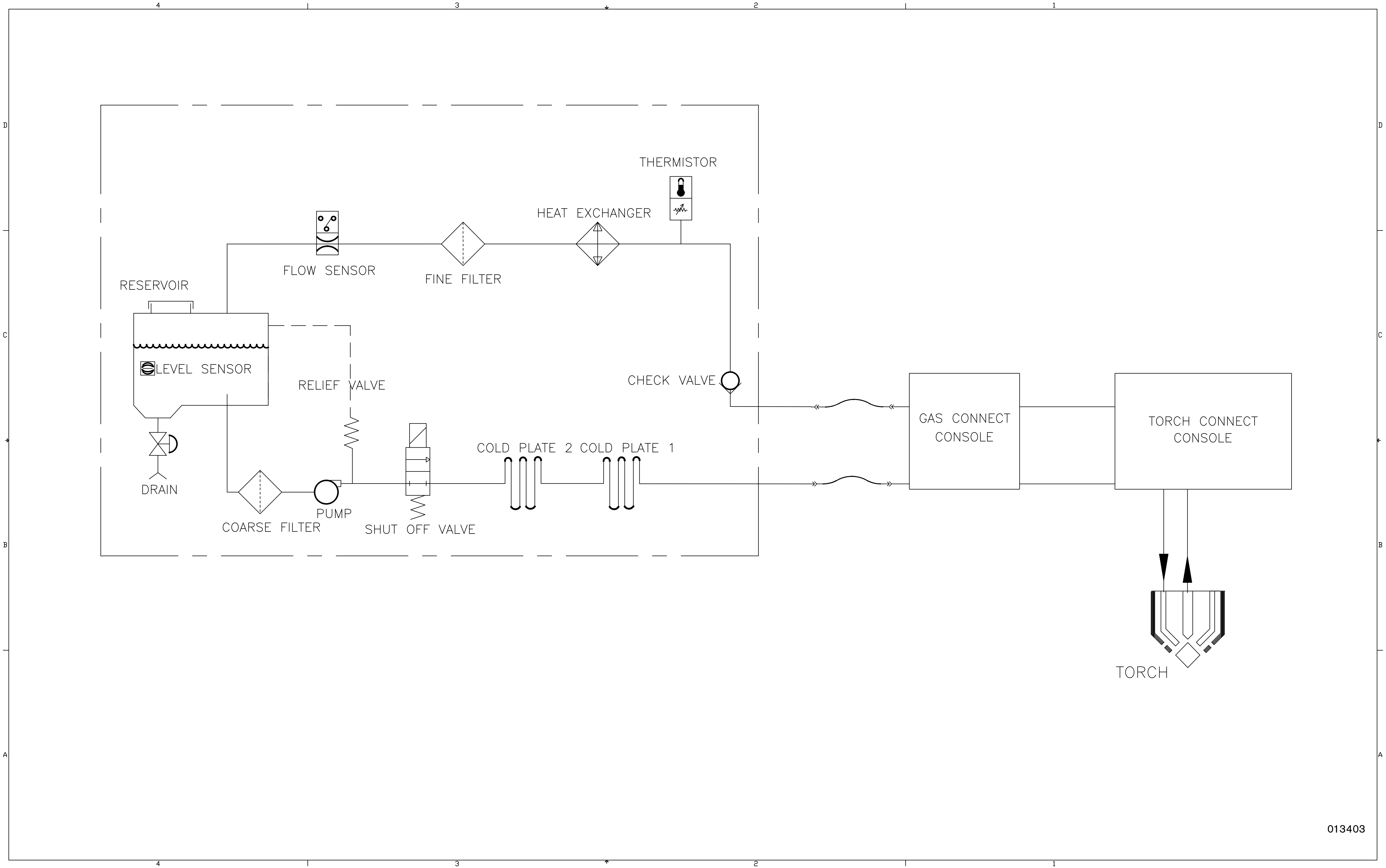
WIRING FOR 200V, 208V, 220V, 240V INPUT SUPPLY VOLTAGES
L1
L2
L3
PE
PE W V U
TB1
229033
209274
T2
1A
1B
1C
SHEET 5-C2 AA
120VAC CNTRS
RED
RED/BLK
IR_CON
L1 N
B1+
B2
2A
2B
2C
J6
A1
A2
M_CON
P1
P2
P3
3A
3B
3C
BLK
220VAC
W SHEET 5-D4
BRN
GRY
T1
4A
4B
4C
ORG
RED
120VAC
X SHEET 5-D3
013403

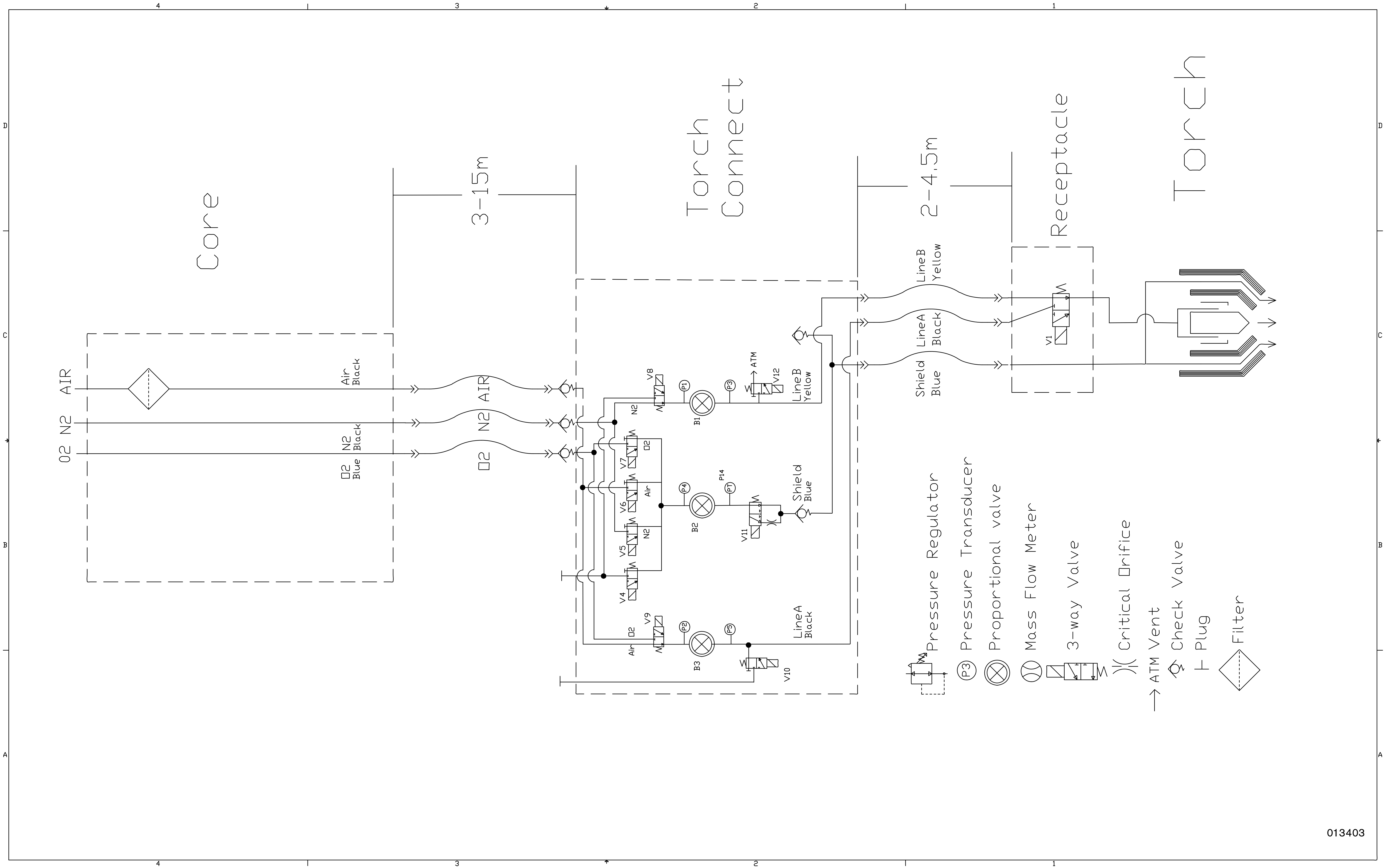


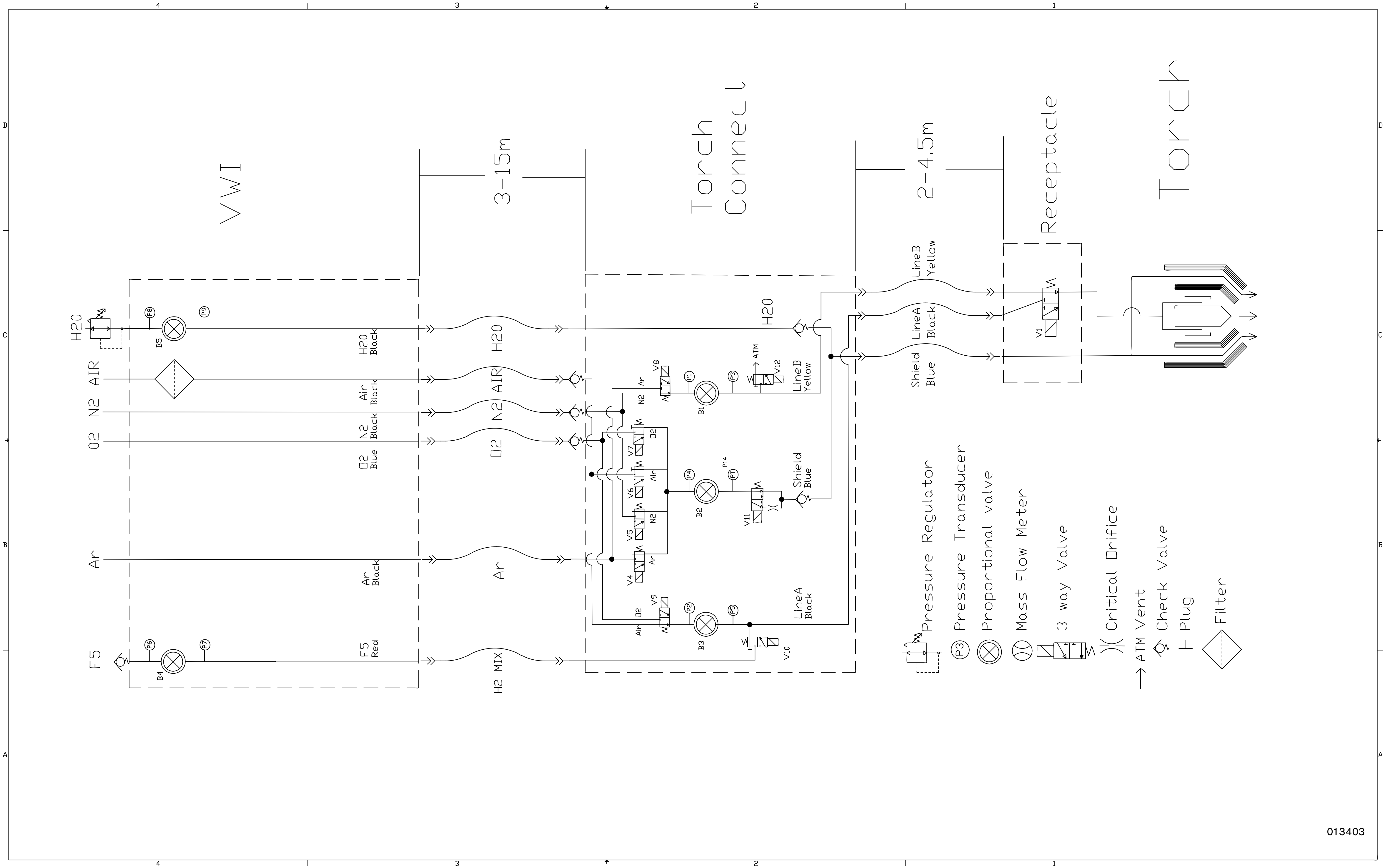

120VAC
SHEET 9-C4 AE
RED/BLK
RED
GRN
EMI FLTR
CATHODE BLOCK
Nozzle form Pwr. Supply
T1 229838
J2.3
J3
HVHF OUT
AC RTN
TORCH
J4
C2 0.22uF 1kVDC 009224
C1 0.22uF 1kVDC 009224
PILOT ARC
J5
J7
J6
COIL SECONDARY IN
J1
SG1 109344 5kV
SG2 109344 5kV
C3 1400pF 20kV 009975
C4 1400pF 20kV 009975
C5 1400pF 20kV 009975
COIL PRIMARY 2
COIL PRIMARY 1
J2
T2 229837
COIL SECONDARY OUT
NOZZLE CONNECTION
Clt Hoses from Cathode Blk
LEAD SET TO TORCH CONNECT
HGHV IGN 141354 PCB 2
D1 HF ENABLE
120VAC
AC RTN
+5V
HF ENABLE
EARTH GND
U1
Q1
HIGH FREQ EN
SHEET 9-A3 AF
RED
BLK
J2.8
J8
DI HF ENABLE
120VAC
SHEET 10-B4 AH
SHEET 10-B1 AG
SHEET 9-C4 AD
RED/BLK
FC1
FC2
RED
J3
LT
24V Power Supply
PS1 229640
24VDC
SHEET 9-C4 AJ
WHT
PS1 24V
PS1 GND
PS1 L
PS1 N
SHEET 10-B2 AG
SHEET 9-D4 AC
SHEET 10-C2 AH
J1
SHEET 3-A4 AQ
SHEET 11-A4 AR
013403

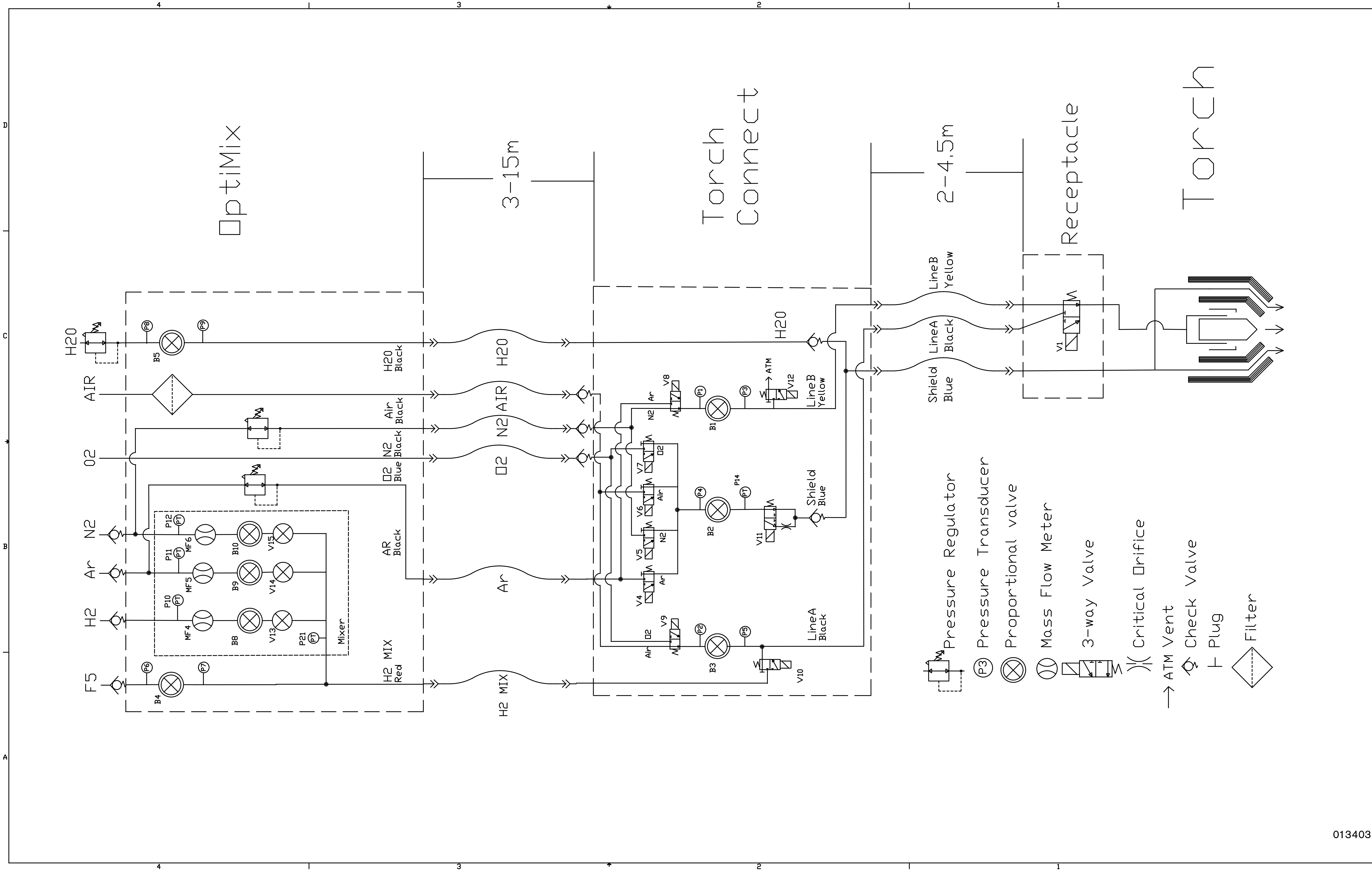
Torch connect console (Sheet 11 of 22)

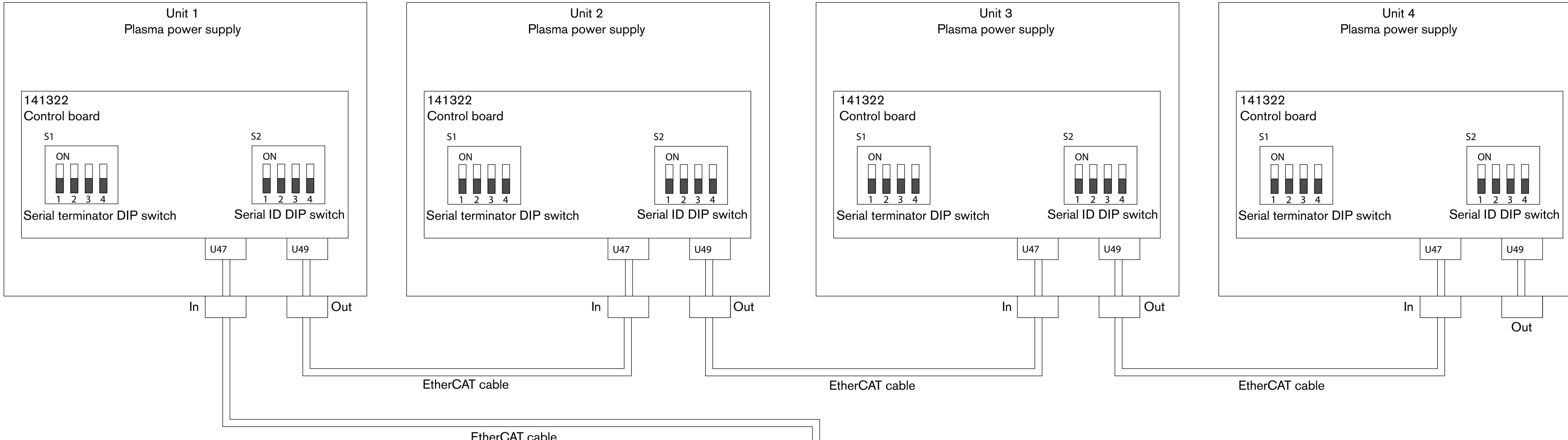



THERMISTOR
HEAT EXCHANGER
FLOW SENSOR
FINE FILTER
RESERVOIR
LEVEL SENSOR
RELIEF VALVE
CHECK VALVE
DRAIN
COLD PLATE 2
COLD PLATE 1
COARSE FILTER
PUMP
SHUT OFF VALVE
GAS CONNECT CONSOLE
TORCH CONNECT CONSOLE
TORCH
013403


Core
3-15m
Torch Connect
2-4.5m
Receptacle
Torch
AIR
N2
O2
Air Black
N2 Black
O2 Blue
LineB Yellow
LineA Black
Shield Blue
V1
V4
V5
V6
V7
V8
V9
V10
V11
V12
B1
B2
B3
P1
P2
P3
P4
P5
P7
P14
ATM
Pressure Regulator
Pressure Transducer
Proportional valve
Mass Flow Meter
3-way Valve
Critical Orifice
ATM Vent
Check Valve
Plug
Filter
013403


VWI
3-15m
Torch Connect
2-4.5m
Receptacle
Torch
H2O
AIR
N2
O2
Ar
F5
H2O Black
Air Black
N2 Black
O2 Blue
Ar Black
F5 Red
H2 MIX
LineB Yellow
LineA Black
Shield Blue
ATM
Pressure Regulator
Pressure Transducer
Proportional valve
Mass Flow Meter
3-way Valve
Critical Orifice
ATM Vent
Check Valve
Plug
Filter
013403

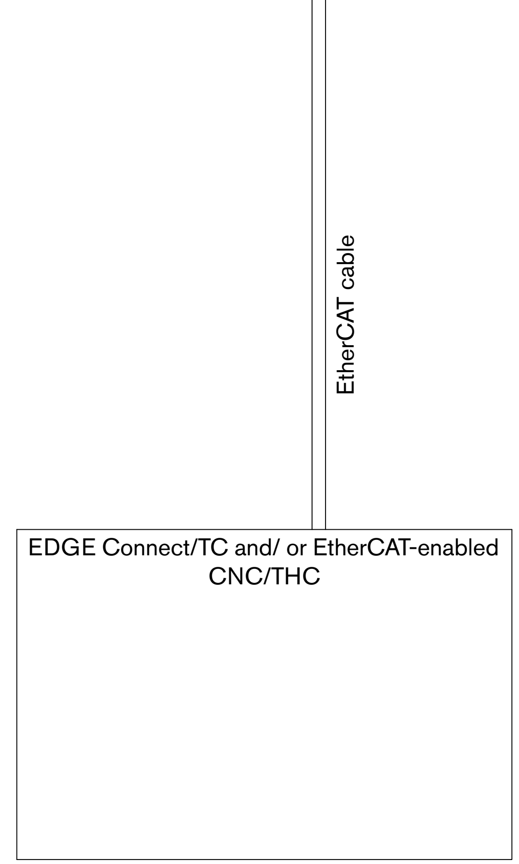

OptiMix
3-15m
Torch Connect
2-4.5m
Receptacle
Torch
H2O
AIR
O2
N2
Ar
H2
F5
H2O Black
Air Black
N2 Black
O2 Blue
AR Black
H2 MIX Red
Mixer
Line B Yellow
Line A Black
Shield Blue
ATM
Pressure Regulator
P3 Pressure Transducer
Proportional valve
Mass Flow Meter
3-way Valve
Critical Orifice
ATM Vent
Check Valve
Plug
Filter
013403

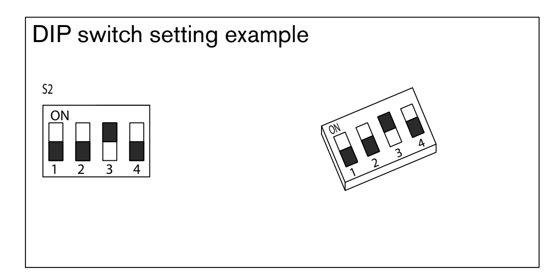


Notes:

1. Serial terminators (S1) and Serial IDs (S2) are not used for EtherCAT connections to EDGE Connect or EDGE Connect TC installations.

2. Serial Terminators (S1) and Serial IDs (S2) are not used for EtherCAT connections to EtherCAT enabled CNC and/or THC installations.

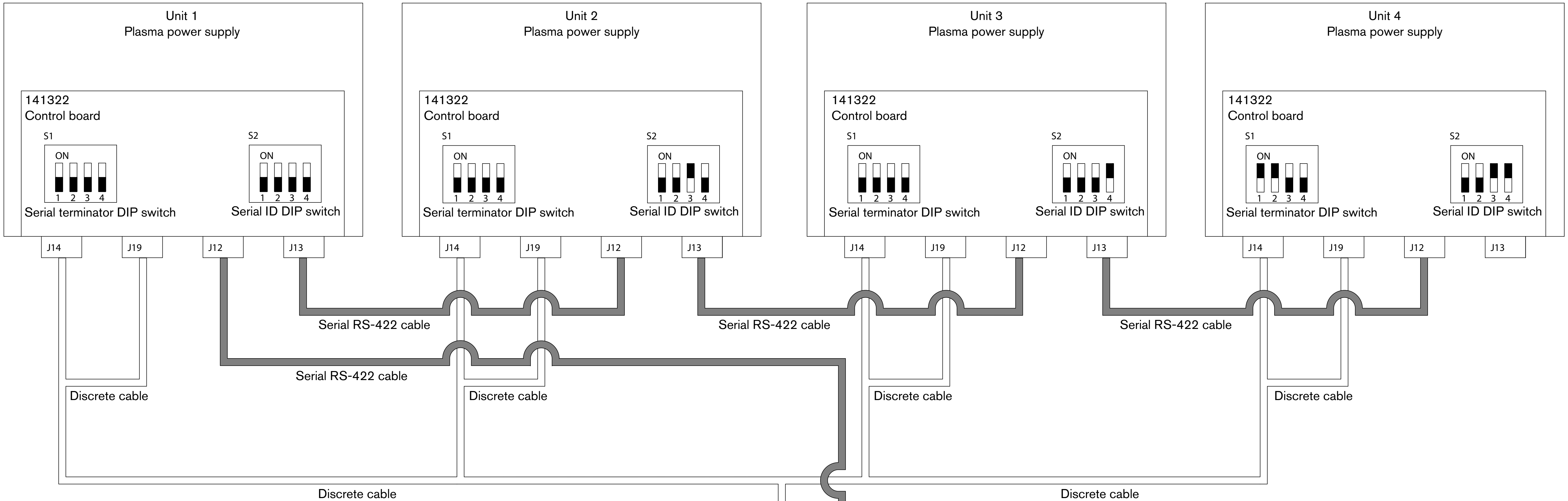


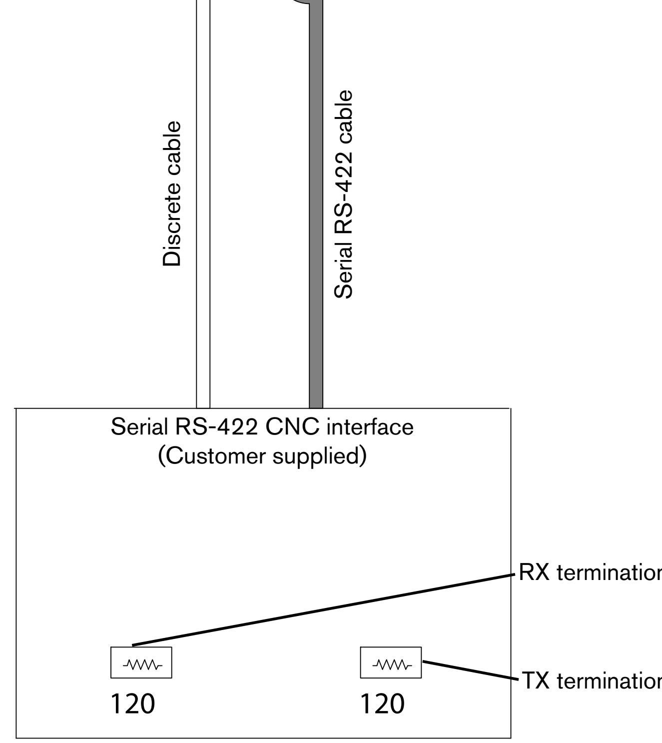


Switch 3 is in the ON position.
Switches 1, 2, and 4 are in the OFF position.

013403

Serial RS-422 and discrete multi-system interface (Sheet 17 of 22)

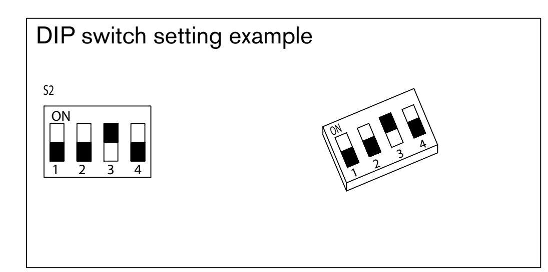




Notes:

1. For single plasma power supply installations, set Serial terminators (S1) as shown in Unit 4 and Serial IDs (S2) as shown in Unit 1.
2. On multi-plasma power supply installations see the illustration. Switch S1 position 1 and 2 are OFF in all plasma power supplies except for the last one where they are set to ON.

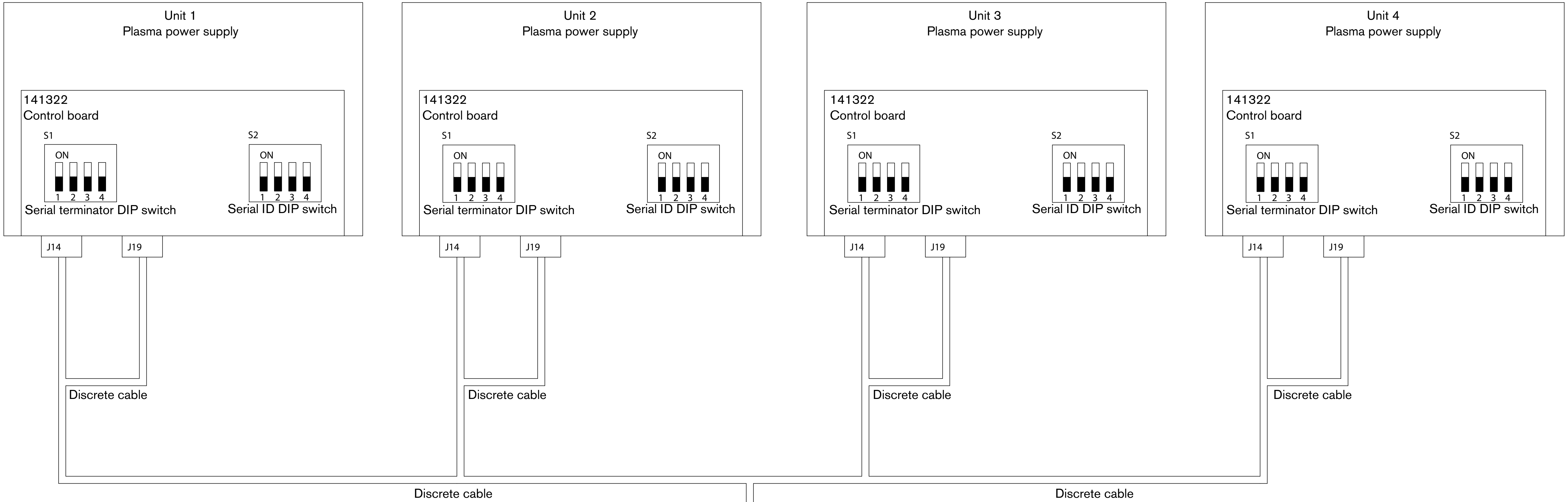
   Termination resistors (120 Ω) or termination jumpers must be installed and set at the CNC for each of the RS-422 RX and TX signal pairs.
3. If a Hypertherm CNC is used and there are intermittent communication failures (PS Link Failure), try reversing switch S1 position 1 and position 2 on the control board, and the termination jumper (J6 or J8) on the serial isolation board in the controller. Only remove the termination jumper on the serial isolation board that is connected to the plasma power supply.

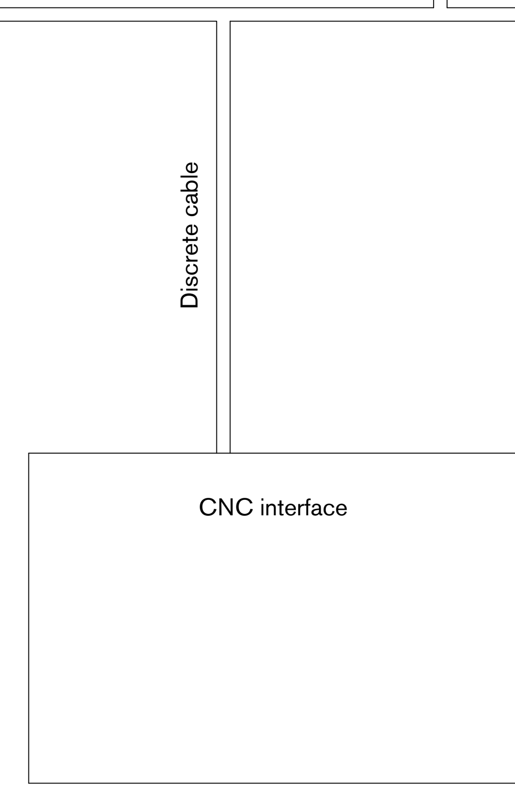


Switch 3 is in the ON position. Switches 1, 2, and 4 are in the OFF position.

013403

Discrete multi-system interface (Sheet 18 of 22)

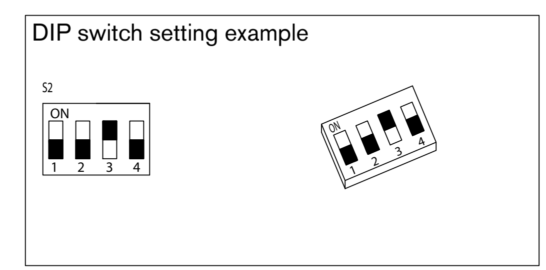




Notes:

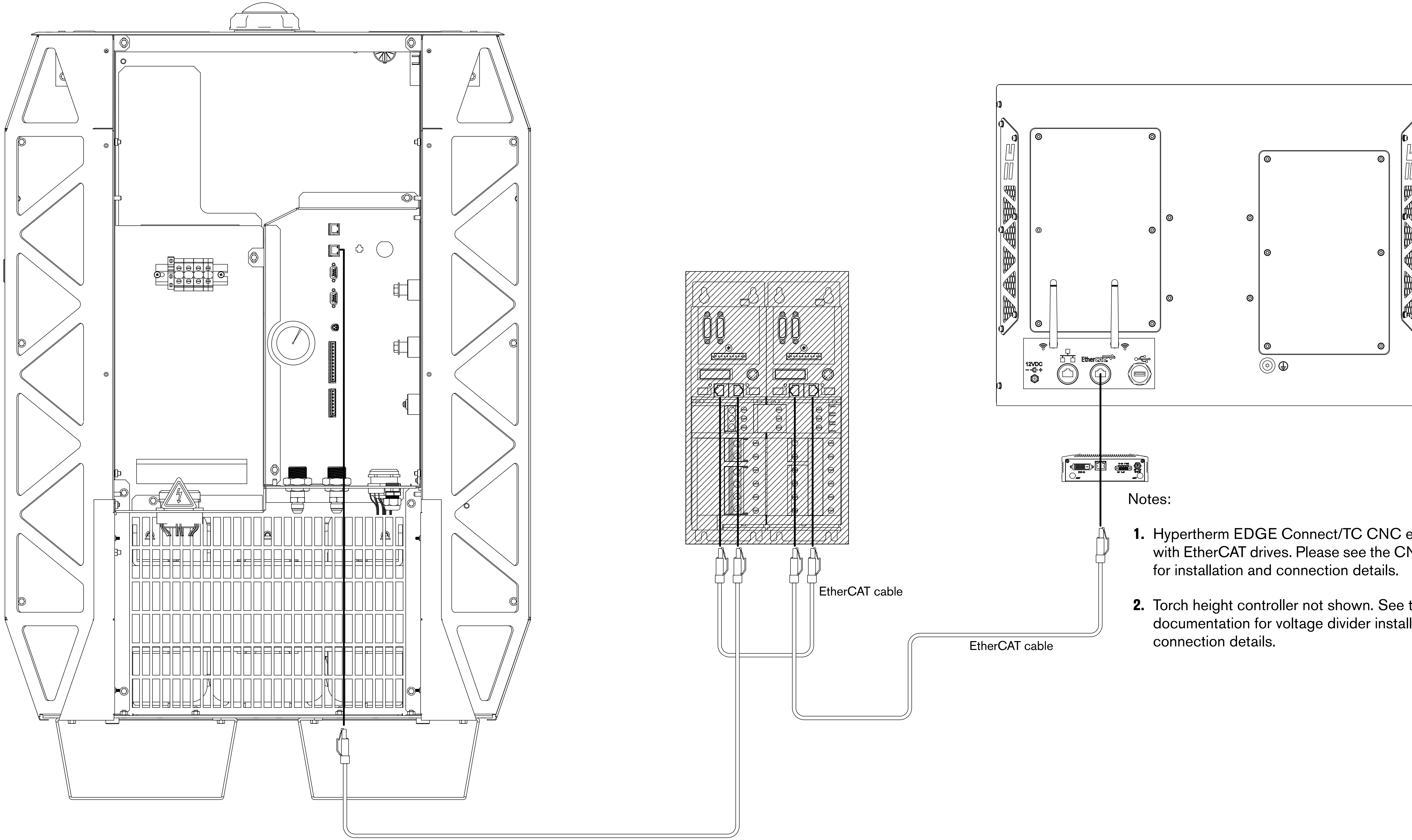
1. Serial terminator DIP switches (S1) and Serial ID DIP switches (S2) are not used for discrete-only CNC connections.

2. The CNC must provide separate inputs and outputs for each XPR plasma power supply. Sole exceptions are PLASMA START+/- and HOLD+/-. These can be wired in parallel from one set of CNC outputs to all XPR plasma power supplies.



Switch 3 is in the ON position.
Switches 1, 2, and 4 are in the OFF position.

013403



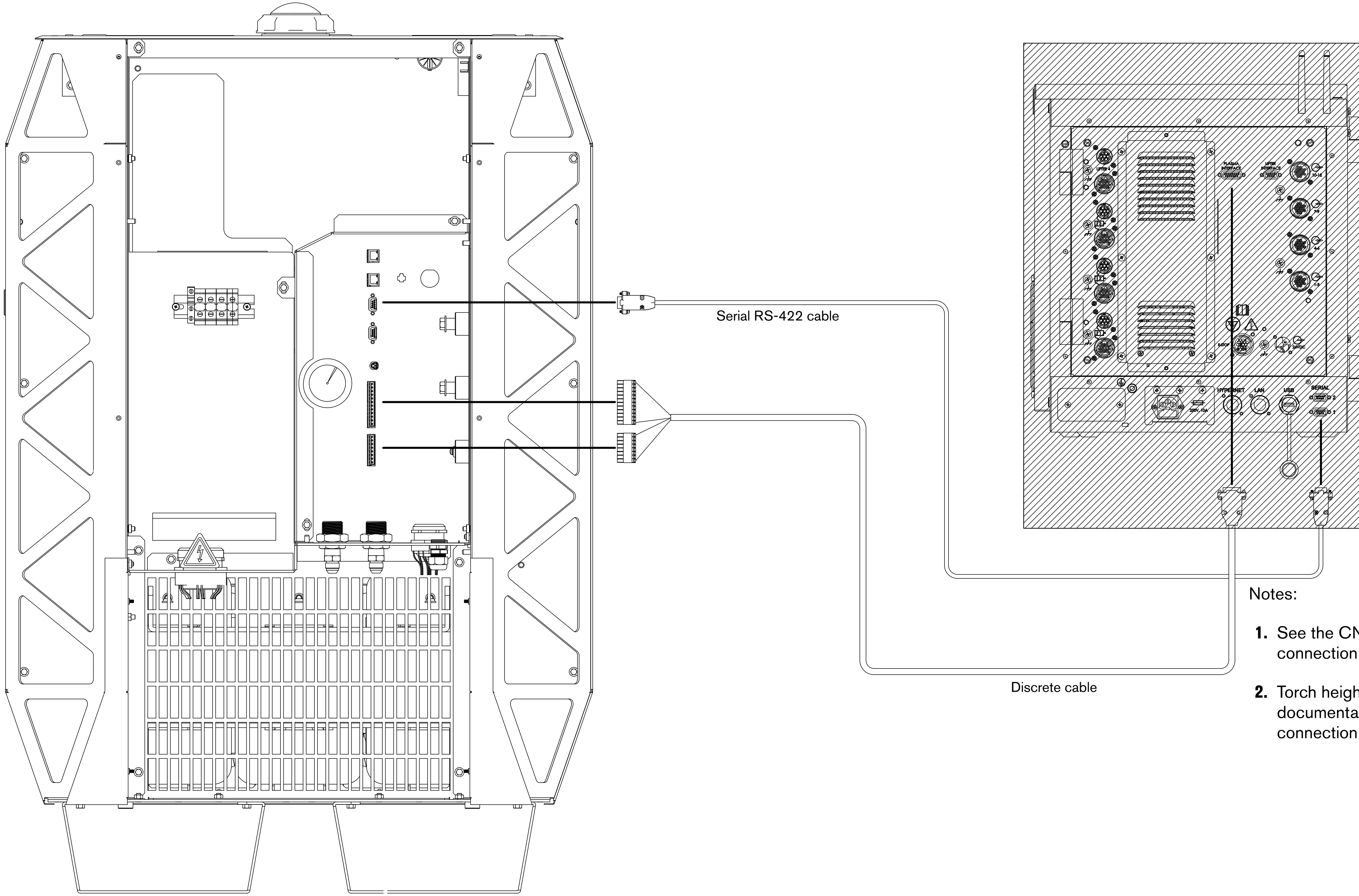
Notes:

1. Hypertherm EDGE Connect/TC CNC examples shown with EtherCAT drives. Please see the CNC documentation for installation and connection details.

2. Torch height controller not shown. See the THC documentation for voltage divider installation and connection details.

013403

Discrete and serial RS-422 CNC connections (Sheet 20 of 22)

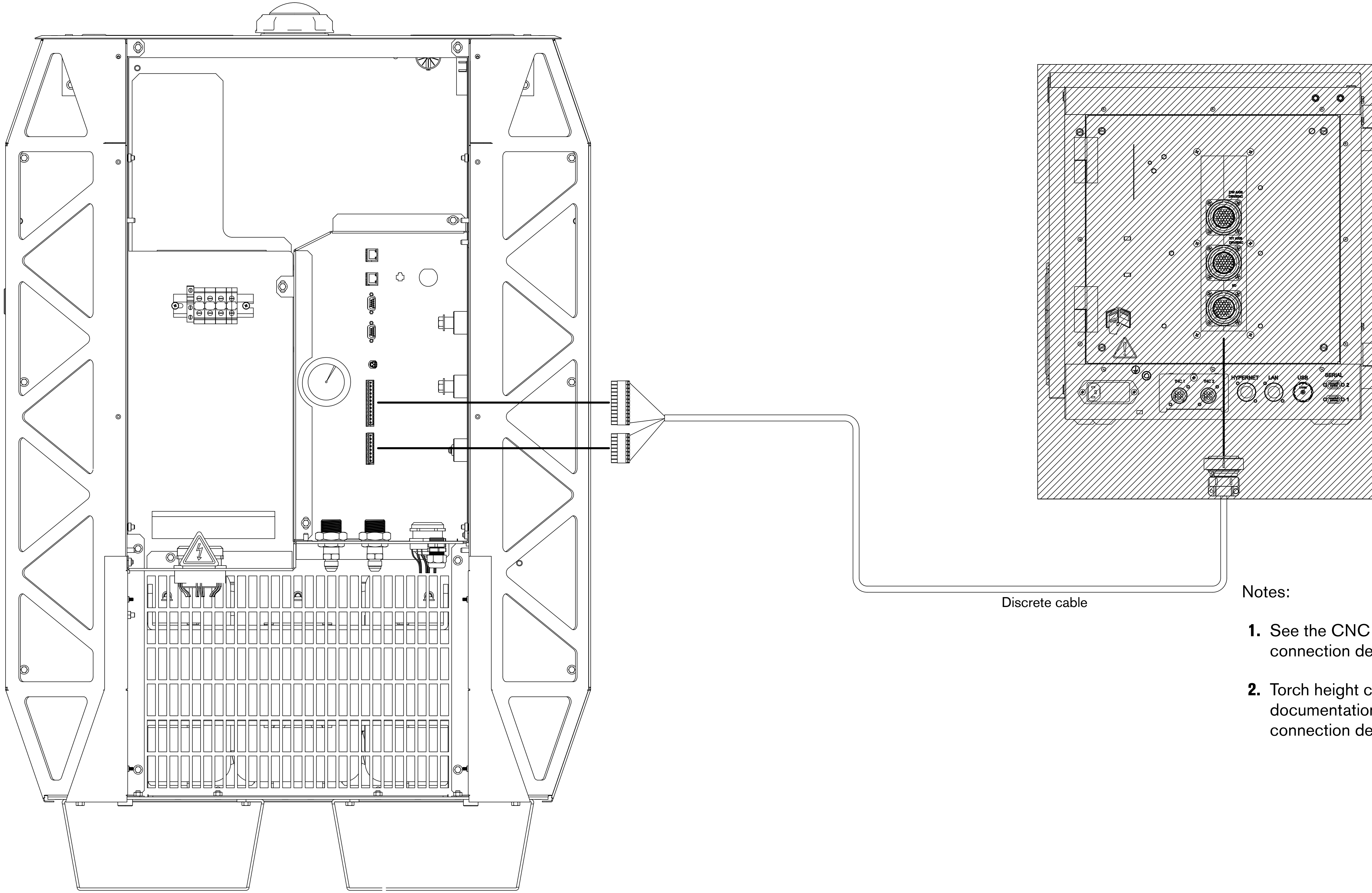


Notes:

1. See the CNC documentation for installation and connection details.
2. Torch height controller not shown. See the THC documentation for voltage divider installation and connection details.

013403

Discrete CNC connections (Sheet 21 of 22)

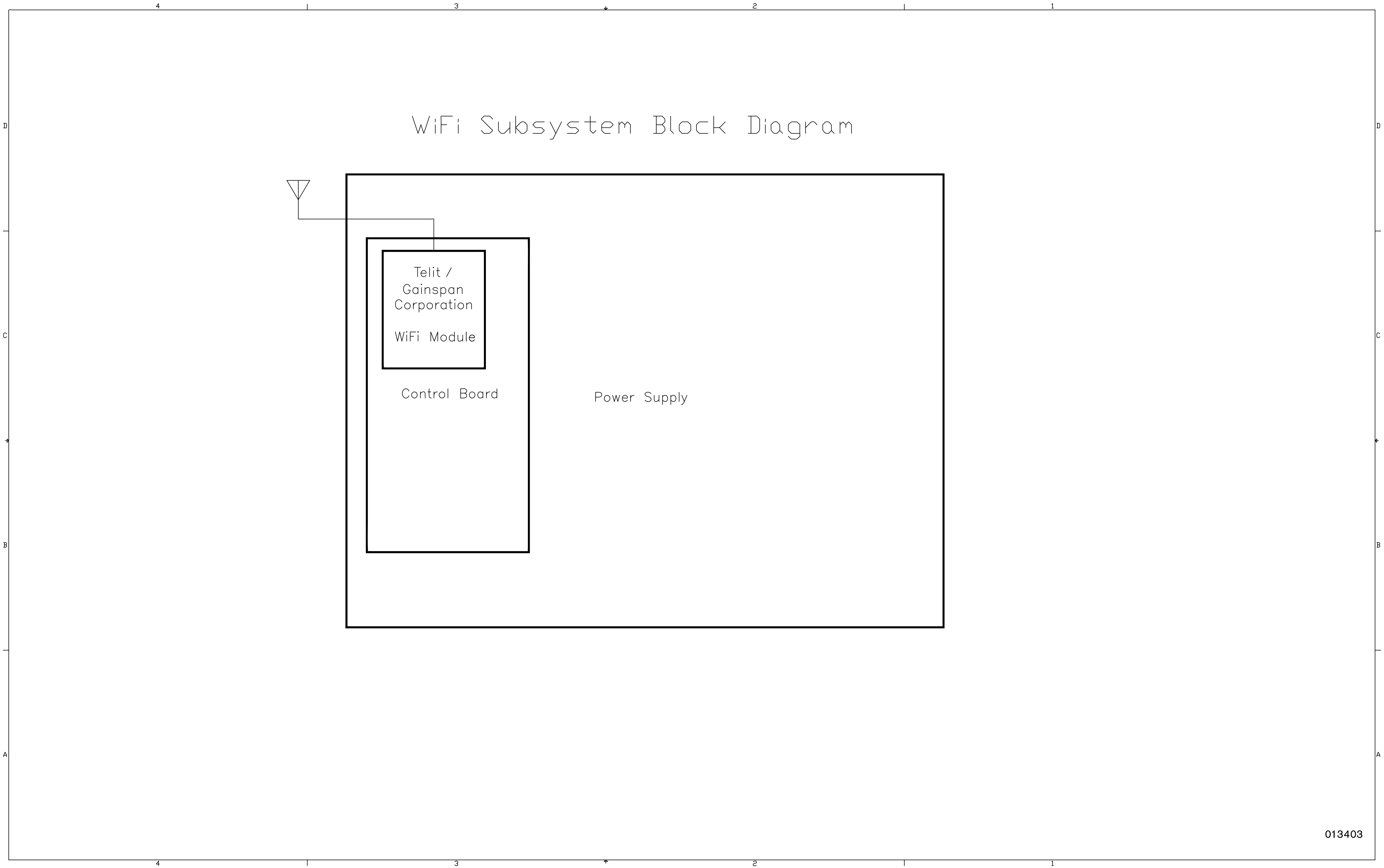


Notes:

1. See the CNC documentation for installation and connection details.

2. Torch height controller not shown. See the THC documentation for voltage divider installation and connection details.

013403


4
3
2
1
D
C
B
A
WiFi Subsystem Block Diagram
Telit /
Gainspan
Corporation
WiFi Module
Control Board
Power Supply
013403