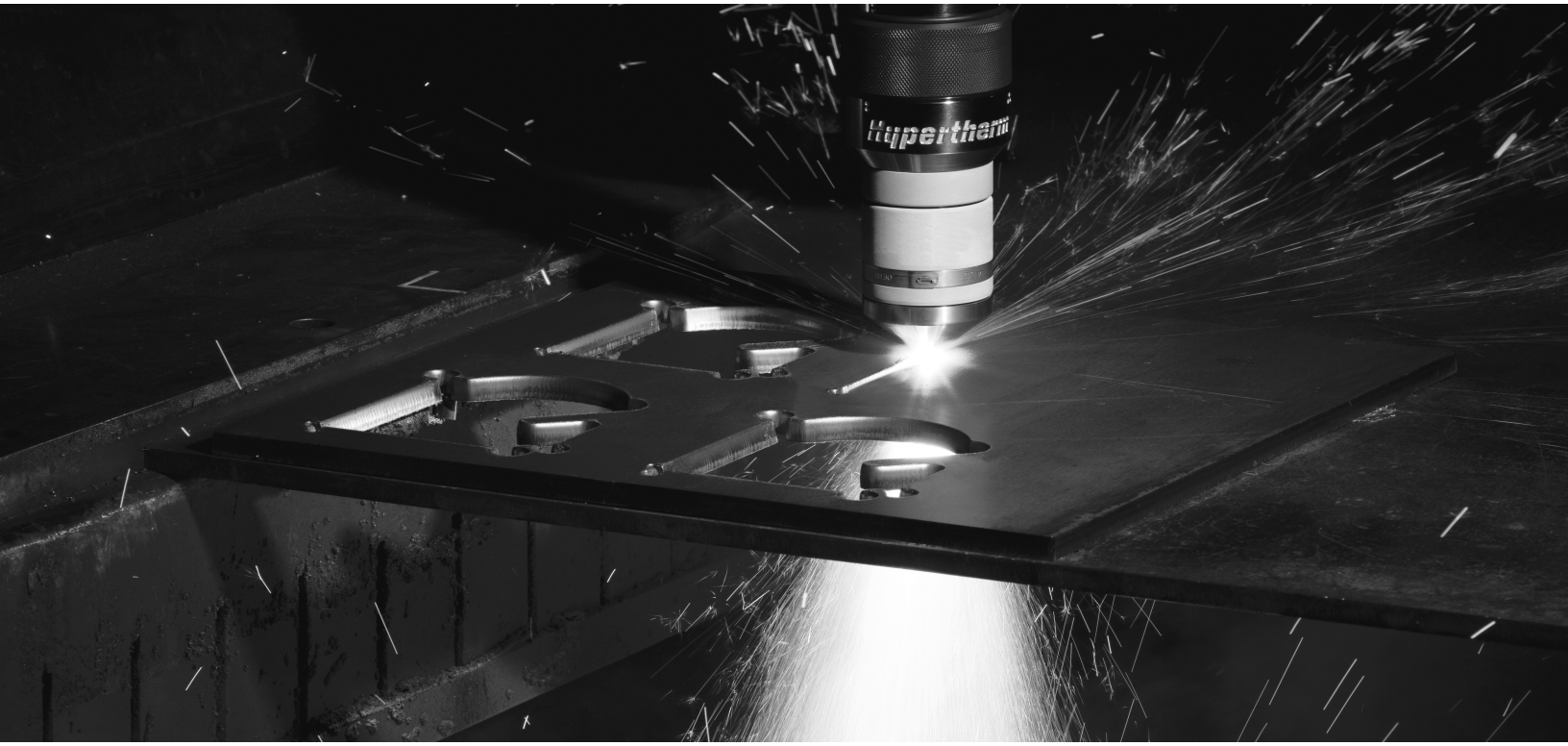
HYPERTHERM®
A Hypertherm Associates Brand

MAXPRO200®

Instruction Manual





807700 - Revision 9.4
August 2026

English
Original Instructions

Register your new Hypertherm system

Benefits of registration

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Maintenance notes: _____

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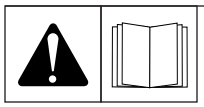
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You can find recycling information for your product at www.hypertherm.com/resources/system-support/recycling/.

Contact us

hypertherm.com/contactus

Hypertherm, Inc.
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Hanover, NH 03755 USA
www.hypertherm.com/contact-us



Safety information

WARNING! Before operating any Hypertherm equipment, read the safety instructions in your product's manual, the Safety and Compliance Manual (80669C), Waterjet Safety and Compliance Manual (80943C), and Radio Frequency Warning Manual (80945C). Failure to follow safety instructions can result in personal injury or in damage to equipment.

Copies of the manuals can come with the product in electronic and printed formats. Electronic copies are also on our website. Many manuals are available in multiple languages at www.hypertherm.com/docs.

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Electromagnetic Compatibility (EMC) introduction

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

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

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

Installation and use

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

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

Assessment of area

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

a. Other supply cables, control cables, signaling and telephone cables; above, below and adjacent to the cutting equipment.

b. Radio and television transmitters and receivers.

c. Computer and other control equipment.

d. Safety critical equipment, for example guarding of industrial equipment.

e. Health of the people around, for example the use of pacemakers and hearing aids.

f. Equipment used for calibration or measurement.

g. Immunity of other equipment in the environment. User shall ensure that other equipment being used in the environment is compatible. This may require additional protection measures.

h. Time of day that cutting or other activities are to be carried out.

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

Methods of reducing emissions

Mains supply

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

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

Maintenance of cutting equipment

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

Cutting cables

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

Equipotential bonding

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

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

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

Earthing of the workpiece

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

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

Screening and shielding

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

Chapter 1: Specifications

System description

General

The MAXPRO200® plasma system is designed to cut a wide range of thicknesses of mild steel, stainless steel, and aluminum.

Plasma power supply

The plasma power supply is a 200 A, 180 VDC constant-current supply. It contains the circuitry to ignite a torch, plus a heat exchanger and a pump to cool the chopper and torch. The plasma power supply has a discrete machine interface to provide communication with a Computer Numerical Control (CNC).

Ignition console

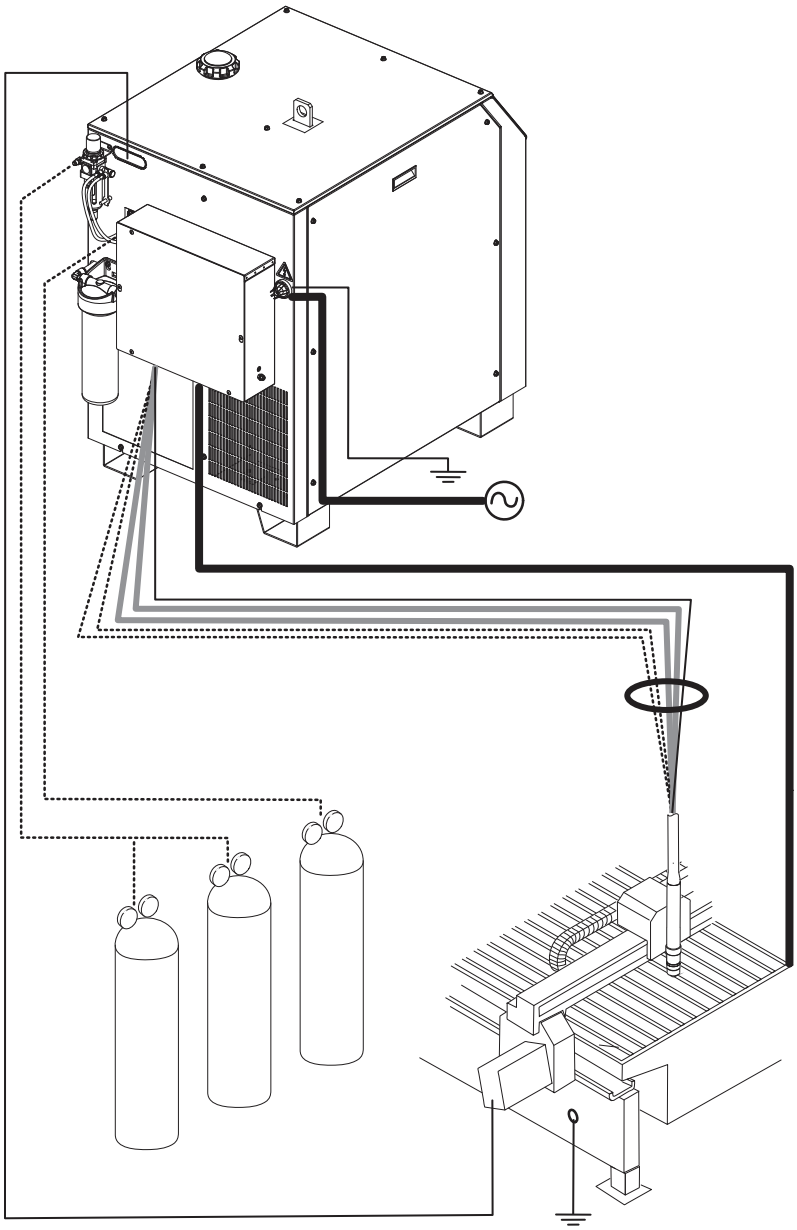
The ignition console is attached to the outside of the rear panel of the plasma power supply enclosure. The ignition console uses a spark-gap assembly. The ignition console converts 120 VAC control voltage from the plasma power supply into high-frequency and high-voltage pulses (9 kV – 18.2 kV) to initiate the pilot arc at the torch electrode-nozzle gap. The high-voltage, high-frequency signal is coupled to the pilot arc lead.

Torch

- The maximum production cutting capacity is the maximum thickness that can be cut with a 100% duty cycle. The maximum production cutting capacity of the MAXPRO200 torch is 32 mm (1-1/4 inches) for mild steel using the 200 A O_2/Air process, 22 mm (7/8 inch) for stainless steel, and 19 mm (5/8 inch) for aluminum using the 200 A Air/Air process.
- Maximum pierce capacity is 32 mm (1.25 inches) for mild steel, 25 mm (1 inch) for stainless steel, and 32 mm (1.25 inch) for aluminum.
- The maximum severance capacity is the maximum thickness that can be severed without regard for speed and cut quality. This thickness should only be cut occasionally and cannot be cut with a 100% duty cycle. The maximum severance capacity of the MAXPRO200 torch is 75 mm (3 inches) for mild steel, 63 mm (2-1/2 inches) for stainless steel, and 75 mm (3 inches) for aluminum.

Gas system

The gas system manages the pressure and timing of the gas supplied to the torch. It consists of a regulator, proportional valves, pressure transducers, and an inline valve located in the torch lead.

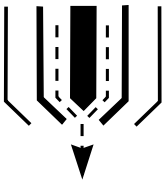
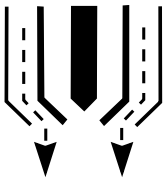
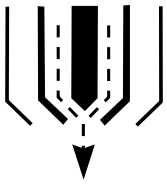
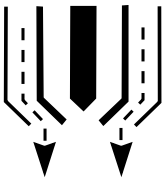
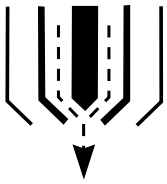
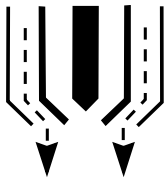


Cooling system

The cooling system uses a liquid-to-air cooled heat exchanger and a pump to reduce the temperature of the coolant. The coolant cools the chopper, torch lead and torch. The cooling system also contains flow and temperature sensors that verify the cooling system is working properly.

System gas requirements

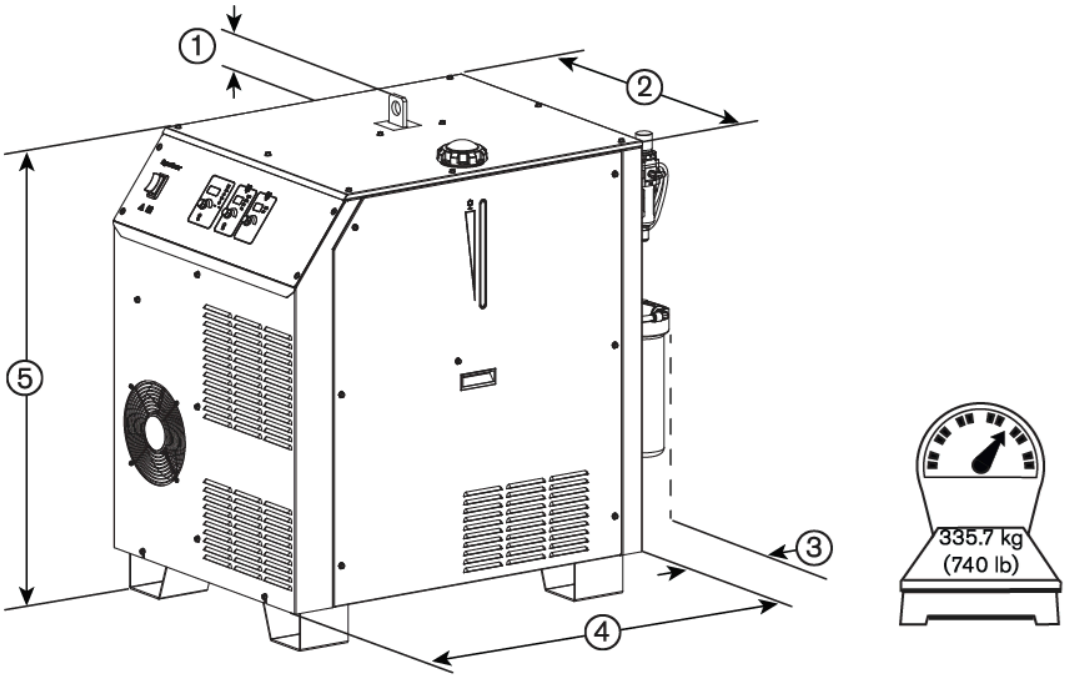
Gas quality and pressure requirements			
Gases	**Quality**	**Pressure +/- 10%**	**Flow rate**
O_2 oxygen	99.5% pure (liquid gas recommended) Clean, dry, and oil free	621 kPa / 6.2 bar / 90 psi	3400 l/h 120 scfh
N_2 nitrogen	99.9% pure (liquid gas recommended) Clean, dry, and oil free	621 kPa / 6.2 bar / 90 psi	11330 l/h 400 scfh
Air	Clean, dry, and oil free (ISO 8573-1 class 1.4.2)	621 kPa / 6.2 bar / 90 psi	11330 l/h 400 scfh

Gases by process						
	Mild steel		**Stainless steel**		**Aluminum**	
Amperage	Plasma gas 	Shield gas 	Plasma gas 	Shield gas 	Plasma gas 	Shield gas 
Cutting 50 A	Air or O_2	Air	Air	Air	Air	Air
Cutting 130 A	Air or O_2	Air	Air	Air	Air	Air
Cutting 130 A			N_2	N_2	N_2	N_2
Cutting 200 A	Air or O_2	Air	Air	Air	Air	Air
Cutting 200 A			N_2	N_2	N_2	N_2

Plasma power supply

Maximum Open Circuit Voltage (OCV) (U_0)	360 VDC
Maximum output current (I_2)	200 A
Output voltage (U_2)	50 – 180 VDC
Duty cycle rating (X)	100% @ 36.7 kW, 40°C (104°F)
Ambient temperature/Duty cycle	Plasma power supplies will operate between -10°C and +40°C (+14°F and 104°F)

Idle state power consumption (CE systems)				34.60 W		
Power source efficiency at rated maximum output power (CE systems)				90.89%		
Power factor				0.98 @ 36.7 kW output		
Cooling				Forced air (Class F)		
Insulation				Class H		
Peak arc striking voltage				14.8 kV		
Plasma power supply part numbers	AC Voltage (U_1)	Phase	Frequency (Hz)	Amperage I_1	Regulatory approval	Power kVA (+/- 10%) (U_1 x I_1 x 1.73)
078610	200/208	3	50-60	108/104	CSA	37.4
078611	220	3	50-60	98	CSA	37.4
078612	240	3	60	90	CSA	37.4
078613	380	3	50-60	57	CCC	37.4
078614	400	3	50-60	54	CE/EAC/ AAA/RCM/ UKr	37.4
078615	415	3	50	52	CE/EAC/ AAA/RCM/ UKr	37.4
078616	440	3	50-60	49	CSA	37.4
078609	480	3	60	45	CSA	37.4
078617	600	3	60	36	CSA	37.4



1 63.5 mm (2.5 inches)

2 688 mm (27.1 inches)

3 133 mm (5.25 inches)

4 998 mm (39.3 inches)

5 927 mm (40.1 inches)

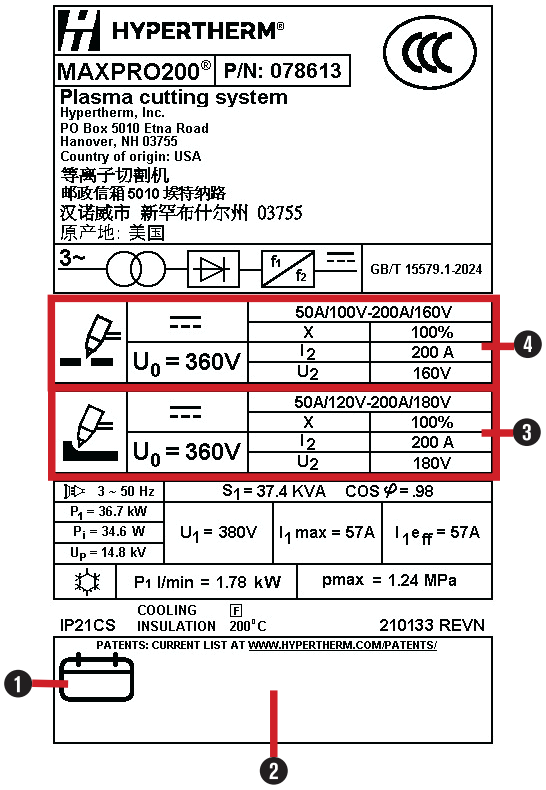
Weight 335.7 kg (740 pounds)

MAXPRO200 data plate

The data plate on the rear of the plasma power supply can have two sets of ratings:

- The **HYP** ratings are Hypertherm® plasma power supply ratings. They show the capacity of the system related to internal testing done by Hypertherm.
- The **IEC** ratings are the minimum ratings that the system must get to meet the requirements of International Electrotechnical Commission (IEC) standard 60974-1.

CSA, CE, and CCC data plates can differ slightly. This image shows a CCC MAXPRO200 data plate:



1 Date made

2 Serial number, bar code

3 Plasma gouging ratings

4 Plasma cutting ratings

Table 1 - Data-plate abbreviations

I_1=	Input current (A)
I_2=	Conventional cutting current (A)
PF =	Power factor
U0 =	Rated no load voltage (V)
U1 =	Input voltage (V)
U2 =	Conventional welding voltage (V)
X =	Duty cycle

Ecodesign requirements for CE models

Table 2 - Ecodesign requirements CE models

Ecodesign requirement	Idle	With load	Description
Output current	–	199.86 A	Measured at the rated duty cycle for the system at the highest output power.
Output voltage	–	184.38 V	
Output active power	–	36.84 kW	
Root Mean Square (RMS) of the supply voltage	401.52 V	399.85 V	Measured at idle state and at the rated duty cycle for the system at the highest output power.
Supply active power	34.55 W	40.53 kW	
Total harmonic distortion of the supply voltage (UTHD)	1.26%	4.34%	
Idle state power consumption by the power source	34.55 W	–	Measured at idle state.
Efficiency	–	90.89%	Calculated at the rated duty cycle for the system at the highest output power.

MAXPRO200 China Energy Label (CEL)

The rear panel of the MAXPRO200 plasma power supply can have a China Energy Label (CEL) with energy-efficiency information.



1 Energy-efficiency rating: Level 1 is most efficient, level 3 is least efficient

2 Manufacturer name and plasma power supply model

3 Energy efficiency (%)

4 Rated output current, power factor under load, and no-load current

Table 3 - Energy-efficiency specifications for the MAXPRO200 plasma power supply

Input voltage	Efficiency rating	Efficiency (%)	Rated current (A)	Power factor under load	No-load current
380	2	90.0	200	0.90	/

MAXPRO200 Ingress Protection (IP) classification

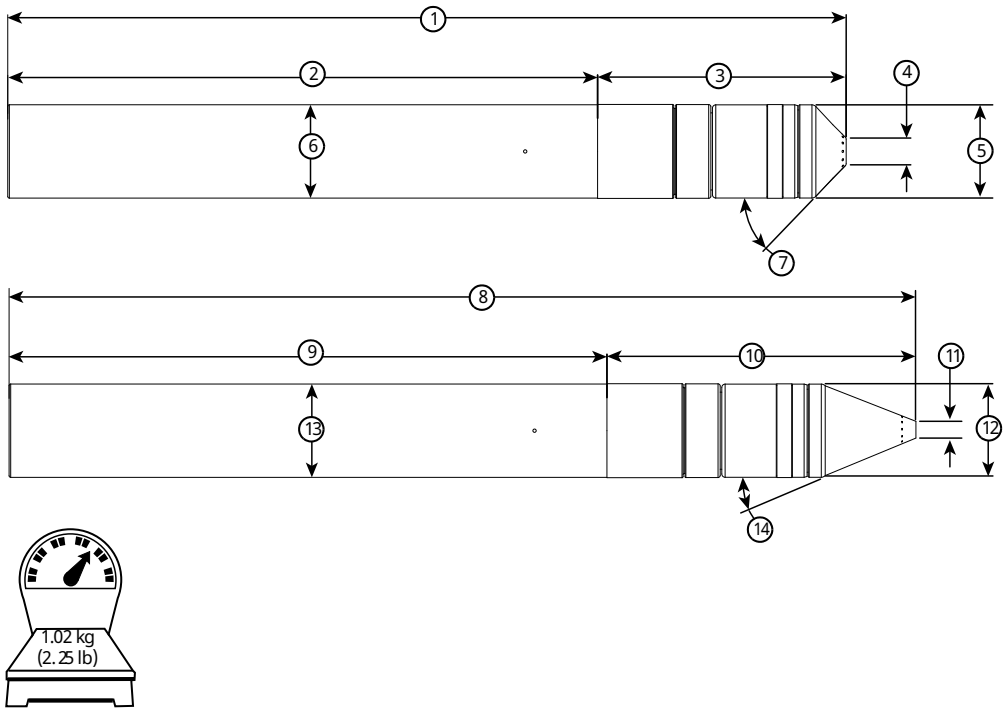
The Ingress Protection (IP) rating specifies the extent of protection an electrical enclosure has against environmental conditions.

The IP rating for the MAXPRO200 plasma cutting system is IP21CS.

Mechanized torches

Straight torch – 428024 or 228937

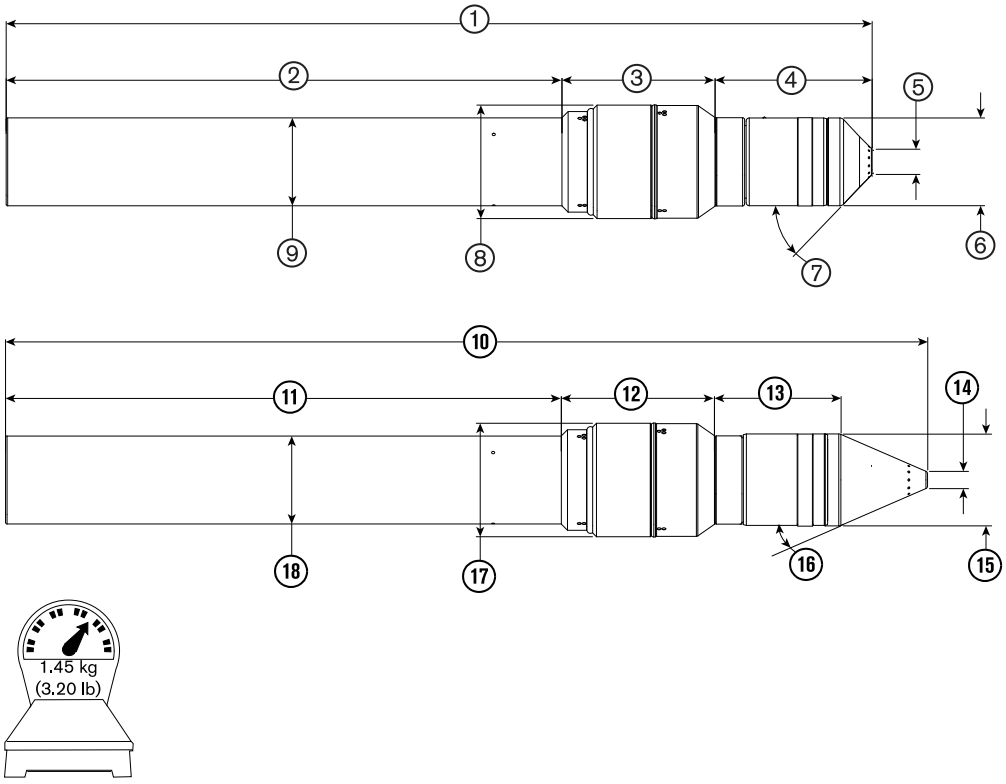
- The torch mounting sleeve for the straight torch is available with an outside diameter of 50.80 mm (2.00 inches) or 44.45 mm (1.75 inches).
- The minimum bend radius for the torch lead is 152.40 mm (6.00 inches).
- The weight of the torch is 1.02 kg (2.25 pounds).
- The image shows standard and extreme bevel consumables for comparison.



Standard MAXPRO200 consumables		Extreme bevel MAXPRO200 consumables	
1	397.15 mm (15.64 in.)	8	424.15 mm (16.71 in.)
2	279.40 mm (11.00 in.)	9	279.40 mm (11.00 in.)
3	117.75 mm (4.64 in.)	10	144.88 mm (5.70 in.)
4	12.70 mm (0.50 in.)	11	7.62 mm (.30 in.)
5	44.20 mm (1.74 in.	12	44.20 mm (1.74 in.)
6	50.80 mm (2.00 in.) or 44.45 mm (1.75 in.)	13	50.80 mm (2.00 in.) or 44.45 mm (1.75 in.)
7	46 degrees	14	23.5 degrees

Quick-disconnect torch – 428027 or 428028

- The torch mounting sleeve for the quick-disconnect torch is available with an outside diameter of 50.80 mm (2.00 inches) or 44.45 mm (1.75 inches).
- The minimum bend radius for the torch lead is 152.40 mm (6.00 inches).
- The weight of the torch is 1.45 kg (3.20 pounds).
- The image shows standard and extreme bevel consumables for comparison.



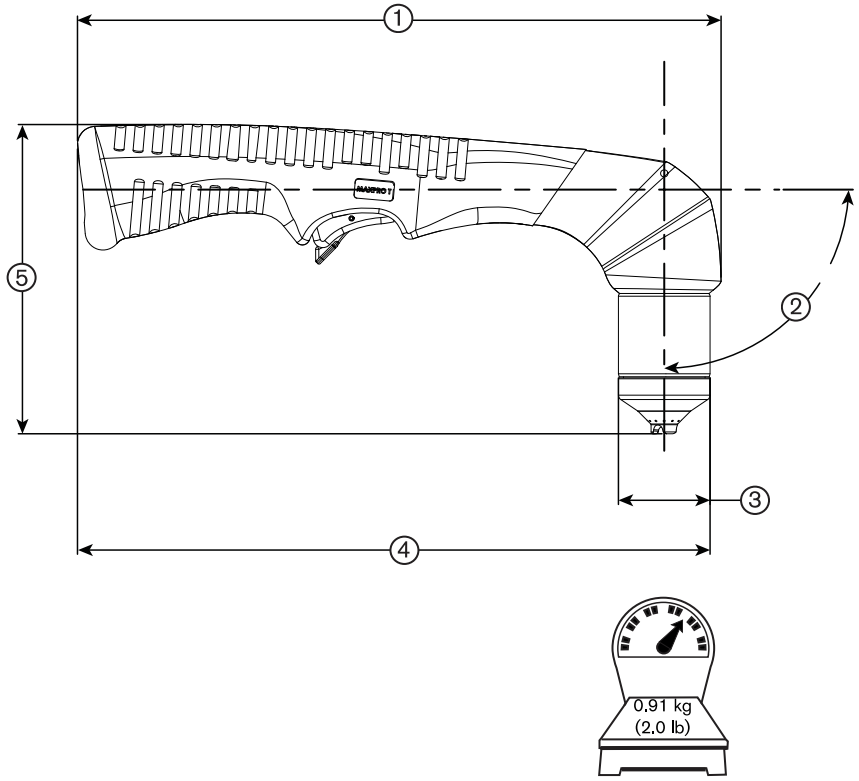
Standard MAXPRO200 consumables		Extreme bevel MAXPRO200 consumables	
1	435.33 mm (17.14 in.)	10	462.28 mm (18.20 in.)
2	279.40 mm (11.00 in.)	11	279.40 mm (11.00 in.)
3	76.98 mm (3.03 in.)	12	76.98 mm (3.03 in.)
4	78.95 mm (3.11 in.)	13	64.52 mm (2.54 in.)
5	12.70 mm (.50 in.)	14	7.62 mm (.30 in.)
6	44.20 mm (1.74 in.)	15	44.20 mm (1.74 in.)

Standard MAXPRO200 consumables		Extreme bevel MAXPRO200 consumables	
7	46 degrees	16	23.5 degrees
8	57.15 mm (2.25 in.)	17	57.15 mm (2.25 in.)
9	50.80 mm (2.00 in.) or 44.45 mm (1.75 in.)	18	50.80 mm (2.00 in.) or 44.45 mm (1.75 in.)

Hand torches

90 degree hand torch – 420108

- The minimum bend radius for the torch lead is 152.4 mm (6.0 inches).
- The weight of the torch is 0.91 kg (2.0 pounds).



1 310.40 mm (12.22 inches)

2 90 degrees

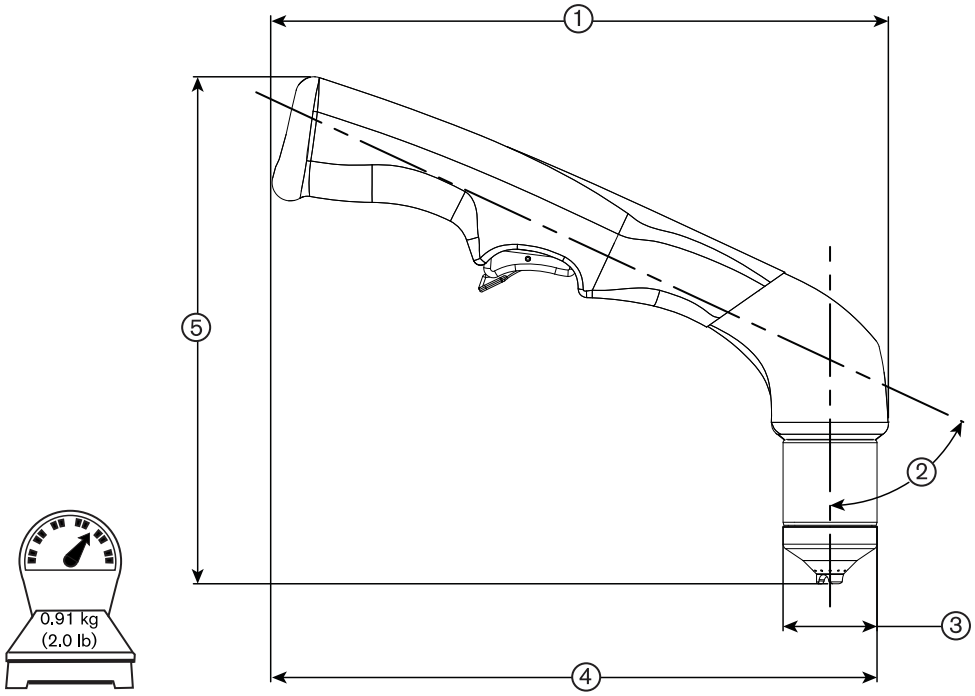
3 44.20 mm (1.74 inches)

4 305.05 mm (12.01 inches)

5 149.10 mm (5.87 inches)

65 degree hand torch – 420107

- The minimum bend radius for the torch lead is 152.4 mm (6.0 inches).
- The weight of the torch is 0.91 kg (2.0 pounds).



1 290.58 mm (11.44 inches)

2 65 degrees

3 44.20 mm (1.74 inches)

4 285.24 mm (11.23 inches)

5 238.51 mm (9.39 inches)

Critical raw materials

Critical raw material	Components that contain more than 1 gram
Borate	All printed circuit boards, torch, torch mounting sleeve
Magnesium	Heatsinks, cold plates
Natural graphite	Pump motor, resistors
Phosphorus	Sheet metal panels

Critical raw material	Components that contain more than 1 gram
Rare earth elements (heavy and light)	Torch breakaway, pump motor
Silicon metal	Heatsinks, cold plates, transformers, inductors, IGBT modules
Tantalum	Capacitors
Tungsten	Power resistors

Safety and EMC symbols and marks

You can see different safety and EMC symbols and marks on your system. Each image identifies a specific regional certification.

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 an 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.

United Kingdom Conformity Assessed mark

CE versions of products that include a UKCA mark of conformity meet the product safety, EMC, RF, and RoHS requirements for export to the UK.

IEC symbols

You can see different IEC symbols on the system. Each image has a specific meaning in the context of operating a plasma cutting system.

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

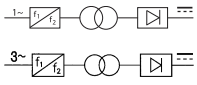


The terminal for the external protective (earth) (PE) conductor

Power is ON



Power is OFF



A 1-phase or 3-phase inverter-based power source



Volt/amperage curve, “drooping” characteristic

Chapter 2: Installation

Upon receipt

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

Claims

Claims for damage during shipment – If your unit was damaged during shipment, you must file a claim with the carrier. Hypertherm will furnish you with a copy of the bill of lading upon request. If you need additional assistance, speak to customer service or your authorized Hypertherm distributor.

Claims for defective or missing merchandise – If any of the merchandise is defective or missing, speak to your supplier. If you need additional assistance, speak to customer service or your authorized Hypertherm distributor.

Installation requirements

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

Direct any technical questions to the nearest Hypertherm Technical Service Department or your authorized Hypertherm distributor.

Acoustical Noise Data Sheets

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)*.

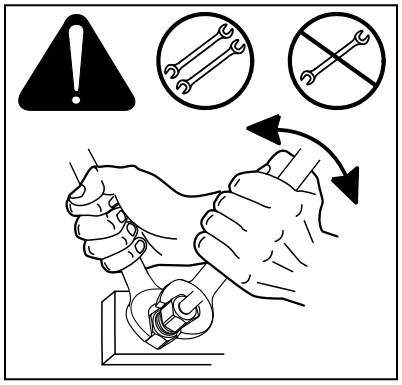
In addition, you can find an *Acoustical Noise Data Sheet* for your system at www.hypertherm.com/docs. In the search box, enter **Acoustical Noise Data Sheet**.

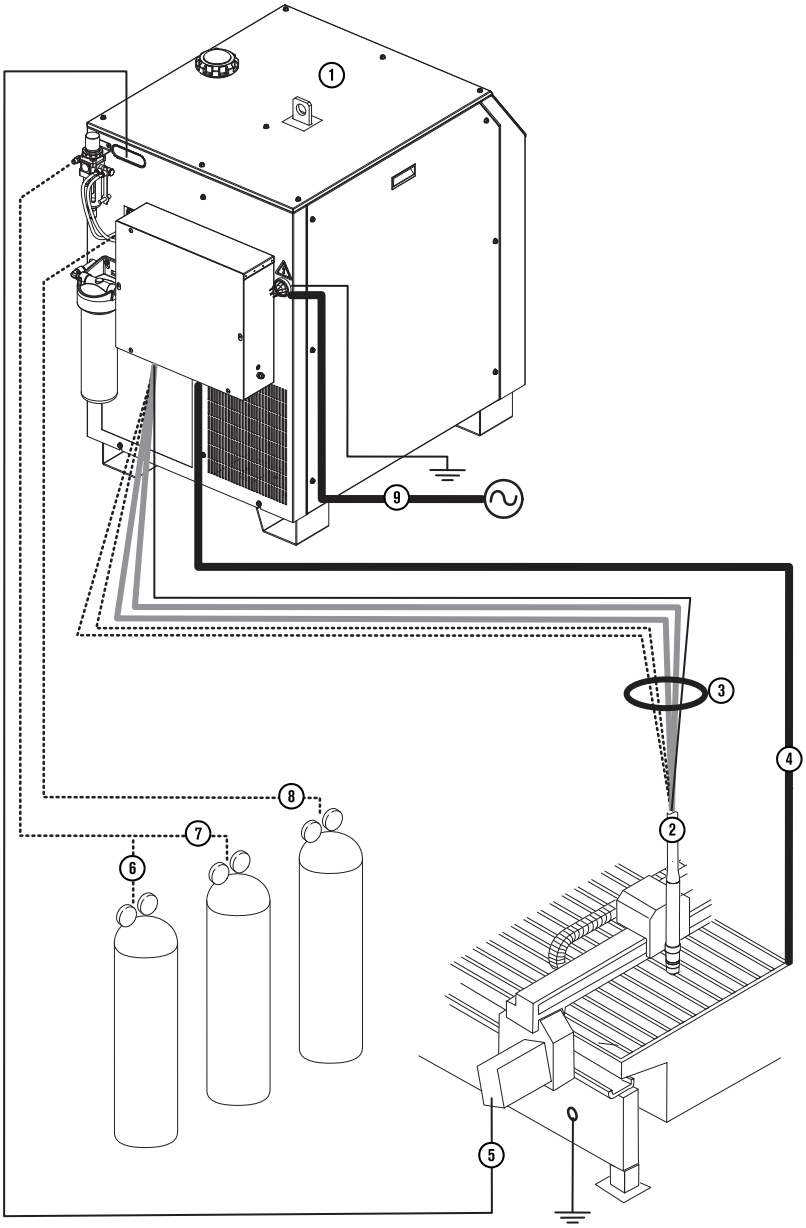
Placement of system components

- Place all system components in position prior to making electrical, gas, and interface connections. Use the diagram for component-placement guidelines.
- Ground all system components to earth. Refer to Recommended grounding and shielding on page 33.
- To prevent leaks in the system, tighten all gas connections as shown.

Table 4 - Torque specifications

Gas or water hose size	kgf-cm	lbf-in	lbf-ft
Up to 10 mm (3/8 in)	8.9-9.8	75-85	6.25-7
12 mm (1/2 in)	41.5-55	360-480	30-40





System components

1 Plasma power supply

2 Torch

Cables and leads

3 Torch lead

4 Work lead

5 CNC interface cable

Supply gas hoses

6 Air

7 N_2

8 O_2

Customer-supplied power cable

9 Main power cable

Recommended grounding and shielding

It is important to use grounding and shielding best practices when you set up a plasma cutting system. This can minimize problems related to EMI, or electrical noise.

This section describes practices for grounding and shielding a plasma cutting system to minimize its susceptibility to EMI (also known as noise). It also describes the service ground, Protective Earth (PE) ground, and Direct Current (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 national and local electrical codes to make sure that the grounding and shielding practices that you use comply with the requirements for your location.

Types of grounding

When you set up a plasma cutting system, make sure that you comply with the four types of grounding: service ground, PE ground, DC power ground, and EMI grounding and shielding.

Service ground

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 cutting system and other systems, such as the CNC and the motor drives, and the supplemental ground rod connected to the cutting table. In the plasma circuits, the ground is carried from the plasma power supply chassis to the chassis of each separate console through the interconnecting cables.

PE ground

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 Alternating Current (AC) service.

DC power ground

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 cutting system. It requires that the positive cable from the plasma cutting system be firmly connected to the cutting table ground bus with a correctly 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

EMI grounding and shielding is the grounding system that limits the amount of EMI emitted by the plasma cutting system and motor drive system. 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

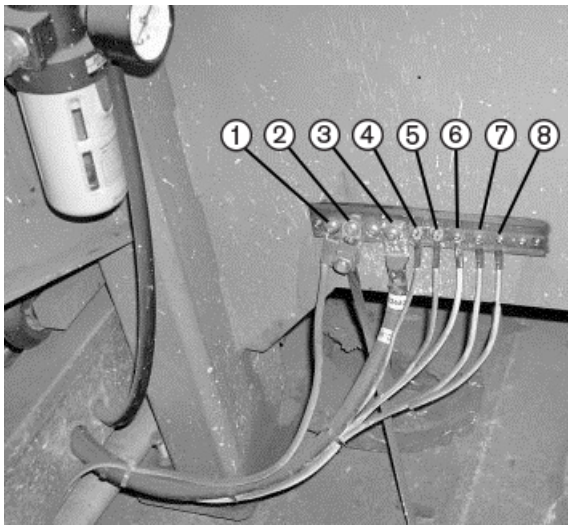
When you set up a plasma cutting system, make sure that you comply with all best practices for correctly grounding the system.

- Unless noted, for XPR® cutting systems, 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 with a plasma cutting system on page 38.
- Unless noted, for MAXPRO200 cutting systems, use cables with a minimum gauge of 13.3 mm^2 (6 AWG) (047040) for the EMI ground cables shown in the Example grounding diagram with a plasma cutting system on page 38.

- 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 Remote High Frequency (RHF) console or combined ignition/gas connect console, if applicable, must each run separately to the table ground bus.
- 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 national and local electrical codes to make sure that the grounding and shielding practices that you use comply with the requirements for your location.
- A ground rod (a local ground) that meets all applicable national and local electric codes must be installed within 6 m (20 ft) of the cutting table. Consult an electrician in your location to make sure that your grounding meets all national and local electric codes.
    - For XPR cutting systems, 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).
    - For MAXPRO200 cutting systems, the PE ground must be connected to the cutting table ground bus bar using a minimum 13.3 mm^2 (6 AWG) grounding cable (047121).
- For the most effective shielding, use the Hypertherm CNC interface cables for Input/Output (I/O) signals, serial communication signals, between plasma cutting systems in multi-drop connections, and for interconnections between all components of the Hypertherm system.
- 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.
- AC power, PE, and service grounds must be connected to all equipment according to national and local codes.
- For a cutting system with a RHF console or combined ignition/gas connect console, the positive, negative, and pilot arc cables should be bundled together for as long a distance as possible. The torch lead, work cable, and the pilot arc (nozzle) cables 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.
- For a cutting 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.

- Each Hypertherm component, and 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 cutting system or to the cutting table.
- For XPR cutting systems, the coupler on the pilot arc and coolant hose assembly must be connected firmly to the gas connect console and TorchConnect™ 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 cable (10 AWG) to the flat terminal on the torch mounting sleeve.
- For MAXPRO200 cutting systems, the metal braided shield on the torch lead must be connected firmly to the ignition/gas connect console and to the torch. It is recommended to be electrically insulated from any metal and from any contact with the floor or building. The torch lead can be run in a plastic cable tray or track, or covered with a plastic or leather sheath.
- 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.
- 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.
- If you are installing a voltage divider Printed Circuit Board (PCB), mount it as closely as possible to where the arc voltage is sampled. One recommended location is inside the plasma power supply enclosure. If a Hypertherm voltage divider PCB 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 cutting system and leave it unconnected at the other end.
- 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.

Figure 1 - Plasma cutting system components connected to a cutting table ground bus



1 Gantry ground bus

2 Ground rod

3 Plasma cutting system work cable (+)

4 XPR: Gas connect console

5 CNC enclosure

6 Torch holder

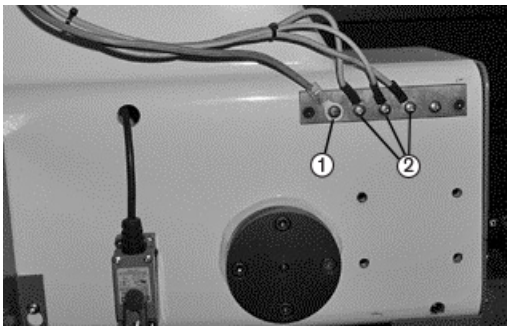
7 Plasma cutting system chassis

8 XPR: TorchConnect console

XPR: Cooler, if applicable (not shown)

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.

Figure 2 - Gantry ground bus example

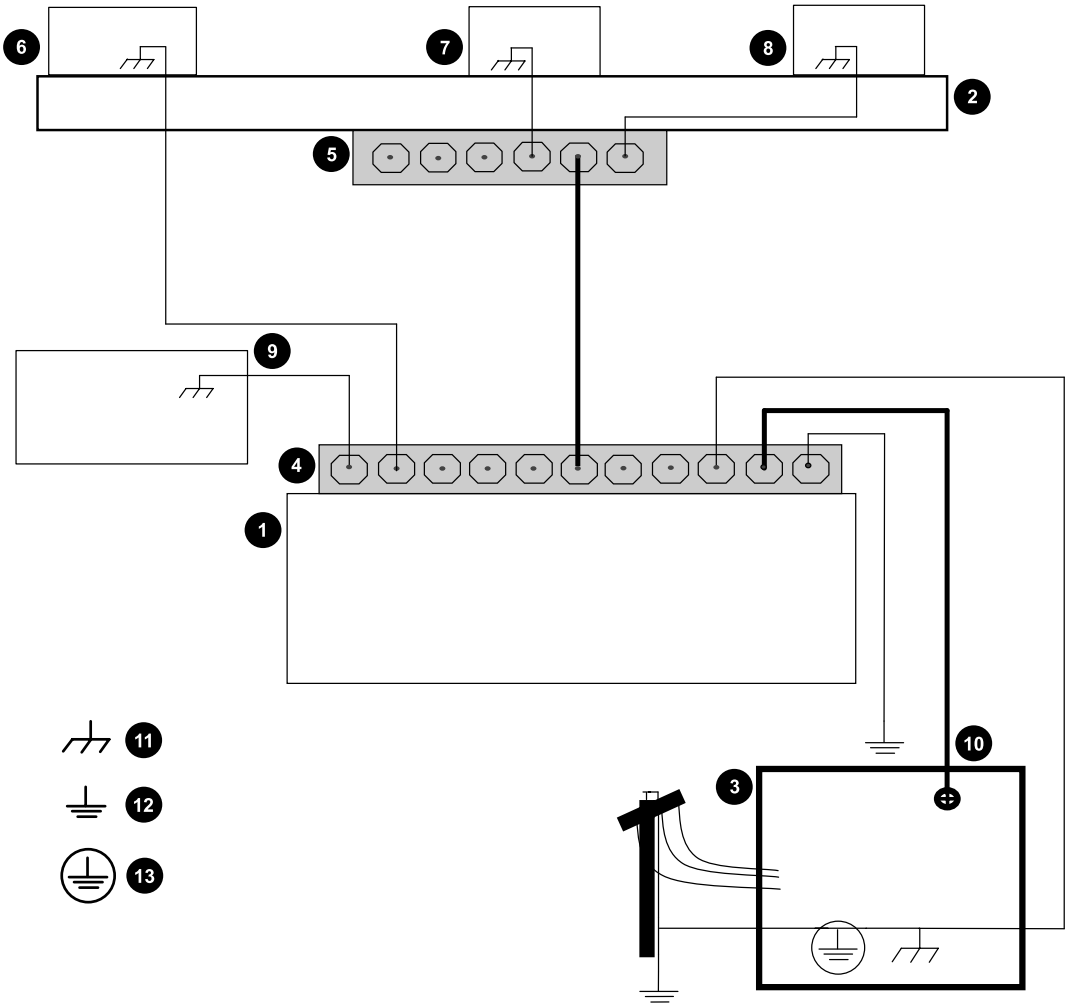


1 Cable to the cutting table ground bus

2 Ground cables from components on the gantry

Example grounding diagram with a plasma cutting system

Figure 3 - Example grounding diagram with a plasma cutting system



1 Cutting table

2 Gantry

3 Plasma system

4 Table ground bus bar

5 Gantry ground bus bar

6 Torch height control lifter

7 System-specific component such as metering console, gas console, or selection console

8 CNC chassis

9 Torch height control module

10 DC power ground (work)

11 Chassis and EMI ground

12 Service ground

13 PE ground

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

Placement of the plasma power supply

⚠ WARNING



ELECTRIC SHOCK CAN KILL

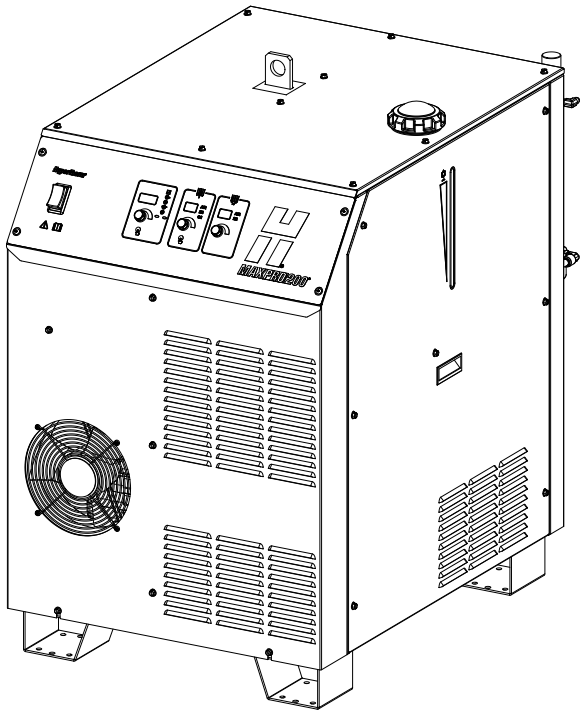
Electric shock can seriously injure or kill you. You can get a serious electric shock if electric power is not disconnected.

Disconnect electric power before doing installation or maintenance. All work that requires removal of the outer cover or panels must be done by a qualified technician. Refer to the *Safety and Compliance Manual (80669C)* for more safety information.

The plasma power supply can be moved by using the lifting eye or by forklift but the forks must be long enough to extend the entire length of the base. Take care when lifting so that the underside of the plasma power supply is not damaged. The forks must also be centered front to back and side to side to prevent tipping while moving. Fork lift speeds should be kept to a minimum, especially when making a turn or going around a corner.

- Place the plasma power supply in an area that is free of excessive moisture, has proper ventilation and is relatively clean. Allow 1 m (3 ft) of space on all sides of the plasma power supply for ventilation and service.

- Cooling air is drawn in through the side panel and is exhausted through the rear of the unit by a cooling fan. Do not place any filter device over the air intake locations, which reduces cooling efficiency and VOIDS THE WARRANTY.
- Do not place the plasma power supply on an incline greater than 10° to prevent it from toppling.



Torch lead connections

Machine torch leads

Part number	Length
229477	7.5 m (25 feet)
229478	15 m (50 feet)
229479	23 m (75 feet)
229480	30 m (100 feet)

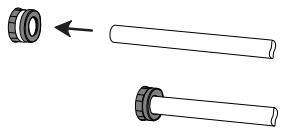
Hand torch leads

Part number	Length
229498	7.5 m (25 feet)
229499	15 m (50 feet)
229500	23 m (75 feet)
229501	30 m (100 feet)

Install the torch lead

The plasma gas and coolant return hose connectors in this procedure have push-to-connect fittings:

- To make a connection, push the hose fitting in the correct connector until the hose stops, 12 mm (0.472 in.).

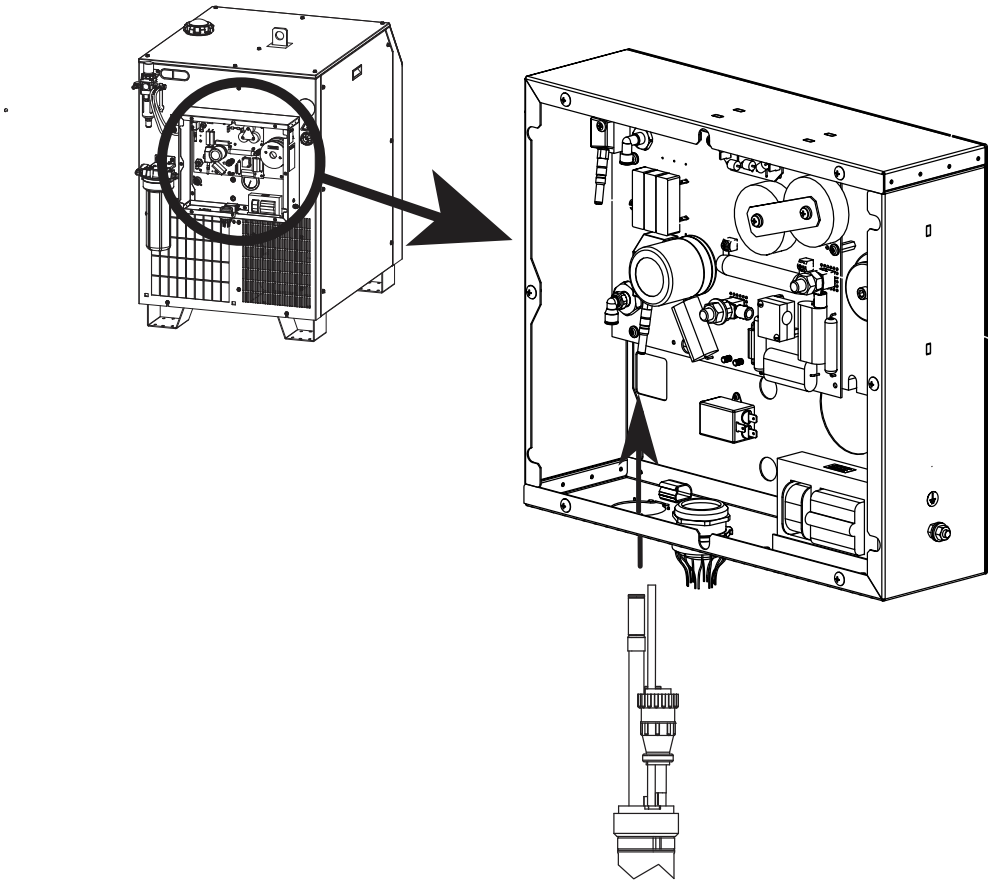


- To disconnect a fitting, push the connector-collar and hose in the direction of the fitting, hold the collar in place, and pull the hose away from the fitting.

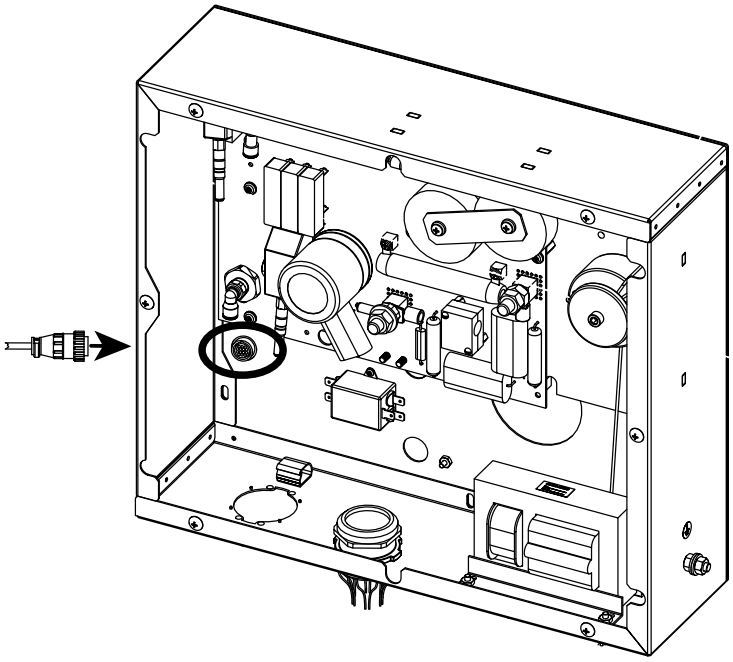


The images in this procedure show an example plasma power supply. Your plasma power supply could look different.

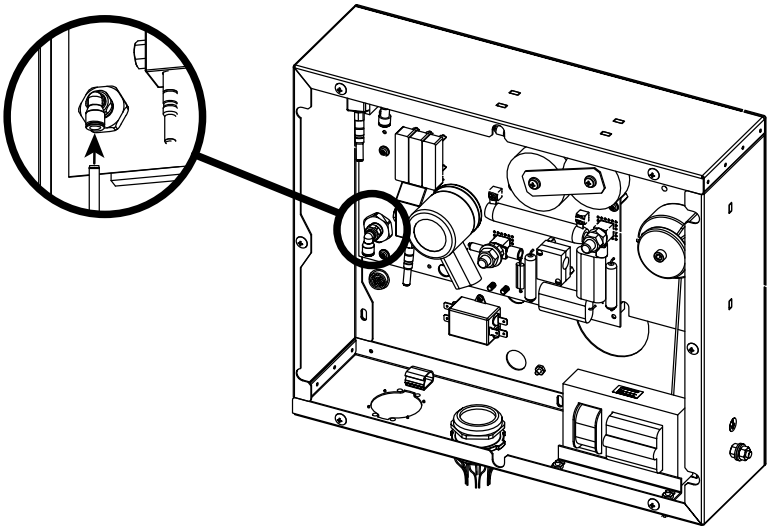
1. Insert the end of the torch lead through the opening of the ignition PCB enclosure as shown.
2. Install the collar on the torch lead to the ignition enclosure:
    a. Align the tabs on the collar with the corresponding openings in the ignition PCB enclosure.
    b. Use your finger to tighten the collar.
    c. Make sure that the collar does not detach when released.



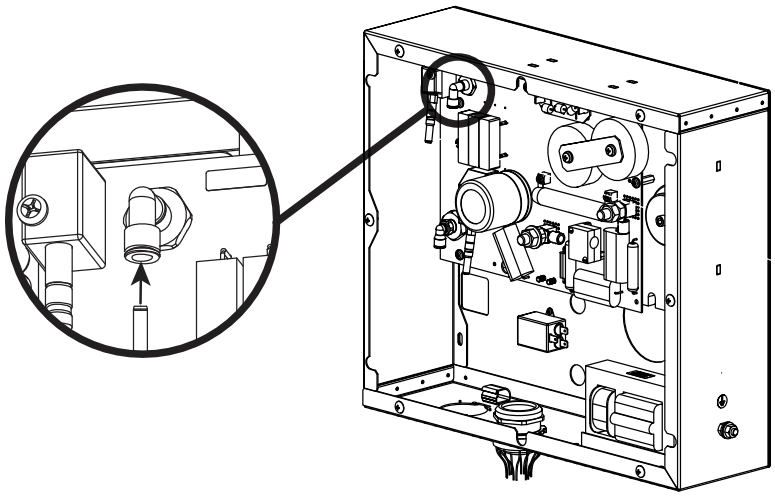
3. Connect the circular plastic connector (CPC) to the CPC receptacle.



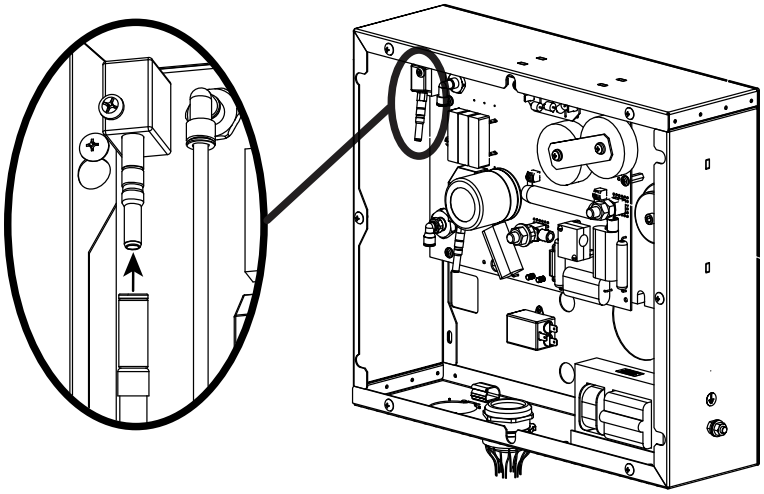
4. Connect the coolant-return hose (red).



5. Connect the plasma gas hose (black).

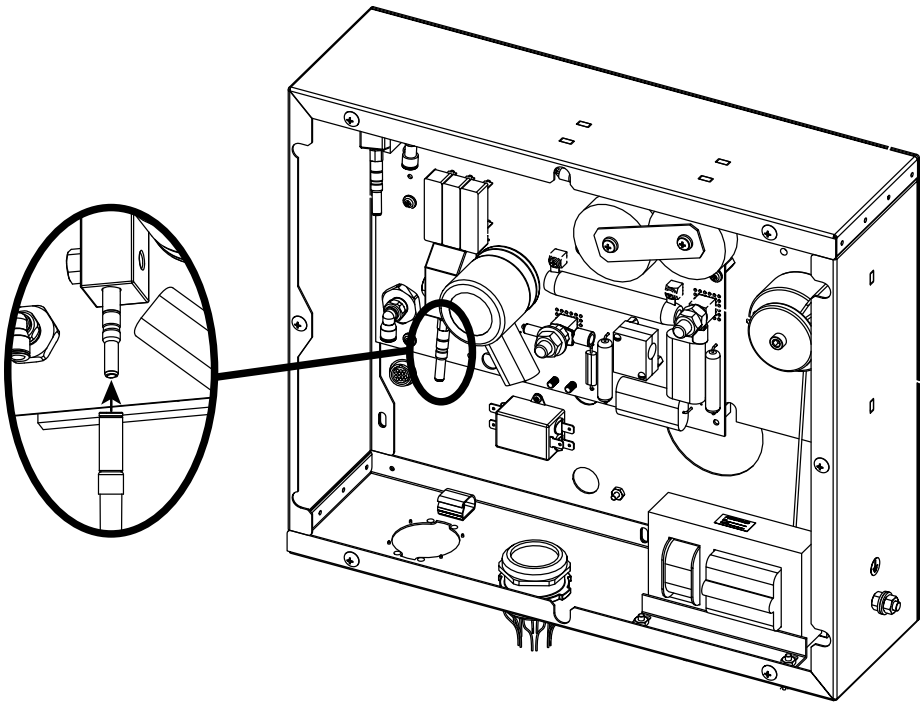


6. Connect the pilot arc/shield gas hose (blue):
    a. Put the hose fitting over the connector.
    b. Push the hose fitting until it clicks into position.



To disconnect this fitting, pull the connector-collar to the hose, and pull the hose away from the fitting.

7. Connect the negative lead/coolant supply hose (blue with green tape).



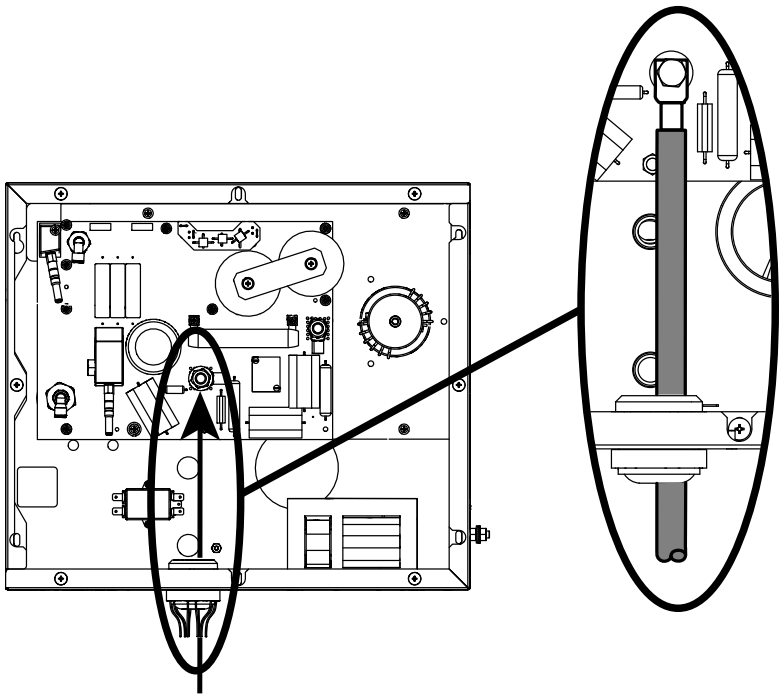
To disconnect this fitting, pull the connector-collar to the hose, and pull the hose away from the fitting.

Work leads

Part number	Length
223335	7.5 m (25 feet)
223336	15 m (50 feet)
223337	23 m (75 feet)
223338	30 m (100 feet)

Install the work lead

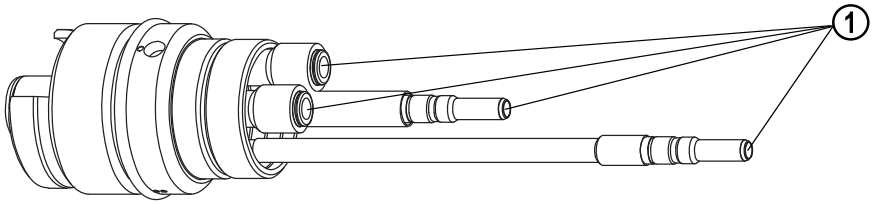
- Remove the first nut and washer from the work lead terminal, and use it to secure the work lead to the terminal.



Connect the torch to the torch lead

The connections between the straight torch main body and the torch leads are identical to the connections between the quick-disconnect receptacle and the torch leads.

- Align the quick-disconnect receptacle, or the straight torch main body, to the torch leads, and secure using the push-to-connect fittings.



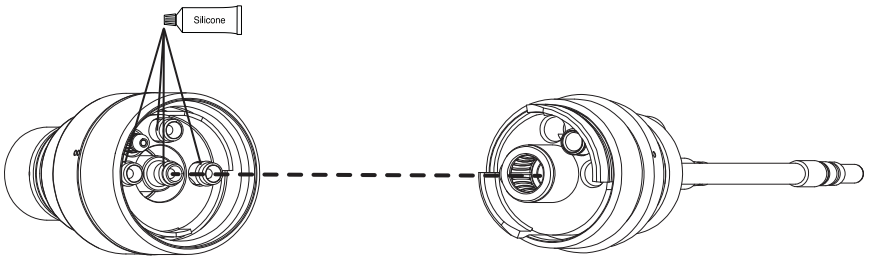
1 Push-to-connect fittings

Connect the torch to the quick-disconnect receptacle

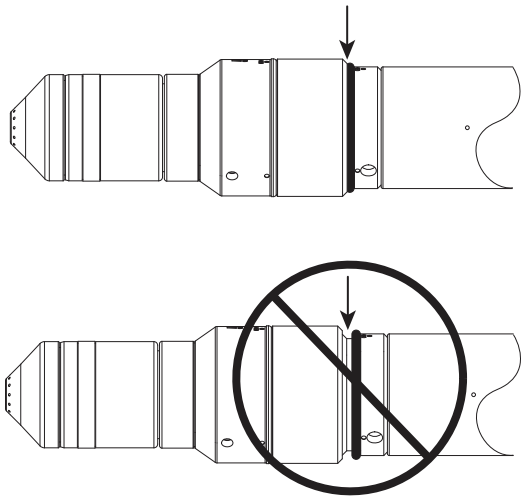
1. Align the torch body to the quick-disconnect receptacle, and connect them by screwing them completely together.

2. Apply a thin film of silicone lubricant to each O-ring.

   Make sure that the O-rings look shiny but do not have excess lubricant.

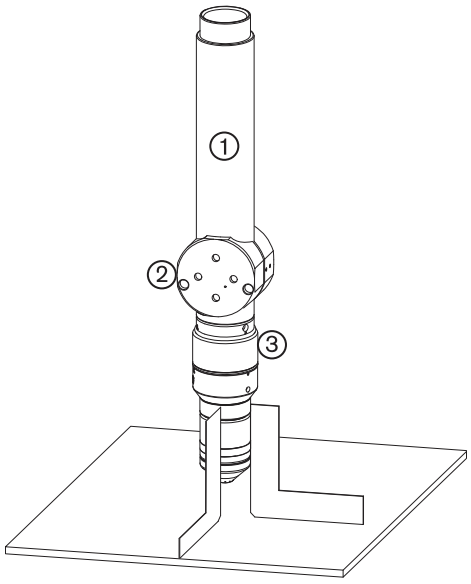


3. Make sure that there is no space between the torch body and the O-ring on the quick-disconnect.



Torch mounting and alignment

Mount and align the torch



1 Torch sleeve

2 Mounting bracket

3 Quick-disconnect receptacle

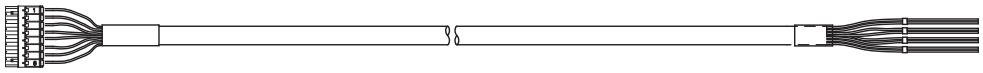
1. Install the torch (with torch leads attached) in the torch mounting bracket.
2. Position the torch below the mounting bracket, with the bracket around the lower portion of the torch sleeve but not touching the torch quick-disconnect.

   Make sure that the bracket is as low on the torch sleeve as possible to minimize vibration at the tip of the torch.
3. **Optional:**

   To align the torch at right angles to the workpiece, use a square as shown.
4. Tighten the securing screws.

CNC interface cable

Part Number	Length
223327	1.3 m (5 feet)
223328	3.0 m (10 feet)
223329	7.5 m (25 feet)
223330	15 m (50 feet)
223331	23 m (75 feet)
223332	30 m (100 feet)

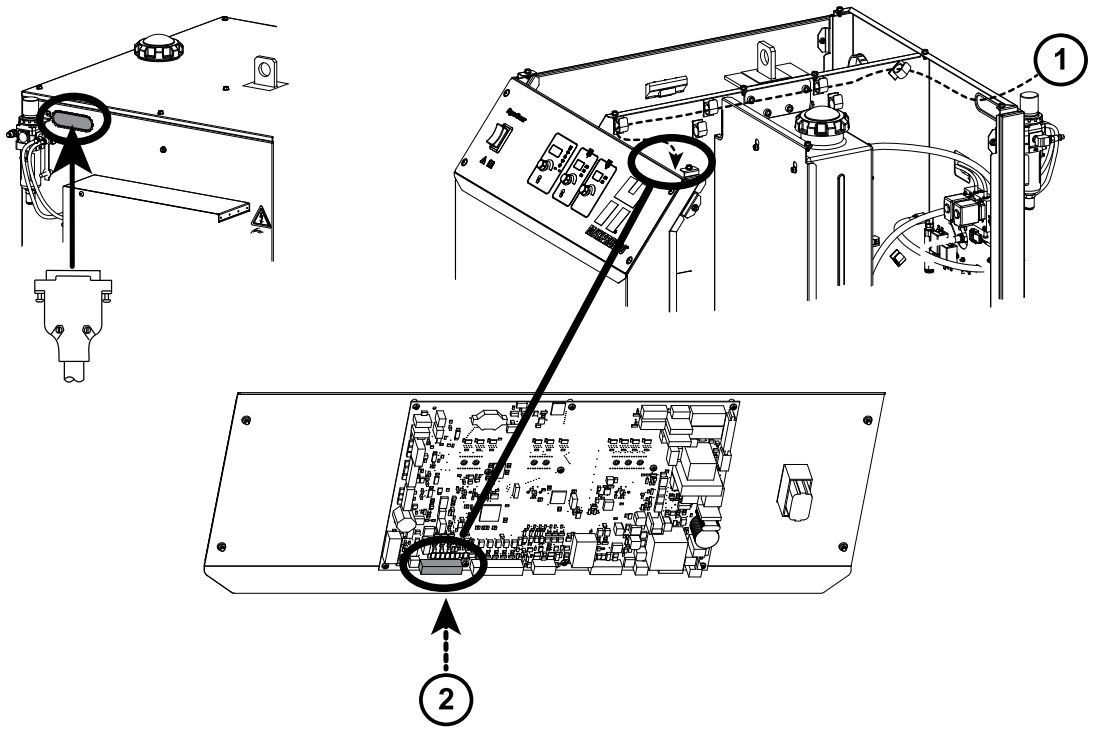


Plasma power supply end					CNC end	
Wire color	**Pin number**	**Input/ Output**	**Signal name**	**Function**	**Input/ Output**	**Notes**
Orange	1	Input	Start +	The CNC initiates preflow, and if the hold input is not active, continues with the plasma arc. The system will stay in preflow if the hold input remains active.	Output	1
White	2	Input	Start -		Output	
Brown	3	Input	Hold +	The CNC delays plasma arc initiation. This signal is normally used in combination with the start signal to synchronize multiple torches.	Output	1 and 3
White	4	input	Hold -		Output	
Black	5	Output	Motion +	Notifies the CNC that an arc transfer has occurred and to begin machine motion once the CNC pierce delay has timed out.	Input	2
White	6	Output	Motion -		Input	
Red	7	Output	Error +	Notifies the CNC that an error has occurred.	Input	2
White	8	Output	Error -		Input	

CNC interface cable routing

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 an output capability, it is normally used solely as an input.
4. There is no +24 VDC power available at the J6 CNC connector.
5. The wire clips on the center panel should be used to help route the CNC cable from the rear panel opening of the plasma power supply to J6 on the control board. Open the clips by depressing the release tab, and add the CNC cable to the wires that are already present in the clip, as shown.

Figure 4 - CNC cable routing and connection to control board



1 From the CNC

2 To J6 on the control board

Set up the remote ON/OFF switch (provided by customer)

Before you begin:

⚠ WARNING

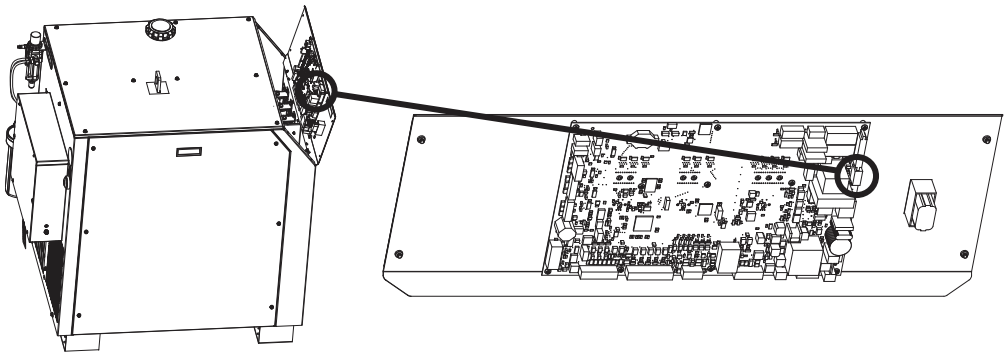


ELECTRIC SHOCK CAN KILL

Electric shock can seriously injure or kill you. You can get a serious electric shock if electric power is not disconnected.

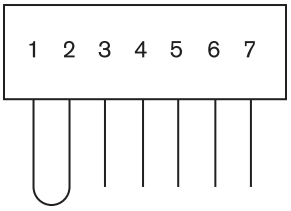
Disconnect electric power before doing installation or maintenance. All work that requires removal of the outer cover or panels must be done by a qualified technician. Refer to the *Safety and Compliance Manual (80669C)* for more safety information.

1. Remove the 4 screws that secure the control panel to the plasma power supply.
2. Locate terminal block J1.8 on the plasma power supply control board.



3. Remove the jumper wire between terminal 1 and terminal 2.

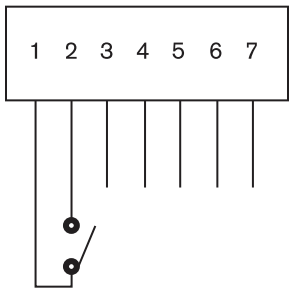
   Use a sturdy tool to depress the corresponding orange release buttons on the spring clamp connector.



4. Connect the switch to terminals 1 and 2 as shown.

   Use a sturdy tool to depress the corresponding orange release buttons on the spring clamp connector.

Use a switch, relay, or solid-state relay that is compatible with 24 VDC at 100 mA. Use wires that are a twisted pair.



What to do next:

- The power switch on the plasma power supply must be in the ON position for the remote switch to function.
- The remote switch must be in the ON position (closed) for the power switch on the plasma power supply to function.

Power requirements

General power requirements

This equipment complies with IEC 61000-3-12 provided that the Short-circuit power (Ssc) is greater than or equal to 5.61 MVA at the point between the user's supply and the public system. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a Ssc greater than or equal to 5.61 MVA.

All switches, slow-blow fuses and power cables are customer-supplied and must be chosen as outlined by applicable national and local electrical codes. Installation must be performed by a licensed electrician. Use a separate, primary, line disconnect switch for the plasma power supply. Recommendations on fuse and circuit breaker sizing are listed below, however actual sizes required will vary based on individual site electrical line conditions (including but not limited to: source impedance, line impedance, and line voltage fluctuation), product inrush characteristics, and regulatory requirements.

The main feed protection device (circuit breaker or fuse) must be sized to handle all branch-feed loads for both inrush and steady-state current. The plasma power supply must be wired into one of the branch-feed circuits. The plasma power supply has a steady-state current listed in the table.

Use a motor-start circuit breaker or equivalent if time delay high inrush fuses are not permitted by local and national codes. Time delay fuses and circuit breakers must be capable of withstanding inrush current that is up to 30 times the rated input current (FLA) for 0.01 seconds and up to 12 times the rated input current (FLA) for 0.1 seconds.

This table is for reference only. All local and national electrical code must be followed.

Table 5 - Power cable sizes for different input voltages

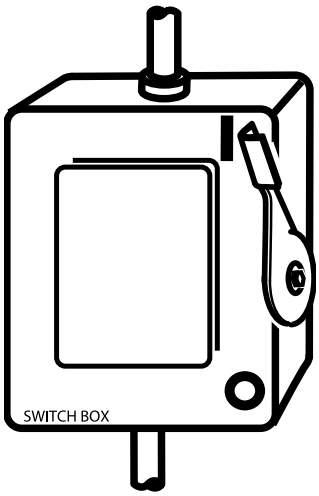
Input voltage	Phase	Rated input current at "X" kW output	Recommended time delay, high inrush, fuse size	Recommended cable size for 15 m (50 feet) maximum length [1]	
				Rated for 60°C (140°F)	Rated for 90°C (194°F)
200/208 VAC	3	108/104 A	175 A	N/A	67.5 mm^2 (2/0)
220 VAC	3	98 A	150 A	85.2 mm^2 (3/0)	42.4 mm^2 (1 AWG)
240 VAC	3	90 A	150 A	85.2 mm^2 (3/0)	42.4 mm^2 (1 AWG)
380 VAC	3	57 A	90 A	33.6 mm^2 (2 AWG)	21.2 mm^2 (4 AWG)
400 VAC	3	54 A	80 A	26.7 mm^2 (3 AWG)	21.2 mm^2 (4 AWG)
415 VAC	3	52 A	80 A	26.7 mm^2 (3 AWG)	21.2 mm^2 (4 AWG)
440 VAC	3	49 A	80 A	26.7 mm^2 (3 AWG)	21.2 mm^2 (4 AWG)
480 VAC	3	45 A	70 A	21.2 mm^2 (4 AWG)	13.3 mm^2 (6 AWG)
600 VAC	3	36 A	50 A	13.3 mm^2 (6 AWG)	8.3 mm^2 (8 AWG)

1 The wire AWG recommendations are from Table 310-16 of the National Electric Code Handbook (USA).

Line-disconnect switch

The line-disconnect switch serves as the supply-voltage disconnecting (isolating) device.

Install this switch near the plasma power supply for easy access by the operator.



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

Make sure that the switch:

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

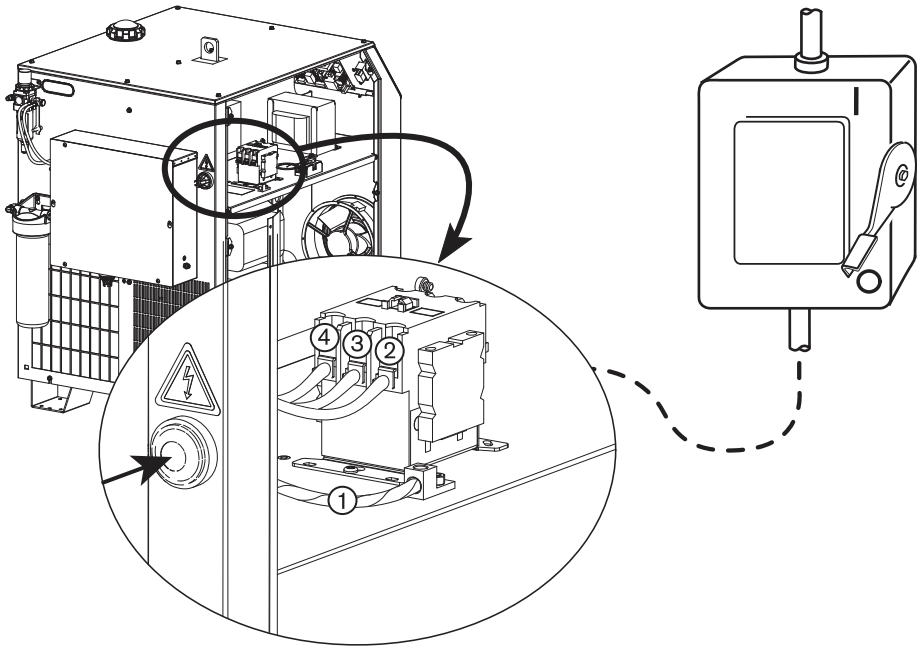
Main power cable

Wire sizes vary based on the temperature rating of the cable insulation and the distance of the unit from the main box.

Use a 4-conductor Type SO input power cable with a conductor temperature rating of 60°C (140°F) or 90°C (194°F). Installation must be performed by a licensed electrician.

Connect the power

North American wire colors	European wire colors
U = Black	U = Black
V = White	V = Blue
W = Red	W = Brown
(PE) Earth ground = Green/yellow	(PE) Earth ground = Green/yellow



1 Ground

2 L1

3 L2

4 L3

Before you begin:

⚠ WARNING

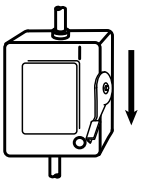


ELECTRIC SHOCK CAN KILL

If the line-disconnect switch is not in the OFF position you can get a serious electric shock. Electric shock can seriously injure or kill you.



The line-disconnect switch must be in the OFF position before you connect the power cord to the cutting system. It 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. Refer to the *Safety and Compliance Manual (80669C)* for more safety information.



1. Insert the power cable through the strain relief at the rear of the plasma power supply.
2. Connect the ground lead (PE) to the GROUND connector as shown.
3. Connect the power leads to the contactor terminals as shown.

4. **Optional:**

   For models with an EMI filter, connect the power leads to the EMI filter terminal block.

   Recommended torque on contactor or EMI filter terminals is 7–8 Nm (60–70 in-lbs).

5. **Make sure that the line-disconnect switch is in the OFF position and stays in the OFF position for the remainder of the system installation.**

6. Connect the power cord leads to the line-disconnect switch following national and local electrical codes.

Torch coolant requirements

The system comes without any coolant in the tank. Before filling the coolant system, determine what coolant mix is correct for your operating conditions.

Observe all warnings and cautions in this documentation and in the *Safety and Compliance Manual (80669C)*. Refer to the *Safety Data Sheets SDS* for your torch and coolant at www.hypertherm.com/docs for data on safety, handling, and storage of propylene glycol and benzotriazole.

⚠ 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

AUTOMOTIVE ANTIFREEZE CAN CAUSE DAMAGE TO THE TORCH COOLANT SYSTEM

Antifreeze contains chemicals that can cause damage to the torch coolant system.

Never use automotive antifreeze as an alternative to Hypertherm coolant.

Premixed coolant for standard operating temperatures

Use Hypertherm premixed coolant (028872) when operating in a temperature range of -12°C to 40°C (10°F to 104°F). Refer to the custom coolant mix recommendations if temperatures during operation are ever outside of this range.

Hypertherm premixed coolant consists of 69.8% water, 30% propylene glycol, and 0.2% benzotriazole.

Custom coolant mix for cold operating temperatures (below -12°C / 10°F)

NOTICE

CHANGES TO COOLANT CAN BE NECESSARY IN VERY COLD TEMPERATURES.

A cracked torch head, hoses, or other damage to the torch coolant system can occur due to freezing.

For operating temperatures colder than the recommended temperature operating range, increase the percentage of propylene glycol in the coolant.

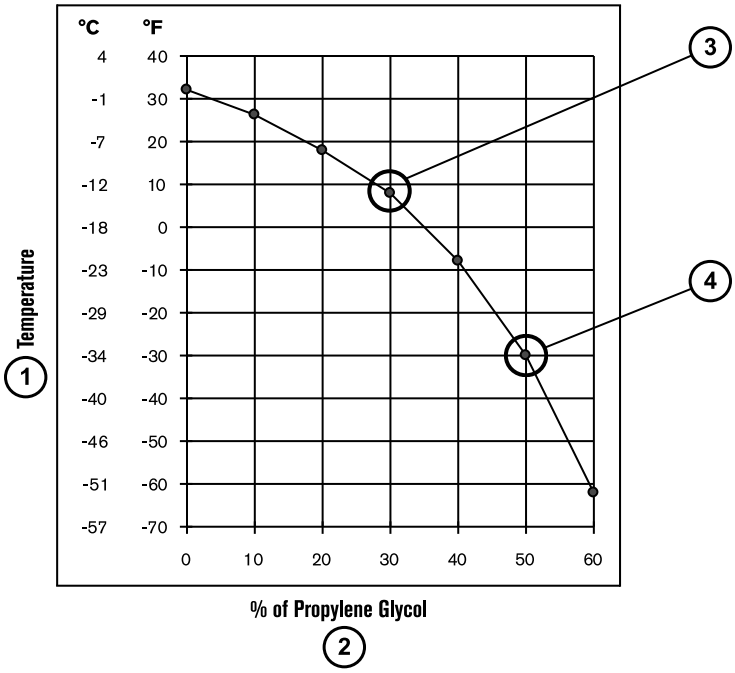
Use the chart shown to determine what percentage of propylene glycol to use in the mixture.

Mix 100% propylene glycol (028873) with the premixed Hypertherm coolant (028872) to increase the percentage of glycol. The 100% glycol solution can also be mixed with purified water to achieve the required protection from freezing.



The maximum percentage of propylene glycol must never exceed 50%.

Figure 5 - Freezing point of propylene glycol solution



1 Temperature

2 Percentage (%) of propylene glycol

3 Hypertherm pre-mix (028872)

4 Maximum glycol percentage (%)

Custom coolant mix for hot operating temperatures (above 38°C / 100°F)

Treated water (with no propylene glycol) can only be used as coolant when operating temperatures are **never** below 0°C (32°F). For operations in very warm temperatures, treated water will provide the best cooling properties.

Treated water refers to a mixture of purified water that meets the required specifications and 1 part benzotriazole (BZT) to 300 parts of water. BZT (128020) acts as a corrosion inhibitor for the copper based coolant system contained in the plasma system.

Water purity requirements

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

Always use water that meets the minimum and maximum specifications in the table below when using a custom coolant mix.

Water that does not meet the minimum purity specifications below can cause excessive deposits on the nozzle that will alter the water flow and produce an unstable arc.

Water that does not meet the maximum purity specifications below can also cause problems. Deionized water that is too pure will cause leaching problems with the coolant system plumbing.

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

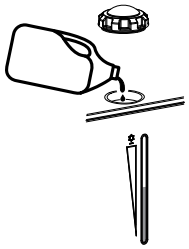
Table 6 - Water purity measurement method

Water purity	Conductivity µS/cm at 25°C (77°F)	Resistivity mΩ-cm at 25°C (77°F)	Dissolved solids (ppm of NaCl)	Grains per gallon (gpg of CaCO2)
Pure water (for reference only)	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)	1000	0.001	495	25

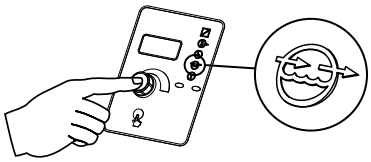
Fill the plasma power supply with coolant

Before you begin: The system will take 14.2 liters to 17.0 liters (3.75 to 4.5 gallons) of coolant depending on the length of the torch leads.

1. Add coolant to the plasma power supply until the tank is full.



2. Turn ON the plasma power supply.
3. Press and release the amperage selector knob as many times as needed until the flow symbol is selected.

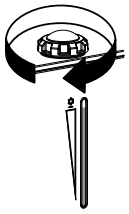


- ☐ The flow rate will be shown in the three digit display.
- ☐ There is a 45 second delay before the system will report a low coolant flow error.
- ☐ If the flow rate has not reached 1.9 liters per minute (lpm) (0.5 gallons per minute [gpm]) the system will turn off the pump.

4. Does the system show an error?

If yes...	1. Turn OFF the power to the system. 2. Add coolant to the tank until it is full again. 3. Repeat these steps as necessary until no error is displayed.
If no...	Continue with the next step.

5. Add coolant to the plasma power supply until the tank is full, and replace the filler cap.

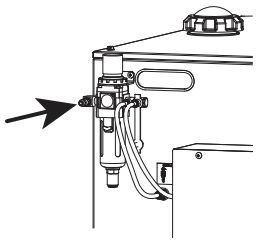


Connect the supply gases

Air/air cutting

Before you begin: Verify that the plasma gas line and the shield gas line are properly connected before connecting the air supply hose and supplying pressurized gas to the system.

- ■ Connect the air supply hose to the filter regulator as shown.



N_2/N_2 supply gas connection

Before you begin: Verify that the plasma gas line and the shield gas line are properly connected before connecting the air supply hose and supplying pressurized gas to the system.

1. Disconnect the air supply hose from the filter regulator.
2. Remove the air fitting 015012 (1/4 inch NPT X #6 MALE) from the filter/regulator:
    a. Install an 015103 adapter to use the nitrogen supply gas hose offered by Hypertherm.
    b. Use the 1/4 inch NPT female port from which the air fitting was removed to connect a user supplied N_2 supply gas hose.
3. Set the gas pressure regulators.

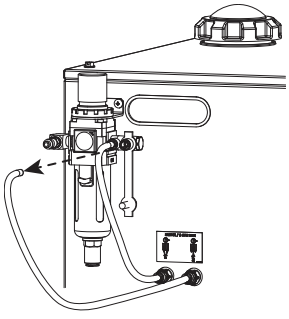
What to do next: Refer to Set the supply gas regulators on page 64.

O_2/Air supply gas hook up

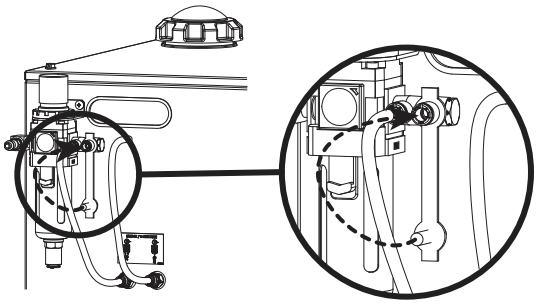
Before you begin:

- Verify that the plasma gas line and the shield gas line are properly connected before connecting the air supply hose and supplying pressurized gas to the system.
- Get an oxygen fitting kit (428054) from Hypertherm, which has the necessary parts to complete this procedure.

1. Disconnect the air supply from the system.
2. Remove the plasma supply tube from filter/regulator output port.



3. Use the supplied plug to block the open plasma outlet port of the filter/regulator.

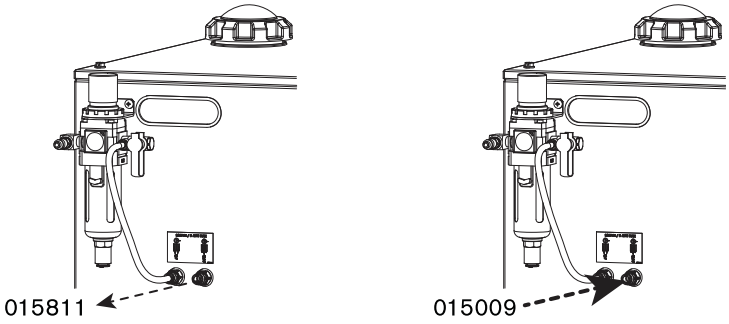


4. Connect only filtered and regulated oxygen to the plasma gas inlet.

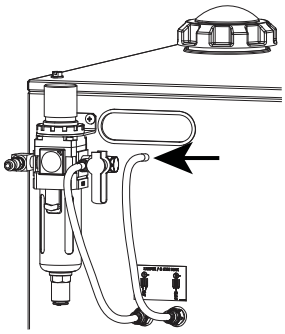
   Refer to Gas regulators on page 64 for a suitable oxygen regulator.

5. Use one of these methods to connect the oxygen supply gas line:

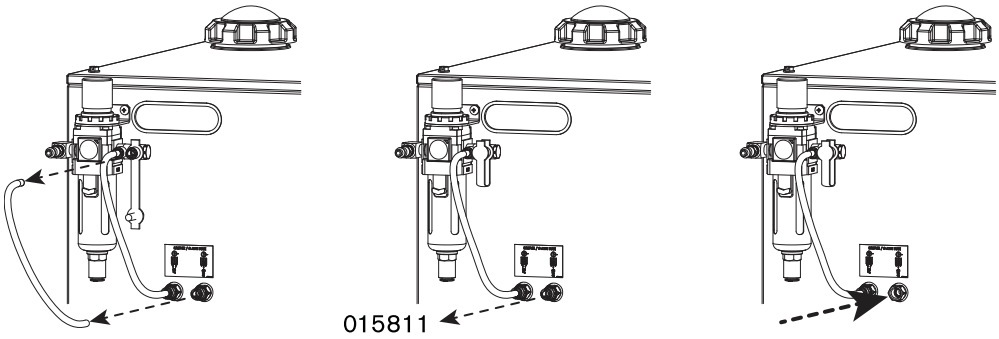
   - Remove the 015811 fitting, and put on an 015009 fitting (from the 428054 oxygen fitting kit). Use the correct Hypertherm supply gas tubing (046231) to connect to the fitting.



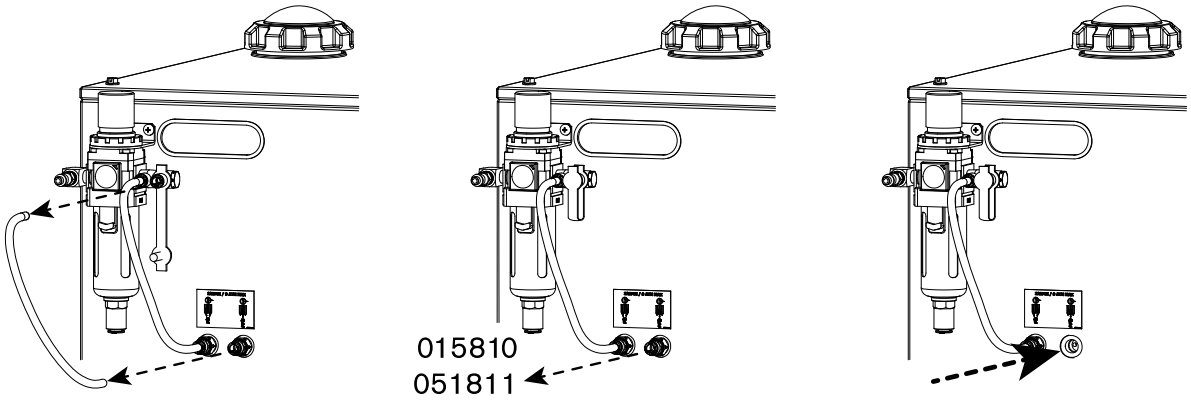
   - Use a suitable O_2 fitting to connect to the 8 mm (5/16 inch) tubing that you removed from the plasma gas inlet.



   - Remove the plasma gas tubing and 8 mm (5/16 inch) fitting (015811), and connect to the 1/4 inch NPT female threads.



- ☐ Remove the bushing and fitting to connect to the 1/4 inch "G" female threads.



6. Reconnect the air supply.
7. Set the gas pressure regulators.

   Refer to Set the supply gas regulators on page 64.

Gas requirements

The system is configured for air/air cutting when it is shipped. Connect an air supply to the filter/regulator that is mounted on the rear panel of the plasma power supply. If cutting with O_2/air or N_2/N_2 you will have to make changes to the gas connections. Refer to Air/air cutting on page 60.

NOTICE

INCORRECT GAS PRESSURES CAN CAUSE BAD PERFORMANCE

Gas leaks or pressure and flow rates that are outside of recommended ranges can cause problems with system performance, result in bad cut quality, and 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, and cut thickness capabilities.

Make sure the incoming gas pressure aligns with system specifications.

Set the supply gas regulators

1. Turn OFF the power to the system.
2. Set all the supply gas regulator pressures to 6.2 bar (90 psi).
3. Turn ON the power to the system.
4. After the purge cycle is complete, press the current selection knob to get to the test mode.
5. When the test mode icon is illuminated, turn the knob to get to test 005, "Flow gas at full pressure".
6. Set all supply regulators to a system inlet pressure of 6.2 bar (90 psi).
7. Press and release the current selection knob until the amperage (A) icon is illuminated.

Gas regulators

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. • Dual-stage gas regulation can restrict gas flow and give bad results if the choice of regulator is bad or if the regulator settings are not correct.

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

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

A separate gas regulator is needed only when cutting with oxygen.

Figure 6 - 2-stage regulator



Figure 7 - 1-stage regulator



Part number	Description
128544	Kit: Oxygen 2-stage regulator [1]
128548	Kit: Oxygen 1-stage regulator (for use with cryogenic liquid nitrogen or oxygen)
022037	2-stage oxygen regulator

1 This kit includes the 2-stage regulator (022037) and the appropriate fittings.

Supply gas plumbing

- Rigid copper plumbing or suitable flexible hose may be used for all gas supplies.
- Do not use steel, black iron, or aluminum pipe.
- After installation, pressurize the entire system and check for leaks.
- Recommended hose diameters are 9.5 mm (3/8 in) for lengths < 23 m (75 ft) and 12.5 mm (1/2 in) for lengths > 23 m (75 ft).

For flexible-hose systems, use a hose designed for inert gas to carry air or nitrogen. Refer to Supply gas hoses on page 68 for part numbers.

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

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

NOTICE

INCORRECT HOSES, CONNECTIONS, OR FITTINGS CAN CAUSE DAMAGE AND BAD PERFORMANCE

Noncompliant hoses, hose connections, or hose fittings can crack or leak. Incorrect fittings can cause malfunctions with the internal valves because contaminants can enter the valves through damaged or loose fittings.

All hoses, hose connections, and hose fittings used for supply-gas plumbing must be designed for use with the appropriate gas and pressure rating. NEVER connect a supply gas to a hose, connection, or fitting that is not designed for that gas type or pressure. A replacement hose, connection, or fitting must meet all applicable regulations and codes.

When cutting with oxygen as the plasma gas, air must also be connected to the filter regulator.

⚠ WARNING





OXYGEN GAS CAN CAUSE A FIRE HAZARD

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. A fire can occur if oxygen is not removed.

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 exhaust ventilation and flashback arrestors for your cutting system. You can get them from your cutting machine supplier.

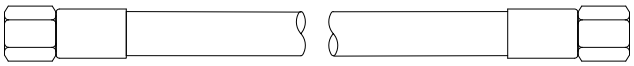
Supply gas hoses

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

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

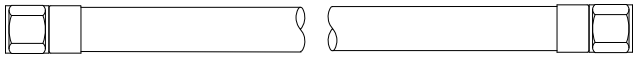
Air



Part number	Length	Part number	Length
024671	3 m (10 ft)	024740	25 m (82 ft)
024658	4.5 m (15 ft)	024744	35 m (115 ft)
024659	7.5 m (25 ft)	024678	45 m (150 ft)

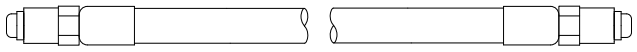
Part number	Length	Part number	Length
024765	10 m (35 ft)	024680	60 m (200 ft)
024660	15 m (50 ft)	024767	75 m (250 ft)
024766	20 m (65 ft)		

Oxygen



Part number	Length	Part number	Length
024607	3 m (10 ft)	024738	25 m (82 ft)
024204	4.5 m (15 ft)	024450	35 m (115 ft)
024205	7.5 m (25 ft)	024159	45 m (150 ft)
024760	10 m (35 ft)	024333	60 m (200 ft)
024155	15 m (50 ft)	024762	75 m (250 ft)
024761	20 m (65 ft)		

Nitrogen



Part number	Length	Part number	Length
024210	3 m (10 ft)	024739	25 m (82 ft)
024203	4.5 m (15 ft)	024451	35 m (115 ft)
024134	7.5 m (25 ft)	024120	45 m (150 ft)
024211	10 m (35 ft)	024124	60 m (200 ft)
024112	15 m (50 ft)	024764	75 m (250 ft)
024763	20 m (65 ft)		

Chapter 3: Operation

Daily start-up

Before you begin: Before turning on the power to the system make sure that the cutting environment and clothing worn by users in that environment meet all the safety requirements outlined in the *Safety and Compliance Manual (80669C)*.

⚠ WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

- Refer to the *Safety and Compliance Manual (80669C)* for important safety information before you operate this system.
- Disconnect electric power before you change consumables or do other maintenance tasks.
- The line-disconnect switch must STAY in the OFF position until all of the consumable changes or other maintenance tasks are complete.

1. Turn OFF the main disconnect switch to the plasma power supply.
2. Remove the consumables from the torch and check for worn or damaged parts.

Always place the consumables on a clean, dry, oil-free surface after removing. Dirty consumables can cause the torch to malfunction and can shorten the life of the coolant pump.

- ☐ See Inspect consumable parts on page 103 for details.
- ☐ Refer to Cut charts on page 117 to choose the correct consumables for your cutting needs.

3. Replace consumable parts.

   See Install consumable parts on page 101 for details.

4. Make sure that the torch is perpendicular to the workpiece.



1 Shield

2 Nozzle retaining cap

3 Nozzle

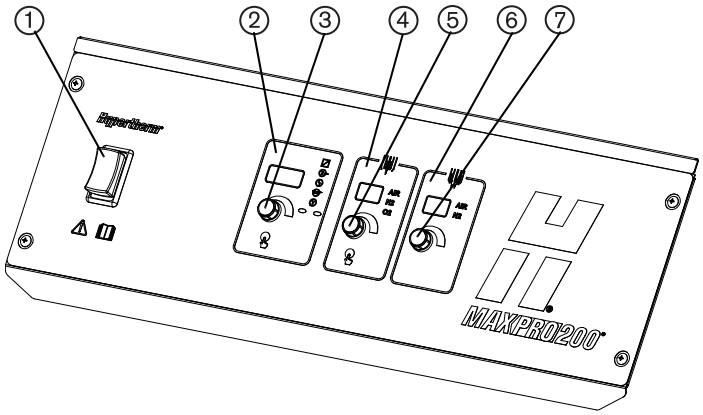
4 Swirl ring

5 Electrode

6 Torch main body (quick-disconnect torch shown)

Controls and indicators

Figure 8 - Control panel descriptions



1 Power switch

2 3-digit display area

3 Current selection knob

4 2-digit plasma display area

5 Plasma gas knob

6 2-digit shield display area

7 Shield gas knob

Plasma power supply operation

System operation overview

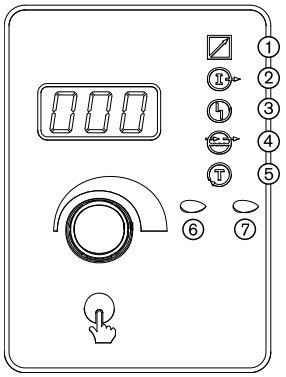
- The system runs a number of tests automatically when the system is turned ON. Refer to Automatic chopper and current sensor tests during power-up on page 226.
- There is power to the control board and other non-high power components when the main disconnect switch is on, even if the switch on the plasma power supply is off. The switch is illuminated to indicate that there is power to the system. Non-high power components include the low power control circuitry in the chopper, but not the high-power Insulated-gate Bipolar Transistor (IGBT) modules, which are switched by the contactor.
- The 3-digit display counts from 1 to 6 to indicate the 6-second purge that occurs when you turn ON the plasma power supply (you will only see 1 through 5). If the system is powered up with the start signal on, the 3-digit display will continue to count up to 98.
- When you turn ON the power to the system the displays shows the last process used.

- The user can lock out all inputs (current, plasma gas, and shield gas) to the system by pressing and holding both the amperage and shield gas control knobs until LOC appears in the 3-digit display. The same process unlocks the system and ULC appears in the 3-digit display. The user can still cycle through the functions in the 3-digit display area (current, fault, coolant flow, and test).
- All three displays show actual values during cutting. The user can make changes to the current, the plasma gas, and the shield gas settings unless the inputs have been locked out or the system is being controlled remotely. The displays show the set values when idle.
- A blinking red dot appears in the bottom right corner of each display when the parameters have been changed from the default setting.

3-digit display functions

Turn the current selection knob to increase or decrease the amperage. Push and release the current selection knob to move from one function to the next.

Figure 9 - 3-digit display



1 **Remote:** The remote icon illuminates when there is serial communication with the plasma power supply. You can still cycle through the functions. But cut parameters can only be changed through the CNC.

2 **Amps:** Increase or decrease the amperage by selecting the amperage (A) icon and turning the knob. The current increases or decreases in 1 A increments when you turn the knob slowly. You can jump from one process amperage to another when you turn the knob quickly.

3 **Fault:** The fault icon illuminates when an error occurs.

If the error code number is 60 or less, press the current selection knob to navigate to the illuminated fault icon. When the fault icon is selected the error code appears in the 3-digit display.

If the error code is 60 or more the system automatically selects the fault icon and the error code number flashes in the 3-digit display.

Press and hold the current selection knob to see the plasma power supply status number for both types of error code.

4 **Coolant flow:** When the coolant flow icon is selected the display shows the coolant flow in gallons per minute. When you turn ON the power to the system and select the coolant flow icon before the plasma power supply finishes the purge count, the flow switch is overridden and coolant will continue to flow for 30 seconds.

5 **Test:** When test icon is selected the system is in test mode. A number of functions can be accessed by turning the current selection knob.

6 **Plasma start:** The plasma start Light Emitting Diode (LED) illuminates white when the plasma start signal is given and stays illuminated until the start signal is removed.

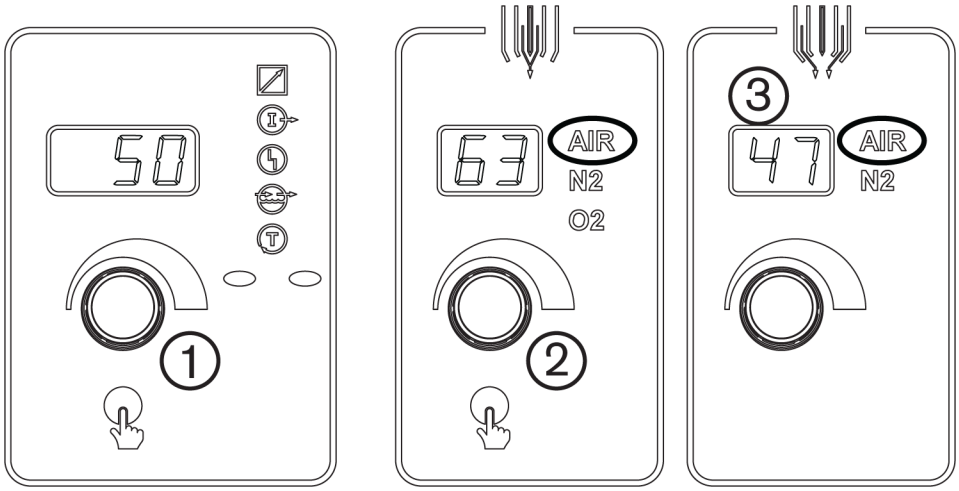
7 **Arc transfer:** The arc transfer LED illuminates green when the arc transfers to the workpiece.

Choosing a cutting process

1. Use the current selection knob to set the amperage (A). Turning the knob slowly increases or decreases the current 1 A at a time. Turning the knob fast lets you jump quickly to the next process current (50 A, 130 A, and 200 A). A blinking red dot appears in the bottom right corner of each display when the parameters have been changed from the default setting. You can return to the default setting by pressing and releasing the knob until you return to the original selection.
2. Push and release the plasma gas knob to cycle through the plasma gas selections. The pressure will automatically be set when you choose a gas. Turning the knob increases or decreases the pressure. A blinking red dot appears in the bottom right corner of each display when the parameters have been changed from the default setting. You can return to the default setting by pressing and releasing the knob until you return to the original gas selection.
3. The shield gas pressure is set automatically when you choose a plasma gas. Turning the knob increases or decreases the pressure. A blinking red dot appears in the bottom right corner of each display when the parameters have been changed from the default setting. You can return to the default setting by pressing and releasing the knob until you return to the original gas selection.



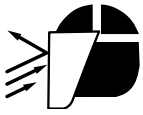
The example shown below is the 50 A, mild steel, air/air process. See the cut chart for details.



Handheld cutting

Safety for handheld cutting

⚠ WARNING



SPARKS AND HOT METAL CAN INJURE EYES AND BURN SKIN

When you fire the torch at an angle, sparks and hot metal will spray out from the torch tip.

Point the torch away from yourself and others. Always put on correct protective equipment including gloves and eye protection.

During handheld cutting, always use full protection:

- A welding helmet with at least a #12 glass
- Welding gloves and a welding jacket
- A heat shield for additional protection - available from Hypertherm (127389)

Specifications for handheld cutting

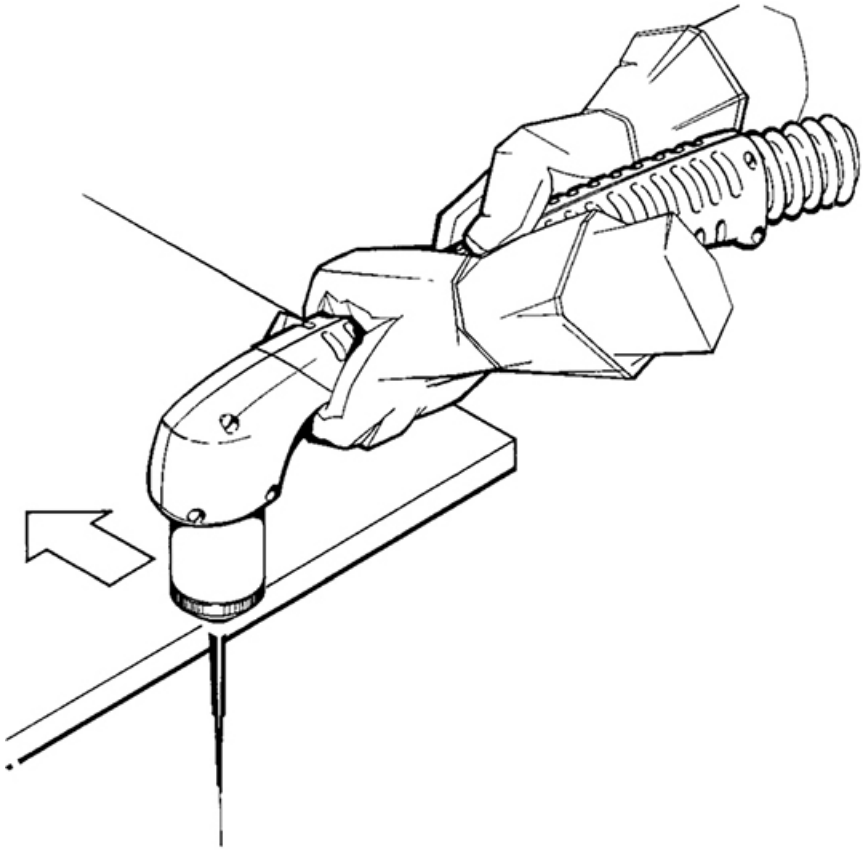
Materials	Mild steel, stainless steel, and aluminum
Current	50 A, 130 A, and 200 A
Plasma gas types	Air, O_2, N_2
Shield gas types	Air, N_2

Consumable selection and gas settings

Refer to Cutting parameters on page 97 for consumable and process information.

Start a cut

1. Start the cut from the edge of the workpiece, as shown, unless you must pierce.
2. For the best results, make sure that the nozzle orifice overlaps the edge of the workpiece about halfway and that the torch (arc) axis is perpendicular to the cut surface.



3. As you cut, make sure that the sparks are coming out of the bottom of the workpiece.

If you get sparks on top of the workpiece, you are moving the torch too fast, or you do not have sufficient power to fully penetrate the workpiece.

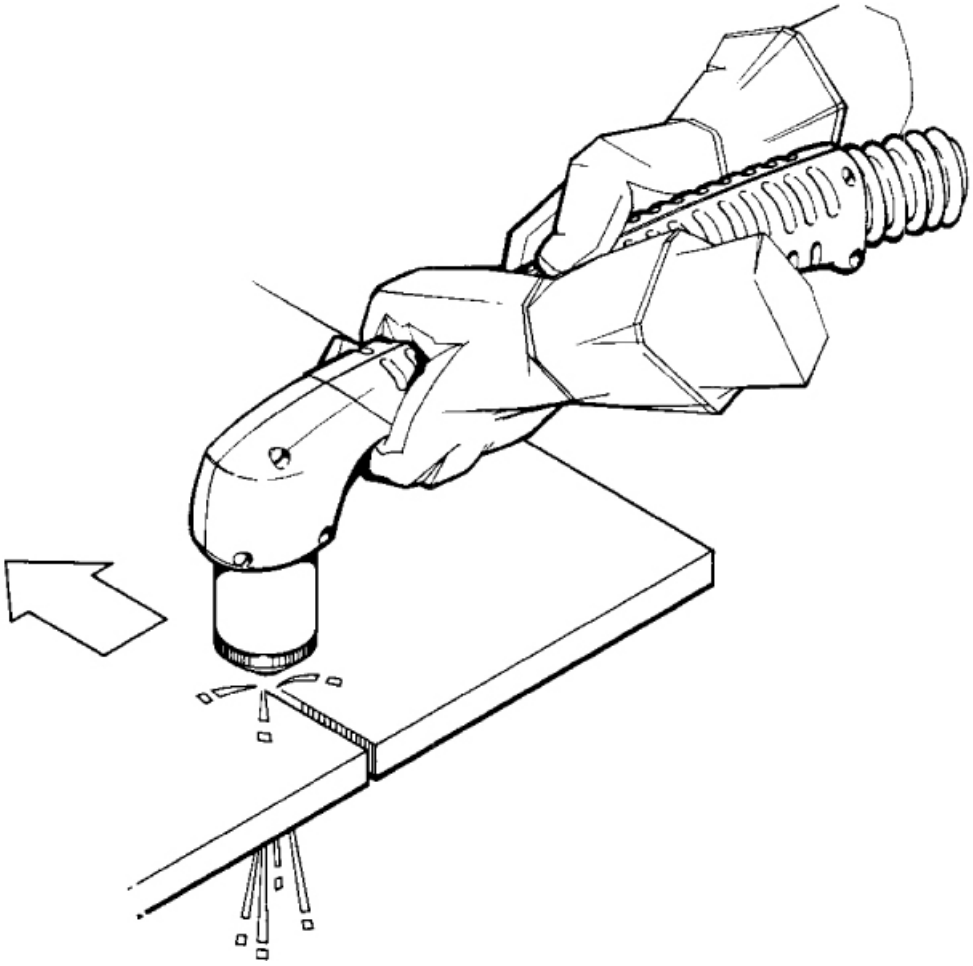
4. Hold the torch lightly on the metal or just off the metal and drag the torch across the metal.

   The arc transfers once the torch is within 6 mm (0.25 inch) of the workpiece.

5. Pull the torch through the cut.

   Pulling the torch is easier than pushing it.

6. Hold the torch so the arc is vertical, and watch the arc as it cuts along the line, as shown.



7. Lightly drag the shield on the workpiece to keep a steady cut.

8. **Optional:**

   For straight-line cuts, use any straight edge as a guide.

Pierce

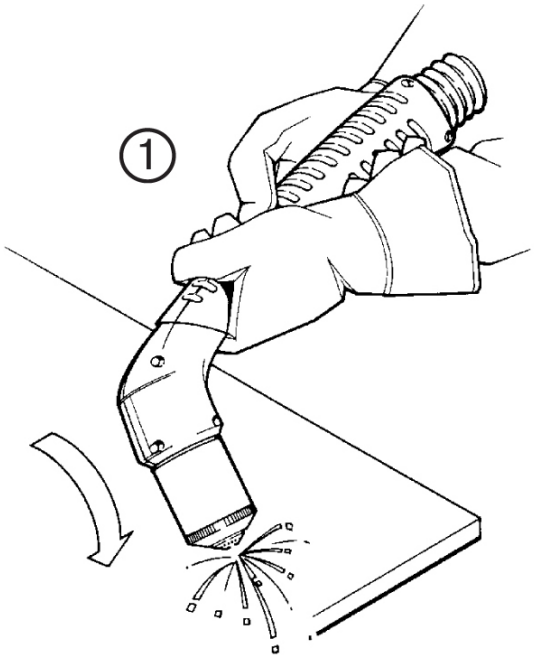
1. Hold the torch so that the shield is approximately 1.5 mm (1/16 inch) away from the workpiece before pulling the torch trigger.

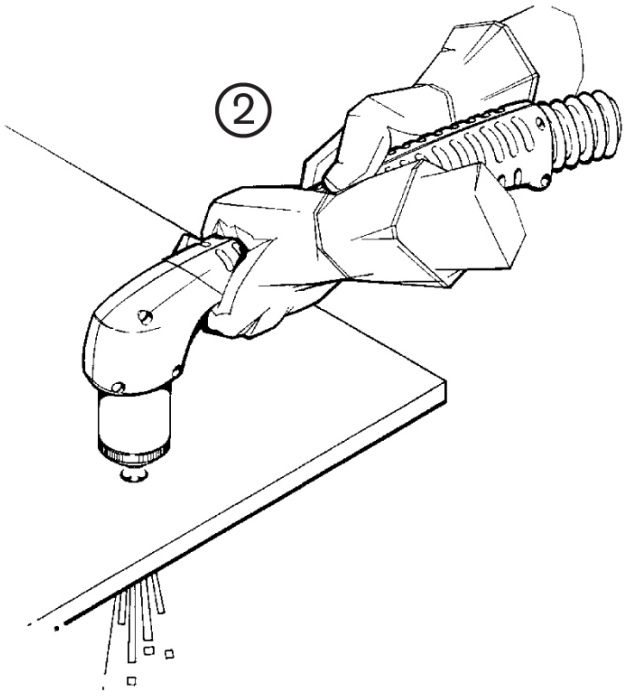
   This method maximizes the life of the consumables.

2. Point the torch away from yourself, and hold it at approximately a 45° angle to the workpiece, then slowly roll it to a vertical position.

   It is important to use this method to cut thicker material. Make sure that the torch is pointed away from you and the people around you to avoid any danger from sparks and hot metal. Start the pierce at an angle to permit the hot metal to escape to one side rather than splashing back against the shield. This protects the operator from the sparks and extends the life of the shield.

3. When the pierce is complete, continue with the cut.

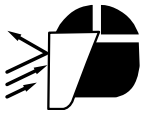




FlushCut cutting

Safety for FlushCut cutting

⚠ WARNING



SPARKS AND HOT METAL CAN INJURE EYES AND BURN SKIN

When you fire the torch at an angle, sparks and hot metal will spray out from the torch tip.

Point the torch away from yourself and others. Always put on correct protective equipment including gloves and eye protection.

During cutting, always use full protection:

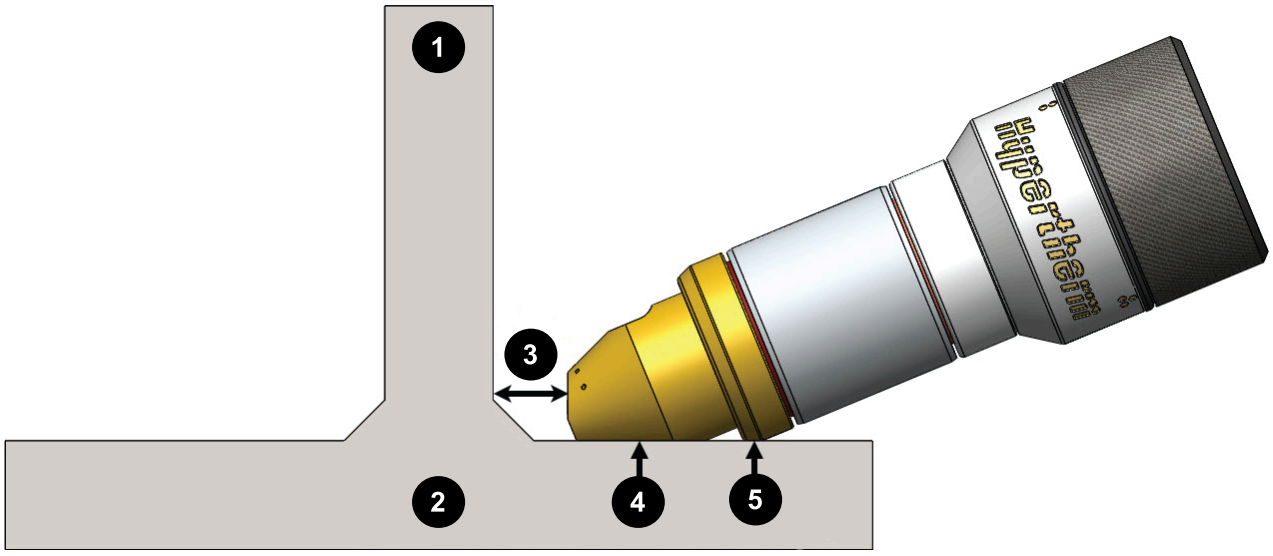
- A welding helmet with at least a #12 glass
- Welding gloves and a welding jacket
- A heat shield for additional protection – available from Hypertherm (127389)

Specifications for FlushCut cutting

Materials	Mild steel
Current	200 A
Plasma gas types	Air
Shield gas types	Air

When to use FlushCut consumable parts

FlushCut™ consumable parts make it possible to do handheld and mechanized cutting of mild steel as close as possible to the bottom of the workpiece without causing damage to the surfaces below the workpiece. Cutting off temporary lift attachments (known also as pad eyes or lifting lugs) is an example of when FlushCut consumable parts are a good choice.



1 Workpiece

2 Surface below the workpiece

3 Recommended torch distance from workpiece for FlushCut cutting: 12 mm (0.50 in.)

4 FlushCut shield in the correct position: flush to the flat surface that is adjacent to the workpiece

5 FlushCut shield-retaining ring in the correct position: flush to the flat surface that is adjacent to the workpiece

Install the FlushCut consumable parts

Make sure the consumable parts are installed correctly on the torch.

⚠ WARNING

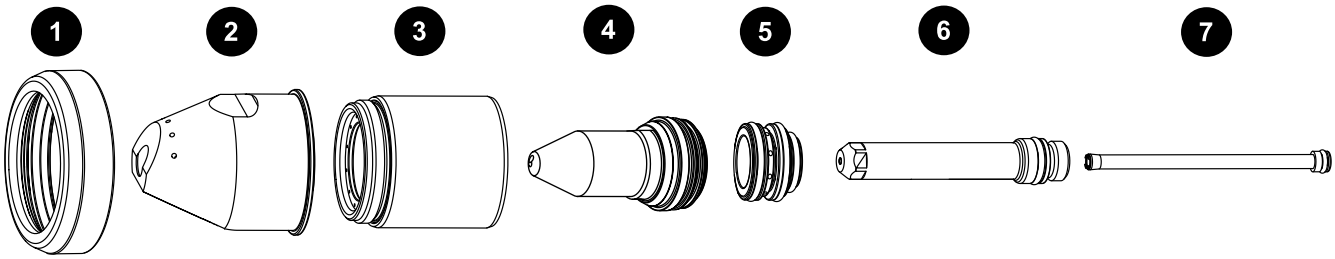


ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.

- Refer to the *Safety and Compliance Manual (80669C)* for important safety information before you operate this system.
- Disconnect electric power before you change consumables or do other maintenance tasks.
- The line-disconnect switch must STAY in the OFF position until all of the consumable changes or other maintenance tasks are complete.

Figure 10 - FlushCut consumable parts before installation

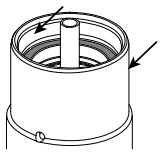


1	Shield-retaining ring: 10087802	**5**	Swirl ring: 220488
2	Shield: 10087213	**6**	Electrode: 420732
3	Nozzle-retaining cap: 420793	**7**	Water tube: 420823
4	Nozzle: 10087212		

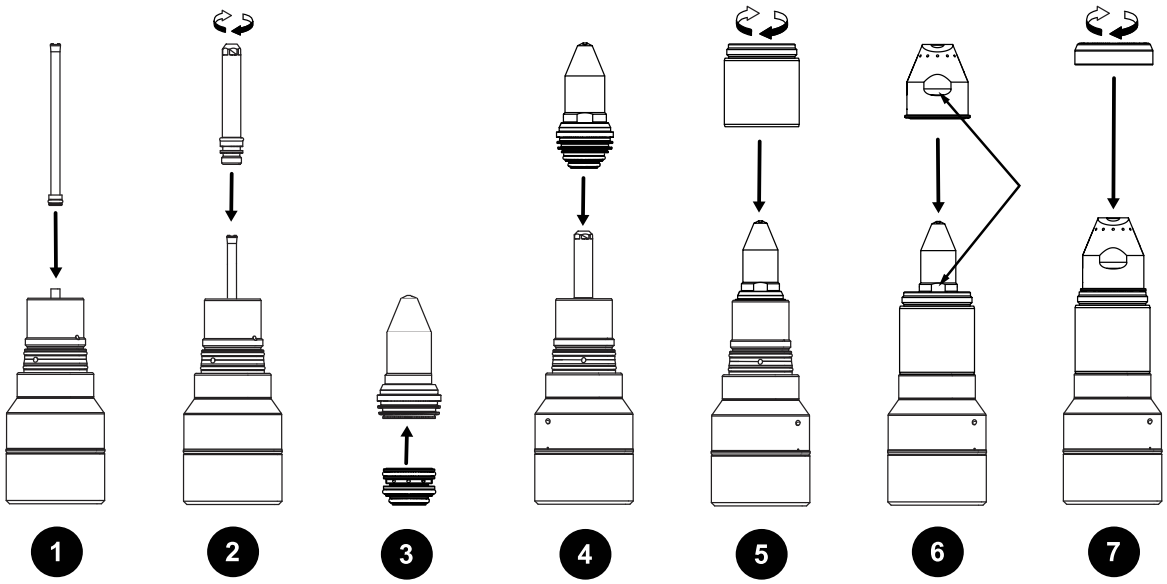
Before you begin: Select the correct consumable parts. Refer to How to select cutting and gouging consumable parts on page 98.

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 on the plasma power supply is not illuminated.
2. Apply a thin layer of silicone lubricant to each O-ring on all consumable parts.

    Make sure that the O-rings are shiny. However, too much lubricant can prevent gas flow. Remove unwanted lubricant if found.
3. Remove the torch from the torch receptacle for mechanized cutting, if applicable.
4. Use a clean, lint-free cloth to wipe the internal and external surfaces of the torch.



5. Install the consumable parts on the torch as shown:



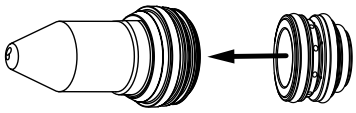
a. Push the water tube in the torch until the water tube stops.

b. Install the electrode over the water tube in the torch.

   Use your fingers to tighten the electrode until the electrode stops, then use the consumable tool (104119) to fully tighten the electrode. Refer to Install consumable parts on page 101.

c. Use your fingers to put the swirl ring in the nozzle.

   Make sure the swirl ring is correctly installed, as shown.

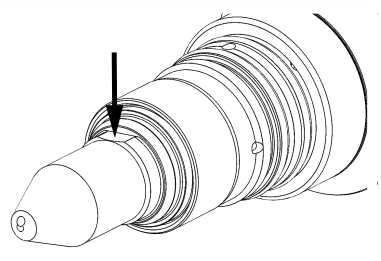


d. Put the nozzle-swirl ring assembly over the electrode and push it in the torch until the assembly stops.

   Make sure the nozzle-swirl ring assembly is fully installed and flush to the torch body, with no space showing between the assembly and torch body.

e. Use your fingers to turn the nozzle to the correct position for FlushCut cutting.

   During cutting, the flat surface on the nozzle will be directly opposite to the surface that the shield touches. It can be good to put the nozzle in the correct position during installation so that it is ready for operation. If necessary, the nozzle position can be changed later.

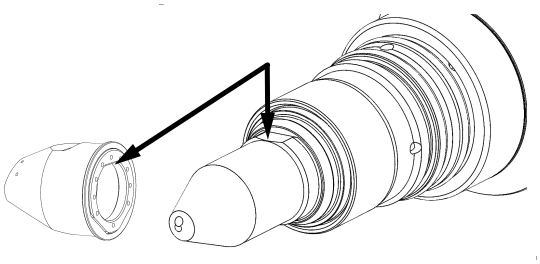


f. Use your fingers to install and tighten the nozzle-retaining cap.

   Make sure the nozzle does not move out of the correct position as you rotate and tighten the nozzle-retaining cap. Use your fingers to hold the nozzle in position. If necessary, loosen the nozzle-retaining cap and change the nozzle position before tightening this connection again.

g. Install the shield over the nozzle on the torch.

   Use your fingers to turn the shield until the flat part of the insulator ring in the shield engages with the flat surface on the nozzle as shown.



The bore holes in the nozzle and the shield do **not** align in the center of these consumable parts. The location of the bore holes keeps the plasma arc pointing in the direction of the workpiece.

h. Install the shield-retaining ring over the shield and use your fingers to tighten the ring until it stops.

6. Refer to Connect the torch to the quick-disconnect receptacle on page 46 for mechanized cutting, if applicable.

What to do next: Before cutting, make sure the consumable parts are in the correct position for the cutting angle you want. Refer to Change the position of the shield to get a different cutting angle if necessary on page 84.

Change the position of the shield to get a different cutting angle if necessary

After the FlushCut consumable parts are installed you can change the position of the shield to get a different cutting angle.

⚠ WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.



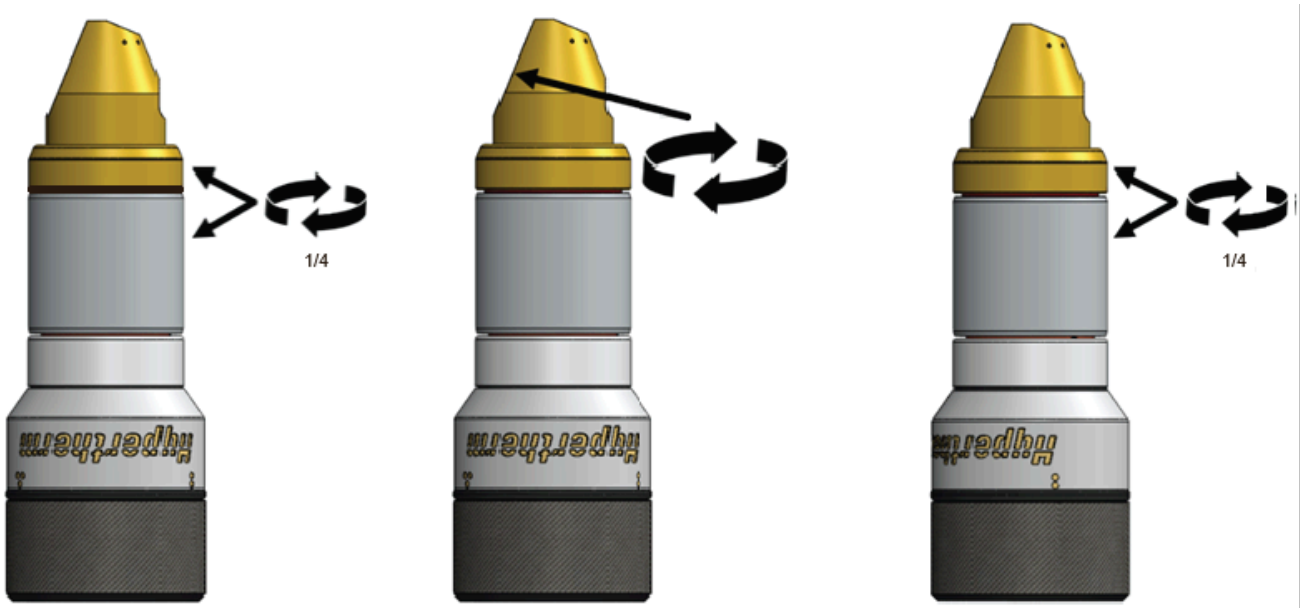
- Refer to the *Safety and Compliance Manual (80669C)* for important safety information before you operate this system.
- Disconnect electric power before you change consumables or do other maintenance tasks.
- The line-disconnect switch must STAY in the OFF position until all of the consumable changes or other maintenance tasks are complete.

Before you begin: Select the correct consumables. Refer to Install the FlushCut consumable parts on page 80.

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 on the plasma power supply is not illuminated.
2. Put on gloves to prevent burns.

    The torch and consumable parts can be hot.
3. Remove the torch from the torch receptacle for mechanized cutting, if applicable.
4. Use your fingers to loosen the consumable parts that hold the nozzle and shield:
    a. Turn the shield-retaining ring a ¼-turn counterclockwise.
    b. Turn the nozzle-retaining cap with a ¼-turn counterclockwise.
5. Use your fingers to move the flat, surface-touching part of the shield to a different position that can give the cutting angle you want.

6. Use your fingers to tighten the consumable parts that hold the nozzle and shield:
    a. Turn the nozzle-retaining cap a ¼-turn clockwise.
    b. Turn the shield-retaining ring a ¼-turn clockwise.
7. Install the torch in the torch receptacle for mechanized cutting, if applicable.



What to do next: Supply power to the cutting system.

Recommended techniques for FlushCut cutting

Use these recommended techniques to get the best FlushCut cutting results.

Safety

Make sure you understand and obey all safety guidelines, including Safety information on page 3, Safety for handheld cutting on page 75, and Safety for FlushCut cutting on page 79.

Consumable parts

Consumable parts that have damage or wear can give bad results. For example, a FlushCut nozzle or shield in bad condition can cause unwanted remnant heights. If you get remnant heights that are too low, replace the nozzle or shield that has damage or wear. If a remnant height is too high, use a washing technique to decrease the need for secondary operations, like grinding.

For steps to do every day before use, refer to Inspect consumable parts on page 103.

Keep the torch and consumable parts away from slag and molten metal that can cause damage to consumable parts.

Edge starts

Edge starts can decrease the occurrence of shield damage from molten metal.

Keep the torch approximately 6 mm (0.25 in.) from the workpiece during pilot-arc transfer.

After pilot-arc transfer is complete, move the torch away from the workpiece to a distance of approximately 12 mm (0.50 in.). Keep the torch at the same 12 mm (0.50 in.) distance from the start of cutting to the end.

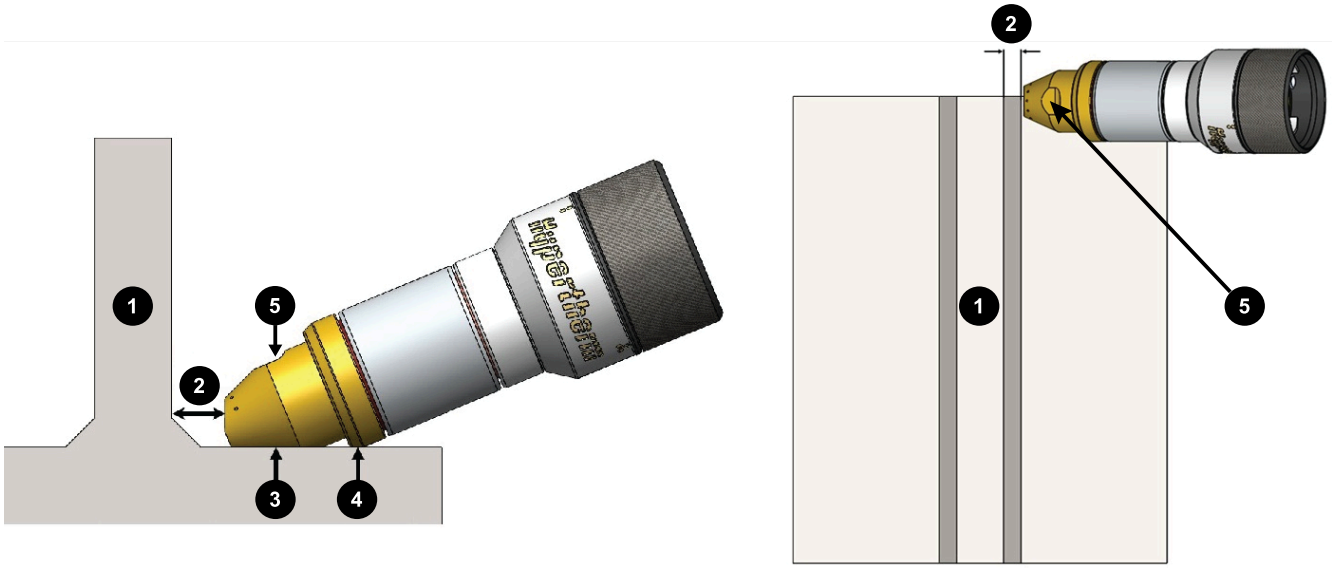
Torch position

Unwanted torch movement during cutting can give bad results. Flat surfaces on the FlushCut consumable parts decreases this problem by making torch movement more smooth and level.

After the plasma arc is established and cutting starts, keep the shield and shield-retaining ring touching the adjacent flat surface near the bottom of the workpiece as shown. If these flat surfaces stay flush during cutting, you will get cuts that are smoother, straighter, and as close a possible to the bottom of the workpiece. Keeping the flat surfaces flush also helps to keep the torch in the correct position during cutting. When the torch distance and torch angle is correct, the plasma arc points in the direction of the workpiece, not the surface below the workpiece. The risk of the plasma arc causing accidental damage to the surfaces below the workpiece decreases when the torch angle is correct.

It can be very helpful to reference the small recess on the shield for signs of torch position and angle during cutting. Because the small recess points in a direction opposite to the flat, surface-touching part of the shield, when its position appears consistent during cutting, the small recess can be a good visual indicator that the related position and angle of the torch is correct.

Figure 11 - The recommended torch distance and torch angle for FlushCut cutting, as shown from the side of the workpiece (left) and from above the workpiece (right)



1 Workpiece

2 Recommended torch distance from workpiece during cutting: 12 mm (0.50 in.)

3 FlushCut shield in the correct position: flush to the flat surface that is adjacent to the workpiece

4 FlushCut shield-retaining ring in the correct position: flush to the flat surface that is adjacent to the workpiece

5 Small recess on the surface of theFlushCut shield that is a visual indicator of torch position and angle during cutting.

Torch speeds

The plasma arc will penetrate straight through the workpiece when the torch is moving at the correct speed for the workpiece thickness. If you find that the plasma arc is bending away from the direction of torch movement, the torch movement is too fast. For recommended torch speeds by workpiece thickness for mechanized FlushCut cutting, refer to Mild steel – Air Plasma / Air Shield – 200 A FlushCut Cutting on page 162.

Additional information

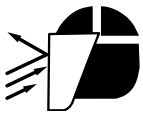
Additional information about recommended FlushCut cutting techniques is available online: go.hypertherm.com/MP200.

go.hypertherm.com/MP200

Gouging

Safety for gouging

⚠ WARNING



SPARKS AND HOT METAL CAN INJURE EYES AND BURN SKIN

When you fire the torch at an angle, sparks and hot metal will spray out from the torch tip.

Point the torch away from yourself and others. Always put on correct protective equipment including gloves and eye protection.

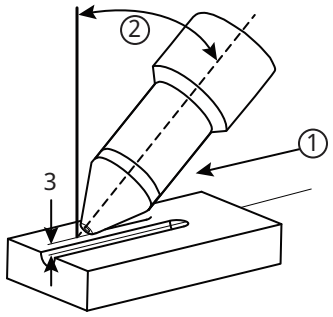
During gouging, always use full protection:

- A welding helmet with at least a #12 glass
- Welding gloves and a welding jacket
- A heat shield for additional protection - available from Hypertherm (127389)

Specifications for gouging

Materials	Mild steel, stainless steel, and aluminum
Current	200 A
Plasma gas types	Air, O_2
Shield gas types	Air

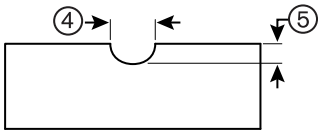
Parameters of operation for frequently-used gouging processes



General parameters for gouging		
1	Speed	508 to 1,270 mm/min (20 to 50 in/min)
2	Angle	45 to 57.5 degrees
3	Standoff	3.1 to 19.0 mm (0.125 to 0.75 inch)
	Maximum arc stretch	76 mm (3 inches) [1]

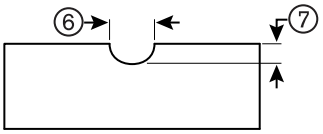
1 For infrequent use, not 100% duty cycle.

Parameters for gouging with 200 A - Air Plasma / Air Shield on mild steel	
Metal-removal rate	19.9 kg/hr (44 lb/hr)
Speed	889 mm/min (35 in/min)
Angle	57.5 degrees
Stand off	4.7 mm (0.187 inch)



4	9.9 mm (0.39 inch)
5	7.6 mm (0.30 inch)

Parameters for gouging with 200 A – O_2 Plasma / Air Shield on mild steel	
Metal-removal rate	19.5 kg/hr (43 lb/hr)
Speed	889 mm/min (35 in/min)
Angle	57.5 degrees
Stand off	7.8 mm (.31 inch)



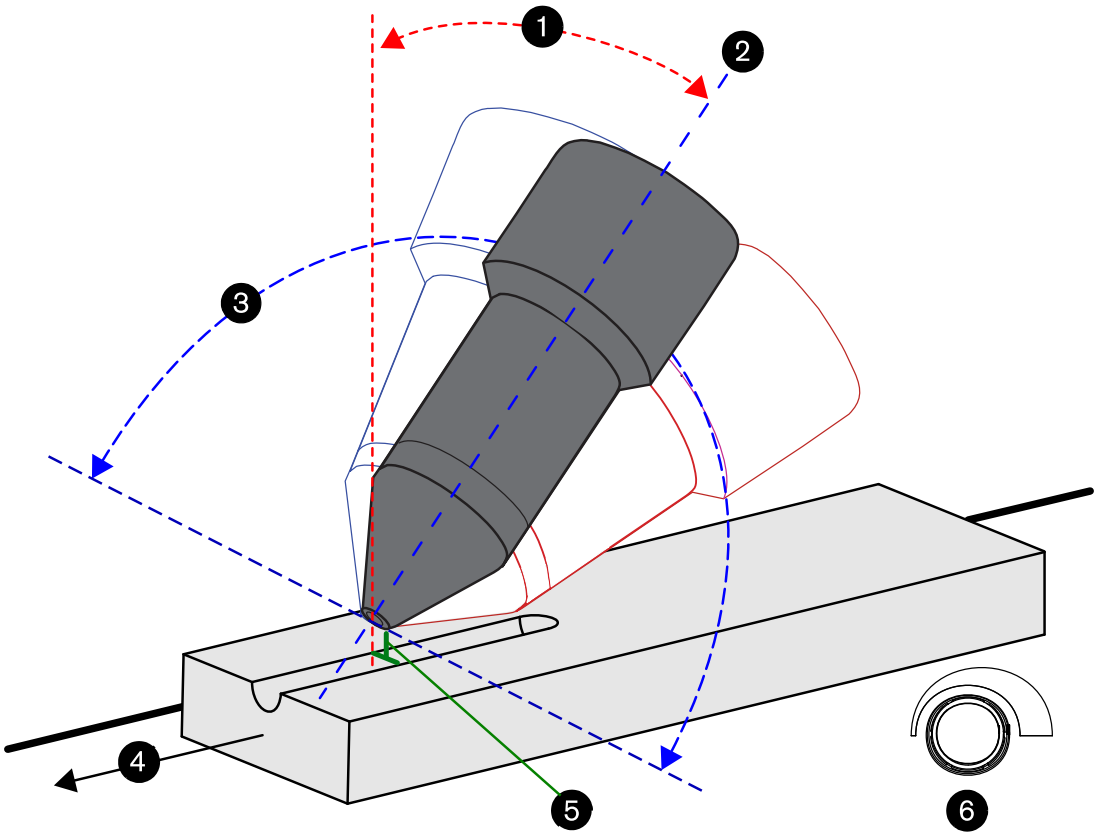
6	11.6 mm (0.46 inch)
7	6.3 mm (0.25 inch)

Refer to Cut charts on page 117 for details about gouging parameters and settings.

How to change the gouge contour and metal-removal rate

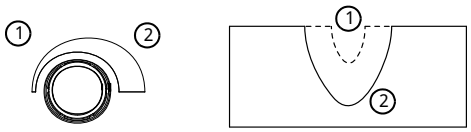
You can change the gouge contour and the metal-removal rate by changing the speed of the torch as it moves along the workpiece, changing the distance between the torch and the workpiece, changing the angle of the torch to the workpiece, and changing the output current (A) of the plasma power supply. For example:

- **Increasing the speed** of the torch will **decrease width** and **decrease depth**.
- **Decreasing the speed** of the torch will **increase width** and **increase depth**.
- **Increasing the standoff** of the torch will **increase width** and **decrease depth**.
- **Decreasing the standoff** of the torch will **decrease width** and **increase depth**.
- **Increasing the angle** of the torch (more vertical) will **decrease width** and **increase depth**.
- **Decreasing the angle** of the torch (less vertical) will **increase width** and **decrease depth**.
- **Increasing the current** of the plasma power supply will **increase width** and **increase depth**.
- **Decreasing the current** of the plasma power supply will **decrease width** and **decrease depth**.



1	Angle of the torch	**4**	Speed of the torch
2	Torch center line	**5**	Standoff / arc stretch
3	Turn of the torch	**6**	Output current (A)

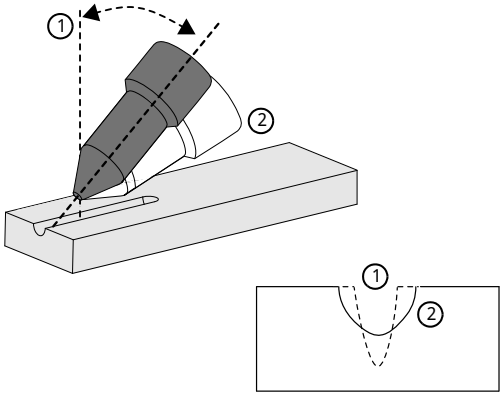
Output current (A)



Use the knob on the front panel of the plasma power supply to change the output current (A). Decrease the amperage (-) to make the gouge narrower and shallower. Increase the amperage (+) to make it wider and deeper.

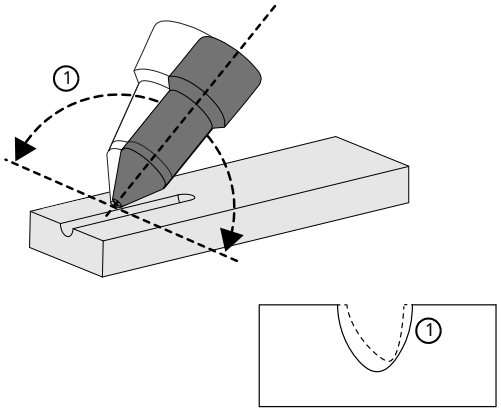
- Arc stretch is related to the amperage of the plasma power supply. The higher the amperage, the longer you can stretch the arc. Hypertherm recommends that you keep amperage and arc stretch consistent.
- The lowest and highest possible amperage settings are related to the plasma power supply and the Hypertherm consumables.

Angle of the torch



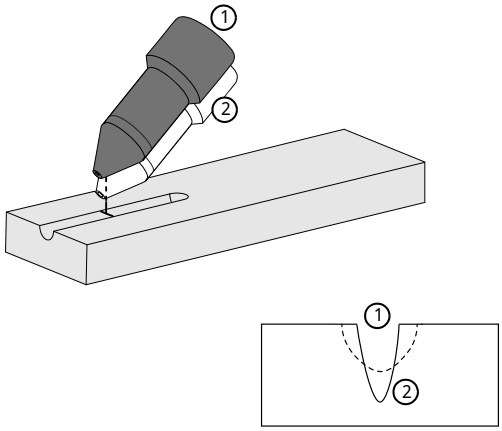
Put the torch in a more vertical position to make the gouge narrower and deeper. Tilt down the torch so that it is more horizontal and near the workpiece to make the gouge wider and more shallow.

Turn of the torch



Turn the torch in the direction of the torch center line to make the gouge flatter and steeper on one side.

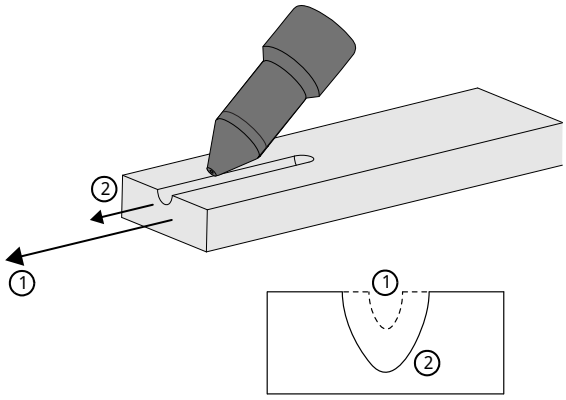
Torch-to-work standoff or arc stretch



Move the torch away from the workpiece to make the gouge wider, shallower, and smoother on the bottom. Move the torch near the workpiece to make the gouge narrower and deeper.

- Arc stretch is related to the amperage of the plasma power supply. The higher the amperage, the longer that you can stretch the arc. Hypertherm recommends that you keep amperage and arc stretch consistent.
- Keep at least a small distance between the torch tip and the molten metal. Contact with molten metal can damage the torch and reduce the life of consumables.

Speed of the torch



Increase the speed of the torch to make the gouge more narrow and more shallow. Decrease the speed of the torch to make the gouge wider and deeper.

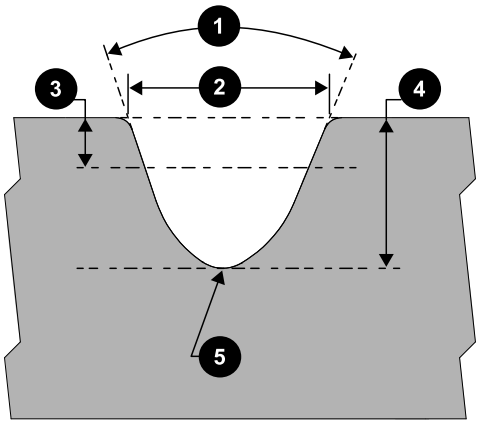
Mechanized gouging

Gouging can be mechanized for repeatable results if the torch is installed on a track-mounted carriage, stationary manipulator, or other fixture. The quality of the torch installation and

software integration can have an effect on the quality of mechanized gouging. Experienced installers and integrators who understand gouging can contribute to good results.

For the best results, Hypertherm recommends a Sensor™ PHC (plasma height control) or Original Equipment Manufacturer (OEM) Torch Height Control (THC) to keep the correct torch-to-work distance during mechanized gouging.

The figure below shows how different settings and conditions of operation can change the gouge width, depth, and angle.



1 Included angle

2 Width

3 1/3 depth

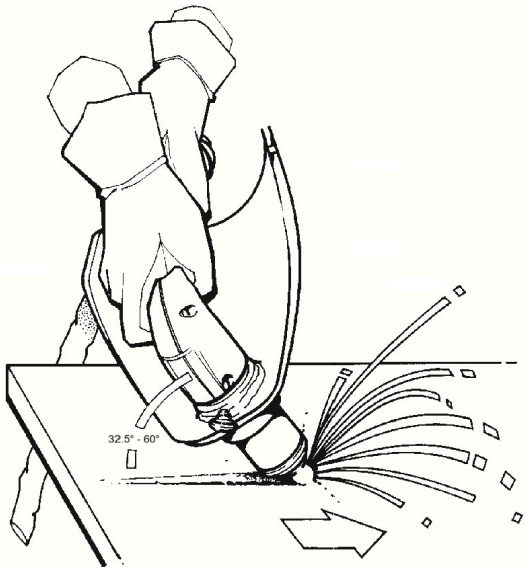
4 Depth

5 Bottom radius

For guidance about how to produce single-pass automated gouges using air / air or O_2 / air on mild steel, refer to *Automated Gouging with Sensor PHC (810730)* available at www.hypertherm.com/docs.

Handheld gouging

Figure 12 - Feeding into the gouge



Before you begin: Select the correct consumables. Refer to How to select cutting and gouging consumable parts on page 98.

1. Hold the torch so that the torch tip is 1.5 mm (1/16 inch) from the workpiece.
2. Move the torch to the angle necessary to get the gouge angle and shape that you want.
3. Make sure that you keep a gap between the torch tip and the workpiece.
4. Pull the trigger to obtain a pilot arc, and transfer the arc to the workpiece.
5. Keep the torch at the same angle to the workpiece as you gouge.
6. Push the plasma arc in the direction of the gouge that you want to create.
7. Keep at least a small distance between the torch tip and the molten metal.

   Contact with molten metal can damage the torch and reduce the life of consumables.

What to do next: Change the torch angle to change the dimensions of the gouge. Refer to How to change the gouge contour and metal-removal rate on page 90.

Handheld gouging techniques

Straight gouge and straight-weaving gouge

Figure 13 - Straight gouge

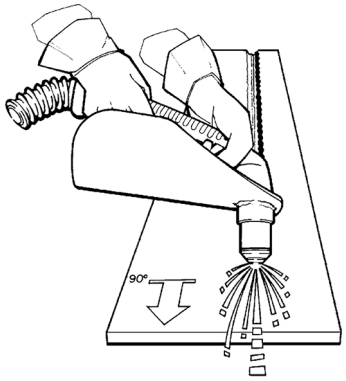
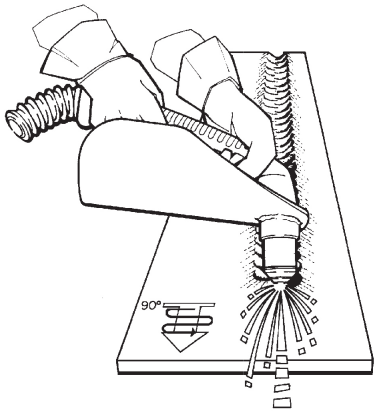


Figure 14 - Straight-weaving gouge



Side gouge and side-weaving gouge

Figure 15 - Side gouge

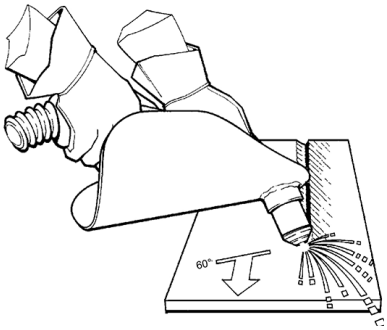
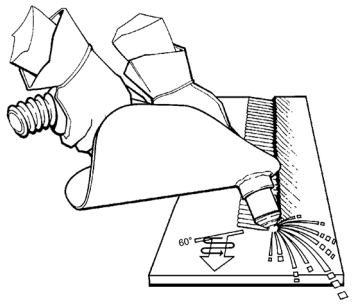


Figure 16 - Side-weaving gouge



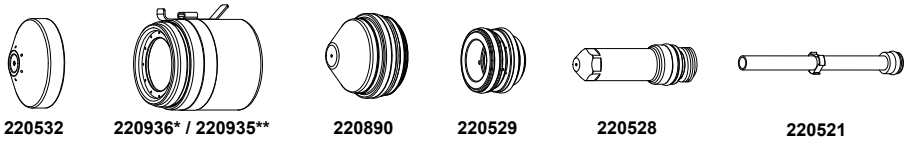
Cutting parameters

The cut charts for the MAXPRO200 show the consumable parts, cutting speeds, and the gas and torch settings required for each process, allowing for differences in the lead length. These parameters are used for cutting with both mechanized and handheld torches. The consumable part numbers listed with each cut chart are specific to mechanized torches. Refer to Handheld consumable parts on page 97 below for the consumables to use with handheld torches.

The cut chart values in this document are recommended for high-quality cuts with minimal dross. Because of differences between installations and material composition, some adjustments can be necessary.

Mechanized consumable parts

The consumable part numbers included with each cut chart are specific to mechanized torches. Each cut chart has a drawing and part number for every consumable, as shown in the example below.



Drawings are for reference only.

Handheld consumable parts

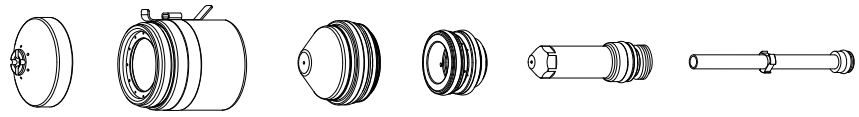
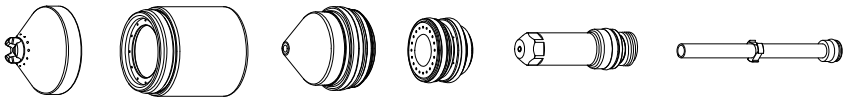
Handheld consumable parts are intended for use with handheld torches to cut mild steel, stainless steel, and aluminum. Use the cutting parameters in the Cut charts on page 117 for cutting with the MAXPRO200 handheld torches.

How to select consumable parts for handheld cutting and gouging

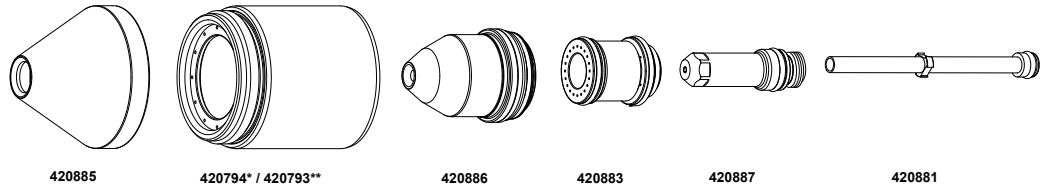
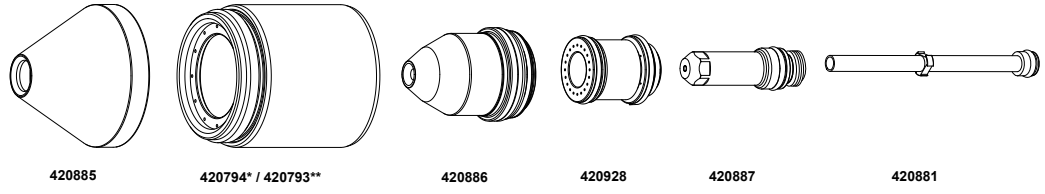
The following sets of consumable parts are intended for use with handheld torches to cut and gouge mild steel, stainless steel, and aluminum. You can use the cutting parameters detailed under Cut charts on page 117 with the MAXPRO200 handheld torches as long as you use the following consumable parts for each process.

Gouging consumable parts can be used with both handheld or mechanized torches.

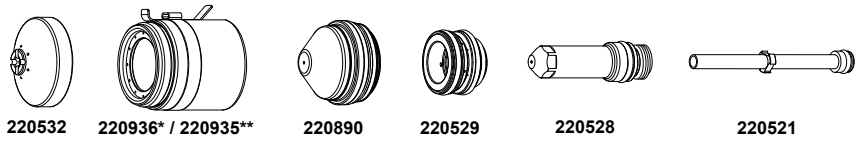
Mild steel cutting

50 A Air Plasma Air Shield	 220532 220936* / 220935** 220890 220529 220528 220521
50 A O_2 Plasma Air Shield	 420063 220935 220891 220529 220528 220521
130 A Air Plasma Air Shield	 420061 220935 220892 220488 220487 220521
130 A O_2 Plasma Air Shield	 420062 220935 220893 220488 220487 220521
200 A Air Plasma Air Shield	 420058 220935 420044 220488 220937 220521
200 A O_2 Plasma Air Shield	 420059 220935 220831 220834 220937 220521
*with Initial Height Sense (IHS) tab / **without IHS tab	

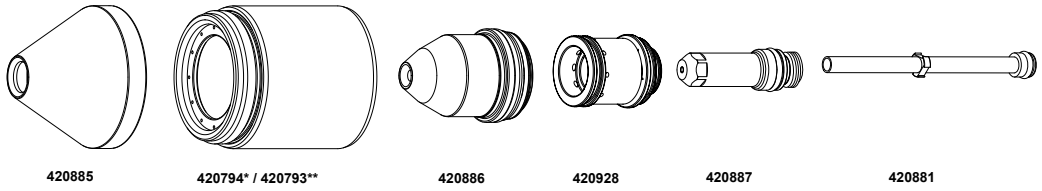
Mild steel gouging

200 A O_2 Plasma Air Shield	
200 A Air Plasma Air Shield	
*with IHS tab / **without IHS tab	

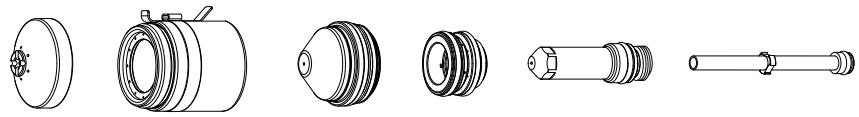
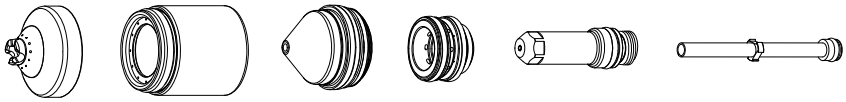
Stainless steel cutting

50 A Air Plasma Air Shield	
130 A Air Plasma Air Shield	
130 A N_2 Plasma N_2 Shield	
200 A Air Plasma Air Shield	
200 A N_2 Plasma N_2 Shield	
*with IHS tab / **without IHS tab	

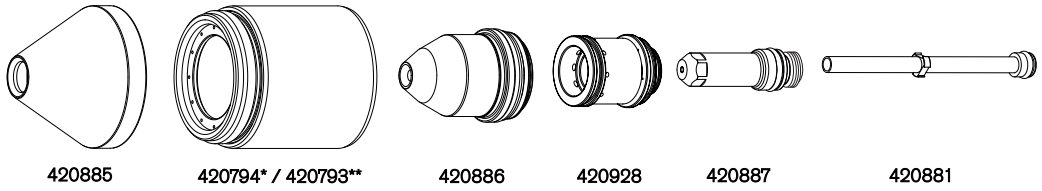
Stainless steel gouging

200 A Air Plasma Air Shield	 420885 420794* / 420793** 420886 420928 420887 420881
*with IHS tab / **without IHS tab	

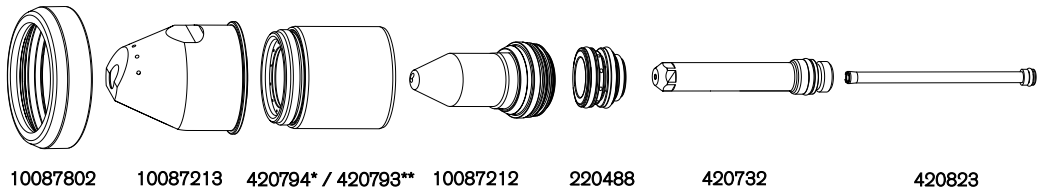
Aluminum cutting

50 A Air Plasma Air Shield	 220532 220936* / 220935** 220890 220529 220528 220521
130 A Air Plasma Air Shield	 420061 220935 220892 220488 220487 220521
130 A N_2 Plasma N_2 Shield	 420061 220935 220892 220529 020415 220521
200 A Air Plasma Air Shield	 420058 220935 420044 220488 220937 220521
200 A N_2 Plasma N_2 Shield	 420058 220935 420044 220529 020415 220521
*with IHS tab / **without IHS tab	

Aluminum gouging

200 A Air Plasma Air Shield	
*withIHS tab / **without IHS tab	

Mild steel cutting with FlushCut consumable parts

200 A Air Plasma Air Shield	
*with IHS tab / **without IHS tab	

Install and inspect consumable parts

Install consumable parts

Before you begin:

- Examine the consumable parts daily for wear before cutting. Refer to Inspect consumable parts on page 103.
- Before removing consumable parts, bring the torch to the edge of the cutting table with the torch lifter raised to its highest point to prevent the consumables from dropping into the water of the water table.

⚠ WARNING



ELECTRIC SHOCK CAN KILL

Electric shock can seriously injure or kill you. You can get a serious electric shock if electric power is not disconnected.

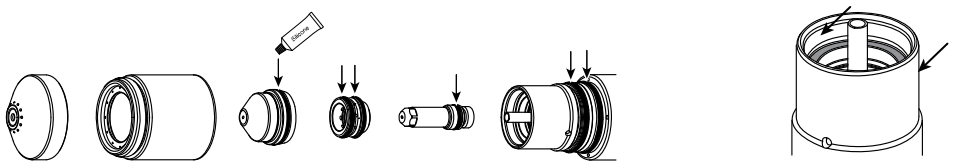
Disconnect electric power before doing installation or maintenance. Refer to the *Safety and Compliance Manual (80669C)* for more safety information.

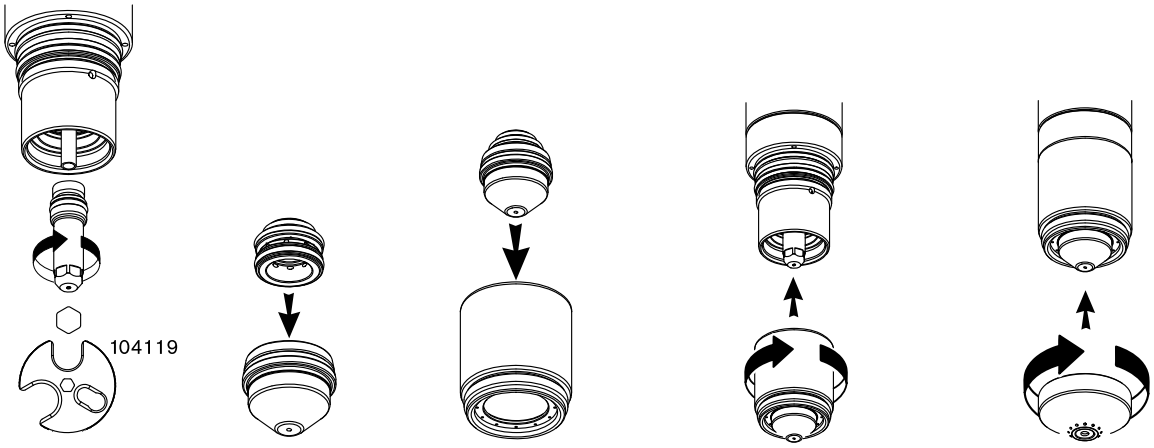
1. Wipe the internal and external surfaces of the torch with a clean cloth or paper towel.
2. As you install each consumable:
    a. Apply a thin layer of silicone lubricant on each O-ring.

       Make sure that the O-ring is shiny but does not have excess lubricant.

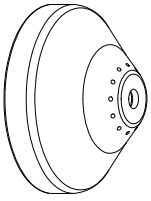
    b. Do not over tighten parts!

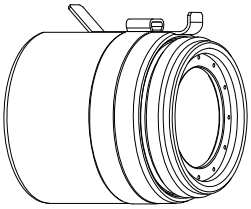
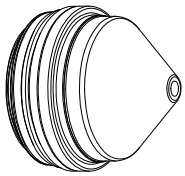
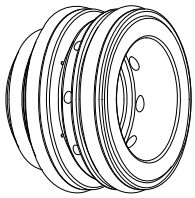
       Tighten only until the mating parts are seated.
3. Install the electrode into the torch head.
4. Install the swirl ring into the nozzle.
5. Install the nozzle and swirl ring into the nozzle retaining cap.
6. Install the nozzle retaining cap onto the torch head.
7. Install the shield onto the nozzle retaining cap.

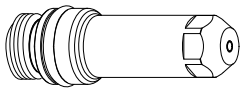




Inspect consumable parts

Inspect	Look for	Action
Shield 	**General:**	
	Erosion or missing material	Replace the shield
	Molten material attached	Replace the shield
	Blocked gas holes	Replace the shield
	Center hole:	
	Must be round	Replace the shield when the center hole is no longer round

Inspect	Look for	Action
Nozzle retaining cap 	**General:**	
	Erosion or missing material	Replace the nozzle retaining cap
	Cracks	Replace the nozzle retaining cap
	Burn marks	Replace the nozzle retaining cap
Nozzle Always replace the nozzle and the electrode as a set 	**General:**	
	Erosion or missing material	Replace the nozzle
	Blocked gas holes	Replace the nozzle
	Center hole:	
	Must be round	Replace the nozzle when the center hole is no longer round
	Signs of arcing	Replace the nozzle
	O-rings:	
	Damage	Replace the O-ring
	Lubricant	Apply a thin film of silicone lubricant if the O-rings are dry
Swirl ring 	**General:**	
	Damage	Replace the swirl ring
	Dirt or debris	Clean and inspect for damage, and replace if damaged
	Blocked gas holes	Replace the swirl ring
	O-rings:	
	Damage	Replace the O-ring
	Lubricant	Apply a thin film of silicone lubricant if the O-rings are dry

Inspect	Look for	Action
Electrode Always replace the nozzle and the electrode as a set 	**Center surface:**	
	Emitter wear - a pit forms as the emitter wears	In general, replace the electrode when the pit depth is 1 mm (0.04 in.) or greater
	O-rings:	
	Damage	Replace the O-ring
	Lubricant	Apply a thin film of silicone lubricant if the O-rings are dry

Torch maintenance

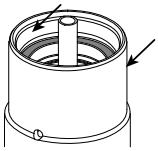
Poor cut quality and premature failure may occur if the torch is not maintained properly.

The torch is manufactured to very tight tolerances to maximize cut quality. The torch should not be subjected to hard impacts that can cause critical features to become misaligned.

The torch should be stored in a clean location when not in use, to avoid contamination of critical surfaces and passages.

Routine maintenance

The following steps should be completed each time consumables are changed:



1. Use a clean cloth to wipe off the torch inside and outside. A cotton swab can be used to access hard-to-reach internal surfaces.

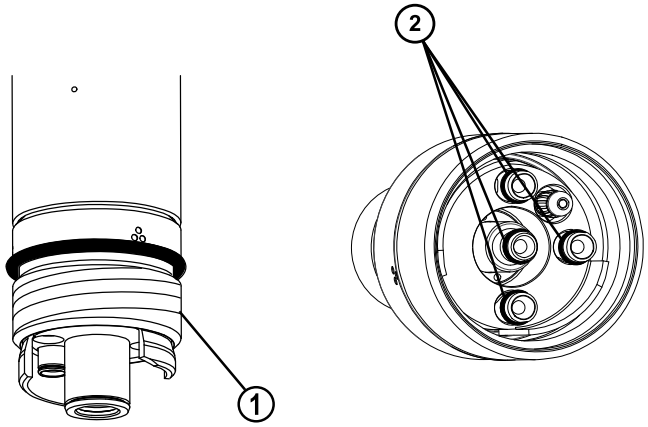
   Make sure that fibers from the cotton swap do not stay on the surfaces.

2. Use compressed air to blow away any remaining dirt and debris from internal and external surfaces.
3. Apply a thin film of silicone lubricant on each external O-ring. The O-rings should look shiny, but there should not be any excess or built-up lubricant.
4. If consumables will be reused, use a clean cloth to wipe them off, and use compressed air to blow them off before they are installed again. This is especially critical for the nozzle retaining cap.

Quick-disconnect maintenance

The following steps should be completed every 5-10 times the consumables are changed:

Figure 17 - Rear view of torch



1 External threads

2 O-rings

1. Remove the torch from the quick-disconnect assembly.
2. Use compressed air to blow off all internal surfaces and the external threads.
3. Use compressed air to blow off all internal surfaces at the rear of the torch.
4. Inspect each of the 4 O-rings at the rear of the torch and the O-ring on the quick-disconnect receptacle for damage. Replace any damaged O-rings. If they are not damaged, apply a thin film of silicone lubricant on each O-ring. The O-rings should look shiny, but there should not be any excess or built-up lubricant.

Maintenance kit

Even with proper care, the O-rings at the rear of the torch will need to be replaced periodically. Hypertherm provides a quick-disconnect torch maintenance kit (228780) with replacement parts. The kit should be kept in stock and be used as part of your routine maintenance schedule. The straight torch and the hand torches only have two replaceable O-rings.

Torch connections

Quick-disconnect torch

Figure 18 - Torch main body

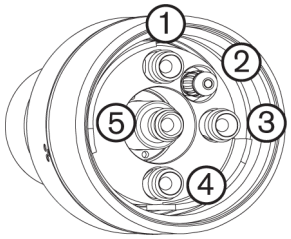
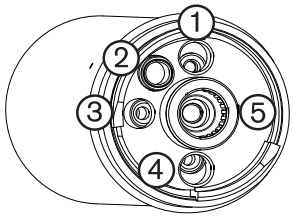


Figure 19 - Quick-disconnect receptacle



1 Shield gas

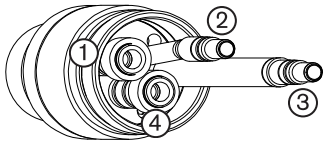
2 Pilot arc

3 Coolant return

4 Plasma gas

5 Coolant supply

Straight torch



1 Plasma gas

2 Coolant supply (also contains the negative lead)

3 Shield gas (also contains the pilot arc lead)

4 Coolant return

Replace the torch water tube

⚠ WARNING

DO NOT CHANGE CONSUMABLE PARTS WHILE IN THE IDLE MODE.

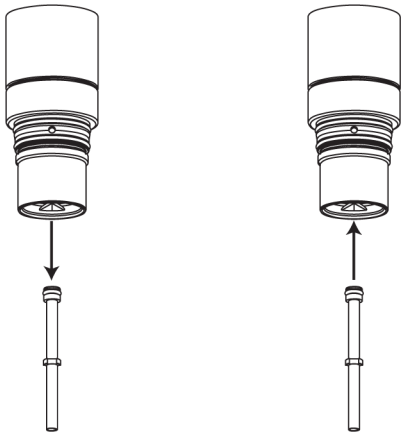
Always disconnect power to the plasma power supply before inspecting or changing torch consumable parts. Use gloves when removing consumables. The torch might be hot.

NOTICE

Different cutting and gouging processes can require different water tubes.

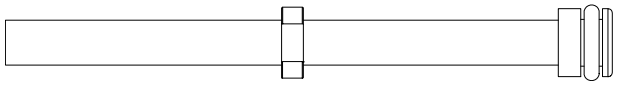
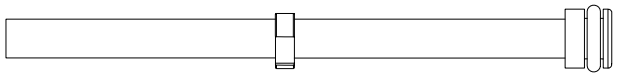
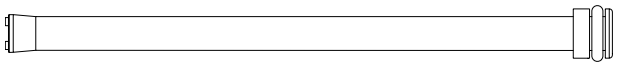
Make sure to select the correct water tube. Failure to select the correct water tube can prevent installation of consumables or decrease cutting system performance.

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



1. Turn OFF all power to the system.
2. Remove consumables from torch. See Install consumable parts on page 101.
3. Remove the old water tube.
4. Select the replacement water tube.

Make sure to select the correct water tube for the process you plan to use:

Standard (220521)	
Gouging (420881)	
Extreme bevel and FlushCut (420823)	

5. Apply a thin film of silicone lubricant on the O-ring, and install a new water tube. The O-ring should look shiny, but there should not be any excess or built-up lubricant.
6. Replace consumables. See Install consumable parts on page 101.

Common cutting faults

Machine torch

- Torch pilot arc will initiate, but will not transfer. Causes can be:
  - Work cable connection on the cutting table is not making good contact.
  - Malfunction in the system. Troubleshooting table on page 199.
  - Torch-to-work distance is too high.
- The workpiece is not totally penetrated, and there is excessive sparking on top of the workpiece. Causes can be:
  - Current is set too low (check cut chart information).
  - Cut speed or cut height is too high (check cut chart information).
  - Torch parts are worn or incorrect (see Inspect consumable parts on page 103).
  - Metal being cut is too thick.
- Dross forms on the bottom of the cut. Causes can be:
  - Cutting speed is not correct (check cut chart information).
  - Arc current is set too low (check cut chart information).
  - Torch parts are worn or incorrect (see Inspect consumable parts on page 103).
- Cut angle is not square. Causes can be:
  - Wrong direction of machine travel. High-quality side is on the right with respect to the forward motion of the torch.
  - Torch-to-work distance is not correct (check cut chart information).

- Cutting speed is not correct (check cut chart information).
- Arc current is not correct (check cut chart information).
- Damaged or worn consumable parts (see Inspect consumable parts on page 103).

- Short consumable life. Causes can be:
  - Arc current, arc voltage, travel speed, motion delay, gas flow rates, or initial torch height not set as specified in the Cut charts.
  - Attempting to cut highly-magnetic metal that has a high nickel content, will shorten consumable life. Long consumable life is difficult to achieve when cutting a workpiece that is magnetized or becomes magnetized easily.
  - Beginning or ending the cut beyond the workpiece surface. This draws the arc sideways and can damage the nozzle or shield. To achieve consumable long life, all cuts must begin and end on the workpiece surface.

Hand torch

- The torch does not cut completely through the workpiece. The causes can be:
  - The cut speed is too fast.
  - The consumables are worn.
  - The metal being cut is too thick for the selected amperage.
  - Gouging consumables are installed instead of drag-cutting consumables.
  - The work clamp is not attached properly to the workpiece.
  - The gas pressure or gas flow rate is too low.
- Cut quality is poor. The causes can be:
  - The workpiece is too thick for the amperage.
  - The wrong consumables are being used (gouging consumables are installed instead of drag-cutting consumables, for example).
  - Moving the torch too quickly or too slowly.
- The arc sputters and consumables life is shorter than expected. The cause can be:
  - Moisture in the gas supply.
  - Incorrect gas pressure.
  - Consumables incorrectly installed.

Optimizing cut quality

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

How to increase cutting speed

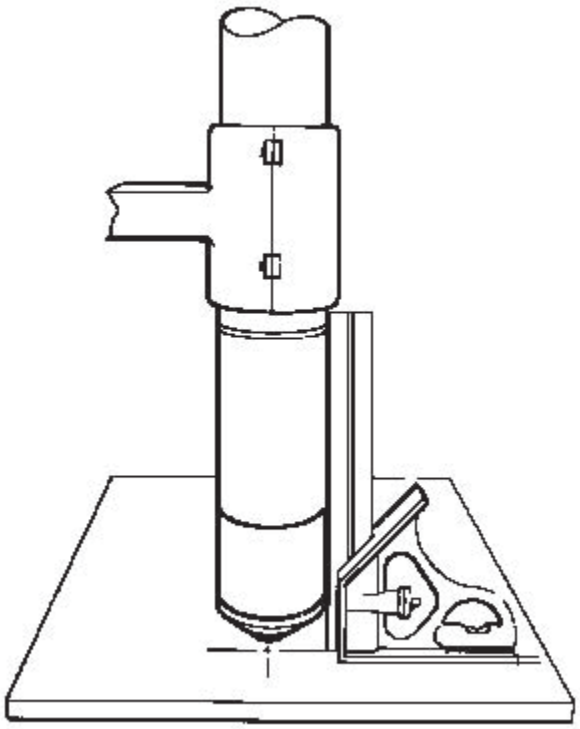
To increase cutting speed, you can decrease the torch-to-work distance. However, decreasing this distance will increase the negative cut angle.

For mechanized applications the torch must not touch the workpiece while piercing or cutting.

For hand held applications the shield can be touching the workpiece to provide stability during cutting.

Tips for table and torch

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



Plasma setup tips

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

Purge the gas lines before cutting.

Maximize the life of consumable parts

The Hypertherm LongLife® process automatically increases the gas and current flow at the start of each cut and decreases them at the end to minimize erosion of the electrode's center surface. The LongLife process also requires that cuts start and stop on the workpiece.

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

Program the path of the torch into the scrap area for ramp-down.



- Program the path of the torch directly from one cut part into the next, without stopping and starting the arc. However, do not allow the path to lead off the workpiece and back on.
- It may be difficult to achieve the full benefits of the LongLife process in some conditions.

Additional factors of cut quality

Cut angle

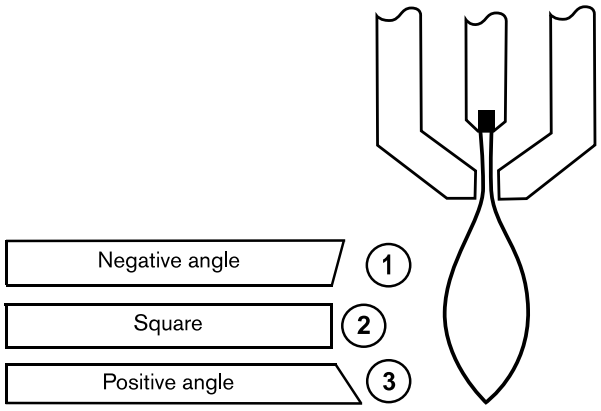
- A cut part whose 4 sides average less than 4° of cut angle is considered acceptable.
- The squarest cut angle will be on the right side with respect to the forward motion of the torch.
- To determine whether a cut-angle problem is being caused by the plasma system or the drive system:
  a. Make a test cut and measure the angle of each side.

b. Rotate the torch 90° in its holder and repeat the process.

c. If the angles are the same in both tests, the problem is in the drive system.

- If a cut-angle problem persists after mechanical causes have been eliminated (see Tips for table and torch on page 111), check the cut height, especially if cut angles are all positive or all negative.
  - A positive cut angle results when more material is removed from the top of the cut than from the bottom.
  - A negative cut angle results when more material is removed from the bottom of the cut.

Cause	Solution
The torch is too low.	Increase arc voltage to raise the torch
The torch is too high.	Decrease arc voltage to lower the torch.



1 Negative angle

2 Square

3 Positive angle

Dross

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

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

- Decrease the cutting speed.
- Decrease arc voltage to decrease the torch-to-work distance.

- Dross is more likely to form on warm or hot metal than on cool metal. The first cut in a series of cuts will likely produce the least dross. As the workpiece heats up, more dross may form during subsequent cuts.
- Dross is more likely to form on mild steel than on stainless steel or aluminum.
- Worn or damaged consumables may produce intermittent dross.

Straightness of the cut surface

A typical plasma cut surface is slightly concave.



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

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



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



How to increase cutting speed

To increase cutting speed, you can decrease the torch-to-work distance. However, decreasing this distance will increase the negative cut angle.

For mechanized applications the torch must not touch the workpiece while piercing or cutting.

For hand held applications the shield can be touching the workpiece to provide stability during cutting.

Estimated kerf-width compensation

The kerf widths in the following charts are for reference. Differences between installations and material composition may cause actual results to vary from those shown in the tables.

Table 7 - Estimated kerf-width compensation – Metric – Mild steel

Mild steel	Thickness (mm)																				
	0.5	**0.8**	**1**	**1.2**	**1.5**	**2**	**2.5**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25**	**32**	**38**	**44**	**50**
50 A Air / Air	1.72	1.51	1.46	1.52	1.62	1.58	1.53	1.47	1.44		1.57										
50 A O_2 / Air	1.36	1.35	1.36	1.37	1.39	1.41	1.42	1.44	1.51		1.52										
130 A Air / Air								2.08	2.21		2.38		2.45	2.48	2.68	3.08	3.46	3.98			
130 A O_2 / Air								2.29	2.35		2.40		2.56	2.63	2.92	3.45	3.82	4.33	4.78		
200 A Air / Air											2.68	2.90	2.98	2.95	3.12	3.53	3.98	4.20	4.37	5.02	5.69
200 A O_2 / Air											2.55	2.95	3.11	3.04	3.13	3.44	3.96	4.60	5.15	5.77	6.40

Table 8 - Estimated kerf-width compensation – Metric – Stainless steel

Stainless steel	Thickness (mm)																				
	0.5	**0.8**	**1**	**1.2**	**1.5**	**2**	**2.5**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25**	**32**	**38**	**44**	**50**
50 A Air / Air	1.45	1.71	1.77	1.68	1.56	1.52	1.50	1.55	1.66		1.71										
130 A Air / Air											2.57		2.70	2.74	2.90	3.19					
130 A N_2 / N_2										2.56	2.40		2.43	2.40	2.59	2.97					
200 A Air / Air									3.03		2.76		2.76	2.76	2.98	3.35	3.42	3.64	3.85		4.67
200 A N_2 / N_2										3.36	3.20		2.94	2.95	3.32	3.92	3.71	4.22	4.70		

Table 9 - Estimated kerf-width compensation – Metric – Aluminum

Aluminum	Thickness (mm)																			
	0.5	**0.8**	**1**	**1.2**	**1.5**	**2**	**2.5**	**3**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25**	**32**	**38**	**44**	**50**
50 A Air / Air	1.40	1.40	1.40	1.40	1.40	1.47	1.50	1.52	1.55		1.58										
130 A Air / Air											2.84		2.80	2.78	2.76	2.77	2.88				
130 A N_2 / N_2										2.73	2.57		2.62	2.46	2.61	3.00					
200 A Air / Air									3.73		3.94		3.44	3.42	3.51	3.73	4.03	4.29	5.38		
200 A N_2 / N_2										3.55	3.35		3.04	3.02	3.16	3.52	4.00	4.57	5.04		

Table 10 - Estimated kerf-width compensation – English – Mild steel

Mild steel	Thickness (inches)																						
	0.018	**0.020**	**0.024**	**0.030**	**0.036**	**0.048**	**0.060**	**0.075**	**0.105**	**0.125**	**0.135**	**3/16**	**1/4**	**5/16**	**3/8**	**1/2**	**5/8**	**3/4**	**7/8**	**1**	**1-1/4**	**1-1/2**	**1-3/4**	**2**
50 A Air / Air	0.069		0.065	0.061	0.056	0.060	0.064	0.063	0.059		0.056	0.058	0.063											
50 A O_2 / Air	0.054		0.053	0.053	0.053	0.054	0.055	0.055	0.056		0.057	0.063	0.059											
130 A Air / Air											0.085	0.090	0.095		0.096	0.098	0.108	0.119		0.137	0.156			
130 A O_2 / Air											0.092	0.093	0.095		0.100	0.105	0.119	0.133		0.151	0.170	0.188		
200 A Air / Air													0.111	0.114	0.118	0.116	0.126	0.135	0.147	0.158	0.165	0.172	0.200	0.227
200 A O_2 / Air													0.109		0.123	0.119	0.125	0.132	0.145	0.157	0.180	0.203	0.229	0.255

Table 11 - Estimated kerf-width compensation – English – Stainless steel

Stainless steel	Thickness (inches)																						
	0.018	0.020	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.135	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1-1/4	1-1/2	1-3/4	2
50 A Air / Air	0.056		0.061	0.066	0.071	0.066	0.061	0.060	0.059	N/A	0.063	0.068	0.067											
130 A Air / Air													0.104		0.106	0.108	0.116	0.124						
130 A N_2 / N_2												0.101	0.093		0.096	0.094	0.105	0.116						
200 A Air / Air												0.119	0.105		0.109	0.109	0.120	0.131	0.135	0.134	0.143	0.152		0.184
200 A N_2 / N_2												0.132	0.124		0.116	0.116	0.136	0.156	0.151	0.145	0.165	0.185		

Table 12 - Estimated kerf-width compensation – English – Aluminum

Aluminum	Thickness (inches)																						
	0.018	0.020	0.024	0.030	0.036	0.048	0.060	0.075	0.105	0.125	0.135	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1	1-1/4	1-1/2	1-3/4	2
50 A Air / Air	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.061	0.061		0.062	0.062											
130 A Air / Air													0.112		0.110	0.109	0.109	0.108		0.114				
130 A N_2 / N_2												0.107	0.099		0.105	0.095	0.106	0.117						
200 A Air / Air												0.151	0.157		0.136	0.134	0.140	0.145	0.152	0.159	0.167	0.213		
200 A N_2 / N_2												0.140	0.130		0.120	0.119	0.127	0.135	0.147	0.159	0.179	0.199		

Cut charts

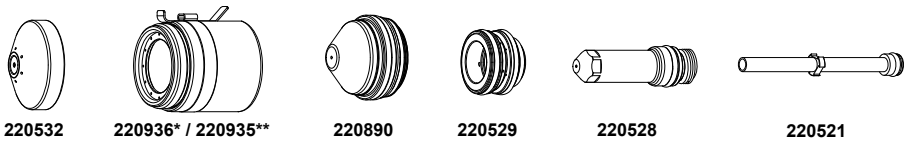
The following cut charts for the MAXPRO200 show the consumable parts, cutting speeds, and the gas and torch settings required for each process, allowing for differences in the lead length. While you can use these parameters for cutting with both mechanized and handheld torches, the consumable part numbers listed with each cut chart are specific to mechanized torches. Refer to How to select cutting and gouging consumable parts on page 98 for the consumables to use for handheld torches for each process.

The cut chart values in this document are recommended to provide high quality cuts with minimal dross. Because of differences between installations and material composition, adjustments may be required to obtain desired results.

Standard consumables

Mild steel – Air Plasma / Air Shield – 50 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
12/25	103/218



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 13 - Mild steel – Air Plasma / Air Shield – 50 A cutting

Metric

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
62	63	63	63	39	42	45	47	**0.5**	112	1.5	9400	3.0	200	0.0
								0.8	111	1.5	8510	3.0	200	0.0
								1.0	111	1.5	8050	3.0	200	0.1
								1.2	110	1.8	7625	3.6	200	0.1
								1.5	110	1.8	7370	3.6	200	0.1
								2.0	110	1.8	6735	3.6	200	0.1
								2.5	111	2.0	5080	4.0	200	0.2
								3.0	111	2.0	3760	4.0	200	0.3
								4.0	113	2.3	2415	4.6	200	0.4
								6.0	118	2.5	1600	4.6	180	0.5

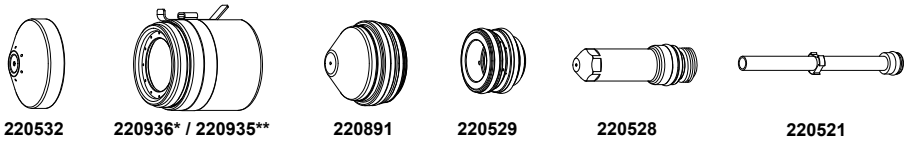
Table 13 - Mild steel – Air Plasma / Air Shield – 50 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
62	63	63	63	39	42	45	47	**0.018**	112	0.06	375	0.12	200	0.0
								0.024	112	0.06	350	0.12	200	0.0
								0.030	111	0.06	340	0.12	200	0.0
								0.036	111	0.06	325	0.12	200	0.1
								0.048	110	0.07	300	0.14	200	0.1
								0.060	110	0.07	290	0.14	200	0.1
								0.075	110	0.07	275	0.14	200	0.1
								0.105	111	0.08	180	0.16	200	0.2
								0.135	111	0.08	110	0.16	200	0.3
								3/16	116	0.09	75	0.18	200	0.4
								1/4	118	0.10	60	0.18	180	0.5

Mild steel – O_2 Plasma / Air Shield – 50 A cutting

Flow rates - lpm/scfh	
O_2 (Plasma)	Air (Shield)
12/25	73/155



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 14 - Mild steel – O_2 Plasma / Air Shield – 50 A cutting

Metric

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	68	69	69	25	27	29	31	**0.5**	98	1.5	7550	3.0	200	0.0
								0.8	96	1.5	7050	3.0	200	0.0
								1.0	90	1.5	6775	3.0	200	0.1
								1.2	94	1.5	6600	3.0	200	0.1
								1.5	99	1.5	6150	3.0	200	0.1
								2.0	99	1.5	5400	3.0	200	0.1
								2.5	99	1.8	4300	3.6	200	0.2
								3.0	99	1.8	3650	3.6	200	0.3
								4.0	101	2.0	2800	3.8	190	0.4
								6.0	103	2.5	1750	3.8	150	0.5

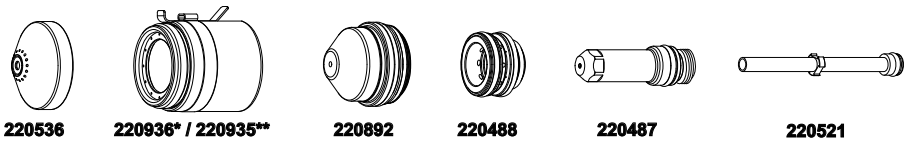
Table 14 - Mild steel – O_2 Plasma / Air Shield – 50 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	68	69	69	25	27	29	31	**0.018**	98	0.06	300	0.12	200	0.0
								0.024	98	0.06	290	0.12	200	0.0
								0.030	98	0.06	280	0.12	200	0.0
								0.036	89	0.06	270	0.12	200	0.1
								0.048	94	0.06	260	0.12	200	0.1
								0.060	99	0.06	240	0.12	200	0.1
								0.075	99	0.06	220	0.12	200	0.1
								0.105	99	0.07	160	0.14	200	0.2
								0.135	99	0.07	130	0.14	200	0.3
								3/16	103	0.09	85	0.15	160	0.4
								1/4	103	0.10	65	0.15	150	0.5

Mild steel – Air Plasma / Air Shield – 130 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
33/70	68/145



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 15 - Mild steel – Air Plasma / Air Shield – 130 A cutting

Metric

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	69	70	71	22	24	26	28	**3.0**	149	3.0	5350	6.0	200	0.1
								4.0	147	3.0	4630	6.0	200	0.2
								6.0	142	2.4	3865	7.2	300	0.3
								10.0	152	4.1	2445	8.2	200	0.5
								12.0	154	4.1	2045	8.2	200	0.5
								15.0	155	4.4	1445	8.8	200	0.8
								20.0	158	4.6	815	9.6	210	1.2
								25.0	166	4.6	415	Edge start		
								32.0	178	5.1	250			

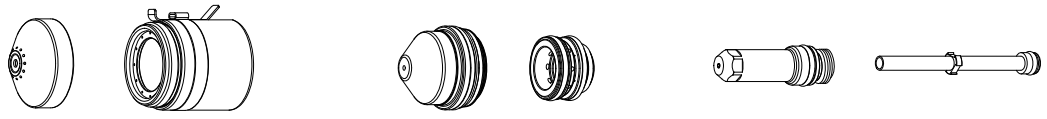
Table 15 - Mild steel – Air Plasma / Air Shield – 130 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	69	70	71	22	24	26	28	**0.135**	149	0.12	220	0.24	200	0.1
								3/16	145	0.12	160	0.24	200	0.2
								1/4	141	0.10	150	0.28	300	0.3
								3/8	151	0.16	100	0.32	200	0.5
								1/2	154	0.16	75	0.32	200	0.5
								5/8	155	0.18	50	0.36	200	0.8
								3/4	156	0.18	35	0.38	210	1.2
								1	167	0.18	15	Edge start		
								1-1/4	178	0.20	10			

Mild steel – O_2 Plasma / Air Shield – 130 A cutting

Flow rates - lpm/scfh	
O_2 (Plasma)	Air (Shield)
20/42	86/183



220491 | 220936* / 220935** 220534* / 220533** | 220893 | 220488 420796 | 220487 | 220521

*with IHS tab / **without IHS tab. These part numbers are mirror-image consumable parts: 220534, 220533, and 420796.

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 16 - Mild steel – O_2 Plasma / Air Shield – 130 A cutting

Metric														
Plasma Cutflow				Shield Cutflow				**Material Thickness**	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
62	62	64	64	30	32	35	37	**3.0**	130	2.6	5900	5.2	200	0.1
								4.0	131	2.7	5325	5.4	200	0.2
								6.0	134	2.8	3925	5.6	200	0.3
								10.0	136	3.0	2680	6.0	200	0.4
								12.0	138	3.0	2200	6.0	200	0.5
								15.0	140	3.6	1665	7.2	200	0.7
								20.0	145	3.9	1195	7.8	200	1.0
								25.0	151	4.1	685	Edge start		
								32.0	158	4.6	515			
								38.0	163	4.6	310			

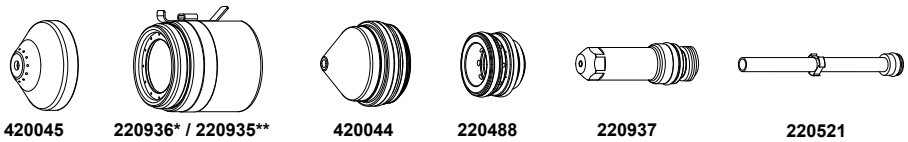
Table 16 - Mild steel – O_2 Plasma / Air Shield – 130 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
62	62	64	64	30	32	35	37	**0.135**	130	0.10	240	0.20	200	0.1
								3/16	132	0.11	190	0.22	200	0.2
								1/4	134	0.11	150	0.22	200	0.3
								3/8	136	0.12	110	0.24	200	0.3
								1/2	138	0.12	80	0.24	200	0.5
								5/8	141	0.15	60	0.30	200	0.7
								3/4	144	0.15	50	0.30	200	1.0
								1	151	0.16	25	Edge start		
								1-1/4	158	0.18	20			
								1-1/2	163	0.18	12			

Mild steel – Air Plasma / Air Shield – 200 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
32/68	123/260



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 17 - Mild steel – Air Plasma / Air Shield – 200 A cutting

Metric

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
52	54	55	56	48	50	54	58	**6.0**	147	1.0	4885	3.0	300	0.3
								8.0	148	1.3	4515	3.9	300	0.5
								10.0	151	3.0	3556	5.2	200	0.8
								12.0	153	3.0	2794	6.0	200	0.9
								15.0	158	4.3	2265	8.6	200	1.0
								20.0	165	4.8	1415	9.6	200	1.4
								25.0	172	6.4	940	11.4	180	1.7
								32.0	176	6.4	630	11.4	180	2.3
								38.0	179	6.4	510	Edge start		
								44.0	189	6.4	320			
								50.0	199	6.4	215			

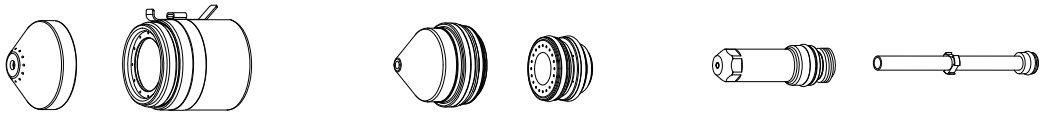
Table 17 - Mild steel – Air Plasma / Air Shield – 200 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
52	54	55	56	48	50	54	58	**1/4**	145	0.04	190	0.12	300	0.3
								5/16	148	0.05	180	0.15	300	0.5
								3/8	151	0.10	140	0.20	200	0.8
								1/2	154	0.13	110	0.25	200	0.9
								5/8	159	0.19	85	0.38	200	1.0
								3/4	164	0.19	60	0.38	200	1.2
								7/8	169	0.19	50	0.38	200	1.4
								1	173	0.25	35	0.45	180	1.7
								1-1/4	176	0.25	25	0.45	180	2.3
								1-1/2	179	0.25	20	Edge start		
								1-3/4	190	0.25	12			
								2	200	0.25	8			

Mild steel – O_2 Plasma / Air Shield – 200 A cutting

Flow rates - lpm/scfh	
O_2 (Plasma)	Air (Shield)
32/67	123/260



220832 | 220936* / 220935** 220534* / 220533** | 220831 | 220834 420795 | 220937 | 220521

*with IHS tab / **without IHS tab. These part numbers are mirror-image consumable parts: 220534, 220533, and 420796.

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 18 - Mild steel – O_2 Plasma / Air Shield – 200 A cutting

Metric

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	69	70	71	48	50	54	58	**6.0**	146	1.5	6210	3.0	200	0.3
								8.0	150	3.4	4850	5.1	150	0.4
								10.0	156	4.6	3735	6.9	150	0.4
								12.0	154	3.8	3415	9.5	250	0.6
								15.0	153	3.1	2845	7.8	250	0.7
								20.0	154	3.0	1920	7.5	250	0.8
								25.0	154	3.2	1430	8.0	250	1.0
								32.0	161	3.1	805	8.9	280	1.3
								38.0	168	4.4	570	Edge start		
								44.0	175	4.4	395			
								50.0	180	4.4	270			

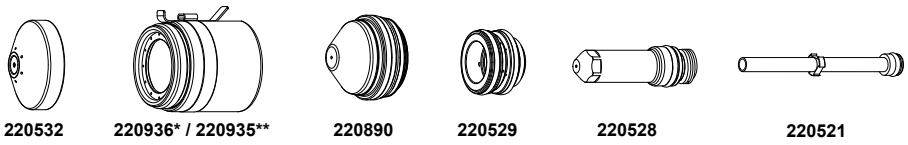
Table 18 - Mild steel – O_2 Plasma / Air Shield – 200 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	69	70	71	48	50	54	58	**1/4**	143	0.08	235	0.15	200	0.3
								3/8	157	0.19	150	0.28	150	0.3
								1/2	153	0.14	130	0.28	200	0.3
								5/8	153	0.12	105	0.28	250	0.5
								3/4	154	0.12	80	0.28	250	0.6
								7/8	154	0.13	65	0.31	250	0.7
								1	154	0.13	55	0.31	250	0.8
								1-1/4	161	0.13	32	0.35	280	1.5
								1-1/2	168	0.18	22	Edge start		
								1-3/4	175	0.18	15			
								2	181	0.18	10			

Stainless steel – Air Plasma / Air Shield – 50 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
12/25	103/218



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 19 - Stainless steel – Air Plasma / Air Shield – 50 A cutting

Metric														
Plasma Cutflow				Shield Cutflow				**Material Thickness**	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
62	63	63	63	39	42	45	47	**0.5**	101	1.5	8000	3.0	200	0.0
								0.8	102	1.6	7750	3.2	200	0.0
								1.0	102	1.8	7115	3.6	200	0.1
								1.2	103	1.8	6350	3.6	200	0.1
								1.5	106	1.8	5335	3.6	200	0.1
								2.0	108	2.0	4200	4.0	200	0.1
								2.5	111	2.0	3300	4.0	200	0.2
								3.0	112	2.0	2800	4.0	200	0.3
								4.0	116	2.2	2300	4.4	200	0.4
								6.0	123	2.5	1400	4.6	180	0.5

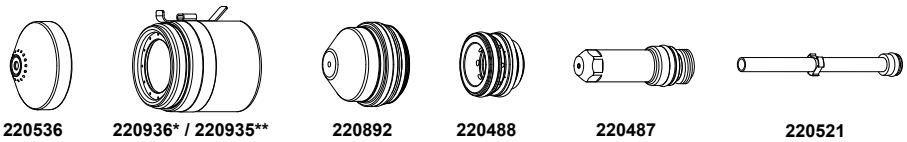
Table 19 - Stainless steel – Air Plasma / Air Shield – 50 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
62	63	63	63	39	42	45	47	**0.018**	101	0.06	300	0.12	200	0.0
								0.024	101	0.06	275	0.12	200	0.0
								0.030	102	0.06	265	0.12	200	0.0
								0.036	102	0.06	250	0.12	200	0.1
								0.048	103	0.07	225	0.14	200	0.1
								0.060	106	0.07	190	0.14	200	0.1
								0.075	107	0.07	165	0.14	200	0.1
								0.105	112	0.08	125	0.16	200	0.2
								0.135	113	0.08	85	0.16	200	0.3
								3/16	119	0.09	55	0.18	200	0.4
								1/4	124	0.10	45	0.18	180	0.5

Stainless steel – Air Plasma / Air Shield – 130 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
33/70	69/145



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 20 - Stainless steel – Air Plasma / Air Shield – 130 A cutting

Metric

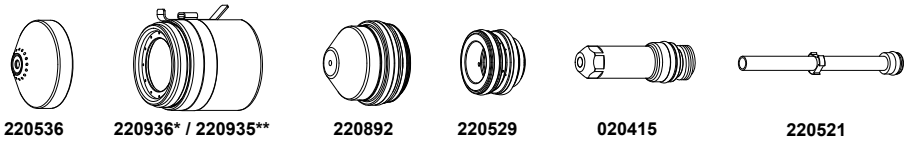
Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	69	70	71	22	24	26	28	**6.0**	147	3.5	2625	7.0	200	0.3
								10.0	153	4.1	1700	8.2	200	0.5
								12.0	155	4.1	1380	8.2	200	0.8
								15.0	160	4.4	900	Edge start		
								20.0	170	4.6	430			

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	69	70	71	22	24	26	28	**1/4**	148	0.14	100	0.28	200	0.3
								3/8	152	0.16	70	0.32	200	0.5
								1/2	156	0.16	50	0.32	200	0.8
								5/8	162	0.18	30	Edge start		
								3/4	168	0.18	20			

Stainless steel – N_2 Plasma / N_2 Shield – 130 A cutting

Flow rates - lpm/scfh	
N_2 (Plasma)	N_2 (Shield)
32/68	104/218



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 21 - Stainless steel – N_2 Plasma / N_2 Shield – 130 A cutting

Metric

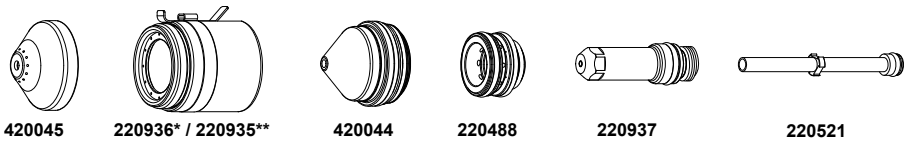
Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	69	70	71	36	39	42	44	**5.0**	148	3.0	3140	6.1	200	0.3
								6.0	151	3.0	2980	6.1	200	0.3
								10.0	152	3.3	1830	6.6	200	0.5
								12.0	154	3.3	1510	6.6	200	0.8
								15.0	158	3.6	1120	Edge start		
								20.0	166	3.8	470			

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	69	70	71	36	39	42	44	**3/16**	149	0.12	125	0.24	200	0.3
								1/4	151	0.12	115	0.24	200	0.3
								3/8	152	0.13	75	0.26	200	0.5
								1/2	154	0.13	55	0.26	200	0.8
								5/8	159	0.14	40	Edge start		
								3/4	165	0.15	25			

Stainless steel – Air Plasma / Air Shield – 200 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
32/68	123/260



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 22 - Stainless steel – Air Plasma / Air Shield – 200 A cutting

Metric

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
52	54	55	56	48	50	54	58	**4.0**	148	2.7	6200	5.4	200	0.4
								6.0	150	3.0	5500	6.0	200	0.4
								10.0	150	3.2	4120	6.4	200	0.5
								12.0	152	3.2	3320	6.4	200	0.8
								15.0	157	3.8	2400	7.6	200	0.8
								20.0	164	4.9	1440	9.8	200	1.0
								25.0	168	5.6	1040	11.8	210	1.6
								32.0	174	5.6	500	Edge start		
								38.0	180	5.6	305			
								50.0	188	5.6	210			

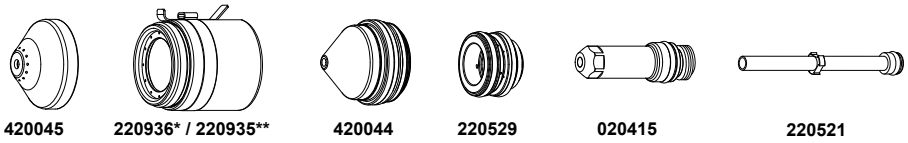
Table 22 - Stainless steel – Air Plasma / Air Shield – 200 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
52	54	55	56	48	50	54	58	**3/16**	149	0.11	240	0.22	200	0.4
								1/4	150	0.12	210	0.24	200	0.4
								3/8	150	0.13	170	0.25	200	0.5
								1/2	153	0.13	120	0.25	200	0.8
								5/8	159	0.16	85	0.32	200	0.8
								3/4	163	0.19	60	0.38	200	1.0
								7/8	166	0.21	50	0.42	200	1.4
								1	168	0.22	40	0.45	210	1.6
								1-1/4	174	0.22	20	Edge start		
								1-1/2	180	0.22	12			
								2	188	0.22	8			

Stainless steel – N_2 Plasma / N_2 Shield – 200 A cutting

Flow rates - lpm/scfh	
N_2 (Plasma)	N_2 (Shield)
37/79	107/225



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 23 - Stainless steel – N_2 Plasma / N_2 Shield – 200 A cutting

Metric														
Plasma Cutflow				Shield Cutflow				**Material Thickness**	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
69	70	71	72	42	45	48	51	**5.0**	156	3.2	4460	6.4	200	0.4
								6.0	159	3.2	3980	6.4	200	0.4
								10.0	160	3.2	2900	6.4	200	0.5
								12.0	162	3.2	2260	6.4	200	0.8
								15.0	165	3.4	1760	7.9	230	0.9
								20.0	172	4.2	1190	10.1	240	1.1
								25.0	185	6.4	790	11.4	180	2.0
								32.0	191	6.4	520	Edge start		
								38.0	197	6.4	310			

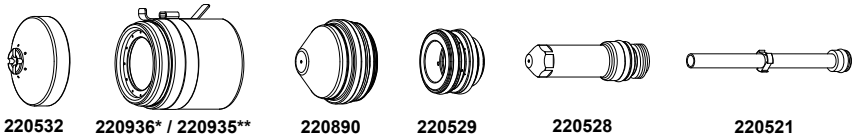
Table 23 - Stainless steel – N_2 Plasma / N_2 Shield – 200 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
69	70	71	72	42	45	48	51	**3/16**	159	0.13	180	0.25	200	0.4
								1/4	159	0.13	150	0.25	200	0.4
								3/8	160	0.13	120	0.25	200	0.5
								1/2	163	0.13	80	0.25	200	0.8
								5/8	166	0.14	65	0.32	230	0.9
								3/4	170	0.16	50	0.38	240	1.0
								7/8	178	0.19	40	0.38	200	1.5
								1	186	0.25	30	0.45	180	2.0
								1-1/4	191	0.25	21	Edge start		
								1-1/2	197	0.25	12			

Aluminum – Air Plasma / Air Shield – 50 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
12/25	104/218



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 24 - Aluminum – Air Plasma / Air Shield – 50 A cutting

Metric														
Plasma Cutflow				Shield Cutflow				**Material Thickness**	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
62	63	63	63	39	42	45	47	**0.5**	112	1.5	8000	3.0	200	0.0
								0.8	113	1.6	7750	3.2	200	0.0
								1.0	114	1.8	7115	3.6	200	0.1
								1.2	114	1.8	6350	3.6	200	0.1
								1.5	115	1.8	5335	3.6	200	0.1
								2.0	120	2.0	4200	4.0	200	0.1
								2.5	123	2.0	3300	4.0	200	0.2
								3.0	124	2.0	2800	4.0	200	0.3
								4.0	125	2.2	2300	4.4	200	0.4
								6.0	130	2.5	1400	4.6	180	0.5

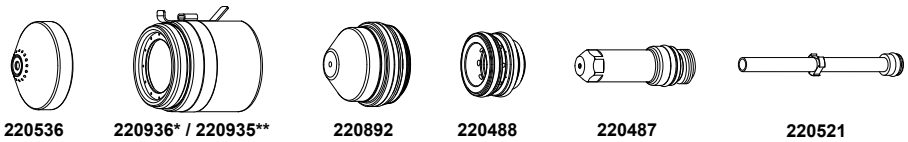
Table 24 - Aluminum – Air Plasma / Air Shield – 50 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
62	63	63	63	39	42	45	47	**0.018**	112	0.06	325	0.12	200	0.0
								0.020	112	0.06	315	0.12	200	0.0
								0.024	112	0.06	305	0.12	200	0.0
								0.030	113	0.06	295	0.12	200	0.1
								0.036	114	0.07	280	0.14	200	0.1
								0.048	114	0.07	230	0.14	200	0.2
								0.060	115	0.07	195	0.14	200	0.2
								0.075	120	0.08	160	0.16	200	0.2
								0.105	123	0.08	120	0.16	200	0.3
								0.125	124	0.08	100	0.16	200	0.3
								3/16	126	0.09	75	0.18	200	0.4
								1/4	131	0.10	50	0.18	180	0.5

Aluminum – Air Plasma / Air Shield – 130 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
33/70	69/145



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 25 - Aluminum – Air Plasma / Air Shield – 130 A cutting

Metric

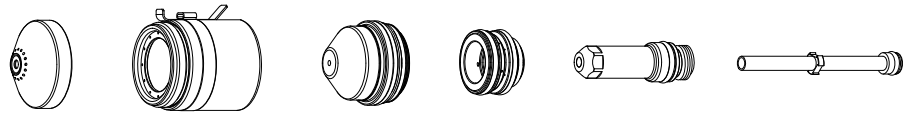
Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	69	70	71	22	24	26	28	**6.0**	156	2.8	2370	5.6	200	0.2
								10.0	161	3.0	1470	6.0	200	0.3
								12.0	163	3.0	1230	6.0	200	0.5
								15.0	165	3.2	1050	6.4	200	0.8
								20.0	169	3.6	725	7.9	220	1.3
								25.0	175	4.0	525	Edge start		

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	69	70	71	22	24	26	28	**1/4**	156	0.11	90	0.22	200	0.2
								3/8	160	0.12	60	0.24	200	0.3
								1/2	164	0.12	45	0.24	200	0.5
								5/8	166	0.13	40	0.26	200	0.8
								3/4	168	0.14	30	0.31	220	1.3
								1	176	0.16	20	Edge start		

Aluminum – N_2 Plasma / N_2 Shield – 130 A cutting

Flow rates - lpm/scfh	
N_2 (Plasma)	N_2 (Shield)
32/68	104/218



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 26 - Aluminum – N_2 Plasma / N_2 Shield – 130 A cutting

Metric

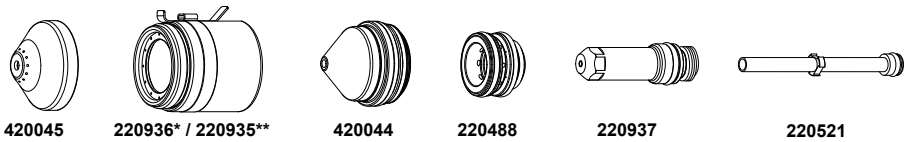
Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	69	70	71	36	39	42	44	**5.0**	153	3.0	3140	6.1	200	0.2
								6.0	154	3.0	2980	6.1	200	0.2
								10.0	158	3.3	1830	6.6	200	0.3
								12.0	160	3.3	1510	6.6	200	0.5
								15.0	162	3.6	1120	7.1	200	0.8
								20.0	166	3.9	470	8.7	220	1.4

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	69	70	71	36	39	42	44	**3/16**	153	0.12	125	0.24	200	0.2
								1/4	154	0.12	115	0.24	200	0.2
								3/8	158	0.13	75	0.26	200	0.3
								1/2	160	0.13	55	0.26	200	0.5
								5/8	163	0.14	40	0.28	200	0.8
								3/4	165	0.15	25	0.33	220	1.3

Aluminum – Air Plasma / Air Shield – 200 A cutting

Flow rates - lpm/scfh	
Air (Plasma)	Air (Shield)
32/68	123/260



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 27 - Aluminum – Air Plasma / Air Shield – 200 A cutting

Metric

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
52	54	55	56	48	50	54	58	**4.0**	150	2.2	6215	4.4	200	0.5
								6.0	156	3.0	5195	6.0	200	0.5
								10.0	156	3.3	3930	6.6	200	0.5
								12.0	159	3.7	3370	7.4	200	0.5
								15.0	163	4.0	2625	8.0	200	0.8
								20.0	169	4.9	1625	9.8	200	1.0
								25.0	177	5.6	1050	11.4	210	1.4
								32.0	187	5.6	515	11.4	210	1.7
								38.0	195	5.6	310	Edge start		

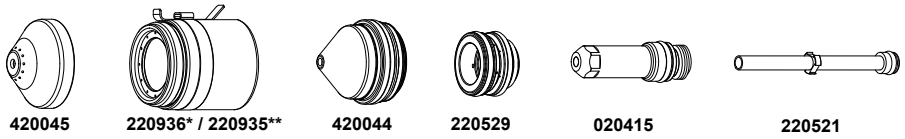
Table 27 - Aluminum – Air Plasma / Air Shield – 200 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
52	54	55	56	48	50	54	58	**3/16**	150	0.10	230	0.20	200	0.5
								1/4	158	0.13	200	0.25	200	0.5
								3/8	155	0.13	160	0.25	200	0.5
								1/2	160	0.15	125	0.30	200	0.5
								5/8	164	0.16	95	0.32	200	0.8
								3/4	168	0.19	70	0.38	200	1.0
								7/8	173	0.21	50	0.42	200	1.2
								1	178	0.22	40	0.45	210	1.4
								1-1/4	187	0.22	20	0.45	210	1.7
								1-1/2	195	0.22	12	Edge start		

Aluminum – N_2 Plasma / N_2 Shield – 200 A cutting

Flow rates - lpm/scfh	
N_2 (Plasma)	N_2 (Shield)
37/79	107/225



*with IHS tab / **without IHS tab

Gas pressure values are set automatically by the system when the process is chosen. The arc voltage settings in these cut charts were measured with a lead length of 30.5 meters (100 feet). Adjustments to arc voltage settings can be necessary for shorter leads.

Table 28 - Aluminum – N_2 Plasma / N_2 Shield – 200 A cutting

Metric

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22 9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
69	70	71	72	42	45	48	51	**5.0**	164	3.2	4770	6.4	200	0.5
								6.0	165	3.2	4530	6.4	200	0.5
								10.0	165	3.2	3930	6.4	200	0.5
								12.0	164	3.2	3370	6.4	200	0.5
								15.0	169	4.1	2620	8.1	200	0.8
								20.0	179	5.1	1630	10.2	200	1.2
								25.0	189	6.4	1050	Edge start		
								32.0	198	6.4	500			
								38.0	206	6.4	310			

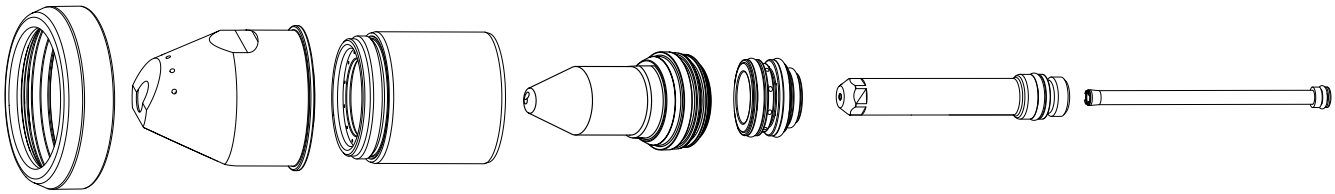
Table 28 - Aluminum – N_2 Plasma / N_2 Shield – 200 A cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Material Thickness	Arc Voltage	Cut Height	Cutting Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
69	70	71	72	42	45	48	51	**3/16**	165	0.13	190	0.25	200	0.5
								1/4	165	0.13	175	0.25	200	0.5
								3/8	165	0.13	160	0.25	200	0.5
								1/2	164	0.13	125	0.25	200	0.5
								5/8	171	0.16	95	0.32	200	0.8
								3/4	177	0.19	70	0.38	200	1.0
								7/8	183	0.25	50	0.45	180	1.5
								1	190	0.25	40	Edge start		
								1-1/4	198	0.25	20			
								1-1/2	206	0.25	12			

FlushCut consumables

Mild steel – Air Plasma / Air Shield – 200 A FlushCut Cutting



10087802 10087213 420794* / 420793** 10087212 220488 420732 420823

*with IHS tab / **without IHS tab

Table 29 - Mild steel – Air Plasma / Air Shield – 200 A FlushCut Cutting

Metric

Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
52	54	55	56	48	50	54	58	**6**	112	2.5	3886	3.0	120	0.3
								8	116	2.5	3300	3.8	150	0.5
								10	119	2.5	2803	5.0	200	0.8
								12	122	6.4	2380	6.4	100	0.9
								15	127	6.4	1863	9.6	150	1.0
								20	136	6.4	1160	9.6	150	1.4
								25	144	9.5	750	11.4	120	1.7
								32	156	9.5	465	11.4	120	2.3
								38	166	9.5	285	Edge start		
								44	176	9.5	174			
								50	186	9.5	107			
								58	199	6.4	70			
								64	201	6.4	70			

Table 29 - Mild steel – Air Plasma / Air Shield – 200 A FlushCut Cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	in	Volts	in	ipm	in	Factor %	Seconds
52	54	55	56	48	50	54	58	**1/4 (0.25)**	112	0.100	150	0.120	120	0.3
								5/16 (0.3125)	116	0.100	135	0.150	150	0.5
								3/8 (0.375)	119	0.100	120	0.200	200	0.8
								1/2 (0.50)	126	0.250	90	0.250	100	0.9
								5/8 (0.625)	129	0.250	70	0.375	150	1.0
								3/4 (0.75)	132	0.250	50	0.375	150	1.2
								7/8 (0.875)	139	0.250	39	0.375	150	1.4
								1 (1.00)	146	0.375	28	0.450	120	1.7
								1-1/4 (1.25)	155	0.375	19	0.450	120	2.3
								1-1/2 (1.50)	164	0.375	11	Edge start		
								1-3/4 (1.75)	177	0.375	7			
								2 (2.00)	189	0.375	4			

Table 29 - Mild steel – Air Plasma / Air Shield – 200 A FlushCut Cutting (continued)

									2-1/4 (2.25)	198	0.250	3	
									2-1/2 (2.50)	200	0.250	3	

Extreme bevel consumables

The MAXPRO200 extreme bevel consumables include the following components:

Part number	Description	Current	Gas
420737	Shield	200 A	Air and O_2
420735	Shield	130 A	Air and O_2
420732	Electrode	200 A	Air and O_2
420824	Electrode	130 A	Air and O_2
420734	Nozzle	200 A	Air
420829	Nozzle	130 A	Air
420733	Nozzle	200 A	O_2
420828	Nozzle	130 A	O_2

Standard MAXPRO200 retaining caps and swirl rings are compatible with extreme bevel consumables. Refer to the extreme bevel cut charts that start on page Mild steel – Air Plasma / Air Shield – 130 A Extreme Bevel Cutting on page 169.

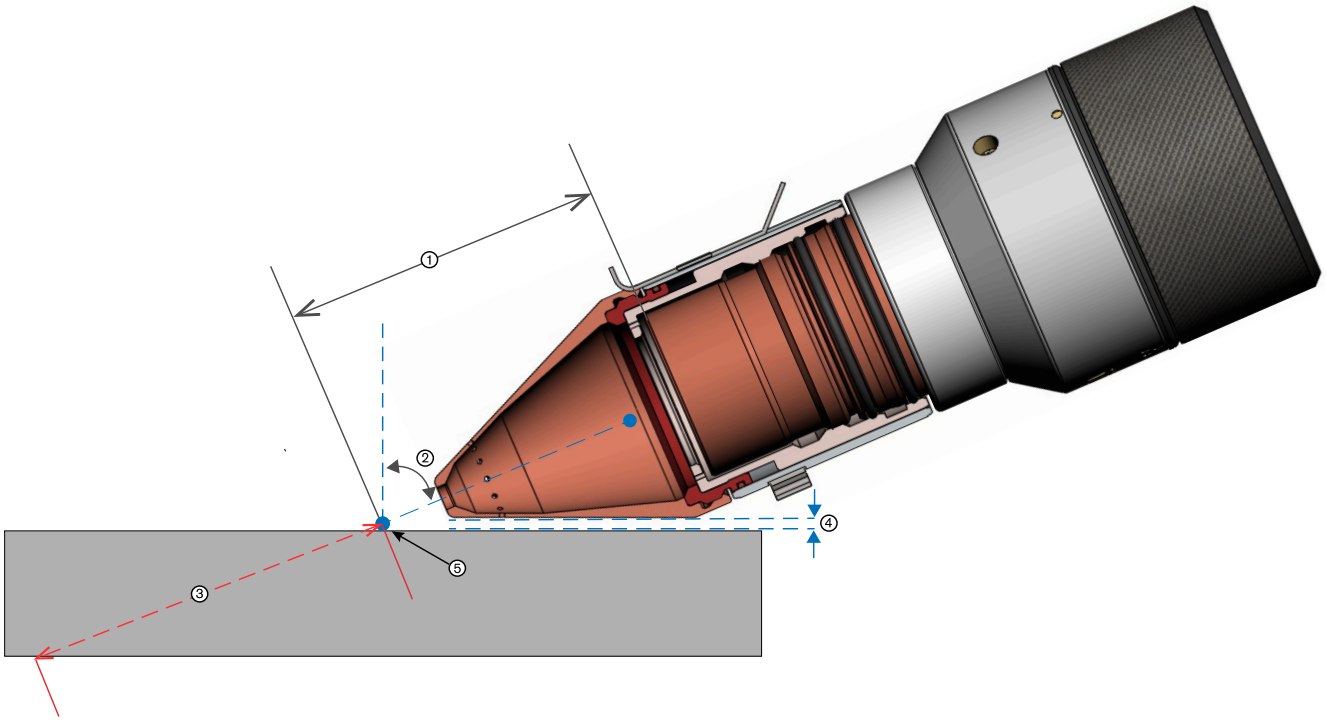
The standard MAXPRO200 water tube is **not** compatible with extreme bevel consumables. You must exchange it with the longer water tube (420823) before cutting with extreme bevel consumables. Refer to Replace the torch water tube on page 108.

Recommended torch-pivot lengths

The bevel-pivot point has an effect on the recommended torch-pivot length. The bevel-pivot point is the intersection of the torch axis and the top of the workpiece when the torch is at its maximum angle and minimum clearance.

Using bevel consumables increases the recommended torch-pivot length by more than 100%, as shown in the following drawing and table.

In this example, the torch-pivot length shows the extreme-bevel consumables at 66.5° and at a clearance of 2 mm (0.080 in.).



1	Torch pivot length
2	Maximum tilt angle
3	Effective thickness
1	Torch pivot length
4	Clearance
5	Bevel pivot point

Table 30 - Recommended torch-pivot lengths by product type

	MAXPRO200 standard mechanized consumables		**MAXPRO200 extreme bevel consumables**	
Torch-pivot length	30 mm (1.18 in.)	31 mm (1.24 in.)	62 mm (2.44 in.)	65 mm (2.55 in.)
Maximum torch angle	45°	45°	66.5°	66.5°
Clearance	2 mm (0.08 in.)	3 mm (0.125 in.)	2 mm (0.08 in.)	3 mm (0.125 in.)

Clearance

Clearance is the minimum distance between the torch and the top of the workpiece. A higher clearance can decrease the chance of torch collisions with the workpiece. But, it can also cause the following conditions:

- Increased cut heights that give bad edge quality and make higher-angle compensations necessary

- Increased voltages that can have a bad effect on the duty cycle of the plasma power supply

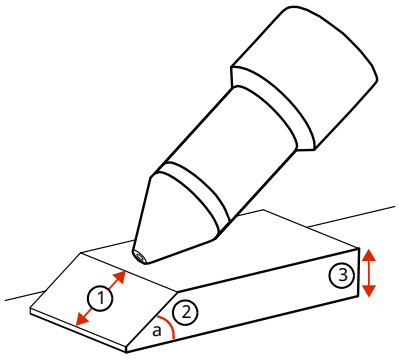
Maximum torch angle

The maximum torch angle with extreme bevel consumables is 66.5 degrees at a clearance of 2 mm (0.080 in). Using a maximum torch angle during bevel cutting increase the effective thickness of the workpiece being cut. For example, bevel cutting a 12 mm (.50 inch) workpiece at a 60-degree angle is like cutting a 25 mm (1 inch) workpiece at a 90-degree angle. Refer to Effective thickness on page 168.

Hypertherm recommends using the default torch-clearance settings to start cutting. Adjust clearance settings only when necessary.

Effective thickness

Effective thickness is directly related to the thickness of the workpiece and the angle of the torch. When cutting at an angle, the thickness that the torch has to cut is increased.



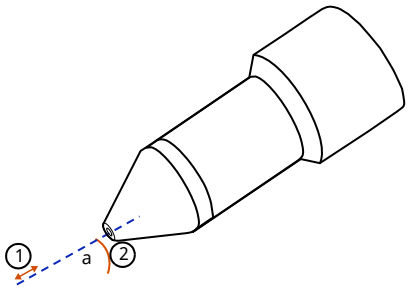
$$\text{Effective thickness } ① = \frac{\text{Workpiece thickness } ③}{\sin(a)\ ②}$$

1 Effective thickness

2 Angle of the torch – sin(a)

3 Workpiece thickness

For pipe cutting, substitute "workpiece thickness" with "wall thickness" to calculate the effective thickness.



$$\text{Effective thickness ①} = \frac{\text{Wall thickness ③}}{\sin(a)②}$$



1 Effective thickness

2 Angle of the torch – sin(a)

3 Wall thickness

The table below shows how effective thickness changes with different torch angles.

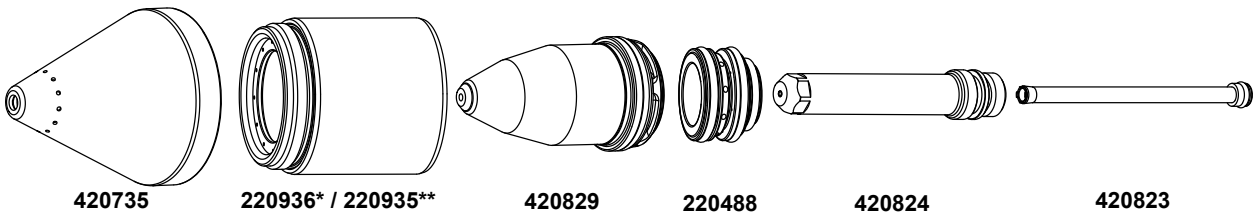
Effective thickness	Torch angle
12 mm (0.50 inch)	90 degrees
17 mm (0.71 inch)	45 degrees
25.4 mm (1.00 inch)	60 degrees

You can calculate the effective thickness for any thickness and torch-angle combination with the following formula:

Effective thickness = Workpiece thickness / sin(a)

Hypertherm recommends that you use the thickness settings in the cut chart that are most similar to the effective thickness that you want to cut. After cutting starts, adjust thickness settings only as necessary.

Mild steel – Air Plasma / Air Shield – 130 A Extreme Bevel Cutting



*with IHS tab / **without IHS tab

Table 31 - Mild steel – Air Plasma / Air Shield – 130 A Extreme Bevel Cutting

Metric

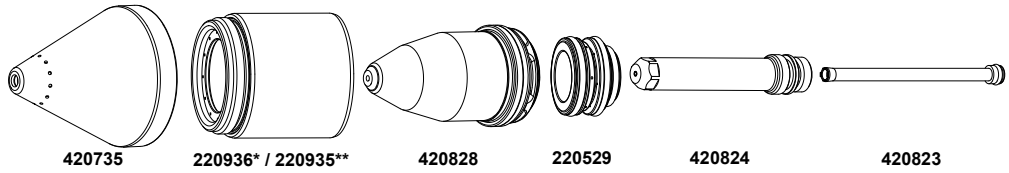
Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	69	70	71	22	24	26	28	**3**	142	3.0	5350	6.0	200	0.1
								4	143	3.0	4630	6.0	200	0.2
								6	146	2.4	3865	7.5	310	0.3
								10	151	4.1	2445	8.2	200	0.5
								12	153	4.1	2045	8.2	200	0.5
								15	157	4.4	1445	8.8	200	0.8
								20	163	4.6	815	9.6	210	1.2
								25	170	4.6	415	Edge start		
								32	179	4.6	250			

Table 31 - Mild steel – Air Plasma / Air Shield – 130 A Extreme Bevel Cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	69	70	71	22	24	26	28	**0.135**	145	0.120	220	0.240	200	0.1
								0.1875	144	0.120	160	0.240	200	0.2
								0.25	143	0.120	150	0.300	250	0.3
								0.375	152	0.160	100	0.320	200	0.5
								0.50	153	0.160	75	0.320	200	0.5
								0.625	158	0.180	50	0.360	200	0.8
								0.75	160	0.180	35	0.375	210	1.2
								1.00	172	0.180	15	Edge start		
								1.25	178	0.180	10			

Mild steel – O_2 Plasma / Air Shield – 130 A Extreme Bevel Cutting



*with IHS tab / **without IHS tab

Table 32 - Mild steel – O_2 Plasma / Air Shield – 130 A Extreme Bevel Cutting

Metric

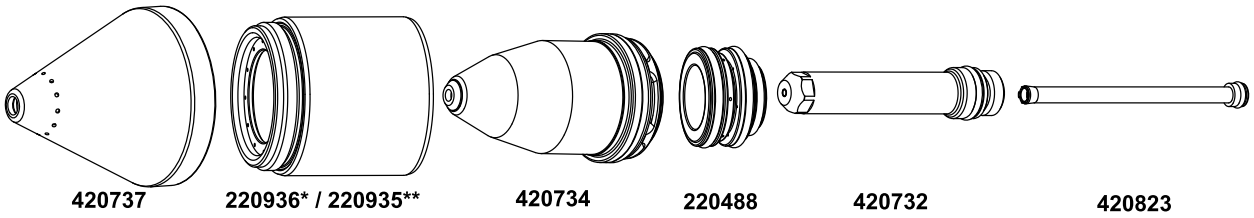
Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
62	62	64	64	30	32	35	37	**3**	130	2.6	5900	5.2	200	0.1
								4	131	2.7	5325	5.4	200	0.2
								6	134	2.8	3925	5.6	200	0.3
								10	136	3.0	2680	6.0	200	0.4
								12	138	3.0	2200	6.0	200	0.5
								15	140	3.6	1310	7.2	200	0.7
								20	145	3.9	880	7.8	200	1.0
								25	151	3.9	845	Edge start		
								32	158	3.9	365			

Table 32 - Mild steel – O_2 Plasma / Air Shield – 130 A Extreme Bevel Cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
62	62	64	64	30	32	35	37	**0.135**	130	0.100	240	0.200	200	0.1
								0.1875	132	0.110	190	0.220	200	0.2
								0.25	134	0.110	150	0.220	200	0.3
								0.375	136	0.120	110	0.240	200	0.3
								0.50	138	0.120	80	0.240	200	0.5
								0.625	141	0.150	50	0.300	200	0.7
								0.75	144	0.150	35	0.300	200	1.0
								1.00	151	0.150	18	Edge start		
								1.25	158	0.150	14			

Mild steel – Air Plasma / Air Shield – 200 A Extreme Bevel Cutting



*with IHS tab / **without IHS tab

Table 33 - Mild steel – Air Plasma / Air Shield – 200 A Extreme Bevel Cutting

Metric

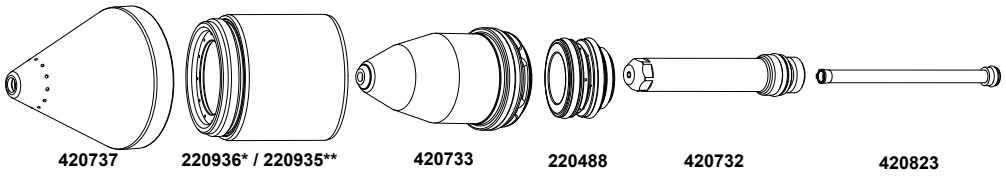
Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
52	54	55	56	48	50	54	58	**6**	137	1.0	4885	3.0	300	0.3
								8	140	1.3	4515	3.9	300	0.5
								10	142	3.0	3556	5.5	180	0.8
								12	144	3.0	2794	6.0	200	0.9
								15	147	4.3	2265	8.6	200	1.0
								20	153	4.8	1415	9.6	200	1.4
								25	159	6.4	940	11.4	180	1.7
								32	167	6.4	630	11.4	180	2.3
								38	174	6.4	510	Edge start		
								44	180	6.4	320			
								50	187	6.4	215			

Table 33 - Mild steel – Air Plasma / Air Shield – 200 A Extreme Bevel Cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
52	54	55	56	48	50	54	58	**.25**	140	0.100	190	0.120	120	0.3
								0.3125	139	0.100	180	0.150	150	0.5
								0.375	138	0.100	140	0.200	200	0.8
								0.50	142	0.130	110	0.250	190	0.9
								0.625	149	0.190	85	0.380	200	1.0
								0.75	152	0.190	60	0.380	200	1.2
								0.875	156	0.190	50	0.380	200	1.4
								1.00	165	0.250	35	0.450	180	1.7
								1.25	166	0.250	25	0.450	180	2.3
								1.50	171	0.250	20	Edge start		
								1.75	181	0.250	12			
								2.00	188	0.250	8			

Mild steel – O_2 Plasma / Air Shield – 200 A Extreme Bevel Cutting



*with IHS tab / **without IHS tab

Table 34 - Mild steel – O_2 Plasma / Air Shield – 200 A Extreme Bevel Cutting

Metric

Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	7.6 m Lead	15.3 m Lead	22.9 m Lead	30.5 m Lead	**mm**	Volts	mm	mm/min	mm	Factor %	Seconds
68	69	70	71	48	50	54	58	**6**	139	1.5	6210	3.0	200	0.3
								8	143	3.4	4850	5.1	150	0.4
								10	148	4.6	3735	6.9	150	0.5
								12	146	3.8	3415	9.5	250	0.7
								15	145	3.1	2845	7.8	250	0.9
								20	146	3.0	1920	7.5	250	1.3
								25	146	3.2	1430	8.0	250	1.6
								32	153	3.1	805	8.9	290	2.5
								38	160	4.4	570	Edge start		
								44	166	4.4	395			
								50	171	4.4	270			

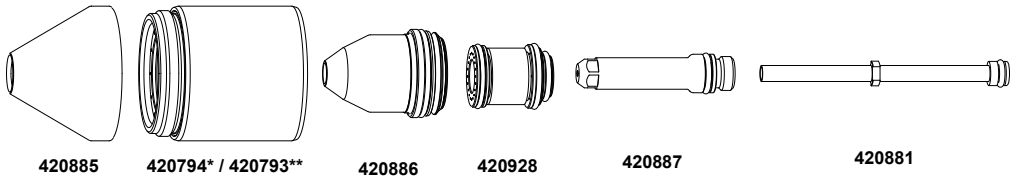
Table 34 - Mild steel – O_2 Plasma / Air Shield – 200 A Extreme Bevel Cutting (continued)

English

Plasma Cutflow				Shield Cutflow				Effective Thickness	Arc Voltage	Cut Height	Cut Speed	Pierce Height		Pierce Delay
25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	25 ft Lead	50 ft Lead	75 ft Lead	100 ft Lead	**in**	Volts	in	ipm	in	Factor %	Seconds
68	69	70	71	48	50	54	58	**.25**	137	0.100	235	0.200	200	0.3
								.375	151	0.190	150	0.280	150	0.5
								0.50	147	0.140	130	0.280	200	0.5
								0.625	147	0.120	105	0.280	250	0.9
								.75	148	0.120	80	0.280	250	1.2
								.875	148	0.130	65	0.280	220	1.4
								1.00	148	0.130	55	0.310	250	1.6
								1.25	155	0.130	32	0.350	270	2.5
								1.50	161	0.180	22	Edge start		
								1.75	168	0.180	15			
								2.00	174	0.180	10			

Gouging consumables

Mild steel – Air Plasma / Air Shield – 200 A Gouging



*with IHS tab / **without IHS tab

Table 35 - Mild steel – Air Plasma / Air Shield – 200 A Gouging

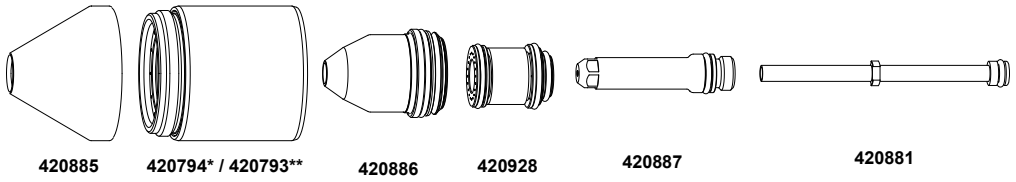
Metric

Torch Angle	Plasma Pressure	Shield Pressure	Arc Voltage	Speed	Standoff	Motion Delay	Width	Depth	Included Angle	Bottom Radius	Metal-Removal Rate
degree	psi	psi	V	mm/min	mm	seconds	mm	mm	degree	mm	kg/hr
57.5	68	48	165	508	3.18	1.2	9.91	10.92	33	1.02	18.1
				635	3.71	1.1	8.89	10.66	44	1.27	18.1
				762	4.24	1.0	8.12	9.90	44	1.27	18.5
				889	4.75	0.9	9.90	7.62	48	1.27	19.9
				1016	5.28	0.8	9.39	6.85	54	1.52	19.5
				1143	5.82	0.7	9.39	6.35	57	1.52	19.5
				1270	6.10	0.6	9.14	5.33	72	1.77	16.7

English

Torch Angle	Plasma Pressure	Shield Pressure	Arc Voltage	Speed	Standoff	Motion Delay	Width	Depth	Included Angle	Bottom Radius	Metal-Removal Rate
degree	psi	psi	V	in/min	in	seconds	in	in	degree	in	lb/hr
57.5	68	48	165	20	0.125	1.2	0.39	0.43	33	0.04	40
				25	0.146	1.1	0.35	0.42	44	0.05	40
				30	0.167	1.0	0.32	0.39	44	0.05	41
				35	0.187	0.9	0.39	0.30	48	0.05	44
				40	0.208	0.8	0.37	0.27	54	0.06	43
				45	0.229	0.7	0.37	0.25	57	0.06	43
				50	0.250	0.6	0.36	0.21	72	0.07	37

Mild steel – O_2 Plasma / Air Shield – 200 A Gouging



*with IHS tab / **without IHS tab

Table 36 - Mild steel – O_2 Plasma / Air Shield – 200 A Gouging

Metric

Torch Angle	Plasma Pressure	Shield Pressure	Arc Voltage	Speed	Standoff	Motion Delay	Width	Depth	Included Angle	Bottom Radius	Metal-Removal Rate
degree	psi	psi	V	mm/min	mm	seconds	mm	mm	degree	mm	kg/hr
57.5	68	48	165	508	5.59	1.2	14.48	9.65	55	2.79	21.3
				635	7.37	1.1	13.21	7.87	64	2.54	19.5
				762	7.87	1.0	12.19	7.11	64	2.28	19.5
				889	7.87	0.9	11.68	6.35	68	2.28	19.5
				1016	7.87	0.8	10.41	5.58	68	2.28	18.1
				1143	8.89	0.7	9.91	5.33	68	2.03	18.1
				1270	8.89	0.6	9.39	5.08	68	2.03	18.1

English

Torch Angle	Plasma Pressure	Shield Pressure	Arc Voltage	Speed	Standoff	Motion Delay	Width	Depth	Included Angle	Bottom Radius	Metal-Removal Rate
degree	psi	psi	V	in/min	in	seconds	in	in	degree	in	lb/hr
57.5	68	48	165	20	0.22	1.2	0.57	0.38	55	0.11	47
				25	0.29	1.1	0.52	0.31	64	0.10	43
				30	0.31	1.0	0.48	0.28	64	0.09	43
				35	0.31	0.9	0.46	0.25	68	0.09	43
				40	0.31	0.8	0.41	0.27	68	0.09	40
				45	0.35	0.7	0.39	0.21	68	0.08	40
				50	0.35	0.6	0.37	0.20	68	0.08	40

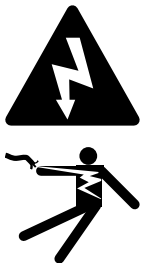
Chapter 4: Maintenance

Introduction

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

In addition to being technically qualified, maintenance personnel must perform all testing with safety in mind. Refer to the *Safety and Compliance Manual (80669C)* for operating precautions and warning formats.

⚠ WARNING



ELECTRIC SHOCK HAZARD

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

Preventive maintenance

For a complete list of preventive maintenance recommendations, see the *MAXPRO200 Preventive Maintenance Program Instruction Manual* (808800).

If you have questions about how to maintain your Hypertherm plasma power system, contact your OEM or regional Hypertherm Technical Service team. You can find contact information for each regional office at www.hypertherm.com on the "Contact us" page.

Plasma power supply state

The state of the plasma power supply is shown in the three digit display. To view the power supply state, navigate to the fault icon and press and hold the current selection knob until the state appears.

State number	Name
00	Power up
01	Initial checks
02	Gas purge
03	Ready for start
04	Preflow
05	Preflow hold
06	Ignite
07	Pilot arc
08	Rampup
09	Main arc
10	Rampdown
11	Rampdown complete
12	End of cycle
14	Shutdown
17	Standby

Sequence of operation and plasma power supply state

Power up (state 00)

1. Initialization of microprocessor hardware.
2. Initialization of plasma power supply, gas system, and display.
3. System will display dots on the current display.

4. System will look for shield gas button press to indicate USB host firmware update.
5. System will stay in this state until the rocker switch is turned on.

Initial checks (state 01)

1. System will turn on the plasma gas channel at 100% flow and will measure the pressure. The system will use this value as the inlet pressure. If the inlet is above or below the minimum, the system will generate error code 63.
2. System will read the torch ID jumpers, and verify it's a valid ID. If no torch ID is detected the system will generate error code 99.
3. System will perform a chopper test, verifying there is no output.
   a. Main contactor off (open), IGBTs off
      - If there is current on channel A the system will generate error code 401
      - If there is current on channel B the system will generate error code 402
      - If there is current on both channels the system will generate error code 400
   b. Main contactor on (closed), IGBTs off
      - If there is current on channel A the system will generate error code 406
      - If there is current on channel B the system will generate error code 407
      - If there is current on both channels the system will generate error code 408
4. System will verify that there is
   a. No transfer signal or the system will generate error code 108
   b. No start signal or the system will generate error code 50
   c. No coolant flow or the system will generate error code 109
5. System will verify that
   a. Temperatures are above the minimum
      - Chopper temperature is above minimum or the system will generate error code 300
      - Transformer temperature is above minimum or the system will generate error code 301
      - Inductor 1 temperature is above minimum or the system will generate error code 302
      - Inductor 2 temperature is above minimum or the system will generate error code 303
      - Coolant temperature is above minimum or the system will generate error code 304
   b. Temperatures are below the maximum values.
      - Chopper temperature is below maximum or the system will generate error code 65

- Transformer temperature is below maximum or the system will generate error code 67
- Inductor 1 temperature is below maximum or the system will generate error code 68
- Inductor 2 temperature is below maximum or the system will generate error code 69
- Coolant temperature is below maximum or the system will generate error code 71

6. After about 1 second the system will advance to state 2 (Gas purge) if there are no high priority errors (Error codes on page 196). If a high priority error is generated the system will go to state number 14 (Shutdown).

Gas purge (state 02)

1. System turns on the plasma and shield gases.
2. System counts the time in seconds and this is displayed on the 3-digit current display.
3. System turns on the coolant pump.
4. After six seconds the system will verify the coolant flow is greater than the minimum value.
5. If the coolant flow is higher than the minimum the system will do a high power test on the chopper.



The system is "live" at this time. The system is applying power to the torch even though no arc will be present at the torch.

6. Chopper LEM Test
   a. Main contactor closed, IGBTs on
      - If there is no current on channel A the system will generate error code 409
      - If there is no current on channel B the system will generate error code 410
      - If there is no current on both channels the system will generate error code 408
   b. Main contactor closed, IGBTs on
      - If channel A current does not go to 0 the system will generate error code 411
      - If channel B current does not go to 0 the system will generate error code 412
      - If the current on both channels does not go to 0 the system will generate error code 413
   c. Main contactor closed, IGBTs on
      - Channel A current detected on channel B input the system will generate error code 415
      - Channel B current detected on channel A input the system will generate error code 416

- Channel A current detected on channel B input and Channel B current detected on channel A input the system will generate error code 414

d. Main contactor closed, IGBTs on
   - Channel A current higher than expected: the system will generate error code 417
   - Channel B current higher than expected: the system will generate error code 418
   - Both channels current higher than expected: the system will generate error code 419

7. If the chopper test is successful and there are no other severe errors the system will advance to state 3 (Ready for start), otherwise the system will go to state 14 (Shutdown).

Ready for start (state 03)

1. System is waiting for a plasma start signal.
2. System is monitoring the over-current signals, and over-temperature conditions.
   - ☐ Chopper temperature in range or the system will generate error code 65
   - ☐ Transformer temperature in range or the system will generate error code 67
   - ☐ Inductor 1 temperature in range or the system will generate error code 68
   - ☐ Inductor 2 temperature in range or the system will generate error code 69
   - ☐ Coolant temperature in range or the system will generate error code 71
   - ☐ Chopper A over-current: the system will generate error code 134
   - ☐ Chopper B over-current: the system will generate error code 138
3. System is monitoring the pilot arc duty cycle to ensure it is less than 50%.
4. Diagnostic mode is active, the system will perform the function for the mode that is selected.
   a. Test gas - the plasma and shield gases flow at a set value
   b. Revision - the display will show the software revision
   c. Plasma leak check - the plasma channel will be pressurized then the pressure trapped. The display on the plasma power supply control panel will show actual pressures. The system will remain in this state until commanded to another test. The pressure in the plasma channel is expected to remain within 2 psi for a period of 5 minutes. The shield gas channel is expected to drop to near 0 psi.
   d. Test gas full pressure - plasma and shield gases flow at full pressure. Low pressure errors will be typical in this mode as the system is attempting to achieve the maximum flow possible.
   e. Torch ID - the display on the plasma power supply control panel will show the torch ID
   f. In-line valve test - the plasma channel will briefly pressurize, then the system will close the Burkert valve in the plasma power supply and open the in-line torch valve. The plasma pressure is expected to drop to near 0 psi (less than 5 psi), in less than 30

seconds.

5. If a plasma start signal is received and there are no temperature errors, the system will advance to state 4 - Preflow.

Preflow (state 04)

1. System will turn on plasma and shield gases.
2. System will verify gas pressures are above the minimum and below the maximum values.
    - Low plasma pressure: the system will generate error code 44
    - High plasma pressure: the system will generate error code 45
    - Low shield pressure: the system will generate error code 53
    - High shield pressure: the system will generate error code 54
3. System will charge the surge injection circuit.
4. System will check for an over-current condition.
    - Chopper A over-current: the system will generate error code 134
    - Chopper B over-current: the system will generate error code 138
5. After 1 second the system will advance to state 5 (Preflow hold).

Preflow hold (state 05)

1. System will continue running the plasma and shield gas until the hold signal is removed.
2. System will verify the gas pressures are within tolerance.
    - Low plasma pressure: the system will generate error code 44
    - High plasma pressure: the system will generate error code 45
    - Low shield pressure: the system will generate error code 53
    - High shield pressure: the system will generate error code 54
3. System will check for an over-current condition.
    - Chopper A over-current: the system will generate error code 134
    - Chopper B over-current: the system will generate error code 138
4. If the hold signal is active for more than 60 seconds, the system will generate error code 32.
5. When the hold signal is removed the system will advance to state 6 (Ignite).

Ignite (state 06)

1. System will execute the ignition sequence by turning off the torch valve, then turning on the High Frequency. The system will turn on the torch valve again, while continuing to activate

the High Frequency.

2. The system will monitor for pilot arc current. If pilot arc current is not detected, the ignition sequence will be repeated up to 5 times, after that the system will have error code 20 (Pilot arc fault) and advance to state 11 (Rampdown Complete).
3. System will check for an over-current condition.
    - Chopper A over-current: the system will generate error code 134
    - Chopper B over-current: the system will generate error code 138
4. If chopper current is detected during the sequence the system will advance to state 7 (Pilot Arc).

Pilot arc (state 07)

1. System will display actual gas pressures on the 2-digit pressure displays.
2. System will verify the gas pressures are within tolerance.
    - Low plasma pressure: the system will generate error code 44
    - High plasma pressure: the system will generate error code 45
    - Low shield pressure: the system will generate error code 53
    - High shield pressure: the system will generate error code 54
3. System will check for over-current.
    - Chopper A over-current: the system will generate error code 134
    - Chopper B over-current: the system will generate error code 138
4. System will check for minimum coolant flow. If it is below minimum the system will generate error code 93.
5. System will check for minimum chopper current. If it is below minimum the system will generate error code 24 (Lost Current Fault).
6. System will check for the arc transfer signal, once it is active the system will advance to state 8, (Rampup).
7. If the transfer signal in not present within 0.5 seconds (Mechanized) or 5.0 seconds (Hand torch) the system will have error code 21 (Transfer fault) and advance to state 11 (Rampdown complete).

Rampup (state 08)

1. System will ramp up the current based on the process parameters.
2. System will verify the gas pressures are within tolerance.
    - Low plasma pressure: the system will generate error code 44

- High plasma pressure: the system will generate error code 45
- Low shield pressure: the system will generate error code 53
- High shield pressure: the system will generate error code 54

3. System will check for over-current.
    - Chopper A over-current: the system will generate error code 134
    - Chopper B over-current: the system will generate error code 138
4. Once the ramp up is finished the system will advance to state 9 (Main arc).

Main arc (state 09)

1. System will display actual current and pressures.
2. System will verify the gas pressures are within tolerance.
    - Low plasma pressure and the system will generate error code 44
    - High plasma pressure and the system will generate error code 45
    - Low shield pressure: the system will generate error code 53
    - High shield pressure: the system will generate error code 54
3. System will check for over-current.
    - Chopper A over-current: the system will generate error code 134
    - Chopper B over-current: the system will generate error code 138
4. System will check for minimum coolant flow, error code 93.
5. System will check the bus voltage (equivalent to Line voltage).
    - Bus voltage high: the system will generate error code 5
    - Bus voltage low: the system will generate error code 6
6. System will check for phase loss (error code 27).
7. System will check for over-temperature conditions.
    - Chopper over temperature: the system will generate error code 65
    - Transformer over temperature: the system will generate error code 67
    - Inductor 1 over temperature: the system will generate error code 68
    - Inductor 2 over temperature: the system will generate error code 69
    - Coolant over temperature: the system will generate error code 71
8. System will check for lost chopper current - error code 24 (Lost Current Fault).
9. System will check for lost transfer - error code 26 (Lost Transfer Fault).
10. If the plasma start signal is removed the system will advance to state 10 (Rampdown).

Rampdown (state 10)

1. System will shut off the plasma and shield gases.
2. System will rampdown the current.
3. When the system reaches the final current, it will advance to state 11 (Rampdown Complete).

Rampdown complete (state 11)

1. Ensure all plasma power supply outputs are off except the main contactor.
2. Advance to state 12 (End of Cycle).

End of cycle (state 12)

1. Turn on plasma and shield gases for postflow.
2. System will verify coolant flow is above the minimum (error code 93).
3. System will verify the plasma start signal is off.
4. Once the plasma start signal is off the system will advance to state 3 (Ready for start).

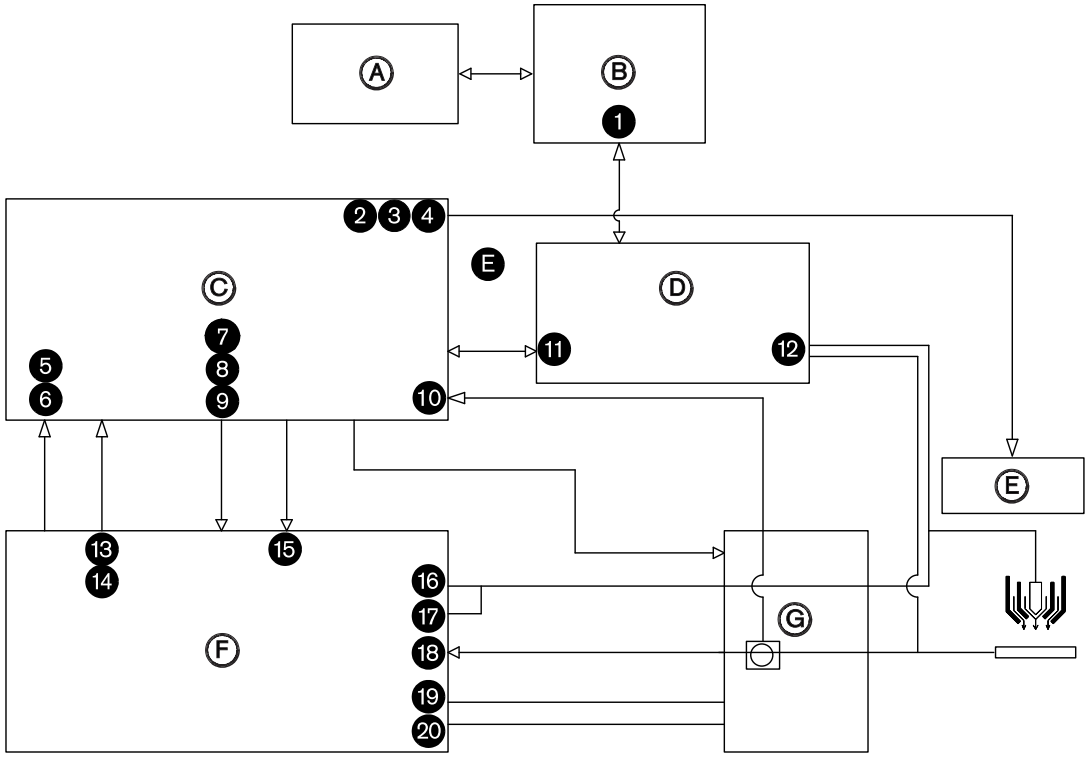
Shutdown (state 14)

1. System will turn off all plasma power supply, coolant, and gas outputs.

Standby (state 17)

1. If the rocker switch is turned off the system will enter the standby state.
2. When the rocker switch is turned on the system will advance to state 0 (Power up).

Block diagram



A CNC

B Sensor THC (Sensor PHC)

C Control PCB1

D Plasma interface board (optional)

E Plasma valve

F Chopper Board PCB2

G I/O Board PCB3

1 CNC interface cable

2 Torch valve

3 Trigger switch (hand torch)

4 Lead length ID

5 Bus voltage

6 Chopper temperature

7 PWM A and PWM B

8 Pilot arc enable

9 High frequency enable

10 Transfer

11 Machine interface cable

12 Arc voltage

13 Chopper A current

14 Chopper B current

15 Chopper power

16 Chopper A output

17 Chopper B output

18 Work lead

19 Pilot arc collector

20 Pilot arc emitter

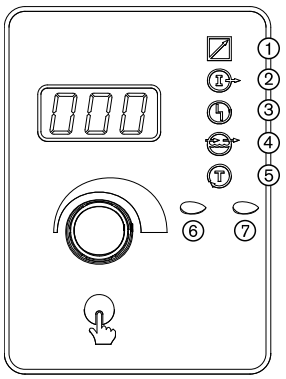
Error codes

When the fault indicator is illuminated the error code number can be seen in the three digit display.

There are three general types of error codes:

- Self clearing - An over temperature error, for example, will clear when the power supply cools off.
- Low priority - The user must select the fault icon and press the current selection knob to see the error code. This type of error can be cleared with the start signal.
- High priority - The system will automatically select the fault icon and show the error code. This type of error requires the power to the system to be turned off and then on again, after the cause of the error has been corrected.

Figure 20 - 3-digit display



1 **Remote:** The remote icon illuminates when there is serial communication with the plasma power supply. You can still cycle through the functions. But cut parameters can only be changed through the CNC.

2 **Amps:** Increase or decrease the amperage by selecting the amperage (A) icon and turning the knob. The current increases or decreases in 1 A increments when you turn the knob slowly. You can jump from one process amperage to another when you turn the knob quickly.

3 **Fault:** The fault icon illuminates when an error occurs.

If the error code number is 60 or less, press the current selection knob to navigate to the illuminated fault icon. When the fault icon is selected the error code appears in the 3-digit display.

If the error code is 60 or more the system automatically selects the fault icon and the error code number flashes in the 3-digit display.

Press and hold the current selection knob to see the plasma power supply status number for both types of error code.

4 **Coolant flow:** When the coolant flow icon is selected the display shows the coolant flow in gallons per minute. When you turn ON the power to the system and select the coolant flow icon before the plasma power supply finishes the purge count, the flow switch is overridden and coolant will continue to flow for 30 seconds.

5 **Test:** When test icon is selected the system is in test mode. A number of functions can be accessed by turning the current selection knob.

6 **Plasma start:** The plasma start LED illuminates white when the plasma start signal is given and stays illuminated until the start signal is removed.

7 **Arc transfer:** The arc transfer LED illuminates green when the arc transfers to the workpiece.

Diagnostic functions

Press and release the current selection knob until the Test icon in the 3-digit display is selected. Turn the current selection knob to access the functions shown in the table below. The function activates when the function number appears in the 3-digit display.

Function	Description
000	No function. Gases will stop flowing if the system was in another test mode.
001	Flow gas at set pressure. Plasma and shield gases flow at the set value.
002	Display software revision. Shows the current software revision of the plasma power supply.
003	Plasma gas leak check. The plasma channel is pressurized and the pressure trapped. The 3-digit display shows the actual pressure. The system remains in this state until you select another function or return to cutting. The pressure in the plasma channel should remain stable (+/- 2 psi) for 5 minutes. The shield gas channel should drop to near zero psi (less than 5 psi).
004	Flow gas at full pressure. The plasma and shield gases flow at full pressure. It is typical to see low pressure errors during this function because the system is attempting to achieve the maximum flow possible. Function 4 is used when setting the supply gas regulators.
005	Display torch ID. The torch ID indicates the lead length that is connected to the system.
006	Inline valve check. The plasma channel is pressurize, the system closes the Bürkert® valve and opens the inline torch valve. The plasma pressure is expected to drop to near zero psi (less than 5 psi) in less than 30 seconds.

Troubleshooting table

Number	Name	Description	Corrective action
000	No Error	System is ready to run	None
005	Low line voltage	Line voltage is close to or less than the lower limit of 102 VAC (120 VAC -15%). The normal lower limit for operation is 108 VAC (120 VAC -10%).	Verify the line voltage at the control transformer and the fuses on the control board. The chopper bus voltage should be 360 VDC nominal. 1. If the voltage is good, use a multimeter to measure across TP102 (gnd) and TP 111 (isolated bus voltage) on the chopper. 2. If the voltage is 2.1 VDC nominal, replace the control board. 3. If the voltage is 0 VDC or 5 VDC, replace the chopper.
006	High line voltage	Line voltage is close to or greater than the upper limit of 138 VAC (120 VAC +15%). The normal upper limit for operation is 132 VAC (120 VAC +10%).	Verify the line voltage at the control transformer and the fuses on the control board. The chopper bus voltage should be 360 VDC nominal. 1. If the voltage is good, use a multimeter to measure across TP102 (gnd) and TP 111 (isolated bus voltage) on the chopper. 2. If the voltage is 2.1 VDC nominal, replace the control board. 3. If the voltage is 0 VDC or 5 VDC, replace the chopper.
020	No pilot arc	No current detected from chopper at ignition and before 1-sec timeout	1. Verify that the correct consumable parts are installed and in good condition. 2. Perform the gas checks (Control board LED list on page 216). 3. Verify that there is spark across spark gap. 4. Inspect CON1 for excessive wear. 5. Perform the torch lead test (Do a torch lead test on page 230). 6. Perform the start circuit test (Start circuit troubleshooting on page 220).

Number	Name	Description	Corrective action
021	No arc transfer	For a machine torch, no current detected on work lead 500-msec after pilot arc current was established. For a hand torch, no current detected on work lead 5-sec after pilot arc current was established.	1. Verify proper transfer/pierce height. 2. Verify proper cutflow settings. 3. Inspect the work lead for damage or loose connections. 4. Perform the torch lead test (Do a torch lead test on page 230).
024	Lost current on chopper	Lost current from chopper after transfer	1. Verify that the correct consumable parts are installed and in good condition. 2. Verify proper cutflow gas settings. 3. Verify the pierce height setting. 4. Verify the pierce delay time. 5. Verify that the arc did not lose contact with the workpiece while cutting (for example, hole cutting, scrap cutting).
026	Lost transfer	Lost the transfer signal after transfer completed.	1. Verify that the correct consumable parts are installed and in good condition. 2. Verify proper cutflow gas settings. 3. Verify the pierce height setting. 4. Verify pierce delay time. 5. Verify that the arc did not loose contact with the workpiece while cutting (for example, hole cutting, scrap cutting). 6. Inspect the work lead for damage or loose connections. 7. Try connecting the work lead directly to the workpiece.
027	Phase imbalance	Phase imbalance to chopper after contactor engaged or while cutting Balanced = ≤ 1% imbalance per U.S. National Electrical Manufacturers' Association (NEMA) specifications.	1. Verify phase-to-phase voltage to plasma power supply. 2. Disconnect power to plasma power supply, remove cover on contactor and inspect contacts for excessive wear. 3. Inspect power cord, contactor, and input to chopper for loose connections. 4. Perform phase loss test. Phase loss detection on page 229. 5. Speak with a licensed electrician.

Number	Name	Description	Corrective action
032	Hold timeout	Hold signal was active for longer than 60 seconds	1. Check the interface cable for damage. The hold wires may be short-circuiting inside. 2. The CNC is maintaining this input, it could be waiting for an IHS complete input from another torch. 3. If the CNC interface cable is good and it is a 1-torch system, change the control board.
044	Low plasma gas pressure	Plasma gas pressure is less than 25% of the set (desired) value	1. Inspect gas supply pressure and volume of gas remaining in supply tanks. 2. Verify the gas settings on the front panel with the parameters in the cut charts. 3. Set the supply gas regulators on page 64. 4. Perform the Flow gas at set pressure test (001), and verify the gas settings on the front panel with the parameters in the cut charts. Control board LED list on page 216.
045	High plasma gas pressure	Plasma gas pressure is greater than 25% of the set (desired) value	1. Verify gas supply pressure settings. 2. Perform the Flow gas at set pressure test (001), and verify the gas settings on the front panel with the parameters in the cut charts. Control board LED list on page 216. 3. Set the supply gas regulators on page 64. 4. The In-line valve may not be opening. Perform the Plasma leak check (003) and the inline valve check (006). Control board LED list on page 216.

Number	Name	Description	Corrective action
050	Start lost/Start at Initialization	Start signal was received and then lost before an arc was established/Start signal was applied when power was applied to the system	1. If a mechanical relay is being used to provide the system with a start signal, this relay is either bouncing when activated or the contacts are faulty. Replace the relay. 2. Inspect the interface cable for damage; faulty crimps, or poor electrical connections. 3. If the interface cable is good and a relay is not driving the start input, the CNC is dropping the start signal before a steady state arc has been established. 4. Remove the start signal from the CNC or THC and turn the system on again. It is normal to see an 050 error when cutting with the hand torch if the start signal is removed before the pilot arc time (5 seconds) has expired.
051	Pilot Arc Overtemp	Maximum pilot arc duration exceeded	1. Allow the plasma power supply to idle with the fans running for 10 seconds. 2. Verify that the pierce height is correct. 3. Minimize pilot arcing off the workpiece.
053	Low shield gas pressure	Shield gas pressure is less than 25% of the set (desired) value	1. Verify gas supply pressure and that sufficient gas remains in your supply. 2. Perform the Flow gas at set pressure test (001), and verify the gas settings on the front panel with the parameters in the cut charts. Control board LED list on page 216. 3. Set the supply gas regulators on page 64.
054	High shield gas pressure	Shield gas pressure is 25% greater than the set (desired) value	1. Check for a restriction or dross on the shield cap 2. Perform the Flow gas at set pressure test (001), and verify the gas settings on the front panel with the parameters in the cut charts. Control board LED list on page 216. 3. Verify that the pressure transducers are providing the system with the proper pressures.
060	Low coolant flow	Coolant flow is less than the required 2.3 lpm (0.6 gpm)	1. Verify that the correct consumables are properly installed. 2. Perform the coolant flow test procedure. Coolant flow test on page 212.

Number	Name	Description	Corrective action
063	Inlet Pressure Fault	Inlet pressure measured was greater than 135 or less than 40 psi	Verify that the input pressures at the regulators are in range.
065	Chopper over-temp at power-up	Chopper is indicating an over-temp at power-up	1. Verify that the heat exchanger fan is spinning. 2. Blow dust out the heat exchanger with compressed air to clean off the fins. 3. Verify that the level of coolant is at the proper height. 4. Verify that the coolant mixture is correct (% propylene glycol). A mixture with a high percentage of propylene glycol will have a lower cooling capacity. 5. Change the consumables. Older consumables emit more heat into the cooling loop. 6. Verify the pump flow rate. If it is less than 2.3 lpm (0.6 GPM) troubleshoot the low flow rate issue.
067	Magnetics over temp	Main transformer has over heated	1. Verify that the magnetics fan is operating properly. Spinning fan blades should be difficult to see. 2. Blow dust out of the system especially from fans and the main transformer. 3. If voltage is low or near 0 VDC, inspect wiring between the transformer's temperature sensor and J1.12, pins 1 and 2 on the control board. Look for shorts between wires or to ground. 4. If wiring is good, the transformer has overheated. Allow the plasma power supply to idle with the fans running for a minimum of 30 minutes to cool the main transformer.

Number	Name	Description	Corrective action
068	Inductor A over temp	Inductor has over heated	1. Verify that the magnetics fan is operating properly. Spinning fan blades should be difficult to see. 2. Blow dust out of the system especially from fans and inductors. 3. If voltage is low or near 0 VDC, inspect wiring between inductor A's temperature sensor and J1.12, pins 4 and 5 on the control board. Look for shorts between wires or to ground. 4. If wiring is good, the inductor has overheated. Allow the plasma power supply to idle with the fans running for a minimum of 30 minutes to cool the inductors.
069	Inductor B over temp	Inductor has over heated	1. Verify that the magnetics fan is operating properly. Spinning fan blades should be difficult to see. 2. Blow dust out of the system especially from fans and inductors. 3. If voltage is low or near 0 VDC, inspect wiring between inductor B's temperature sensor and J1.12, pins 7 and 8 on the control board. Look for shorts between wires or to ground. 4. If wiring is good, the inductor has overheated. Allow the plasma power supply to idle with the fans running for a minimum of 30 minutes to cool the inductors.
071	Coolant over temp	Torch coolant has overheated	1. Verify that the heat exchanger fan is spinning. 2. Blow dust out the heat exchanger with compressed air to clean off the fins. 3. Verify that the level of coolant is at the proper height. 4. Verify that the coolant mixture is correct (% propylene glycol). A mixture with a high percentage of propylene glycol will have a lower cooling capacity. 5. Change the consumables. Older consumables emit more heat into the cooling loop. 6. Verify the pump Flow rate. If it is less than 0.5 gpm troubleshoot the low flow rate issue. 7. Replace the coolant temperature sensor if it is open or shorted. Replacement part number is 229474.

Number	Name	Description	Corrective action
093	No coolant flow	Coolant flow was below 1.9 lpm (0.5 gpm) while the system was running or the coolant flow was below 1.7 lpm (0.45 gpm) while cutting.	1. Verify that the level of coolant is at the proper level. 2. Verify that the coolant filter is in good condition. replace if necessary. 3. The pump motor may have reached its internal thermal trip point. Make sure the side panel is installed, for proper airflow, and that the heat exchanger fan is working properly. 4. Perform the coolant flow test. Coolant flow test on page 212. 5. See the corrective actions for the low coolant flow error (60).
097	No Torch Found	Torch or torch ID jumper missing or installed incorrectly	1. Verify that the torch connection by the I/O panel (CPC plug) is good. 2. Verify the pin out on the torch lead connection.
102	Current Sensor A Fault	A fault was detected on channel A of the chopper	1. Turn OFF the line power to the system. Check the wiring between the control board and the chopper for damaged wires and proper connections and then turn ON the line power again so the automatic diagnostic checks will run. 2. If the error changes to a 409 error replace the chopper assembly.
108	Transfer at power-up	The system has detected current on the work lead during power-up	1. Verify that the chopper PCB is functioning properly by checking the LED on the board against the LED list in the Maintenance section. Start circuit troubleshooting on page 220. 2. Replace the chopper PCB if connections are correct and not damaged. 3. Verify that the main contactor (CON1) is not welded closed, or closing at power-up.
109	Coolant Flow At power-up	Coolant flow measured during power-up and before pump motor has been turned on.	1. Verify that the shield cap is properly installed. A loose shield cap can allow shield gas to get into the coolant, and cause a coolant flow error. 2. Verify that the torch lead connections are good. 3. Turn off the power to the system, wait 30 seconds, and turn the power back on. Sometimes if you turn the power off and then on too quickly it may cause a 109 error.

Number	Name	Description	Corrective action
134	Chopper A over current	Chopper A current exceeded maximum	1. Verify that the chopper PCB is functioning properly by checking the LED on the board against the LED list in the Maintenance section. 2. Turn off the power to the system and then turn it on again to verify that the system passes the initial power up test. 3. Verify the current output on J2.1 white to black (4 VDC=100 A). 4. If the wiring is good, the IGBT may have failed. Replace the chopper assembly.
138	Chopper B over current	Chopper B current has exceeded maximum	1. Verify that the chopper PCB is functioning properly by checking the LED on the board against the LED list in the Maintenance section. Start circuit troubleshooting on page 220. 2. Turn off the power to the system and then turn it on again to verify that the system passes the initial power up test. 3. Verify the current output on J2.6 white to black (4 VDC=100 A). 4. If the wiring is good, the IGBT may have failed. Replace the chopper assembly.
161	High coolant flow rate	Coolant flow rate has exceeded maximum	1. Check to make sure the shield cap is properly installed. A loose shield cap can allow shield gas to get into the coolant, and cause this error. 2. Check to make sure the consumables are installed properly and are not damaged.
190	Current Sensor B Fault	A fault was detected on channel B of the chopper	1. Turn OFF the power to the system. Check the wiring between the control board and the chopper for damaged wires and proper connections and then turn ON the power again so the automatic diagnostic checks will run. 2. If the error changes to a 410 error replace the chopper assembly.
300	Temp sensor unplugged Chopper	The temperature reading was unexpectedly low, possibly indicating the sensor is unplugged	1. Verify that the red and black wires on chopper J2.8 are plugged into the control board at J1.22. 2. Verify the cold plate temperature sensor wires are plugged into the chopper at J2.9 (10K ohm nominal).

Number	Name	Description	Corrective action
301	Temp sensor unplugged Transformer	The temperature reading was unexpectedly low, possibly indicating the sensor is unplugged	Verify the electrical connection back to the control board at J1.12 pins 1-2 (10K ohm nominal).
302	Temp sensor unplugged Inductor 1	The temperature reading was unexpectedly low, possibly indicating the sensor is unplugged	Verify the electrical connection back to the control board at J1.12 pins 4-5 (10K ohm nominal).
303	Temp sensor unplugged Inductor 2	The temperature reading was unexpectedly low, possibly indicating the sensor is unplugged	Verify the electrical connection back to the control board at J1.12 pins 7-8 (10K ohm nominal).
304	Temp sensor unplugged Coolant	The temperature reading was unexpectedly low, possibly indicating the sensor is unplugged	Verify the electrical connection back to the control board at J1.18 pins 6-7 (10K ohm nominal).
400	Current sensor A and Current sensor B current with contactor off	During the chopper test, current was detected on channel A and on channel B when no current was expected	1. Verify that the contactor is not welded shut or always ON. 2. Verify that there is no DC output on the I/O board from the Torch to Work connections. If DC output is found, replace the chopper. 3. Verify that the LED for PWM is not active.
401	Current sensor A current with contactor off	During the chopper test, current was detected on channel A when no current was expected	1. Verify that the contactor is not welded shut or always ON. 2. Verify that there is no DC output on the I/O board from the Torch to Work connections. If DC output is found, replace the chopper. 3. Verify that the LED for PWM is not active.
402	Current sensor B current with contactor off	During the chopper test, current was detected on channel B when no current was expected	1. Verify that the contactor is not welded shut or always ON. 2. Verify that there is no DC output on the I/O board from the Torch to Work connections. If DC output is found, replace the chopper. 3. Verify that the LED for PWM is not active.
405	Current sensor A and Current sensor B current with contactor on and PWM off	During the chopper test, current was detected on channel A and on channel B when no current was expected	1. Verify that the LED for PWM is not active. 2. Verify that there is no DC output on the I/O board from the Torch to Work connections. If DC output is found, replace the chopper.

Number	Name	Description	Corrective action
406	Current sensor A current with contactor on and PWM off	During the chopper test, current was detected on channel A when no current was expected	1. Verify that the LED for PWM is not active. 2. Verify that there is no DC output on the I/O board from the Torch to Work connections. If DC output is found, replace the chopper.
407	Current sensor B current with contactor on and PWM off	During the chopper test, current was detected on channel B when no current was expected	1. Verify that the LED for PWM is not active. 2. Verify that there is no DC output on the I/O board from the Torch to Work connections. If DC output is found, replace the chopper.
408	With choppers active, no current on Current sensor A and Current sensor B during chopper test	No current detected on channel A and channel B when current was expected	1. Verify the output voltage from the contactor. 2. Verify the DC voltage on both bridges of the Chopper. 3. Verify the DC output on the I/O board for each chopper test. 4. Verify that the 10 Ohm resistor on the I/O board is not damaged. 5. Disconnect any exterior equipment from the I/O Board (Example: Arc Voltage connection). 6. Replace the chopper.
409	With choppers active, no current on Current sensor A during chopper test	No current was detected on channel A when current was expected	1. Verify the output voltage from the contactor. 2. Verify the DC voltage on Chopper. 3. Verify the DC output on the I/O board for each chopper test. 4. Verify that the 10 Ohm resistor on the I/O board is not damaged. 5. Disconnect any exterior equipment from the I/O Board (Example: Arc Voltage connection). 6. Replace the chopper.
410	With choppers active, no current on Current sensor B during chopper test	No current was detected on channel B when current was expected	1. Verify the output voltage from the contactor. 2. Verify the DC voltage on Chopper. 3. Verify the DC output on the I/O board for each chopper test. 4. Verify that the 10 Ohm resistor on the I/O board is not damaged. 5. Disconnect any exterior equipment from the I/O Board (Example: Arc Voltage connection). 6. Replace the chopper.
411	Current detected for longer than expected on Current sensor A and Current sensor B	Current on channel A and channel B did not return to 0 as expected	Verify that the surge circuit on the I/O board is functioning properly.

Number	Name	Description	Corrective action
412	Current detected for longer than expected on Current sensor A	Current on channel A did not return to 0 as expected	Verify that the surge circuit on the I/O board is functioning properly.
413	Current detected for longer than expected on Current sensor B	Current on channel B did not return to 0 as expected	Verify that the surge circuit on the I/O board is functioning properly.
414	Current sensor A and Current sensor B signals crossed	Current from output A was detected on channel B and output from channel B was detected on channel A	Verify that the current sensor wiring is not crossed.
415	Current detected on Current sensor B when expected on Current sensor A	Current from output A was detected on channel B	Verify that the current sensor wiring is not crossed.
416	Current detected on Current sensor A when expected on Current sensor B	Current from output B was detected on channel A	Verify that the current sensor wiring is not crossed.
417	Current too high on Current sensor A	Current exceeded the maximum expected value on channel A	1. Verify that the 10 Ohm resistor on the I/O board is not damaged. 2. Disconnect any exterior equipment from the I/O Board (Example: Arc Voltage connection).
418	Current too high on Current sensor B	Current exceeded the maximum expected value on channel B	1. Verify that the 10 Ohm resistor on the I/O board is not damaged. 2. Disconnect any exterior equipment from the I/O Board (Example: Arc Voltage connection).
419	Current too high on Current sensor A and Current sensor B	Current exceeded the maximum expected value on channel A and channel B	1. Verify that the 10 Ohm resistor on the I/O board is not damaged. 2. Disconnect any exterior equipment from the I/O Board (Example: Arc Voltage connection).

Initial checks

Before you begin: Before trouble-shooting, do a visual check and verify that proper voltages are present at the power source, transformers and power distribution board.

⚠ WARNING



ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you.



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

1. Disconnect line power by turning OFF the main disconnect switch.
2. Remove the plasma power supply's top panel and 2 side panels.
3. Inspect interior of plasma power supply for discoloration on PC boards, or other apparent damage. If a component or module is obviously defective, replace it before doing any testing. Refer to the Parts List section to identify parts and part numbers.
4. If no damage is apparent, connect power to the plasma power supply, and turn ON the main disconnect switch.
5. Measure the voltage between the L1, L2 and L3 terminals of TB1 located on the left side of the plasma power supply. See figure on next page. Also refer to the wiring diagram in Section 7, if required. The voltage between any 2 of the 3 terminals should be equal to the supply voltage. If there is a problem at this point, disconnect main power and check all connections, the power cable, and fuses at the line disconnect switch. Repair or replace any defective component.

Power measurement

Before you begin:

⚠ DANGER



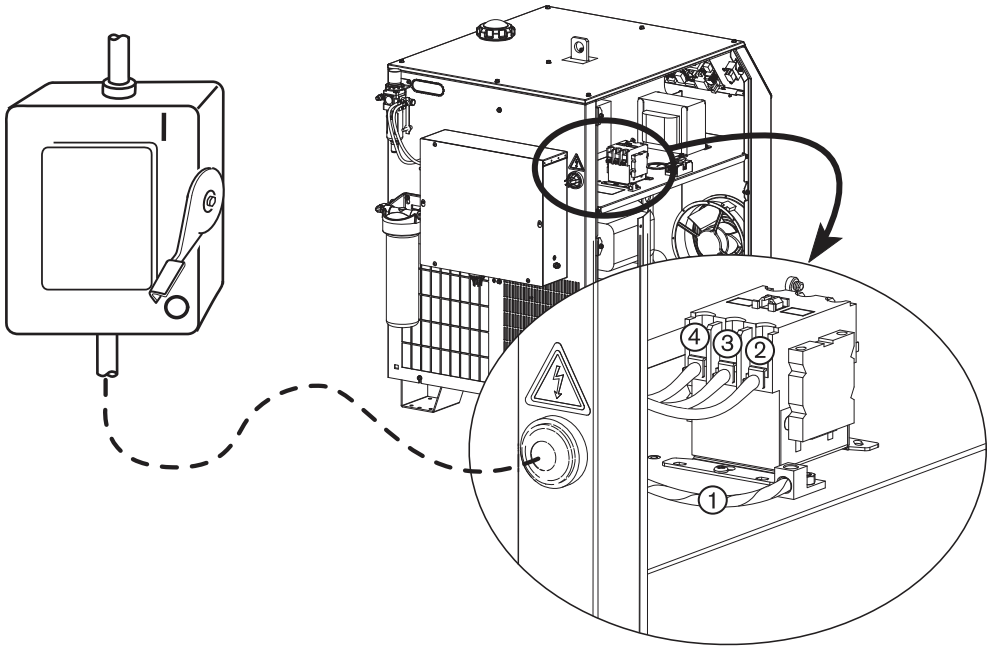
ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages at the terminal block and contactors that can cause injury or death.



Use extreme caution if you measure primary power at the terminal block and contactors. There is line voltage at the contactor when the line-disconnect switch is ON.

1. Check the lines in the following order:
    a. L1 to L2
    b. L1 to L3
    c. L2 to L3



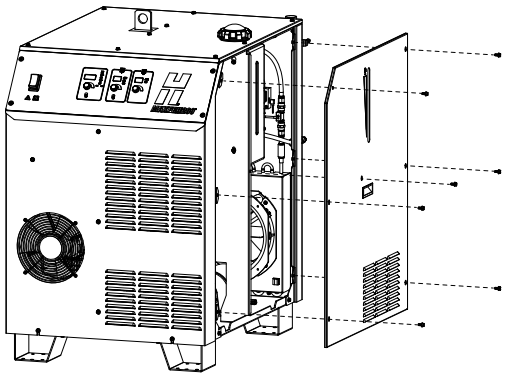
1 Ground
2 L1
3 L2
4 L3

2. Check each line to ground. If one line is 10% or higher than the other two, put that leg on L1.

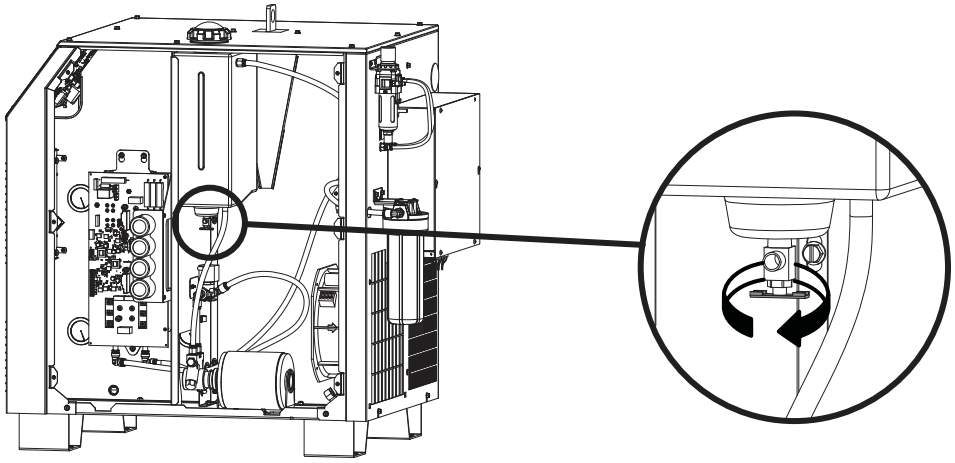
Plasma power supply coolant system servicing

Draining the coolant system

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



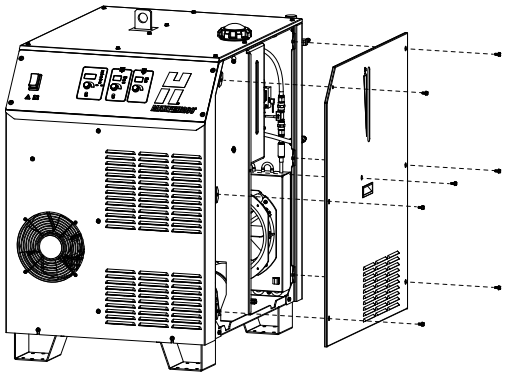
2. Locate the coolant drain valve and use a 20 liter (5 gallon) container to catch the coolant. Coolant will flow as soon as the drain is opened. Close the drain valve when the coolant stops flowing. Always dispose of coolant according to local and national codes.



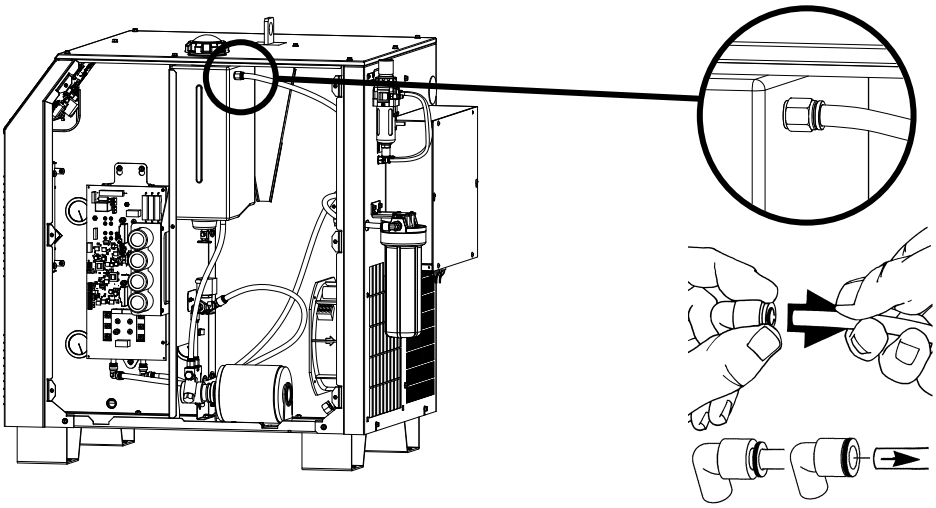
Coolant flow test

The control board receives an electrical signal in Hz from the flow sensor, that is converted and shown as flow in gallons per minute (gpm). Normal flow is 4.5 lpm (1.2 gpm), but this will vary depending on lead lengths and whether the power is 50 Hz or 60 Hz. PCB4 will allow the system to operate if the coolant flow is 1.9 lpm (0.5 gpm) or greater. If the system shows a coolant flow error (093) the system will need to be turned OFF and then ON again and the following test needs to be performed to determine if the problem is coolant flow or the flow switch.

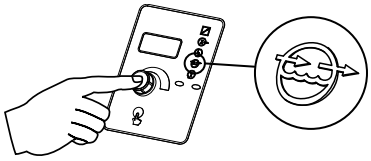
1. Turn OFF the power, and remove the right-side panel from the plasma power supply.



2. Remove the return hose at the top of the coolant tank. Push the connector-collar toward the fitting, and pull the hose away from the fitting This will release the coolant hose. No tools required. Put the end of the return hose into a 4 liter (1 gallon) container.



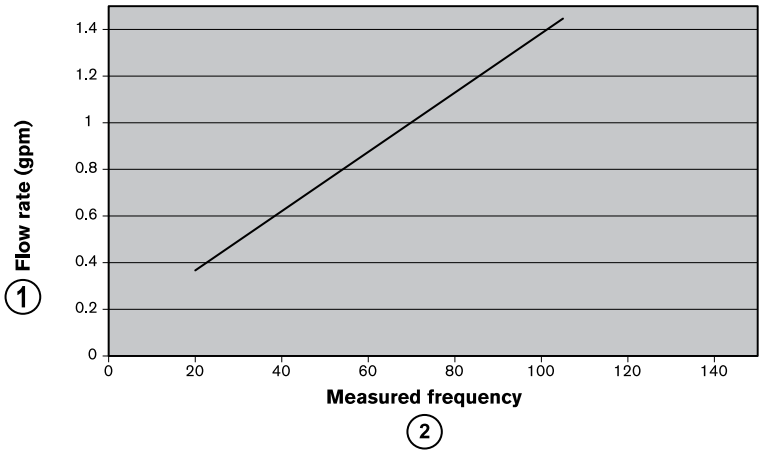
3. You will need to enable the flow function before the count reaches 5 in the 3-digit display. Turn ON the power and press and release the current knob twice until the flow function is enabled. Turn OFF the power after the coolant flows for 30 seconds.



4. Measure the amount of coolant in the container. There should be about 2 liters (0.5 gallon). If there is less than 1 liter (0.25 gallon) there may be a restriction in the coolant system or a problem with the pump or flow sensor.
5. Verify the flow sensor output by measuring the flow output (in frequency) at the control board. Measure the Frequency on J21 pin 3 (pulse) and pin 2 (ground). Once you have the frequency use the chart below to get the flow sensors measured flow rate. If this number

differs more than 0.8 lpm (0.2 gpm) from your bucket test, the flow sensor may need to be replaced.

The 3-digit display shows actual coolant flow. You can compare that measurement to the measurement you get in step 5 to troubleshoot for a PCB problem.



1 Flow rate (gpm)

2 Measured frequency

Coolant system filter replacement

Before you begin:

NOTICE

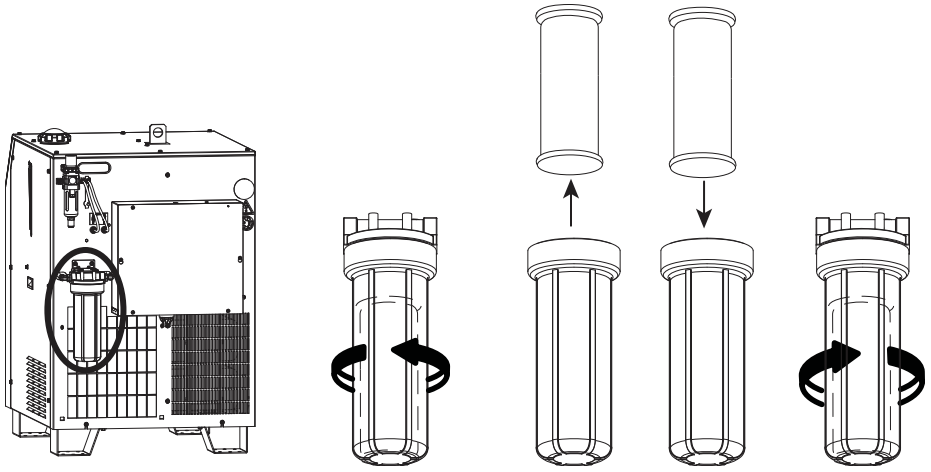
LOSS OF COOLANT IS POSSIBLE.

Coolant will flow from the filter when the housing is removed.

Drain coolant before replacing the filter.

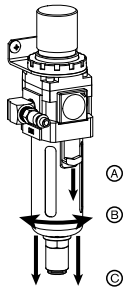
1. Make sure the coolant has been drained from the system, then turn OFF all power to the system.
2. Remove the filter housing. Make sure the O-ring inside the filter housing remains in place.
3. Remove and discard the filter element.
4. Install the new filter element 027005.

5. Make sure the O-ring is properly installed before re-installing the housing.
6. Refill the plasma power supply with coolant. See Fill the plasma power supply with coolant on page 59.

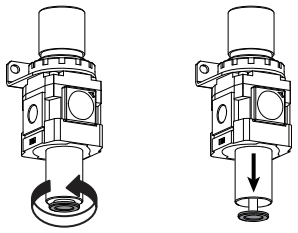


Air filter element replacement

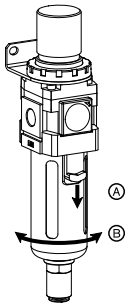
1. Disconnect the electrical power and the gas supply and remove the filter bowl and the old filter element.
    a. Pull down and hold the black release tab.
    b. Rotate the filter bowl in either direction until it releases.
    c. Pull the filter bowl down to remove it. The bowl has an O-ring around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



2. Turn the plastic disk under the filter element counter-clockwise about 1/4 turn and remove the old filter element. Install the new filter element 011093.



3. Re-install the filter bowl.
    a. Hold down the black tab and slide the filter bowl over the new filter element.
    b. Rotate the filter bowl until it locks in place.



Control board

Control board LED list

LED	Description	LED	Description
D1	Torch ID 0	D46	High frequency ignition (ON = HF circuit active)
D2	Torch ID 1	D51	Contactor output (ON = contacts closed)
D3	Torch ID 2	D61	Torch valve driver error (ON = error)
D4	Torch ID 3	D62	Torch valve driver OK (ON = 24V power is OK)
D6	CNC start signal (ON = active)	D64	Not used
D9	Hold input (ON = active)	D65	Transfer detect (ON = 3.5A or more detected on the work lead)
D12	Motion output	D68	Coolant flow input (pulses from flow sensor)
D14	Error output	D70	Pump enable (ON = pump motor active)

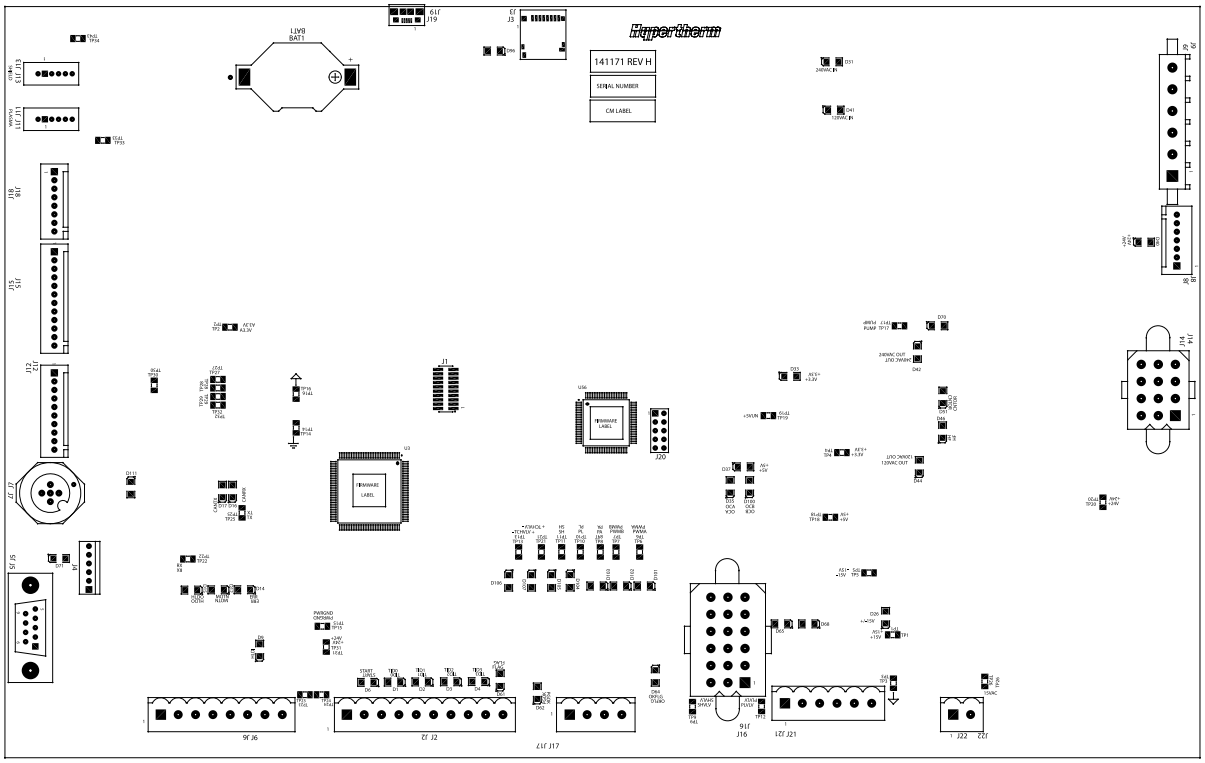
LED	Description	LED	Description
D15	Hold output	D71	Serial communications TX
D16	CAN RX	D96	USB BUS voltage error flag
D17	CAN TX	D100	Over current on chopper B (ON = over-current)
D26	+15/-15V voltage indicator	D101	Chopper A PWM
D31	Fused side of 240VAC input power	D102	Chopper B PWM
D33	+3.3V voltage indicator	D103	Pilot arc enable
D35	Overcurrent on chopper A (ON = over-current)	D104	Plasma valve PWM
D37	+5V voltage indicator	D105	Shield valve PWM
D40	+24V voltage indicator	D106	Torch valve enable
D41	Fused side of 120VAC input power	D107	Not used
D42	240V input detection (ON = 240VAC input detected)	D111	Serial communications RX
D44	120V input detection (ON = 120VAC input detected)		

Control board test points

Test point	Description	Test point	Description
TP1	+15V	TP18	+5V regulated
TP2	Analog 3.3V	TP19	+5V unregulated (should be 7V or higher)
TP3	Signal ground	TP20	+24V
TP4	+3.3V	TP21	Not used
TP5	-15V	TP22	Serial communications RX
TP6	PWM channel A (5V)	TP23	CNC start +
TP7	PWM channel B (5V)	TP24	CNC start -
TP8	Pilot arc enable (5V)	TP25	Serial communications TX
TP9	Shield valve output (24V)	TP26	15VAC power output to chopper
TP10	Plasma valve enable (5V)	TP27	Inductor 2 temp input (analog 3.3V)
TP11	Shield valve enable (5V)	TP28	Inductor 1 temp input (analog 3.3V)

Test point	Description	Test point	Description
TP12	Plasma valve output (24V)	TP29	Main transformer temp input (analog 3.3V)
TP13	Plasma valve enable	TP30	Multiplexed transformer and inductor temps input
TP14	Digital logic ground	TP31	+24V (same connection as TP20)
TP15	Power ground	TP32	Spare input not used (analog 3.3V)
TP16	Analog/signal ground	TP33	Plasma pressure input (analog 5V)
TP17	Pump motor enable (5V)	TP34	Shield pressure input (analog 5V)

Control board diagram



Gas leak tests

Refer to Diagnostic functions on page 197 for details about getting to the gas test functions.

Function	Description
001	Flow gas at set pressure. Plasma and shield gases flow at the set value.
003	Plasma gas leak check. The plasma channel is pressurized and the pressure trapped. The 3-digit display shows the actual pressure. The system remains in this state until you select another function or return to cutting. The pressure in the plasma channel should remain stable (+/- 2 psi) for 5 minutes. The shield gas channel should drop to near zero psi (less than 5 psi).
004	Flow gas at full pressure. The plasma and shield gases flow at full pressure. It is typical to see low pressure errors during this function because the system is attempting to achieve the maximum flow possible. Function 4 is used when setting the supply gas regulators.
006	In-line valve check. The plasma channel is pressurized, the system closes the Bürkert valve and opens the inline torch valve. The plasma pressure is expected to drop to near zero psi (less than 5 psi) in less than 30 seconds.

Start circuit

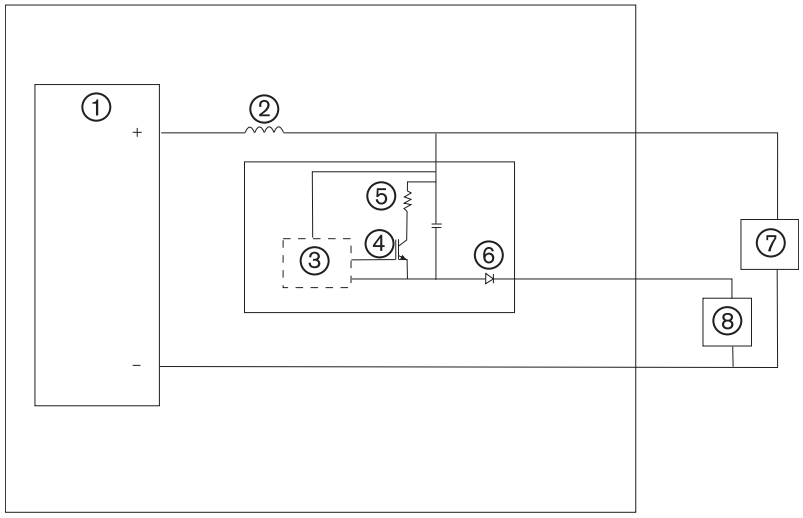
Start circuit operation

The start circuit is a high-speed switch that quickly transfers the pilot arc current from the pilot arc lead to the work lead. the start circuit is built into the chopper in the MAXPRO200. The start circuit performs 2 functions:

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

Start circuit functional schematic

Figure 21 - Plasma power supply



1	Chopper	**5**	Power resistors
2	Choke	**6**	Diode
3	Plasma power supply control board	**7**	Cutting arc
4	IGBT	**8**	Pilot arc

Start circuit troubleshooting

- D14 should always be illuminated.
- Refer to Chopper PCB diagram with LED and test point list on page 223.
- D3 illuminates as soon as the torch fires and will extinguish as soon as the arc transfers to the workpiece. If arc transfer is immediate, the LED may not illuminate.
- If there is no arc at the torch or if the arc will not transfer do the following steps.

Before you begin:

DANGER

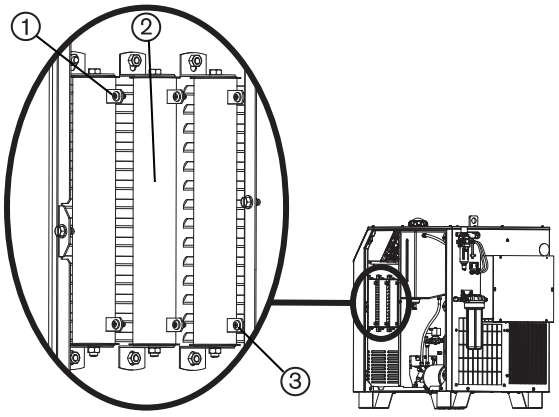


ELECTRIC SHOCK CAN KILL

The plasma power supply contains dangerous electric voltages that can seriously injure or kill you. 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.

- Refer to the *Safety and Compliance Manual (80669C)* for important safety information before you operate this system.
- Disconnect electric power before you do installation or maintenance tasks.
- The line-disconnect switch must STAY in the OFF position until all of the installation or maintenance tasks are complete.
- 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.
- All work that requires removal of the plasma power supply outer cover or panels must be done by a qualified technician.

1. Turn OFF all power to the system.



1 R34 (J2 COLLECTOR)

2 R35

3 R36 (PA WORK)

2. Remove the 6 AWG wire labeled R36 from the R36 power resistor terminal (PA WORK), not the smaller 140 mm (5.5 inch) 10 AWG wire that connects to R34.

3. Verify a series resistance of 3 Ω between J2 (COLLECTOR, wire labeled J2.2) and R36 (PA WORK). If the resistance value is not correct, check the wiring connections between J2 (COLLECTOR, wire labeled J2.2) and R34, between R34 (no label on wire) and R35, and between R35 (no label on wire) and R36.

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

4. Verify a resistance of 1 Ω across each of R34, R35, and R36.

   - The work lead should not have any cuts or breaks. Verify a resistance of 1Ω or less. The work lead connection to the cutting table should be clean and have good contact to the table.
   - Verify that D14 is illuminated. If it is not illuminated the board may need to be replaced or the board may not be receiving power.
   - Fire the torch in the air and verify that D3 is illuminated. If it is not illuminated, but a pilot arc is established, the pilot arc IGBT (Q7) may need to be replaced.

5. Place a 10 AWG (6 mm^2) jumper in parallel across the work lead (WORK, H8, wire labeled J2.9) and J7 (Nozzle, H9, wire labeled J2.7).

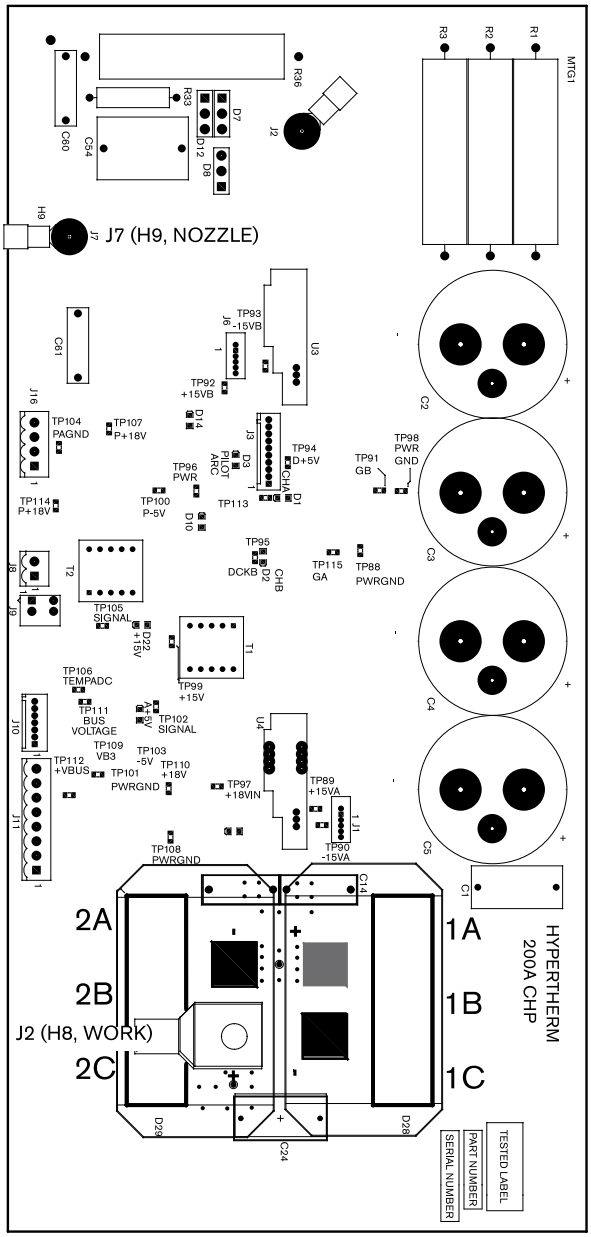
6. Perform a test cut.

   The nozzle will wear out after just a few starts.

7. If the arc transfers, check R34, R35, R36, Q7, the chopper, and the wiring between them.

8. Replace parts as necessary.

Chopper PCB diagram with LED and test point list



Chopper PCB LED list

LED	Description
D1	Chopper A PWM
D2	Chopper B PWM
D3	Pilot arc enable
D6	+18V/-5V chopper circuit power indicator
D10	Gate drive optocoupler +5V power indicator
D14	Pilot arc circuit power indicator
D20	Bus voltage +5V circuit power indicator
D22	Chopper +15V power indicator

Chopper PCB test points

Test point	Description
TP88	Chopper ground
TP89	+15V (chopper A)
TP90	-15V (chopper A)
TP91	IGBT chopper B gate drive
TP92	+15V (chopper B)
TP93	-15V (chopper B)
TP94	Gate drive optocoupler +5V
TP95	Chopper B PWM
TP96	Pilot arc circuit ground
TP97	Chopper unregulated +18V (should be +18.5 or higher)
TP98	Chopper ground
TP99	Chopper +15V
TP101	Chopper ground
TP102	Signal (Bus voltage) ground
TP103	Chopper -5V
TP104	Pilot arc ground
TP105	Signal (chopper temp) ground

Test point	Description
TP106	Chopper temp (0-5V analog)
TP107	Pilot arc +18V
TP108	Non-isolated chopper ground
TP109	Non-isolated Bus voltage (0-5V analog)
TP110	Chopper +18V
TP111	Isolated Bus voltage (0-5V analog)
TP112	Bus voltage +5V
TP113	Chopper A PWM
TP114	Pilot arc unregulated +18V (should be +18.5 or higher)
TP115	IGBT chopper A gate drive

Pilot arc current levels

Plasma gas	50 A	130 A	200 A
Air	20 A	35 A	40 A
N_2	–	35 A	40 A
O_2	20 A	35 A	40 A

Transfer current

Transfer is determined by CS1 on PCB3 (I/O board). Transfer occurs when the current on the work lead is > 7 A.

Chopper tests

⚠ WARNING



ELECTRIC SHOCK HAZARD

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

Automatic chopper and current sensor tests during power-up

After you turn ON the power to the system and the preflow starts, the system will automatically run the following series of tests:

The system performs a chopper test verifying there is no output current (A). Less than 5 A is considered "no current".

1. The main contactor is open, each IGBT is off.
   a. If there is current on channel A, error code 401 is displayed.
   b. If there is current on channel B, error code 402 is displayed.
   c. If there is current on both channels, error code 400 is displayed.
2. The main contactor is closed, each IGBT is off.
   a. If there is current on channel A, error code 406 is displayed.
   b. If there is current on channel B, error code 407 is displayed.
   c. If there is current on both channels, error code 405 is displayed.

   If the coolant flow is above the minimum level the system will do a high power test on the chopper.

   The system is "live" at this time. The system is applying power to the torch even though no arc will be present at the torch.

   The system performs a chopper LEM Test. The test checks for current between 10-60 A. Less than 5 A is considered "no current".
3. The main contactor is closed, each IGBT is on.
   a. If there is no current on channel A, error code 409 is displayed.

   b. If there is no current on channel B, error code 410 is displayed.
   c. If there is no current on both channels, error code 408 is displayed.
4. The main contactor is closed, each IGBT is on.
   a. If channel A current does not go to 0, error code 412 is displayed.
   b. If channel B current does not go to 0, error code 413 is displayed.
   c. If the current on both channels does not go to 0, error code 411 is displayed.
5. The main contactor is closed, each IGBT is on.
   a. Channel A current detected on channel B input, error code 415 is displayed.
   b. Channel B current detected on channel A input, error code 416 is displayed.
   c. Channel A current detected on channel B input and Channel B current detected on channel A input, error code 414 is displayed.
6. The main contactor is closed, each IGBT is on.
   a. Channel A current higher than expected, error code 417 is displayed.
   b. Channel B current higher than expected, error code 418 is displayed.
   c. Current on both channels is higher than expected, error code 419 is displayed.

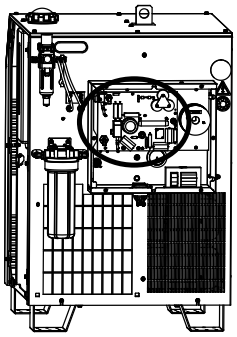
If the chopper test is successful and there are no other severe errors the system will advance to state #3, "Ready for start", otherwise the system will go to state #14 "Shutdown".

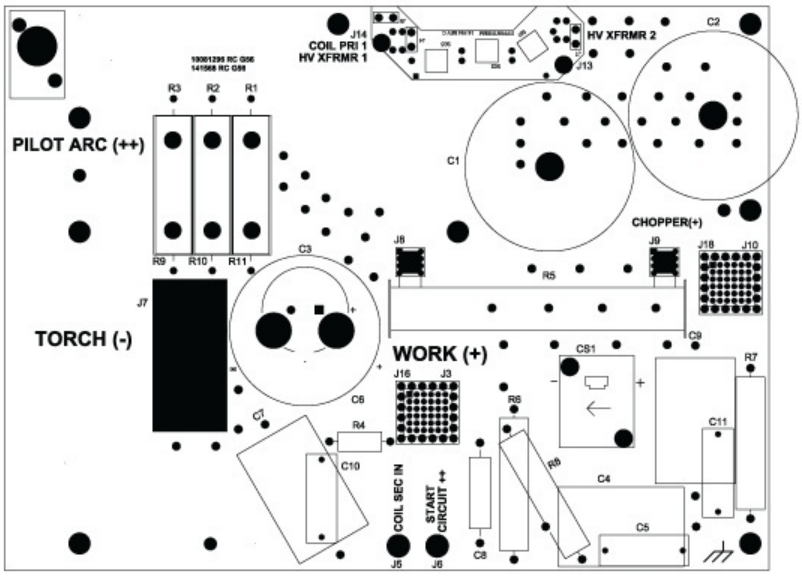
Using a meter to measure open circuit voltage (OCV)

The open circuit voltage (OCV) is 360 VDC with no load on the system and can only be measured when the contactor is closed. The VAC on the chopper bridges are 127 VAC on 1A-1B-1C and 2A-2B-2C.

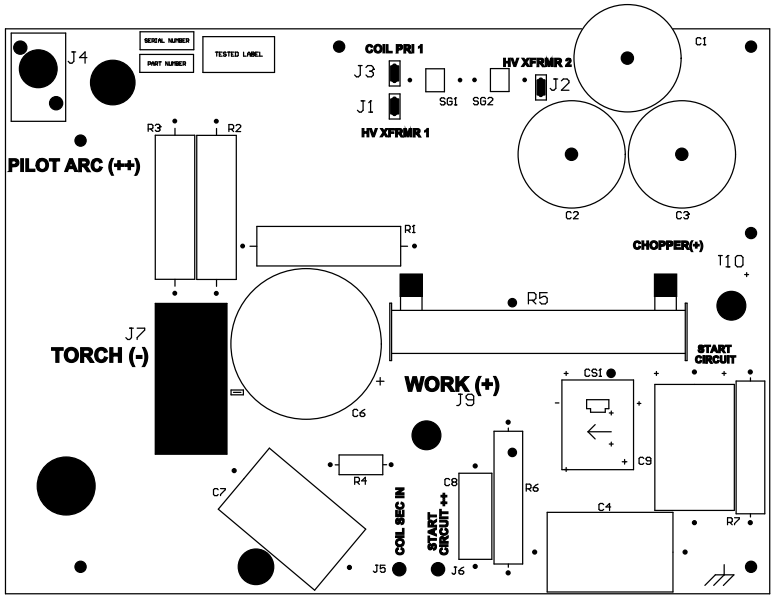
Before you begin: Use clip-on test leads to keep your hands and the meter outside the plasma power supply.

1. Connect the meter to J9 (WORK) and J7 (NEGATIVE) on the I/O board.
2. Turn ON the power to the system.
3. The automatic chopper test will begin when the purge cycle starts. You will hear the main contactor close and 0 to 5 seconds later the meter should show 360 VDC. This is the OCV for chopper channel A. The voltage will start to decrease, then spike back up to 360 VDC again. The second reading represents the OCV for chopper channel B.





1



2

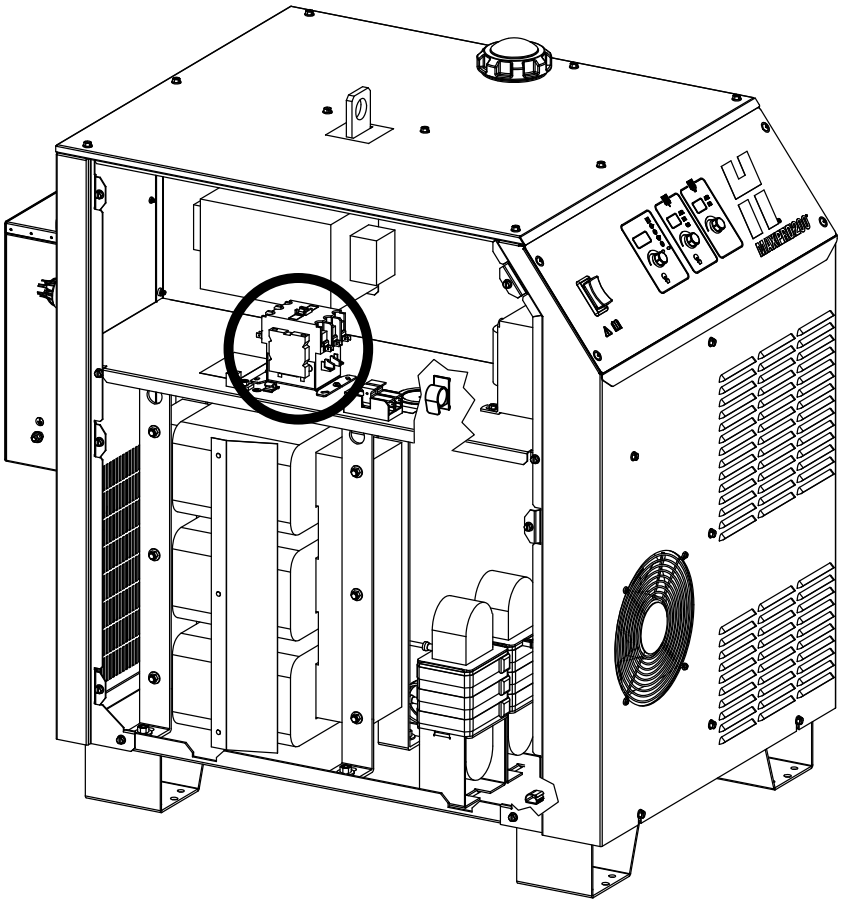
1 Newer style ignition PCB that uses the 141595 kit for replacement spark gaps.

2 Older style ignition PCB that uses the 428041 kit for replacement spark gaps.

Not all systems use the same spark-gap replacement kit. If the ignition PCB in your plasma power supply looks like the first image and contains a removable PCB as shown, use the 141595 kit to replace the spark gaps. If the ignition PCB looks like the second image, use the 428041 kit to replace the spark gaps

Phase loss detection

1. Turn OFF all power to the system and remove the cover from the contactor (CON1).



2. Inspect the condition of the 3 contacts for excessive wear.
3. If one or more of the contacts are worn excessively, replace CON1 and restart the system.

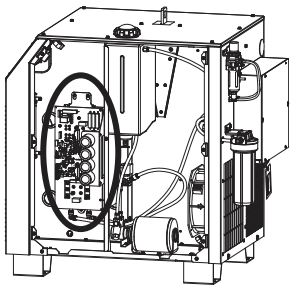


1 Contacts in good condition

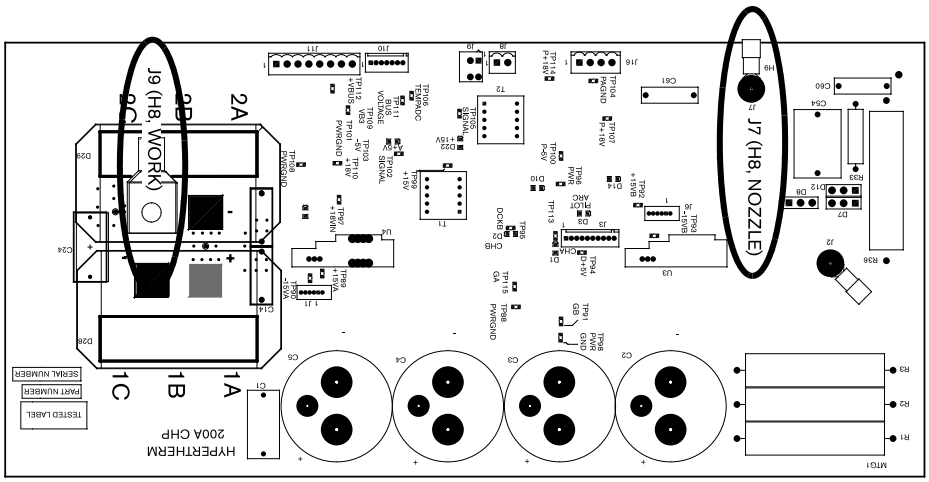
2 Contacts with excessive wear

Do a torch lead test

1. Turn OFF all power to the system.
2. Locate the chopper board.



3. Install a temporary jumper wire between J7 (H9, NOZZLE) and the work lead connection J9 (H8, WORK) on the chopper board.



4. Measure the ohm value between the nozzle and the workpiece for a resistance reading < 4 ohms.

A resistance that is > 4 ohms indicates a faulty connection between the torch and I/O board or between the I/O board and the plasma power supply.

5. Is there damage to the pilot arc wire on the torch lead?

If yes...	Replace the torch lead.
If no...	Replace the torch head.

Preventive maintenance

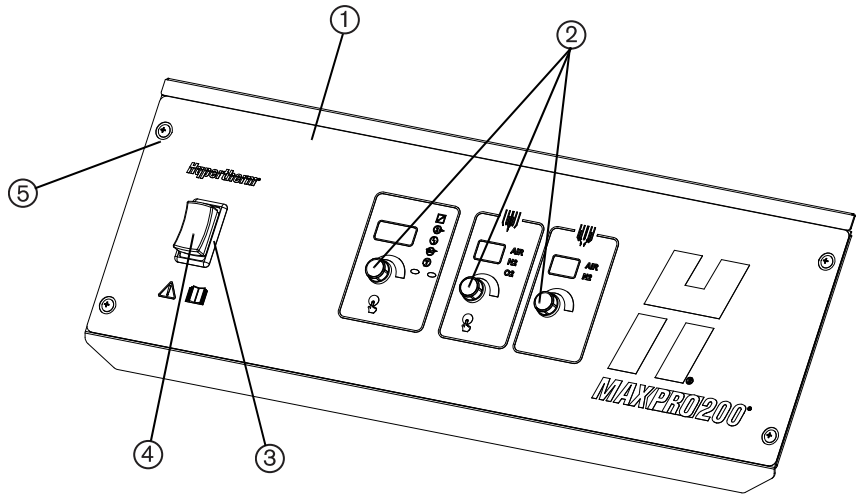
Hypertherm created a Preventive Maintenance Program (PMP) specifically for your plasma system. The PMP has two parts: a cleaning and inspection plan and a component replacement plan.

See the *MAXPRO200 Preventive Maintenance Program Instruction Manual (808800)* for part numbers.

If you have questions about how to maintain your Hypertherm plasma power system, contact your OEM or regional Hypertherm Technical Service team. You can find contact information for each regional office at www.hypertherm.com on the "Contact us" page.

Chapter 5: Parts List

Control panel parts

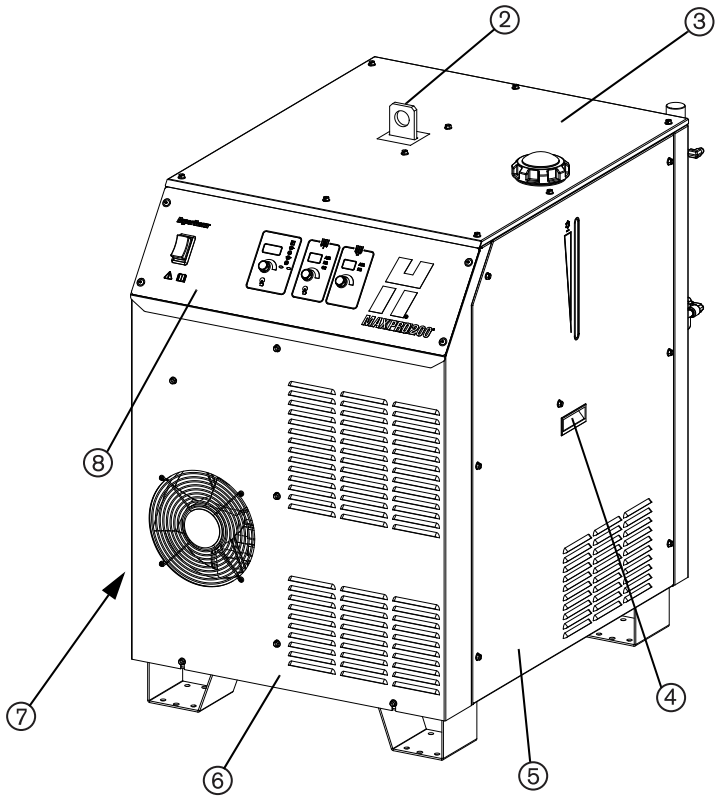


Item	Part Number	Description	Quantity
1	428032	Control panel replacement kit	1
2	108797	Knob: soft black, no pointer	3
3	007050	Rocker switch bezel	1
4	005678	Rocker switch	1
5	075237	Screw (control panel and enclosure panels): 10-32, TORX® T-25	18

Plasma power supply parts 1

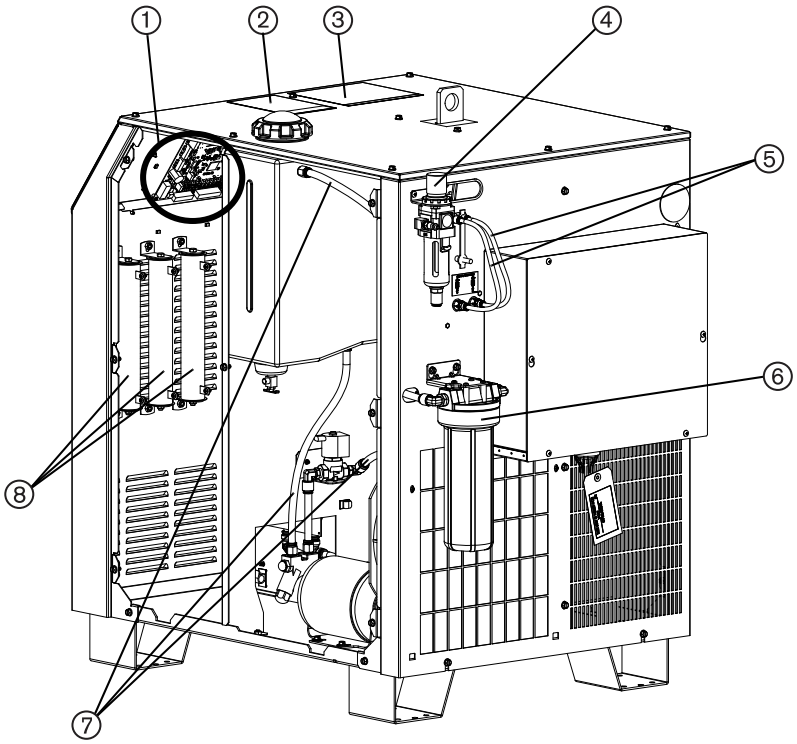
Part number	Voltage (AC)
078610	200/208 volt
078611	220 volt
078612	240 volt
078613	380 volt
078614	400 volt
078615	415 volt
078616	440 volt
078609	480 volt
078617	600 volt

Plasma power supply parts 2



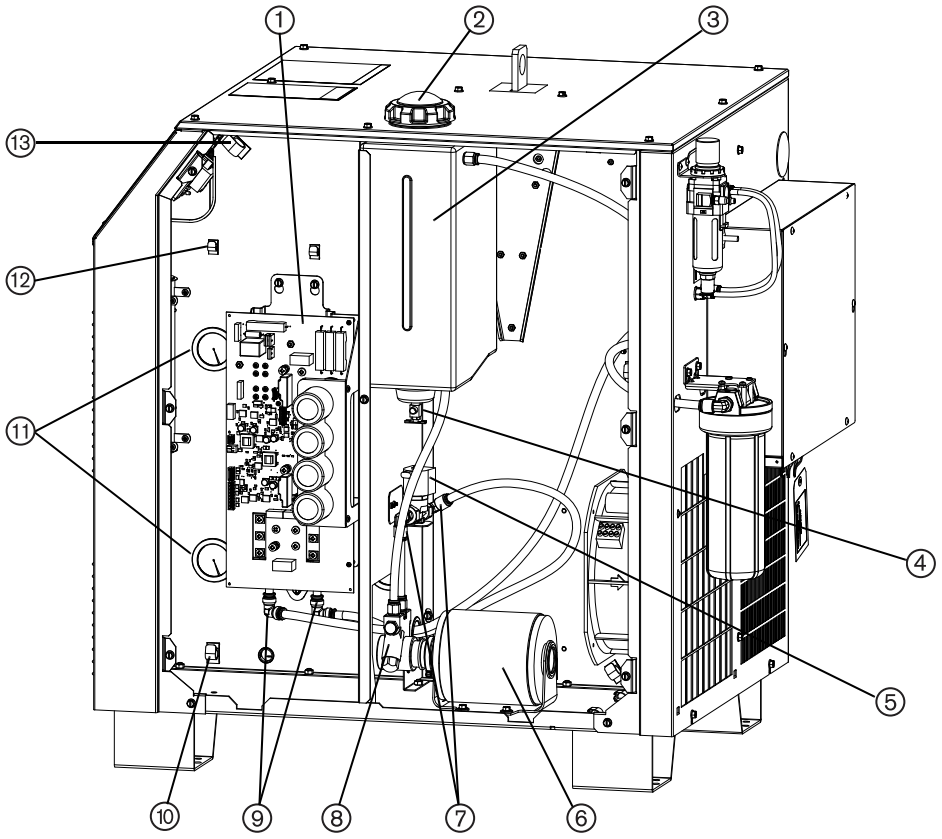
Item	Part Number	Description	Quantity
1	See Plasma power supply parts 1 on page 233.	Plasma power supply	1
2	428033	Lift eye replacement kit	1
3	428031	Top panel replacement kit	1
4	027967	Handle: side panels	2
5	428029	Right side panel replacement kit	1
6	101188	Front panel	1
7	428030	Left side (not shown) panel replacement kit	1
8	428032	Control panel replacement kit	1
Not shown	10087757	Rear-panel replacement kit	1
Not shown	428035	Optional caster (wheel) kit	1

Plasma power supply parts 3



Item	Part Number	Description	Quantity
1	141171	Control Board	1
2	110261	Label: Warning instant start	1
3	010298	Label: Warnings	1
4	011114	Air filter/regulator: 7-125 psi, 1/4 inch, auto drain with valve	1
	011093	Air filter element	1
5	228862	Gas hoses kit (not all hoses shown)	1
6	428038	Coolant filter replacement kit	1
	027005	Coolant filter element	1
7	228861	Coolant hose kit (not all hoses shown)	1
8	109377	Resistor: 1 ohm, 500 watts	3

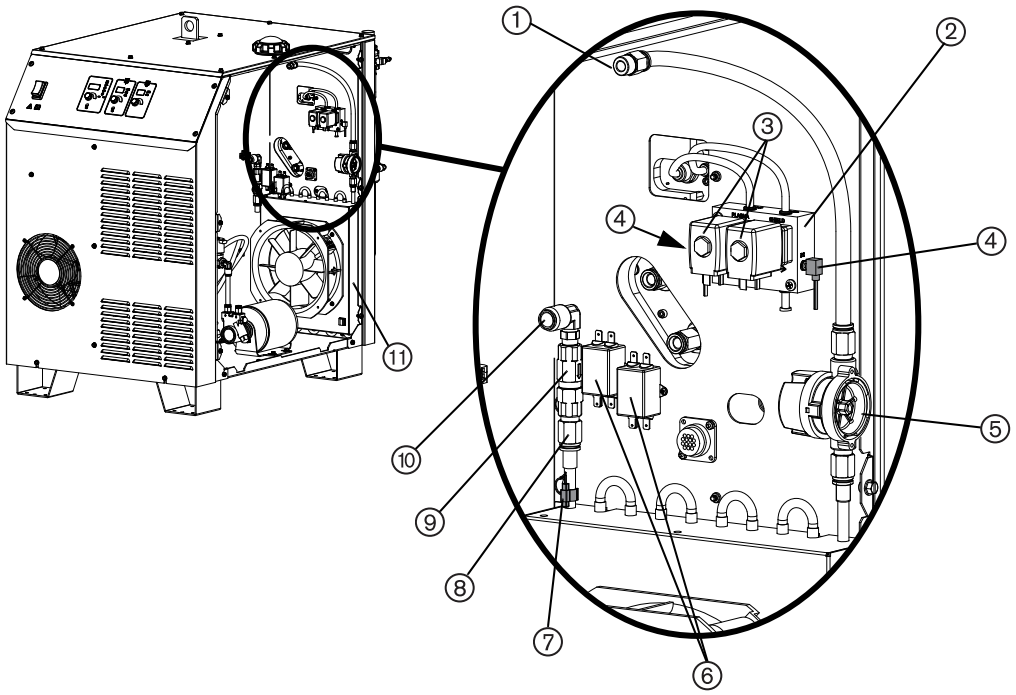
Plasma power supply parts 4



Item	Part Number	Description	Quantity
1	428036	Chopper replacement kit	1
2	127014	Coolant reservoir cap	1
3	002546	Coolant reservoir	1
4	006099	Coolant drain valve	1
5	228993	Coolant solenoid valve replacement kit	1
6	428039	Pump motor replacement kit	1
7	015665	Fitting: male elbow, 3/8 inch NPT x 1/2 inch push-in tube	2
8	428043	Pump replacement kit	1
9	015815	Fitting: elbow, 1/2 inch x 1/2 inch push-in tube, brass	2
10	074354	Cable holder: for 1/2 inch diameter cable	17

Item	Part Number	Description	Quantity
11	104407	Bushing: dust seal	6
12	074353	Cable holder: for 1/4 inch diameter cable	10
13	074355	Cable holder: for 3/4 inch diameter cable	10

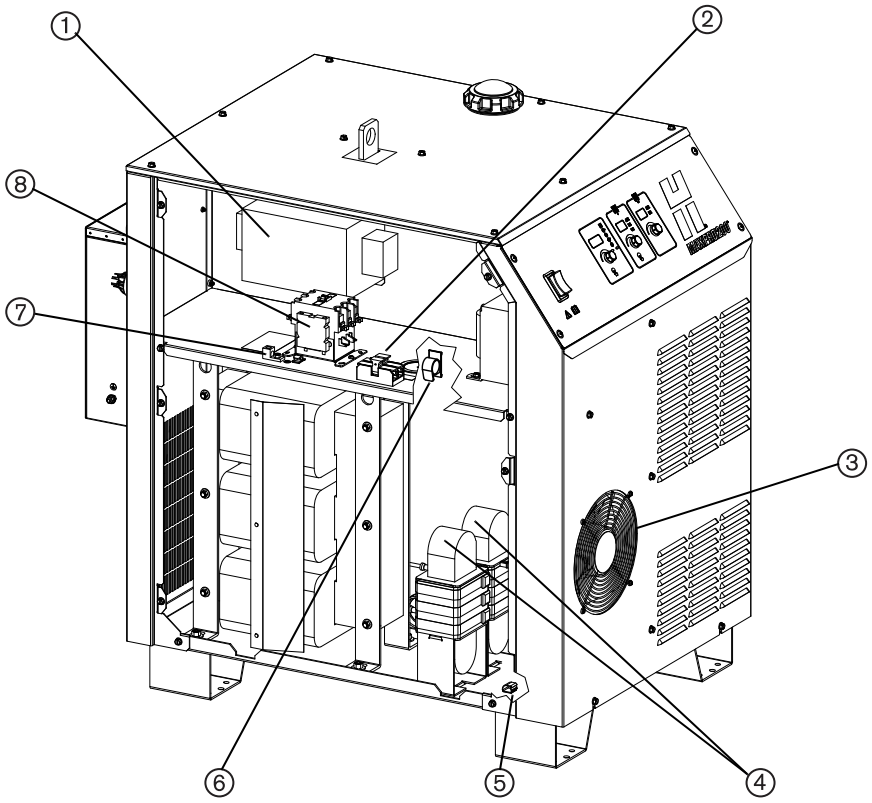
Plasma power supply parts 5



Item	Part Number	Description	Quantity
1	015669	Male connector 3/8 inch NPT x 1/2 inch	7
2	428034	Gas manifold replacement kit	1
3	006128	Solenoid valve	2
4	428042	Pressure transducer replacement kit	2
5	428037	Flow meter replacement kit	1
6	109636	EMI filter: 250 VAC, 1 amp, 1 phase	2
7	229474	Thermistor: 3/8 inch diameter, copper pipe clip with connector	1

Item	Part Number	Description	Quantity
8	015663	Male connector 1/4 inch NPT x 1/2 inch tube	1
9	006075	Check valve	1
10	015664	Male elbow 1/4 inch NPT x 1/2 inch push-in tube	1
11	229482	Heat exchanger (with fan)	1
	127091	Heat exchanger fan only	1

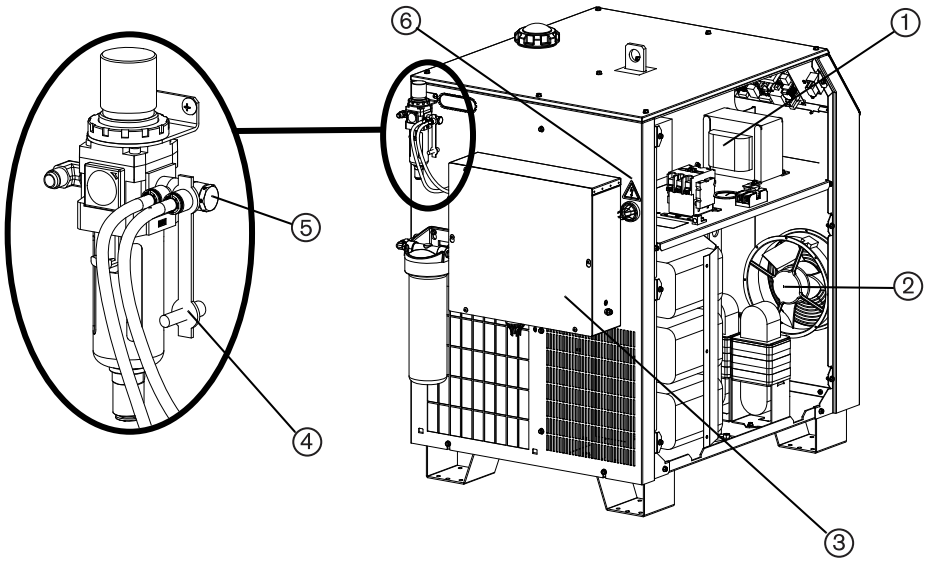
Plasma power supply parts 6



Item	Part Number	Description	Quantity
1	209177	EMI filter, 400V and 415V power supplies	
2	008301	Fuse holder	1
	108571	Fuse holder cover	1

Item	Part Number	Description	Quantity
	110513	Fuse label: F1-F2	1
	008551	Fuse: 7.5 amp, 600 volt: 380V, 400V, 415V, 440V, 480V, and 600V power supplies	2
	008709	Fuse: 20 amp, 500 volt: 200/208V, 220V, and 240V power supplies	2
3	027567	Fan guard	1
4	014373	Inductor	2
5	074212	Cable holder: self sticking, for 1/2 inch diameter cable	5
6	074356	Cable holder: for 1.0 inch diameter cable	5
7	108671	Terminal block: 14 AWG - 2/0	1
8	003249	Contactor: 380V, 400V, 415V, 440V, 480V, and 600V power supplies	1
	003233	Contactor: 200/208V, 220V, and 240V power supplies	1
	228309	Transformer thermistor (not shown)	1

Plasma power supply parts 7

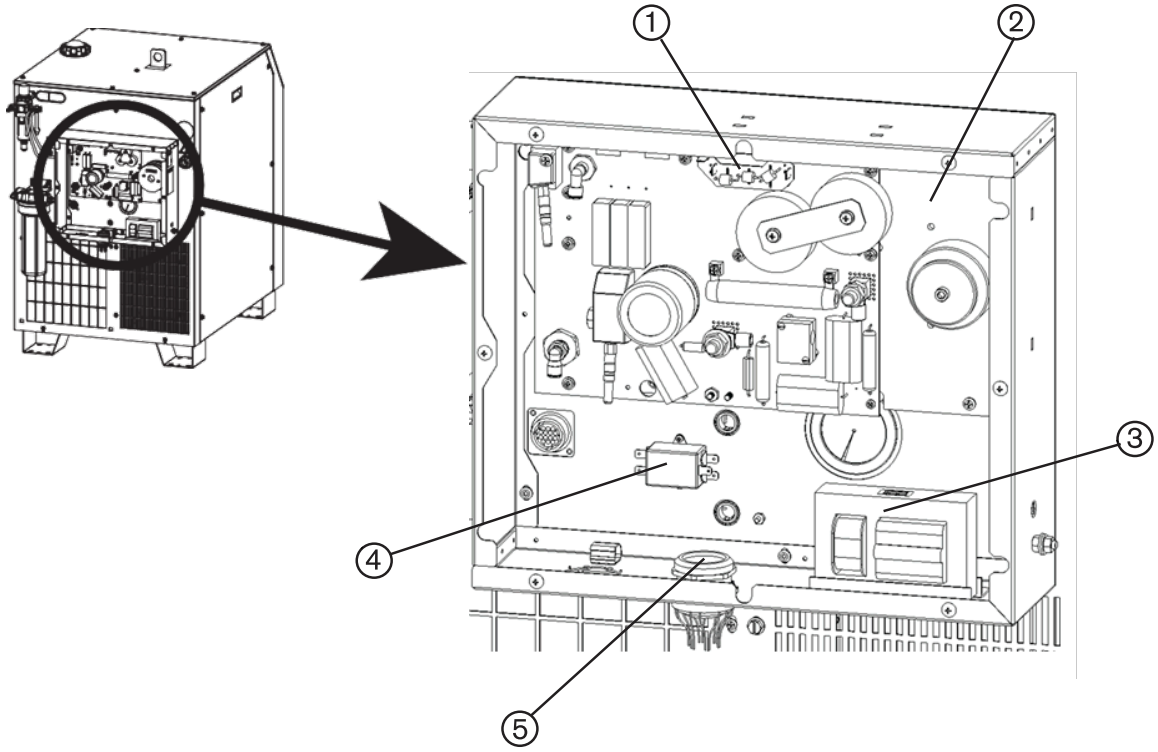


Item	Part Number	Description	Quantity
1	See Table 37 on page 240	Control transformer	1
2	027079	Fan: 450-550 cfm, 120 VAC 50-60 Hz	1
3	101205	Ignition enclosure panel (ignition)	1
4	428044	Inlet gas-plug replacement kit	1
5	015812	Adaptor:1/4 inch NPT O-ring x 5/16 inch	1
6	010875	Label: Danger voltage	1
Not shown	008482	Power cord strain relief (380 V, 400 V, 415 V, 440 V, 480 V, and 600 V plasma power supplies)	1
Not shown	008052	Power cord strain relief (200 V/208 V, 220 V, and 240 V plasma power supplies)	1
Not shown	428054	MAXPRO200 Oxygen fitting kit	1
Not shown	015015	Adapter: 1/4 inch NPT, #6, Male, 90 degree	1
Not shown	015817	Adapter: 3/8 inch FNPT x 1/2 inch push-in tube	1

Table 37 - Control transformers

Part number	Description	Part number	Description
229535	200 volt, 50-60 Hz	229538	415 volt, 50-60 Hz
229536	220 volt, 50-60 Hz	229539	440 volt, 50-60 Hz
229537	240 volt, 60 Hz	229488	480 volt, 60 Hz
229514	380 volt, 50 Hz	229540	600 volt, 50-60 Hz
229515	400 volt, 50 Hz		

Ignition enclosure parts



Item	Part Number	Description	Quantity
1	141595*	Replacement spark gap PCB	1
2	428041	I/O panel replacement kit (includes PCB)	1
3	229487	Ignition transformer	1
4	109636	EMI filter	1
5	008482	Work lead strain relief (380V, 400V, 415V, 440V, 480V, and 600V plasma power supplies)	1
	008052	Work lead strain relief (200 V/208V, 220V, and, 240V plasma power supplies)	1

Not all systems use the same spark-gap replacement kit. If the ignition PCB in your plasma power supply looks like the image that is shown and has a removable PCB, use the 141595 kit to replace the spark gaps. If the ignition PCB looks different, use the 428041 kit to replace the spark gaps.

Height control connection kits

Sensor THC connection kit - 428023



This kit should only be ordered when purchasing a Sensor THC torch height control and a Hypertherm CNC that is shipped with a voltage divider card (packaged separately from the CNC). If you only need the voltage divider card order part number 141201.

The kit contains two wire groups (229554 and 229602). A CNC interface cable is not supplied. The desired length should be ordered separately.

Sensor PHC connection kit - 428022

The kit contains a PHC plasma interface assembly (228256) with a 1.3 m (5 feet) interface cable attached. A CNC interface cable is not supplied. The desired length should be ordered separately.

Remote-start pendant

Part Number	Description
428061	Remote-start pendant for MAXPRO200, 7.5 m (25 feet)
428062	Remote-start pendant for MAXPRO200, 15 m (50 feet)

Wire groups and harnesses

Part Number	Description
229437	Main wire harness: all power supplies
229438	Primary power wire group for 380V, 400V, 415V, 440V, 480V, and 600V power supplies
229439	EMI filter wire group for 400V and 415V power supplies
229558	Contactor wire adaptors
229561	Primary power wire group for 200/208V, 220V, and 240V power supplies

USB cables for software updates

Cable for USB update - 223291

This cable allows the system software to be upgraded using a USB memory stick.



Cable for USB update - 223273

This cable allows the system software to be upgraded using a laptop.



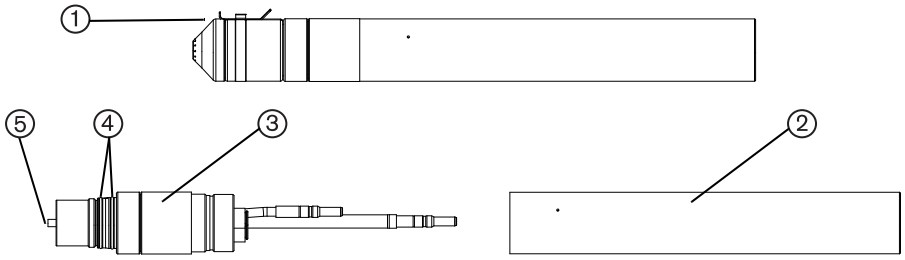
Plasma power supply gas hose kit - 228862

The kit contains:

Part Number	Description	Length
046077	Tubing: 1/4 inch OD, blue	1 foot
046078	Tubing: 1/4 inch OD, black	1 foot
046231	Tubing: 5/16 inch OD, black	2 feet

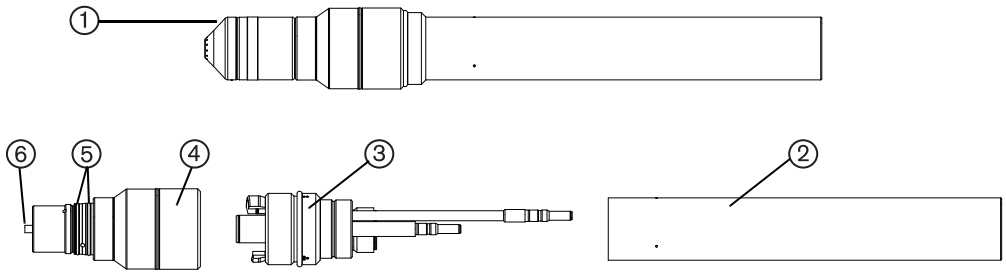
Machine torches

Straight torch



Item	Part Number	Description	Quantity
1	428024	Machine torch assembly with 2.0 inch mounting sleeve	1
	228937	Machine torch assembly with 1-3/4 inch mounting sleeve	1
2	220943	Torch Mounting sleeve: 2 inch	1
	220942	Torch Mounting sleeve: 1-3/4 inch	1
3	420087	Straight torch main body	1
4	044026	O-ring: 1.239 inch x 0.070 inch	2
5	220521	Water tube	1

Quick-disconnect torch



Item	Part Number	Description	Quantity
1	428027	Quick-disconnect torch assembly with 2.0 inch mounting sleeve	1
	428028	Quick-disconnect torch assembly with 1-3/4 inch mounting sleeve	1
2	220943	Torch Mounting sleeve: 2 inch	1
	220942	Torch Mounting sleeve: 1-3/4 inch	1
3	420033	Quick-disconnect torch receptacle	1
4	220921	Quick-disconnect torch main body	1
5	044026	O-ring: 1.239 inch x 0.070 inch	2
6	220521	Water tube	1

Leads and cables

Machine torch leads

Part number	Length
229477	7.5 m (25 feet)
229478	15 m (50 feet)
229479	23 m (75 feet)
229480	30 m (100 feet)

CNC cables

Part Number	Length
223327	1.3 m (5 feet)
223328	3.0 m (10 feet)
223329	7.5 m (25 feet)
223330	15 m (50 feet)
223331	23 m (75 feet)
223332	30 m (100 feet)

Work leads

Part number	Length
223335	7.5 m (25 feet)
223336	15 m (50 feet)
223337	23 m (75 feet)
223338	30 m (100 feet)

Work clamp

Part Number	Description
008539	Ground clamp

Hand torch leads

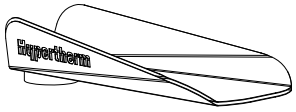
Part number	Length
229498	7.5 m (25 feet)
229499	15 m (50 feet)
229500	23 m (75 feet)
229501	30 m (100 feet)

Inline valve kit

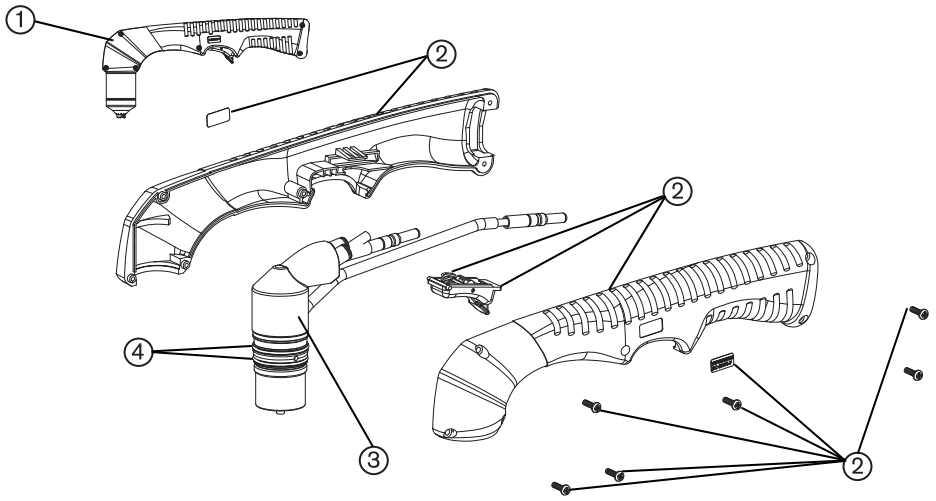
Part Number	Description
428055	Replacement for the valve located in the torch lead

Hand torch heat shield - 127389

Hand torch heat shield – 127389

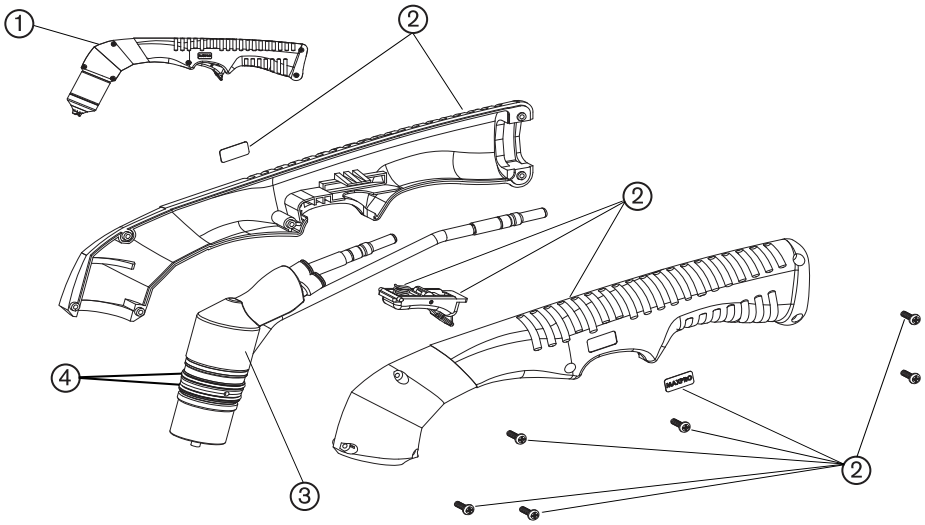


90-degree hand torch



Item	Part Number	Description	Quantity
1	420108	90 degree hand torch assembly	1
	228980	90 degree hand torch assembly with 7.5 m (25 feet) lead	1
	228981	90 degree hand torch assembly with 15 m (50 feet) lead	1
	228982	90 degree hand torch assembly with 23 m (75 feet) lead	1
	228983	90 degree hand torch assembly with 30 m (100 feet) lead	1
2	228985	Handle replacement kit	1
	001905	90 degree torch handle (left and right sides)	1
	002244	Safety trigger	1
	027254	Safety trigger spring	1
	075841	Pan head screws	6
	210185	Hand torch label	1
	210209	Hypertherm IEC label	1
3	420070	Torch main body	1
4	044026	O-ring: 1.239 inch x 0.070 inch	2

65-degree hand torch



Item	Part Number	Description	Quantity
1	420107	65 degree hand torch assembly	1
	228976	65 degree hand torch assembly with 7.5 m (25 feet) lead	1
	228977	65 degree hand torch assembly with 15 m (50 feet) lead	1
	228978	65 degree hand torch assembly with 23 m (75 feet) lead	1
	228979	65 degree hand torch assembly with 30 m (100 feet) lead	1
2	228986	Handle replacement kit	1
	001906	65 degree torch handle (left and right sides)	1
	002244	Safety trigger	1
	027254	Safety trigger spring	1
	075841	Pan head screws	6
	210184	Hand torch label	1
	210209	Hypertherm IEC label	1
3	420109	Torch main body	1
4	044026	O-ring: 1.239 inch x 0.070 inch	2

Consumable parts kits

Mechanized torch consumable kit - 428013

Part number	Description	Quantity
020415	Electrode: 200A and 130A, N_2	2
027055	Silicone lubricant: 1/4 ounce tube	1
044026	O-ring: 1.239 x 0.070	2
104119	Consumable tool	1
220487	Electrode: 130 A, O_2/Air	4
220488	Swirl ring: 130 A, O_2/Air and 200 A, Air	2
220491	Shield:130 A, O_2	1
220521	Water tube	1
220528	Electrode 50 A, O_2/Air	4
220529	Swirl ring: 50 A, O_2/Air and 130A or 200A, N_2	1
220532	Shield: 50A, O_2/Air	1
220536	Shield:130A, Air/N_2	1
220831	Nozzle: 200A, O_2	2
220832	Shield: 200A, O_2	1
220834	Swirl ring: 200A, O_2	1
220890	Nozzle: 50A, Air	2
220891	Nozzle: 50A, O_2	2
220892	Nozzle: 130A, Air/N_2	2
220893	Nozzle: 130A, O_2	2
220935	Shield cap: O_2/Air/N_2, clockwise	1
220936	Shield cap: O_2/Air/N_2, clockwise, with IHS tab	1
220937	Electrode: 200, O_2/Air	6
420044	Nozzle: 200A, Air/N_2	6

Part number	Description	Quantity
420045	Shield: 200A, Air/N_2	2
428054	MAXPRO200 Oxygen fitting kit	1
881430	MAXPRO200 machine torch brochure	1

Extreme bevel consumable kit - 528058

Part number	Description	Quantity
420823	Water tube: MAXPRO200 Extreme bevel	1
420732	Electrode: 200A Air/O_2 Extreme bevel	6
420824	Electrode: 130A Air/O_2 Extreme bevel	2
220488	Swirl ring: 200A	1
220529	Swirl ring: 130A	1
420734	Nozzle: 200A, Air Extreme bevel	3
420733	Nozzle: 200A, O_2, Extreme bevel	3
420829	Nozzle: 130A, Air Extreme bevel	1
420828	Nozzle: 130A, O_2 Extreme bevel	1
420737	Shield: 200A, Air/O_2 Extreme bevel	3
420735	Shield: 130A, Air/O_2 Extreme bevel	1
220935	Shield cap: O_2/Air/N_2, clockwise	1
220936	Shield cap: O_2/Air/N_2, clockwise, with IHS tab	1
027055	Silicone lubricant: 1/4 ounce tube	1
104119	Consumable tool	1
428054	MAXPRO200 Oxygen fitting kit	1
811270	MAXPRO200 Extreme bevel cut charts	1

Hand torch consumable kit - 428014

Part number	Description	Quantity
027055	Silicone lubricant: 1/4 ounce tube	1
044026	O-ring: 1.239 x 0.070	2
104119	Consumable tool	1
220488	Swirl ring: 130A, O_2/Air and 200 A, Air	2
220521	Water tube	1
220831	Nozzle: 200A, O_2	2
220834	Swirl ring: 200A, O_2	1
220935	Shield cap: O_2/Air/N_2, clockwise	2
220937	Electrode: 200A, O_2/Air	8
420044	Nozzle: 200A, Air/N_2	4
420058	Shield: 200A, Air/N_2	2
420059	Shield: 200A, O_2	1
420066	Nozzle: 200A, Air, Gouging	2
420067	Shield: 200A, Air, Gouging	2
428054	MAXPRO200 Oxygen fitting kit	1
881440	MAXPRO200 hand torch brochure	1

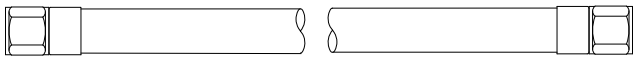
Supply gas hoses

NOTICE

PTFE TAPE CAN CAUSE CLOGGED VALVES, REGULATORS, AND TORCHES

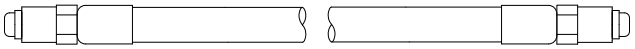
Never use PTFE tape on any joint preparation. Use only a liquid or paste thread sealant on male thread ends.

Oxygen



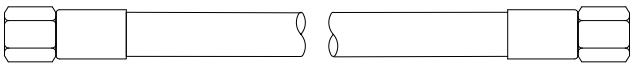
Part number	Length	Part number	Length
024607	3 m (10 ft)	024738	25 m (82 ft)
024204	4.5 m (15 ft)	024450	35 m (115 ft)
024205	7.5 m (25 ft)	024159	45 m (150 ft)
024760	10 m (35 ft)	024333	60 m (200 ft)
024155	15 m (50 ft)	024762	75 m (250 ft)
024761	20 m (65 ft)		

Nitrogen



Part number	Length	Part number	Length
024210	3 m (10 ft)	024739	25 m (82 ft)
024203	4.5 m (15 ft)	024451	35 m (115 ft)
024134	7.5 m (25 ft)	024120	45 m (150 ft)
024211	10 m (35 ft)	024124	60 m (200 ft)
024112	15 m (50 ft)	024764	75 m (250 ft)
024763	20 m (65 ft)		

Air



Part number	Length	Part number	Length
024671	3 m (10 ft)	024740	25 m (82 ft)
024658	4.5 m (15 ft)	024744	35 m (115 ft)
024659	7.5 m (25 ft)	024678	45 m (150 ft)
024765	10 m (35 ft)	024680	60 m (200 ft)
024660	15 m (50 ft)	024767	75 m (250 ft)
024766	20 m (65 ft)		

Recommended spare parts

Part number	Description	Quantity
003233	Contactor: 200/208V, 220V, and 240V power supplies	1
003249	Contactor: 380V, 400V, 415V, 440V, 480V, and 600V power supplies	1
011093	Air filter element	1
027005	Coolant filter element	1
027055	Silicone lubricant: 1/4 ounce tube	1
027079	Fan: 450-550 cfm, 120 VAC 50-60 Hz	1
028872	Coolant solution, 70/30 PG, 1 gallon	4
127091	Heat exchanger fan	1
141171	Control Board	1
220921	Quick-disconnect torch main body	1
220942	Torch Mounting sleeve: 1-3/4 inch	1
220943	Torch Mounting sleeve: 2 inch	1
420033	Quick-disconnect torch receptacle	1
420070	90 degree torch main body	1
420087	Straight torch main body	1
420109	65 degree torch main body	1
428034	Gas manifold replacement kit	1
428035	Castor wheel kit	1
428036	Chopper replacement kit	1
428037	Flow meter replacement kit	1
428038	Coolant filter replacement kit	1
428039	Pump motor replacement kit	1
141595	Replacement spark gap PCB	1
428041	I/O panel replacement kit (includes PCB)	1
428042	Pressure transducer replacement kit	1
428043	Pump replacement kit	1

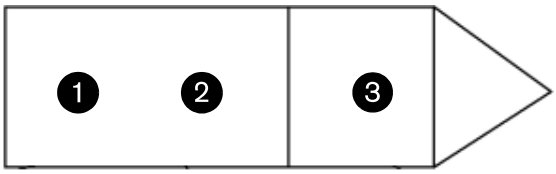
Part number	Description	Quantity
428044	Inlet gas-plug replacement kit	1
428054	MAXPRO200 Oxygen fitting kit	1
428055	In-line valve replacement kit	1

Chapter 6: Wiring Diagrams

MAXPRO200 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 corner of each page.
- References to other pages use the following connection symbol.



1 Approximate location of sheet number (4 is an example)

2 Approximate location of sheet coordinates (D3 is an example)

3 Approximate location of reference block (C is an example)

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).

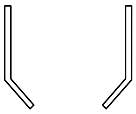
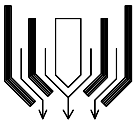
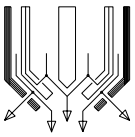
Table 38 - Wiring diagram symbols

	Battery		Ground clamp		Receptacle
	Cap, polarized		Ground, chassis		Relay, coil
	Cap, not polarized		Ground, earth		Relay, normally closed
	Cap, feed-through		IGBT		Relay, normally open
	Circuit breaker		Inductor		Relay, solid state, AC
	Coax shield		LED		Relay, solid state, DC
	Current sensor		Lamp		Relay, solid state
	Current sensor		MOV		Resistor
	DC supply		Pin		SCR
	Diode		Socket		Shield
	Door interlock		Plug		Shunt
	Fan		PNP transistor		Spark gap
	Feed-through LC		Potentiometer		Switch, flow
	Filter, AC		Push button, normally closed		Switch, level, normally closed
	Fuse		Push button, normally open		Switch, pressure, normally closed
	Switch, pressure, normally open		Time delay open, NO/off		Valve, solenoid

Table 38 - Wiring diagram symbols (continued)

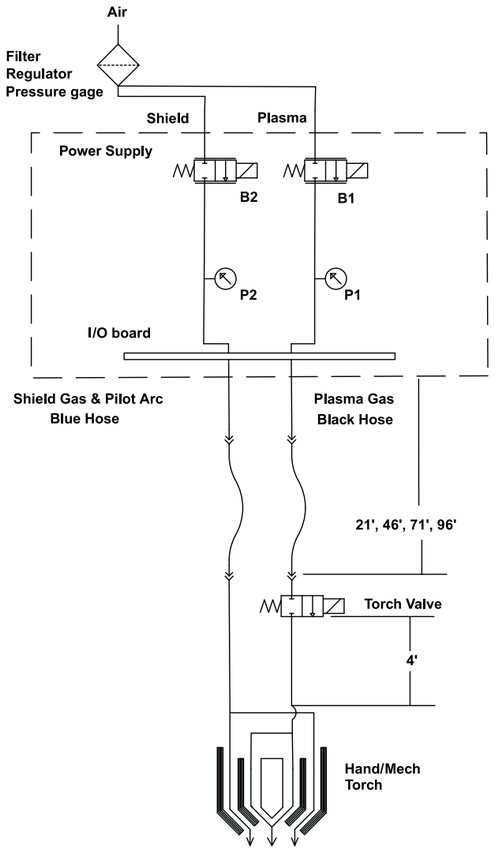
	Switch, 1 pole, 1 throw		Time delay open, NC/on		Voltage source
	Switch, 1 pole, 2 throw		Time delay closed, NO/off		Zener diode
	Switch, 1 pole, 2 throw, center off		Transformer		
	Switch, temperature, normally closed		Transformer, air core		
	Switch, temperature, normally open		Transformer, coil		
	Terminal block		Triac		
	Time delay closed, NC/off		VAC source		

Table 39 - Torch symbols

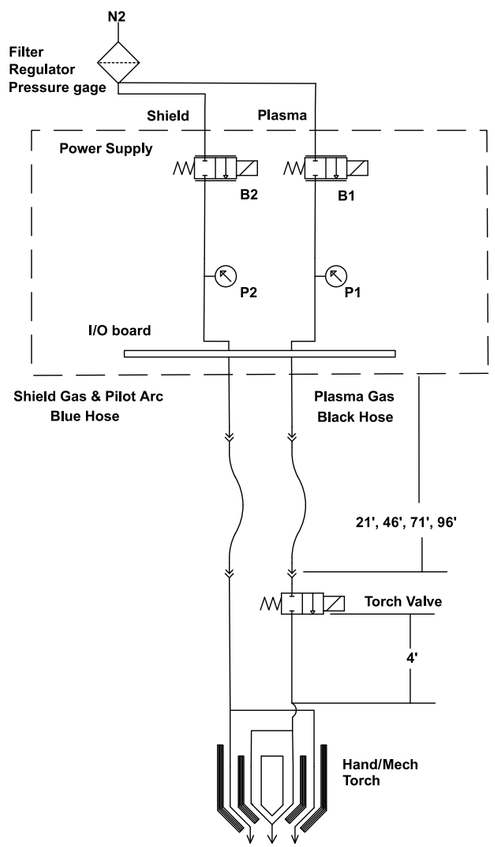
	Electrode
	Nozzle
	Shield
	Torch
	Torch, HyDefinition®

Gas schematic

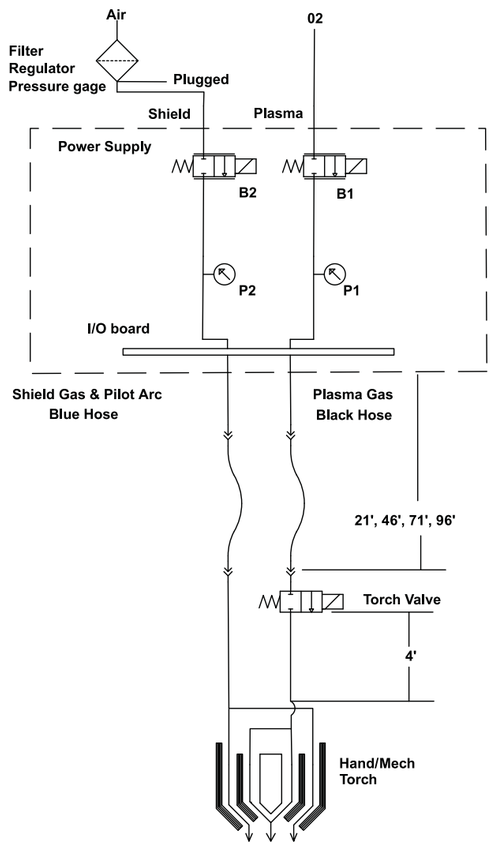
Air/Air



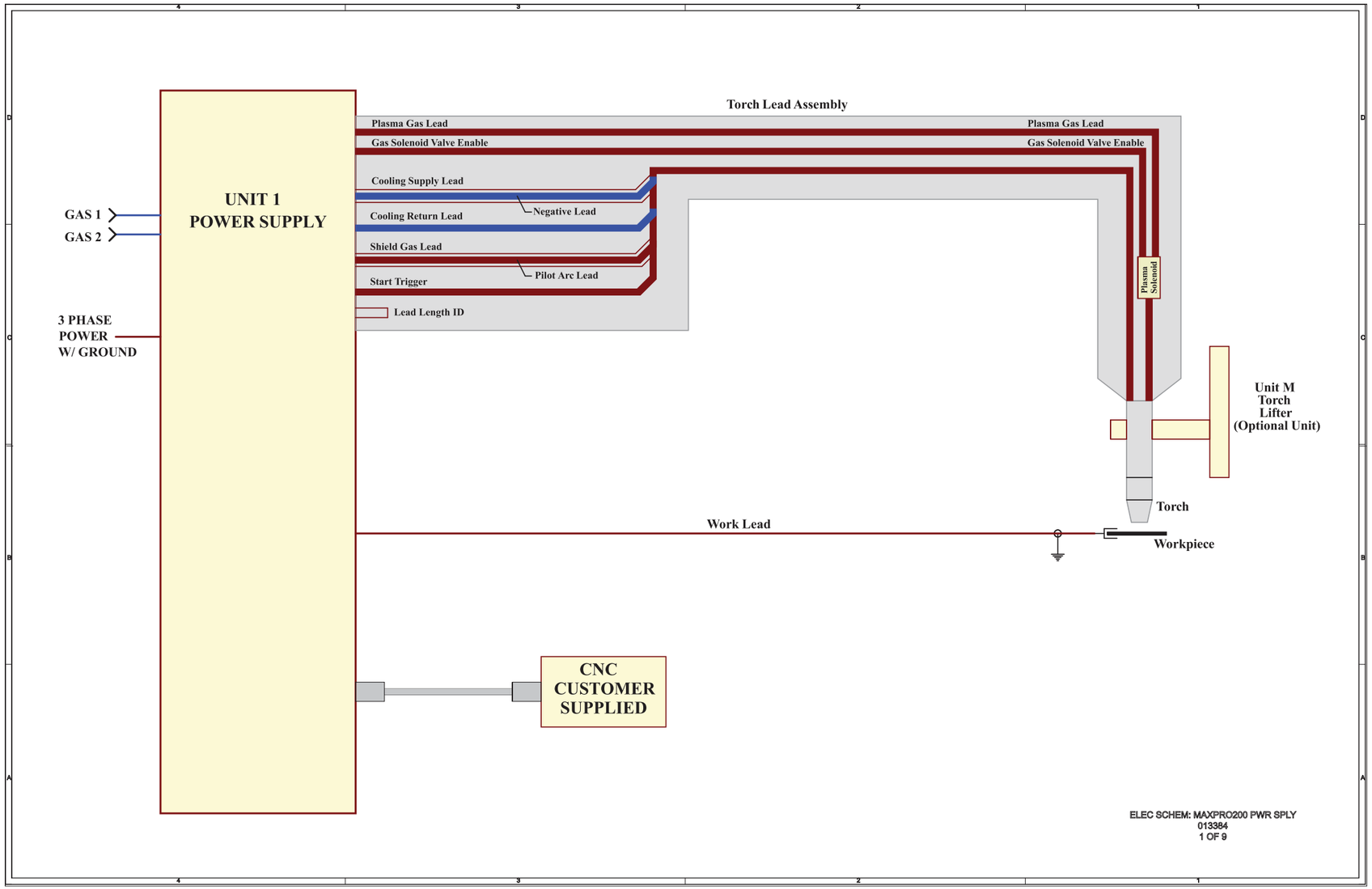
N2/N2



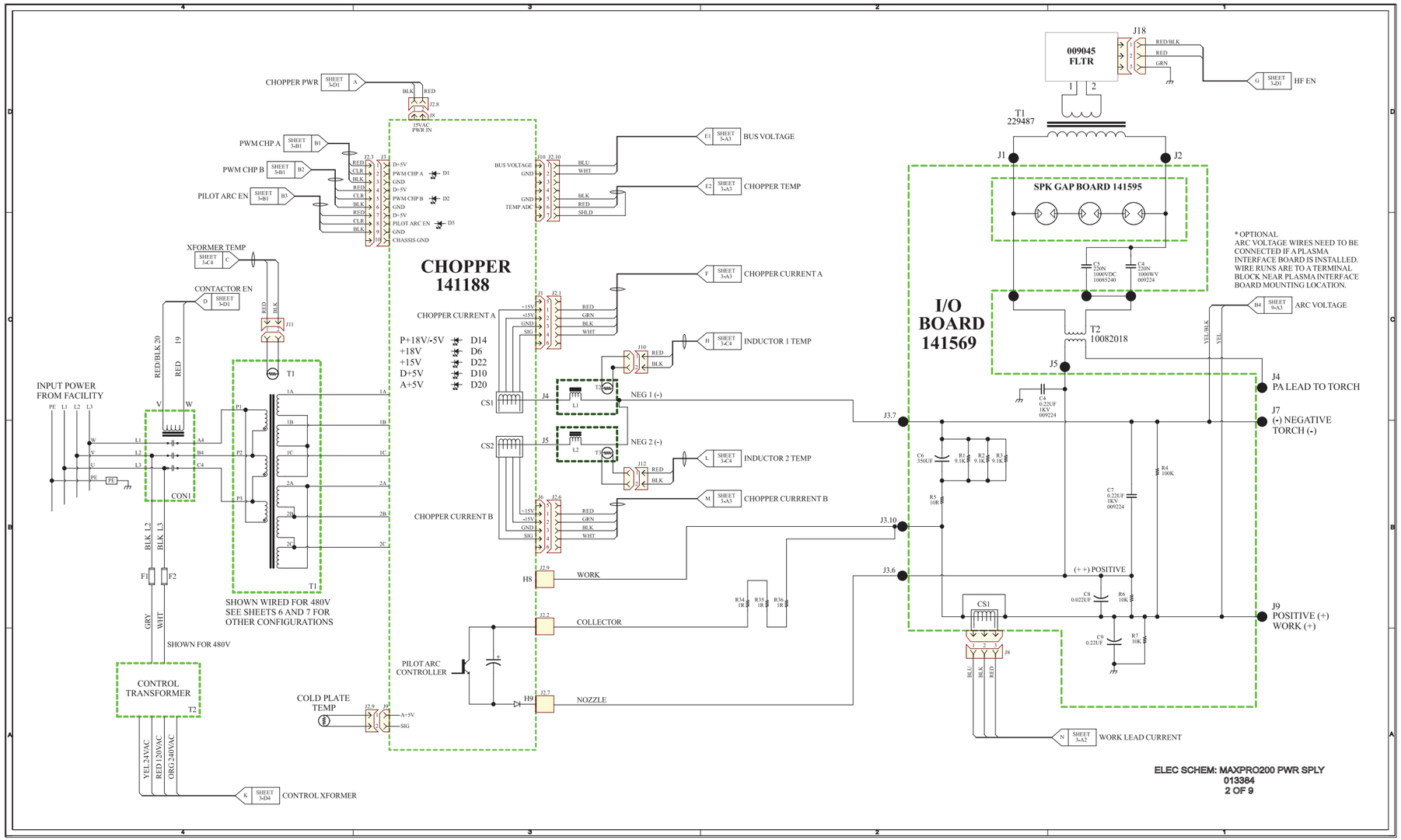
O2/AIR



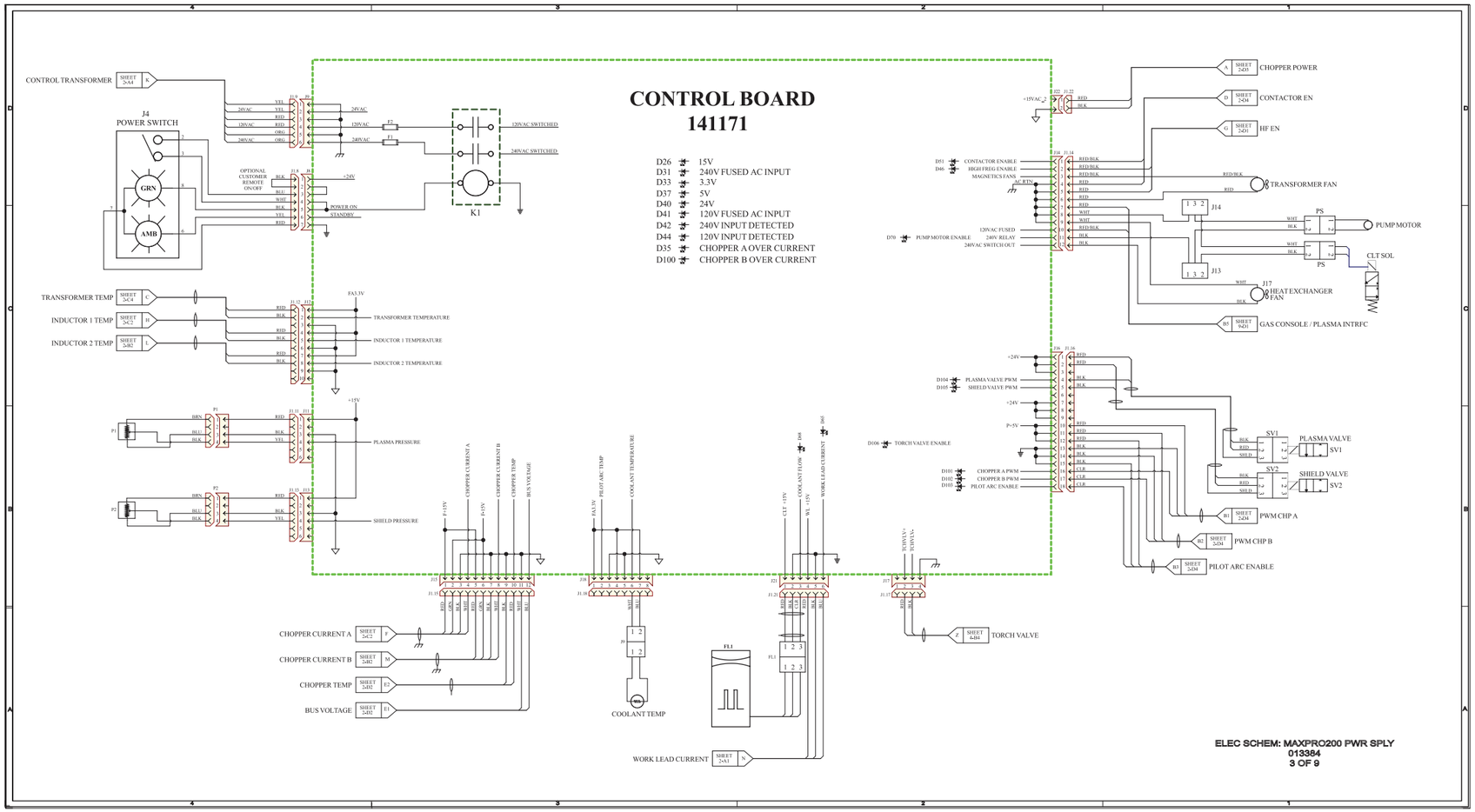
Sheet 1 of 9


Torch Lead Assembly
Plasma Gas Lead
Gas Solenoid Valve Enable
Cooling Supply Lead
Cooling Return Lead
Shield Gas Lead
Start Trigger
Lead Length ID
Negative Lead
Pilot Arc Lead
Plasma Gas Lead
Gas Solenoid Valve Enable
Plasma Solenoid
GAS 1
GAS 2
3 PHASE POWER W/ GROUND
UNIT 1 POWER SUPPLY
Unit M Torch Lifter (Optional Unit)
Torch
Work Lead
Workpiece
CNC CUSTOMER SUPPLIED
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
1 OF 9

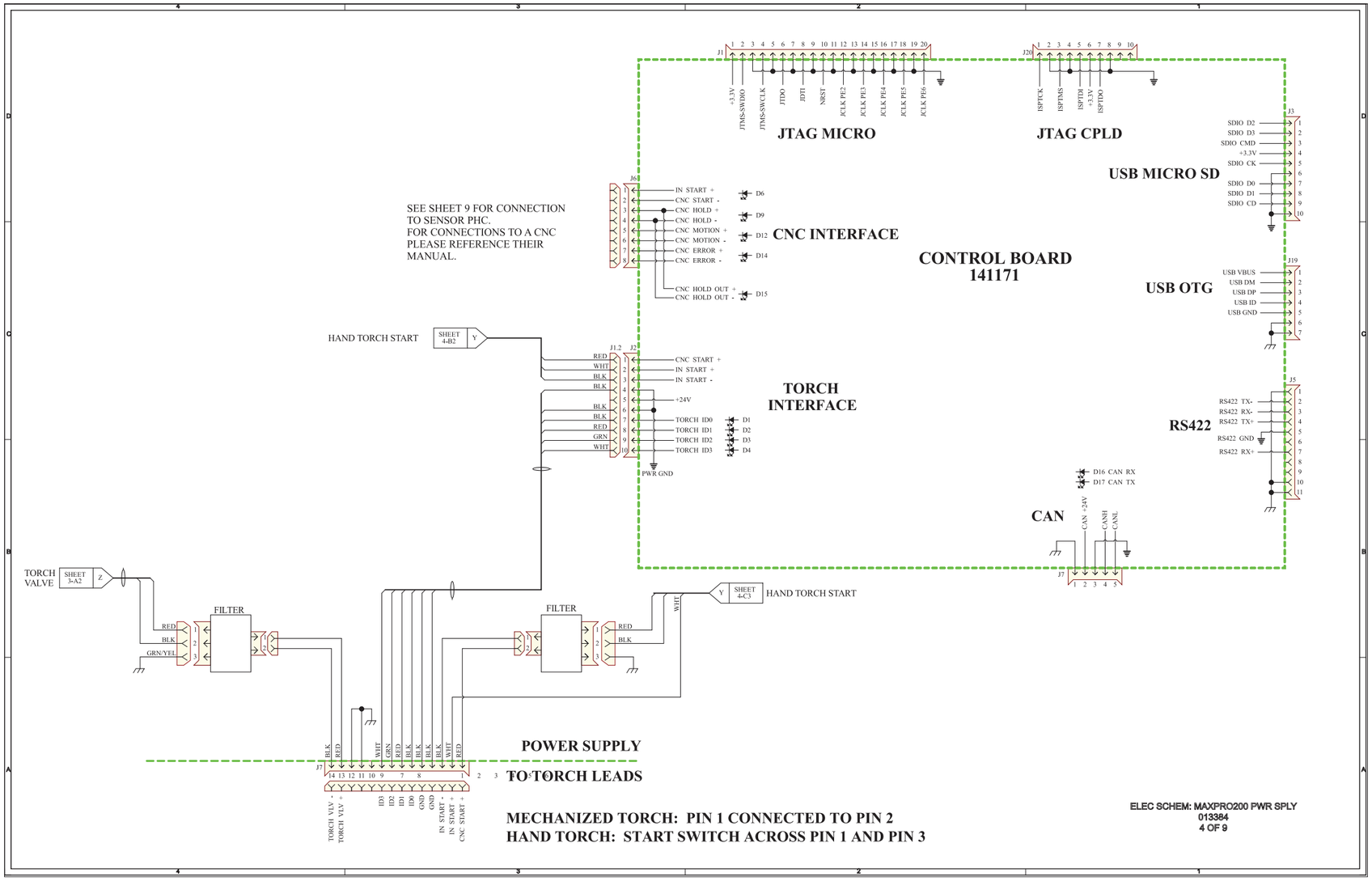
Sheet 2 of 9


CHOPPER PWR
PWM CHP A
PWM CHP B
PILOT ARC EN
XFORMER TEMP
CONTACTOR EN
CHOPPER 141188
CHOPPER CURRENT A
P+18V/-5V D14
+18V D6
+15V D22
D+5V D10
A+5V D20
CHOPPER CURRENT B
PILOT ARC CONTROLLER
COLD PLATE TEMP
WORK
COLLECTOR
NOZZLE
BUS VOLTAGE
CHOPPER TEMP
CHOPPER CURRENT A
INDUCTOR 1 TEMP
NEG 1 (-)
NEG 2 (-)
INDUCTOR 2 TEMP
CHOPPER CURRENT B
INPUT POWER FROM FACILITY
SHOWN WIRED FOR 480V
SEE SHEETS 6 AND 7 FOR
OTHER CONFIGURATIONS
SHOWN FOR 480V
CONTROL TRANSFORMER
CONTROL XFORMER
009045 FLTR
HF EN
T1 229487
I/O BOARD 141569
SPK GAP BOARD 141595
* OPTIONAL
ARC VOLTAGE WIRES NEED TO BE
CONNECTED IF A PLASMA
INTERFACE BOARD IS INSTALLED.
WIRE RUNS ARE TO A TERMINAL
BLOCK NEAR PLASMA INTERFACE
BOARD MOUNTING LOCATION.
ARC VOLTAGE
T2 10082018
J4 PA LEAD TO TORCH
J7 (-) NEGATIVE TORCH (-)
(++) POSITIVE
J9 POSITIVE (+) WORK (+)
WORK LEAD CURRENT
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
2 OF 9

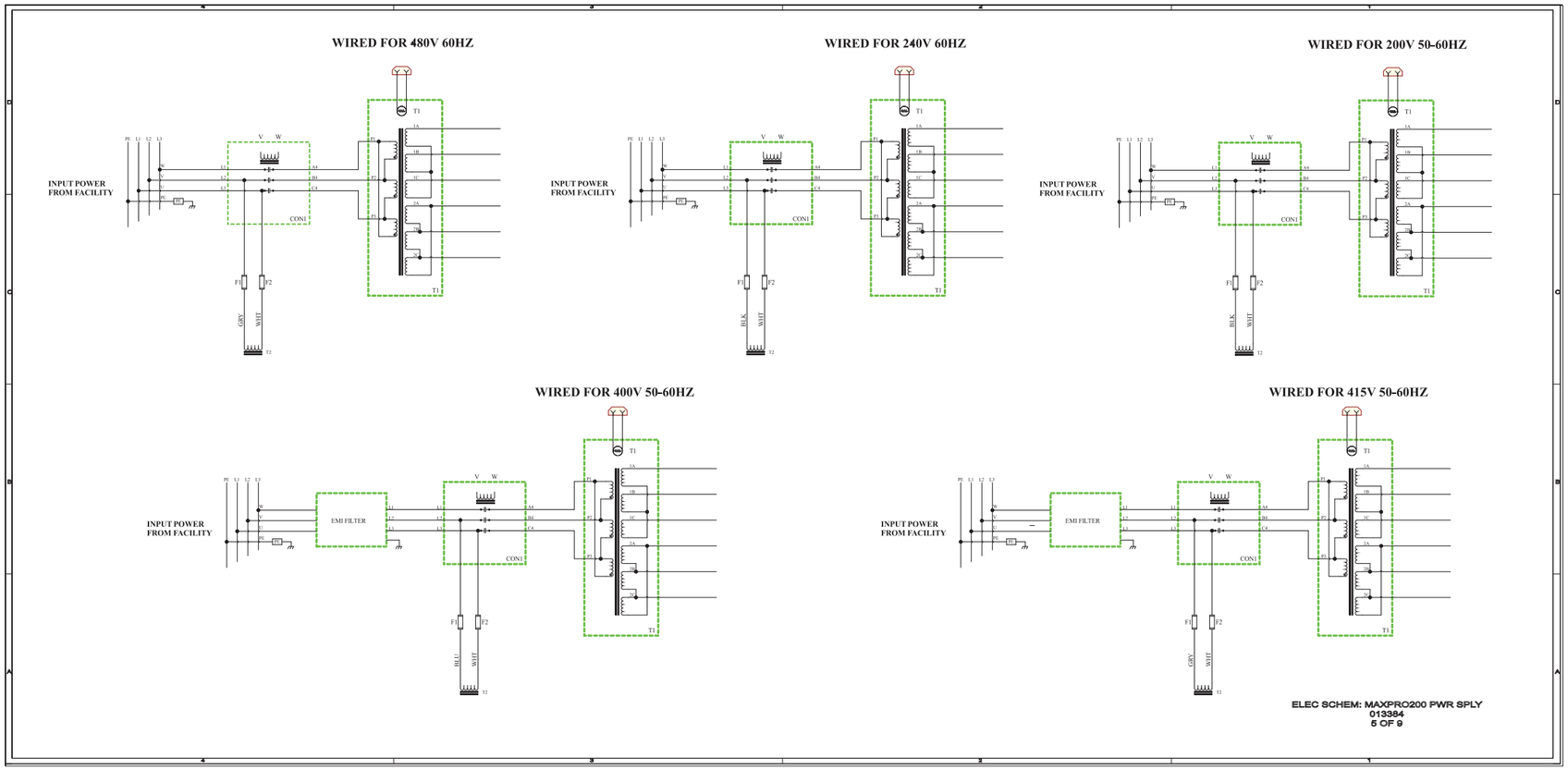
Sheet 3 of 9


CONTROL BOARD
141171
D26 15V
D31 240V FUSED AC INPUT
D33 3.3V
D37 5V
D40 24V
D41 120V FUSED AC INPUT
D42 240V INPUT DETECTED
D44 120V INPUT DETECTED
D35 CHOPPER A OVER CURRENT
D100 CHOPPER B OVER CURRENT
CONTROL TRANSFORMER
J4
POWER SWITCH
GRN
AMB
OPTIONAL CUSTOMER REMOTE ON/OFF
POWER ON STANDBY
120VAC SWITCHED
240VAC SWITCHED
K1
TRANSFORMER TEMP
INDUCTOR 1 TEMP
INDUCTOR 2 TEMP
TRANSFORMER TEMPERATURE
INDUCTOR 1 TEMPERATURE
INDUCTOR 2 TEMPERATURE
PLASMA PRESSURE
SHIELD PRESSURE
CHOPPER CURRENT A
CHOPPER CURRENT B
CHOPPER TEMP
BUS VOLTAGE
PILOT ARC TEMP
COOLANT TEMPERATURE
COOLANT FLOW
WORK LEAD CURRENT
TORCH VALVE ENABLE
TORCH VALVE
FL1
CHOPPER POWER
CONTACTOR EN
HF EN
CONTACTOR ENABLE
HIGH FREQ ENABLE
MAGNETICS FANS
AC RTN
TRANSFORMER FAN
PUMP MOTOR ENABLE
120VAC FUSED
240V RELAY
240VAC SWITCH OUT
PUMP MOTOR
CLT SOL
HEAT EXCHANGER FAN
GAS CONSOLE / PLASMA INTRFC
PLASMA VALVE PWM
SHIELD VALVE PWM
PLASMA VALVE
SHIELD VALVE
CHOPPER A PWM
CHOPPER B PWM
PILOT ARC ENABLE
PWM CHP A
PWM CHP B
PILOT ARC ENABLE
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
3 OF 9

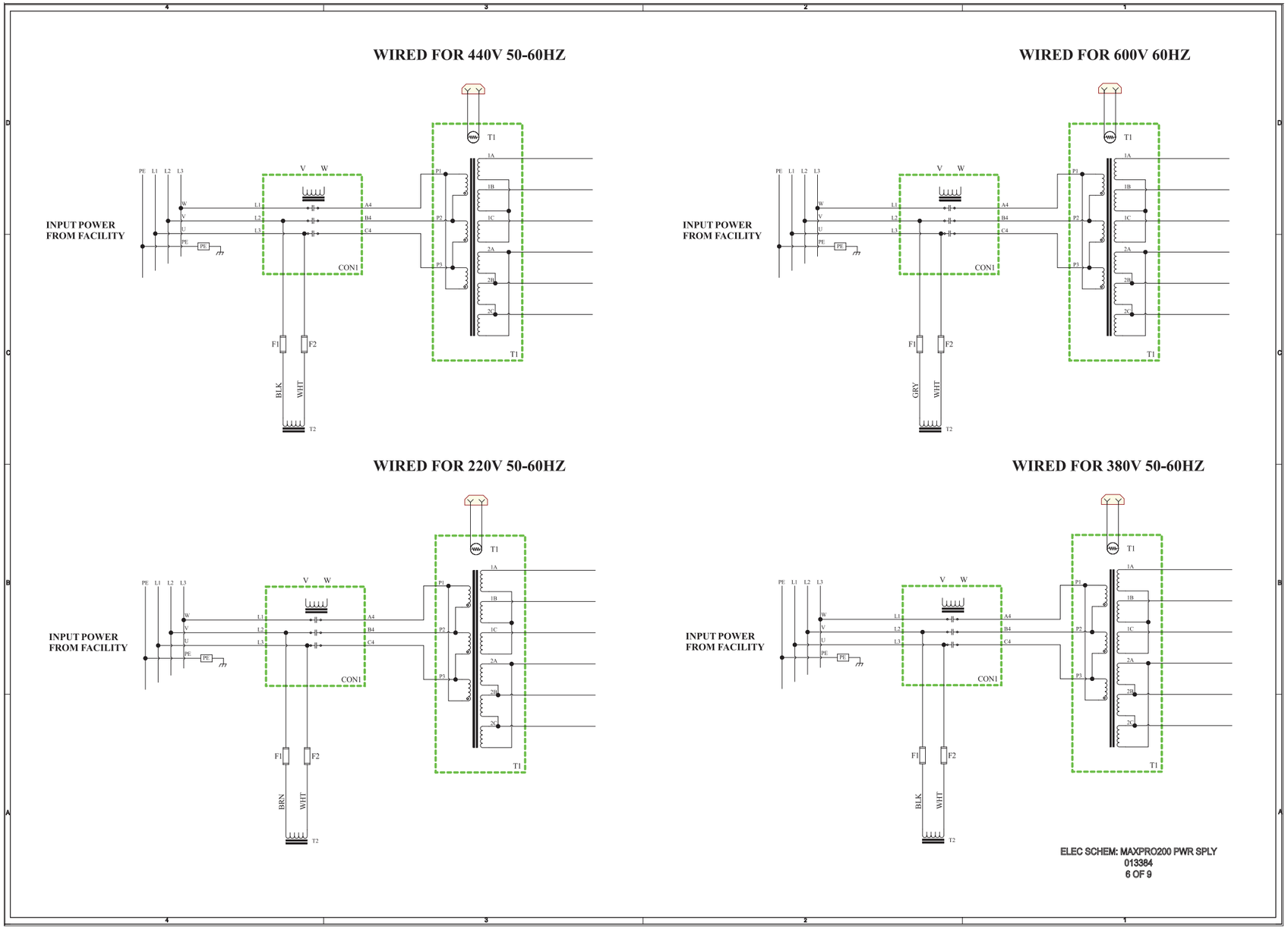
Sheet 4 of 9


JTAG MICRO
JTAG CPLD
USB MICRO SD
CNC INTERFACE
CONTROL BOARD
141171
USB OTG
TORCH
INTERFACE
RS422
CAN
POWER SUPPLY
TO TORCH LEADS
MECHANIZED TORCH: PIN 1 CONNECTED TO PIN 2
HAND TORCH: START SWITCH ACROSS PIN 1 AND PIN 3
SEE SHEET 9 FOR CONNECTION TO SENSOR PHC. FOR CONNECTIONS TO A CNC PLEASE REFERENCE THEIR MANUAL.
HAND TORCH START
TORCH VALVE
FILTER
FILTER
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
4 OF 9

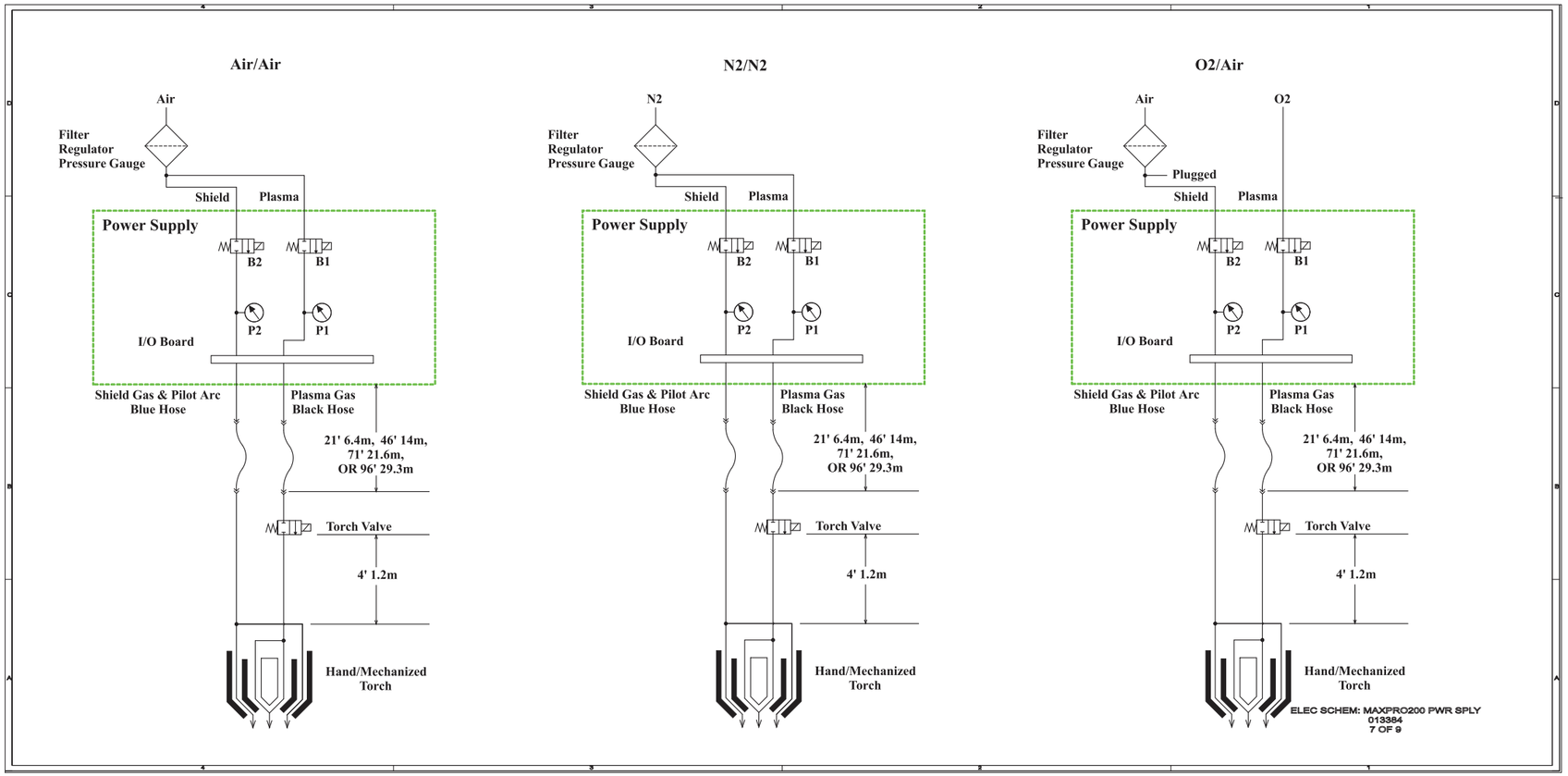
Sheet 5 of 9


WIRED FOR 480V 60HZ
WIRED FOR 240V 60HZ
WIRED FOR 200V 50-60HZ
WIRED FOR 400V 50-60HZ
WIRED FOR 415V 50-60HZ
INPUT POWER FROM FACILITY
EMI FILTER
CON1
T1
F1
F2
GRY
WHT
BLK
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
5 OF 9

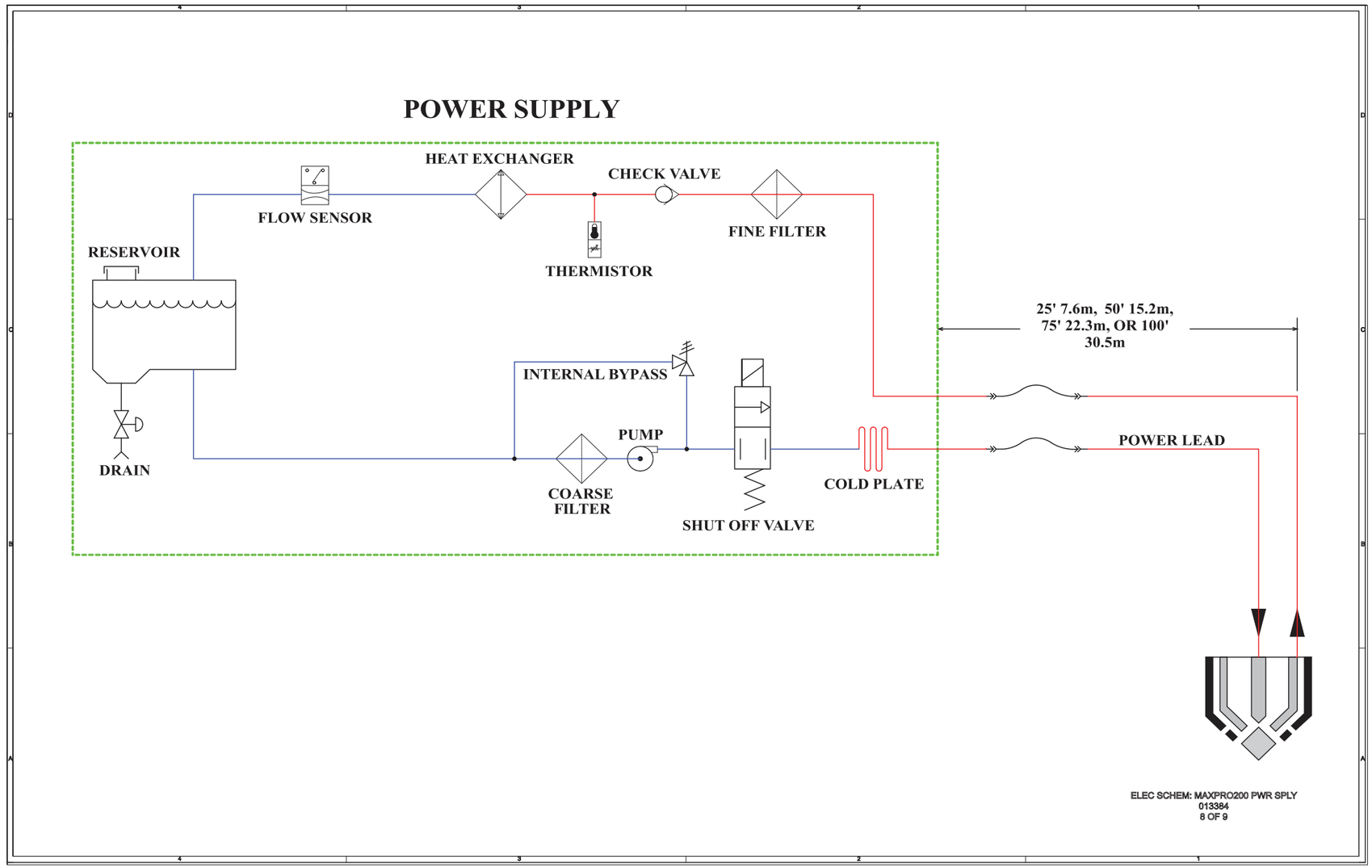
Sheet 6 of 9


WIRED FOR 440V 50-60HZ
INPUT POWER FROM FACILITY
PE L1 L2 L3
W V U PE
V W
L1 L2 L3
A4 B4 C4
CON1
T1
P1 P2 P3
1A 1B 1C 2A 2B 2C
F1 F2
BLK WHT
T2
WIRED FOR 600V 60HZ
INPUT POWER FROM FACILITY
GRY WHT
WIRED FOR 220V 50-60HZ
INPUT POWER FROM FACILITY
BRN WHT
WIRED FOR 380V 50-60HZ
INPUT POWER FROM FACILITY
BLK WHT
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
6 OF 9

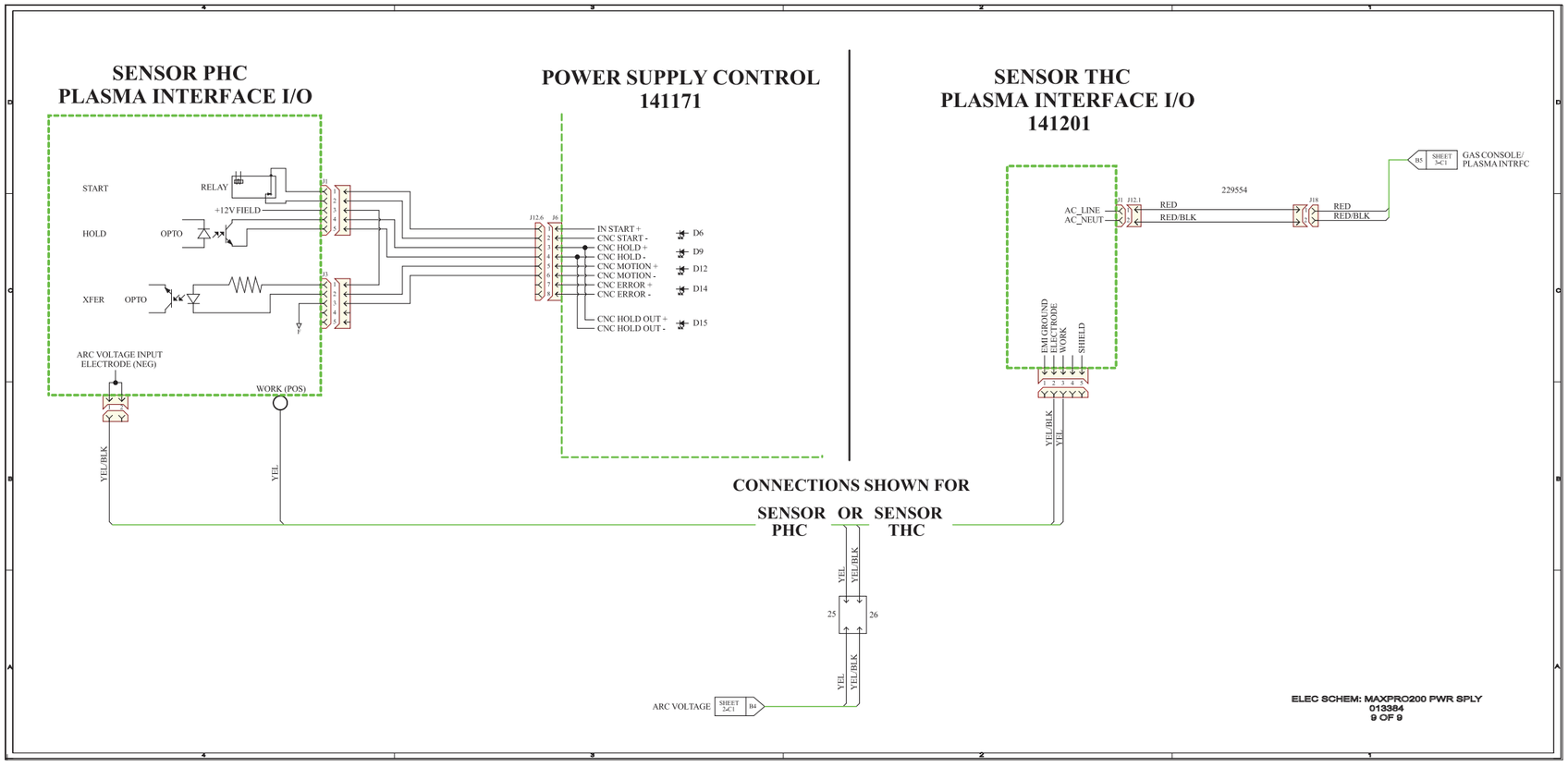
Sheet 7 of 9


Air/Air
Air
Filter
Regulator
Pressure Gauge
Shield
Plasma
Power Supply
B2
B1
P2
P1
I/O Board
Shield Gas & Pilot Arc
Blue Hose
Plasma Gas
Black Hose
21' 6.4m, 46' 14m,
71' 21.6m,
OR 96' 29.3m
Torch Valve
4' 1.2m
Hand/Mechanized
Torch
N2/N2
N2
Filter
Regulator
Pressure Gauge
Shield
Plasma
Power Supply
B2
B1
P2
P1
I/O Board
Shield Gas & Pilot Arc
Blue Hose
Plasma Gas
Black Hose
21' 6.4m, 46' 14m,
71' 21.6m,
OR 96' 29.3m
Torch Valve
4' 1.2m
Hand/Mechanized
Torch
O2/Air
Air
O2
Filter
Regulator
Pressure Gauge
Plugged
Shield
Plasma
Power Supply
B2
B1
P2
P1
I/O Board
Shield Gas & Pilot Arc
Blue Hose
Plasma Gas
Black Hose
21' 6.4m, 46' 14m,
71' 21.6m,
OR 96' 29.3m
Torch Valve
4' 1.2m
Hand/Mechanized
Torch
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
7 OF 9

Sheet 8 of 9


POWER SUPPLY
HEAT EXCHANGER
CHECK VALVE
FLOW SENSOR
FINE FILTER
THERMISTOR
RESERVOIR
25' 7.6m, 50' 15.2m,
75' 22.3m, OR 100'
30.5m
INTERNAL BYPASS
PUMP
POWER LEAD
DRAIN
COARSE
FILTER
COLD PLATE
SHUT OFF VALVE
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
8 OF 9

Sheet 9 of 9


SENSOR PHC
PLASMA INTERFACE I/O
POWER SUPPLY CONTROL
141171
SENSOR THC
PLASMA INTERFACE I/O
141201
START
RELAY
+12V FIELD
HOLD
OPTO
XFER
OPTO
ARC VOLTAGE INPUT
ELECTRODE (NEG)
WORK (POS)
YEL/BLK
YEL
IN START +
CNC START -
CNC HOLD +
CNC HOLD -
CNC MOTION +
CNC MOTION -
CNC ERROR +
CNC ERROR -
CNC HOLD OUT +
CNC HOLD OUT -
D6
D9
D12
D14
D15
229554
AC_LINE
AC_NEUT
RED
RED/BLK
RED
RED/BLK
GAS CONSOLE/
PLASMA INTRFC
EMI GROUND
ELECTRODE
WORK
SHIELD
YEL/BLK
YEL
CONNECTIONS SHOWN FOR
SENSOR PHC OR SENSOR THC
YEL
YEL/BLK
25
26
YEL
YEL/BLK
ARC VOLTAGE
ELEC SCHEM: MAXPRO200 PWR SPLY
013384
9 OF 9