Hypertherm®

powermax45®

Plasma arc cutting system

Service Manual – 806110
Revision 2

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For your records

Serial number:_____

Purchase date: _____

Distributor: _____

_____

_____

Maintenance notes:

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powermax45®

Service Manual

(P/N 806110)

Revision 2 – April, 2013

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⚠ Safety information ⚠

Before operating any Hypertherm equipment, read the separate *Safety and Compliance Manual* (80669C) included with your product for important safety information.

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Introduction

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

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

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

Installation and use

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

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

Assessment of area

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

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

b. Radio and television transmitters and receivers.

c. Computer and other control equipment.

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

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

f. Equipment used for calibration or measurement.

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

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

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

Methods of reducing emissions

Mains supply

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

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

Maintenance of cutting equipment

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

Cutting cables

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

Equipotential bonding

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

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

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

Earthing of the workpiece

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

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

Screening and shielding

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

Attention

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

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

General

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

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

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

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

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

Patent indemnity

Except only in cases of products not manufactured by Hypertherm or manufactured by a person other than Hypertherm not in strict conformity with Hypertherm's specifications and in cases of designs, processes, formulae, or combinations not developed or purported to be developed by Hypertherm, Hypertherm will have the right to defend or settle, at its own expense, any suit or proceeding brought against you alleging that the use of the Hypertherm product, alone and not in combination with any other product not supplied by Hypertherm, infringes any patent of any third party. You shall notify Hypertherm promptly upon learning of any action or threatened action in connection with any such alleged infringement (and in any event no longer than fourteen (14) days after learning of any action or threat of action), and Hypertherm's obligation to defend shall be conditioned upon Hypertherm's sole control of, and the indemnified party's cooperation and assistance in, the defense of the claim.

Limitation of liability

In no event shall Hypertherm be liable to any person or entity for any incidental, consequential direct, indirect, punitive or exemplary damages (including but not limited to lost profits) regardless of whether such liability is based on breach of contract, tort, strict liability, breach of warranty, failure of essential purpose, or otherwise, and even if advised of the possibility of such damages.

National and local codes

National and local codes governing plumbing and electrical installation shall take precedence over any instructions contained in this manual. In no event shall Hypertherm be liable for injury to persons or property damage by reason of any code violation or poor work practices.

Liability cap

In no event shall Hypertherm's liability, if any, whether such liability is based on breach of contract, tort, strict liability, breach of warranties, failure of essential purpose or otherwise, for any claim, action, suit or proceeding (whether in court, arbitration, regulatory proceeding or otherwise) arising out of or relating to the use of the Products exceed in the aggregate the amount paid for the Products that gave rise to such claim.

Insurance

At all times you will have and maintain insurance in such quantities and types, and with coverage sufficient and appropriate to defend and to hold Hypertherm harmless in the event of any cause of action arising from the use of the products.

Transfer of rights

You may transfer any remaining rights you may have hereunder only in connection with the sale of all or substantially all of your assets or capital stock to a successor in interest who agrees to be bound by all of the terms and conditions of this Warranty. Within thirty (30) days before any such transfer occurs, you agree to notify in writing Hypertherm, which reserves the right of approval. Should you fail timely to notify Hypertherm and seek its approval as set forth herein, the Warranty set forth herein shall be null and void and you will have no further recourse against Hypertherm under the Warranty or otherwise.

Section 1

SPECIFICATIONS

In this section:

System description

The Powermax45 is a highly portable, 45-amp, handheld and mechanized plasma cutting system appropriate for a wide range of applications. The Powermax45 uses air or nitrogen to cut electrically conductive metals, such as mild or stainless steel or aluminum. With it, you can cut thicknesses up to 25.4 mm (1 inch) and pierce thicknesses up to 9.5 mm (3/8 inch).

The standard Powermax45 includes one complete set of the consumables needed for cutting (shield, retaining cap, swirl ring, nozzle, electrode), 2 spare electrodes, 2 spare nozzles, gouging consumables (handheld configurations only), a quick-disconnect air fitting (1/4 NPT on CSA units and 1/4 NPT x G-1/4 BSPP on CE units), a consumables box, a shoulder strap, an Operator Manual, a Quick Setup Card, and a Setup DVD. Mechanized configurations include a remote-start pendant as well.

You can order additional consumables and accessories – such as the plasma cutting guide – from any Hypertherm distributor. See the *Parts* section for a list of spare and optional parts.

The power cords on the 200–240 V CSA power supplies are shipped with a 50 A, 250 V plug (NEMA 6-50P) on the power cord. The CE units and the 480 V CSA units are shipped without a plug on the power cord. See *Prepare the electrical power* in the *Power Supply Setup* section for more information.

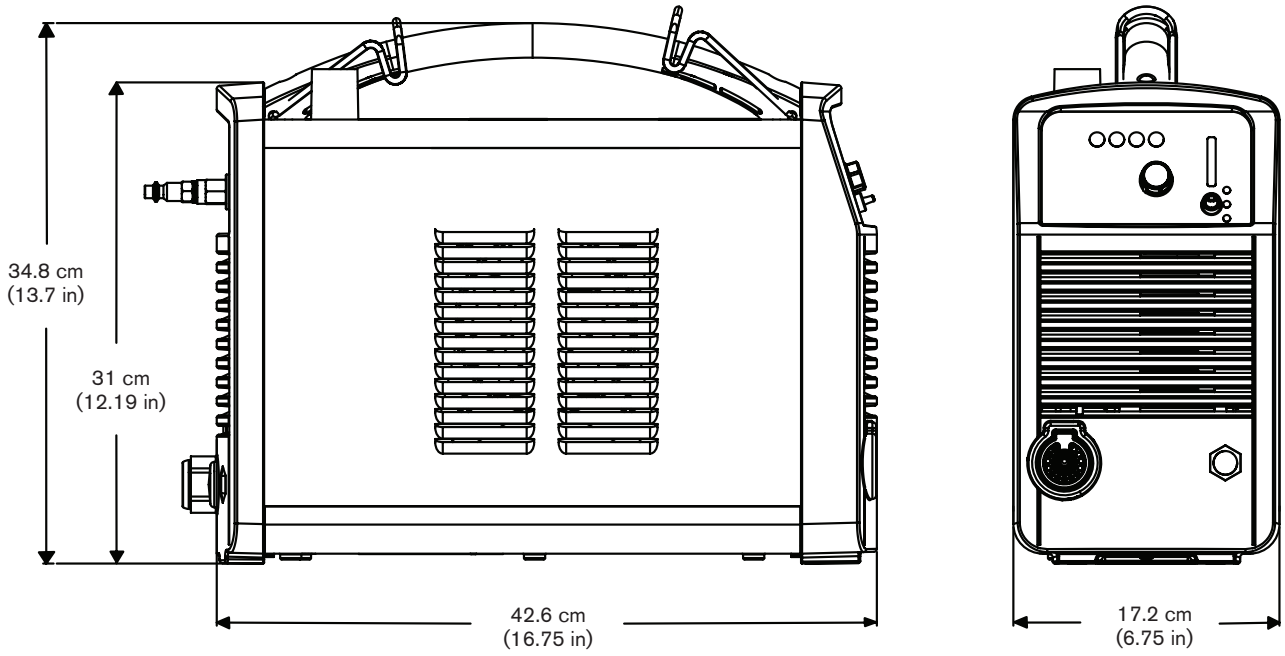
Where to find information

System specifications, such as size, weight, detailed electrical specifications, and cut speeds can be found in this section. For information on:

- Safety information – see the *Safety and Compliance Manual* for detailed safety information.
- Setup requirements, including power requirements, grounding, power cord configurations, extension cord requirements, and generator recommendations – see the *Power Supply Setup* section.
- Handheld and machine torch consumables, cut charts, and torch setup information – see the *Torch Setup* section.
- Information about the controls and LEDs, steps for system operation, and hints for improving cut quality – see the *Operation* section.
- Troubleshooting – see the *Troubleshooting and System Tests* section.
- Maintenance and repair instructions – see the *Component Replacement* section.
- Part numbers and ordering information for accessories, consumables, and replacement parts – see the *Parts* section.
- Wiring and timing diagrams – see the *Wiring Diagrams* section.

Power supply dimensions and weights

Dimensions



Weights

Power supply weights given below include the hand torch with 6.1 m (20 foot) lead, a 6.1 m (20 foot) work lead, and a 3 m (10 foot) power cord.

- CSA 200–240 V power supply: 16.8 kg (37 pounds)
- CSA 480 V power supply: 15.9 kg (35 pounds)
- CE 230 V power supply: 16.6 kg (36.5 pounds)
- CE 400 V power supply: 15.9 kg (35 pounds)

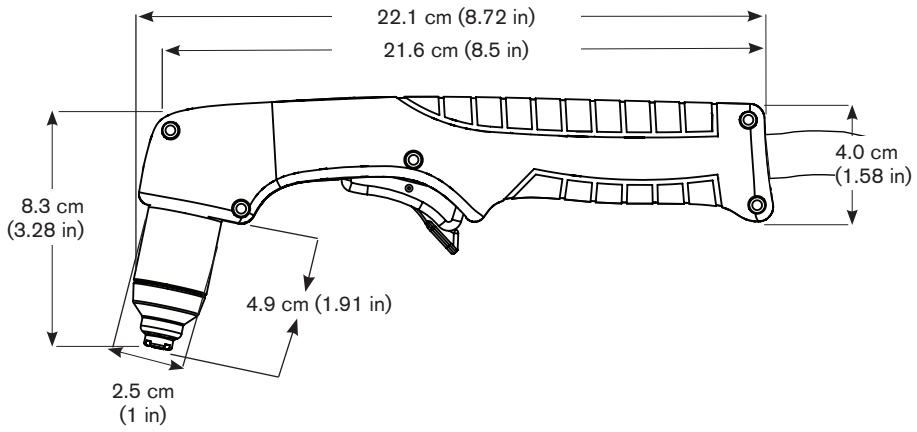
Power supply ratings

Rated open-circuit voltage (U_0) CSA/CE, single-phase CE, 3-phase CSA, 3-phase	275 VDC (CSA/CE single-phase) 275 VDC (CE 3-phase) 278 VDC (CSA 3-phase)	
Rated output current (I_2)	20 A to 45 A	
Rated output voltage (U_2)	132 VDC	
Duty cycle at 40° C (See data plate on power supply for more information on duty cycle.)	50% (I_2=45 A, U_2=132 V) 60% (I_2=41 A, U_2=132 V) 100% (I_2=32 A, U_2=132 V)	
Operating temperature	-10° to 40° C (14° to 104° F)	
Storage temperature	-25° to 55° C (-13° to 131° F)	
Power factor 200–240 V CSA, 230 V CE, 1-phase 400 V CE, 3-phase 480 V CSA, 3-phase	0.99 0.94 0.93	
Input voltage (U_1) / Input current (I_1) at rated output ($U_{2\ MAX}$, $I_{2\ MAX}$) (See *Voltage configurations* in the *Power Supply Setup* section for more information.)	200–240 VAC / 34–28 A (200–240 V CSA) 230 VAC / 30 A (230 V CE)* 400 VAC / 10 A (400 V CE)** 480 VAC / 8.5 A (480 V CSA)	
Gas type	Air	Nitrogen
Gas quality	Clean, dry, oil-free per ISO 8573-1 Class 1.2.2	99.995% pure
Recommended gas inlet flow and pressure	170 l/min at 6.2 bar (360 scfh at 90 psi)	

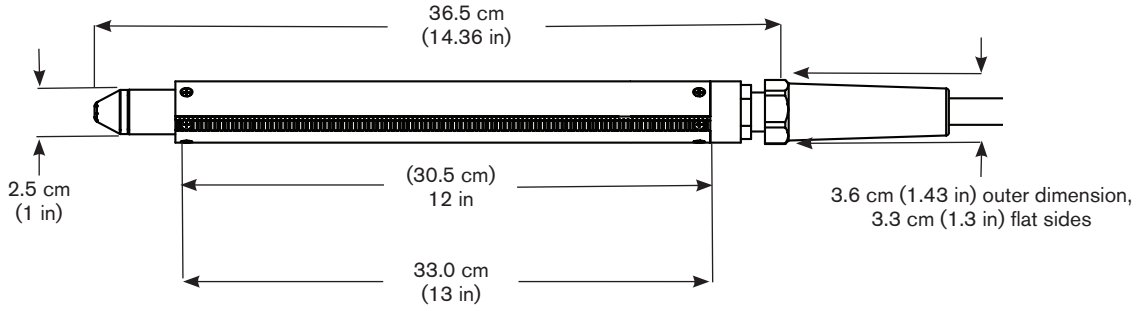
* Equipment complies with IEC 61000-3-12.

** Equipment complies with IEC 61000-3-12 provided that the short-circuit power S_{sc} is greater than or equal to 692 KVA at the interface 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 short-circuit power S_{sc} greater than or equal to 692 KVA.

T45v torch dimensions



T45m torch dimensions



T45v and T45m torch specifications

Handheld cut capacity (material thickness)	
Recommended cut capacity (hand cutting)	12.7 mm (1/2 inch)
Maximum cut capacity (hand cutting or mechanized edge start)	19.1 mm (3/4 inch)
Severance capacity (hand cutting or mechanized edge start)	25.4 mm (1 inch)
Mechanized pierce capacity (material thickness)	
Pierce capacity (for edge starts, the capacities are the same as the handheld capacities)	9.5 mm (3/8 inch)
Recommended cut speed (on mild steel)	
6.35 mm (1/4 inch)	1524 mm/min (60 ipm)
9.53 mm (3/8 inch)	813 mm/min (32 ipm)
12.7 mm (1/2 inch)	508 mm/min (20 ipm)
19.1 mm (3/4 inch)	203 mm/min (8 ipm)
25.4 mm (1 inch)	102 mm/min (4 ipm)
Gouging capacity	
Metal removal rate on mild steel	2.8 kg/hr (6.2 lbs/hr)
Weight	
T45v torch only	0.27 kg (0.6 lb)
T45v with 6.1 m (20 foot) lead	1.55 kg (3.4 lb)
T45v with 15.24 m (50 foot) lead	3.54 kg (7.8 lb)
T45m torch only	0.45 kg (1.0 lb)
T45m with 7.62 m (25 foot) lead	2.27 kg (5.0 lb)
T45m with 10.7 m (35 foot) lead	2.90 kg (6.4 lb)
T45m with 15.24 m (50 foot) lead	3.85 kg (8.5 lb)

Symbols and marks

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

S mark symbol

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

CSA mark

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

CE marking

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

GOST-TR mark

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

C-Tick mark

N30932

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

CCC mark

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

UkrSEPRO mark

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

IEC symbols

The following symbols may appear on the power supply data plate, control labels, switches, and LEDs.


Direct current (DC)


Alternating current (AC)


Plasma torch cutting


Plate metal cutting


Expanded metal cutting


Gouging

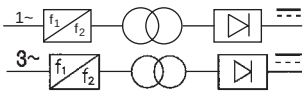

AC input power connection


The terminal for the external protective (earth) conductor


Gas test mode

Power is ON


Power is OFF



An inverter-based power source, either 1-phase or 3-phase


Volt/amp curve, “drooping” characteristic

Power is ON (LED)


System fault (LED)


Inlet gas pressure fault (LED)


Missing or loose consumables (LED)


Power supply is out of temperature range (LED)

Section 2

POWER SUPPLY SETUP

In this section:

Unpack the Powermax45

1. Verify that all items on your order have been received in good condition. Contact your distributor if any parts are damaged or missing.

2. Inspect the power supply for damage that may have occurred during shipping. If there is evidence of damage, refer to Claims, below. All communications regarding this equipment must include the model number and the serial number located on the bottom of the power supply.

3. Before you set up and operate this Hypertherm system, read the *Safety and Compliance Manual*.

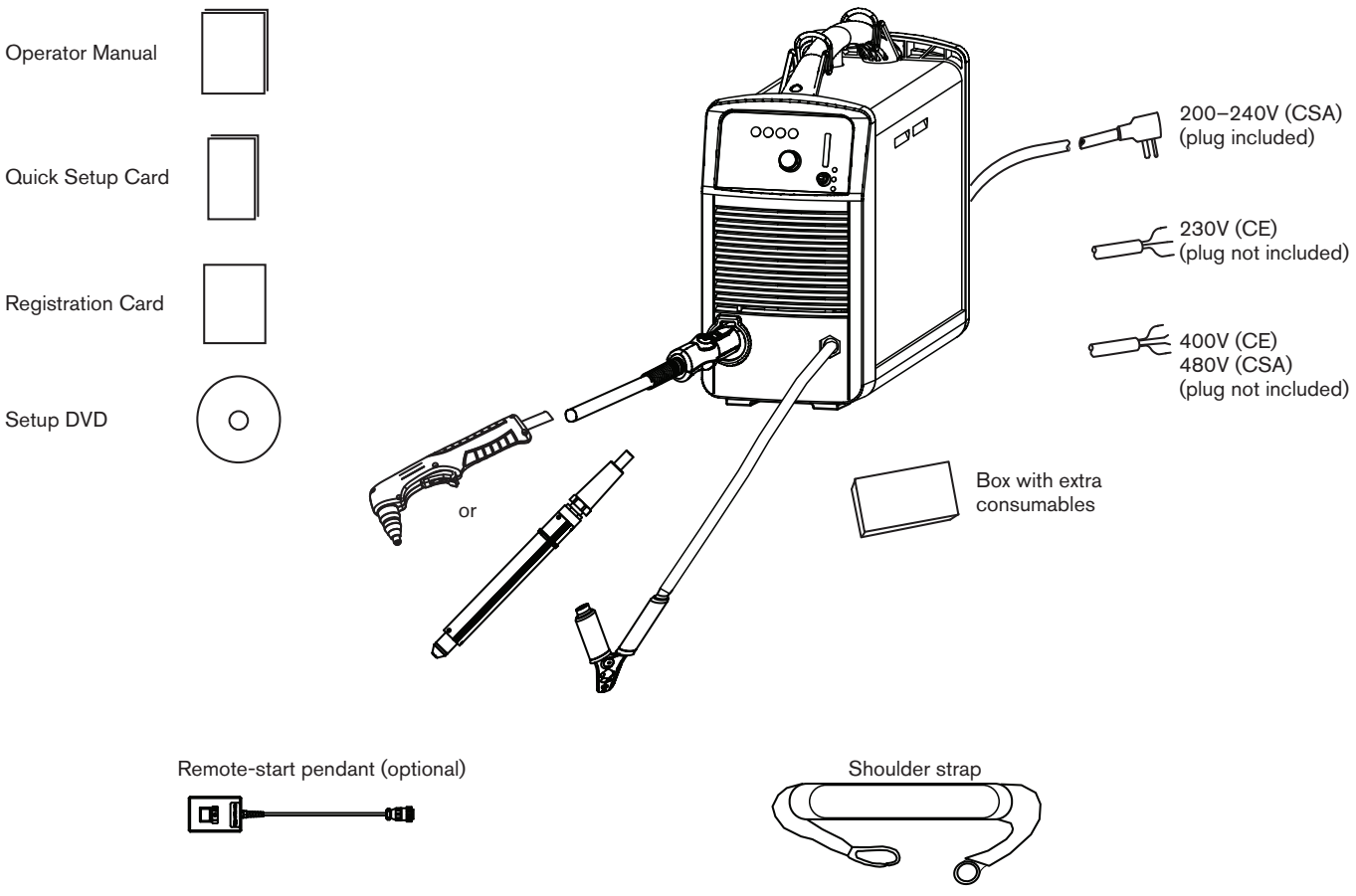
Claims

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

- **Claims for defective or missing merchandise** – If any component is missing or defective, contact your Hypertherm distributor. If you need additional assistance, call the nearest Hypertherm office listed in the front of this manual.

Contents

Verify the items in the box against the illustration.



Position the power supply

Locate the Powermax45 near an appropriate 200–240 volt power receptacle for CSA or CE 1-phase power supplies, a 400 volt receptacle for 3-phase CE power supplies, or a 480 volt receptacle for 3-phase CSA power supplies. The Powermax45 has a 3 m (10-foot) power cord. Allow at least 0.25 m (10 inches) of space around the power supply for proper ventilation.

Prepare the electrical power

The maximum output voltage will vary based on your input voltage and the circuit's amperage. Because the current draw varies during startup, slow-blow fuses are recommended as shown in the following chart. Slow-blow fuses can withstand currents up to 10 times the rated value for short periods of time.

Voltage configurations

The following chart shows the maximum rated output for typical combinations of input voltage and amperage. Acceptable input voltages can be ±10% of the values given below.

CAUTION

Protect the circuit with appropriately sized time-delay (slow-blow) fuses and a line-disconnect switch.

Model	Input voltage	Phase	Rated output	Input current at 6 kw output	Input current during arc stretch	Recommended slow-blow fuse size
CSA	200–240 VAC	1	45 A, 132 V	34–28 A	55–45 A	50 A
	208 VAC	1	45 A, 132 V	33 A	54.5 A	50 A
	480 VAC	3	45 A, 132 V	8.5 A	12 A	15 or 20* A
CE	200–240 VAC	1	45 A, 132 V	34–28 A	55–45 A	35 or 50* A
	400 VAC	3	45 A, 132 V	10 A	15.5 A	15 or 20* A
CE/CCC	220 VAC	1	45 A, 132 V	31 A	53 A	35 or 50* A
	380 VAC	3	45 A, 132 V	11 A	14 A	15 A

* Use the higher amperage fuse for applications that require a long arc stretch.

Install a line-disconnect switch

Use a line-disconnect switch for each power supply so that the operator can turn off the incoming power quickly in an emergency. Locate the switch so that it is easily accessible to the operator. Installation must be performed by a licensed electrician according to national and local codes. The interrupt level of the switch must be equal to or exceed the continuous rating of the fuses. In addition, the switch should:

- Isolate the electrical equipment and disconnect all live conductors from the incoming supply voltage when in the OFF position.
- Have one OFF and one ON position that are clearly marked with O (OFF) and I (ON).
- Have an external operating handle that can be locked in the OFF position.
- Contain a power-operated mechanism that serves as an emergency stop.
- Have slow-blow fuses installed as recommended in the table on the previous page.

Requirements for grounding

To ensure personal safety, proper operation, and to reduce electromagnetic interference (EMI), the Powermax45 must be properly grounded:

- The power supply must be grounded through the power cord according to national and local electrical codes.
- Single-phase service must be of the 3-wire type with a green or green/yellow wire for the protective earth ground and must comply with national and local requirements. **Do not use a 2-wire service.**
- Three-phase service must be of the 4-wire type with a green or green/yellow wire for the protective earth ground and must comply with national and local requirements.
- Refer to the *Safety and Compliance Manual* for more information.

Power cord considerations

Powermax45 power supplies are shipped with CSA and CE power cord configurations.

The power cords on the 200–240 V CSA power supplies are shipped with a 50 amp, 250 V plug (NEMA 6-50P) on the power cord.

The CE power supplies and the 480 V CSA power supplies are shipped without a plug on the power cord. Obtain the correct plug for your unit (230 V CE, 400 V CE, or 480 V CSA) and location and have it installed by a licensed electrician.

Extension cord recommendations

Use an extension cord of an appropriate wire size for the cord length and system voltage. Use a cord that meets national and local codes.

The following tables provide the recommended gauge size for various lengths and input voltages. The lengths in the tables are the length of the extension cord only; they do not include the power supply's power cord.

Metric

Input voltage	Phase	< 3 m	3–7.5 m	7.5–15 m	15–30 m	30–45 m
208 VAC	1	10 mm^2	10 mm^2	10 mm^2	16 mm^2	25 mm^2
220 VAC	1	10 mm^2	10 mm^2	10 mm^2	16 mm^2	25 mm^2
200–240 VAC	1	10 mm^2	10 mm^2	10 mm^2	16 mm^2	25 mm^2
380 VAC	3	4 mm^2	4 mm^2	4 mm^2	6 mm^2	6 mm^2
400 VAC	3	4 mm^2	4 mm^2	4 mm^2	6 mm^2	6 mm^2
480 VAC	3	4 mm^2	4 mm^2	4 mm^2	6 mm^2	6 mm^2

English

Input voltage	Phase	< 10 feet	10–25 feet	25–50 feet	50–100 feet	100–150 feet
208 VAC	1	8 AWG	8 AWG	8 AWG	6 AWG	4 AWG
220 VAC	1	8 AWG	8 AWG	8 AWG	6 AWG	4 AWG
200–240 VAC	1	8 AWG	8 AWG	8 AWG	6 AWG	4 AWG
380 VAC	3	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG
400 VAC	3	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG
480 VAC	3	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG

Generator recommendations

Generators used with the Powermax45 should satisfy the following requirements:

CSA

- 1-phase, 50/60 Hz, 230/240 VAC
- 3-phase, 50/60 Hz, 480 VAC

CE

- 1-phase, 50/60 Hz, 230 VAC
- 3-phase, 50/60 Hz, 380/400 VAC (400 VAC recommended for best performance)

Engine drive rating	Engine drive output current			Performance (arc stretch)
	1-phase (CSA/CE)	3-phase (CE)	3-phase (CSA)	
8 KW	33 A	11.5 A	10 A	Good arc stretch at 45 A cutting current
6 KW	25 A	9 A	7 A	Limited arc stretch at 45 A cutting current Good arc stretch at 30 A cutting current

Notes: Based on the generator rating, age, and condition, adjust the cutting current as needed.

If a fault occurs while using a generator, turning the power switch quickly to OFF and then to ON again (sometimes called a “quick reset”) may not clear the fault. Instead, turn the power supply off and wait 30 to 45 seconds before turning it on again.

Prepare the gas supply

The gas supply for the Powermax45 can be shop-compressed or cylinder-compressed. A high-pressure regulator must be used on either type of supply and must be capable of delivering gas to the filter on the power supply at 170 l/min at 6.2 bar (360 scfh at 90 psi).

WARNING

Do not allow the gas supply pressure to exceed 9.3 bar (135 psi). The filter bowl may explode if this pressure is exceeded.

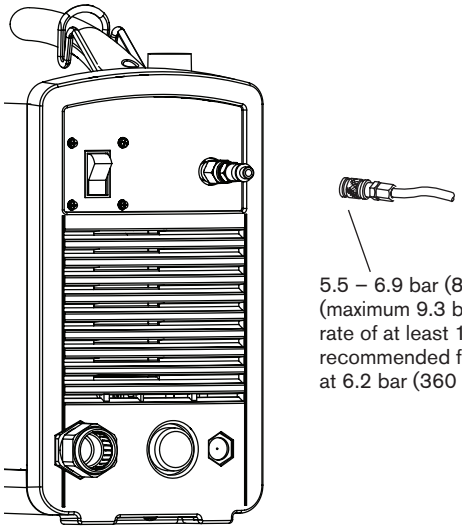
If gas supply quality is poor, cut speeds decrease, cut quality deteriorates, cutting thickness capability decreases, and the life for consumables shortens. For optimum performance, the gas should have a maximum particle size of 0.1 micron at a maximum concentration of 0.1 mg/m^3, a maximum dew point of -40° C (-40° F), and a maximum oil concentration of 0.1 mg/m^3 (per ISO 8573-1 Class 1.2.2).

Connect the gas supply

Connect the gas supply to the power supply using an inert gas hose with a 9.5 mm (3/8 inch) internal diameter and a 1/4 NPT quick-disconnect coupler or a 1/4 NPT x G-1/4 BSPP (CE units) quick-disconnect coupler.

CAUTION

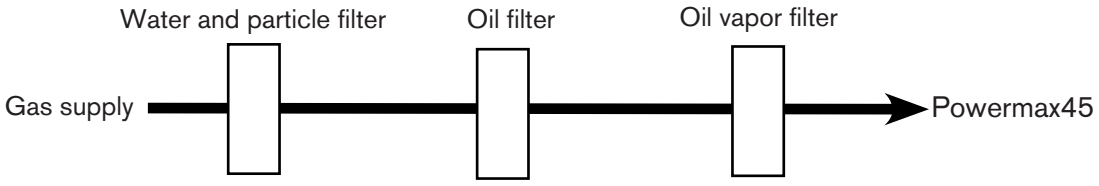
Synthetic lubricants containing esters that are used in some air compressors will damage polycarbonates used in the air regulator bowl.



5.5 – 6.9 bar (80 – 100 psi) gas supply (maximum 9.3 bar or 135 psi) with a flow rate of at least 165.2 l/min (350 scfh). The recommended flow rate and pressure is 170 l/min at 6.2 bar (360 scfh at 90 psi).

Additional gas filtration

When site conditions introduce moisture, oil, or other contaminants into the gas line, use a three-stage coalescing filtration system, such as the Eliminizer filter kit (128647) available from Hypertherm distributors. A three-stage filtering system works as shown below to clean contaminants from the gas supply.



The filtering system should be installed between the quick-disconnect coupler and the power supply.

Section 3

TORCH SETUP

In this section:

Introduction

Both the T45v hand torch and the T45m machine torch are available for the Powermax45. The torch FastConnect™ system makes it easy to remove the torch for transport or to switch from one torch to the other if your applications require the use of both torches.

This section explains how to set up your torch and choose the appropriate consumables for the job.

Consumable life

How often you will need to change the consumables on your Powermax45 will depend on a number of factors:

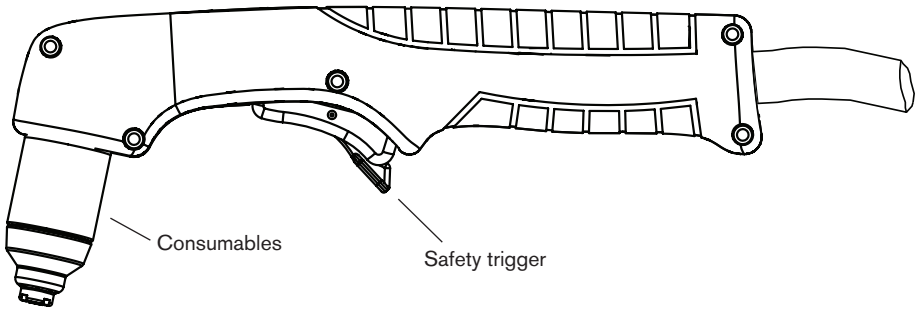
- The thickness of the metal being cut.
- The length of the average cut.
- Whether you are doing machine or hand cutting.
- The air quality (presence of oil, moisture, or other contaminants).
- Whether you are piercing the metal or starting cuts from the edge.
- Proper torch-to-work distance when gouging or cutting with unshielded consumables.
- Proper pierce height.
- Which consumables you are using. The T30v (Powermax30) 30 amp consumables will have a shorter life when used on the T45v. However, they provide optimum cut quality for certain applications.

Under normal conditions, the electrode will wear out first during machine cutting, and the nozzle will wear out first when hand cutting.

A good rule of thumb is that a set of consumables will last approximately 1 to 2 hours of actual “arc on” time for hand cutting, depending on these factors. For cutting with a machine torch, consumables may last up to 3 to 5 hours.

You will find more information about proper cutting techniques in the *Operation* section.

Hand torch setup



Choose the consumables

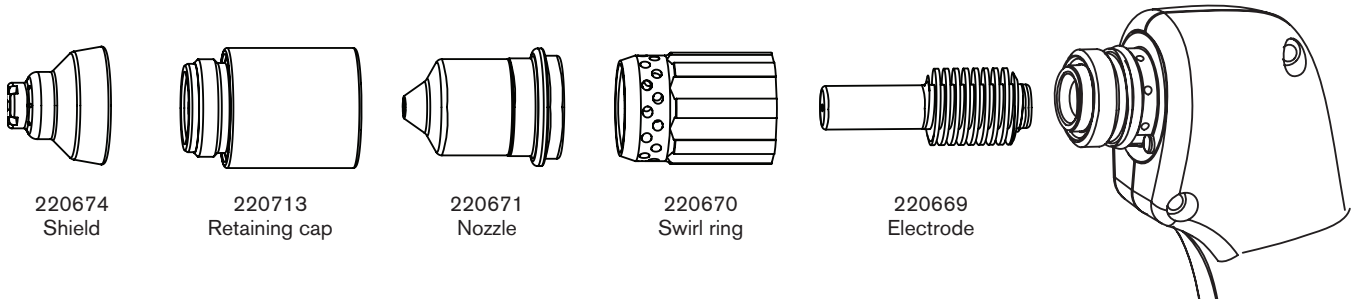
The Powermax45 with the T45v handheld torch comes with a full set of consumables for cutting installed on the torch, spare electrodes and nozzles in the consumables box, and consumables for gouging in the consumables box. In non-CE-regulated countries, you can also purchase unshielded consumables that are useful for certain applications.

With shielded consumables, you drag the torch tip along the metal to cut. With unshielded consumables, you must keep the torch a small distance, about 2 mm (0.08 inch), away from the metal. Unshielded consumables generally have a shorter life than shielded consumables; however, you may find that visibility and accessibility are better for some applications.

Consumables for hand cutting are shown below. Notice that the retaining cap, swirl ring, and electrode are the same for shielded, unshielded, and gouging applications. Only the shield (deflector for unshielded consumables) and the nozzle are different.

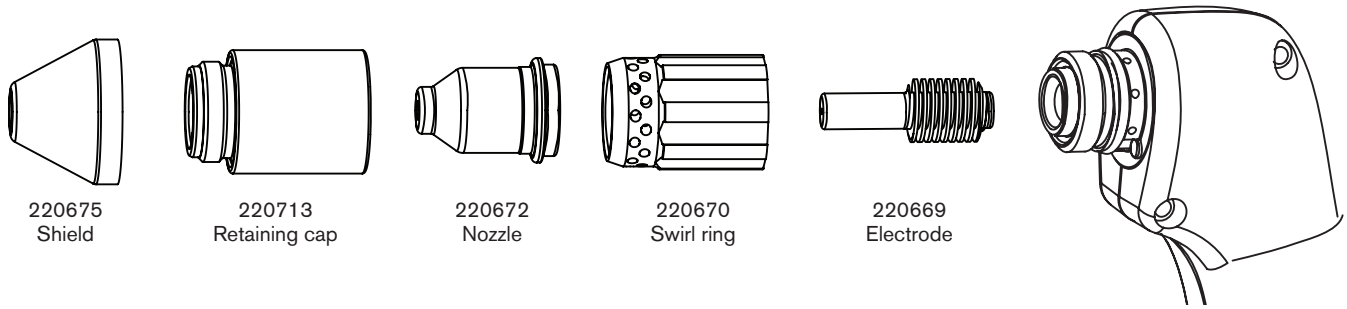
For the best cut quality on thin gauge stainless steel, you may prefer to reduce the amperage setting to 30 amps and use the T30v (Powermax30) 30 A consumables available from Hypertherm.

T45v shielded consumables



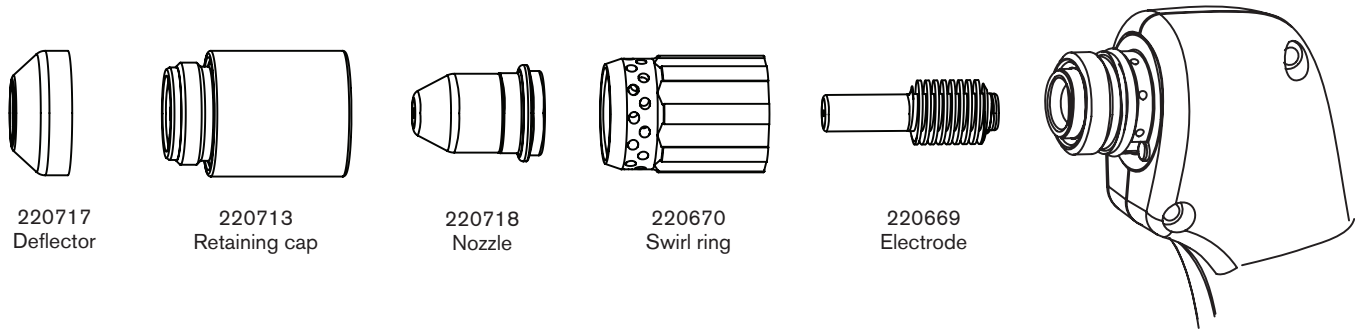
220674 Shield | 220713 Retaining cap | 220671 Nozzle | 220670 Swirl ring | 220669 Electrode

T45v gouging consumables



220675 Shield | 220713 Retaining cap | 220672 Nozzle | 220670 Swirl ring | 220669 Electrode

T45v unshielded consumables*



220717
Deflector

220713
Retaining cap

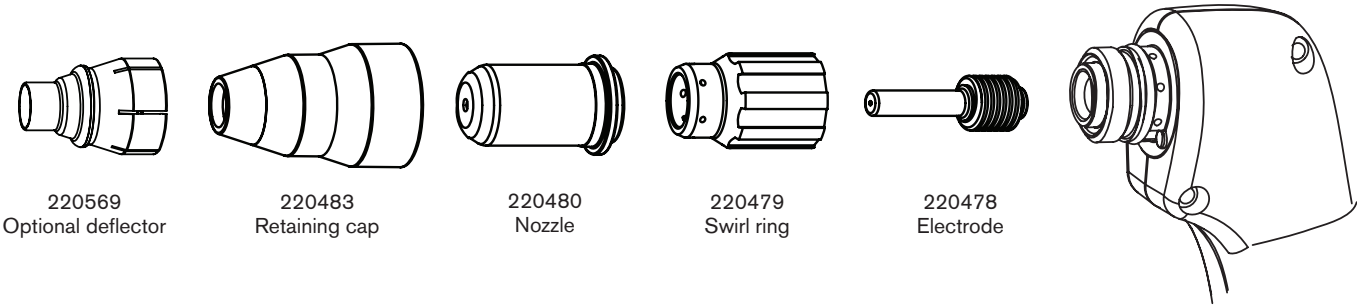
220718
Nozzle

220670
Swirl ring

220669
Electrode

* Unshielded consumables are not available for use in CE-regulated countries.

T30v (Powermax30) 30 A consumables



220569
Optional deflector

220483
Retaining cap

220480
Nozzle

220479
Swirl ring

220478
Electrode

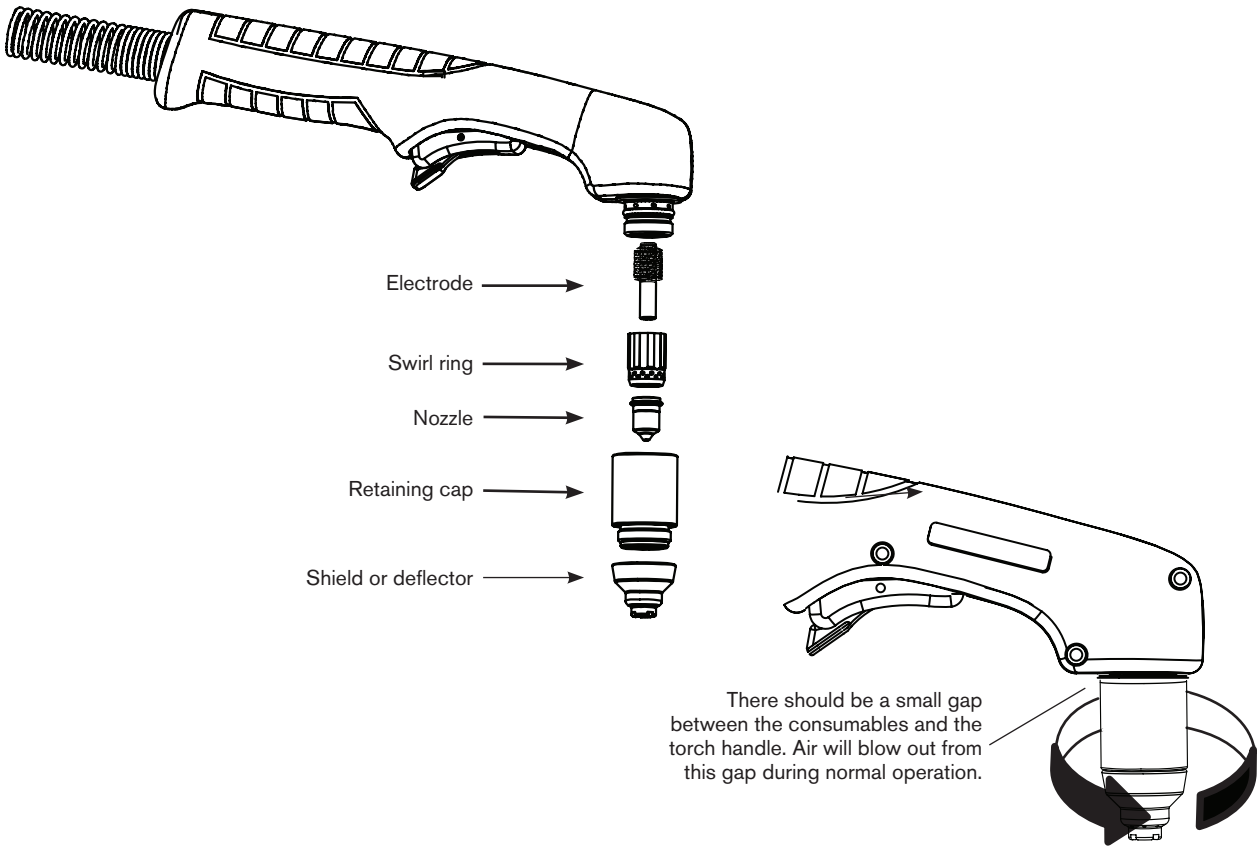
Install the consumables

WARNING
INSTANT-ON TORCHES
PLASMA ARC CAN CAUSE INJURY AND BURNS

The plasma arc comes on immediately when the torch trigger is activated. Make sure the power is OFF before changing consumables.

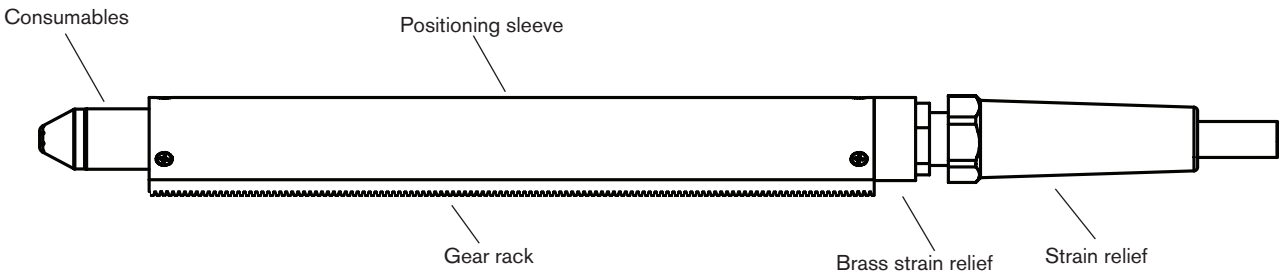
To operate the T45v torch, it must have a complete set of consumable parts installed: a shield or deflector, retaining cap, nozzle, swirl ring and electrode.

With the power switch in the OFF (O) position, verify that the torch consumables are installed as shown.



Note: Tighten only to finger-tight. Overtightening will cause the torch to misfire.

Machine torch setup



Before using the T45m, you must:

- Mount the torch on your cutting table or other equipment.
- Choose and install the consumables.
- Align the torch.
- Attach the torch lead to the power supply.
- Set up the power supply for remote starting with either the remote-start pendant or a machine interface cable.

Mount the torch

Depending on the type of cutting table you have, you may or may not need to disassemble the torch to route it through the track and mount it. If your cutting table's track is large enough for you to thread the torch through it without removing the torch body from the lead, do so and then attach the torch to the lifter per the manufacturer's instructions.

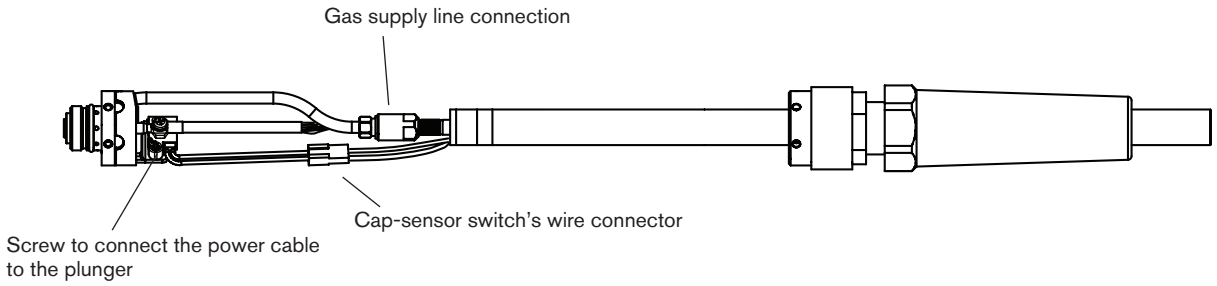
Note: The T45m can be mounted on a wide variety of X-Y tables, track burners, pipe bevelers, and other equipment. Install the torch per the manufacturer's instructions and following the instructions below for disassembly if necessary.

If you need to disassemble the torch, follow these steps:

1. Disconnect the torch lead from the power supply and remove the consumables from the torch.

2. Remove the gear rack from the positioning sleeve by removing the 2 black screws that secure it to the positioning sleeve. Remove the 6 screws (3 at each end) that secure the positioning sleeve to the brass strain relief ring and to the torch body. Slide the positioning sleeve off the torch.

3. Disconnect the wires for the cap-sensor switch at the connector in the middle.



4. Use a #2 Phillips screwdriver and a 6 mm (1/4 inch) nut driver (or adjustable wrench) to remove the screw and nut that secure the torch's power cable to the plunger. (Turn the plunger if necessary to gain access to the screw.)

5. Use 6 mm (1/4 inch) and 10 mm (3/8 inch) or adjustable wrenches to loosen the nut that secures the gas supply line to the torch lead. Set the torch body aside.

   Note: Cover the end of the gas line on the torch lead with tape to keep dirt and other contaminants from getting in the gas line when you route the lead through the track.

6. Route the torch lead through the cutting table's track.

7. Reattach the torch's power cable to the torch plunger using the screw and nut. Rotate the plunger so that the screw does not interfere with the cap-sensor switch.

8. Reconnect the gas line to the torch lead.

9. Press the two halves of the cap-sensor switch's wire connector together.

10. Slide the positioning sleeve over the torch body and check the alignment of the screw holes. Replace the three screws at each end.

11. If you will be using the gear rack, re-attach it with the 2 black screws you removed earlier.

12. Attach the torch to the lifter per the manufacturer's instructions.

Choose the consumables (cut charts)

WARNING
INSTANT-ON TORCHES
PLASMA ARC CAN CAUSE INJURY AND BURNS

The plasma arc comes on immediately when the torch trigger is activated. Make sure the power is OFF before changing consumables.

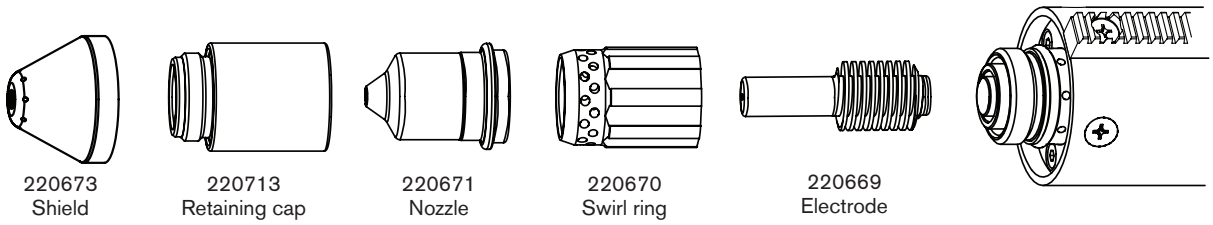
A complete set of shielded consumables is shipped with the T45m machine torch. In addition, an ohmic sensing retaining cap is available for use with the T45m shielded consumables. Unshielded consumables and the T30v (Powermax30) 30 A consumables are also available for use with the T45m.

Using the cut charts

The following sections provide illustrations of the consumable sets and cut charts for each set. Maximum cut speeds are the fastest speeds possible to cut material without regard to cut quality. Recommended cut speeds are a good starting point for finding the best quality cut (best angle, least dross, and best cut surface finish). You will need to adjust the speeds for your application and your table to obtain the desired cut quality.

When cutting thin metal (3 mm/10 Ga or thinner), you may achieve a higher cut quality by using the T30v (Powermax30) 30 A consumables and cut charts.

T45m shielded consumables



220673
Shield

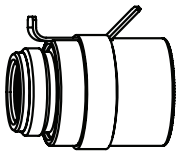
220713
Retaining cap

220671
Nozzle

220670
Swirl ring

220669
Electrode

or



220719
Ohmic sensing retaining cap

The cut charts for these consumables are shown on the following pages.

T45m shielded consumables

Mild steel
Metric

Air flowrate (lpm)	
Hot	151
Cold	165.2

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	0.5	1.5	3.8 mm	250%	0.0	9150	117	10160*	118
	0.8					8650	116	10160*	117
	0.9					8100	115	10160*	117
	1.5				0.2	5650	111	7100	115
45	0.9	1.5	3.8 mm	250%	0.0	9652	115	10160*	112
	1.5					8890	116	10160*	115
	1.9				0.1	7100	117	9144	115
	2.7				0.3	4800	117	6096	115
	3.4				0.4	3550	117	4445	115
	4.8				0.5	2150	118	2794	115
	6.4				0.6	1500	120	1905	116
	9.5				0.9	510	122	1016	116
	12.7		Edge start recommended			510	132	635	125
	15.9					280	138	356	127
	19.1					200	140	254	131
	25.4					100	146	127	142

* Maximum cut speed is limited by the test table's maximum speed (10160 mm/min).

T45m shielded consumables

Mild steel
English

Air flowrate (scfh)	
Hot	320
Cold	360

						Recommended		Maximum	
Arc current (amps)	**Material thickness**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.018 in (26 Ga)	0.06	0.15 in	250%	0.0	360	117	400*	118
	0.030 in (22 Ga)					340	116	400*	117
	0.036 in (20 Ga)					320	115	400*	117
	0.060 in (16 Ga)				0.2	225	111	280	115
45	0.036 in (20 Ga)	0.06	0.15 in	250%	0.0	380	115	400*	112
	0.060 in (16 Ga)					350	116	400*	115
	0.075 in (14 Ga)				0.1	280	117	360	115
	0.105 in (12 Ga)				0.3	190	117	240	115
	0.135 in (10 Ga)				0.4	140	117	175	115
	0.188 in (3/16 in)				0.5	85	118	110	115
	0.250 in (1/4 in)				0.6	60	120	75	116
	0.375 in (3/8 in)				0.9	32	122	40	116
	0.500 in (1/2 in)		Edge start recommended			20	132	25	125
	0.625 in (5/8 in)					11	138	14	127
	0.750 in (3/4 in)					8	140	10	131
	1.000 in (1 in)					4	146	5	142

* Maximum cut speed is limited by the test table's maximum speed (400 ipm).

T45m shielded consumables

Stainless steel
Metric

Air flowrate (lpm)	
Hot	151
Cold	165.2

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	0.5	1.5	3.8 mm	250%	0.0	9150	119	10160*	123
	0.8					8650	117	10160*	121
	0.9					8100	115	10160*	119
	1.5				0.2	3750	113	4700	118
45	0.9	1.5	3.8 mm	250%	0.0	7600	112	10160*	109
	1.5					8100	112	10160*	125
	1.9				0.1	7100	118	9144	115
	2.7				0.3	4050	118	5080	116
	3.4				0.4	3050	121	3810	118
	4.8				0.5	1780	122	2159	118
	6.4				0.6	1100	124	1397	120
	9.5				0.8	760	126	813	121
	12.7		Edge start recommended			350	132	457	128
	19.1					175	136	229	131

* Maximum cut speed is limited by the test able's maximum speed (10160 mm/min).

T45m shielded consumables

Stainless steel
English

Air flowrate (scfh)	
Hot	320
Cold	360

						Recommended		Maximum	
Arc current (amps)	**Material thickness**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.018 in (26 Ga)	0.06	0.15 in	250%	0.0	360	117	400*	123
	0.030 in (22 Ga)					340	116	400*	121
	0.036 in (20 Ga)					320	115	400*	119
	0.060 in (16 Ga)				0.2	145	111	185	118
45	0.036 in (20 Ga)	0.06	0.15 in	250%	0.0	300	115	400*	109
	0.060 in (16 Ga)					320	116	400*	125
	0.075 in (14 Ga)				0.1	280	117	360	115
	0.105 in (12 Ga)				0.3	160	117	200	116
	0.135 in (10 Ga)				0.4	120	117	150	118
	0.188 in (3/16 in)				0.5	70	118	85	118
	0.250 in (1/4 in)				0.6	44	120	55	120
	0.375 in (3/8 in)				0.8	30	122	32	121
	0.500 in (1/2 in)		Edge start recommended			14	132	18	128
	0.750 in (3/4 in)					7	140	9	131

* Maximum cut speed is limited by the test table's maximum speed (400 ipm).

T45m shielded consumables

Aluminum
Metric

Air flowrate (lpm)	
Hot	151
Cold	165.2

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	1.2	1.5	3.8 mm	250%	0.0	9150	117	10160*	120
	1.5				0.2	8650	118	10160*	121
	1.9					5450	118	6860	121
45	1.5	1.5	3.8 mm	250%	0.0	9150	116	10160*	114
	1.9					8650	117	10160	116
	2.7					7100	120	9144	119
	3.4				0.1	5600	122	7112	120
	4.8				0.2	2550	123	3302	120
	6.4				0.3	2050	123	2540	120
	9.5				0.5	840	130	1067	125
	12.7		Edge start recommended			510	134	635	130
	19.1					200	143	254	138

* Maximum cut speed is limited by the test table's maximum speed (10160 mm/min).

T45m shielded consumables

Aluminum
English

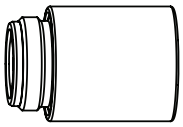
Air flowrate (scfh)	
Hot	320
Cold	360

						Recommended		Maximum	
Arc current (amps)	**Material thickness**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.018 in (26 Ga)	0.06	0.15 in	250%	0.0	360	117	400*	120
	0.060 in (16 Ga)				0.2	340	118	400*	121
	0.075 in (14 Ga)					215	118	270	121
45	0.060 in (16 Ga)	0.06	0.15 in	250%	0.0	360	116	400*	114
	0.075 in (14 Ga)					340	117	400*	116
	0.105 in (12 Ga)					280	120	360	119
	0.135 in (10 Ga)				0.1	220	122	280	120
	0.188 in (3/16 in)				0.2	100	123	130	120
	0.250 in (1/4 in)				0.3	80	123	100	120
	0.375 in (3/8 in)				0.5	33	130	42	125
	0.500 in (1/2 in)		Edge start recommended			20	134	25	130
	0.750 in (3/4 in)					8	143	10	138

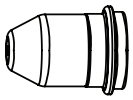
* Maximum cut speed is limited by the test table's maximum speed (400 ipm).

T45m unshielded consumables

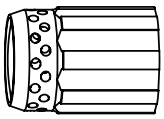
220717
Deflector



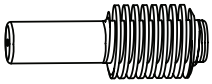
220713
Retaining cap



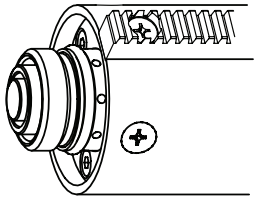
220718
Nozzle



220670
Swirl ring



220669
Electrode



Mild steel
Metric

Air flowrate (lpm)	
Hot	151
Cold	165.2

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	0.5	2.0	5.0 mm	250%	0.0	9150	118	10160*	114
	0.8					8650	118	10160*	116
	0.9					8100	117	10160*	120
	1.5				0.2	5800	113	7250	119
45	0.9	2.0	5.0 mm	250%	0.0	9650	118	10160*	110
	1.5					8900	114	10160*	113
	1.9					6100	114	7620	114
	2.7				0.3	4450	116	5588	114
	3.4				0.4	3400	118	4318	116
	4.8				0.4	2150	118	2794	116
	6.4				0.5	1500	118	1905	118
	9.5				0.7	810	120	1016	118
	12.7		Edge start recommended			510	130	635	124
	15.9					280	132	356	126
	19.1					200	138	254	132
	25.4					100	145	127	140

* Maximum cut speed is limited by the test table's maximum speed (10160 mm/min).

T45m unshielded consumables

Mild steel
English

Air flowrate (scfh)	
Hot	320
Cold	360

						Recommended		Maximum	
Arc current (amps)	**Material thickness**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.018 in (26 Ga)	0.08	0.2 in	250%	0.0	360	118	400*	114
	0.030 in (22 Ga)					340	118	400*	116
	0.036 in (20 Ga)					320	117	400*	120
	0.060 in (16 Ga)				0.2	225	113	285	119
45	0.036 in (20 Ga)	0.08	0.2 in	250%	0.0	380	118	400*	110
	0.060 in (16 Ga)					350	114	400*	113
	0.075 in (14 Ga)					240	114	300	114
	0.105 in (12 Ga)				0.3	175	116	220	114
	0.135 in (10 Ga)				0.4	135	118	170	116
	0.188 in (3/16 in)				0.4	85	118	110	116
	0.250 in (1/4 in)				0.5	60	118	75	118
	0.375 in (3/8 in)				0.7	32	120	40	118
	0.500 in (1/2 in)		Edge start recommended			20	130	25	124
	0.625 in (5/8 in)					11	132	14	126
	0.750 in (3/4 in)					8	138	10	132
	1.000 in (1 in)					4	145	5	140

* Maximum cut speed is limited by the test table's maximum speed (400 ipm).

T45m unshielded consumables

Stainless steel
Metric

Air flowrate (lpm)	
Hot	151
Cold	165.2

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	0.5	2.0	5.0 mm	250%	0.0	9144	113	10160*	125
	0.8					8128	115	10160*	128
	0.9					7000	114	9000	125
	1.5				0.2	3650	112	4800	118
45	0.9	2.0	5.0 mm	250%	0.0	8900	112	10160*	110
	1.5					8100	115	10160*	113
	1.9				0.1	7112	116	9144	114
	2.7				0.3	4100	118	5080	116
	3.4				0.4	2800	120	3556	118
	4.8				0.5	1650	120	2032	118
	6.4				0.6	1010	121	1270	118
	9.5				0.8	610	125	762	120
	12.7		Edge start recommended			355	130	457	126
	19.1					175	133	229	138

* Maximum cut speed is limited by the test table's maximum speed (10160 mm/min).

T45m unshielded consumables

Stainless steel
English

Air flowrate (scfh)	
Hot	320
Cold	360

						Recommended		Maximum	
Arc current (amps)	**Material thickness**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.018 in (26 Ga)	0.08	0.2 in	250%	0.0	400*	113	400*	125
	0.030 in (22 Ga)					400*	115	400*	128
	0.036 in (20 Ga)					345	114	345	125
	0.060 in (16 Ga)				0.2	145	112	180	118
45	0.036 in (20 Ga)	0.08	0.2 in	250%	0.0	350	112	400*	110
	0.060 in (16 Ga)					320	115	400*	113
	0.075 in (14 Ga)				0.1	280	116	360	114
	0.105 in (12 Ga)				0.3	160	118	200	116
	0.135 in (10 Ga)				0.4	110	120	140	118
	0.188 in (3/16 in)				0.5	64	120	80	118
	0.250 in (1/4 in)				0.6	40	121	50	118
	0.375 in (3/8 in)				0.8	24	125	30	120
	0.500 in (1/2 in)		Edge start recommended			14	130	18	126
	0.750 in (3/4 in)					7	133	9	138

* Maximum cut speed is limited by the test table's maximum speed (400 ipm).

T45m unshielded consumables

Aluminum
Metric

Air flowrate (lpm)	
Hot	151
Cold	165.2

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	1.2	2.0	5.0 mm	250%	0.0	8900	122	10160*	121
	1.5				0.1	8100	120	10160*	118
	1.9				0.2	5700	121	7100	119
45	1.5	2.0	5.0 mm	250%	0.0	8900	120	10160*	116
	1.9					8100	120	10160*	116
	2.7					7200	122	9144	118
	3.4				0.1	5500	123	6858	118
	4.8				0.3	2540	123	3175	118
	6.4				0.3	1820	128	2286	124
	9.5				0.5	710	130	914	124
	12.7		Edge start recommended			510	131	635	125
	19.1					200	148	254	143

* Maximum cut speed is limited by the test table's maximum speed (10160 mm/min).

T45m unshielded consumables

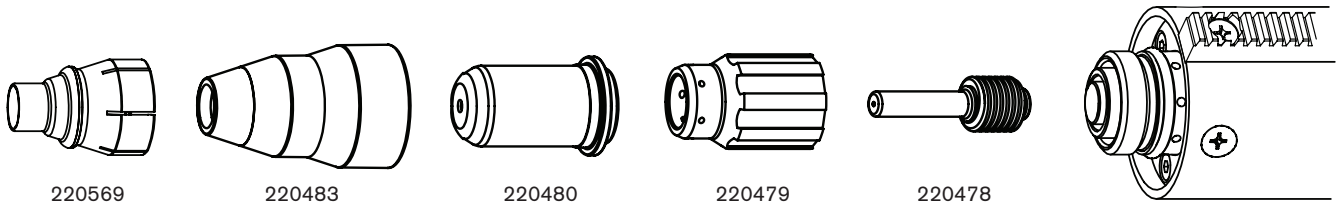
Air flowrate (scfh)	
Hot	320
Cold	360

Aluminum
English

						Recommended		Maximum	
Arc current (amps)	**Material thickness**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.018 in (26 Ga)	0.08	0.20 in	250%	0.0	350	122	400*	121
	0.060 in (16 Ga)				0.1	320	120	400*	118
	0.075 in (14 Ga)				0.2	225	121	280	119
45	0.060 in (16 Ga)	0.08	0.20 in	250%	0.0	350	120	400*	116
	0.075 in (14 Ga)					320	120	400*	116
	0.105 in (12 Ga)					285	122	360	118
	0.135 in (10 Ga)				0.1	215	123	270	118
	0.188 in (3/16 in)				0.3	100	123	125	118
	0.250 in (1/4 in)				0.3	72	128	90	124
	0.375 in (3/8 in)				0.5	28	130	36	124
	0.500 in (1/2 in)		Edge start recommended			20	131	25	125
	0.750 in (3/4 in)					8	148	10	143

* Maximum cut speed is limited by the test table's maximum speed (400 ipm).

T30v (Powermax30) 30 A consumables



220569
Optional deflector

220483
Retaining cap

220480
Nozzle

220479
Swirl ring

220478
Electrode

Mild steel
Metric

Air flowrate (lpm)	
Hot	131.2
Cold	146.3

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	0.5	0.5	2.5 mm	500%	0.0	8900	105	10160*	98
	0.8					8100	102	10160*	103
	0.9					7100	101	8900	100
	1.5				0.2	4450	97	5600	100
	1.9				0.4	3050	98	3800	97
	2.7					2050	96	2550	96
	3.4					1270	100	1650	101

* Maximum cut speed is limited by the test table's maximum speed (10160 mm/min).

T30v (Powermax30) 30 A consumables

Mild steel
English

Air flowrate (scfh)	
Hot	280
Cold	310

						Recommended		Maximum	
Arc current (amps)	**Material thickness (in)**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.018 (26 Ga)	0.02	0.1 in	500%	0.0	350	105	400*	98
	0.030 (22 Ga)					320	102	400*	103
	0.036 (20 Ga)					280	101	350	100
	0.060 (16 Ga)				0.2	175	97	220	100
	0.075 (14 Ga)				0.4	120	98	150	97
	0.105 (12 Ga)					80	96	100	96
	0.135 (10 Ga)					50	100	65	101

T30v (Powermax30) 30 A consumables

Stainless steel
Metric

Air flowrate (lpm)	
Hot	131.2
Cold	146.3

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	0.5	0.5	2.5 mm	500%	0.0	8900	103	10160*	102
	0.8					8100	98	10160*	100
	0.9					7600	97	6850	98
	1.5				0.2	3800	99	4800	98
	1.9				0.4	2800	101	3450	97
	2.7					1500	101	1900	98
	3.4					1150	102	1400	97

* Maximum cut speed is limited by the test table's maximum speed (400 ipm or 10160 mm/min).

T30v (Powermax30) 30 A consumables

Stainless steel
English

Air flowrate (scfh)	
Hot	280
Cold	310

						Recommended		Maximum	
Arc current (amps)	**Material thickness (in)**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.018 (26 Ga)	0.02	0.1 in	500%	0.0	350	103	400*	102
	0.030 (22 Ga)					320	98	400*	100
	0.036 (20 Ga)					300	97	380	98
	0.060 (16 Ga)				0.2	150	99	190	98
	0.075 (14 Ga)				0.4	110	101	135	97
	0.105 (12 Ga)					60	101	75	98
	0.135 (10 Ga)					45	102	55	97

T30v (Powermax30) 30 A consumables

Aluminum
Metric

Air flowrate (lpm)	
Hot	131.2
Cold	146.3

						Recommended		Maximum	
Arc current (amps)	**Material thickness (mm)**	**Torch-to-work distance (mm)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (mm/min)**	**Voltage (V)**	**Cut Speed (mm/min)**	**Voltage (V)**
30	0.5	0.5	2.5 mm	500%	0.0	8100	107	10160*	105
	0.8					6100	104	7650	103
	0.9					4800	104	6100	103
	1.5				0.2	3700	103	4550	103
	1.9					2400	101	3050	101

* Maximum cut speed is limited by the test table's maximum speed (400 ipm or 10160 mm/min).

T30v (Powermax30) 30 A consumables

Aluminum
English

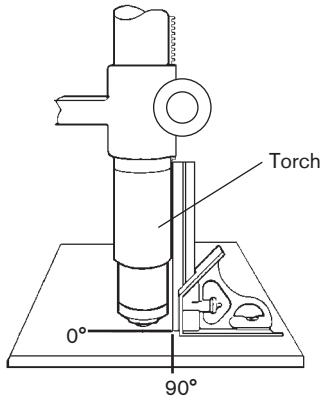
Air flowrate (scfh)	
Hot	280
Cold	310

						Recommended		Maximum	
Arc current (amps)	**Material thickness (in)**	**Torch-to-work distance (in)**	**Initial pierce height**		**Pierce time delay (sec)**	**Cut Speed (ipm)**	**Voltage (V)**	**Cut Speed (ipm)**	**Voltage (V)**
30	0.036 (20 Ga)	0.02	0.10 in	500%	0.0	320	107	400*	105
	0.060 (16 Ga)					240	104	300	103
	0.075 (14 Ga)					190	104	240	103
	0.105 (12 Ga)				0.2	145	103	180	103
	0.135 (10 Ga)					95	101	120	101

* Maximum cut speed is limited by the test table's maximum speed (400 ipm).

Align the torch

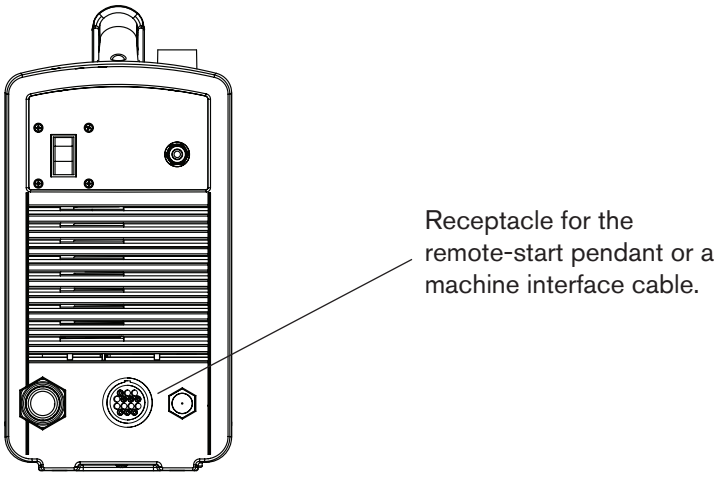
Mount the machine torch perpendicular to the workpiece in order to get a vertical cut. Use a square to align the torch at 0° and 90°.



Connect the remote-start pendant

Configurations of a Powermax45 with a T45m also can include a 7.62 m / 25-foot (128650), 15.24 m / 50-foot (128651), or 22.86 m / 75-foot (128652) remote-start pendant. To use the Hypertherm remote-start pendant, plug it into the receptacle on the rear of the power supply.

Note: The remote-start pendant is for use only with a machine torch. It will not operate if a hand torch is installed.



Connect a machine interface cable

The Powermax45 is equipped with a factory-installed voltage divider that is designed to be safely connected without tools. The built-in voltage divider provides a 50:1 arc voltage. A receptacle on the rear of the power supply provides access to the 50:1 arc voltage and signals for arc transfer and plasma start.

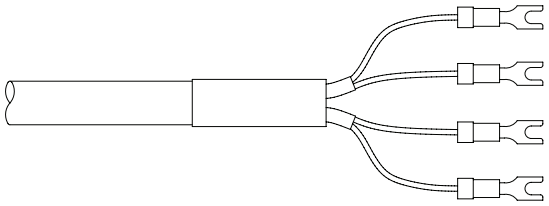
CAUTION

The factory-installed internal voltage divider provides a maximum of 7 V under open circuit conditions. This is an impedance-protected functional extra low voltage (ELV) output to prevent shock, energy, and fire under normal conditions at the machine interface receptacle and under single fault conditions with the machine interface wiring. The voltage divider is not fault tolerant and ELV outputs do not comply with safety extra low voltage (SELV) requirements for direct connection to computer products.

Hypertherm offers several choices of machine interface cables for the Powermax45:

- To use the built-in voltage divider that provides a 50:1 arc voltage in addition to signals for arc transfer and plasma start:
  - — Use kit number 228350 (7.62 m, 25 feet) or 228351 (15.24 m, 50 feet) for 6 wires terminated with spade connectors. (The following diagram shows an example of spade connectors.)
  - — Use part number 223048 (7.62 m, 25 feet) or 123896 (15.24 m, 50 feet) for a cable terminated with a D-sub connector. (Compatible with Hypertherm's EDGE® Pro Ti and Sensor™ PHC products.)

- To use signals for arc transfer and plasma start only, use either part number 023206 (7.62 m, 25 feet) or part number 023279 (15.24 m, 50 feet). These cables have spade connectors as shown here:



Note: The cover on the machine interface receptacle prevents dust and moisture from damaging the receptacle when not in use. This cover should be replaced if damaged or lost (127204).

Installation of the machine interface cable must be performed by a qualified service technician. To install a machine interface cable:

1. Turn OFF the power and disconnect the power cord.

2. Remove the machine interface receptacle's cover from the rear of the power supply.

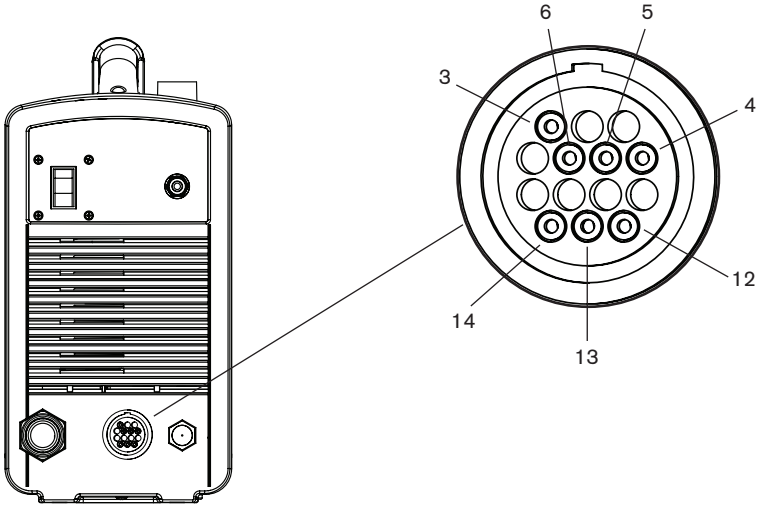
3. Connect the Hypertherm machine interface cable to the power supply.

4. If you are using a cable with a D-sub connector on the other end, plug it into the appropriate pin connector on the torch height controller or CNC. Secure it with the screws on the D-sub connector.

   If you are using a cable with wires and spade connectors on the other end, terminate the machine interface cable inside the electrical enclosure of listed and certified torch height controllers or CNC controllers to prevent operator access to the connections after installation. Verify that the connections are correct and that all live parts are enclosed and protected before operating the equipment.

   Note: The integration of Hypertherm equipment and customer-supplied equipment including interconnecting cords and cables, if not listed and certified as a system, is subject to inspection by local authorities at the final installation site.

The connector sockets for each type of signal available through the machine interface cable are shown below. The table on page 3-27 provides details about each signal type.



Refer to the following table when connecting the Powermax45 to a torch height controller or CNC with a machine interface cable.

Signal	Type	Notes	Connector sockets	External cable wires
Start (start plasma)	Input	Normally open. 18 VDC open circuit voltage at START terminals. Requires dry contact closure to activate.	3, 4	Green, black
Transfer (start machine motion)	Output	Normally open. Dry contact closure when the arc transfers. 120 VAC/1 A maximum at the machine interface relay or switching device (supplied by the customer).	12, 14	Red, black
Ground	Ground		13	
Voltage divider	Output	Divided arc signal of 50:1 (provides a maximum of 7 V).	5 (-), 6 (+)	Black (-), white (+)

Accessing raw arc voltage

Connecting a cable to the Powermax45 power board to bypass the voltage divider and access raw arc voltage must be done by a qualified service technician.

WARNING
HIGH VOLTAGE AND CURRENT

Connecting directly to the plasma circuit for access to raw arc voltage increases the risk of shock hazard, energy hazard, and fire hazard in the event of a single fault. The output voltage and the output current of the circuit are specified on the data plate.

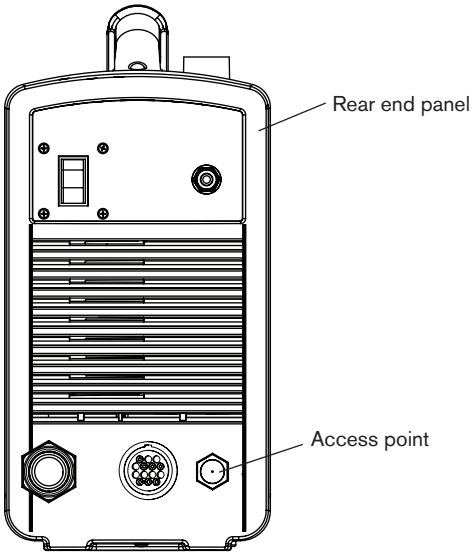
To access raw arc voltage on a Powermax45, you will need kit number 228352 and an 18 AWG, 2 wire, non-shielded cable similar to OLFLEX® 190 (601802) in the length needed to go between the power supply and the CNC or other equipment plus an additional 45.72 cm (18 inches).

1. On the end of the cable that will be attached to the power supply, strip the outer jacket 11.43 cm (4.5 inches). Cut 6.35 cm (2.5 inches) off of wire 2 so that wire 1 is 11.43 cm (4.5 inches) long and wire 2 is 5.08 cm (2 inches) long. Then strip 1.27 cm (0.5 inches) of wire insulation off of each wire.

2. Crimp a #8 insulated ring on the end of wire 1 and a #10 insulated ring on the end of wire 2.

3. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.

4. Separate the rear panel from the Powermax45 by removing the screw from the bottom and backing the end panel away from the base so that there is enough room to drill out the access point without risk of hitting the interior components.



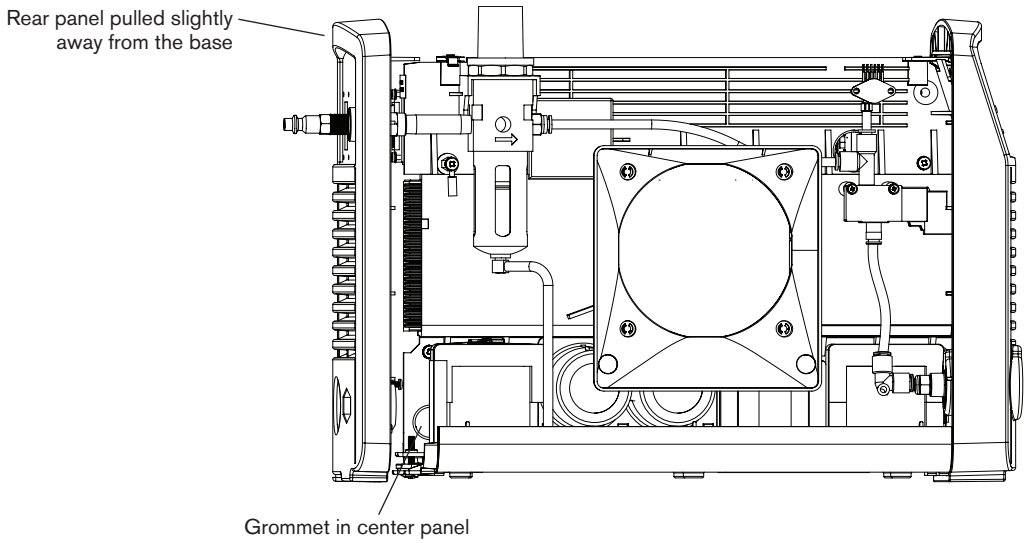
5. Use a drill with a 19/32 inch drill bit to drill out the access point on the rear panel.

6. Route the cable through the strain relief and tighten it down so that 45.72 cm (18 inches) of insulated wire is on the side of the strain relief that will go inside the power supply.

7. Thread the 45.72 cm (18 inches) of wire through the hole you drilled in the rear panel and fit the strain relief into the hole. If necessary, drill out any remaining rough spots so that the strain relief fits snugly.

8. Tighten the strain relief nut on the inside of the rear panel to hold the strain relief in place.

9. Find the grommet closest to the rear panel and at the bottom of the center panel. Route the 2 wires through the grommet to the power board side of the power supply.

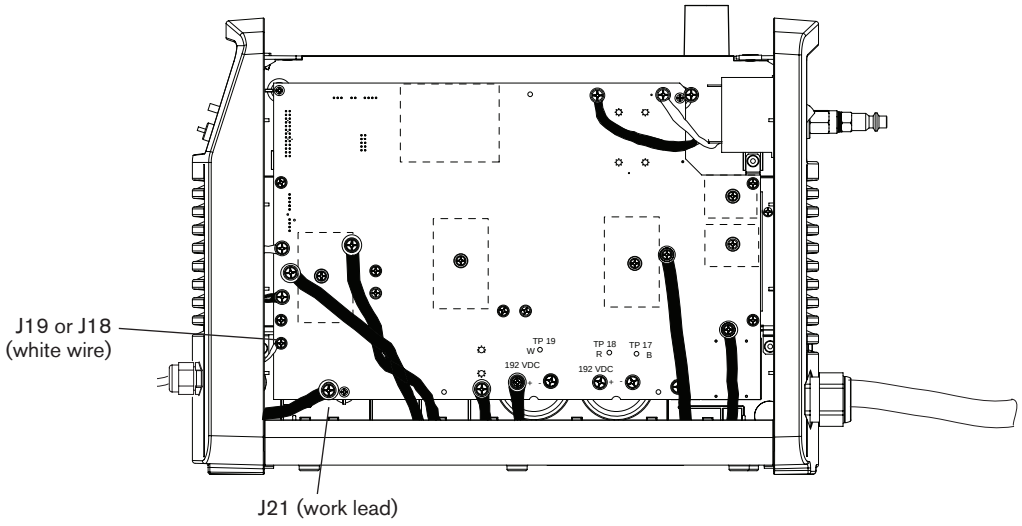


10. Route the wires along the base of the unit and behind the cables connected to the power board.

11. Remove the work lead connector screw at J21 and the white wire connector screw at J19 (J18 for 400 V CE and 480 V CSA power supplies).

12. Connect wire 1 to J19 (J18 for 400 V CE and 480 V CSA power supplies) with the ring connector for wire 1 closest to the power board and the connector for the white wire closest to the head of the screw. Turn the ring connector for wire 1 upside down so that the slight bend in the ring connector base creates a little space between the wire and the board. Tighten the screw to 23.0 kg cm (20 inch-pounds).

13. Connect wire 2 to J21. This time, put the connector for the work lead closest to the power board and put the ring connector for wire 2 closest to the head of the screw. Torque the screw to 23.0 kg cm (20 inch-pounds).



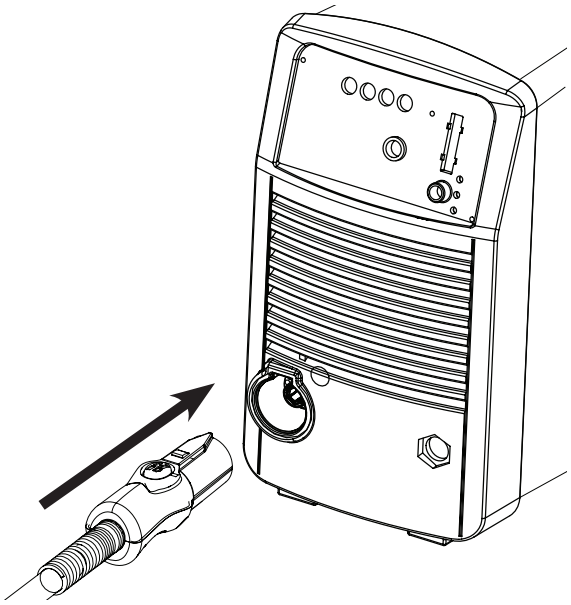
14. Replace the rear panel and secure it with the screw. Replace the Mylar barrier in front of the power board. Replace the cover.

15. Connect the other end of the cable to the equipment according to the manufacturer's instructions.

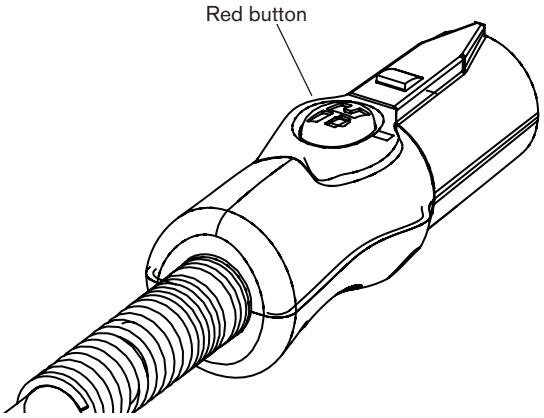
    NOTE: The integration of Hypertherm equipment and customer-supplied equipment including interconnecting cords and cables, if not listed and certified as a system, is subject to inspection by local authorities at the final installation site.

Connect the torch lead

The Powermax45 has a FastConnect system for connecting and disconnecting the hand and machine torches. When connecting or disconnecting a torch, first power OFF the system. To connect either torch, push the connector into receptacle on the front of the power supply.



To remove the torch, press the red button on the connector and pull the connector out of the receptacle.



Section 4

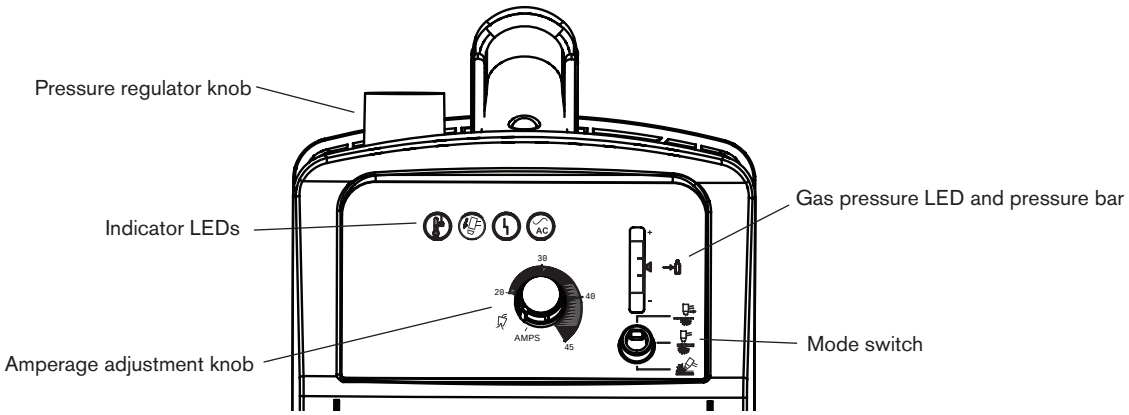
OPERATION

In this section:

Controls and indicators

The Powermax45 has an ON/OFF switch, an amperage adjustment knob, a pressure regulator knob, a mode switch, 4 indicator LEDs, and a gas pressure LED, which are described below.

Front controls and LEDs



Temperature LED (yellow)

When illuminated, this LED indicates that the power supply temperature is outside the acceptable range.

Torch cap sensor LED (yellow)

When illuminated, this LED indicates that the consumables are loose, improperly installed, or missing. For information on the possible fault conditions, refer to the *Troubleshooting guide* topic in the *Troubleshooting and System Tests* section. If this LED illuminates, the power must be turned OFF, the consumables installed properly, and the system turned ON again to reset it.

Fault LED (yellow)

When illuminated, this LED indicates that there is a fault with the power supply. Some fault conditions will cause one or more of the LEDs to blink. For information on what these fault conditions are and how to correct them, refer to the *Troubleshooting guide* topic in the *Troubleshooting and System Tests* section.

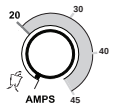
Power ON LED (green)

When illuminated, this LED indicates that the power switch has been set to I (ON) and that the safety interlocks are satisfied.

Gas pressure LED and pressure bar (yellow/green)

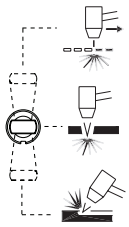
When the LED indicator in the pressure bar illuminates green and is centered in the vertical bar, the gas pressure is set correctly for the mode of cutting selected with the mode switch. If the pressure is too high for the selected mode, the indicator in the pressure bar will be above the mid-point of the bar. If it is too low, the indicator will be below the mid-point. At the highest and lowest points on the bar, the indicator will illuminate yellow.

If the indicator is at the lowest part of the bar and is flashing, then the gas pressure is less than the minimum required pressure.



Amperage adjustment knob

Set this knob to the gas test position (fully counter-clockwise) before adjusting the gas pressure with the pressure regulator knob on the top of the power supply. Once the gas pressure is set, turn the knob clockwise to set the output amperage. The torch will not fire when the knob is in gas-test position.



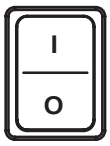
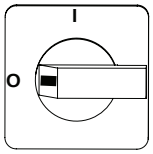
Mode switch and LEDs

The mode switch can be set in one of three positions:

- Continuous pilot arc to cut expanded metal or grate (top).
- Non-continuous pilot arc to cut metal plate (middle).
- Gouging (bottom).

After you change the mode switch, verify that the gas pressure is still set correctly. Different modes of cutting require different pressure settings.

Rear controls

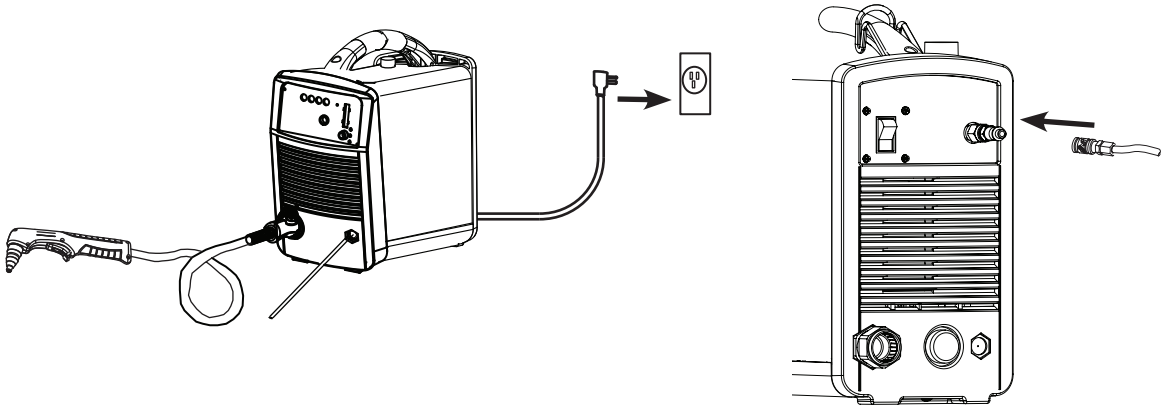
200–240 V CSA / 230 V CE	400 V CE / 480 V CSA	
		**ON (I)/OFF (O) power switch** Activates the power supply and its control circuits.

Operate the Powermax45

Follow the steps below to begin cutting or gouging with the Powermax45.

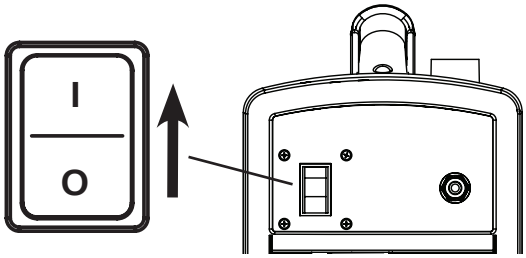
Connect the electrical power and gas supply

Plug in the power cord and connect the gas supply line. For more information about the electrical requirements and the gas supply requirements of the Powermax45, see the *Power Supply Setup* section.

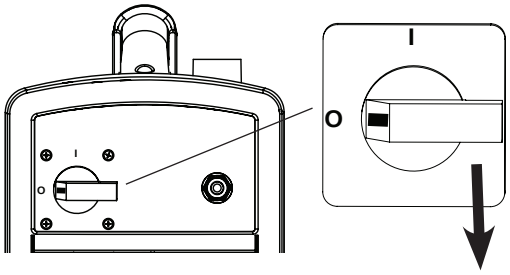


Power ON the system

Set the ON/OFF switch to the ON (I) position.



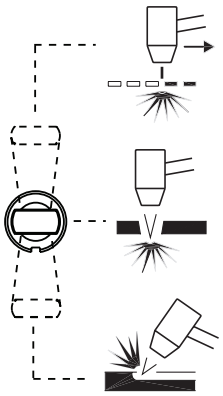
200–240 V CSA / 230 V CE



400 V CE / 480 V CSA

Set the mode switch

Use the mode switch to select the type of work you will be doing:



To cut expanded metal or grate (top position). Use this setting to cut metal with holes in it or for any job requiring a continuous pilot arc. Leaving the mode switch on this setting when cutting standard metal plate will result in reduced consumable life.

To cut metal plate (middle position). Use this setting to cut metal up to 25.4 mm (1-inch) thick or pierce metal up to 12.7 mm (1/2-inch) thick.

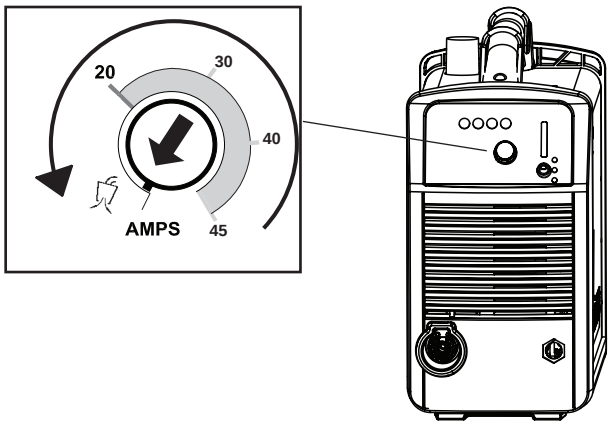
Gouging (bottom position). Use this setting to gouge metal. Leaving the mode switch on this setting while cutting results in poor cut quality.

Adjust the gas pressure

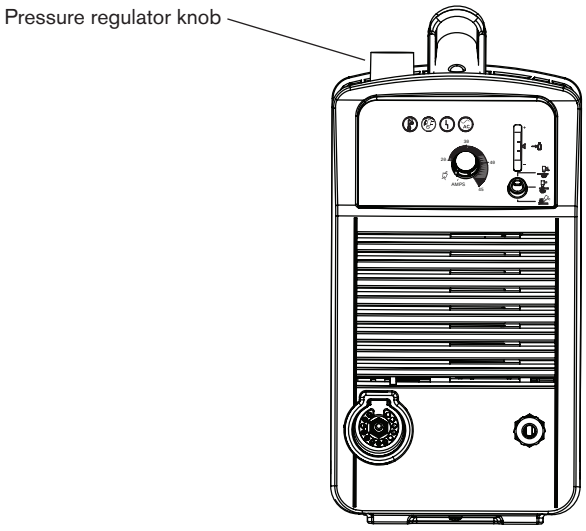
Look at the gas pressure LED. If it illuminates green in the center of the pressure bar, the incoming gas pressure is correct for the mode you have selected. If the LED illuminates yellow, either above or below the center, the gas pressure needs to be adjusted.

To adjust the pressure:

1. Turn the amperage knob counter-clockwise to the gas-test position as shown below.



2. With the amperage knob in the gas test position, pull up on the pressure regulator knob on top of the system to unlock it.



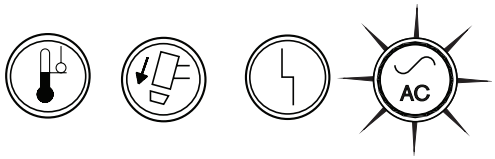
3. Turn the pressure regulator knob until the gas pressure LED shows a green bar in the center of the pressure bar.

4. Press down on the pressure regulator knob to lock it in position.

5. Turn the amperage knob to the cutting current appropriate for your application. If you are using T30v (Powermax30) 30 A consumables, do not set the amperage knob above 30 A.

Check the indicator LEDs

Verify that the green power ON LED on the front of the power supply is illuminated, that the gas pressure LED shows a green bar in the center of the gauge, and that none of the other LEDs are illuminated or blinking. If the temperature, torch cap sensor, or fault LEDs are illuminated or blinking, or if the power ON LED blinks, correct the fault condition before continuing. See the *Troubleshooting guide* topic in the *Troubleshooting and System Tests* section for more information.

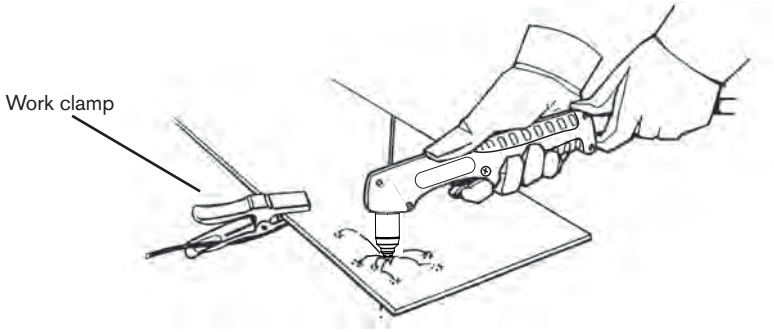


Attach the work clamp

The work clamp must be attached to the workpiece while you are cutting.

Note: If you are using the Powermax45 with a cutting table, you can ground it through the table instead of using the work clamp. See your table manufacturer's instructions for more information.

- Ensure that the work clamp and the workpiece make good metal-to-metal contact.
- For the best cut quality, attach the work clamp as close as possible to the area being cut.
- **Do not attach the work clamp to the portion of the workpiece to be cut away.**



When the power ON LED is illuminated, none of the other LEDs are illuminated or blinking, the gas pressure LED indicates pressure is in the correct range, the amperage knob is set, and the work clamp is attached, the system is ready for use.

Understand duty-cycle limitations

The duty cycle is the amount of time, in minutes, that a plasma arc can remain on within a 10-minute period when operating at an ambient temperature of 40° C (104° F). With a Powermax45:

- At 45 A, the arc can remain on for 5 minutes out of 10 minutes without causing the unit to overheat (50% duty cycle).
- At 41 A, the arc can remain on for 6 minutes out of 10 (60%).
- At 32 A, the arc can remain on for 10 minutes out of 10 (100%).

If the power supply overheats because the duty cycle is exceeded, the temperature LED will illuminate, the arc will shut off, and the cooling fan will continue to run. To resume cutting, wait for the temperature LED to extinguish.

The next section explains how to operate the hand torch. To use the machine torch, see *How to use the machine torch* on page 4-12.

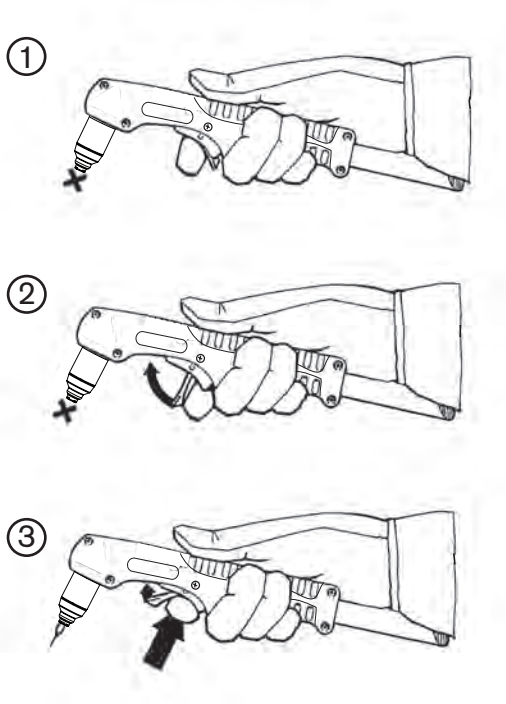
How to use the hand torch

WARNING
INSTANT-ON TORCHES
PLASMA ARC CAN CAUSE INJURY AND BURNS

Plasma arc comes on immediately when the torch trigger is activated. The plasma arc will cut quickly through gloves and skin.
- **Keep away from the torch tip.**
- **Do not hold the workpiece and keep your hands clear of the cutting path.**
- **Never point the torch toward yourself or others.**

Operate the safety trigger

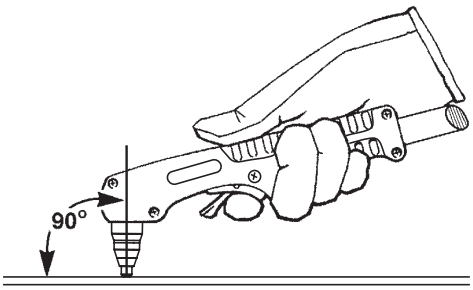
The T45v is equipped with a safety trigger to prevent accidental firings. When you are ready to cut with the torch, flip the yellow safety trigger forward (toward the torch head) and press the red torch trigger as show below.



Hand torch cutting hints

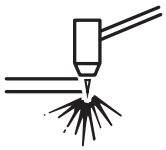
- With shielded consumables, drag the nozzle lightly along the workpiece to maintain a steady cut. With unshielded consumables, maintain an approximate 2 mm (0.08-inch) distance between the tip of the torch and the workpiece. (This is between 1.6–3.2 mm, or between 1/16th and 1/8th of an inch.)
- While cutting, make sure that sparks exit from the bottom of the workpiece. The sparks should be lagging slightly behind the torch as you cut (15° – 30° angle from vertical).
- If sparks are spraying up from the workpiece, move the torch more slowly, or set the output current higher.

- Hold the torch nozzle perpendicular to the workpiece so that the nozzle is at a 90° angle to the cutting surface, and watch the arc as it cuts along the line.

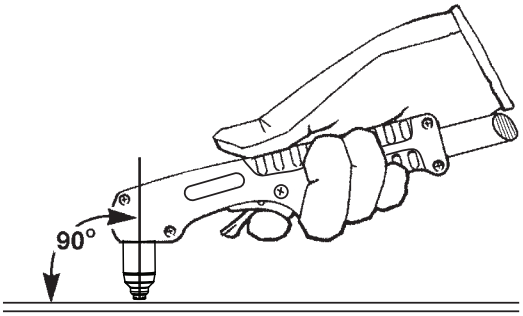


- If you fire the torch unnecessarily, you shorten the life of the nozzle and electrode.
- Pulling, or dragging, the torch along the cut is easier than pushing it.
- For straight-line cuts, use a straight edge as a guide. To cut circles, use a template or a radius cutter attachment (a circle cutting guide). See the *Parts* section for part numbers for the Hypertherm plasma cutting guides for cutting circles and making bevel cuts.

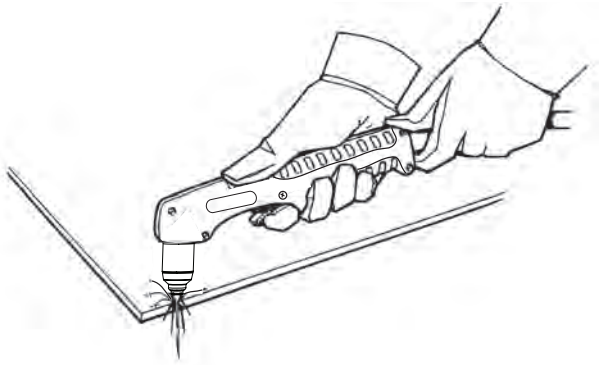
Start a cut from the edge of the workpiece



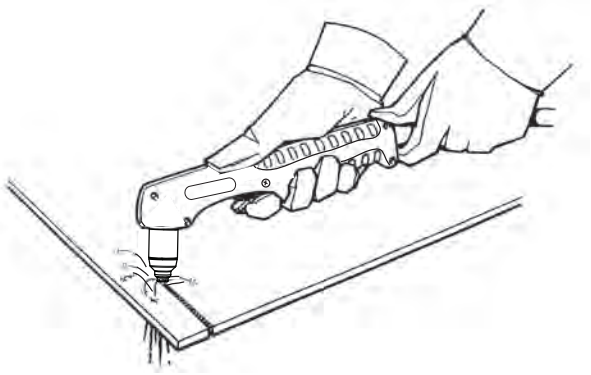
1. With the work clamp attached to the workpiece, hold the torch nozzle perpendicular (90°) to the edge of the workpiece. If you are using the shielded consumables, no standoff is needed. With unshielded consumables, maintain an approximate 2 mm (0.08-inch) standoff.



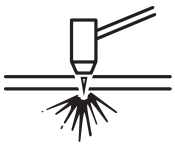
2. Press the torch trigger to start the arc. Pause at the edge until the arc has cut completely through the workpiece.



3. Drag the nozzle lightly across the workpiece to proceed with the cut. Maintain a steady, even pace.



Pierce a workpiece

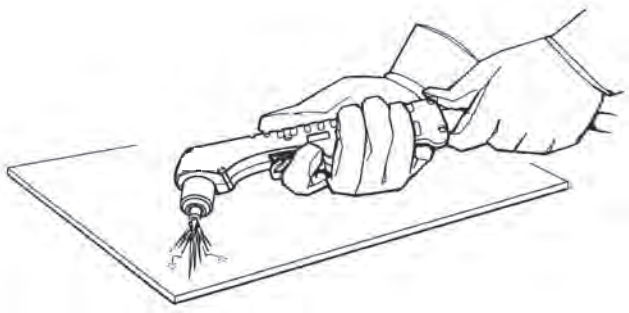


WARNING

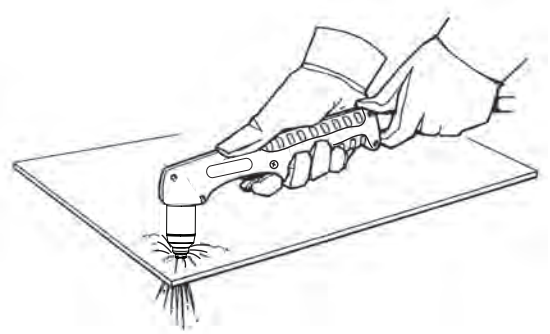
SPARKS AND HOT METAL CAN INJURE EYES AND BURN SKIN. When firing the torch at an angle, sparks and hot metal will spray out from the nozzle. Point the torch away from yourself and others.

1. With the work clamp attached to the workpiece, hold the torch at an approximate 30° angle to the workpiece with the nozzle within 1.5 mm (1/16 inch) of it before firing the torch.

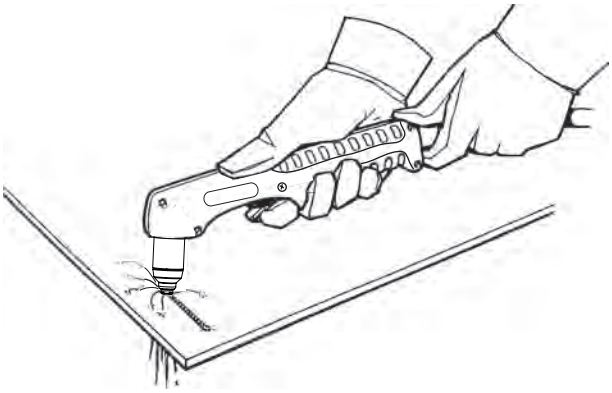
2. Fire the torch while still at an angle to the workpiece, then slowly rotate the torch to a perpendicular (90°) position.



3. Hold the torch in place while continuing to press the trigger. When sparks exit from the bottom of the workpiece, the arc has pierced the material.



4. When the pierce is complete, drag the nozzle lightly along the workpiece to proceed with the cut.



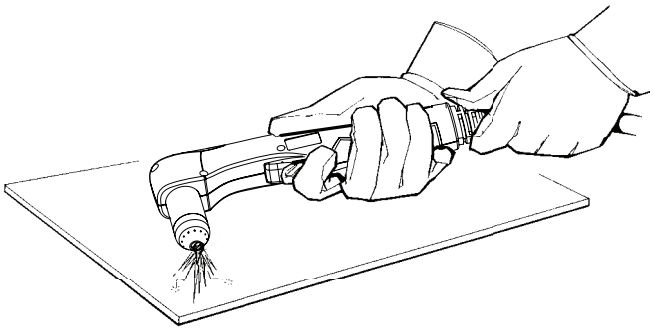
Gouge a workpiece

WARNING

SPARKS AND HOT METAL CAN INJURE EYES AND BURN SKIN. When firing the torch at an angle, sparks and hot metal will spray out from the nozzle. Point the torch away from yourself and others.

1. Hold the torch so that the nozzle is within 1.5 mm (1/16 inch) from the workpiece before firing the torch.

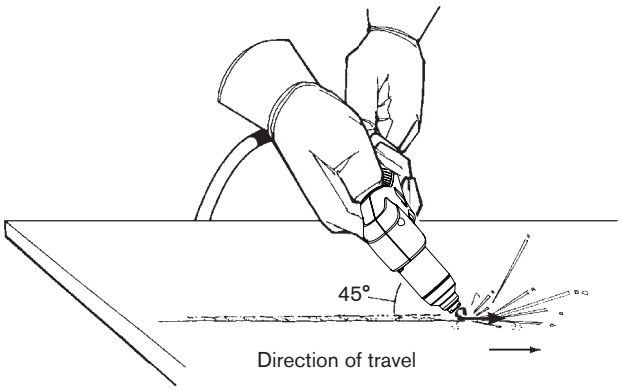
2. Hold the torch at a 45° angle to the workpiece with a small gap between the torch tip and the workpiece. Press the trigger to obtain a pilot arc. Transfer the arc to the workpiece.



3. Maintain an approximate 45° angle to the workpiece as you feed into the gouge.

   In other words, push the plasma arc in the direction of the gouge you want to create. Keep a small distance between the torch tip and the molten metal to avoid reducing consumable life or damaging the torch.

   Changing the torch angle changes the dimensions of the gouge.



Note: A heat shield is available for added hand and torch protection (220049).

You can vary the depth of the gouge by varying the angle of the torch to the workpiece. The following tables show the gouging profile at 45° and 60° on mild steel and stainless steel.

Mild steel gouging profile

Torch angle	Speed	Width	Depth
45°	254 mm/min (10 ipm)	7.75 mm (0.3051 inch)	1.05 mm (0.0415 inch)
	508 mm/min (20 ipm)	6.50 mm (0.2550 inch)	2.94 mm (0.1158 inch)
	762 mm/min (30 ipm)	5.76 mm (0.2267 inch)	1.87 mm (0.0735 inch)
	1016 mm/min (40 ipm)	5.30 mm (0.2087 inch)	1.31 mm (0.0517 inch)
	1270 mm/min (50 ipm)	4.73 mm (0.1863 inch)	1.03 mm (0.0406 inch)
60°	254 mm/min (10 ipm)	8.06 mm (0.3173 inch)	4.18 mm (0.1645 inch)
	508 mm/min (20 ipm)	6.15 mm (0.2423 inch)	2.39 mm (0.0941 inch)
	762 mm/min (30 ipm)	6.00 mm (0.2351 inch)	1.39 mm (0.0546 inch)
	1016 mm/min (40 ipm)	5.80 mm (0.2281 inch)	1.21 mm (0.0476 inch)
	1270 mm/min (50 ipm)	4.61 mm (0.1816 inch)	0.73 mm (0.0289 inch)

Stainless steel gouging profile

Torch angle	Speed	Width	Depth
45°	254 mm/min (10 ipm)	6.37 mm (0.2508 inch)	3.05 mm (0.1200 inch)
	508 mm/min (20 ipm)	5.74 mm (0.2258 inch)	1.96 mm (0.0772 inch)
	762 mm/min (30 ipm)	5.28 mm (0.2077 inch)	1.09 mm (0.0428 inch)
	1016 mm/min (40 ipm)	4.83 mm (0.1901 inch)	1.73 mm (0.0680 inch)
	1270 mm/min (50 ipm)	4.42 mm (0.1739 inch)	1.47 mm (0.0580 inch)
60°	254 mm/min (10 ipm)	6.55 mm (0.2580 inch)	5.92 mm (0.2330 inch)
	508 mm/min (20 ipm)	6.42 mm (0.2526 inch)	2.01 mm (0.0792 inch)
	762 mm/min (30 ipm)	5.92 mm (0.2329 inch)	1.45 mm (0.0569 inch)
	1016 mm/min (40 ipm)	5.36 mm (0.2110 inch)	1.10 mm (0.0432 inch)
	1270 mm/min (50 ipm)	5.09 mm (0.2003 inch)	0.82 mm (0.0322 inch)

Common hand-cutting faults

The torch sputters and hisses, but does not produce an arc. The cause can be:

- The consumables are too tight. Loosen the consumables about 1/8th of a turn and try again. Never tighten the consumables beyond just finger-tight.

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.
- Gouging consumables are installed instead of 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 metal being cut is too thick.
- The wrong consumables are being used (gouging consumables are installed instead of cutting consumables, for example).
- You are 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.
- The gas pressure is too low.

How to use the machine torch

Since the Powermax45 and the T45m can be used with a wide variety of cutting tables, track burners, pipe bevelers, and such, you will need to refer to the manufacturer's instructions for specifics on operating the machine torch in your configuration. However, the information in the following sections can help you optimize cut quality and maximize consumable life.

Ensure the torch and table are set up correctly

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

Understand and optimize cut quality

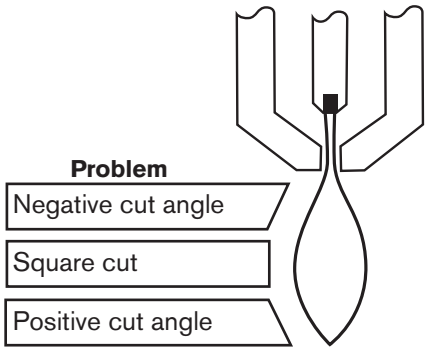
There are several factors to consider in cut quality:

- Cut angle – The degree of angularity of the cut edge.
- Dross – The molten material that solidifies on the top or bottom of the workpiece.
- Straightness of the cut surface – The cut surface can be concave or convex.

The following sections explain how these factors can affect cut quality.

Cut or bevel angle

- A positive cut angle, or bevel, 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.	Raise the torch; or if you are using a torch height control, increase the arc voltage.
The torch is too high.	Lower the torch; or if you are using a torch height control, decrease the arc voltage.

Notes: The squarest cut angle will be on the right side with respect to the forward motion of the torch. The left side will always have some degree of bevel.

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

If a cut-angle problem persists after "mechanical causes" have been eliminated (see *Ensure the torch and table are set up correctly* on page 4-12), check the torch-to-work distance, especially if the cut angles are all positive or all negative. Also consider the material being cut. If the metal is magnetized or hardened, you are more likely to experience cut angle problems.

Dross

Some amount of dross will always be present when cutting with air plasma. However, you can minimize the amount and type of dross by adjusting your system correctly for your application.

Dross appears on the top edge of both pieces of the plate when the torch is too low (or voltage is too high if using a torch height control). Adjust the torch or the voltage in small increments (5 volts or less) until the dross is reduced.

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 this type of dross.

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

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

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

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

Worn or damaged consumables may produce intermittent dross.

Straightness of the cut surface

A typical plasma cut surface is slightly concave.

The cut surface may become more concave or convex. Correct torch height is required to keep the cut surface acceptably close to straight. Worn consumables also affect the straightness of the cut.

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

A convex cut surface occurs when the torch-to-work distance is too great or the cutting current is too high. First, try lowering the torch, then reduce the cutting current.

To pierce a workpiece using the machine torch

As with the hand torch, you can start a cut with the machine torch at the edge of the workpiece or by piercing the workpiece. Piercing will result in a shorter consumable life than with edge starts.

The cut charts include a column for the height at which the torch should be when starting a pierce. For the Powermax45, the pierce height is generally 2.5 times the torch cutting height. Refer to the cut charts for specifics.

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

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

Common machine-cutting faults

The torch pilot arc will initiate, but will not transfer. Causes can be:

- The work cables connection on the cutting table is not making good contact or the table is not properly grounded.
- The torch-to-work distance is too great.

The workpiece is not totally penetrated, and there is excessive sparking on the top of the workpiece. Causes can be:

- The work cable's connection on the cutting table is not making good contact or the table is not properly grounded.
- The amperage is set too low. See the cut charts in the *Torch Setup* section for more information.
- The cut speed is too high. See the cut charts in the *Torch Setup* section for more information.
- The consumables are worn and need to be replaced.
- The metal being cut exceeds the maximum capacity. See *T45v and T45m torch specifications* in the *Specifications* section.

Dross forms on the bottom of the cut. Causes can be:

- The cutting speed is not correct. See the cut charts in the *Torch Setup* section for more information.
- The amperage is set too low. See the cut charts in the *Torch Setup* section for more information.
- The consumables are worn and need to be changed.

The cut angle is not square. Causes can be:

- The direction of the torch travel is incorrect. The high-quality cut is always on the right with respect to the forward motion of the torch.
- The distance between the torch and the workpiece is not correct.
- The cutting speed is not correct. See the cut charts in the *Torch Setup* section for more information.
- The consumables are worn and need to be replaced.

The consumable life is shortened. Causes can be:

- The arc current, arc voltage, travel speed, and other variables are not set as specified in the cut charts.
- Firing the arc in the air (beginning or ending the cut off of the plate surface). Starting at the edge is acceptable as long as the arc makes contact with the workpiece when started.
- Starting a pierce with an incorrect torch height. For the Powermax45, the pierce height is generally 2.5 times the torch cutting height. Refer to the cut charts for specifics.

Section 5

TROUBLESHOOTING AND SYSTEM TESTS

In this section:

Theory of operation

General

Refer to the following *functional description* topics, to *Sequence of operation* on page 5-4, and to the *Wiring Diagrams* section.

200–240 V CSA and 230 V CE 1-phase power supply functional description

AC power enters the system through the power switch (S1) to the input diode bridge (D48). The voltage from the diode bridge supplies the power factor correction (PFC) boost converter, which provides a nominal 385 VDC bus voltage. The bus voltage then supplies voltage and current to the inverter and the flyback circuit power supply (DC to DC converter) on the power board (PCB2). The power board provides noise suppression and spike protection. A “soft start” is implemented via the power board resistor and relays (K1, K2).

The PFC boost converter consists of an insulated gate bipolar transistor (IGBT Q2), PFC choke, and control circuit. It provides a 385 VDC bus voltage when the input AC voltage is between 200 and 240 VAC.

The inverter consists of a dual IGBT package (Q3), the power transformer, a current sense transducer, and the control circuit. The inverter operates as a pulse-width modulated half-bridge circuit driving an isolation transformer. The secondary of the isolation transformer is rectified by the output bridge (D38).

The output circuitry consists of 2 current sense transducers located on the power board, the pilot arc IGBT (inside the D38 module), and the output choke.

The control board’s digital signal processor (DSP) monitors and regulates the system’s operation and safety circuits. The amperage adjustment knob is used to set the output current to the desired value between 20 and 45 amps. The system compares the set-point to the output current by monitoring the current sense transducers and adjusting the pulse-width output of the inverter IGBTs (Q3). A trip coil on the power switch provides over-voltage protection.

400 V CE 3-phase power supply functional description

AC power enters the system through the power switch (S1) to the input diode bridge (D48). The voltage from the diode bridge supplies the power factor correction (PFC) choke, which provides a nominal 560 VDC bus voltage. The bus voltage then supplies voltage and current to the inverter and the flyback circuit power supply (DC to DC converter) on the power board (PCB2). The power board provides noise suppression and spike protection. A “soft start” is implemented via the power board resistor and relays (K2).

The inverter consists of a dual IGBT package (Q2), the power transformer, a current sense transducer, and the control circuit. The inverter operates as a pulse-width modulated half-bridge circuit driving an isolation transformer. The secondary of the isolation transformer is rectified by the output bridge (D40).

The output circuitry consists of 2 current sense transducers located on the power board, the pilot arc IGBT (inside the D40 module), and the output choke.

The control board’s digital signal processor (DSP) monitors and regulates the system’s operation and safety circuits. The amperage adjustment knob is used to set the output current to the desired value between 20 and 45 amps. The system compares the set-point to the output current by monitoring the current sense transducers and adjusting the pulse-width output of the inverter IGBT (Q2).

480 V CSA 3-phase power supply functional description

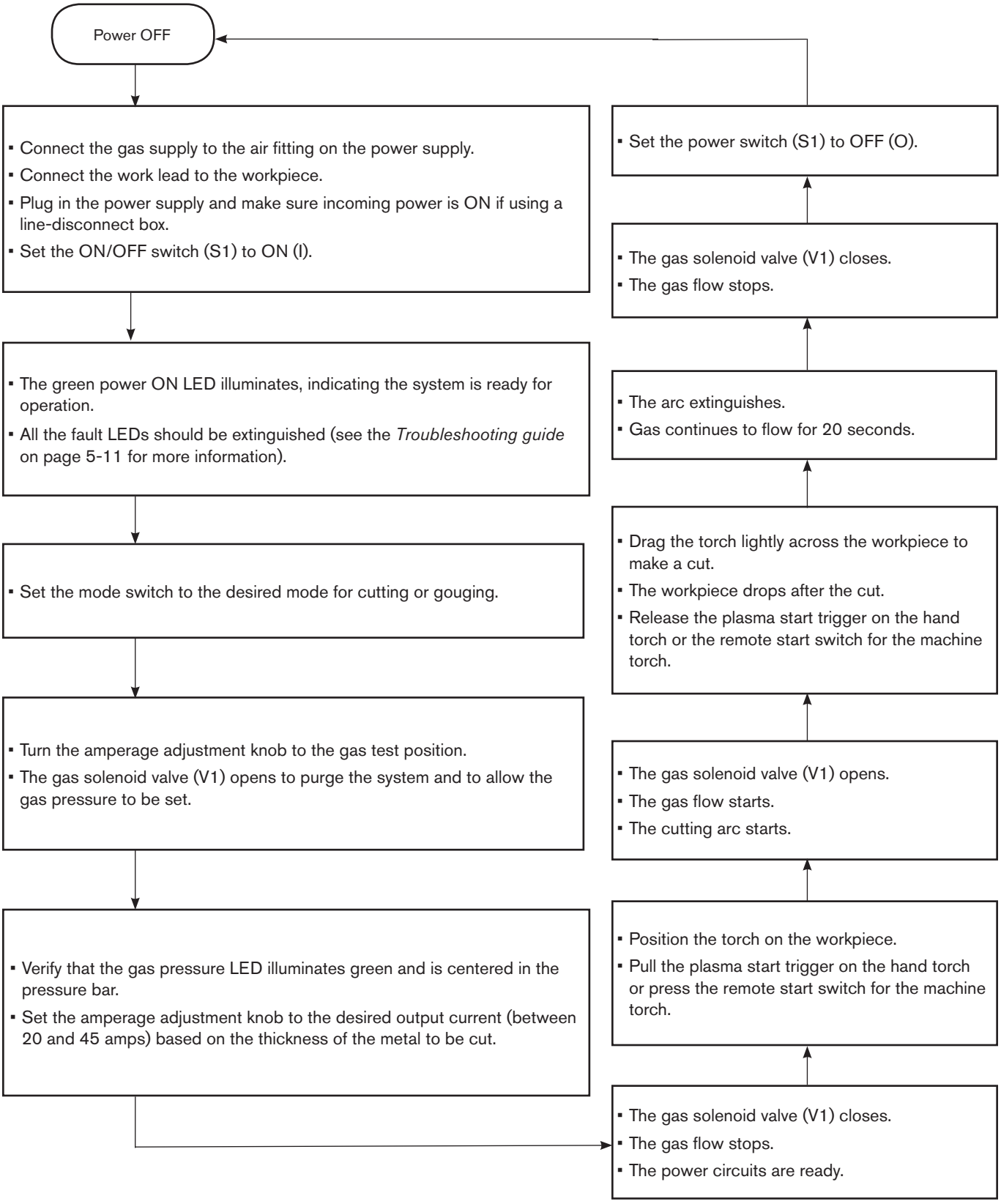
AC power enters the system through the power switch (S1) to the input diode bridge (D48). The voltage from the diode bridge supplies the power factor correction (PFC) choke, which provides a nominal 670 VDC bus voltage. The bus voltage then supplies voltage and current to the inverter and the flyback circuit power supply (DC to DC converter) on the power board (PCB2). The power board provides noise suppression and spike protection. A “soft start” is implemented via the power board resistor and relays (K2).

The inverter consists of a dual IGBT package (Q2), the power transformer, a current sense transducer, and the control circuit. The inverter operates as a pulse-width modulated half-bridge circuit driving an isolation transformer. The secondary of the isolation transformer is rectified by the output bridge (D40).

The output circuitry consists of 2 current sense transducers located on the power board, the pilot arc IGBT (inside the D40 module), and the output choke.

The control board’s digital signal processor (DSP) monitors and regulates the system’s operation and safety circuits. The amperage adjustment knob is used to set the output current to the desired value between 20 and 45 amps. The system compares the set-point to the output current by monitoring the current sense transducers and adjusting the pulse-width output of the inverter IGBT (Q2).

Sequence of operation



Troubleshooting preparation

The complexity of the circuits requires that service technicians have a working knowledge of inverter power supply theory. In addition to being technically qualified, technicians must perform all testing with safety in mind.

If questions or problems arise during servicing, call the Hypertherm Technical Services team listed in the front of this manual.

Test equipment

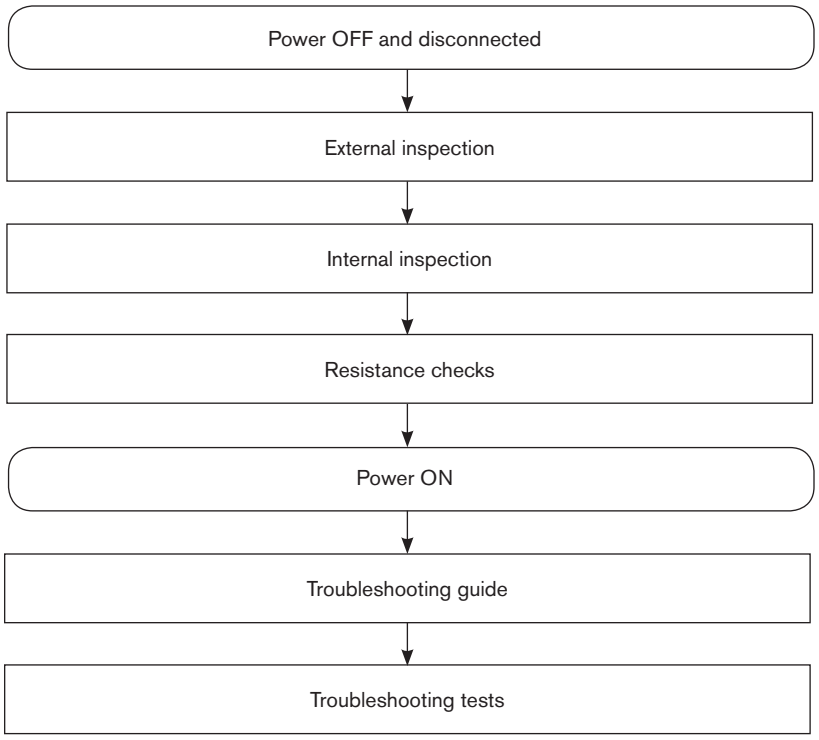
- Multimeter with a variety of jumper leads, including E-Z Hooks®.

Troubleshooting procedures and sequence

When performing the troubleshooting procedures,

- Read the *Safety and Compliance Manual* for detailed safety information;
- Refer to the *Wiring Diagrams* section for the system's electrical schematic;
- Refer to the *Component Replacement* section for part replacement procedures;
- Refer to the *Parts* section to locate power supply components and torch components.

After the problem has been located and repaired, refer to the *Sequence of operation* flow diagram on page 5-4 to test the power supply for proper operation.



	**DANGER**
	**ELECTRIC SHOCK CAN KILL** ▪ **Turn off the power and remove the input power plug from its receptacle before removing the cover from the power supply. If the power supply is connected directly to a line disconnect box, switch the line disconnect to OFF (O). In the U.S., use a "lock-out / tag-out" procedure until the service or maintenance work is complete. In other countries, follow appropriate national or local safety procedures.** ▪ **Do not touch live electrical parts! If power is required for servicing, use extreme caution when working near live electrical circuits. Dangerous voltages exist inside the power supply that can cause serious injury or death.** ▪ **Do not attempt to repair the power board or control board. Do not cut away or remove any protective conformal coating from either board. To do so will risk a short circuit between the AC input circuit and the output circuit and may result in serious injury or death.**
	**HOT PARTS CAN CAUSE SEVERE BURNS** ▪ **Allow the power supply to cool before servicing.**
	**MOVING BLADES CAN CAUSE INJURY** ▪ **Keep hands away from moving parts.**
	**STATIC ELECTRICITY CAN DAMAGE CIRCUIT BOARDS** ▪ **Put on a grounded wrist strap before handling PC boards.**

External inspection

1. Inspect the exterior of the power supply for damage to the cover and external components, such as the power cord and plug.
2. Inspect the torch and the torch lead for damage.

Internal inspection

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Gently pull on the end panel nearest the screw you are removing to keep pressure on the screw. When the screw is almost out, tilt the screwdriver slightly to help pull the screw out of the recessed hole.
3. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Set the handle and screws aside. Continue to tilt the end panels outward to release the fan side of the cover from its track. Then lift the cover off the power supply.

4. Remove the Mylar barrier from the power board side of the power supply. Be certain to replace the barrier when you are finished working on the power supply.

5. Inspect the inside of the power supply, especially on the side with the power board. Look for broken or loose wiring connections, burn and char marks, damaged components, and so on. Repair or replace as necessary.

Initial resistance check

All resistance values must be taken with the power cord disconnected and all internal power supply wires attached. Perform the steps in *Internal inspection* on page 5-6 before continuing in this section.

- If resistance values are not close (**±25%**) to the values given in this section, isolate the problem by removing wires attached to the resistance check points or component until the problem is found.
- After the problem has been located and repaired, refer to the *Sequence of operation* flow diagram on page 5-4 to test the power supply for proper operation.

1. With the power disconnected and the torch removed from the power supply, set the ON/OFF switch (S1) to ON (I).

2. Check the resistance across the input leads (the leads are identified with “AC” printed on the power board).
   - 200–240 V CSA and 230 V CE: resistance across the input leads = 75 kΩ.
   - 400 V CE and 480 V CSA: resistance across the input leads = 2.5 MΩ.

3. Check the resistance from the input leads to ground to verify that it reads as open. For all power supplies, the resistance from input to ground should read as > 20 MΩ.

   Note: With the power disconnected and the ON/OFF switch (S1) set to OFF (O), all circuits should read as open.

   The electrical values shown are ±25%.

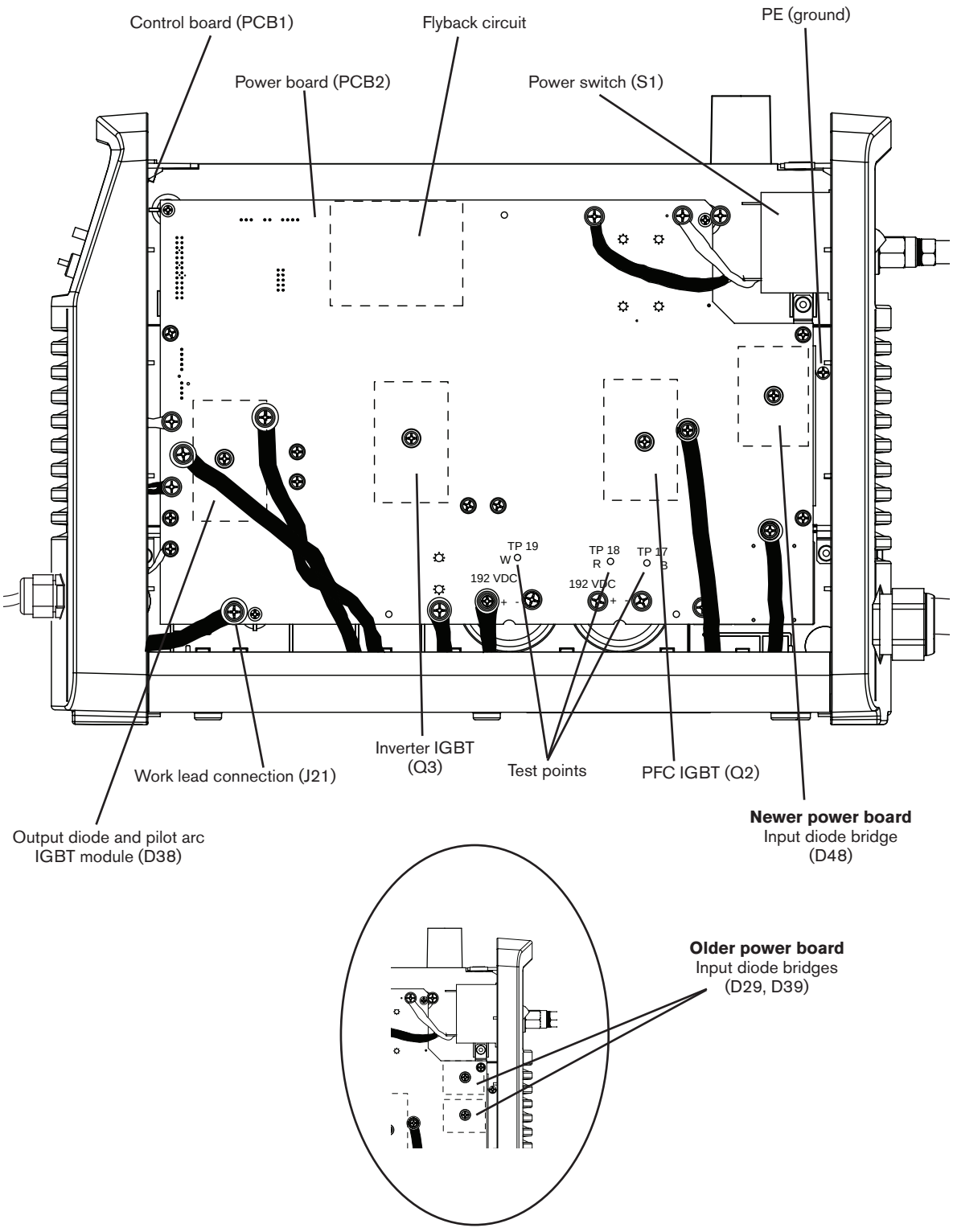
4. Check the output resistance for the values shown in the following table.

Measure resistance from	200–240 V CSA and 230 V CE power board location	400 V CE and 480 V CSA power board location	Approximate values
Work lead to nozzle	J21 to J17	J21 to J16	100 kΩ
Work lead to electrode	J21 to J19	J21 to J18	20 kΩ
Electrode to nozzle	J19 to J17	J18 to J16	120 kΩ
Output to ground			> 20 MΩ

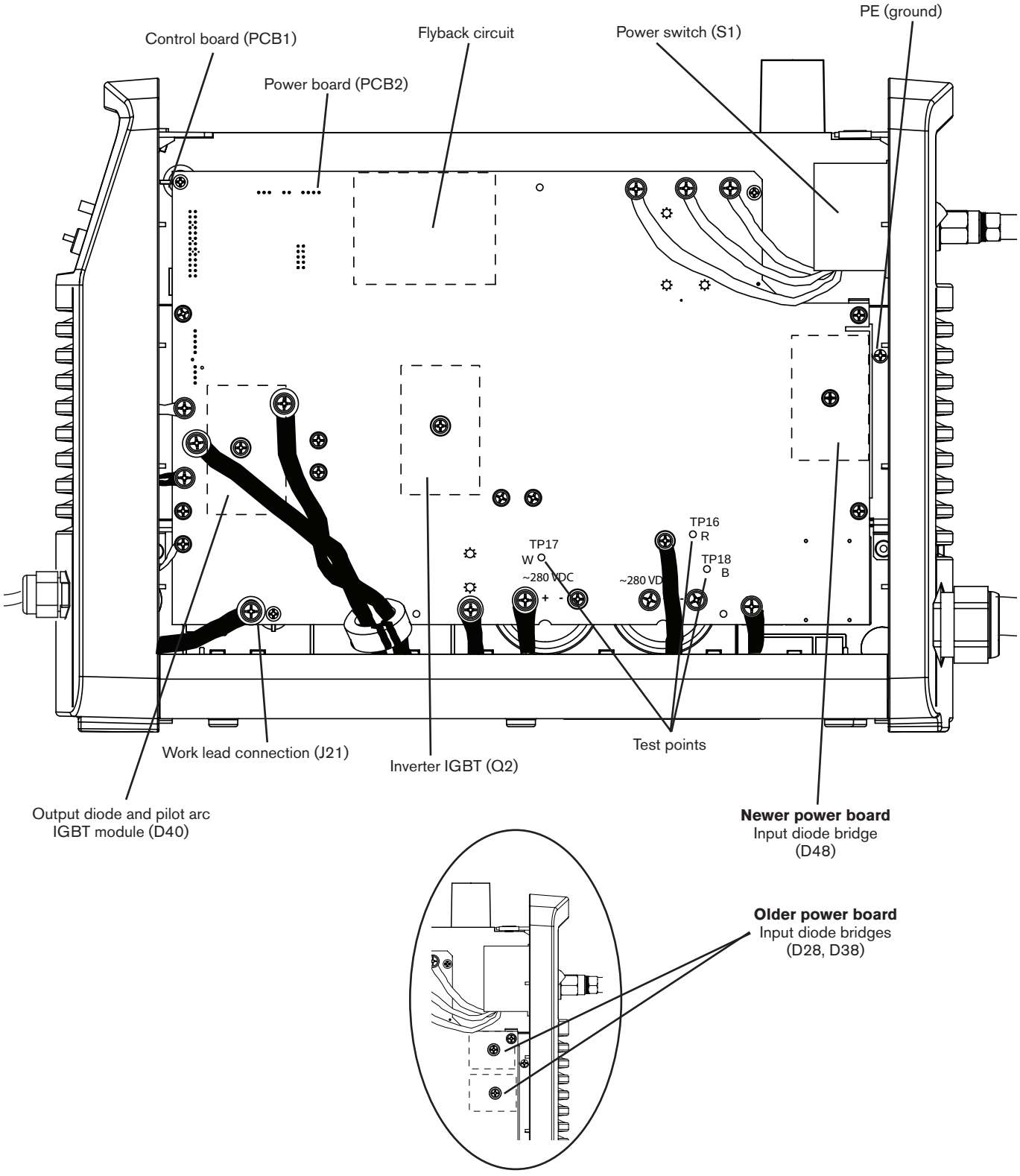
If no problems were found during the visual inspection or the initial resistance check, and the power supply still does not operate correctly, see the *Troubleshooting guide* on page 5-11.

Note: The *Troubleshooting guide* provides most probable causes and solutions. Study the system wiring diagram and understand the theory of operation before troubleshooting. Before purchasing any major replacement component, verify the problem with Hypertherm Technical Service or the nearest Hypertherm repair facility.

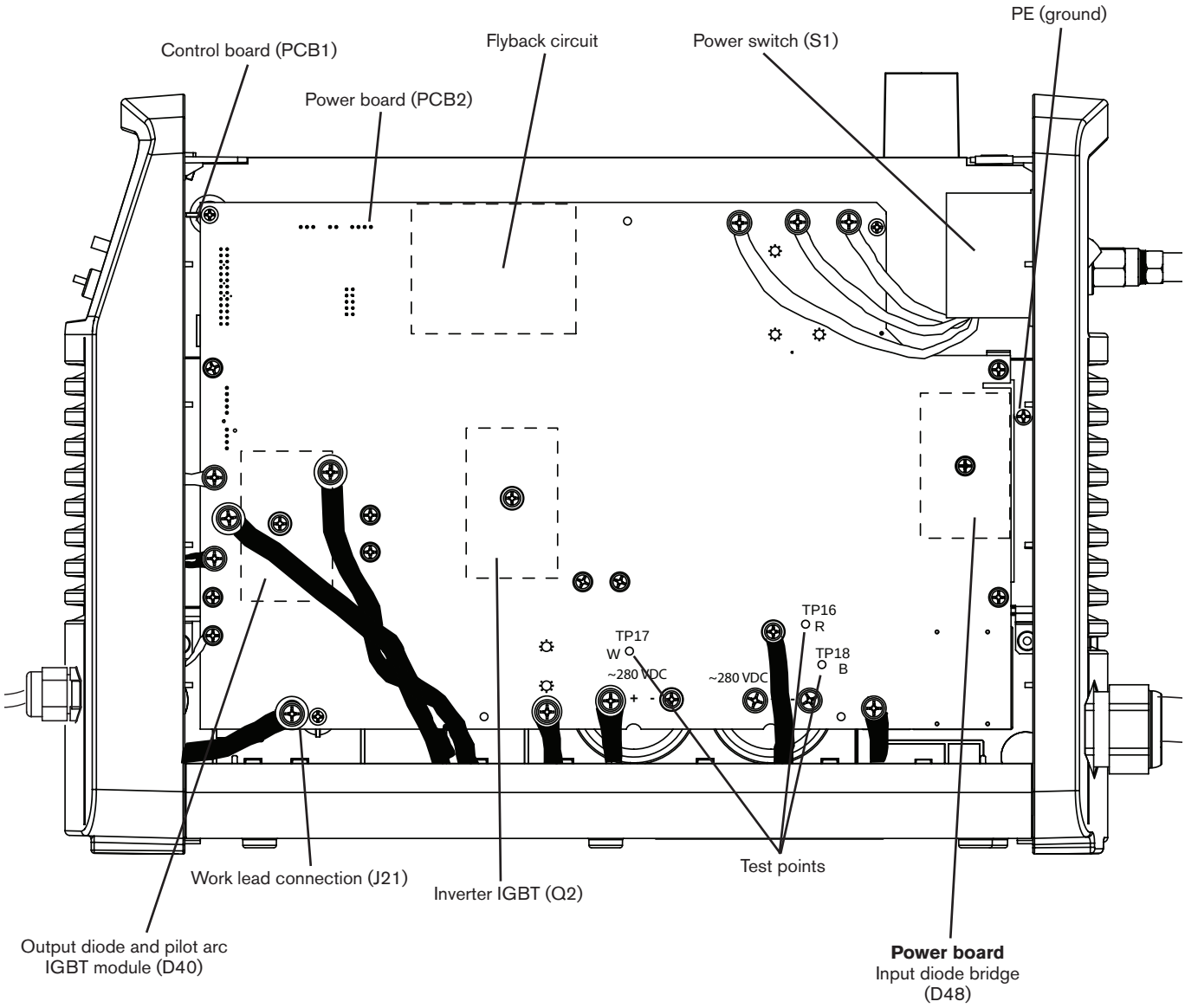
200–240 V CSA and 230 V CE power supply overview



400 V CE power supply overview



480 V CSA power supply overview

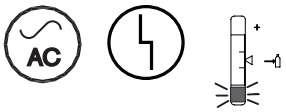


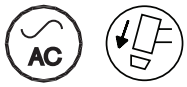
Troubleshooting guide

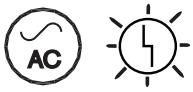
See *System tests* on page 5-18 for detailed test procedures.

It is important to note, when troubleshooting a problem on the Powermax45, how the front panel LEDs operate. To help diagnose transient problems, an illuminated or blinking LED, including the bottom bar on the gas pressure bar, may continue to illuminate or blink for 10 to 20 seconds after the system is powered OFF. Once the system is powered ON, the LED should not illuminate or blink if the fault has been cleared.

Also, note that there is no static gas pressure reading. So the gas pressure LEDs may not indicate a low pressure situation if the gas was not connected when the system was powered ON. Attempting to fire the torch without the gas connected will cause the bottom yellow gas pressure LED to blink.

Problem	This may mean	Cause	Solution
The ON/OFF power switch is set to ON (I), but the power ON LED is not illuminated.	There is insufficient voltage to the control circuits or a short-circuited power component.	▪ The system has no incoming voltage or an improper incoming voltage. ▪ The power board is faulty.	▪ Check to see that the system is plugged into an appropriately-sized circuit and that the circuit breaker has not been tripped. ▪ Perform *Test 1 – voltage input* on page 5-18 to check the incoming voltage and the power switch.
The power ON LED is illuminated, the fault LED is illuminated, and the bottom LED on the gas pressure bar is illuminated yellow and is blinking. 	There is insufficient gas pressure to the machine.	▪ There is no gas attached to the system. ▪ The gas supply line has a restriction or the air filter element is dirty. ▪ The reading at the pressure transducer is below the minimum acceptable gas pressure.	▪ Ensure that the gas supply is connected correctly. ▪ Check the gas supply line for restrictions or damage. ▪ Check the air filter element and replace it if necessary. ▪ Perform *Test 9 – pressure transducer* on page 5-28 to verify that the pressure transducer functions correctly.

Problem	This may mean	Cause	Solution
The power ON LED is illuminated and the yellow temperature LED is illuminated. 	The internal system temperature is either over or under its operating range (approximately -30° C to 80° C).	▪ The power supply is too cold. ▪ You have exceeded the duty cycle. (For more information about duty cycle, see the *Operation* section.)	▪ Allow the power supply to warm up if it has been extremely cold. ▪ Check the area around the system to make sure that the air flow is not blocked. ▪ If the duty cycle has been exceeded, let the system cool before using it again. ▪ Perform *Test 8 – fan* on page 5-27 to make sure the fan is operating correctly.
The power ON LED is blinking. 	The incoming voltage is not correct.	▪ The incoming voltage is either too high or too low (a variance greater than ±15% of the rated voltage).	▪ Perform *Test 1 – voltage input* on page 5-18 to check the incoming line voltage.
The power ON LED is illuminated and the torch cap LED is illuminated. 	The cap-sensing circuit is not satisfied.	▪ The consumables are loose, improperly installed, or missing. ▪ The cap-sensor switch is faulty.	▪ Correctly install the consumables. ▪ Perform *Test 7 – torch cap sensor* on page 5-27 to test the cap-sensor switch.
The power ON LED is illuminated and the torch cap LED blinks. 	This indicates either a “torch stuck open” or “torch stuck closed” situation.	▪ The consumables are installed incorrectly, they are worn, or were removed while the power supply is ON. ▪ The torch plunger is stuck. ▪ The torch or lead has a broken wire.	▪ Check the consumables for wear and replace if necessary. ▪ Make sure they are properly installed. ▪ Verify that they are finger-tight. Try loosening them 1/8th of a turn and restarting the power supply. ▪ Perform *Test 5 – torch stuck open (TSO) or torch stuck closed (TSC)* on page 5-25 and replace the torch head if necessary.

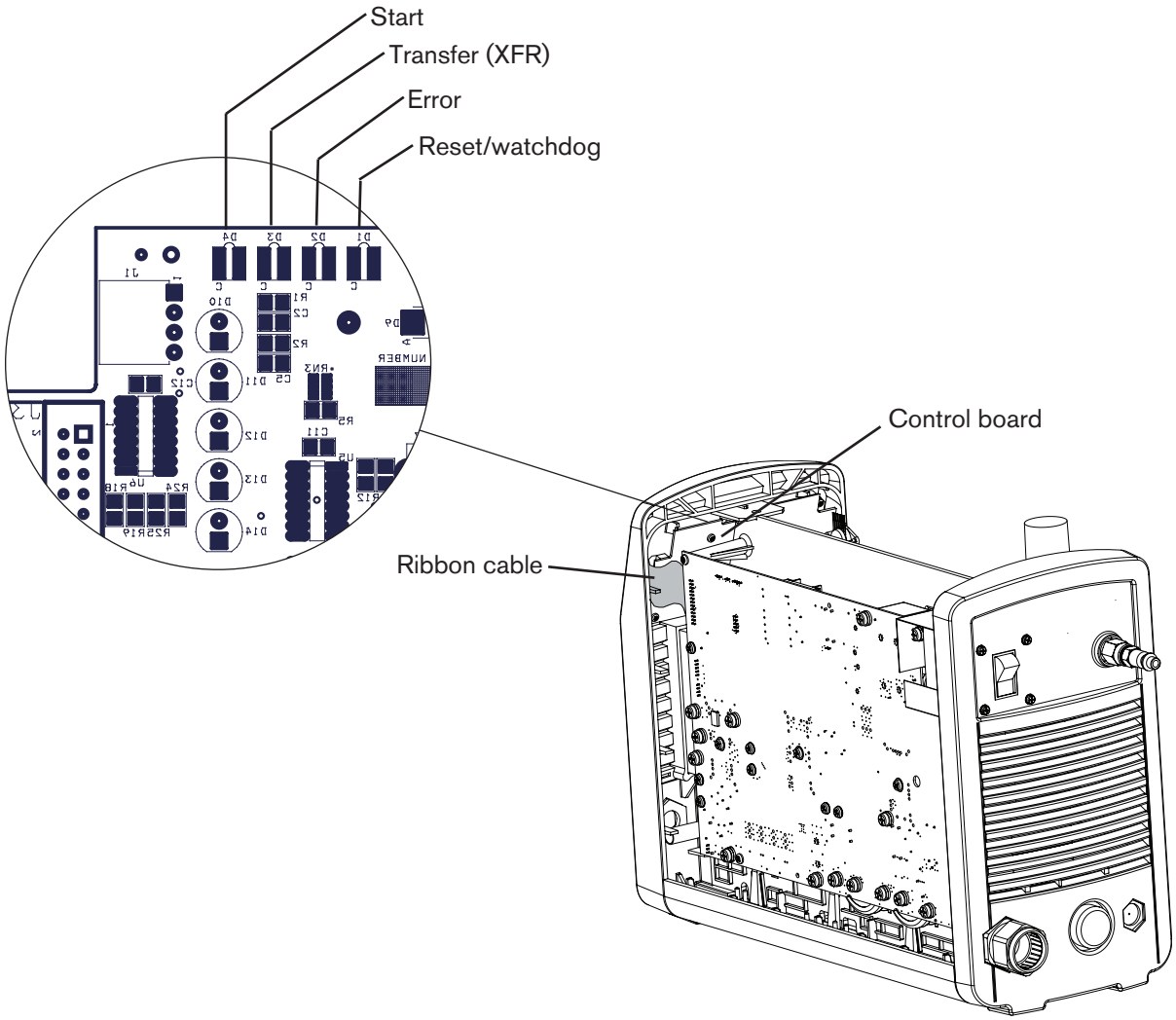
Problem	This may mean	Cause	Solution
The power ON LED is illuminated or is blinking and the fault LED is blinking. 	A major fault has occurred in the power supply.	▪ Any of the fan, solenoid valve, control board, or power board may be faulty.	▪ The error LED on the control board should be flashing. The number of times it flashes between pauses indicates which components to test. See *Control Board LEDs* on page 5-16.
The power ON LED is illuminated and the fault LED and the temperature LED alternately flash when the system is powered ON. 	The system was powered on while the plasma start signal was being sent.	▪ The system was powered on while the torch trigger was being pulled or the trigger was activated too soon after the system was powered on. ▪ The start circuit is stuck closed.	▪ Release the torch trigger and turn OFF the power supply and then turn it ON again to reset the unit. Be sure to allow time for the soft start circuit to be satisfied. ▪ Perform *Test 6 – plasma start* on page 5-26 to test the start signal.
The power ON LED is illuminated and no fault LEDs are illuminated, but no gas flows when the torch trigger is pulled. 	The start signal is not reaching the control board.	▪ The torch or torch lead may be damaged. ▪ The power board may be faulty. ▪ The control board may be faulty.	▪ Ensure that the gas is connected (gas pressure LED will illuminate yellow after the torch is activated). ▪ Inspect the torch and torch lead for damage. ▪ Verify that the control board start LED illuminates when the trigger is pulled. If it does not, perform *Test 6 – plasma start* on page 5-26 to check the start signal from the power board.
Gas flows when the system is powered ON. 	The incoming gas pressure is too high or the system is in gas test mode.	▪ Verify that the mode switch is not set to gas test mode. ▪ The gas pressure from the compressor or cylinder may be too high. ▪ The gas solenoid valve may be faulty.	▪ Check the gas supply to make sure that it does not exceed 9.3 bar (135 psi). If necessary, reduce the pressure. ▪ Perform *Test 4 – solenoid valve* on page 5-24 to verify that the gas solenoid valve is functioning correctly.

Problem	This may mean	Cause	Solution
When pulling the torch's trigger, gas flows from the torch, but the torch does not fire or fires only for a short period of time, or the pilot arc starts but extinguishes before the normal 5-second time-out period.	The consumables, torch, or torch lead are not functioning correctly, the gas pressure may be too low or too high, the air quality may be poor, or there is a voltage imbalance on the power board.	▪ The consumables may be worn or damaged. ▪ The torch or torch lead may be damaged. ▪ The gas pressure is too high or too low or the gas supply is restricted. ▪ The gas filter element is dirty. ▪ The power board is faulty.	▪ Inspect the consumables, torch, and lead. Replace any damaged parts. ▪ Verify that the gas supply is providing at least 4.5 bar (65 psi) and does not exceed 9.3 bar (135 psi). ▪ Repair any restrictions in the supply line. ▪ Replace the gas filter element if dirty. ▪ Perform *Test 3 – VBUS and voltage balance* on page 5-20 to test the voltage balance on the power board.
Arc goes out while cutting or intermittently will not fire.	The arc lost contact with the workpiece.	▪ The work lead or work lead connection may be faulty. ▪ The material being cut may require the use of continuous pilot arc mode.	▪ If you are cutting expanded metal, grate, or any metal with holes, set the mode switch to continuous pilot arc mode. ▪ Check for loose connections at the work clamp and at the power supply. ▪ Reposition the work lead on the workpiece. ▪ Clean the cutting surface to ensure a better connection with the work lead.
The cut quality is poor or the cut does not sever the metal.	The consumables are worn, there is a poor work lead connection, the output from the power supply is too low, or the power board is producing low current.	▪ The consumables need to be replaced. ▪ The work lead may be damaged or not properly connected to the work piece. ▪ The amps adjustment knob may be set too low. ▪ The power board may be faulty.	▪ Inspect the consumables and replace if necessary. ▪ Inspect the work lead for damage. Reposition it and clean the work surface to ensure good contact. ▪ Check the amps adjustment knob setting. If your input circuit is 200 V, 34 A; 240 V, 28 A; 400 V, 10 A; or 480 V, 8.5 A, turn the knob to the highest setting.

Problem	This may mean	Cause	Solution
The pilot arc extinguishes when you move the plasma arc off the work piece while still pulling the torch's trigger.	The continuous pilot arc feature is not working.	▪ The mode switch may be set incorrectly. ▪ The power board or the control board may be faulty.	▪ Verify that the mode switch is set to continuous pilot arc. ▪ Perform *Test 2 – power board voltage checks* on page 5-19 and *Test 3 – VBUS and voltage balance* on page 5-20 to verify that the power board is functioning properly. If the power board is faulty, replace it. Otherwise, replace the control board.

Control Board LEDs

The Powermax45 control board (PCB1) has 4 diagnostic LEDs.



The control board LEDs are:

- Start – The power supply has a start signal. This LED illuminates when the power supply receives a start signal and remains illuminated during normal operation.
- Transfer – This LED illuminates when there is proper arc transfer between the torch and the workpiece, and will flash during continuous pilot arc operation (such as when cutting expanded metal or moving the arc off the plate and then back on).
- Error – The Error LED illuminates whenever there is a fault in the system. If the Fault LED on the front panel flashes and the Error LED on the control board also flashes, there is a major fault in the system. **The number of flashes between pauses indicates which component may have failed.**
- Reset – This LED illuminates when the reset circuit is active or the watchdog circuit fires.

During normal operation, the power ON LED on the front of the power supply and the Start and Transfer LEDs on the control board illuminate. When a problem occurs with the system, one or more of the LEDs on the front of the power supply and the Error LED or the Reset LED on the control board may illuminate or flash.

Use the control board Error and Reset LEDs to troubleshoot

The Error and Reset LEDs provide information to use when troubleshooting a system failure. If the LEDs on the front of the power supply are flashing, look at the Error LED on the control board to determine where the fault may be. Count the number of flashes and then look at the table below to determine the corrective action.

Reset LED

When the control board's Reset LED illuminates, the voltages on the power board may be incorrect. Perform the following tests at J7 on 200–240 V CSA power supplies and 230 V CE power supplies or J8 on 400 V CE and 480 V CSA power supplies (the pin numbers are the same for all power supplies) on the power board (see *Test 2 – power board voltage checks* on page 5-19):

- Test pin 25 to ground for 3.3 VDC (±10%).
- Test pin 24 to ground for 5 VDC (±10%).
- Test pin 12 to ground for 2.2 VDC (±10%).

If the values you find are not within ±10% of the above values, detach the control board's ribbon cable and perform the tests again. If you find the correct values the second time, replace the control board. Otherwise, replace the power board.

Error LED

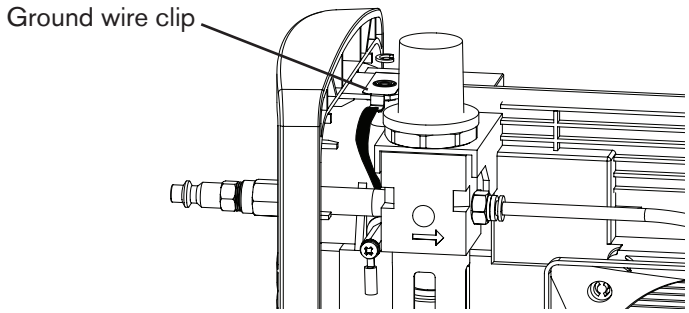
The number of times the Error LED flashes indicates the problem detected. Each flash is a half-second long and each series of flashes is separated by a 2-second pause. See *System tests* on page 5-18 for detailed test procedures.

The following table shows the meaning associated with each set of flashes.

Number of error LED flashes	Problem indicated	Solution
1	Faulty control board	Replace the control board.
2	Faulty power board	Replace the power board.
3	Either a faulty power board or a faulty control board	▪ Perform *Test 3 – VBUS and voltage balance* on page 5-20. If any of the values are incorrect, replace the power board. ▪ Perform *Test 2 – power board voltage checks* on page 5-19. If any of the values for pins 5, 7, or 12 are incorrect, remove the control board and test again. If the values are correct, replace the control board. ▪ When performing test 2, if the values for pins 5, 7, and 12 are correct, but any other values are incorrect, replace the power board.
4	Faulty gas solenoid valve	Replace the gas solenoid valve.
5	Faulty fan	Replace the fan.
6	Machine motion relay fault	Replace the power board.

System tests

There is a ground clip near the top of the rear end cap that can be used as ground for any tests that require the multimeter to be attached to ground. There is also a ground on the heat sink with access next to the power board and below the power switch.



WARNING

Voltages of up to 50 VDC continue to be present on the DC bus for at least 30 seconds after disconnecting the input power. Allow bus voltages to dissipate before performing any tests.

Test 1 – voltage input

Check the incoming voltage and the line voltage to the top of the power switch (S1).

1. Disconnect the electrical power and set the ON/OFF switch to OFF (O).
2. Once you have your test leads in place, reconnect the electrical power. Leave the ON/OFF switch set to OFF. The voltage should equal the line voltage of the incoming circuit.
3. If the AC voltage is incorrect, check to see that you have power to the unit. If you do have power, check the power cord for damage.
4. With the electrical power connected, set the ON/OFF switch to ON (I), and measure the AC voltage from J1 to J2 (labeled “AC” on the power board). This value should be the same as the incoming line voltage. If it is not, check the ON/OFF switch.
5. If the power ON LED is still illuminated, perform *Test 2 – power board voltage checks* on page 5-19 to determine whether the power board or the control board is faulty.

   Note: All values can be ±15%.

Single phase	
L	Black (CSA) Brown (CE)
N	White (CSA) Blue (CE)
PE	Green (CSA) Green/yellow (CE)

Three phase (CE)	
L1	Brown
L2	Black
L3	Gray
PE	Green/yellow

Three phase (CSA)	
L1	Black
L2	White
L3	Red
PE	Green

Test 2 – power board voltage checks

With the power ON, use a meter to verify the voltages at the J7 pins (J8 on 400 V CE and 480 V CSA power supplies) listed in the following table to be certain that the power board is functioning correctly. If any of the values are incorrect, replace the power board.

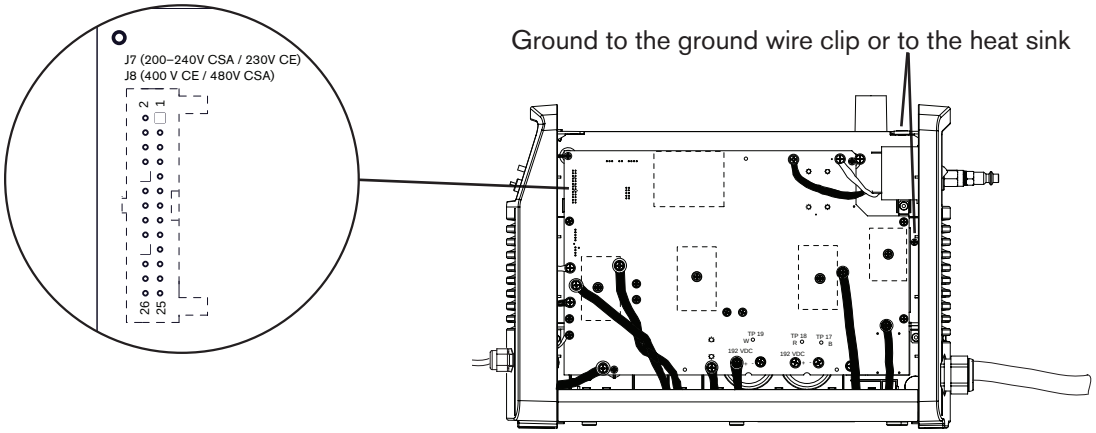
CAUTION

Do not use -VBUS as ground – doing so could destroy the power supply. Instead ground to either the ground wire clip on the rear panel or to the heat sink as shown below.

Note: All values can be ±10%.

J7 or J8 pin number to ground	Test	Expected value (200–240 V CSA or 230 V CE)	Expected value (400 V CE or 480 V CSA)
19	VACR (rectified AC line voltage)	1.95 V at 230 line voltage	2.7 V at 400 line voltage (CE) 2.016 VDC at 480 line voltage (CSA)
21	VBUS (DC bus voltage)	2.28 VDC at 385 VBUS	2.178 VDC at 560 VBUS (CE) 2.016 VDC at 670 VBUS (CSA)
18 (200–240 and 230 V only)	IPFC (input current)	< 0.1 VDC	Not applicable
20	IFB (output current)	< 0.1 VDC	< 0.1 VDC
22	ITF (transfer current)	< 0.1 VDC	< 0.1 VDC
25	3.3 VDC	3.3 VDC ±5%	3.3 VDC ±5%
24	5 VDC	5 VDC ±5%	5 VDC ±5%
12	24 V sense pin	2.2 VDC	2.2 VDC
16	Start signal	3.2 VDC closed 0 VDC open	3.2 VDC closed 0 VDC open

Note: To test the values at pin 16, you must have the torch and power supply positioned such that you can safely pull and release the torch's trigger.



Test 3 – VBUS and voltage balance

Test the power board to ensure that the circuits are balanced. There are three procedures below. Use the first procedure if you have a 200–240 V CSA power supply or a 230 V CE power supply. Use the second procedure if you have a 400 V CE power supply. Use the third procedure if you have a 480 V CSA power supply.

For this test, you can use the test point loops or you can test on the capacitor screws. The test points are labeled on the back of the power board, as are the voltages and positive and negative capacitor terminals.

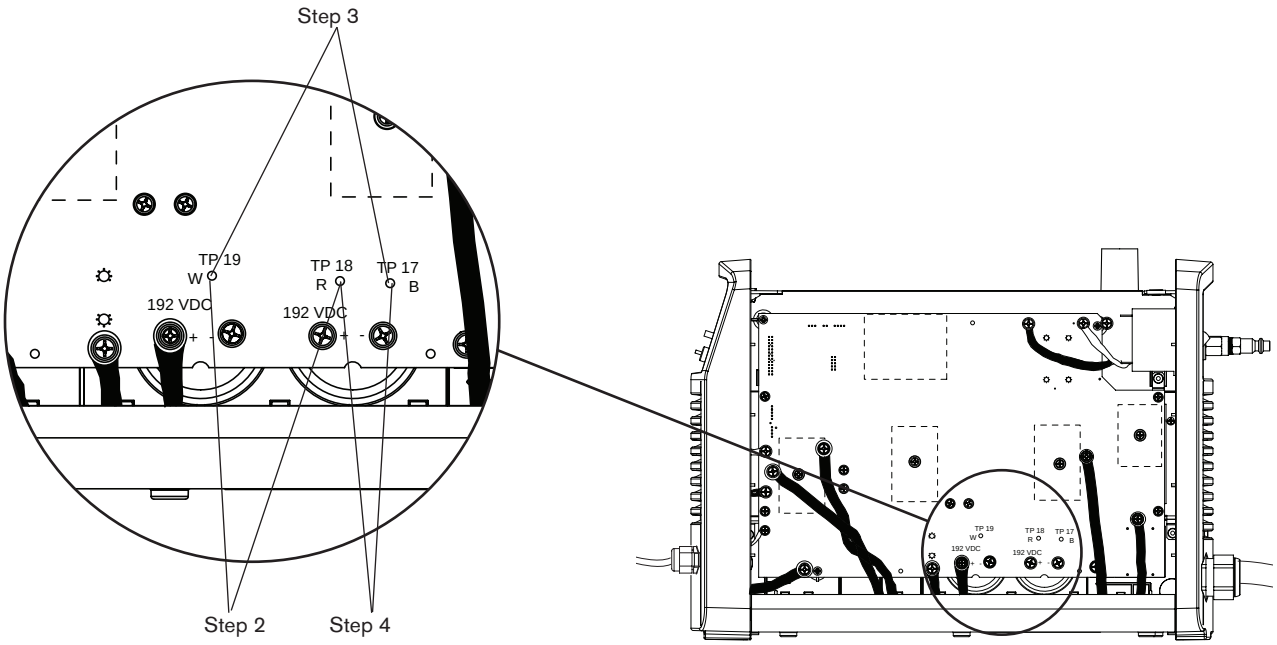
CAUTION

To test using the test points, do not use a multimeter with test probes. Use E-Z Hook leads instead and attach them to the test point loops.

Test for 200–240 V CSA and 230 V CE power supplies

1. Turn OFF the power.
2. Position the multimeter leads to measure the boosted bus voltage on the power board by attaching the test leads to TP (test point) 19 and TP 18. Turn on the power. The multimeter should read 385 VDC. If you get a value other than 385 VDC, multiply the reading by 0.00601. Compare that value to a reading at pin 21 on J7. They should have the same value.
3. Turn the power OFF. Attach the E-Z Hooks to TP 19 and TP 17. Turn the power ON after you have connected the multimeter. This value should be 192.5 VDC or one-half of whatever value you found in step 2.

   Note: All values can be ±10%.
4. Turn the power OFF and move the E-Z Hooks to TP 18 and TP 17. Turn the power ON after you have connected the multimeter. This value should be 192.5 VDC or one-half of whatever value you found in step 2.
5. The values found in steps 3 and 4 should be approximately equal. If they differ by more than 30 V, replace the power board.



Test for 400 V CE power supplies

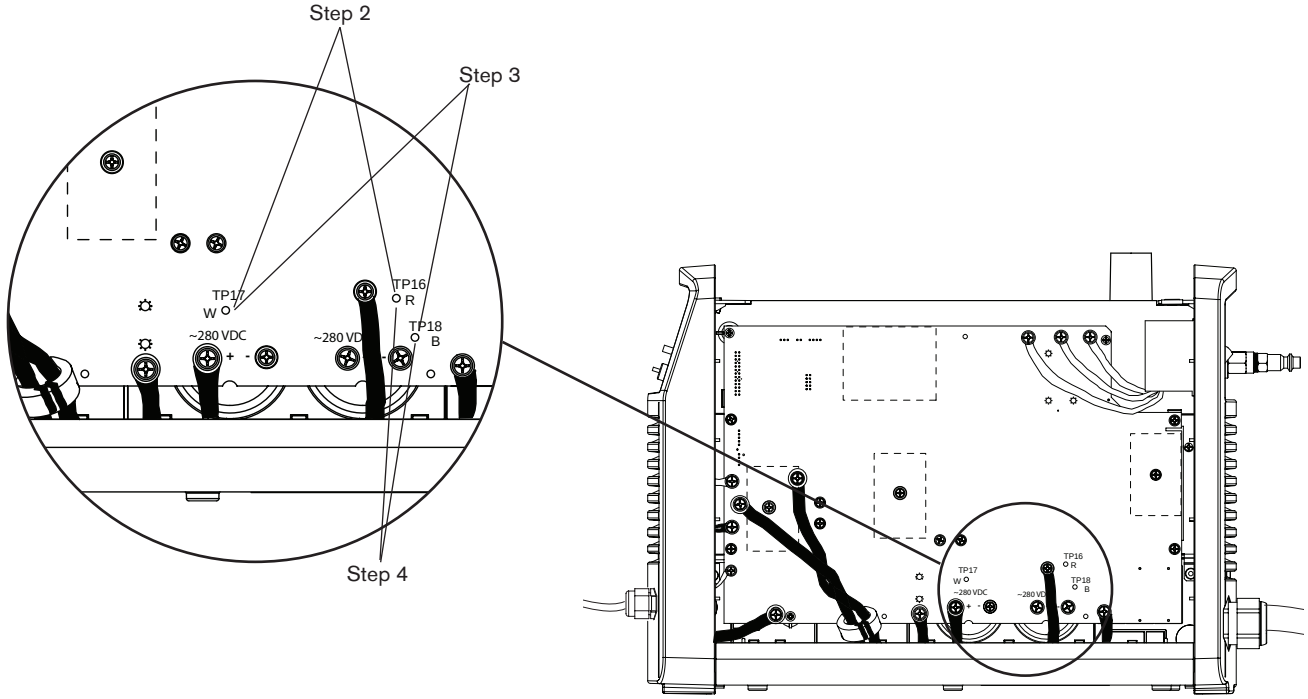
For this test, you can use the test point loops or you can test on the capacitor screws. The test points are labeled on the back of the power board, as are the voltages and positive and negative capacitor terminals.

CAUTION

To test using the test points, do not use a multimeter with test probes. Use E-Z Hook leads instead and attach them to the test point loops.

1. Turn OFF the power.
2. Position the multimeter leads to measure the voltage on the power board by attaching the test leads with the negative lead on TP 17 and the positive lead on TP 16. Turn on the power. The multimeter should read 560 VDC. If you get a value other than 560 VDC, multiply the reading by 0.00601. Compare that value to a reading at pin 21 on J8. They should have the same value.
3. Attach E-Z Hooks to TP (test point) 17 and TP 18. Turn the power ON after you have connected the multimeter. This value should be 280 VDC or one-half of whatever value you found in step 2.

   Note: All values can be ±10%.
4. Turn the power OFF and move the E-Z Hooks to TP 18 and TP 16. Turn the power ON after you have connected the multimeter. This value should be 280 VDC or one-half of whatever value you found in step 2.
5. The values found in steps 3 and 4 should be approximately equal. If they differ by more than 30 V, replace the power board.



Test for 480 V CSA power supplies

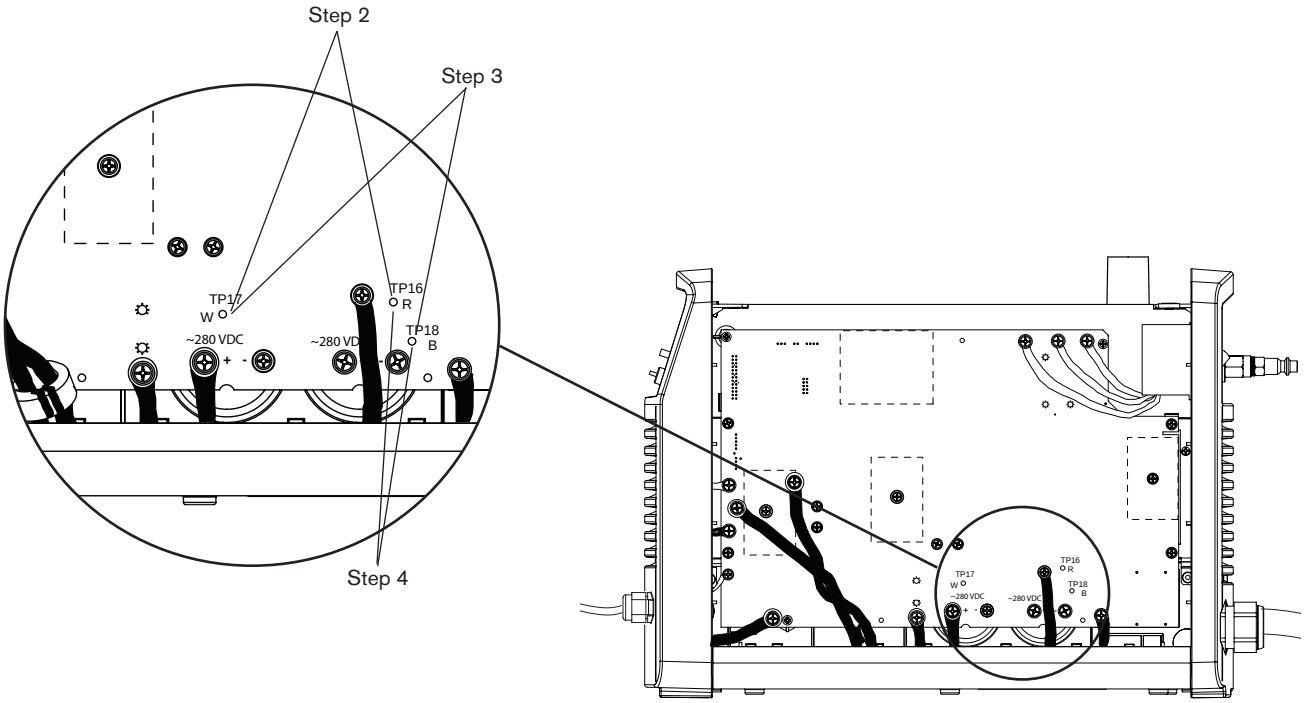
For this test, you can use the test point loops or you can test on the capacitor screws. The test points are labeled on the back of the power board, as are the voltages and positive and negative capacitor terminals.

CAUTION

To test using the test points, do not use a multimeter with test probes. Use E-Z Hook leads instead and attach them to the test point loops.

1. Turn OFF the power.
2. Position the multimeter leads to measure the voltage on the power board by attaching the test leads with the negative lead on TP 17 and the positive lead on TP 16. Turn on the power. The multimeter should read 670 VDC. If you get a value other than 670 VDC, multiply the reading by 0.003. Compare that value to a reading at pin 21 on J8. They should have the same value.
3. Attach E-Z Hooks to TP (test point) 17 and TP 18. Turn the power ON after you have connected the multimeter. This value should be 335 VDC or one-half of whatever value you found in step 2.

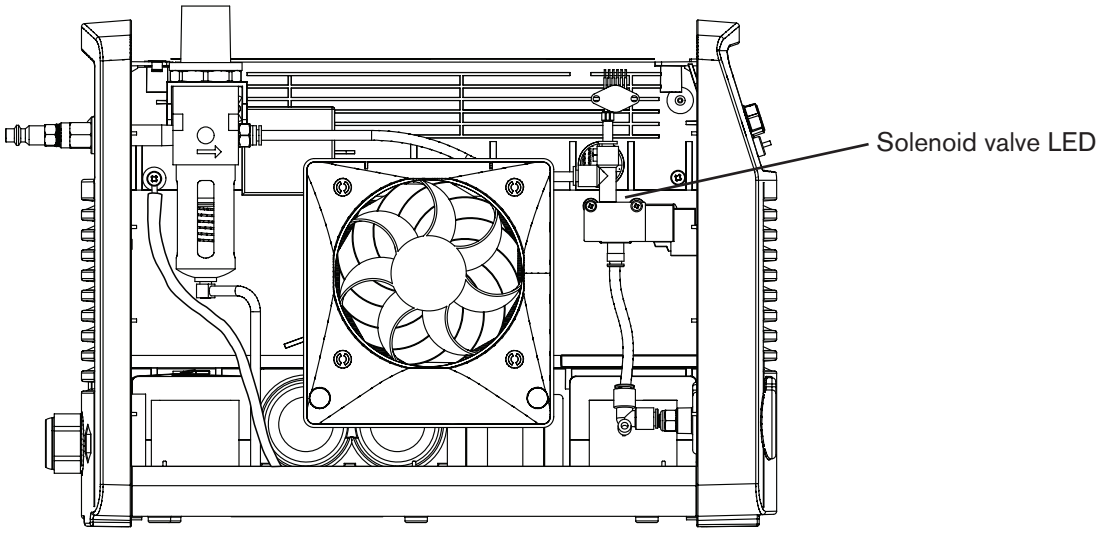
   Note: All values can be ±10%.
4. Turn the power OFF and move the E-Z Hooks to TP 18 and TP 16. Turn the power ON after you have connected the multimeter. This value should be 335 VDC or one-half of whatever value you found in step 2.
5. The values found in steps 3 and 4 should be approximately equal. If they differ by more than 30 V, replace the power board.

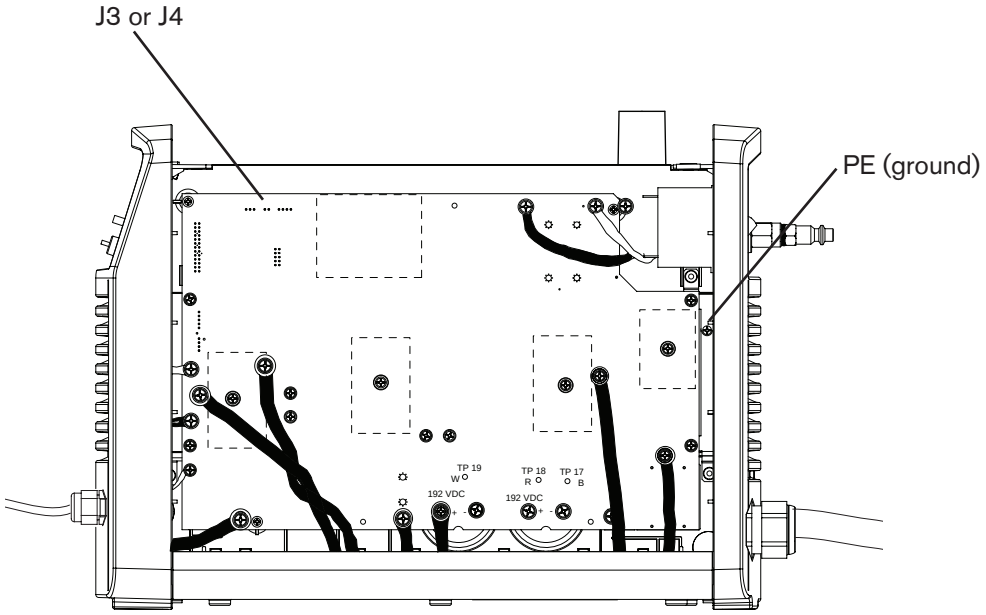


Test 4 – solenoid valve

If gas is not flowing properly, test the solenoid valve for proper operation.

1. There is an LED on the solenoid valve that illuminates red when the torch is fired or when the amperage control knob is set to gas text mode. It stays illuminated until postflow stops. Turn the amperage knob to gas test and verify that the LED illuminates.
2. Place a jumper from pin 4 of J3 (J4 for 400 V CE and 480 V CSA power supplies) on the power board to ground. You should hear the valve click.
3. If you do not hear the valve click or the LED does not illuminate and a voltage check on pin 4 of J3 (or J4) reads 24 VDC, replace the solenoid valve.





Test 5 – torch stuck open (TSO) or torch stuck closed (TSC)

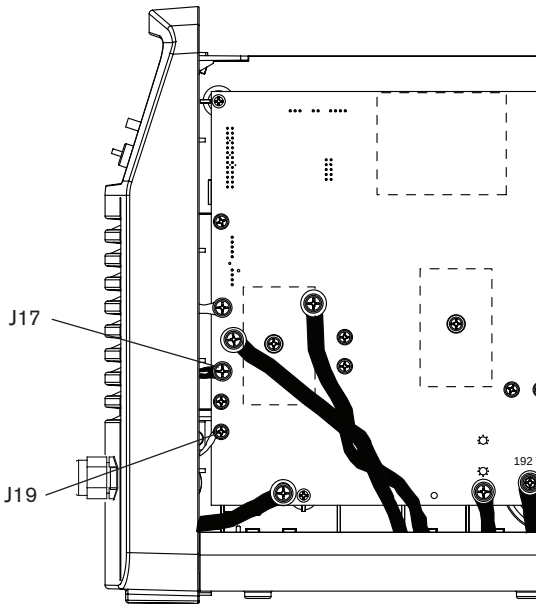
Before the torch is activated and gas starts to flow, the nozzle and electrode should be in contact or touching. If not, the power supply will detect a TSO, or “torch stuck open,” fault. If the electrode and nozzle remain closed after the torch receives a start signal, the power supply will detect a TSC, or “torch stuck closed.” In either case, you will have gas flow.

Use the following test to determine if the torch is stuck in either position.

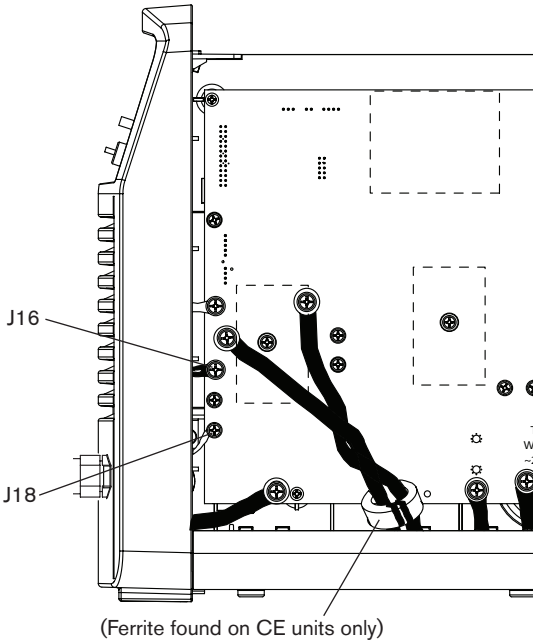
1. Turn OFF (O) the power.
2. Measure the resistance from J17 to J19 for 200–240 V CSA and 230 V CE power supplies. Measure the resistance from J16 to J18 for 400 V CE and 480 V CSA power supplies. The resistance should read as closed (very low resistance).

	CAUTION
To avoid causing a short or damage to your meter, do not fire the torch with the multimeter connected to the power board.	

3. Turn ON (I) the power. Set the amperage adjustment knob to gas test mode. The resistance should read as very high resistance.
4. If the resistance reads incorrectly, then the nozzle and electrode are in contact or touching, or one of the wires in the torch lead is broken. Make sure that the torch plunger moves freely in the torch head. If it does not, replace the torch head. If the torch parts are working properly, replace the torch lead.
5. Because TSO and TSC failures can be intermittent, repeat the test several times.



200–240 V CSA and 230 V CE power supplies



400 V CE and 480 V CSA power supplies

Test 6 – plasma start

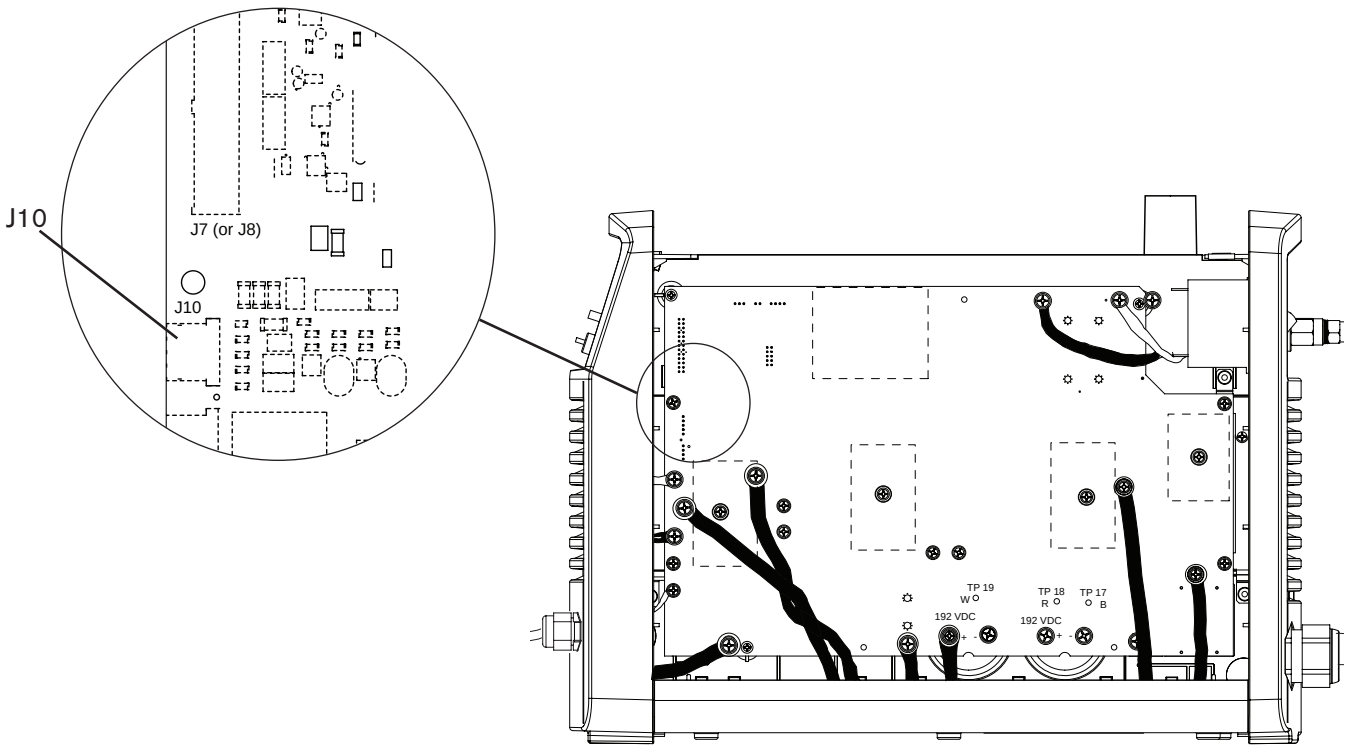
Verify that the control board LED is receiving a valid start signal.

1. With the power ON, look at the Start LED on the control board. It should illuminate whenever the torch is activated.
2. Set the ON/OFF switch to OFF (O). Check the resistance between pins 2 and 3 of J10 on the power board. With the trigger or start signal engaged, the resistance should be 10 Ω or less. With the trigger or start signal disengaged, the circuit should read as approximately 3 kΩ. If this test fails, check the torch's start switch and the torch wires.

   NOTE: If the torch will not fire after completing this test, verify that J10 is connected properly – that the pins are not offset and the connector is not backwards.
3. Set the ON/OFF switch to ON (I). Measure pin 16 of J7 (or J8 for 400 V CE and 480 V CSA power supplies) to ground (see *Test 2 – power board voltage checks* on page 5-19). It should measure as 0 VDC for an open circuit or 3.2 VDC for a closed circuit. If the values are not correct, replace the power board.

CAUTION

While testing, remove the consumables to avoid accidentally firing the torch.



Test 7 – torch cap sensor

Test the cap-sensor switch and torch leads.

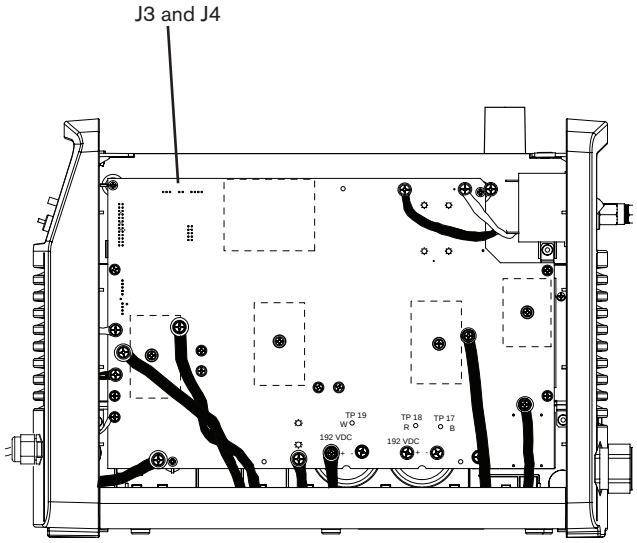
1. Set the ON/OFF switch to OFF (O).
2. Measure the resistance between pins 1 and 2 of J10 on the power board. It should measure less than 10 Ω. If it reads as open, the cap-sensor switch circuit is not satisfied.
3. If the torch plunger moves smoothly and the consumables are correctly installed, then either the cap-sensor switch is faulty or the torch lead has a broken wire. Replace the faulty part.

Test 8 – fan

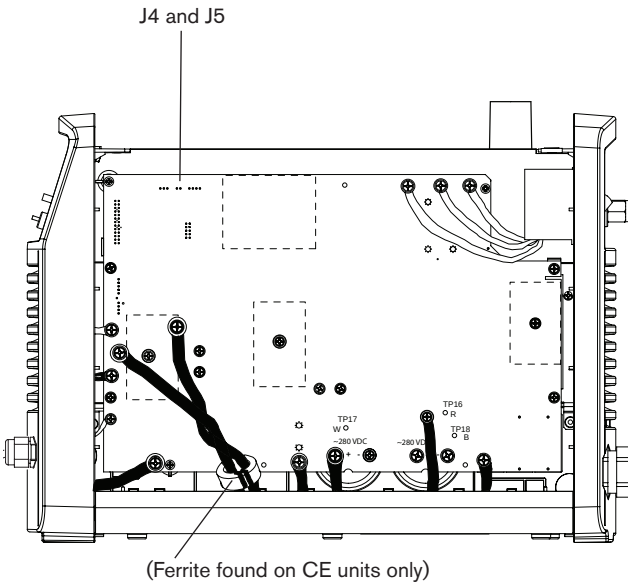
Test the fan for proper operation.

- Place a jumper from pin 1 of J3 to pin 1 of J4 on 200–240 V CSA power supplies and 230 V CE power supplies or from pin 1 of J4 to pin 1 of J5 on 400 V CE and 480 V CSA power supplies. If the fan does not operate, replace the fan.

  NOTE: Testing the fan can trigger a fault due to protection features on the fan driver chip. You can disregard this fault if it occurs as a result of a fan test. The purpose of the fan test is to ensure the fan is operating properly, not to test the fan drive circuit.



200–240 V CSA and 230 V CE power supplies



400 V CE and 480 V CSA power supplies

Test 9 – pressure transducer

Test the pressure transducer to ensure that the system is receiving the proper gas pressure.

1. Turn ON the power.
2. Check the voltage between pins 1 and 2 of J5 for 200–240 V CSA and 230 V CE power supplies or pins 1 and 2 of J6 for 400 V CE and 480 V CSA power supplies. It should read approximately 0.2 V if there is no gas pressure. If the gas pressure is within system tolerances, the circuit should read approximately 3.3 V.

   The minimum acceptable gas pressure varies by torch type, torch lead length, and mode switch setting as shown in the following table.

	Normal	Continuous pilot arc	Gouging
Handheld, 6.1 m (20 feet)	3.45 bar (50 psi)	3.45 bar (50 psi)	1.72 bar (25 psi)
Handheld, 15.24 m (50 feet)	3.80 bar (55 psi)	3.80 bar (55 psi)	2.07 bar (30 psi)
Mechanized, 7.62 m (25 feet)	3.45 bar (50 psi)	3.45 bar (50 psi)	1.72 bar (25 psi)
Mechanized, 10.7 m (35 feet)	3.45 bar (55 psi)	3.45 bar (50 psi)	1.72 bar (25 psi)
Mechanized, 15.25 m (50 feet)	3.80 bar (55 psi)	3.80 bar (55 psi)	2.07 bar (30 psi)

Test 10 – power switch trip coil

The 200–240 V CSA and the 230 V CE power supplies have over-voltage protection on the power switch in the form of a mechanical trip coil. If voltage provided by the incoming circuit is greater than the maximum voltage, the trip coil will switch OFF the power supply.

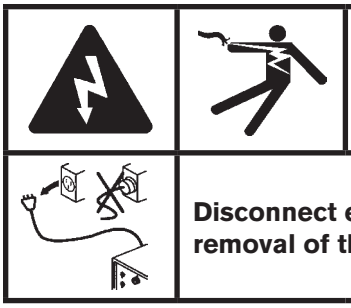
If the power supply appears to be shutting down unexpectedly, test the power switch:

1. With the power switch in the OFF position, disconnect the electrical power.
2. Move the power switch to the ON position. If the switch stays in position, the trip coil mechanism is functioning properly. If it does not stay in the ON position, replace the power switch.

Section 6

COMPONENT REPLACEMENT

In this section:



DANGER
ELECTRIC SHOCK CAN KILL

Disconnect electrical power before performing any maintenance. All work requiring removal of the power supply cover must be performed by a qualified technician.

Remove and replace the cover and Mylar® barrier

The first step in most maintenance and repair procedures for the Powermax45 is removing the cover and the Mylar barrier. To protect your power supply, it is important to replace both items properly when the maintenance is complete.

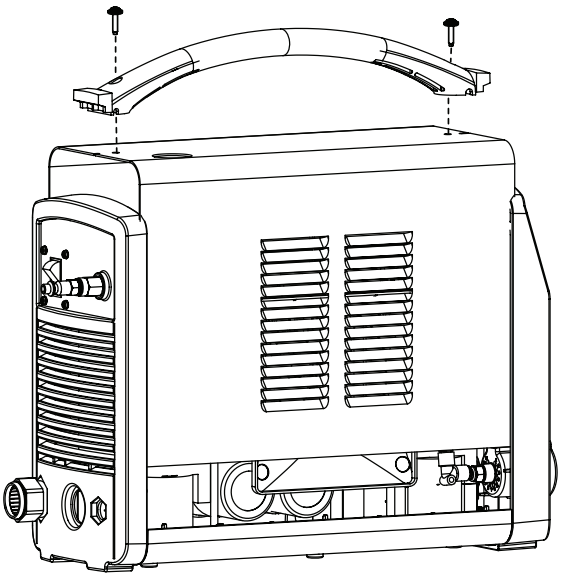
Removal

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Gently pull on the end panel nearest the screw you are removing to keep pressure on the screw. When the screw is almost out, tilt the screwdriver slightly to help pull the screw out of the recessed hole.

3. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Set the handle and screws aside. Continue to tilt the end panels outward to release the fan side of the cover from its track. Then lift the cover off the power supply.

4. Remove the Mylar barrier from the power-board side of the power supply. The Mylar barrier is flexible and can be bent slightly for removal.



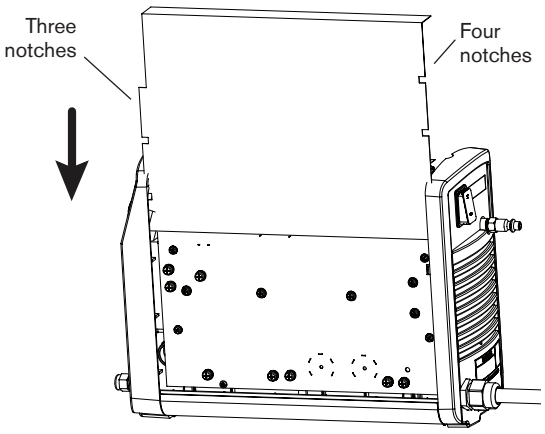
Replacement

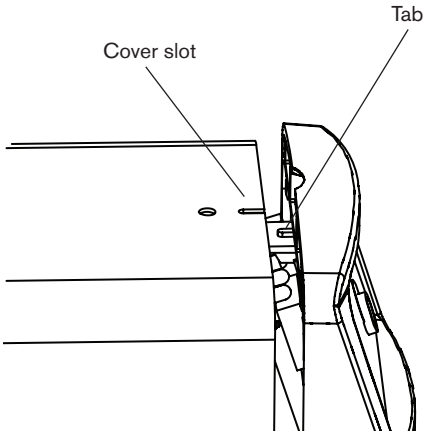
1. Hold the Mylar barrier so that the edge with the 3 notches is on the left and the edge with 4 notches is on the right.

2. There is a perforation across the top, about 4.45 cm (1.75 inches) down from the top edge. If you are replacing the Mylar barrier with a new one, you will need to fold it along this perforation so that the top edge bends away from you.

3. Position the barrier so that the folded section will cover the top of the power board. Slide the barrier into place with the bottom edge between the ribs on the base and the power board. The notches on each side of the barrier should align with the ribs on the inside of the end caps.

4. Being careful not to pinch any of the wires, slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks and that the slot in the top of the cover is aligned with the tab on the front end cap so that the louvers in the cover are in front of the fan. Position the handle over the holes in the top of the cover, then secure the cover with the 2 screws.





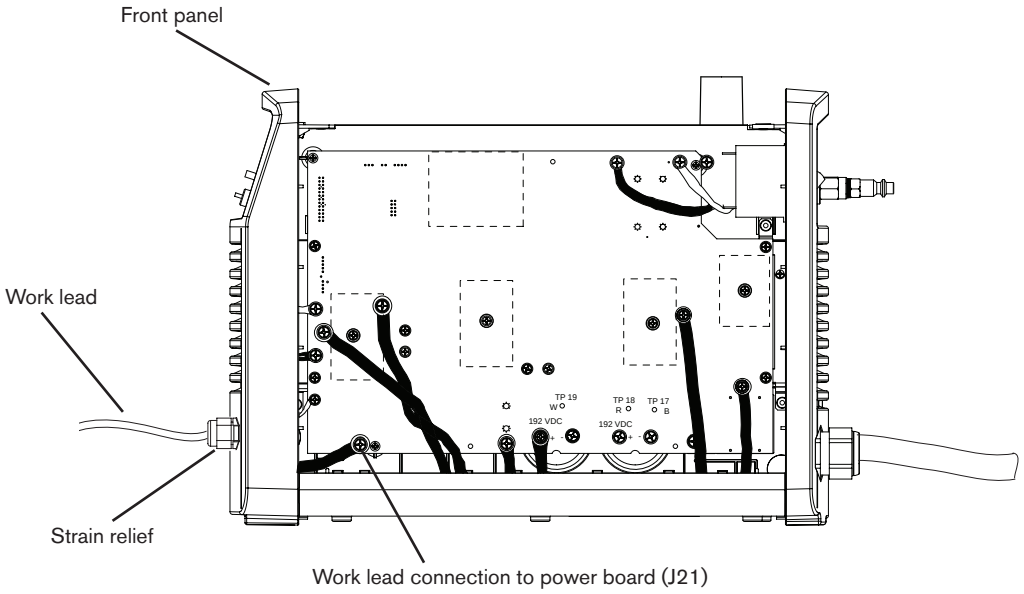
Replace the work lead (CSA and CE)

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.

3. Remove the screw from J21 (also labeled “work lead”) on the power board that attaches the lead to the board. Set the screw aside.

4. Gently tilt the front panel away from the power supply. From the inside of the panel, unscrew the nut that secures the strain relief to the end cap.



5. Thread the connector end of the new work lead through the front panel and fit the strain relief into the hole in the panel.

6. Slide the nut over the work lead's connector. Gently tilt the front panel away from the power supply and screw the nut onto the strain relief.

7. Attach the work lead to the power board at J21 using the screw that you removed earlier. The torque setting for this connection is 23.0 kg cm (20 inch-pounds).

8. Realign the front panel.

9. Replace the Mylar barrier and slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then secure the cover with the 2 screws.

10. Reconnect the electrical power and the gas supply.

Replace the power cord (200–240 V CSA)

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.

   The 200–240 V CSA power cord has a black wire and a white wire that connect to the power switch, and a green ground wire that connects to the heat sink.

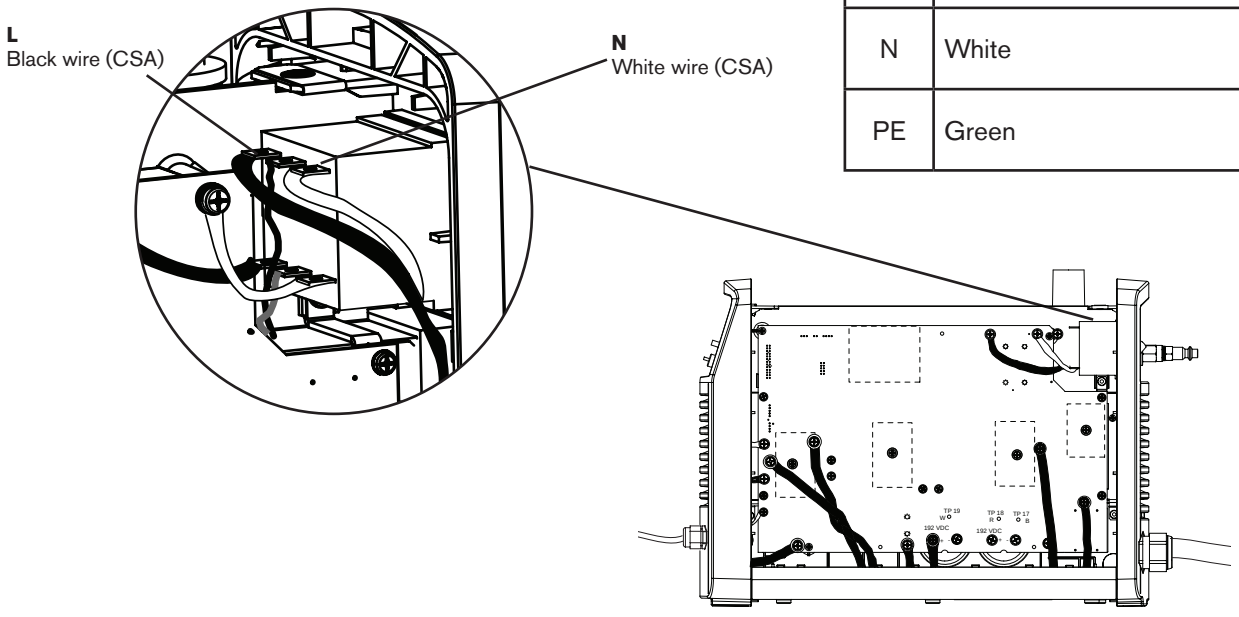
3. Remove the rear end panel or gently tilt it away from the power supply until you can access the screws that secure the power cord wires to the back of the power switch.

   NOTE: To remove the rear end panel, you must first remove the air fitting.

4. Remove the screws that secure the connectors for the white and black wires from the power switch to disconnect them.

5. Remove the screw that holds the green wire to the heat sink.

Single phase (CSA)	
L	Black
N	White
PE	Green



6. On the outside of the power supply, loosen the power cord's strain relief retention nut so that the wires move freely. If you will replace the strain relief, use an adjustable wrench to unscrew the strain relief nut on the inside of the power supply to remove the old strain relief.

7. From the outside of the power supply, pull the old power cord through the strain relief or through the hole in the rear end panel to remove it.

8. If you are replacing the old strain relief with the new strain relief contained in the kit, slide the new strain relief onto the new power cord and route the wires for the new power cord through the hole in the end panel. Slide the new strain relief nut over the wires and screw it to the strain relief from the inside of the end panel. Hand tighten the nut and then over-tighten slightly more.

   If you are keeping the old strain relief in place, route the wires for the new power cord through the strain relief.

9. Screw the connector for the black wire onto the pin on the upper left side of the power switch with a torque setting of 23.0 kg cm (20 inch-pounds).

10. Screw the connector for the white wire onto the pin on the upper right side of the power switch with a torque setting of 23.0 kg cm (20 inch-pounds).

11. Tighten the green ground wire to the heat sink with a torque setting of 17.3 kg cm (15 inch-pounds).

12. Position the wires in the wire chase up the side of the end panel and out of the way of the power board.

13. Replace or reposition the end panel. Make sure that the screw hole in the ground clip aligns with the screw holes in the end panel and the power supply.

14. Tighten the strain relief's retention nut on the outside of the end panel to secure the new power cord.

15. Being careful not to pinch any of the wires, replace the Mylar barrier and slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

16. Reconnect the electrical power and the gas supply.

Replace the power cord (230 V CE)

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.

   The 230 V CE power cord has a brown wire and a blue wire that connect to the power switch, and a green/yellow ground wire that connects to the heat sink.

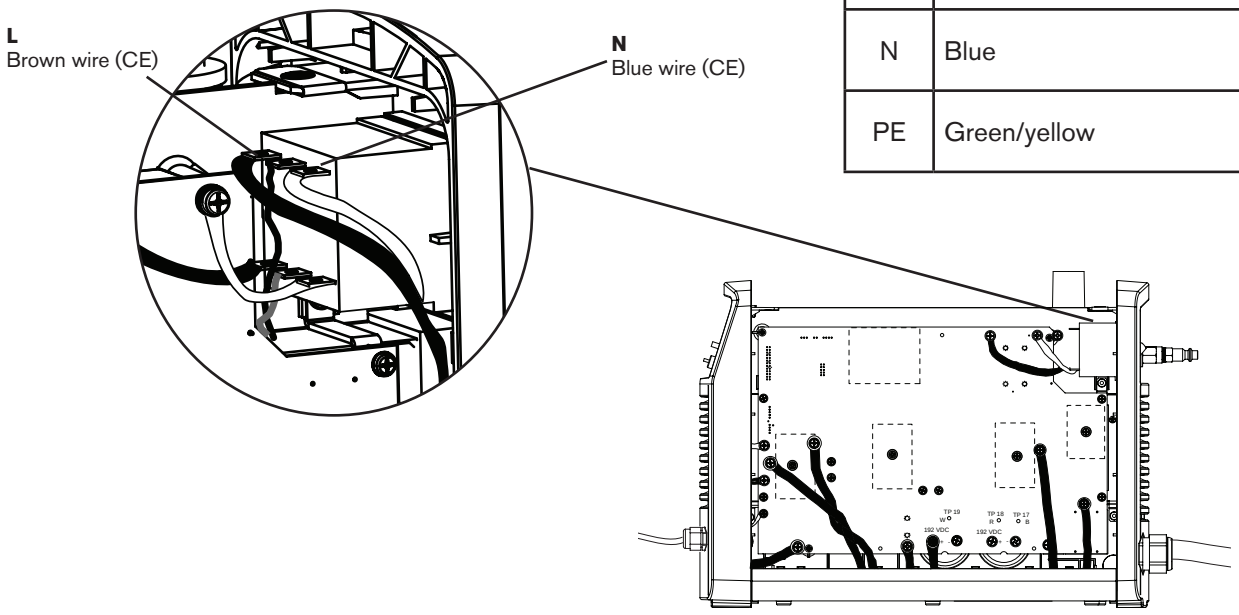
3. Remove the rear end panel or gently tilt it away from the power supply until you can access the screws that secure the power cord wires to the back of the power switch.

   NOTE: To remove the rear end panel, you must first remove the air fitting.

4. Remove the screws that secure the connectors for the blue and brown wires from the power switch to disconnect them.

5. Remove the screw that holds the green/yellow wire to the heat sink.

Single phase (CE)	
L	Brown
N	Blue
PE	Green/yellow



6. On the outside of the power supply, loosen the power cord's strain relief retention nut so that the wires move freely.

7. From the inside of the power supply, pull the wires through the strain relief and the hole in the rear end panel to remove the old power cord.

8. If you are replacing the old strain relief with the new strain relief contained in the kit:

   a. Use an adjustable wrench to unscrew the strain relief nut on the inside of the power supply to remove the old strain relief.

   b. Slide the new strain relief through the hole in the rear end panel of the power supply.

   c. Secure the strain relief on the inside of the power supply using the new strain relief nut. Hand tighten the nut and then over-tighten slightly more.

9. From the inside of the power supply, route the wires of the new power cord through the strain relief in the rear end panel. Do not remove the tubular ferrite bead from the power switch end of the brown and blue wires. (Because the CE power cord includes the ferrite bead, you cannot route the power cord through the strain relief from the outside of the power supply.)

10. Slide the strain relief retention nut over the wires of the new power cord and slide the retention nut forward toward the power supply.

11. Screw the connector for the brown wire onto the pin on the upper left side of the power switch with a torque setting of 23.0 kg cm (20 inch-pounds).

12. Screw the connector for the blue wire onto the pin on the upper right side of the power switch with a torque setting of 23.0 kg cm (20 inch-pounds).

13. Tighten the green/yellow ground wire to the heat sink with a torque setting of 17.3 kg cm (15 inch-pounds).

14. Position the wires in the wire chase up the side of the end panel and out of the way of the power board.

15. Replace or reposition the end panel. Make sure that the screw hole in the ground clip aligns with the screw holes in the end panel and the power supply.

16. Tighten the strain relief's retention nut on the outside of the end panel to secure the new power cord.

17. If you are installing a plug on the new power cord, use a plug that meets national and local electrical codes. The plug must be connected to the power cord by a licensed electrician.

18. Being careful not to pinch any of the wires, replace the Mylar barrier and slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

19. Reconnect the electrical power and the gas supply.

Replace the power cord (400 V CE)

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.

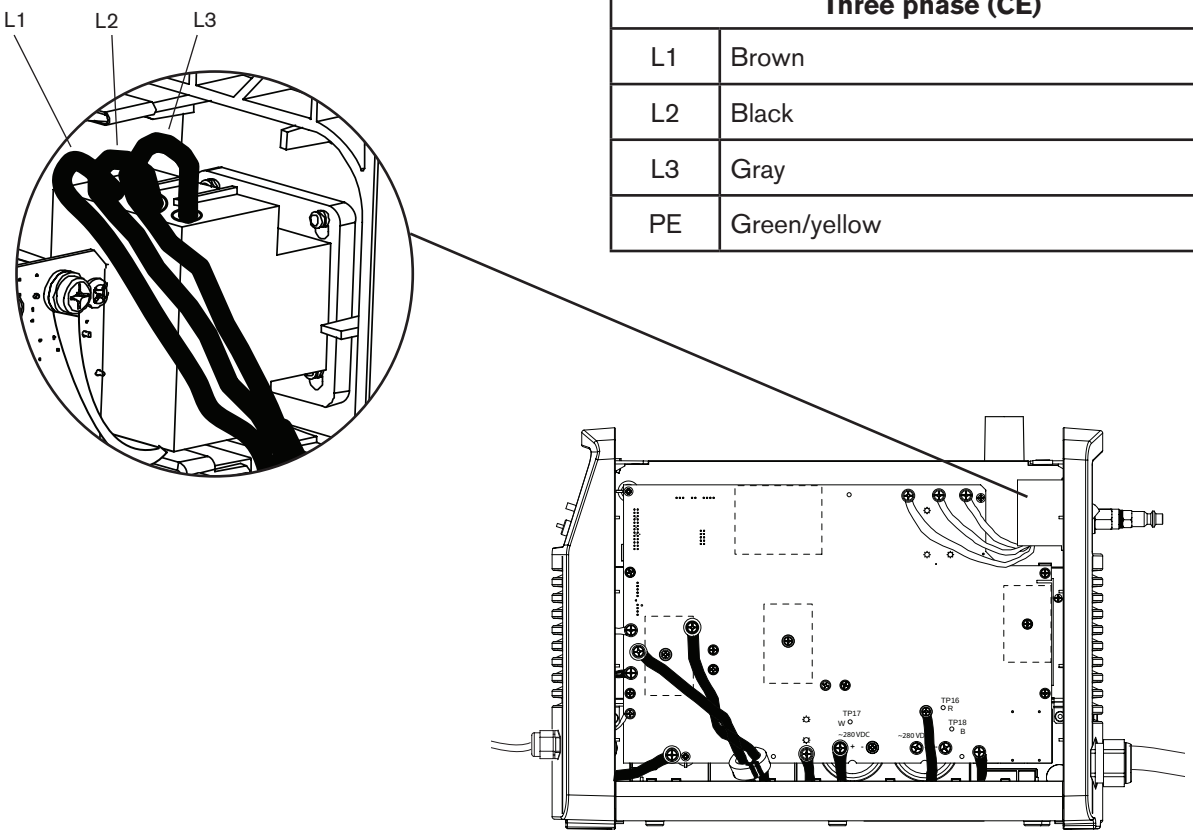
   The 400 V CE power cord has 3 wires – brown, black, and gray – that connect to the power switch and a green/yellow ground wire that connects to the heat sink.

3. Remove the rear end panel or gently tilt it away from the power supply until you can access the screws that secure the power cord wires to the back of the power switch.

   NOTE: To remove the rear end panel, you must first remove the air fitting.

4. Remove the 3 screws that secure the power cord wires to the power switch and gently pull the wires out of the switch.

5. Remove the screw that holds the green/yellow ground wire to the heat sink.



Three phase (CE)	
L1	Brown
L2	Black
L3	Gray
PE	Green/yellow

6. On the outside of the power supply, loosen the strain relief retention nut so that the wires move freely.

7. From the inside of the power supply, pull the wires through the strain relief and the hole in the end panel to remove the old power cord.

8. If you are replacing the old strain relief with the new strain relief contained in the kit:

   a. Use an adjustable wrench to unscrew the strain relief nut on the inside of the power supply to remove the old strain relief.

   b. Slide the new strain relief through the hole in the rear end panel of the power supply.

   c. Secure the strain relief on the inside of the power supply using the new strain relief nut. Hand tighten the nut and then over-tighten slightly more.

9. From the inside of the power supply, route the wires of the new power cord through the strain relief in the rear end panel. Do not remove the tubular ferrite bead from the power switch end of the brown, black, and gray wires. (Because the CE power cord includes the ferrite bead, you cannot route the power cord through the strain relief from the outside of the power supply.)

10. Slide the strain relief retention nut over the wires of the new power cord and slide the retention nut forward toward the power supply.

11. Press the connector for the brown wire into the hole on the top left side of the power switch (L1) and replace the screw that secures it. Torque the screw to 11.5 kg cm (10 inch-pounds).

12. Press the connector for the black wire into the hole on the top middle of the power switch (L2) and replace the screw that secures it. Torque the screw to 11.5 kg cm (10 inch-pounds).

13. Press the connector for the gray wire into the hole on the top right of the power switch (L3) and replace the screw that secures it. Torque the screw to 11.5 kg cm (10 inch-pounds).

14. Tighten the green/yellow ground wire to the heat sink with a torque setting of 17.3 kg cm (15 inch-pounds).

15. Position the wires in the wire chase up the side of the end panel and out of the way of the power board.

16. Replace or reposition the end panel. Make sure that the screw hole in the ground clip aligns with the screw holes in the end panel and the power supply.

17. Tighten the strain relief's retention nut on the outside of the end panel to secure the new power cord.

18. If you are installing a plug on the new power cord, use a plug that meets national and local electrical codes. The plug must be connected to the power cord by a licensed electrician.

19. Being careful not to pinch any of the wires, replace the Mylar barrier and slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

20. Reconnect the electrical power and the gas supply.

Replace the power cord (480 V CSA)

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.

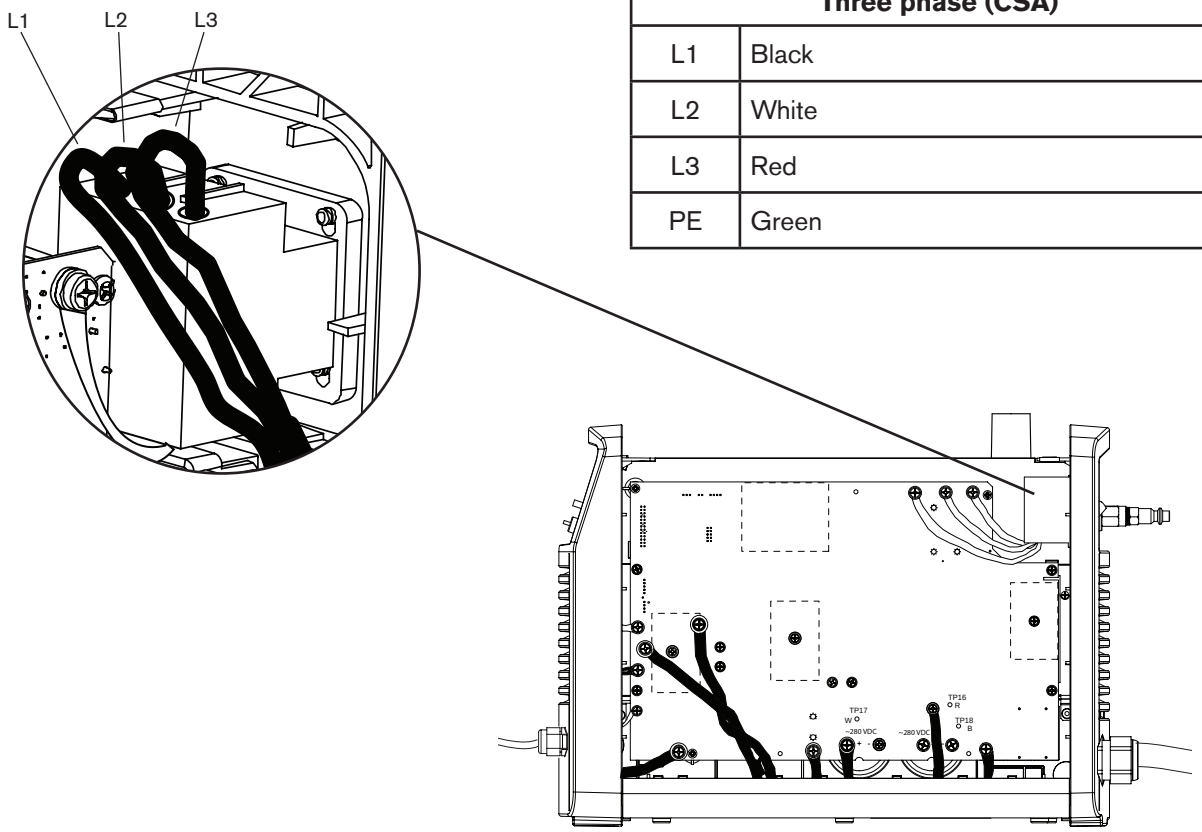
   The 480 V CSA power cord has 3 wires – black, white, and red – that connect to the power switch and a green ground wire that connects to the heat sink.

3. Remove the rear end panel or gently tilt it away from the power supply until you can access the screws that secure the power cord wires to the back of the power switch.

   NOTE: To remove the rear end panel, you must first remove the air fitting.

4. Remove the 3 screws that secure the power cord wires to the power switch and gently pull the wires out of the switch.

5. Remove the screw that holds the green ground wire to the heat sink.



Three phase (CSA)	
L1	Black
L2	White
L3	Red
PE	Green

6. On the outside of the power supply, loosen the strain relief retention nut so that the wires move freely. If you are replacing the strain relief, use an adjustable wrench to unscrew the strain relief nut on the inside of the power supply to remove the old strain relief.

7. From the outside of the power supply, pull the wires through the strain relief and the hole in the end panel to remove the old power cord.

8. If you are replacing the old strain relief with the new strain relief contained in the kit, slide the new strain relief onto the new power cord and route the wires for the new power cord through the hole in the end panel. Slide the new strain relief nut over the wires and screw it to the strain relief from the inside of the end panel. Hand tighten the nut and then over-tighten slightly more.

   If you are keeping the old strain relief in place, route the wires for the new power cord through the strain relief.

9. Press the connector for the black wire into the hole on the top left side of the power switch (L1) and replace the screw that secures it. Torque the screw to 11.5 kg cm (10 inch-pounds).

10. Press the connector for the white wire into the hole on the top middle of the power switch (L2) and replace the screw that secures it. Torque the screw to 11.5 kg cm (10 inch-pounds).

11. Press the connector for the red wire into the hole on the top right of the power switch (L3) and replace the screw that secures it. Torque the screw to 11.5 kg cm (10 inch-pounds).

12. Tighten the green ground wire to the heat sink with a torque setting of 17.3 kg cm (15 inch-pounds).

13. Position the wires in the wire chase up the side of the end panel and out of the way of the power board.

14. Replace or reposition the end panel. Make sure that the screw hole in the ground clip aligns with the screw holes in the end panel and the power supply.

15. Tighten the strain relief's retention nut on the outside of the end panel to secure the new power cord.

16. If you are installing a plug on the new power cord, use a plug that meets national and local electrical codes. The plug must be connected to the power cord by a licensed electrician.

17. Being careful not to pinch any of the wires, replace the Mylar barrier and slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

18. Reconnect the electrical power and the gas supply.

Replace the fan

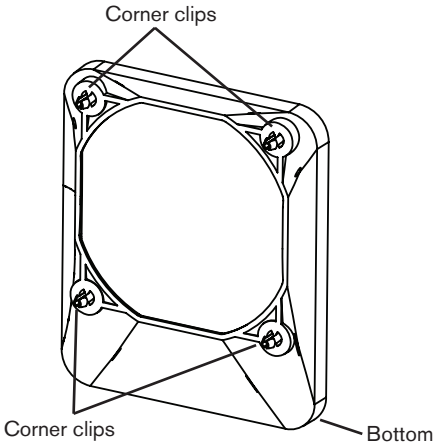
1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

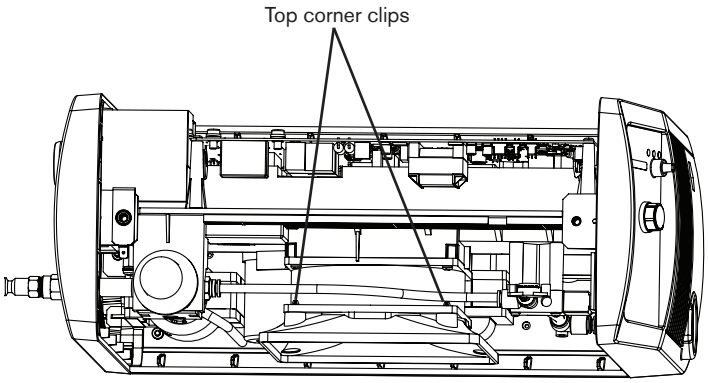
2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply.

3. Detach the connector from J4 (200–240 V CSA and 230 V CE) or J5 (400 V CE and 480 V CSA) on the power board. You may have to lift the top edge of the Mylar barrier to see the connector.

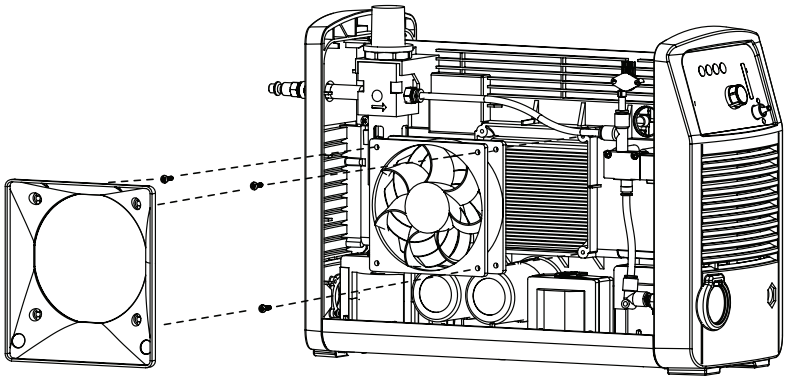
4. From the top of the power supply, use needlenose pliers to compress and release the 4 corner clips on the fan's plenum. After you release the top clips, you can tilt the plenum away from the power supply to reach the bottom 2 clips. Lift the plenum off the fan casing.

5. Insert a #1 Phillips screwdriver through the holes in the fan casing to remove the retaining screw from each corner of the fan.





6. Slide the old fan out from the power supply.
7. Slide the new fan into place.
8. Replace the 4 retaining screws.
9. Orient the fan plenum so that the wider end is at the bottom, and snap it into place.

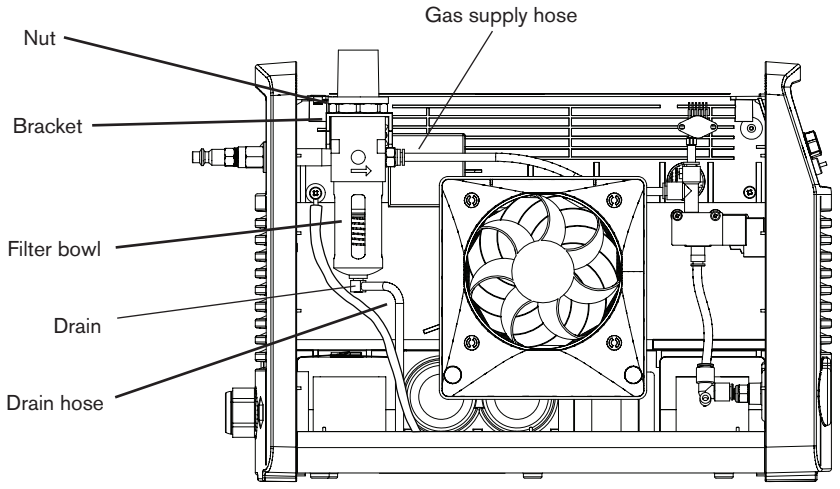


10. Attach the connector for the red and black wires on the left side of the fan to J4 (200–240 V CSA and 230 V CE) or J5 (400 V CE and 480 V CSA) on the power board.
11. Being careful not to pinch any of the wires, slide the cover back onto the power supply. Make sure that the bottom edges are in the tracks. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.
12. Reconnect the electrical power and the gas supply.

Replace the gas filter element

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply.
3. Remove the drain hose from the drain in the bottom of the power supply's base.
4. Compress the hose fitting's collar on the gas supply hose and pull the gas hose from the fitting.
5. Unscrew the nut that holds the filter in the bracket. Tip the bottom of the filter away from the power supply.
6. Unscrew the drain from the bottom of the filter. (You may want to remove the hose to make this easier.)

7. Unscrew the filter bowl from the body and remove it.



8. Remove the glass filter tube by twisting it and pulling gently until it releases.

9. Unscrew the element from the filter body while being careful not to allow the element to rotate.

10. Screw the new element to the filter body.

11. Place the glass filter tube inside the filter bowl and screw the drain onto the bottom of the filter bowl. Reattach the hose if you removed it earlier.

12. Reattach the filter bowl to the filter body, making sure that the drain and drain hose point toward the front edge of the fan.

13. Reposition the filter assembly in the bracket and replace its retainer nut.

14. Reconnect the gas supply hose and press the drain hose onto the drain in the bottom of the power supply.

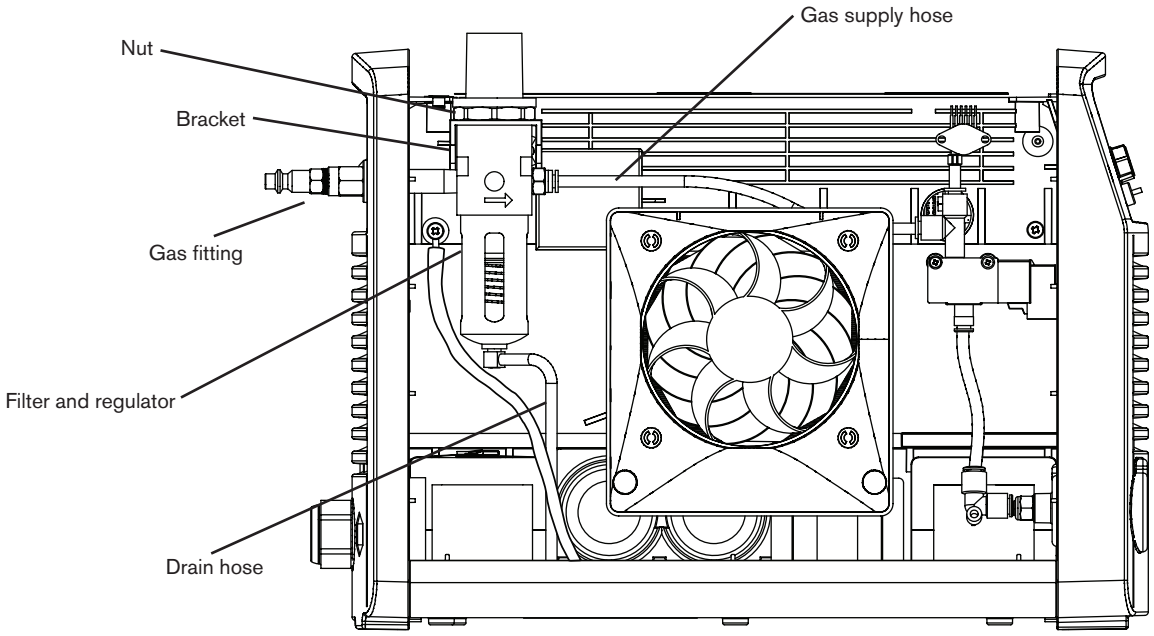
15. Reconnect the gas supply and check for leaks.

16. Slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

17. Reconnect the electrical power and the gas supply.

Replace the air filter and regulator

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply.
3. Remove the gas fitting from the rear of the power supply.
4. Remove the drain hose from the hole in the bottom of the power supply's base.
5. Disconnect the gas supply hose from the filter.



6. Unscrew the nut that holds the air filter in the bracket. Tip the bottom of the air filter away from the power supply and slide the filter out of the bracket.
7. Position the new gas filter in the bracket and replace the retainer nut.
8. Route the drain hose through the hole in the base of the power supply.
9. Connect the gas supply hose to the new filter. If you are replacing the hose, cut the new hose to the same length as the old hose.
10. Reconnect the gas fitting, and then reconnect the gas supply to test it for leaks.
11. Being careful not to pinch any of the wires, slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.
12. Reconnect the electrical power.

Replace the control board

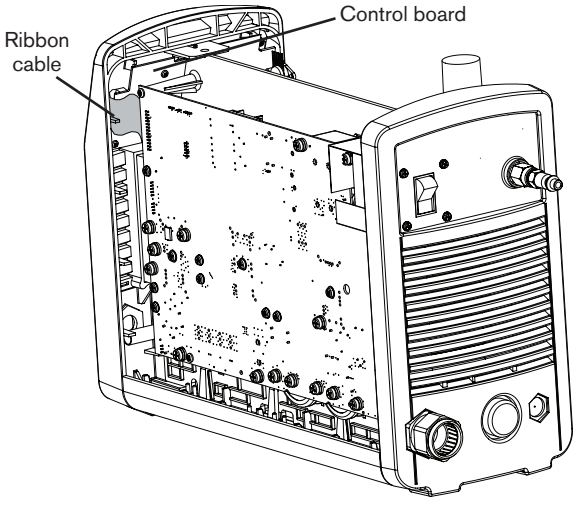
1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.
2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.
3. Remove the amperage control knob by pulling it straight out from the end panel.
4. Remove the front end panel, or gently tilt it away from the base.
5. Detach the ribbon cable from the power board at J7 (200–240 V CSA and 230 V CE) or J8 (400 V CE and 480 V CSA).

CAUTION

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

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

6. Test the new control board before installing it by attaching its ribbon cable to the power board. Reconnect the power, turn the system on, and verify that the start LED on the control board is the only LED illuminated. Also, the fault LEDs on the front panel should be extinguished.
7. Disconnect the electrical power and the ribbon cable again, and set aside the new control board.
8. Remove the 3 retaining screws from the old control board and lift it out of the power supply.
9. Screw the new control board into place with the 3 retaining screws and then attach the ribbon cable.
10. Press the amperage control knob onto the post. There is a flat side on the post. Ensure that the flat side of the opening in the knob aligns with the flat side on the post.



11. Reposition the front end panel.
12. Being careful not to pinch any of the wires, replace the Mylar barrier and slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.
13. Reconnect the electrical power and the gas supply.

Replace the power board (200–240 V CSA and 230 V CE)

Before beginning this procedure, make sure you have the correct power board for your system. The replacement kit number for a 200–240 V CSA power board is 228261. The replacement kit number for a 230 V CE power board is 228259. The procedure below applies to the 200–240 V CSA and the 230 V CE power boards.

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.

CAUTION

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

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

3. Detach the ribbon cable from J7 on the heat sink side of the power board. (See the illustrations following this procedure for the location of the ribbon cable and the components listed in the steps that follow.)

4. Remove the connectors at J10, J12, and J22 on the heat sink side of the power board.

5. Remove the connectors at J3, J4, and J5 on the heat sink side of the power board.

6. Remove the connector for the red and black wires from the power switch at J6 from the heat sink side of the power board. J6 is located about an inch down from the top edge of the board.

7. Remove the wires for the transformers and inductors at J13, J14, J15, J16, J17, J18, J19, and J20**.**

8. Remove the work lead ring terminal from J21 and the 4 capacitor screws.

9. Remove the 3 retaining screws, the 4 heat sink assembly screws, and the 4 resistor screws.

10. *If you have an older 200–240 V CSA or 230 V CE power board* that has 2 input bridge diodes (and without the small slot below the heat sink assembly screw hole), remove the 3 screws that attach the IGBTs and the 2 screws that attach the input bridge diodes to the heat sink. There are holes in the power board to provide access to them.

    If you have a newer 200–240 V CSA or 230 V CE power board that has a single input bridge diode (and has a small slot below the heat sink assembly screw hole), remove the 3 screws that attach the IGBTs and the screw that attaches the input bridge diode to the heat sink. There are holes in the power board to provide access to them.

11. Remove the screw at J1 that secures the white wire and the screw at J2 that secures the black wire from the ON/OFF switch to the power board.

12. Stand up the unit again. Tuck out of the way all the wires that you detached.

13. Pull the board straight out from the power supply.

14. Before installing a new power board, clean the heat sink with isopropyl alcohol. Gently scrub away any residual thermal compound, being careful not to scratch the heat sink. Wipe it with a clean cloth.

15. Spread a thin layer of thermal compound (included in the parts kit) 2 mm thick (about the thickness of a sheet of paper) on all the IGBTs and the input bridge diode.

    NOTE: Remix the compound if the material separates.

16. Line up the holes for the capacitor screws with the capacitors; the pressure relief vents should be visible from the two notches in the power board.

17. Push the power board straight in.

18. Replace the 4 heat sink assembly screws and torque them to 23.0 kg cm (20 inch-pounds).

19. Replace the 3 retaining screws and the 4 resistor screws. Torque these screws to 17.3 kg cm (15 inch-pounds).

20. Reconnect the white wire from the ON/OFF switch to J1 and the black wire to J2. Torque them to 23.0 kg cm (20 inch-pounds).

21. Replace the 3 screws that attach the IGBTs and the screw that attaches the input bridge diode to the heat sink. The torque setting for these is **23.0 kg cm (20 inch-pounds)**. (If you replaced an older 200–240 V CSA or 230 V CE power board you will have an additional screw left over.)

22. Replace the 4 capacitor screws. Be sure to reattach the black wire to the left-most screw. Torque these screws to 23.0 kg cm (20 inch-pounds).

23. Reconnect the wires to the transformers and inductors at J13, J14, J15, J16, J17, J18, J19, and J20 and the work lead ring terminal at J21. Torque them to 23.0 kg cm (20 inch-pounds).

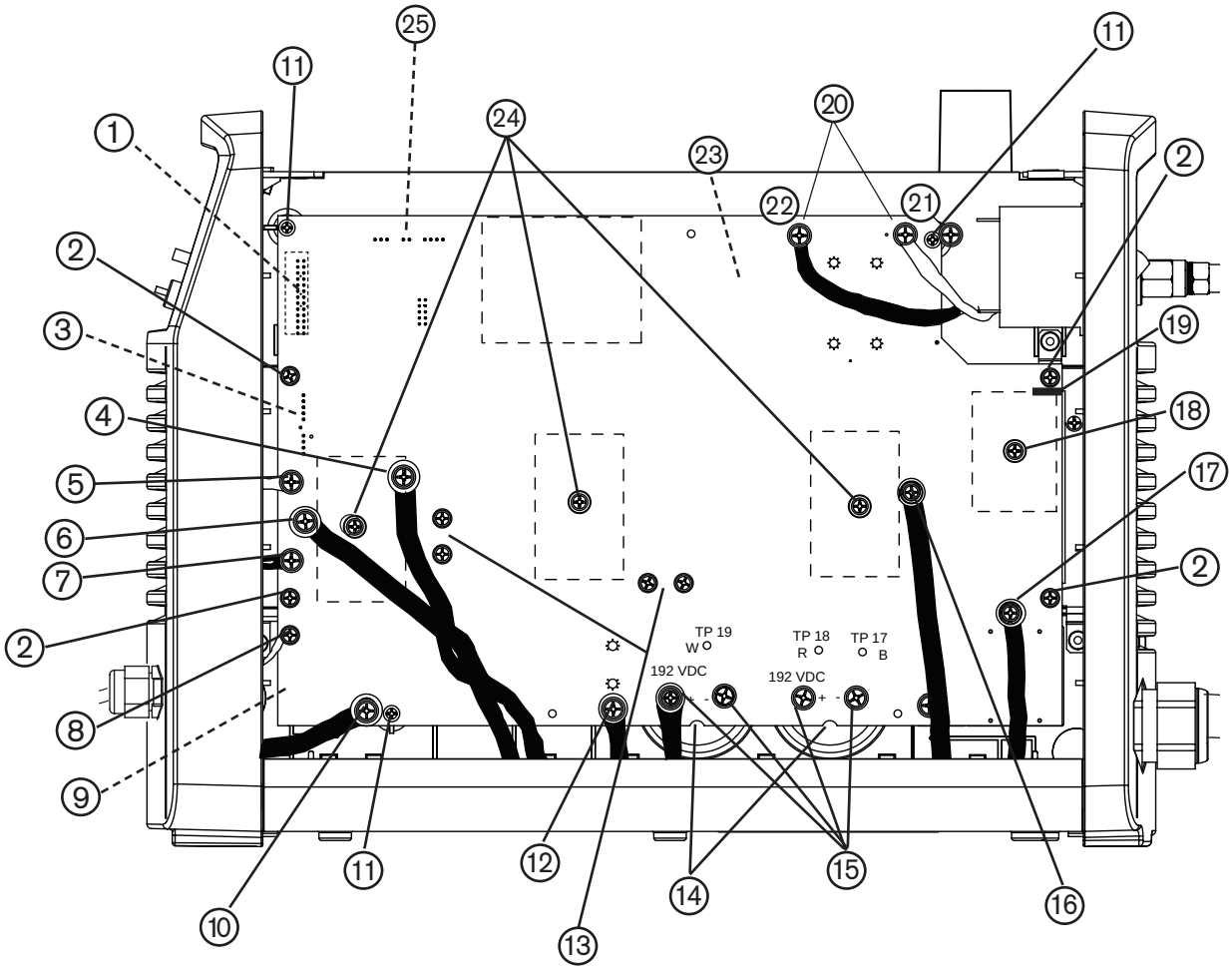
24. Replace the connectors at J10 and J12 and the connectors at J3, J4, J5, and J6.

25. Reconnect the ribbon cable from the control board to the power board at J7.

26. Being careful not to pinch any of the wires, replace the Mylar barrier and slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

27. Reconnect the electrical power and the gas supply.

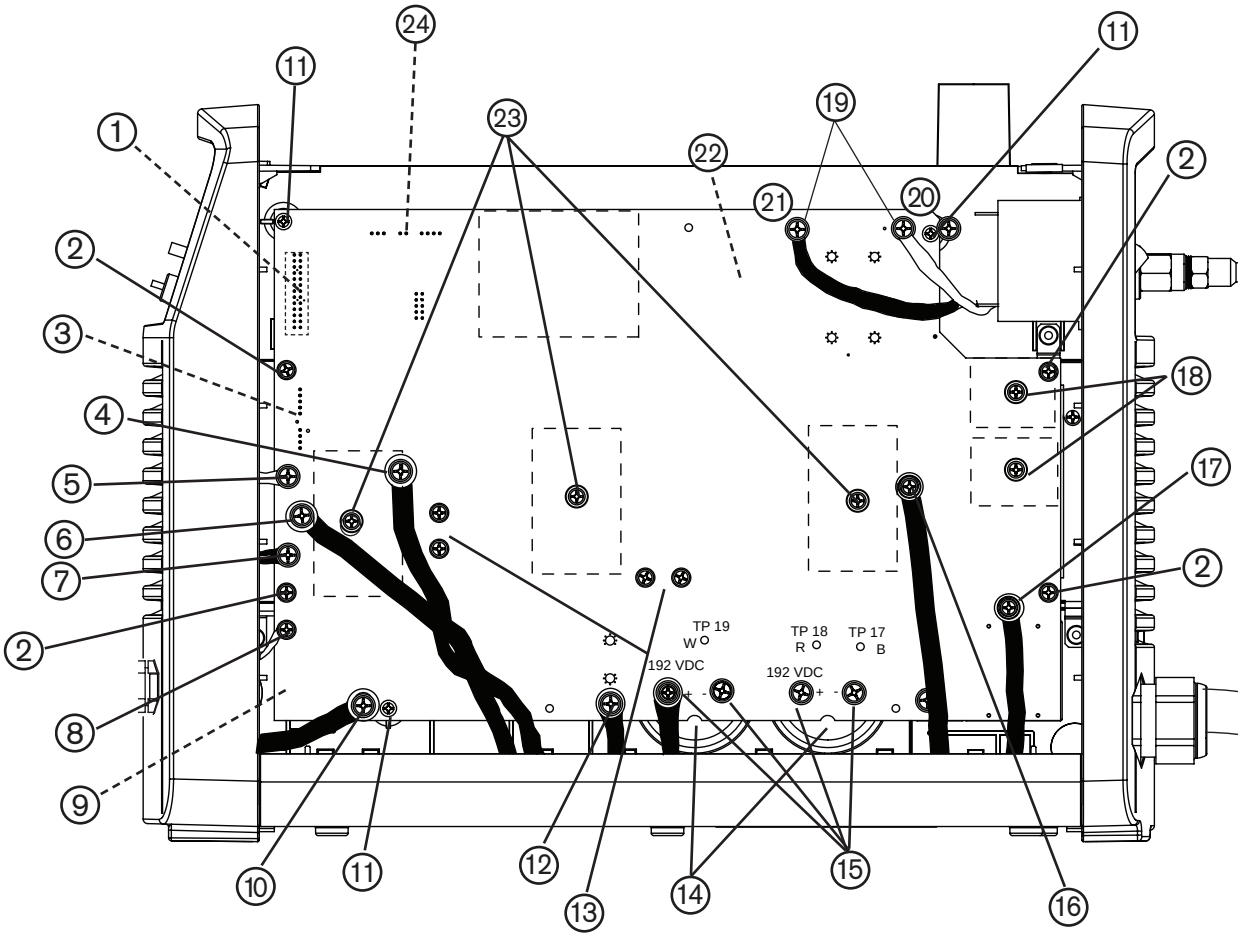
Newer 200–240 V CSA and 230 V CE power board



Item	Description
1	Ribbon cable (J7 connector)
2	Heat sink assembly screw
3	J10 and J12 connectors
4	J13 connector
5	J14 connector
6	J16 connector
7	J17 connector
8	J19 connector
9	J22 connector
10	Work lead connector (J21)
11	Retaining screw
12	J20 connector
13	Resistor screws (4)

Item	Description
14	Pressure relief vents
15	Capacitor screws (4)
16	J15 connector
17	J18 connector
18	Input bridge diode screw
19	Newer boards have a slot here
20	ON/OFF switch wires
21	J1 connector
22	J2 connector
23	J6 connector
24	IGBT attachment screws (3)
25	J3, J4, and J5 connectors

Older 200–240 V CSA and 230 V CE power board



Item	Description	Item	Description
1	Ribbon cable (J7 connector)	**13**	Resistor screws (4)
2	Heat sink assembly screw	**14**	Pressure relief vents
3	J10 and J12 connectors	**15**	Capacitor screws (4)
4	J13 connector	**16**	J15 connector
5	J14 connector	**17**	J18 connector
6	J16 connector	**18**	Input bridge diode screws (2)
7	J17 connector	**19**	ON/OFF switch wires
8	J19 connector	**20**	J1 connector
9	J22 connector	**21**	J2 connector
10	Work lead connector (J21)	**22**	J6 connector
11	Retaining screw	**23**	IGBT attachment screws (3)
12	J20 connector	**24**	J3, J4, and J5 connectors

Replace the power board (400 V CE and 480 V CSA)

Before beginning this procedure, make sure you have the correct power board for your system. The kit number for a 400 V CE power board is 228260. The kit number for a 480 V CSA power board is 428078. These power boards have a small slot immediately below the heat sink assembly screw hole and a single input bridge diode.

1. Turn OFF the power, disconnect the power cord, and disconnect the gas supply.

2. Use a #2 Phillips screwdriver to remove the 2 screws from the handle on the top of the power supply. Tip the end panels back slightly so that you can get the edges of the handle out from underneath them. Lift the cover off the power supply. Remove the Mylar barrier that protects the power board.

CAUTION

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

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

3. Detach the ribbon cable from J8 on the heat sink side of the power board. (See the illustrations following this procedure for the location of the ribbon cable and the components listed in the steps that follow.)

4. Remove the connectors at J10, J12, and J22 on the heat sink side of the power board.

5. Remove the connectors at J4, J5, and J6 on the heat sink side of the power board.

6. Remove the wires for the transformers and inductors at J13, J14, J15, J16, J17, J18, J19, and J20**.**

7. Remove the work lead ring terminal from J21 and the 4 capacitor screws.

8. Remove the 3 retaining screws, the 4 resistor screws, and the 4 heat sink assembly screws.

9. *If you have an older 400 V CE power board* that has 2 input bridge diodes (and without the small slot below the heat sink assembly screw hole), remove the 2 screws that attach the IGBTs and the 2 screws that attach the input bridge diodes to the heat sink. There are holes in the power board to provide access to them.

   If you have a newer 400 V CE or 480 V CSA power board that has a single input bridge diode (and has a small slot below the heat sink assembly screw hole), remove the 2 screws that attach the IGBTs and the screw that attaches the input bridge diode to the heat sink. There are holes in the power board to provide access to them.

10. Remove the screws at J1, J2, and J3 that secure the 3 white wires from the bottom of the ON/OFF switch to the power board.

11. Stand up the unit again. Tuck out of the way all the wires that you detached.

12. Pull the board straight out from the power supply.

13. Before installing a new power board, clean the heat sink with isopropyl alcohol. Gently scrub away any residual thermal compound, being careful not to scratch the heat sink. Wipe it with a clean cloth.

14. Spread a thin layer of thermal compound (included in the parts kit) 2 mm thick (about the thickness of a sheet of paper) on all the IGBTs and the input bridge diode.

    NOTE: Remix the compound if the material separates.

15. Line up the holes for the capacitor screws with the capacitors; the pressure relief vents should be visible from the two notches in the power board.

16. Push the power board straight in.

17. Replace the 4 heat sink assembly screws and torque them to 23.0 kg cm (20 inch-pounds).

18. Replace the 3 retaining screws and the 4 resistor screws. Torque these screws to 17.3 kg cm (15 inch-pounds).

19. Reconnect the 3 white wires from the ON/OFF switch to J1, J2, and J3. Torque them to 23.0 kg cm (20 inch-pounds).

20. Replace the 2 screws that attach the IGBTs and the screw that attaches the input bridge diode to the heat sink. The torque setting for these screws is 23.0 kg cm (20 inch-pounds). (If you replaced an older 400 V CE power board you will have an additional screw left over.)

21. Replace the 4 capacitor screws and torque them to 23.0 kg cm (20 inch-pounds). Be sure to reattach the black wire to the left-most screw.

22. Reconnect the wires to the transformers and inductors at J13, J14, J15, J16, J17, J18, J19, and J20 and the work lead ring terminal at J21. Torque them to 23.0 kg cm (20 inch-pounds).

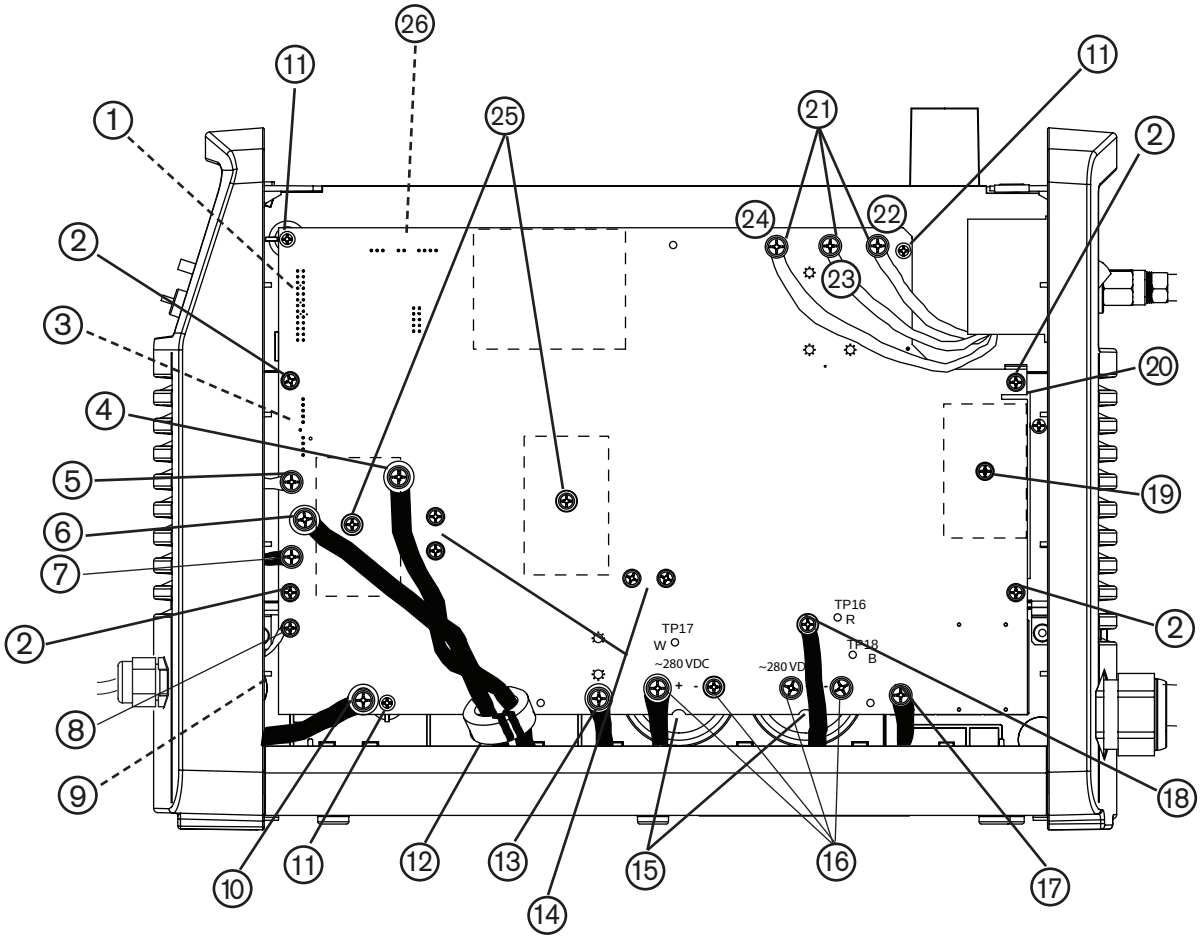
23. Replace the connectors at J10, J12, and J22 and the connectors at J4, J5, and J6.

24. Reconnect the ribbon cable from the control board to the power board at J8.

25. Being careful not to pinch any of the wires, replace the Mylar barrier and slide the cover back onto the power supply. Position the handle over the holes in the top of the cover, then use the 2 screws to secure the cover.

26. Reconnect the electrical power and the gas supply.

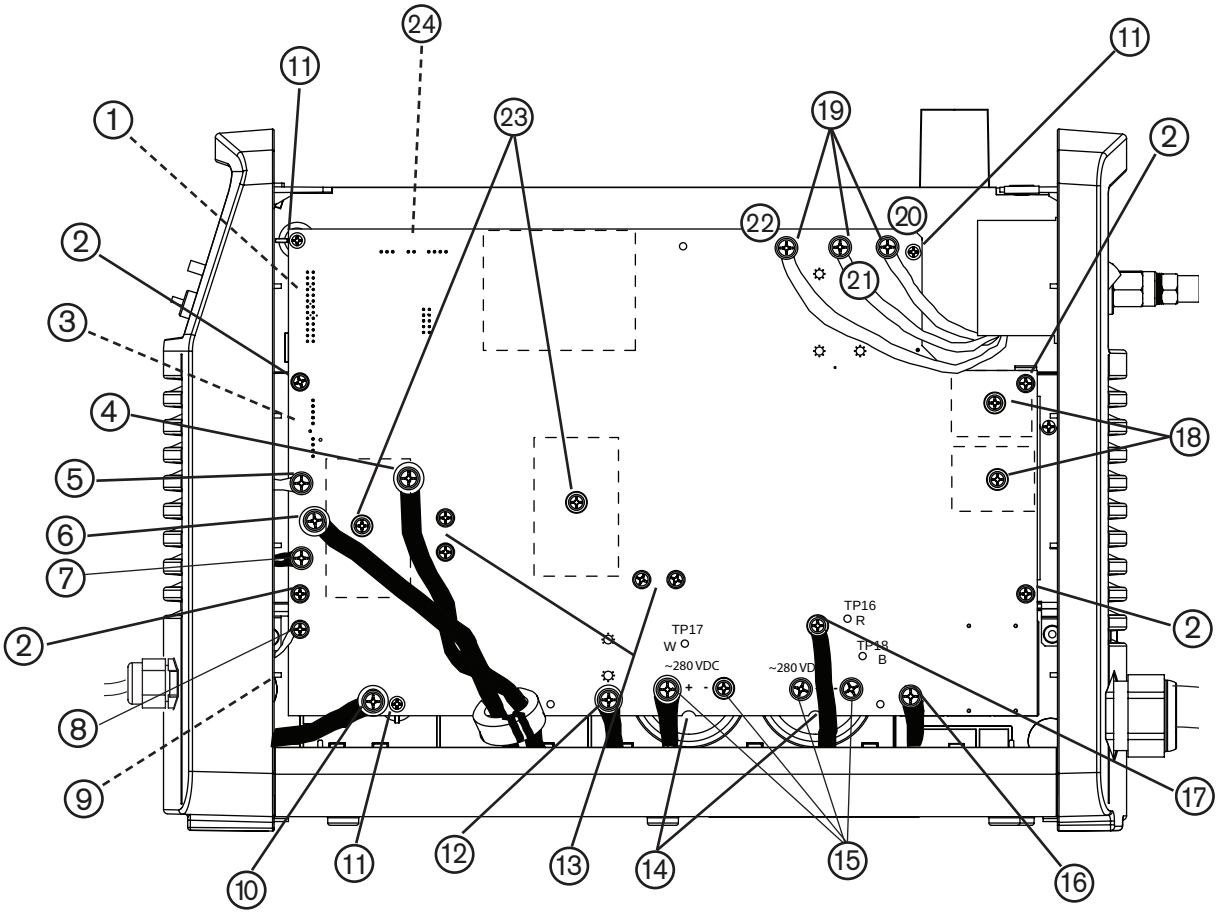
Newer 400 V CE and 480 V CSA power board



Item	Description
1	Ribbon cable (J8 connector)
2	Heat sink assembly screw
3	J10 and J12 connectors
4	J13 connector
5	J14 connector
6	J15 connector
7	J16 connector
8	J18 connector
9	J22 connector
10	Work lead connector (J21)
11	Retaining screw
12	Ferrite (CE units only)
13	J20 connector

Item	Description
14	Resistor screws (4)
15	Pressure relief vents
16	Capacitor screws (4)
17	J19 connector
18	J17 connector
19	Input bridge diode screw
20	Newer boards have a slot here
21	ON/OFF switch wires
22	J1 connector
23	J2 connector
24	J3 connector
25	IGBT attachment screws (2)
26	J4, J5, and J6 connectors

Older 400 V CE power board



Item	Description
1	Ribbon cable (J8 connector)
2	Heat sink assembly screw
3	J10 and J12 connectors
4	J13 connector
5	J14 connector
6	J15 connector
7	J16 connector
8	J18 connector
9	J22 connector
10	Work lead connector (J21)
11	Retaining screw
12	J20 connector

Item	Description
13	Resistor screws (4)
14	Pressure relief vents
15	Capacitor screws (4)
16	J19 connector
17	J17 connector
18	Input bridge diode screws (2)
19	ON/OFF switch wires
20	J1 connector
21	J2 connector
22	J3 connector
23	IGBT attachment screws (2)
24	J4, J5, and J6 connectors

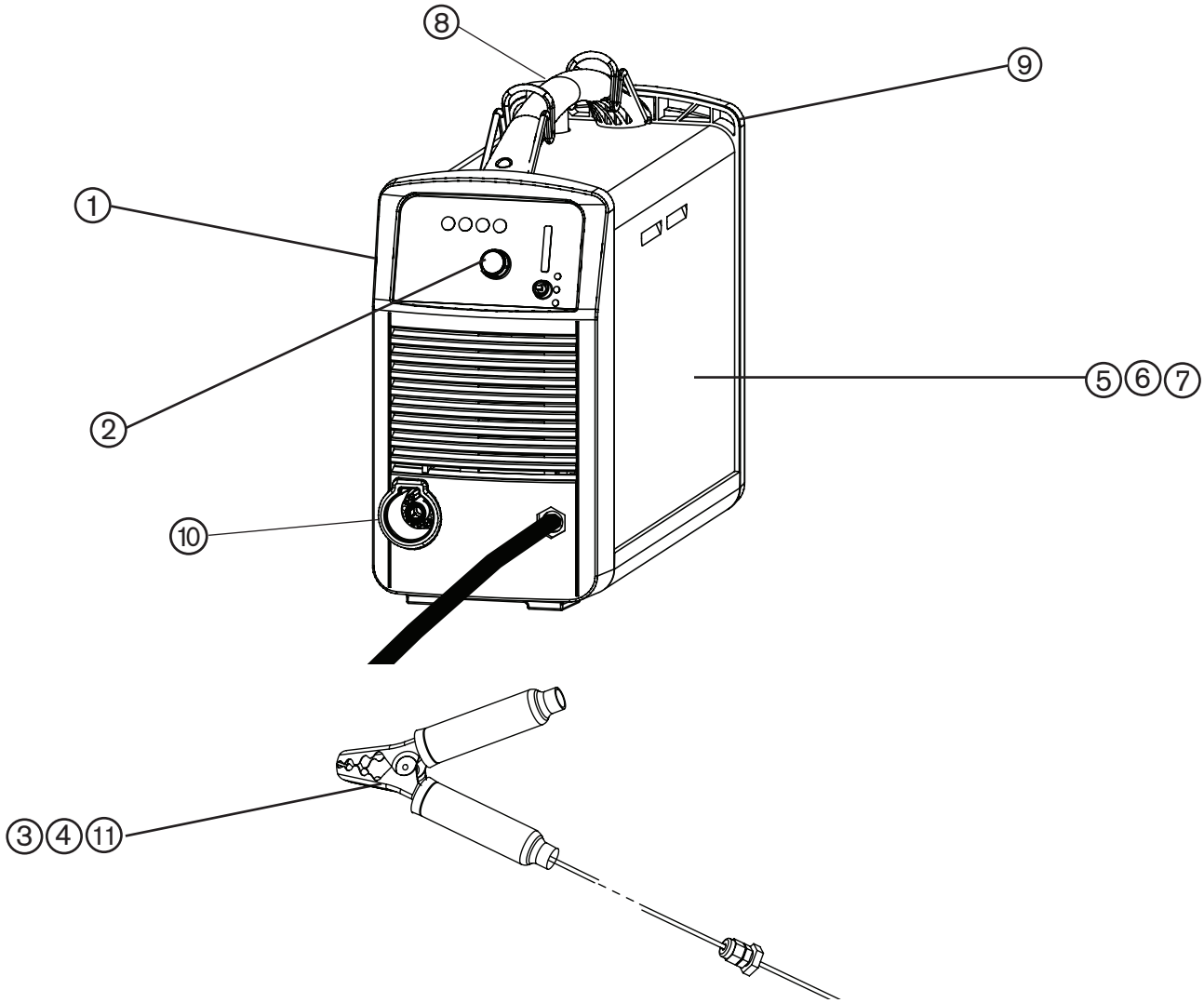
Section 7

PARTS

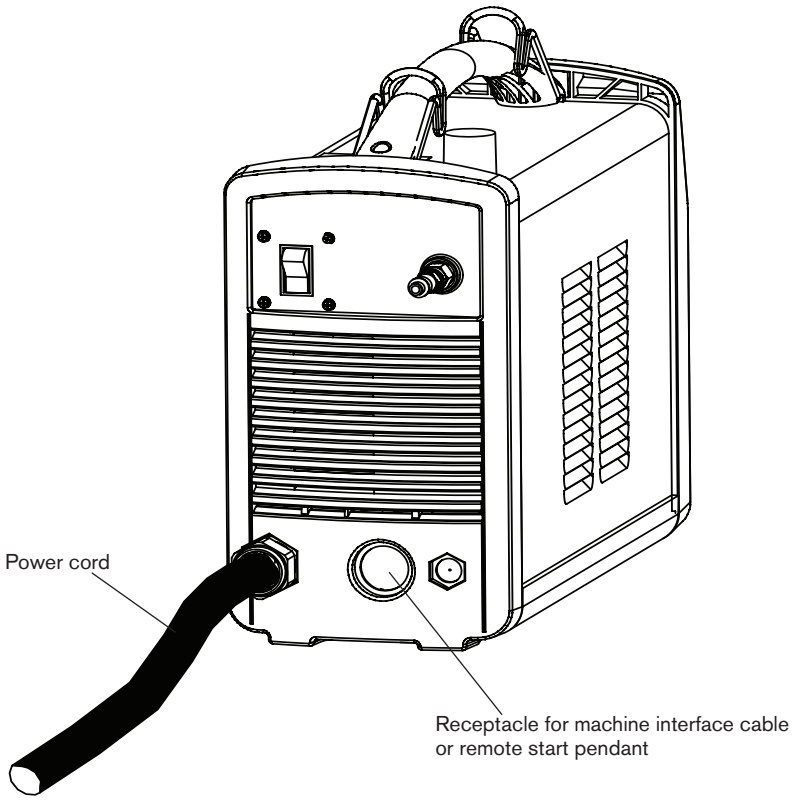
In this section:

Power supply parts

Exterior

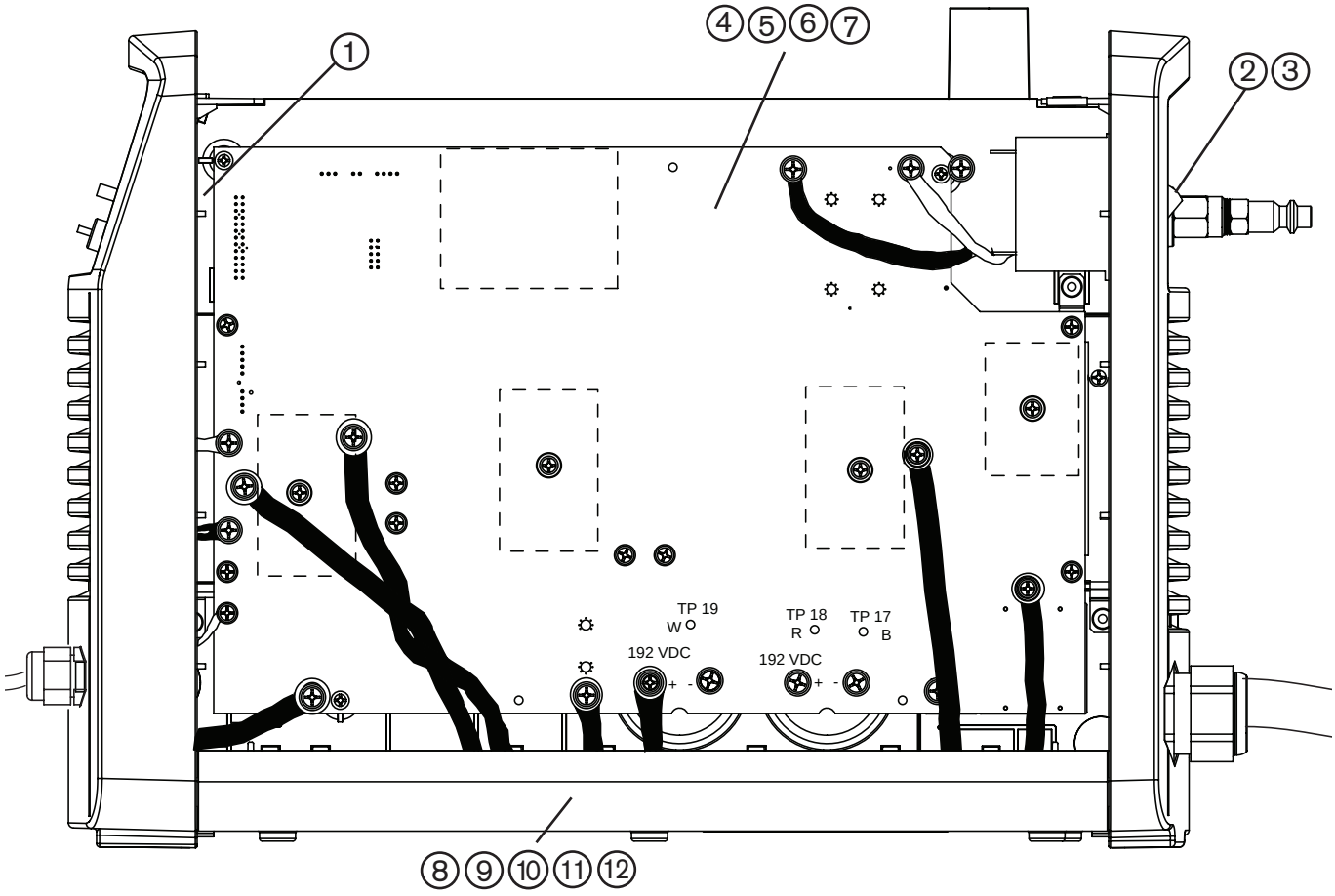


Item	Part number	Description	Qty.
	228270	Kit: Cover screws	1
1	228269	Kit: Front panel	1
2	108616	Current adjustment knob	1
3	228300	Kit: Work lead assembly, 6.1 m (20 feet)	1
4	228307	Kit: Work lead assembly, 15.24 m (50 feet)	1
5	228281	Kit: Power supply cover with labels, 200–240 V CSA	1
6	228283	Kit: Power supply cover with labels, CE	1
7	428076	Kit: Power supply cover with labels (Built in America), 480 V CSA	1
8	228268	Kit: Rear panel	1
9	228267	Kit: Powermax45 handle and screws	1
10	228282	Kit: FastConnect™ replacement (power supply half)	1
11	228561	Kit: Ground clamp	1



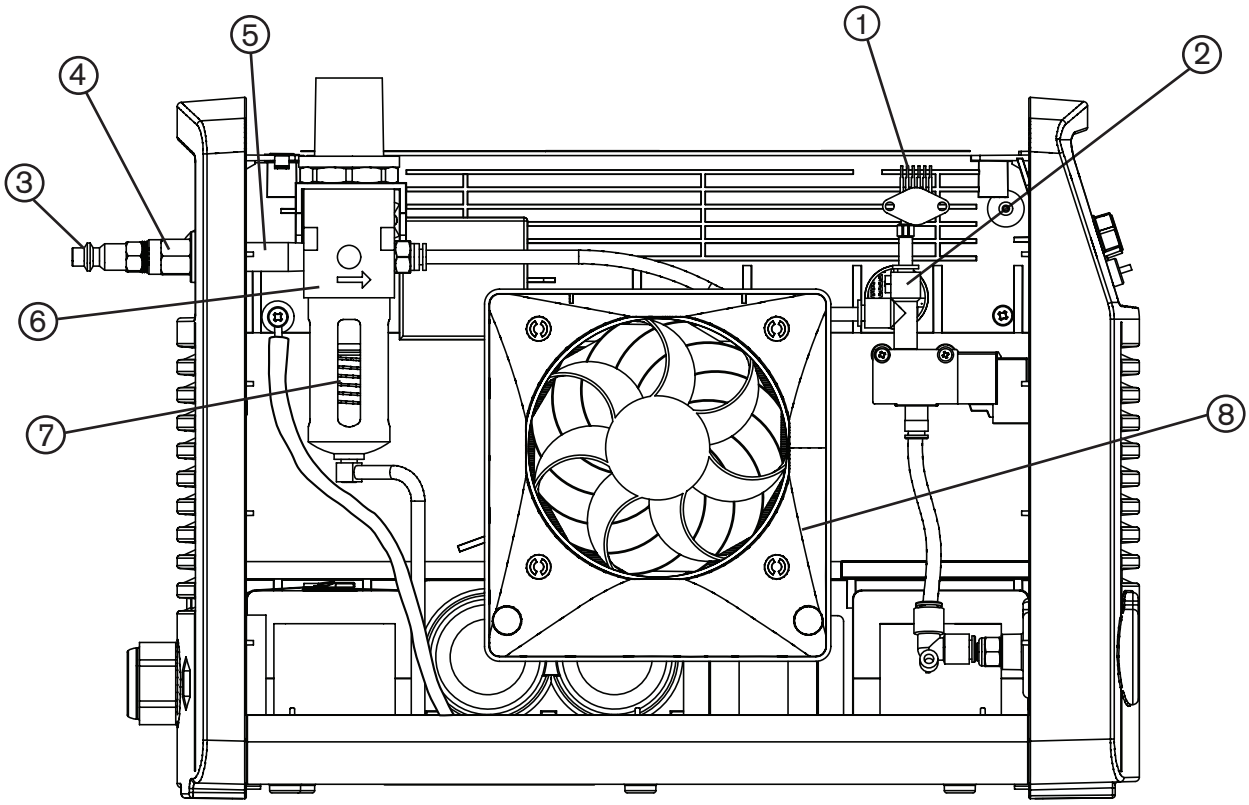
Part number	Description
228278	Kit: CSA power cord, 1-phase, 200–240 V, 3 m (10 feet)
228277	Kit: CE power cord, 1-phase, 230 V, 3 m (10 feet)
228276	Kit: CE power cord, 3-phase, 400 V, 3 m (10 feet)
428077	Kit: CSA power cord, 3-phase, 480 V, 3 m (10 feet)
023206	Machine interface cable (start plasma, arc transfer, and ground), 7.62 m (25 feet)
023279	Machine interface cable (start plasma, arc transfer, and ground), 15.24 m (50 feet)
123966	Powermax45 machine interface cable (start plasma, arc transfer, 50:1 voltage divider, and ground), 7.62 m (25 feet), spade connectors
123967	Powermax45 machine interface cable (start plasma, arc transfer, 50:1 voltage divider, and ground), 15.24 m (50 feet), spade connectors
223048	Machine interface cable (start plasma, arc transfer, 50:1 voltage divider, and ground), 7.62 m (25 feet), D-sub connector with screws
123896	Machine interface cable (start plasma, arc transfer, 50:1 voltage divider, and ground), 15.24 m (50 feet), D-sub connector with screws

Interior, power board side



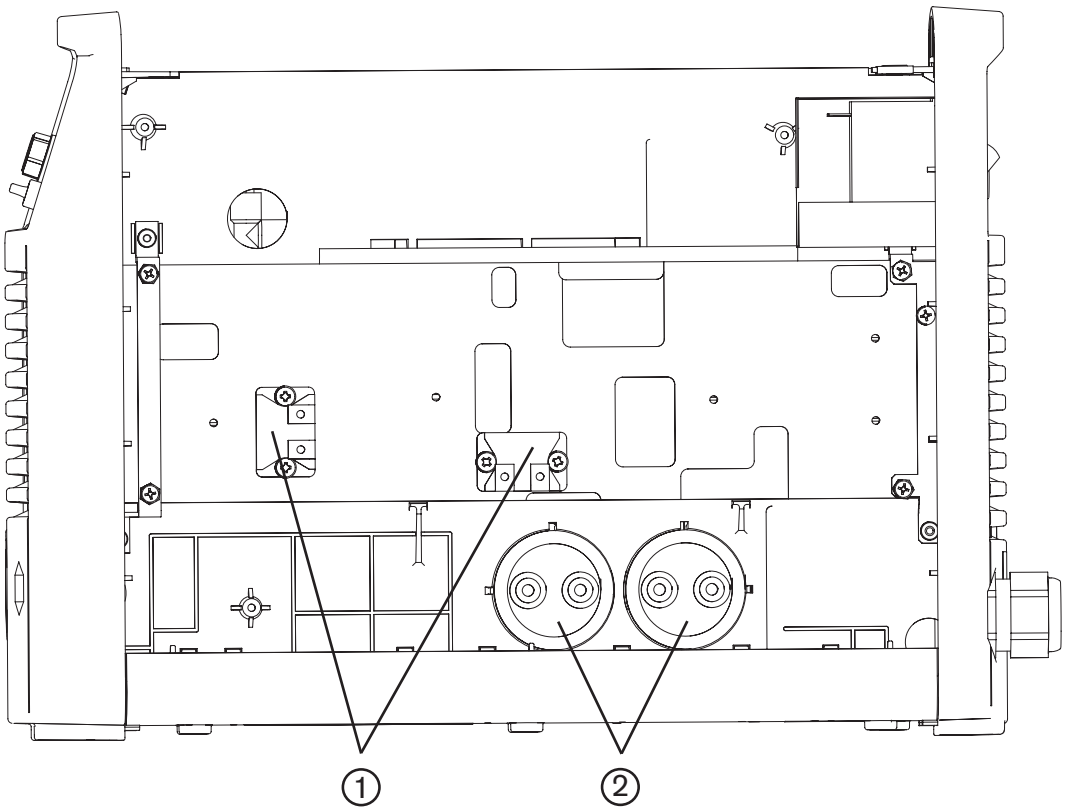
Item	Part number	Description	Designator	Qty.
1	228262	Kit: Control board, 200–240 V CSA, 230 V CE, 400 V CE	PCB1	1
	428098	Kit: Control board, 480 V CSA	PCB1	1
2	228266	Kit: Powermax45 power switch, 200–240 V CSA and 230 V CE		1
3	228288	Kit: Powermax45 power switch, 400 V CE and 480 V CSA		1
4	228261	Kit: Power board, 200–240 V CSA	PCB2	1
5	428078	Kit: Power board, 480 V CSA	PCB2	1
6	228260	Kit: Power board, 400 V CE	PCB2	1
7	228259	Kit: Power board, 230 V CE	PCB2	1
8	228258	Kit: Base		1
9	228265	Kit: Magnetics assembly, 200–240 V CSA		1
10	228273	Kit: Magnetics assembly, 230 V CE		1
11	228263	Kit: Magnetics assembly, 400 V CE		1
12	428079	Kit: Magnetics assembly, 480 V CSA		1
	228279	Kit: Powermax45 insulator (not shown)		1
	228290	Kit: Powermax45 wire group (not shown)		1

Interior, fan side



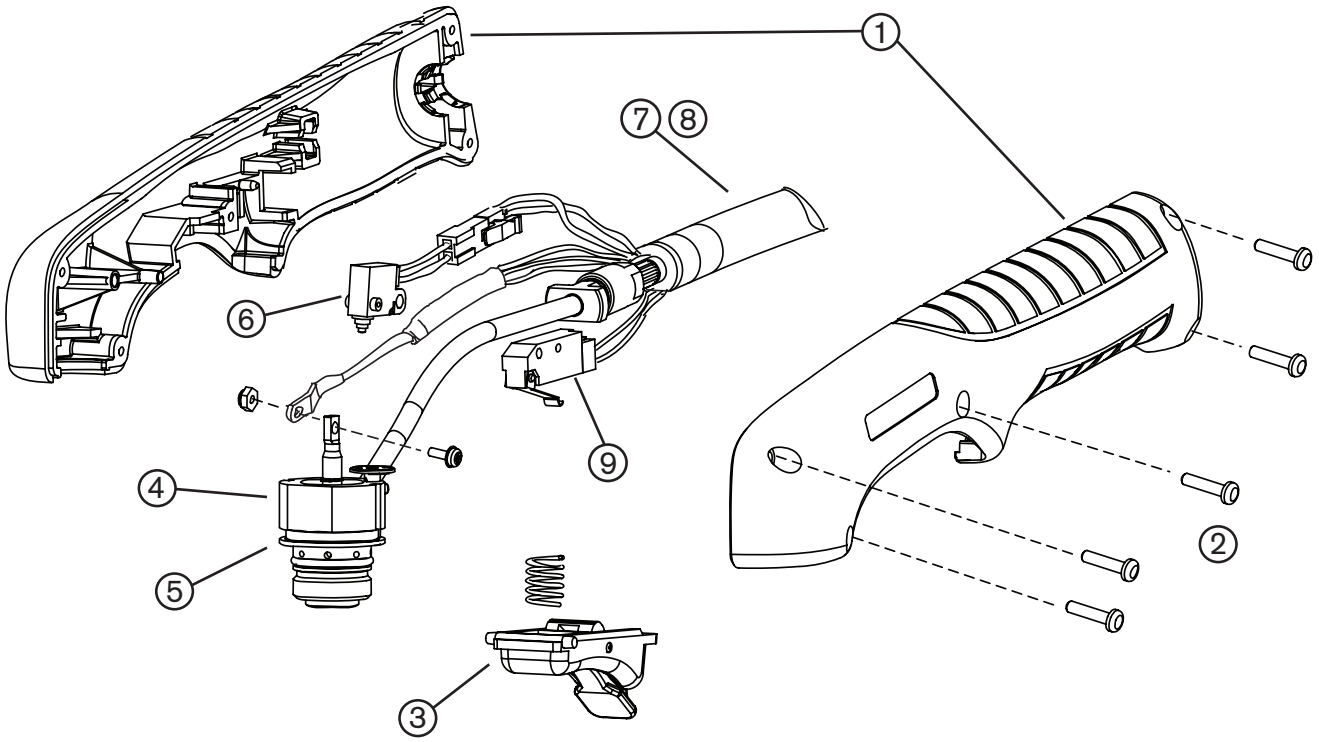
Item	Part number	Description	Designator	Qty.
1	228284	Kit: Pressure sensor cable		1
2	228285	Kit: Solenoid valve	V1	1
3	015337	Quick disconnect, 1/4”, NPT, stainless nipple		1
4	015551	1/4” brass coupling		1
5	015511	1/4” X 2” brass nipple		1
6	228287	Kit: Filter and regulator		1
7	228302	Kit: Air filter element		1
8	228286	Kit: Fan assembly	M1	1

Interior, heat sink side



Item	Part number	Description	Qty.
1	428065	Kit: Snubber resistors	2
2	228301	Kit: Capacitors, 200–240 V CSA and 230 V CE	2
	228426	Kit: Capacitors, 400 V CE	2
	428080	Kit: Capacitors, 480 V CSA	2

T45v hand torch parts



The entire hand torch and lead assembly can be replaced, or individual component parts can be replaced. Part numbers starting with 088 indicate complete torch and lead assemblies.

Item	Part number	Description	Qty.
	088008*	T45v hand torch assembly with 6.1 m (20 feet) lead	1
	088009*	T45v hand torch assembly with 15.24 m (50 feet) lead	1
1	228313	Kit: T45v torch handle replacement	1
2	075714	T45v torch handle screws, #4 x 1/2 SLTD Torx PAN, S/B	5
3	002244	Safety trigger and spring replacement	1
4	228346	Kit: Torch head replacement	1
5	058503	O-ring: Viton 0.626 x 0.070	1
6	228109	Kit: T45v torch cap-sensor switch replacement	1
7	228315	Kit: T45v torch lead replacement, 6.1 m (20 feet)	1
8	228316	Kit: T45v torch lead replacement, 15.24 m (50 feet)	1
9	128642	Kit: Start switch replacement	1

* The torch assembly also includes one set of the consumables listed on the next page.

T45v hand torch consumables

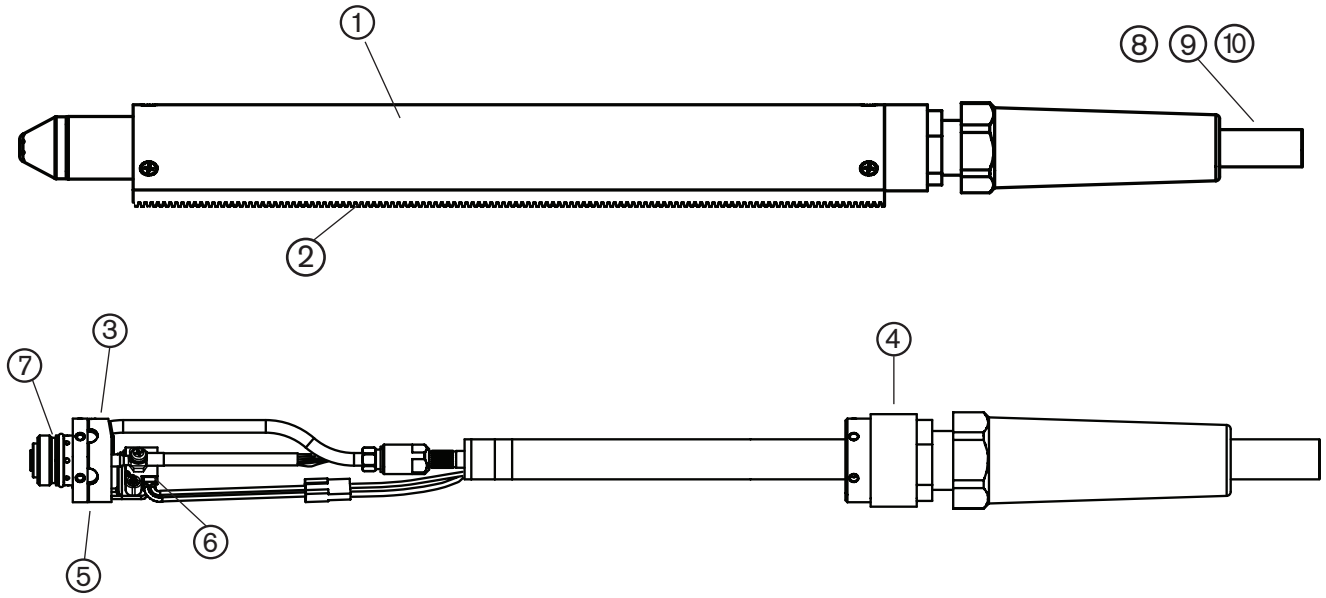
Part number	Description
Shielded	
220669	Electrode
220670	Swirl ring
220713	Retaining cap
220671	Nozzle
220674	Shield
Gouging*	
220675	Shield
220672	Nozzle
Unshielded*	
220717	Deflector
220718	Nozzle

* The swirl ring, retaining cap, and electrode for these applications are the same as those for the shielded application. Unshielded consumables for the hand torch are not available in CE-regulated countries.

T30v (Powermax30) 30 A consumables

Part number	Description
220569	Deflector
220483	Retaining cap
220480	Nozzle
220479	Swirl ring
220478	Electrode

T45m machine torch parts



The entire machine torch and lead assembly can be replaced, or individual component parts can be replaced. Part numbers starting with 088 indicate complete torch and lead assemblies.

Item	Part number	Description	Qty.
	088010*	T45m machine torch assembly with 7.62 m (25 feet) lead	1
	088011*	T45m machine torch assembly with 10.67 m (35 feet) lead	1
	088012*	T45m machine torch assembly with 15.24 m (50 feet) lead	1
1	228228	Kit: T45m positioning sleeve	1
2	228229	Kit: T45m removable gear rack	1
3	228322	Kit: T45m front mounting ring	1
4	228323	Kit: T45m rear mounting ring	1
5	228320	Kit: T45m torch head replacement	1
6	228321	Kit: T45m cap-sensor switch replacement	1
7	058503	O-ring: Viton 0.626 x 0.070	1
8	228317	Kit: T45m torch lead replacement, 7.62 m (25 feet)	1
9	228318	Kit: T45m torch lead replacement, 10.67 m (35 feet)	1
10	228319	Kit: T45m torch lead replacement, 15.24 m (50 feet)	1

* Top assembly includes one set of the following consumables:

220669	Electrode	1
220670	Swirl ring	1
220713	Retaining cap	1
220671	Nozzle	1
220673	Shield	1

T45m machine torch consumables

Part number	Description
Shielded	
220669	Electrode
220670	Swirl ring
220713	Retaining cap
220719	Ohmic sensing retaining cap
220671	Nozzle
220673	Shield
Unshielded*	
220717	Deflector
220718	Nozzle

* The swirl ring, retaining cap, and electrode for the unshielded application are the same as those for the shielded application.

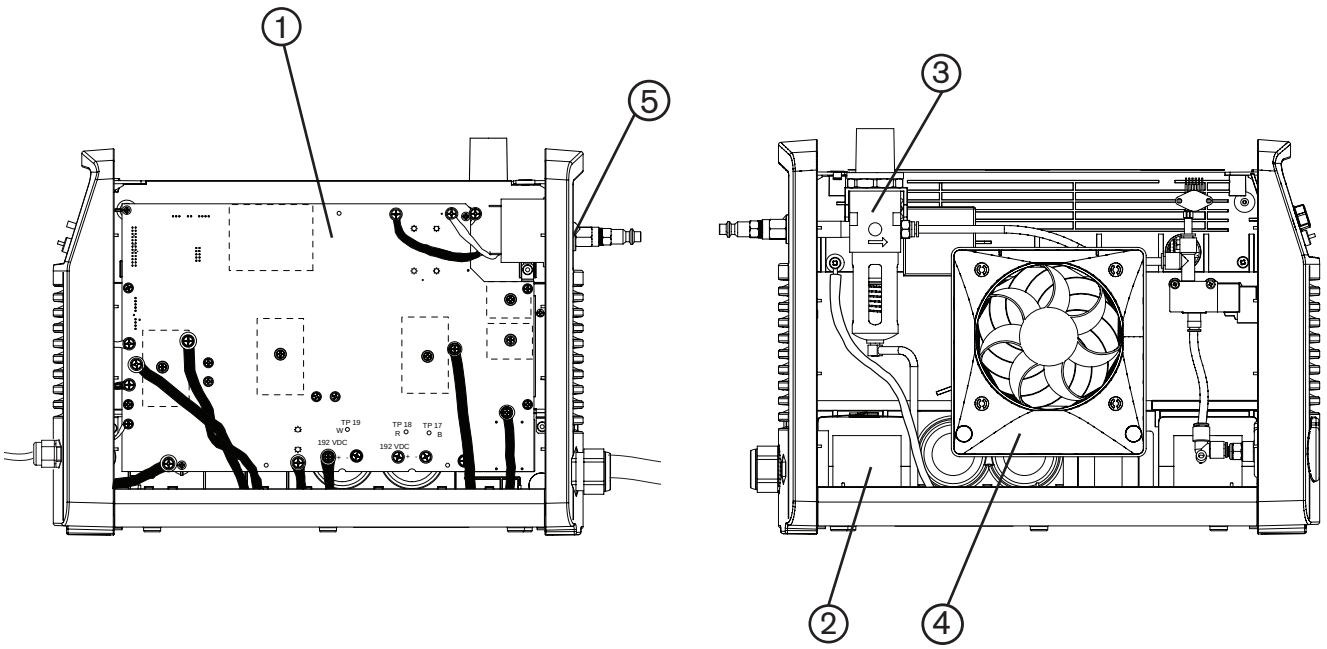
The T30v (Powermax30) 30 A consumables can be used on the T45m as well. The part numbers are listed under *T30v (Powermax30) 30 A consumables* on page 7-8.

Accessory parts

Part number	Description
024548	Brown leather torch sheathing, 7.5 m (25 feet)
024877	Black leather torch sheathing, 7.5 m (25 feet)
128658	Gouging heat shield
127102	Basic plasma (circle) cutting guide
027668	Deluxe plasma (circle) cutting guide
127219	Powermax45 dust cover
127217	Powermax45 shoulder strap
128647	Kit: Eliminizer air filtration
127103	Face shield, shade 8 lens
127239	Face shield, shade 6 lens
127105	Replacement lens for face shield, shade 8
127243	Replacement lens for face shield, shade 6
127169	Leather cutting gloves
128650	Remote start pendant for machine torch, 7.62 m (25 feet)
128651	Remote start pendant for machine torch, 15.24 m (50 feet)
128652	Remote start pendant for machine torch, 22.86 m (75 feet)

Safety-critical parts

Genuine Hypertherm parts are the factory-recommended parts for your Hypertherm system. Any damage caused by the use of other than genuine Hypertherm parts may not be covered by the Hypertherm warranty. In addition, the parts listed below are considered safety-critical parts that must be replaced only with Hypertherm parts to maintain the warranty and all system certifications, including CE, CSA, GOST, and CCC certification.



Item	Part number	Description
1	228261	Kit: Power board (200–240 V CSA) and subcomponents
	228260	Kit: Power board (400 V CE) and subcomponents
	228259	Kit: Power board (230 V CE) and subcomponents
	428078	Kit: Power board (480 V CSA) and subcomponents
2	228265	Kit: Magnetics assembly, 200–240 V CSA
	228273	Kit: Magnetics assembly, 230 V CE
	228263	Kit: Magnetics assembly, 400 V CE
	428079	Kit: Magnetics assembly, 480 V CSA
3	228287	Kit: Filter and regulator
4	228286	Kit: Fan assembly
5	228266	Kit: Powermax45 power switch, 200–240 V CSA and 230 V CE
	228288	Kit: Powermax45 power switch, 400 V CE and 480 V CSA
	228278	Kit: CSA power cord, 1-phase, 200–240 V, 3 m (10 feet) (not shown)
	228277	Kit: CE power cord, 1-phase, 230 V, 3 m (10 feet) (not shown)
	228276	Kit: CE power cord, 3-phase, 400 V, 3 m (10 feet) (not shown)
	428077	Kit: CSA power cord, 3-phase, 480 V, 3 m (10 feet) (not shown)

Recommended spare parts

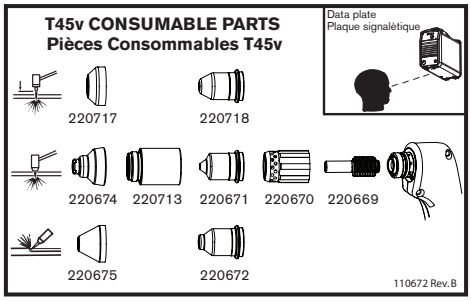
Hypertherm recommends that service centers keep the following spare parts on hand for repairs, either because these parts are critical or because they are usually exposed to heavy and repeated wear. You may find that you need to revise or expand this list for your customers, based on the particular conditions for your region and working environments.

Part number	Description	Page reference
228561	Kit: Ground clamp	7-2
228300	Kit: Work lead assembly, 6.1 m (20 feet)	7-2
228266	Kit: Powermax45 power switch, 200–240 V CSA and 230 V CE	7-4
228288	Kit: Powermax45 power switch, 400 V CE and 480 V CSA	7-4
228262	Kit: Control board, 200–240 V CSA, 230 V CE, 400 V CE	7-4
428098	Kit: Control board, 480 V CSA	7-4
228261	Kit: Power board, 200–240 V CSA	7-4
428078	Kit: Power board, 480 V CSA	7-4
228260	Kit: Power board, 400 V CE	7-4
228259	Kit: Power board, 230 V CE	7-4
228285	Kit: Solenoid valve	7-5
228287	Kit: Filter and regulator	7-5
228302	Kit: Air filter element	7-5
058503	O-ring: Viton 0.626 x 0.070	7-7
228313	Kit: T45v torch handle replacement	7-7
075714	T45v torch handle screws (5 required)	7-7
002244	T45v torch trigger assembly with spring	7-7
228109	Kit: T45v torch cap-sensor switch replacement	7-7
088008	T45v hand torch assembly with 6.1 m (20 feet) lead	7-7
088009	T45v hand torch assembly with 15.24 m (50 feet) lead	7-7
228315	Kit: T45v torch lead replacement, 6.1 m (20 feet)	7-7
228316	Kit: T45v torch lead replacement, 15.24 m (50 feet)	7-7
088010	T45m machine torch assembly with 7.62 m (25 feet) lead	7-9
088012	T45m machine torch assembly with 15.24 m (50 feet) lead	7-9
228228	Kit: T45m positioning sleeve	7-9
228229	Kit: T45m removable gear rack	7-9
228322	Kit: T45m front mounting ring	7-9
228323	Kit: T45m rear mounting ring	7-9
228321	Kit T45m cap-sensor switch replacement	7-9
228317	Kit: T45m torch lead replacement, 7.62 m (25 feet)	7-9
228319	Kit: T45m torch lead replacement, 15.24 m (50 feet)	7-9

Powermax45 labels

Part number	Description
228272	Kit: Powermax45 labels, CE
228264	Kit: Powermax45 labels, 200–240 V CSA
428075	Kit: Powermax45 labels (Built in America), 480 V CSA

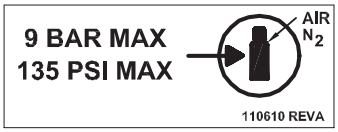
The label kits include the consumable label, appropriate safety labels, as well as front and side decals. The consumable and safety labels are pictured below.



Consumable label

CE safety label

CSA safety label



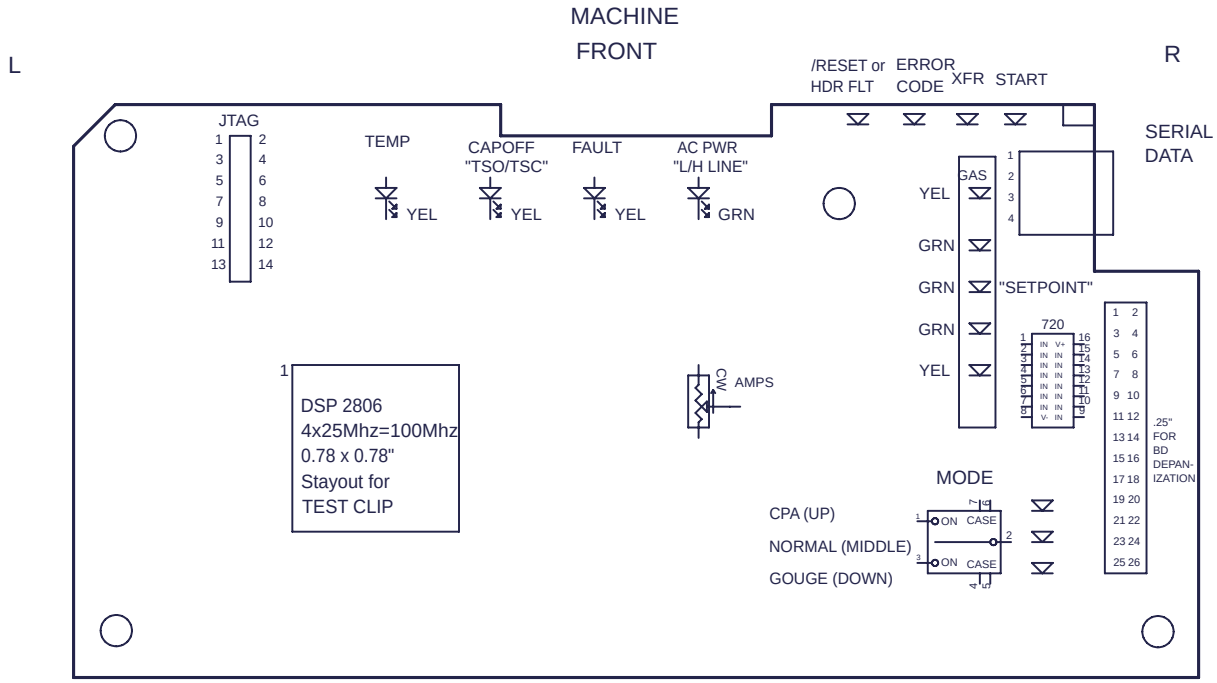
Maximum pressure label

Section 8

WIRING DIAGRAMS

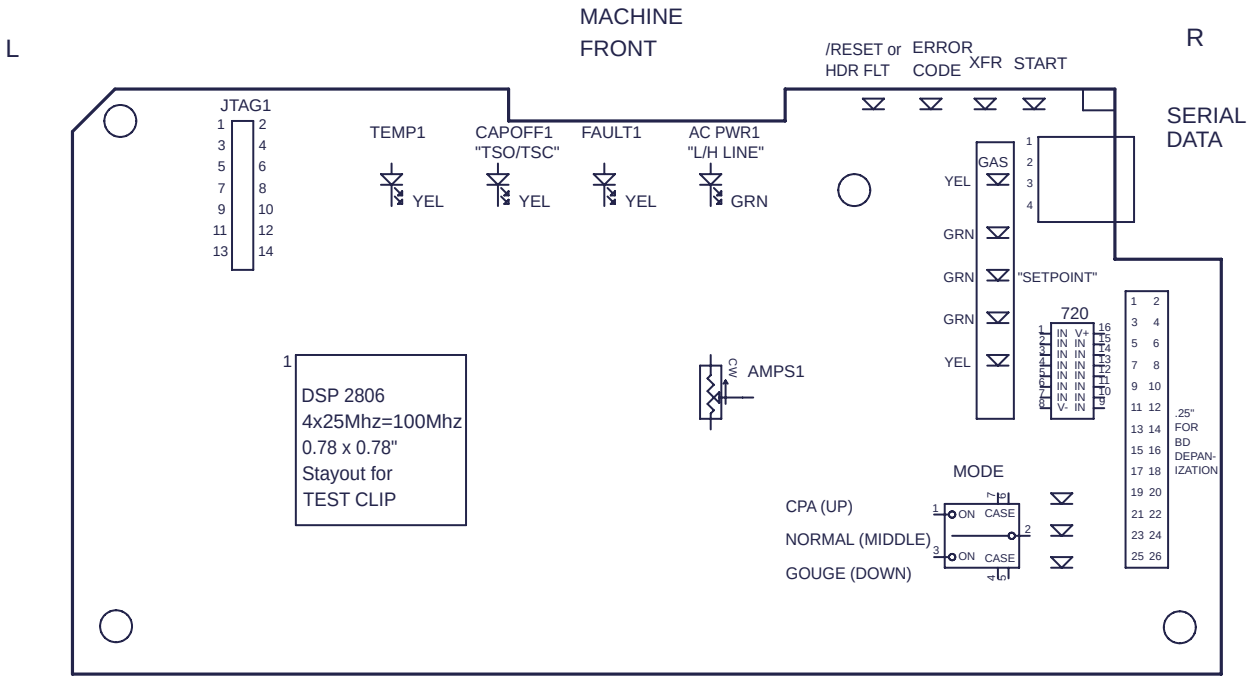
In this section:

Control board diagram: 200–240 V CSA and 230 V CE



J7 pin number to ground	Test	Expected value (200–240 V CSA or 230 V CE)
19	VACR (rectified AC line voltage)	1.95 V at 230 line voltage
21	VBUS (DC bus voltage)	2.28 VDC at 385 VBUS
18 (200–240 and 230 V only)	IPFC (input current)	< 0.1 VDC
20	IFB (output current)	< 0.1 VDC
22	ITF (transfer current)	< 0.1 VDC
25	3.3 VDC	3.3 VDC ±5%
24	5 VDC	5 VDC ±5%
12	24 V sense pin	2.2 VDC
16	Start signal	3.2 VDC closed 0 VDC open

Control board diagram: 400 V CE and 480 V CSA



J8 pin number to ground	Test	Expected value (400 V CE or 480 V CSA)
19	VACR (rectified AC line voltage)	2.7 V at 400 line voltage (CE) 2.016 VDC at 480 line voltage (CSA)
21	VBUS (DC bus voltage)	2.178 VDC at 560 VBUS (CE) 2.016 VDC at 670 VBUS (CSA)
20	IFB (output current)	< 0.1 VDC
22	ITF (transfer current)	< 0.1 VDC
25	3.3 VDC	3.3 VDC ±5%
24	5 VDC	5 VDC ±5%
12	24 V sense pin	2.2 VDC
16	Start signal	3.2 VDC closed 0 VDC open

Power board wiring diagram: 200–240 V CSA and 230 V CE

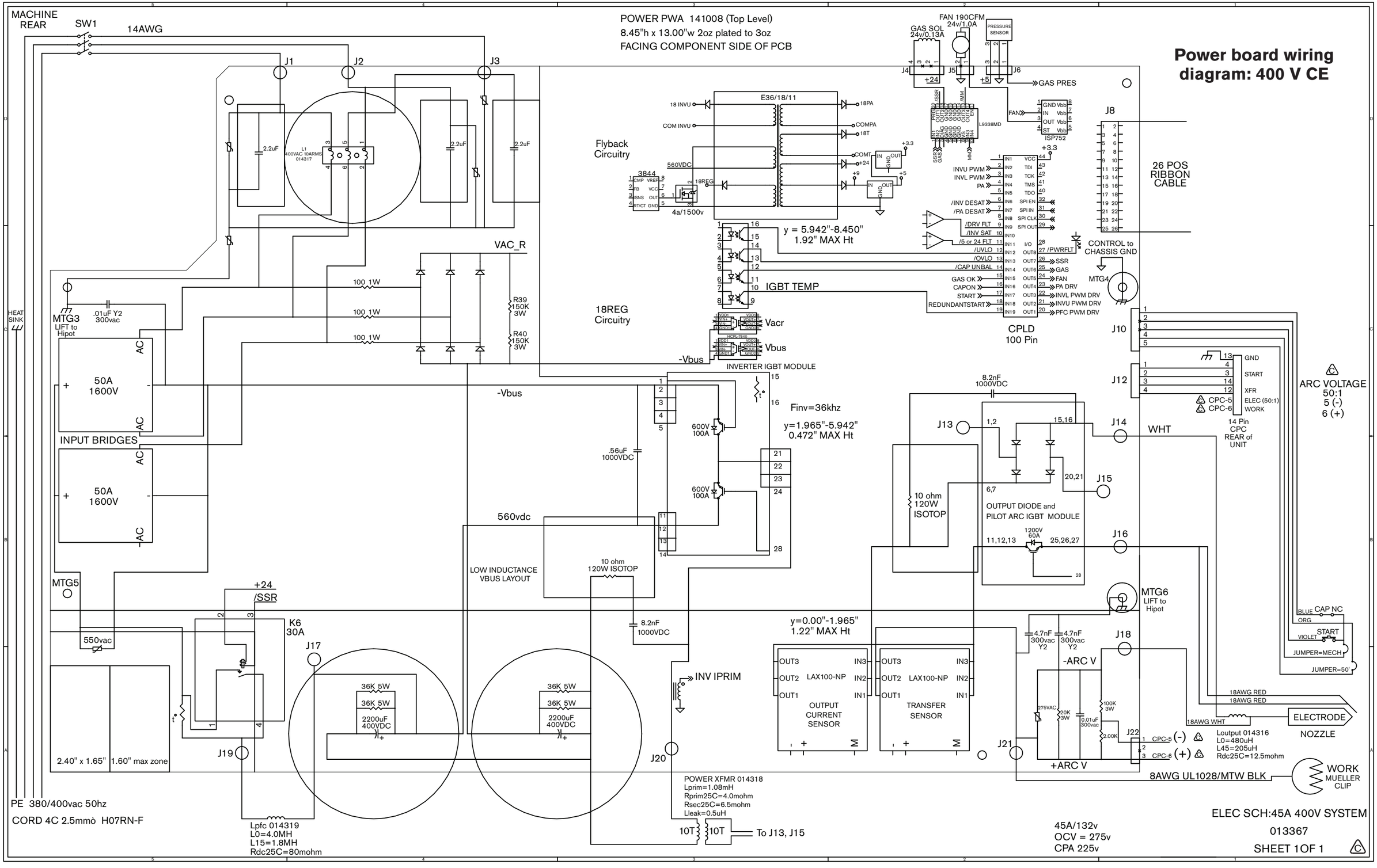
MACHINE
REAR

10AWG
50A/250V with 32v TRIP COIL

POWER PWA
230V CSA = 141005 (Top Level)
230V CE = 141046 (Top Level)
8.45"h x 13.00"w 2oz plated to 3oz
FACING COMPONENT SIDE OF PCB

FAN 190CFM
24v/1.0A
GAS SOL
24v/0.13A
PRESSURE SENSOR
GAS PRES
J1
J2
J3
J4
J5
J6
J7
+24
+5
+3.3
/SSR
2.2uF 300vac X2
10 ohm
NTC
L1
CM Choke
CE unit only
K6
30A
003192
240VAC
K5
30A
003192
240VAC
E36/18/11
18 INVU
COM INVU
385VDC
18PA
COMPA
18T
COMT
18REG
3844
L9338MD
ISP752
SSR GAS
MM
FAN
26 POS
RIBBON
CABLE
CONTROL to
CHASSIS GND
MTG4
IGBT TEMP
y = 5.942"-8.450"
1.92" MAX Ht
CPLD
100 Pin
PFC PWM
INVU PWM
INVL PWM
PA
/PFC DESAT
/INV DESAT
/PA DESAT
/PFC OC
/DRV FLT
/INV SAT
/5 or 24 FLT
/UVLO
/OVLO
/CAP UNBAL
GAS OK
CAP ON
START
REDUNDANT START
SSR
GAS
FAN
PA DRV
INVL PWM DRV
INVU PWM DRV
PFC PWM DRV
HEAT
SINK
MTG3
LIFT to
Hipot
Y Cap
300vac
75k 2w
D29 50A
1600V
INPUT BRIDGES
D39 50A
1600V
PFC IGBT
MODULE
LAX100-NP
IN3
IN2
IN1
OUT3
OUT2
OUT1
M
-Vbus
Vacr
Vbus
INVERTER IGBT MODULE
Finv=36khz
600V
100A
y=1.965"-5.942"
0.472" MAX Ht
8.2nF
1000VDC
J10
J12
J13
J14
J15
J16
J17
J18
J19
J20
J21
J22
GND
START
XFR
ELEC (50:1)
WORK
CPC-5
CPC-6
ARC VOLTAGE
50:1
5 (-)
6 (+)
14 Pin
CPC
REAR of
UNIT
WHT
Fpfc=24khz
Iline Limit
58arms
600V
130A
PFC DIODE
60A 600V
CLAMP DIODE
60A 600V
nc
1.2uF
630VDC
385vdc
LOW INDUCTANCE
VBUS LAYOUT
10 ohm
120W ISOTOP
OUTPUT DIODE and
PILOT ARC IGBT MODULE
1200V
60A
MTG5
MTG6
LIFT to
Hipot
y=0.00"-1.965"
1.22" MAX Ht
OUTPUT
CURRENT
SENSOR
TRANSFER
SENSOR
4.7nF
300vac
Y2
-ARC V
+ARC V
275VAC
20K
3W
100K
3W
0.01uF
300vac
2.00K
CAP NC
START
JUMPER=MECH
JUMPER=50'
BLUE
ORG
VIOLET
18AWG RED
18AWG WHT
ELECTRODE
NOZZLE
Loutput 014316
L0=480uH
L45=205uH
Rdc25C=12.5mohm
8AWG BLK
WORK
MUELLER
CLIP
2.40" x 1.65" 1.60" max zone
27K 3W
5600uF
250VDC
8.2uF
630VDC
15 4W
INV IPRIM
POWER XFMR
CSA = 014315
CE = 014331
Lprim=0.53mH
Rprim25C=2.5mohm
Rsec25C=5.7mohm
Lleak=0.5uH typ
7T
10T
To J13, J16
PE 200-240vac
47-63hz
POWER CORD
Lpfc 014314
L0=300uh
L75=180uh
Rdc25C=10.8mohm
45A/132v
OCV = 275v
CPA 225v
ELEC SCH:45A 230V SYSTEM
013366
SHEET 1OF 1
C

Power board wiring diagram: 400 V CE



Power board wiring diagram: 480 V CSA

POWER PWA 141301 (Top Level)
8.45"h x 13.00"w 2oz plated to 3oz
FACING COMPONENT SIDE OF PCB

MACHINE REAR
SW1
14AWG
HEAT SINK
1 INPUT BRIDGE
PE 480vac 50hz
CORD 4C 2.5mmð H07RN-F
MTG3 LIFT to Hipot
.01uF Y2 300vac
INPUT BRIDGE
95A 1600V
AC AC AC
J1 J2 J3
2.2uF
2.2uF
2.2uF
VAC_R
100 1W
100 1W
100 1W
R39 150K 3W
R40 150K 3W
-Vbus
INVERTER IGBT MODULE
.56uF 1000VDC
600V 100A
600V 100A
Finv=36khz
y=1.965"-5.942"
0.472" MAX Ht
670vdc
LOW INDUCTANCE VBUS LAYOUT
10 ohm 120W ISOTOP
8.2nF 1000VDC
INV IPRIM
J20
POWER XFMR 014318
Lprim=1.1mH
Rprim25C=5.5mohm
Rsec25C=6.3mohm
Lleak=1uH
12T 10T
To J13, J15
MTG5
+24
/SSR
K6 30A
625vac
J17
56K5W
56K5W
1800uF 450VDC
56K5W
56K5W
1800uF 450VDC
J19
2.40" x 1.65"
1.60" max zone
Lpfc 014319
L0=4.0MH
L15=1.8MH
Rdc25C=80mohm
FLYBACK CIRCUITRY
18 INVU
COM INVU
E36/18/11
18PA
COMPA
18T
COMT
+24
+9
+5
+3.3
670VDC
3844
18REG
4a/1500v
18REG CIRCUITRY
y = 5.942"-8.450"
1.92" MAX Ht
IGBT TEMP
FAN 190CFM 24v/1.0A
GAS SOL 24v/0.13A
PRESSURE SENSOR
J4 J5 J6
+24 +5
GAS PRES
FAN
L9338MD
ISP752
SSR GAS MAN
+3.3
INVU PWM
INVL PWM
PA
/INV DESAT
/PA DESAT
/DRV FLT
/INV SAT
/5 or 24 FLT
/UVLO
/OVLO
/CAP UNBAL
GAS OK
CAPON
START
REDUNDANTSTART
CPLD 100 Pin
27/PWRFLT
SSR
GAS
FAN
PA DRV
INVL PWM DRV
INVU PWM DRV
PFC PWM DRV
J8
26 POS RIBBON CABLE
CONTROL TO CHASSIS GND
MTG4
J10
J12
GND
START
XFR
ELEC (50:1)
WORK
CPC-5
CPC-6
14 PIN CPC REAR OF UNIT
ARC VOLTAGE 50:1
5 (-)
6 (+)
8.2nF 1000VDC
J13
1,2
15,16
J14
WHT
10 ohm 120W ISOTOP
6,7
OUTPUT DIODE AND PILOT ARC IGBT MODULE
1200V 60A
11,12,13
25,26,27
20,21
J15
J16
28
MTG6 LIFT to Hipot
y=0.00"-1.965"
1.22" MAX Ht
LAX100-NP
OUTPUT CURRENT SENSOR
LAX100-NP
TRANSFER SENSOR
4.7nF 300vac Y2
4.7nF 300vac Y2
J18
-ARC V
+ARC V
275 VAC
20K 3W
0.01uF 300vac
100K 3W
2.00K
J22
J21
1 CPC-5 (-)
2
3 CPC-6 (+)
18AWG RED
18AWG RED
18AWG WHT
ELECTRODE
NOZZLE
Loutput 014316
L0=480uH
L45=205uH
Rdc25C=12.5mohm
8AWG UL1028/MTW BLK
WORK
MUELLER CLIP
BLUE CAP NC
ORG
START
VIOLET
JUMPER=MECH
JUMPER=50'

MATERIAL	THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES WITHOUT PERMISSION FROM HYPERTHERM, INC.	Hypertherm 21 Great Hollow Road, Hanover, NH 03755 603-643-3441
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE: 2 PL DECIMAL ±.01 3 PL DECIMAL ±.005 FRACTIONS ±1/64 ANGULAR ±2° PART MUST BE FREE OF BURRS AND SHARP EDGES. BREAK SHARP EDGES IF NECESSARY WITH CHAMFER OR RADIUS .015 MAX.	DESCRIPTION: ELEC SCHEM:45A 480V CSA SYS	
	ITEM NO. 013390 / SCALE 1=1 / SHEET 1 OF 1 / REVISION B	
	DRAWN BY CSM / DATE 2/8/13 / APPROVED BY VG / DATE 02-13-13	