HyDefinition® HD3070™

Plasma Arc Cutting System with Manual Gas Console

Instruction Manual
802170 – Revision 18

Hypertherm®
The world leader in plasma cutting technology

Page of Change	Description of Change **Rev16 to 17** 7/12/02
iv, v, vi, vii	Updated Main Table of Contents to reflect changes below.
2-1	Updated TOC
2.10 & 11	Added page after 2-10 with torch art and dimensions for both the straight and 45 degree recepticles. Moved text from 2-10 to 2-11
3.28	Added caution about vent hose.
4.1	Updated TOC
4.13-4.16	Put in updated version of "How to get better cut quality". It now starts on page 4-14 instead of 4-13.
5.7	Said continued on page 5-7. Changed to 5-9.

Page of Change	Description of Change **Rev15 to 16** 2/11/02
iii. iv, v, vi	Corrected Main Table of Contents
3.1	Corrected Table of Contents
5.1	Corrected Table of Contents
5.19	Updated graphic to resemble new board
5.21	Updated graphic to resemble new board
6.1	Corrected Table of Contents
6.4	Changed item # 5 (041591) to 041753 & 081040 to 081078. Updated graphic to resemble new board

PAGE	SUBJECT
Cover	New Revision
Title Page	New Revision
ii	Added plumbing/electrical code statement to warranty page
1- 1 thru 6	New saftey section
1a- 1 thru 6	New french saftey section
2- 8	General corrections
3- 2	Bolded pre-installation for plumbing/electrical codes
3- 3	Revised hard plumbing statement
3- 4	Shifted text from pg 3-3
3- 12	Revised Figure 3-6 to included mounting dimensions
3- 27	Revised figure reference
3- 29	revised 14 call out
3- 30	Revised figure reference
3- 31	New blow back hose kit; ECO 10698
3- 36	Correction; pushbutton reference
3- 37	New coolant tank
4- 3	Art enhancement
4- 10	Correction: 120590 swirl ring
4- 18	Correction: Aluminum
4- 29	Correction: 120590 swirl ring
4- 33	Correction: Aluminum
5- 34	Correction: PAC186 reference
5- 36	Correction: PAC186 reference
6- 14/15	New coolant tank
6- 18/19	New flowmeter parts
6- 22/23	Added #008890 contact
6- 27	Correction: 120590 swirl ring
6- 28	Correction: 020637
7- 1/2	Deleted section; Information in safety section
d- 5	New coolant tank

PAGE	SUBJECT
Cover	New Revision
Title Page	New Revision
3- 3	Added oxygen warning
3- 4	Revised Hard Plumbing requirements
3- 6.1	Fuse size correction
3- 34	Changed coolant mixture
3- 36	Corrected figure ref
4- 10	Revise Consumables to include 100A Aluminium
4- 15	Removed LongLife trade mark
4- 18	Added 100A aluminium cutting
4- 29	Revised 70A aluminium cut chart to remove 1/2"
4- 33	Added 100A aluminium cut chart
5- 3 & 4	General corrections/improvements
5- 15/16	Revised graphics
5- 17	Revised graphics & revised coolant temperature check
5- 18	Revised graphics
6- 9	Added 003065 Aux contact
6- 18/19	Revised flowmeter parts list
6- 28/29	Revise Consumables to include 100A Aluminium
Diagrams	Elec Schematic 013-2-272 SHT 5 Rev Y

Cover	New Revision
Title Page	New Revision
3- 4	General correction, H35 content
3- 18	General correction, part nomenclature
3- 24	General correction, 023721 length
3- 27	General correction, delete ref to section 6
3- 34	General correction
3- 36	General correction
3- 37	Revised figure to show current configuration
4- 4	General correction and added graphics
4- 5	Text displaced to page
4- 8	Added purge gas lines instructions
4- 13	Added cut-angle graphic and deleted text to improve clarity
4- 14 & 15	Text displaced to page
4- 16	Revised drop-part description to improve clarity
4- 17	Text displaced to page
4- 30	General correction, travel speed error
4- 31 & 32	General correction, initial pierce height nomenclature
5- 3 & 4	Deleted P/N from text & improved clarity
5- 17	Revised input gas LED fault pressure
5- 18	Revised flow switch FS1 sensing to 0.5 gpm
5- 24 thru 27	General correction
5- 28	Deleted schematic number from text
5- 31	Deleted schematic number from text
5- 34	General correction to improved clarity
6- 1	Revised section contents list
6- 6	General correction, spelling error
6- 14 & 15	New flow switch. Added pump coupling & drain valve
6- 23	Revised to 30A consumables
6- 31 thru 36	Deleted. Refer to section 3 for leads, cables & hoses
7- 2	Revised standards index
7- 3 & 4	Deleted
d- 5	Revised figure to show current configuration
sd- 1	Corrected drawing title
Diagrams	013-318, all sheets, General correction
Diagrams	129-255, revised to show current configuration
Diagrams	013-272, sht 3 revised to show current configuration

Cover	New Revision
Title Page	New Revision
2- 10	Off-valve spec corrections
3- 1	Revised content list
3- 5	Text shifted off page
3- 6	Power requirements clarifications
3- 6.1	Text shifted to page
3- 6.2	Revised grounding requirements
3- 9	General correction, figure & item references
3- 19	General correction, technical - Figure 3-15
3- 21	General correction, technical - Cable run list
3- 24	Add 100&150 ft. cables
3- 34	Added coolant conductivity
3- 36 & 37	Add new figure & delete ref to part list figure
4- 10	Added CCW Consumables
4- 15	Ramp down clarification
4- 16	Drop part clarification
4- 21 thru 32	Revise cut chart notes, ref ccw consumables
5- 19	Revise/correct error code descriptions & fig 5-3
5- 20	Add new error code 13; phase loss protection
5- 21	Revise/update figure 5-4 & related text
6- 1	Revised content list
6- 4	Add new firmware & control PCB; phase loss protection
6- 5	Delete 005199; duplicate entry
6- 6	Add new phase loss protection PCB
6- 7	Format enhancement
6- 8	Format enhancement
6- 16	Parts List, Add new 3-cap spark gap & PC board
6- 17	Figure, Add new 3-cap spark gap & PC board
6- 27	Add CCW Consumables
6- 28	Add CCW Consumables
6- 29	Add CCW Consumables
6- 33	Add 100&150 ft. cables
E- Appendix	New, System grounding
Diagrams	Phase loss protection PCB, Revise elec. Diagram 013-272

Cover	Uprevved manual due to changes below
Title Page	Uprevved manual due to changes below
2.01	Revised Section Content List
2.02	Revised Gass Console Description
2.03	Revised Gass Console Description
2.05	Revised Gass Console Call-Out
2.06	Revised Gass Console Call-Out
2.07	Revised Gass Console P/N & Specifications
2.08	Revised Gass Console P/N & Specifications
2.09	Revised Off-Valve Assy P/N
2.10	Removed Motion Control System Specifications
3.01	Revised Section Content List
3.02	Revised HD3070 System Components List
3.03	Revised Methane Connection
3.04	Added H35 Gas
3.06	Reformat Page
3.07	Reformat Page
3.10	Revised Gas Console Install Requirements
3.12	New Gas Console
3.15	Added New Gas Console and Off-Valve Assy
3.17	General Correction
3.20	Revised Figure 3-16
3.21	Revised Cable Signal List
3.22	Revised Cable Signal List
3.29	Revised Figure 3-24; New Gas Console, Lead Set, & Off-Valve Assy
3.32	Revised Gas Supply Hose Connections
4.01	Revised Section Content List
4.03	Revised Figure 4-1
4.04	Revised Gas Console Operation
4.05 - 4.06	Revised figure 4-2
4.07	General Corrections
4.08	Revised Gas Console Operation
4.09	General Corrections
4.10	Added New 100A SS Consumables
4.11	General Corrections
4.12	Revised Figure 4-7
4.13	General Corrections
4.14	General Corrections
4.16	General Corrections
4.18	Added New 100A SS Data
4.19 - 4.31	General Corrections
4.32	Added New 100A SS Cut Chart
5.01	Revised Section Content List
5.03	Revised Gas Console Call-Out
5.04	Added PAC186 Torch
5.15	Removed Reference to Diagram & Schematic Numbers

5.16	General Corrections
5.20	General Corrections
5.22	Revised REC 4 Signal Names
5.23 - 5.27	Revised Figures 5-5 & 5-6 for New Signal Data
5.28 - 5.30	Removed Designators from Charts; Added 100A Chart
5.34	General Corrections
6.01	Revised Section Content List
6.02 - 6.15	Added Power Supply for Clarification
6.18 - 6.21	Added New Gas Console
6.22	Revised Item 3 Nomenclature
6.25	Revised for New Off-Valve Assy
6.26	Revised PAC184 Consumable Parts Kit List, New Box
6.28	Added Consumable Parts for 100A SS
6.29	Added Consumable Parts for 100A SS
6.30	Revised PAC184 Consumable Parts Kit List, New Box & for 100A SS
6.35	Revised Figure 6-32; New Gas Lead Set
Appendix A	New MSDS for Propylene Gycol
Diagrams	New Gas System Schematic & RHF Console/Gas Console Schematic

Changed Page	Description	IM217 Rev 9 to 10 9/97

Cover	Uprevved manual due to changes below
Title Page	Uprevved manual due to changes below
0.04 & 0.06	Changed PAC184 Torch Assembly wording to Assemblies
2.01	Changed PAC184 Torch Assembly wording to Assemblies
2.03	Changed PAC184 Torch Assembly wording to Assemblies; added text
2.08	Changed PAC184 Torch Assembly (028839) to
	PAC184 Torch Assemblies (028839, 128199)
3.02	Changed PAC184 Torch Assembly (028839) to
	PAC184 Torch Assembly (028839 or 128199)
4.11	Fig. 4-4, Changed Shield Cap part number to 120221/120543
4.19 & 4.20	Changed Shield Cap part number to 120221/120543
6.01	Changed PAC184 Torch Assembly wording to Assemblies
6.11	Fig. 6-8, updated to show new pilot arc circuit 129264 & new fuse
	(F5) 108049
6.12	Fig. 6-9, updated new fuse (F5) 108049
6.20	Added new PAC184 Torch Assy 128199 & new Shield Cap 120543
6.24	Added new Shield Cap 120543
013-4-272	Power Unit Electrical Diagram (2 sheets), Rev R

Changed Page	Description	IM217 Rev 8 to 9 7/16/97
Cover	Uprevved manual due to changes below	
Title Page	Uprevved manual due to changes below	
0.06	Deleted PS service parts kit	
0.07	Added coolant schematic129-2-255	
3.36	Changed step 2 to include coolant shutoff valve	
5.03	Changed filter element to 027005 under Power Supply Inspection	
5.15	Added coolant system schematic number 129-2-255 to text	
6.01	Deleted Power Supply Service Parts Kit	
6.14	Added new Coolant SA 129255 part numbers	
6.15	Changed Power Supply art to show coolant SA changes	
6.16	Deleted Power Supply Service Parts Kit	
6.20	Item 3- Changed O-ring part number to 044025	
d.05	Changed Power Supply art to show coolant SA changes	
sd.01	Added coolant system schematic number 129-2-255	
129-2-255	Added coolant system schematic, Rev A	

Changed Page	Description	IM217 Rev 7 to 8 06/2/97
Cover	Uprevved manual due to changes below	
Title Page	Uprevved manual due to changes below	
3.16	Changed 3 & 4 to indicate addition of check valve	
3.17	Changed Power Supply art to show new check valves	
3.20	Changed Power Supply art to show new check valves	
3.23	Changed Power Supply art to show new check valves	
3.33	Changed PAC185 to PAC186	
4.04	Made text changes for readability	
6.14	Added check valve part number 006075, item 13	
6.15	Changed Power Supply art to show new check valves, item 13	
6.16	New part number for capacitors 009975, item 10	
6.16	New part number for 6 kV transformer 129199, item 11	

Cover	Uprevved manual due to LVD compliance & other changes
Title Page	Uprevved manual due to LVD compliance & other changes
0.03 - 0.10	updated table of contents
1.01 - 1.04	New Safety section
1a.01 - 1a.04	New French Safety section
2.01	Changed Off-Valve Assembly to Off-Valve Assemblies
2.04	Changed Off-Valve Assemblies paragraph
2.09	Changed Off-Valve Assembly to Off-Valve Assemblies
3.02	Changed Off-Vlve Assy 129056 to Off-Vlve Assy 129056 or 129174
3.15	Changed Off-Vlve Assy 129056 to Off-Vlve Assys 129056/129174
3.18	Added new part number to Fig 3-12
3.19	Added new part number to Fig 3-13
3.24	Added new part numbers to Fig 3-20
3.27	Added new torch lead set part numbers and note* to Fig 3-23
3.29	Added note* to Fig 3-24
3.30	Added note* to page
3.31	Added note* to Fig 3-25
4.01	Change to Blow Back Option to Purge Coolant Hoses
4.02 & 4.03	Changed STATUS LED descriptions
4.12	Change title to Blow Back Option to Purge Coolant Hoses
5.06	Changed STATUS LED information in bottom box
5.11	Changed STATUS LED information in 3.3
5.15 - 5.18	Changed STATUS LED Troubleshooting information
5.22	Removed refs to solenoid valve SV8, SV9 & SV10; inserted Not used
5.23-5.25 & 5.27	Removed refs to SV8, SV9 & SV10; inserted Not used-LED (D8) P6.1
6.01	Changed Off-Valve Assembly to Off-Valve Assemblies
6.02	Changed part no. of PC BD Assy, interlock display
6.05 & 6.06	Changed part no. of chopper. Added temp sw.
6.09	Changed part no. of PC BD Assy, power distribution
6.14	Changed part no. of heat exchanger water/air, item 5
6.18 & 6.19	Added note* to page that SV8, SV9 & SV10 removed & obsoleted
6.23	Changed Off-Valve Assembly to Off-Valve Assemblies
6.29- 6.31	Added new part numbers to Figs 6-22, 6-23 & 6-27
6.32 & 6.33	Added new torch lead set part numbers and note* to Fig 6-31
6.34	Added note* to Fig 6-33
013-2-267	Manual Gas System Schematic (3 sheets), Rev B
013-4-272	Power Unit Electrical Diagram (2 sheets), Rev M
013-4-274	RHF Console & Gas Console Electrical Diagram (1 sheet), Rev D

HyDefinition HD3070

Instruction Manual

(P/N 802170)

Revision 18 – November, 2013

Hypertherm, Inc.
Hanover, NH USA

www.hypertherm.com

Hypertherm, Inc.
Etna Road, P.O. Box 5010
Hanover, NH 03755 USA
603-643-3441 Tel (Main Office)
603-643-5352 Fax (All Departments)
800-643-9878 Tel (Technical Service)
800-737-2978 Tel (Customer Service)

Hypertherm Automation
5 Technology Drive
West Lebanon, NH 03755 USA
603-298-7970 Tel
603-298-7977 Fax

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

Hypertherm Singapore Pte Ltd
No. 19 Kaki Bukit Road 2
K.B. Warehouse Complex
Singapore 417847, Republic of Singapore
65 841 2489 Tel
65 841 2490 Fax
65 841 2489 (Technical Service)

Japan
1952-14 Yata-Natsumegi
Mishima City, Shizuoka Pref.
411-0801 Japan
81 0 559 75 7387 Tel
81 0 559 75 7376 Fax

Hypertherm UK Ltd
9 Berkeley Court, Manor Park
Runcorn, Cheshire, England WA7 1TQ
44 1928 579 074 Tel
44 1928 579 604 Fax

France
15 Impasse des Rosiers
95610 Eragny, France
0805 050 111 Tel
0805 050 222 Fax

Hypertherm S.r.L.
Via Torino 2
20123 Milano, Italia
39 02 725 46 312 Tel
39 02 725 46 400 Fax
39 02 725 46 314 (Technical Service)

Hypertherm B.V.
Burg. Haverkampstraat 13
7091 CN Dinxperlo, Nederland
31 315 655866 Tel
31 315 655886 Fax

Hypertherm B.V. (ETSO)
Vaartveld 9
4704 SE Roosendaal, Nederland
00 800 49 73 7843 – toll-free in Europa
31 165 596900 Tel
31 165 596901 Fax

Hypertherm Brasil Ltda.
Rua Visconde de Santa Isabel, 20 – Sala 611
Vila Isabel, RJ
Brasil CEP 20560-120
55 21 2278 6162 Tel
55 21 2578 0947 Fax

EMC INTRODUCTION

Hypertherm's CE-marked equipment is built in compliance with standard EN50199. The equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

The limits required by EN50199 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 plasma 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 Workpiece*. In other cases it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

ASSESSMENT OF AREA

Before installing the equipment the user shall make an assessment of potential electromagnetic problems in the surrounding area. The following shall be taken into account:
a. Other supply cables, control cables, signalling 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 for those changes and adjustments covered in the manufacturer's instructions. In particular, 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 at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of 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 steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitances selected according to national regulations.

Note. The cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, for example, by allowing parallel cutting current return paths which may damage the earth circuits of other equipment. Further guidance is given in IEC TC26 (sec)94 and IEC TC26/108A/CD Arc Welding Equipment 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

220/380/415V CE Power Supplies

The 220/380/415V CE power supply complies with the EMC European standard EN50199.

Information about this standard and other line filtering information pertaining to this power supply is located in Appendix D of this manual.

WARNING

Genuine Hypertherm parts are the factory-recommended replacement 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.

WARNING

You are 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, if Hypertherm is notified of a defect (i) with respect to the power supply within a period of two (2) years from the date of its delivery to you, with the exception of G3 Series 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. This warranty shall not apply to any Product which has been incorrectly installed, modified, or otherwise damaged. 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 prepaid. Hypertherm shall not be liable for any repairs, replacement, or adjustments of Products covered by this warranty, except those made pursuant to this paragraph or with Hypertherm's prior written consent. **The warranty 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 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 Hypertherm's obligation to indemnify 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, indirect, or punitive damages (including but not limited to lost profits) regardless of whether such liability is based on breach of contract, tort, strict liability, breach of warranties, failure of essential purpose or otherwise and even if advised of the possibility of such damages.

LIABILITY CAP

In no event shall Hypertherm's liability, 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 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.

NATIONAL AND LOCAL CODES

National and Local codes governing plumbing and electrical installation shall take precedent 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.

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.

Hypertherm

Section 1

SAFETY

In this section:

RECOGNIZE SAFETY INFORMATION

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

FOLLOW SAFETY INSTRUCTIONS

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

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

DANGER WARNING CAUTION

A signal word DANGER or WARNING is used with a safety symbol. DANGER identifies the most serious hazards.

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

CUTTING CAN CAUSE FIRE OR EXPLOSION

Fire Prevention

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

Explosion Prevention

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

WARNING

Explosion Hazard
Argon-Hydrogen and Methane

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

WARNING

Hydrogen Detonation with Aluminum Cutting

- When cutting aluminum underwater, or with the water touching the underside of the aluminum, free hydrogen gas may collect under the workpiece and detonate during plasma cutting operations.
- Install an aeration manifold on the floor of the water table to eliminate the possibility of hydrogen detonation. Refer to the Appendix section of this manual for aeration manifold details.


ELECTRIC SHOCK CAN KILL

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

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

Electric Shock Prevention

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

- Wear insulated gloves and boots, and keep your body and clothing dry.
- Do not stand, sit or lie on – or touch – any wet surface when using the plasma system.
- Insulate yourself from work and ground using dry insulating mats or covers big enough to prevent any physical contact with the work or ground. If you must work in or near a damp area, use extreme caution.
- Provide a disconnect switch close to the power supply with properly sized fuses. This switch allows the operator to turn off the power supply quickly in an emergency situation.
- When using a water table, be sure that it is correctly connected to earth ground.
- Install and ground this equipment according to the instruction manual and in accordance with national and local codes.
- Inspect the input power cord frequently for damage or cracking of the cover. Replace a damaged power cord immediately. **Bare wiring can kill.**
- Inspect and replace any worn or damaged torch leads.
- Do not pick up the workpiece, including the waste cutoff, while you cut. Leave the workpiece in place or on the workbench with the work cable attached during the cutting process.
- Before checking, cleaning or changing torch parts, disconnect the main power or unplug the power supply.
- Never bypass or shortcut the safety interlocks.
- Before removing any power supply or system enclosure cover, disconnect electrical input power. Wait 5 minutes after disconnecting the main power to allow capacitors to discharge.
- Never operate the plasma system unless the power supply covers are in place. Exposed power supply connections present a severe electrical hazard.
- When making input connections, attach proper grounding conductor first.
- Each Hypertherm plasma system is designed to be used only with specific Hypertherm torches. Do not substitute other torches which could overheat and present a safety hazard.

CUTTING CAN PRODUCE TOXIC FUMES

Cutting can produce toxic fumes and gases that deplete oxygen and cause injury or death.

- Keep the cutting area well ventilated or use an approved air-supplied respirator.
- Do not cut in locations near degreasing, cleaning or spraying operations. The vapors from certain chlorinated solvents decompose to form phosgene gas when exposed to ultraviolet radiation.
- Do not cut metal coated or containing toxic materials, such as zinc (galvanized), lead, cadmium or beryllium, unless the area is well ventilated and the operator wears an air-supplied respirator. The coatings and any metals containing these elements can produce toxic fumes when cut.
- Never cut containers with potentially toxic materials inside – they must be emptied and properly cleaned first.
- This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer.

A PLASMA ARC CAN CAUSE INJURY AND BURNS

Instant-On Torches
Plasma arc comes on immediately when the torch switch is activated.

The plasma arc will cut quickly through gloves and skin.
- Keep away from the torch tip.
- Do not hold metal near the cutting path.
- Never point the torch toward yourself or others.

ARC RAYS CAN BURN EYES AND SKIN

Eye Protection Plasma arc rays produce intense visible and invisible (ultraviolet and infrared) rays that can burn eyes and skin.
- Use eye protection in accordance with applicable national or local codes.
- Wear eye protection (safety glasses or goggles with side shields, and a welding helmet) with appropriate lens shading to protect your eyes from the arc's ultraviolet and infrared rays.

Arc Current	Lens Shade AWS (USA)	Lens Shade ISO 4850
Up to 100 A	No. 8	No. 11
100-200 A	No. 10	No. 11-12
200-400 A	No. 12	No. 13
Over 400 A	No. 14	No. 14

Skin Protection Wear protective clothing to protect against burns caused by ultraviolet light, sparks and hot metal.
- Gauntlet gloves, safety shoes and hat.
- Flame-retardant clothing to cover all exposed areas.
- Cuffless trousers to prevent entry of sparks and slag.
- Remove any combustibles, such as a butane lighter or matches, from your pockets before cutting.

Cutting Area Prepare the cutting area to reduce reflection and transmission of ultraviolet light:
- Paint walls and other surfaces with dark colors to reduce reflection.
- Use protective screens or barriers to protect others from flash and glare.
- Warn others not to watch the arc. Use placards or signs.

GROUNDING SAFETY

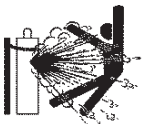
Work Cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

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

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

COMPRESSED GAS EQUIPMENT SAFETY

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



GAS CYLINDERS CAN EXPLODE IF DAMAGED

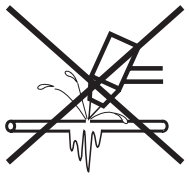
Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

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

NOISE CAN DAMAGE HEARING

Prolonged exposure to noise from cutting or gouging can damage hearing.

- Use approved ear protection when using plasma system.
- Warn others nearby about the noise hazard.



A PLASMA ARC CAN DAMAGE FROZEN PIPES

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

PACEMAKER AND HEARING AID OPERATION

Pacemaker and hearing aid operation can be affected by magnetic fields from high currents.
Pacemaker and hearing aid wearers should consult a doctor before going near any plasma arc cutting and gouging operations.

To reduce magnetic field hazards:

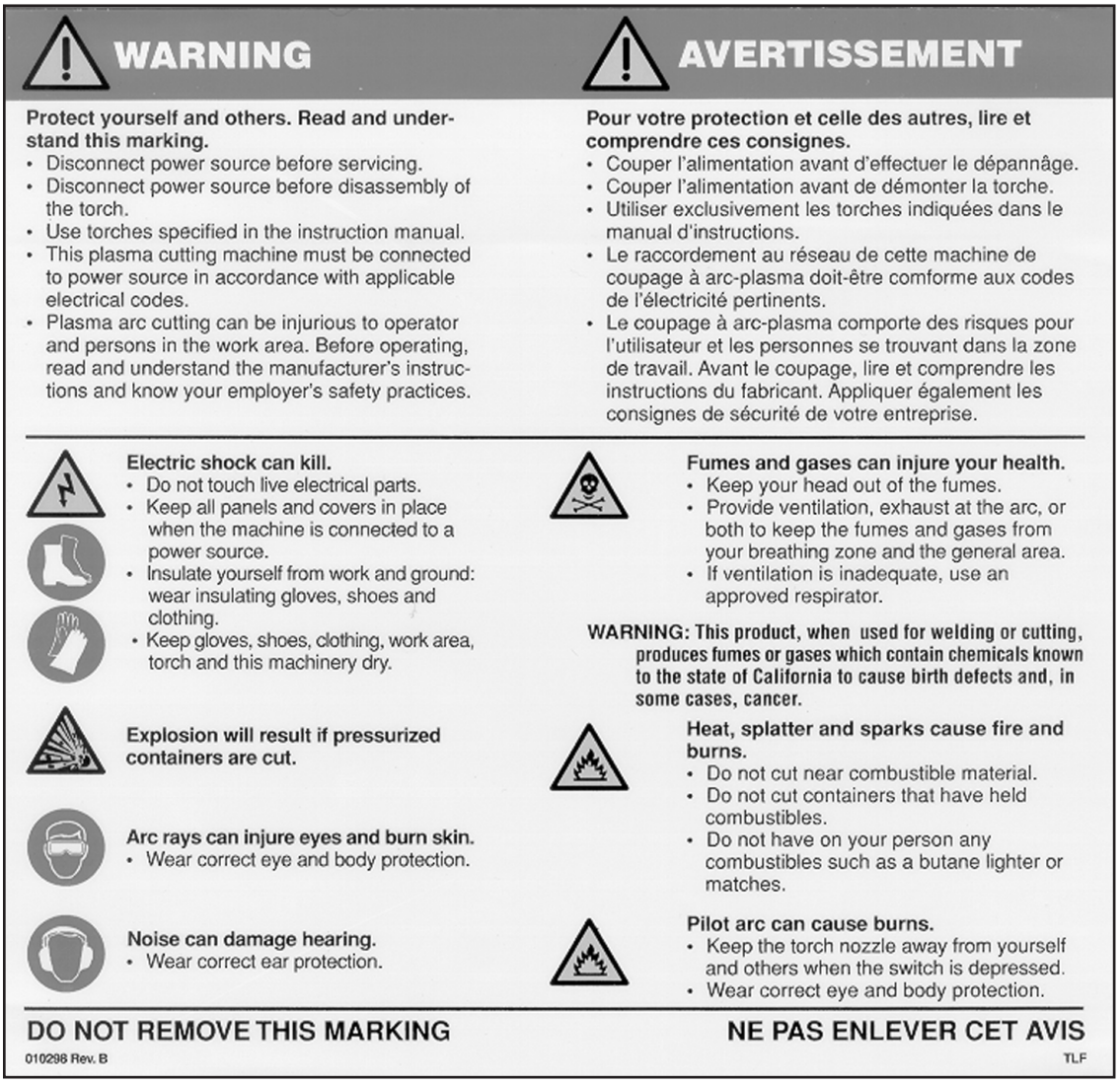
- Keep both the work cable and the torch lead to one side, away from your body.
- Route the torch leads as close as possible to the work cable.
- Do not wrap or drape the torch lead or work cable around your body.
- Keep as far away from the power supply as possible.

ADDITIONAL SAFETY INFORMATION

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

WARNING LABEL

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



WARNING

Protect yourself and others. Read and understand this marking.

- Disconnect power source before servicing.
- Disconnect power source before disassembly of the torch.
- Use torches specified in the instruction manual.
- This plasma cutting machine must be connected to power source in accordance with applicable electrical codes.
- Plasma arc cutting can be injurious to operator and persons in the work area. Before operating, read and understand the manufacturer's instructions and know your employer's safety practices.

Electric shock can kill.

- Do not touch live electrical parts.
- Keep all panels and covers in place when the machine is connected to a power source.
- Insulate yourself from work and ground: wear insulating gloves, shoes and clothing.
- Keep gloves, shoes, clothing, work area, torch and this machinery dry.

Explosion will result if pressurized containers are cut.

Arc rays can injure eyes and burn skin.

- Wear correct eye and body protection.

Noise can damage hearing.

- Wear correct ear protection.

AVERTISSEMENT

Pour votre protection et celle des autres, lire et comprendre ces consignes.

- Couper l'alimentation avant d'effectuer le dépannâge.
- Couper l'alimentation avant de démonter la torche.
- Utiliser exclusivement les torches indiquées dans le manual d'instructions.
- Le raccordement au réseau de cette machine de coupage à arc-plasma doit-être comforme aux codes de l'électricité pertinents.
- Le coupage à arc-plasma comporte des risques pour l'utilisateur et les personnes se trouvant dans la zone de travail. Avant le coupage, lire et comprendre les instructions du fabricant. Appliquer également les consignes de sécurité de votre entreprise.

Fumes and gases can injure your health.

- Keep your head out of the fumes.
- Provide ventilation, exhaust at the arc, or both to keep the fumes and gases from your breathing zone and the general area.
- If ventilation is inadequate, use an approved respirator.

WARNING: This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the state of California to cause birth defects and, in some cases, cancer.

Heat, splatter and sparks cause fire and burns.

- Do not cut near combustible material.
- Do not cut containers that have held combustibles.
- Do not have on your person any combustibles such as a butane lighter or matches.

Pilot arc can cause burns.

- Keep the torch nozzle away from yourself and others when the switch is depressed.
- Wear correct eye and body protection.

DO NOT REMOVE THIS MARKING

NE PAS ENLEVER CET AVIS

010298 Rev. B

TLF

Hypertherm

Section 1a

SÉCURITÉ

Dans cette section :

IDENTIFIER LES CONSIGNES DE SÉCURITÉ

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

SUIVRE LES INSTRUCTIONS DE SÉCURITÉ

Lire attentivement toutes les consignes de sécurité dans le présent manuel et sur les étiquettes de sécurité se trouvant sur la machine.

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

DANGER AVERTISSEMENT PRÉCAUTION

Les signaux DANGER ou AVERTISSEMENT sont utilisés avec un symbole de sécurité, DANGER correspondant aux risques les plus sérieux.

- Les étiquettes de sécurité DANGER et AVERTISSEMENT sont situées sur la machine pour signaler certains dangers spécifiques.
- Les messages d'AVERTISSEMENT précèdent les instructions d'utilisation expliquées dans ce manuel et signalent les risques de blessures ou de mort au cas où ces instructions ne seraient pas suivies correctement.
- Les messages de PRÉCAUTION précèdent les instructions d'utilisation contenues dans ce manuel et signalent que le matériel risque d'être endommagé si les instructions ne sont pas suivies correctement.

LE COUPAGE PEUT PROVOQUER UN INCENDIE OU UNE EXPLOSION

Prévention des incendies

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

Prévention des explosions

- Ne pas couper en présence de poussière ou de vapeurs.
- Ne pas couper de bouteilles, de tuyaux ou autres récipients fermés et pressurisés.
- Ne pas couper de récipients contenant des matières combustibles.

AVERTISSEMENT

Risque d'explosion argon-hydrogène et méthane

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

AVERTISSEMENT

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

- Lors du coupage de l'aluminium sous l'eau, ou si l'eau touche la partie inférieure de la pièce d'aluminium, de l'hydrogène libre peut s'accumuler sous la pièce à couper et détonner lors du coupage plasma.
- Installer un collecteur d'aération au fond de la table à eau afin d'éliminer les risques de détonation de l'hydrogène. Se référer à l'annexe du manuel pour plus de renseignements sur les collecteurs d'aération.


LES CHOCS ÉLECTRIQUES PEUVENT ÊTRE FATALS

Toucher une pièce électrique sous tension peut provoquer un choc électrique fatal ou des brûlures graves.

- La mise en fonctionnement du système plasma ferme un circuit électrique entre la torche et la pièce à couper. La pièce à couper et tout autre élément en contact avec cette pièce font partie du circuit électrique.
- Ne jamais toucher le corps de la torche, la pièce à couper ou l'eau de la table à eau pendant le fonctionnement du système plasma.

Prévention des chocs électriques

Tous les systèmes plasma Hypertherm utilisent des hautes tensions pour le coupage (souvent de 200 à 400 V). On doit prendre les précautions suivantes quand on utilise le système plasma :

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

LE COUPAGE PEUT PRODUIRE DES VAPEURS TOXIQUES

Le coupage peut produire des vapeurs et des gaz toxiques qui réduisent le niveau d'oxygène dans l'air et peuvent provoquer des blessures, voire la mort.

- Conserver le poste de coupage bien aéré ou utiliser un masque respiratoire homologué.
- Ne pas procéder au coupage près d'endroits où s'effectuent le dégraissage, le nettoyage ou la vaporisation. Certains solvants chlorés se décomposent sous l'effet des rayons ultraviolets et forment du phosgène.
- Ne pas couper des métaux peints ou contenant des matières toxiques comme le zinc (galvanisé), le plomb, le cadmium ou le béryllium, à moins que la zone de travail soit très bien ventilée et que l'opérateur porte un masque respiratoire. Les revêtements et métaux contenant ces matières peuvent produire des vapeurs toxiques lors du coupage.
- Ne jamais couper de récipients pouvant contenir des matières inflammables avant de les avoir vidés et nettoyés correctement.
- Quand on utilise ce produit pour le soudage ou le coupage, il dégage des fumées et des gaz qui contiennent des produits chimiques qui, selon l'État de Californie, provoquent des anomalies congénitales et, dans certains cas, le cancer.

L'ARC PLASMA PEUT PROVOQUER DES BLESSURES OU DES BRÛLURES

Torches à allumage instantané

L'arc plasma s'allume immédiatement après que la torche soit mise en marche.

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

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

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

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

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

Courant de l'arc	Puissance des verres teintés AWS (É.-U.)	ISO 4850
Jusqu'à 100 A	N° 8	N° 11
100-200 A	N° 10	N° 11-12
200-400 A	N° 12	N° 13
Plus de 400 A	N° 14	N° 14

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

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

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

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

MISE À LA MASSE ET À LA TERRE

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

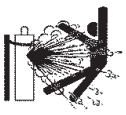
Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

Alimentation

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

SÉCURITÉ DES BOUTEILLES DE GAZ COMPRIMÉ

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



LES BOUTEILLES DE GAZ COMPRIMÉ PEUVENT EXPLOSER EN CAS DE DOMMAGES

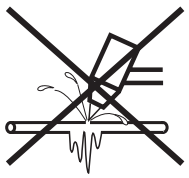
Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

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

LE BRUIT PEUT PROVOQUER DES PROBLÈMES AUDITIFS

Une exposition prolongée au bruit du coupage ou du gougeage peut provoquer des problèmes auditifs.

- Utiliser un casque de protection homologué lors de l'utilisation du système plasma.
- Prévenir les personnes aux alentours des risques encourus en cas d'exposition au bruit.



UN ARC PLASMA PEUT ENDOMMAGER LES TUYAUX GELÉS

Les tuyaux gelés peuvent être endommagés ou éclater si l'on essaie de les dégeler avec une torche plasma.

PACEMAKERS ET PROTHÈSES AUDITIVES

Les champs magnétiques produits par les courants à haute tension peuvent affecter le fonctionnement des prothèses auditives et des pacemakers. Les personnes portant ce type d'appareil doivent consulter un médecin avant de s'approcher d'un lieu où s'effectue le coupage ou le gougeage plasma.

Pour réduire les risques associés aux champs magnétiques :

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

Étiquette de sécurité

Cette étiquette est affichée sur la source de courant. Il est important que l'utilisateur et le technicien de maintenance comprennent la signification des symboles de sécurité.

Hypertherm

Section 2

SPECIFICATIONS

In this section:

Description

General

This manual provides the information needed to install, operate and maintain the HD3070 plasma cutting system for either robotically controlled or x-y table cutting applications. This precision cutting, dual gas machine-torch system consists of a power supply, RHF console, gas console, torch quick disconnect assembly, off-valve assembly and machine torch assembly. Refer to Figures 2-1 and 2-2.

The HD3070 can be configured for different cutting applications by providing a selectable current output at 15, 30, 50, 70 or 100 amps for optimum performance on cutting most metals from gauge to 1/2-inch (12.7 mm) thick. This allows the operator wide variations in cutting speeds on the same thickness of metal. The gas console provides four inlets for the different plasma and shield gases required for different cutting applications. The HD3070 is designed to cut mild steel, stainless steel, copper and aluminum with the appropriate gases and consumables selected. Plasma gases required for cutting are oxygen, air, or H35 and nitrogen, depending on the application. The shield gas aids in assisting cut quality by providing an atmosphere around the plasma arc on the surface of the workpiece. The shield gas also cools the shield at the front end of the torch.

Under microprocessor control, the HD3070 provides extended life (LongLife) for the torch nozzle and electrode. To get long life, all cuts must begin and end on the plate surface; this allows for the proper ramping up and down of gases and DC current

Power Supply

This unit houses a 100-amp, 15 kw chopper which produces a constant current DC output, variable from 15 to 100 amps. It contains a microprocessor control PCB which regulates all the plasma system functions: start sequence, machine interface functions, gas and cut parameters, and off sequence. The power supply main on/off power is controlled locally or remotely by the CNC machine. The power supply also houses the cooling system required to cool the torch. The power supply interconnects with the RHF console, machine interface, gas console, and workpiece.

An EMI filter, standard with all 220/380/415V power supplies (078024), meets the CE requirement for filtering incoming power. Refer to Appendix D to connect incoming power to the filter and for part numbers.

Gas Console

This unit houses the solenoid valves, flowmeters, pressure gauges, and switches used for plasma and shield gas flow control. The four flowmeters (with metering valves) are used to set the test preflow flowrates and test cut flowrates for the plasma and shield gases. The three pressure gauges, located on the left side of the console, indicate the pressures of the set test preflow and test cut flowrates. These gauges should not be used to set the flowrates. They should be used only in troubleshooting, if the correct flowrate values cannot be obtained.

This unit also provides a five inlet gas supply area where the required plasma and shield gases can be connected. A toggle switch is used to select the plasma gases. The plasma and shield gases are monitored by three gas inlet pressure gauges: one for oxygen or air, one for nitrogen or methane, and one for H35.

The gas console interconnects with the power supply, and the torch off-valve assembly via the gas lead set.

RHF Console

This unit houses the high frequency starting circuit which is needed to fire the torch and permits more effective RF shielding. The RHF Console has a water barrier to separate water and electrical components. Also housed in the console is a door interlock switch and a cathode manifold. The cathode manifold is used to interface power/coolant leads between the power supply and torch. The power/coolant leads and a pilot arc lead make up the shielded torch lead set which connects with the torch.

PAC184 Machine Torch Assemblies

The PAC184 machine torch is a dual gas (plasma and shield) plasma arc cutting torch. The slimmer design allows it to be used primarily in robotic cutting applications. The torch assembly includes the torch main body and consumables. The torch is cooled by a closed-loop system which distributes the coolant to and from the torch by way of the quick disconnect assembly, RHF console and the cooling subassemblies in the power supply. There are two torch assemblies: one torch assembly comes without an IHS tab on the shield cap; the other torch assembly comes with an IHS tab on the shield cap. See Figure 2-3.

PAC186 Machine Torch Assemblies

The PAC186 machine torch is a dual gas (plasma and shield) plasma arc cutting torch designed for X-Y table cutting applications. The torch assembly includes the torch main body and consumables. The torch is cooled by a closed-loop system which distributes the coolant to and from the torch by way of the quick disconnect assembly, RHF console and the cooling subassemblies in the power supply. There are two torch assemblies: one torch assembly comes without an IHS tab on the shield cap; the other torch assembly comes with an IHS tab on the shield cap. See Figure 2-3.

45° Torch Quick Disconnect Assembly

The torch quick disconnect assembly is primarily used for robotic cutting applications. Inputs from the RHF console using the torch lead set are: electrode cooling water supply and return, power, and pilot arc. Inputs from the off-valve assembly are for torch blow back and plasma and shield gases. The quick disconnect also includes a 10 inch strain relief, which clamps on the end of the torch sleeve, to prevent damage to the leads and hoses.

Straight Torch Quick Disconnect Assembly

The torch quick disconnect assembly allows mechanized changing of torches by the cutting machine. Inputs from the RHF console using the torch lead set are: electrode cooling water supply and return, power, and pilot arc. Inputs from the off-valve assembly are for torch blow back and plasma and shield gases.

Off-Valve Assemblies

Two off-valve assemblies are offered: one with a blow back solenoid valve and the other without a blow back solenoid valve. Both off-valve assemblies provide on/off control between the preflow and operate gas flows. This

assembly consists of three solenoid valves which provide inlet and outlet gas connections. The inlet connections (plasma gas, shield gas and preflow gas) are input from the gas console using the gas lead set. The outlet connections (blow back [if desired], plasma gas and shield gas) are output to the torch quick disconnect assembly.

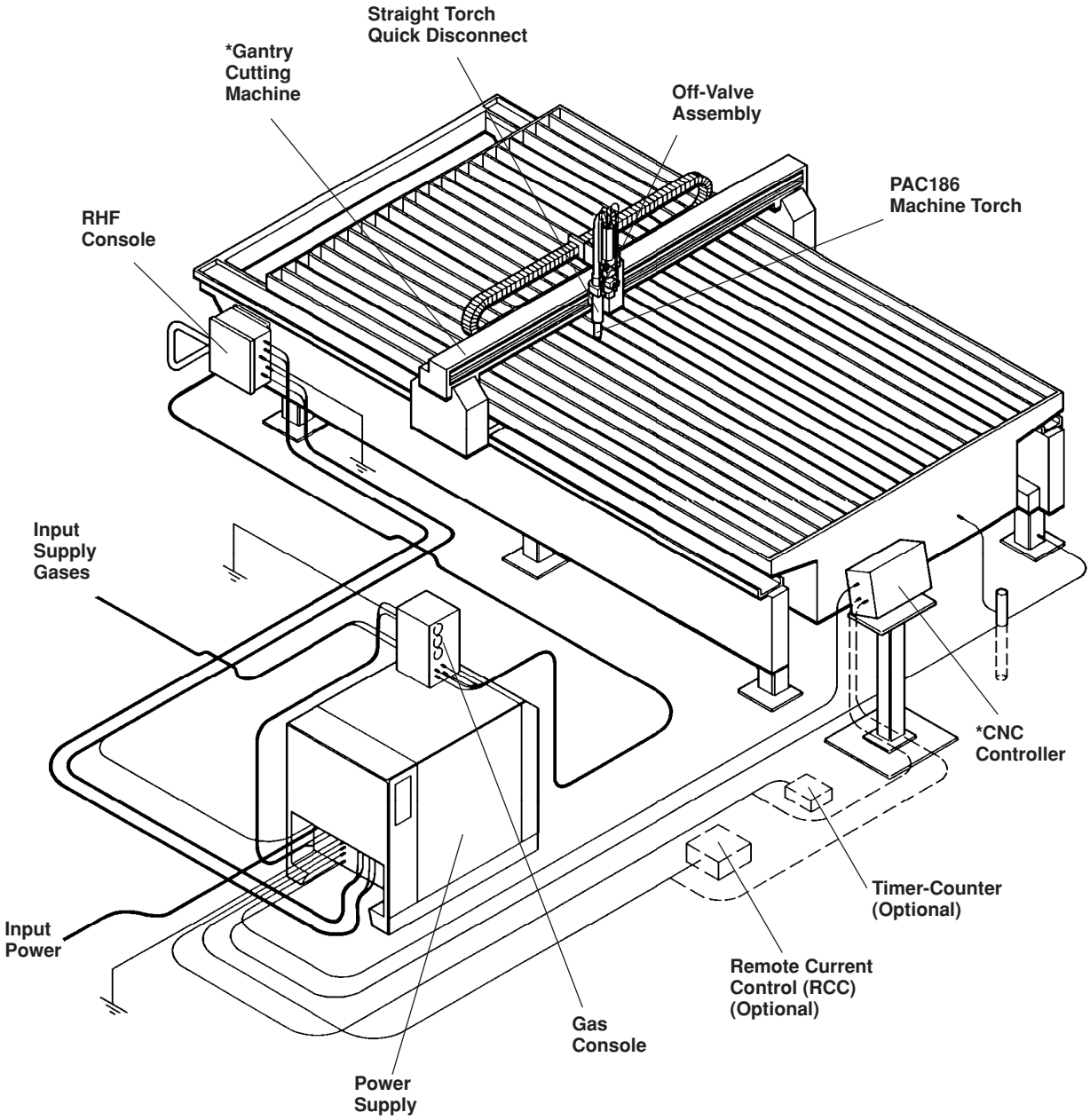
Optional Units

Timer-Counter

The timer/counter allows the operator to monitor the number of arc starts, the cumulative time that the arc is on in hours, and the number of arc blow outs. The arc starts and arc errors LCD counters can be reset. This unit connects with the power supply.Refer to Appendix B for installation, operation and parts information.

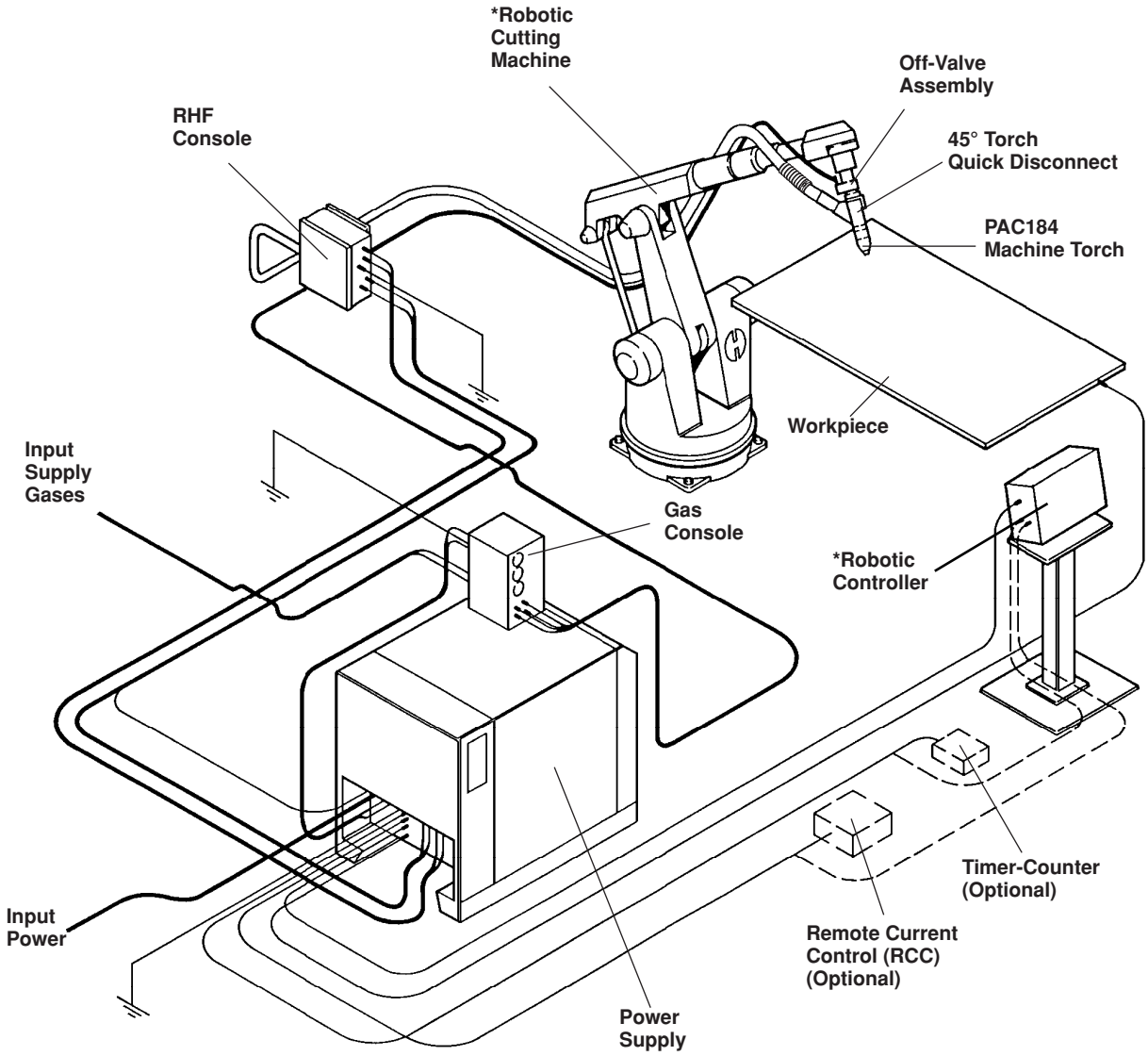
Remote Current Control (RCC)

The RCC allows the operator the ability to select the cutting current from a remote location. This unit connects with the power supply. Refer to Appendix C for installation, operation and parts information.



*** Non Hypertherm Components**

Figure 2-1 HD3070 System Components with Gantry Cutting Machine



*** Non Hypertherm Components**

Figure 2-2 HD3070 System Components with Robotic Cutting Machine

Specifications

Power Supply (078019, 078023, 078024, 078025, 078030)

Maximum OCV (U_0)	280 VDC
Output Current (I_2)	15 to 100 amps
Output Voltage (U_2)	150 VDC
Duty Cycle Rating (X)	80% at 100 amps
Cooling	Forced Air (Class F)
Ambient temperatures/duty cycle	Power supplies will operate between +14° and 104° F (-10° and +40° C). Power supplies operated in an ambient temperature above 86° F (30° C) may show some decrease in duty cycle.

Input Power (U_1 Input Voltage, I_1 Input Current)**:**

078019	240/480 VAC, 3 Ph, 60 Hz, 50/25 amps
078023	208 VAC, 3 Ph, 60 Hz, 58 amps
078024	220/380/415 VAC, 3 Ph, 50/60 Hz, 54/30/28 amps (see Appendix D)
078025	600 VAC, 3 Ph, 60 Hz, 20 amps
078030	200 VAC, 3 Ph, 50/60 Hz, 60 amps

Torch Cooling Requirements:

Coolant Tank Capacity	2.9 gallons (11 liters)
Coolant	Propylene glycol/deionized water/benzotriazole (refer to Section 3, Torch Coolant Requirements for specifications, warning, and caution).
Flow Rate	≈ 1 gallon/minute (3.8 liters/minute)
Pressure	150 psi (10.2 bar)

Dimensions and Weight:

Width	24.25 inches (616 mm)
Height	36 inches (914 mm)
Depth	38.25 inches (972 mm)
Weight	545 pounds (247 kg)

Gas Console (078059)

Input power from power supply (intrlk'd)	120 VAC
Output power to off-valve assembly	120 VAC
Output to CNC	Active (low or closed)

Dimensions and Weight:

Width	12.5 inches (318 mm) w/o hardware; 15 inches (381 mm) w/hardware
Height	15 inches (381 mm)
Depth	10 inches (254 mm) w/o hardware; 11.5 inches (292 mm) w/hardware
Weight	35 pounds (16 kg)

Gas Supply Requirements:

Plasma Gas Type ..... **Oxygen (O_2)** (15, 30, 50, 70 or 100 amp mild steel cutting) **Air** (30, 50, or 70 amp stainless steel cutting; 70 amp aluminum cutting) **Argon/Hydrogen (H35 = 35% Hydrogen/65% Argon)** and **Nitrogen (N_2)** mixture (100 amp stainless steel cutting)

Shield Gas Type ..... **Oxygen (O_2)** and **Nitrogen (N_2)** mixture (15, 30, 50, 70 or 100 amp mild steel cutting) **Methane (CH_4)** and **Air** mixture (70 amp stainless steel cutting) **Air** (30 and 50 amp stainless steel cutting) **Methane (CH_4)** (70 amp aluminum cutting) **Nitrogen (N_2)** (100 amp aluminum and stainless steel cutting)

Oxygen Gas Quality ..... 99.95 % pure (liquid gas recommended)
Nitrogen Gas Quality ..... 99.995 % pure (liquid gas recommended)
H35 Quality (35% Hydrogen/65% Argon) ..... 99.995 % pure (liquid gas recommended)
Air Quality ..... Clean, dry and oil-free
Methane Quality ..... 93 % pure (commercial grade)
All Gas and Air Inlet Pressures ..... 120 psi (8.2 bar)
Air Flowrate ..... 81.7 scfh (2313 l/hr) at fullscale
Oxygen Flowrate ..... 77.8 scfh (2203 l/hr) at fullscale
H35 Flowrate ..... 85 scfh (2407 l/hr) at fullscale
Nitrogen Flowrate ..... 83.1 scfh (2353 l/hr) at fullscale
Methane Flowrate ..... 110 scfh (3114 l/hr) at fullscale

RHF Console (078010)

Input power from power supply (intrlk'd) ..... 120 VAC
Output power ..... 2700 VAC
High frequency spark gap ..... 0.020 ± 0.001 inch (0.51 ± 0.03 mm)

Dimensions and Weight:

Width ..... 12.63 inches (321 mm)
Height ..... 13.5 inches (343 mm)
Depth ..... 6.5 inches (165 mm)
Weight ..... 20 pounds (9 kg)

PAC184 Machine Torch Assemblies (028839, 128199)

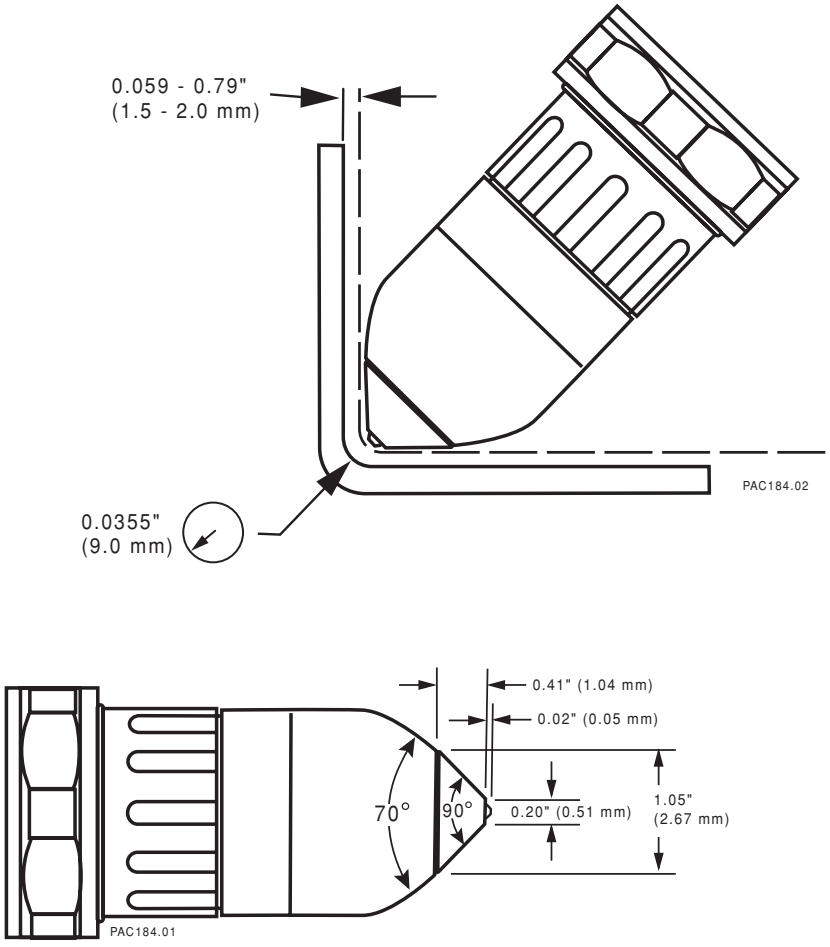
Maximum cutting thickness ..... 1/4 inch (6.4 mm)
Maximum current at 100% duty cycle ..... 30 amps

Torch Cooling Requirements:

Coolant.....Propylene glycol/deionized water/benzotriazole (refer to Section 3, Torch Coolant Requirements for specifications, warning, and caution).
Flow Rate.....≈ 1 gallon/minute (3.8 liters/minute)
Pressure .....150 psi (10.2 bar)

Dimensions and Weight (see Figure 2-3)**:**

Diameter.....1.75 inches (44 mm)
Length .....3.44 inches (88 mm)
Weight .....1 pound (0.45 kg)



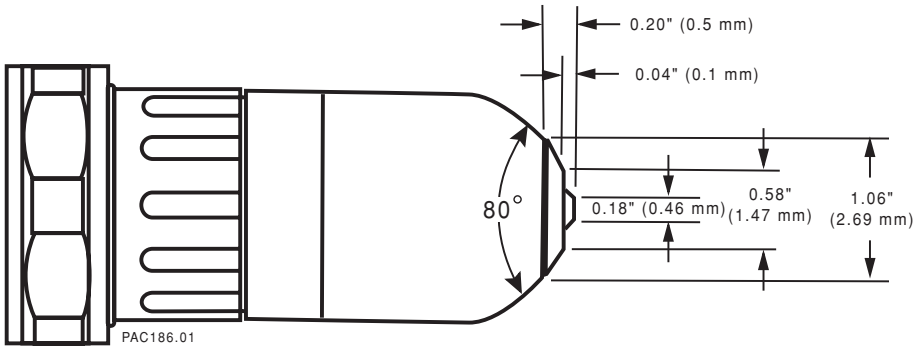
PAC184 Torch Assembly

PAC186 Machine Torch Assemblies (128101, 128102)

Maximum cutting thickness .....1/2 inch (12.7 mm)
Maximum current at 80% duty cycle .....100 amps

Torch Cooling Requirements:
Coolant.....Propylene glycol/deionized water/benzotriazole (refer to Section 3, Torch Coolant Requirements for specifications, warning, and caution).
Flow Rate .....≈ 1 gallon/minute (3.8 liters/minute)
Pressure .....150 psi (10.2 bar)

Dimensions and Weight (see Figure 2-3)**:**
Diameter.....1.75 inches (44 mm)
Length .....3.44 inches (88 mm)
Weight .....1 pound (0.45 kg)

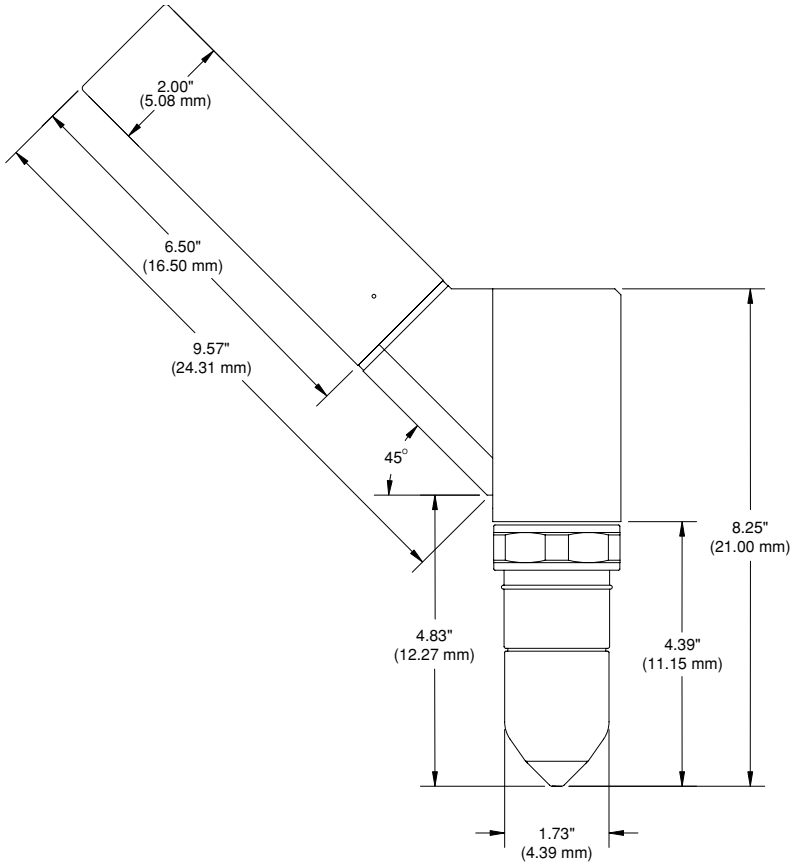


PAC186 Torch Assembly

45° Torch Quick Disconnect Assembly (028840)

Dimensions and Weight:

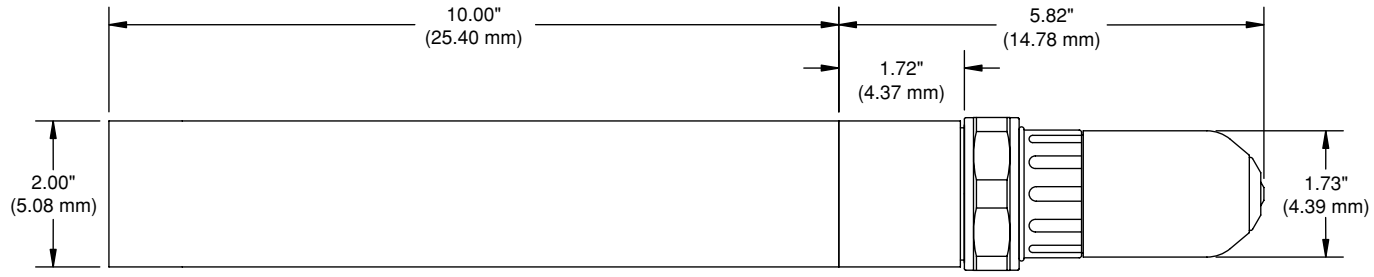
Width .....2.13 inches (54 mm)
Length .....4.19 inches (107 mm)
Depth.....4.56 inches (117 mm)
Weight .....1 pound (0.45 kg)



Straight Torch Quick Disconnect Assembly (028855)

Dimensions and Weight:

Diameter (outer) .....2 inches (51 mm)
Length .....2.5 inches (63 mm)
Weight .....1 pound (0.45 kg)



Off-Valve Assemblies (129239, 129281)

Input Power from Gas Console .....120 VAC

Dimensions and Weight:
Diameter (side to side) .....5.75 inches (146 mm)
Diameter (front to back) .....4.25 inches (108 mm)
Weight .....4 pounds (1.8 kg)

Motion Control System (Customer Supplied)

Travel Speed (maximum) .....200 ipm (5.08 m/min)
Braking .....Positive (drifting through stop point not acceptable)
Weight .....Must be able to handle combined weight of PAC184/PAC186 torch, torch quick disconnect assembly, off-valve assembly, and lead sets.

Optional Units

Timer-Counter (078049)

Receives error signals and machine arc time and machine start signals from power supply .....Dry contacts

Dimensions and Weight:
Width .....6.5 inches (165 mm)
Height .....2.5 inches (64 mm)
Depth .....8.5 inches (216 mm)
Weight .....3 pounds (1.4 kg)

Refer to Appendix B for installation, operation and parts information.

Remote Current Control (RCC) (078050)

Receives current setpoint signals from power supply

Dimensions and Weight:
Width .....6.5 inches (165 mm)
Height .....2.37 inches (61 mm)
Depth .....8.5 inches (216 mm)
Weight .....3 pounds (1.4 kg)

Refer to Appendix C for installation, operation and parts information.

IEC Symbols Used


Direct Current (DC).


Alternating current (AC).


Plasma cutting torch.


AC input power connection.


The terminal for the external protective (earthed) conductor.

A chopper-based power source.


Anode (+) work clamp.


Temperature switch.


Pressure switch.


Plasma torch in the TEST position (cooling and cutting gas exiting nozzle).

The power is on.


The power is off.


Volt/amp curve.

Hypertherm

Section 3

INSTALLATION

In this section:

Pre-Installation

Prior to the installation of the HD3070 plasma cutting system, the components must be unpacked and the following requirements must be fulfilled. Their purpose is to aid you in the installation of your plasma cutting system and to allow maximum performance.

Installation and service of the electrical and plumbing systems must conform to national or local electrical and plumbing codes. Have this work performed only by qualified, licensed personnel.

If questions arise at any time, call Technical Service listed in the front of this manual or your authorized Hypertherm distributor.

Upon Receipt

Before unpacking the HD3070 System, inspect the box(es) for evidence of damage during shipment. If there is evidence of damage, refer to *Claims for Damage During Shipment* below for details. Remove all packing material and remove the units and items from the box(es). Verify that the components listed below are included. Alert Hypertherm if any of the items are damaged or missing. All communications regarding this equipment must include the model number and serial number (located on the back of the units). Refer to *Claims* below for details.

HD3070 System Components

- Power Supply (078019, 078023, 0768024, 078025 or 078030)
- Gas Console (078059)
- Remote High Frequency Console (RHF) (078010)
- PAC184 Torch Assembly (028839 or 128199)
  PAC186 Torch Assembly (128101 or 128102)
- 45° Torch Quick Disconnect Assembly (028840) or
  Straight Torch Quick Disconnect Assembly (028855)
- Off-Valve Assembly (129239 or 129281)
- PAC184 Consumable Parts Kit (028842 or 028900)
- PAC186 Consumable Parts Kit (128097 or 128098)
- Power Supply Service Parts Kit (028724)
- System Interconnecting Cables & Hoses
- HD3070 with Manual Gas Console Instruction Manual (802170)

Optional Units
- Timer/Counter(078049)
- Remote Current Control (RCC) (078050)

Claims

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

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

Gas Requirements

The following gases required by the HD3070 plasma system for cutting are provided **by the customer.** Bottled liquid gas is recommended. If the purity level of the gas is too low or if there are leaks in the supply hoses or connections:

- System can be contaminated
- Cut speeds can decrease
- Cut quality can deteriorate
- Cutting thickness capability can decrease
- Parts life can shorten

If making hard plumbing connections, avoid using iron pipe. Never use PTFE tape on any joint preparation. After installation, pressurize the entire system and check for leaks.

Oxygen (O_2)

WARNING
FIRE HAZARD

Oxygen can cause a potential fire hazard. Install an exhaust ventilation system when using oxygen gas.

The customer must provide a regulated oxygen supply to the gas console at **99.95 %** purity, at a pressure of **120 psi (8.2 bar)** and at a flowrate of **77.8 scfh (2203 l/hr)**. Connect the oxygen supply with a 3/8-inch ID hose to the **O_2** input adapter (1/4 NPT right handed 'B', 9/16-inch 18 thread, male) on the gas console.

Nitrogen (N_2)

The customer must provide a regulated nitrogen supply to the gas console at **99.995 %** purity, at a pressure of **120 psi (8.2 bar)** and at a flowrate of **83.1 scfh (2353 l/hr)**. Connect the nitrogen supply with a 3/8-inch ID hose to the **N_2** input adapter (1/4 NPT right handed 'B', 9/16-inch 18 thread, inert female) on the gas console.

Air

Either cylinder compressed air or shop compressed air can be used to supply the plasma and shield gas requirements. Air supplied to the gas console must be clean, dry and oil-free, at a pressure of **120 psi (8.2 bar)** and at a flowrate of **81.7 scfh (2313 l/hr)**. Connect the air supply to the **AIR** input adapter with a 3/8-inch ID hose (1/4 NPT #6, 9/16-inch 18 thread, male flare).

Methane (CH_4)

WARNING
EXPLOSION HAZARD

Methane is a combustible gas and can be an explosion hazard. Keep open flames away from the methane cylinders and gas hoses.

The customer must provide a regulated commercial grade methane supply to the gas console at **93 %** purity, at a pressure of **120 psi (8.2 bar)** and at a flowrate of **110 scfh (3114 l/hr)**. Bottled liquid gas is recommended. Connect the methane supply with a 3/8-inch ID hose to the **CH_4** input adapter (1/4 NPT, left handed 'B', 9/16-inch 18 thread, male) on the gas console.

Argon-Hydrogen (H35)

WARNING
EXPLOSION HAZARD

H35 is a combustible gas and can be an explosion hazard. Keep open flames away from the gas cylinders and gas hoses.

The customer must provide a regulated H35 supply to the gas console at 99.995 % purity, at a pressure of 120 psi (8.2 bar) and at a flowrate of 85 scfh (2407 l/hr). Connect the H35 supply with a 3/8-inch ID hose to the H35 input adapter (1/4 NPT left handed 'B', 9/16-inch 18 thread, male) on the gas console.

Power Supply Placement

Place the power supply according to the criteria below and the dimensions called out in Figure 3-1. Once the power supply has been placed, locate the line disconnect box on a wall near the power supply, so that the power supply can be quickly turned off in an emergency situation.

Note: A lifting eye is provided for moving the power supply into place with a crane or hoist. To access the lifting eye, remove the 6 screws from the top cover and remove cover. It may also be moved by forklift if the forks are long enough to extend more than half way the length of the base. Care should be used when lifting with the forks so that the underside of the power supply is not damaged.

- Place the units in an area that is free of excessive moisture, has proper ventilation, and is relatively clean. Allow room for accessing the sides of the power supply for servicing.

- Place the power supply so that air flow is not blocked in any way. (Cooling air is drawn in through the front panel grating, and is exhausted through the rear of the unit by a cooling fan.) Do not place any filter device over the air intake locations. This reduces cooling efficiency and VOIDS THE WARRANTY.

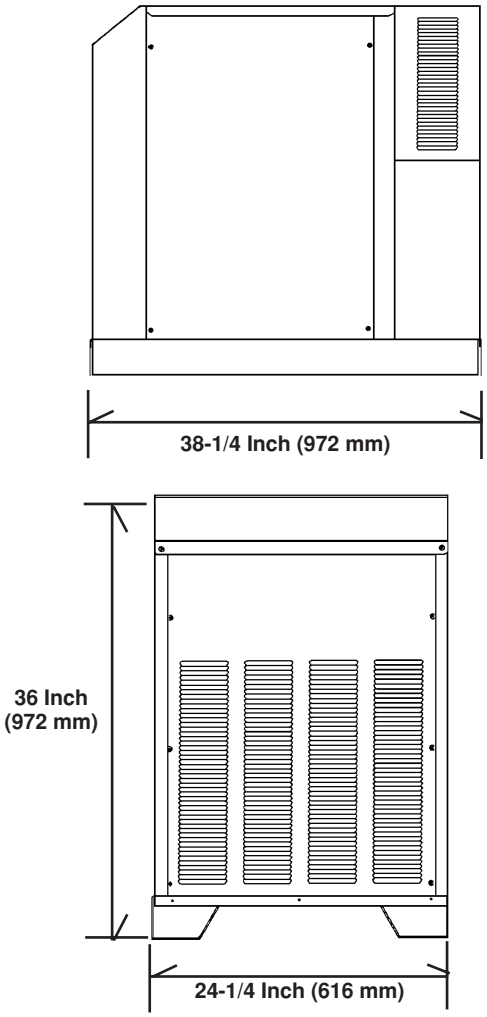


Figure 3-1 HD3070 Power Supply Dimensions

Power Requirements

WARNING

Electrical installation must be performed by qualified personnel only.

All switches, slow-blow fuses and power cables are customer supplied and must be chosen as directed by applicable national and/or local electrical codes.

Use a separate primary line disconnect switch for each HD3070 power supply and slave.

Note: Input voltage must not drop below 15% of the values listed below. The power supply will go into an idle mode and display an error on the control board if the input voltage is too low.

Size the disconnect box(es) to Table 3-1 requirements for the HD3070 power supply.

Line Disconnect Switch

The line disconnect switch serves as the supply voltage disconnecting (isolating) device. Install this switch on a wall near the power supply for easy accessibility by the operator. The line disconnect switch must be installed by qualified personnel following all applicable local and national codes. The switch should:

- Isolate the electrical equipment and disconnect all live conductors from the supply voltage when in the OFF position
- Have one OFF and one ON position clearly marked with “0 (OFF)” and “I (ON)”
- Have an external operating handle capable of being locked in the OFF position
- Contain a power operated mechanism that serves as an emergency stop
- Have slow-blow fuses installed for the proper breaking capacity (Table 3-1)

Power Cable

The power cable is customer supplied. Use an 8-4 conductor Type SO input power cable with a conductor temperature rating of 140°F (60°C).

Table 3-1 Line Voltage Disconnect Box Fusing Requirements

Input Voltage (VAC)	Phase/Hz	Rated Input Current @ 15 kw Output (amps)	Recommended Slow- Blow Fuse Sizes (amps)
200	3/50-60	60	70
208	3/60	58	70
220	3/50-60	54	70
240	3/60	50	60
380	3/50-60	30	40
415	3/50-60	28	35
480	3/60	25	30
600	3/60	20	25

240/480V Power Supply Linkboard Configurations

- The 240/480-volt power supplies (078019) are shipped configured for 480-volt operation. The links must be moved for 240-volt operation (Figure 3-2).

220/380/415V Power Supply Linkboard Configurations

- The 220/380/415-volt, 3PH, 50 Hz power supplies (078024) are normally shipped from the factory set up for 380-volt operation, unless otherwise specified. To change the power supply to a different voltage (220 or 415 volts), the links must be moved (Figure 3-3).

Work Table Grounding

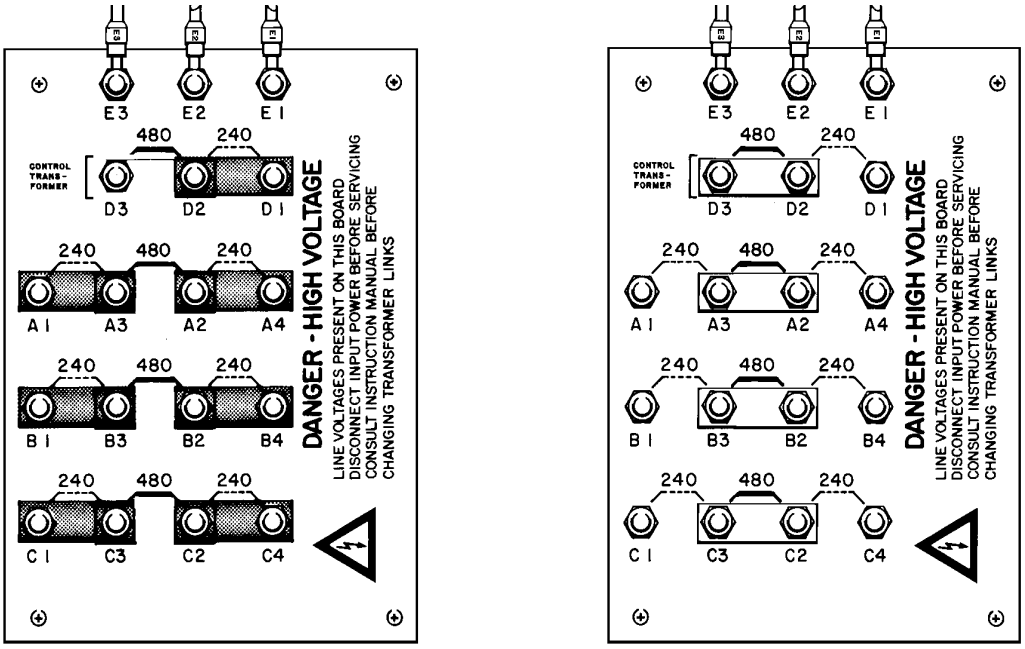
- The work table must be grounded properly to ensure personal safety, and to reduce the emission of radio-frequency interference.

- See Appendix E for important grounding instructions.

Equipment Grounding

- The power supply, RHF console and gas console provide connections for protective earth (PE) grounding.

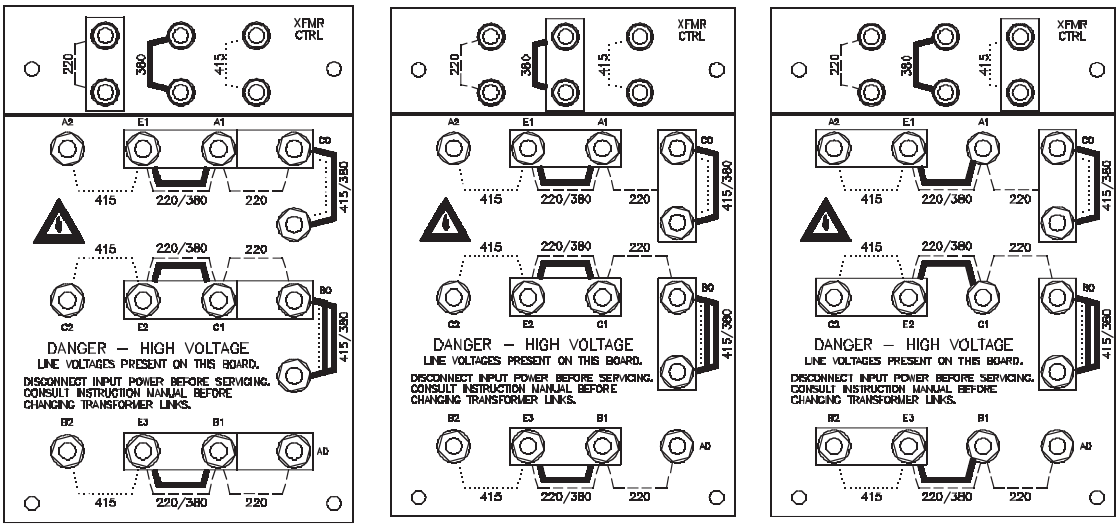
- See Appendix E for important grounding instructions.



240-Volt

480-Volt

Figure 3-2 Dual Voltage 240/480-Volt Linkboard Configurations



220-Volt

380-Volt

415-Volt

Figure 3-3 220/380/415V Linkboard Configurations

Connect Power Cable

After the power supply and line disconnect switch have been placed, connect the power cable to the power supply first and then connect it to the line disconnect switch.

Power Supply

To connect the power cable to a 220/380/415V power supply (078024), refer to Appendix D. For other power supply voltages use the procedure below.

1. Insert the power cable through the strain relief at the lower right rear of the power supply. Connect the power cable leads to **TB1** the rear center panel of the right side (see Figure 3-4).

2. Connect the power leads to the **L1 (U)**, **L2 (V)**, and **L3 (W)** terminals of **TB1.** Make sure that all electrical connections are tight to avoid excessive heating.

3. Connect the ground lead to the ground stud.

Line Voltage Disconnect Box

Connecting the power cable to the disconnect box must conform to national and local electrical codes. This work should be performed only by qualified, licensed personnel.

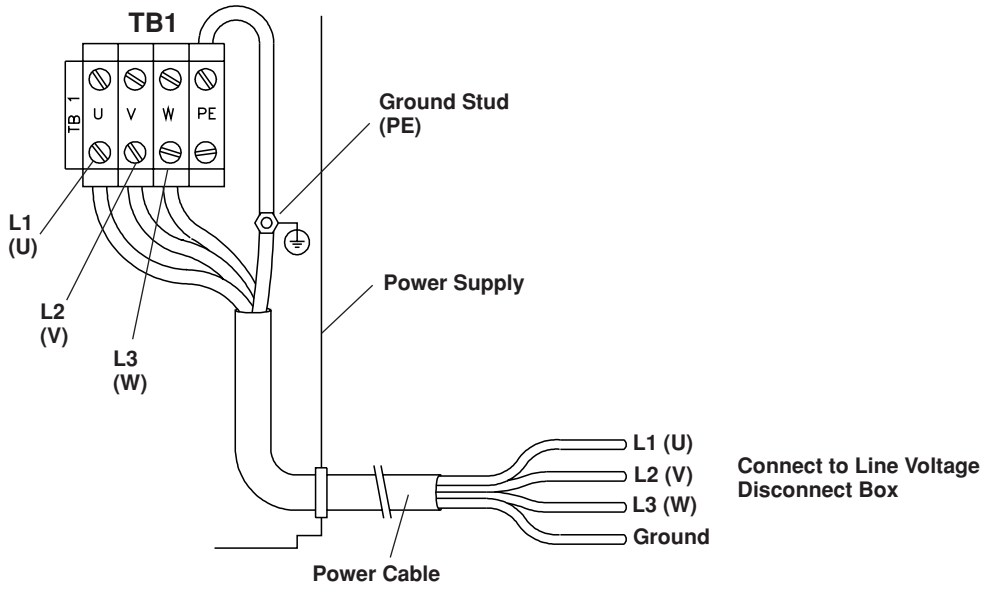


Figure 3-4 Power Supply Power Cable Connections

Local/External Pierce Delay Function

The power supply is shipped with the PIERCE DELAY potentiometer on the power supply control panel enabled. Perform the steps below to enable the external pierce complete function. Refer to Section 6, Figure 6-2, item 5 to locate control board 1XPCB3 and power supply (power unit) wiring diagram for wiring information.

1. Remove the power supply front panel and locate control board 1XPCB3.

2. Disconnect PL10 from REC5 on 1XPCB3.

3. Locate the blue jumper wire connected to PL10 pin 7. Connect the free end of the jumper to PL10 pin 5.

4. Reconnect PL10 to REC5.

To reestablish local control, remove jumper wire from PL10 pin 5.

Local/External Current Set Function

The power supply is shipped with the AMPS thumbwheel switch on the power supply control panel enabled. Perform the steps below to enable the external current set function. Refer to Section 6, Figure 6-2, item 5 to locate control board 1XPCB3 and power supply (power unit) wiring diagram for wiring information.

1. Remove the power supply front panel and locate control board 1XPCB3.

2. Disconnect PL27-B (thumbwheel switch connector) from REC27 and then connect PL27-A (external current set) to REC27.

3. Connect the current setpoint cable (Figure 3-22) between 1X2 (rear of power supply) and CNC Interface.

To reestablish local control, disconnect PL27-A from REC27 and connect PL27-B to REC27. Then disconnect current setpoint cable between 1X2 and CNC Interface.

Torch Lifter Requirement

The HD3070 requires a motorized torch lifter with sufficient vertical travel to cut all required metal thicknesses. Vertical travel must be in increments of 0.010 inch (0.25 mm) and have a travel speed of 200 ipm (5.08 m/min) maximum and braking should be positive. A unit which drifts through the stop point is not acceptable.

Installation

This section provides the user with the necessary information to install the HD3070 system. Installation of the HD3070 System should not be undertaken unless all of the pre-installation requirements presented in front of this section have been completed. This section includes the following:

- Placing and mounting the system units.
- Interconnecting the units with the electrical control cables, cooling hoses and torch and gas lead sets.
- Mounting the PAC184 or PAC186 torch to the torch quick disconnect.
- Adding the torch coolant.

System Units Placement

Position the RHF console and gas console prior to making electrical, gas, and coolant connections. Also mount the torch quick disconnect and off-valve assembly. Note that power supply placement information is presented in *Pre-Installation* in the front of this section.

Remote High Frequency Console

Place the RHF console in a convenient location to allow easy routing and connection of the torch lead set. Bolt the unit to the mounting surface. See Figure 3-5.

Gas Console

Place the gas console in a convenient location near the operator for easy plasma gas and injection water monitoring adjustment. The gas console must be located within 100 feet of the torch. Bolt the unit to the mounting surface. See Figure 3-6.

Torch Quick Disconnect Assemblies/Off-Valve Assembly

The torch quick disconnect assemblies and off-valve assembly are shipped loose. The 45° quick disconnect, generally used with the PAC184 torch, is normally mounted onto a robotic arm using the four 1/4-20 mounting holes. See Figure 3-7 for torch quick disconnect mounting hole dimensions.

The straight quick disconnect assembly, generally used with the PAC186 torch, is normally mounted onto a torch lifter on a x-y cutting table.

The off-valve assembly may be mounted up to a distance of four feet from either of the torch quick disconnects.

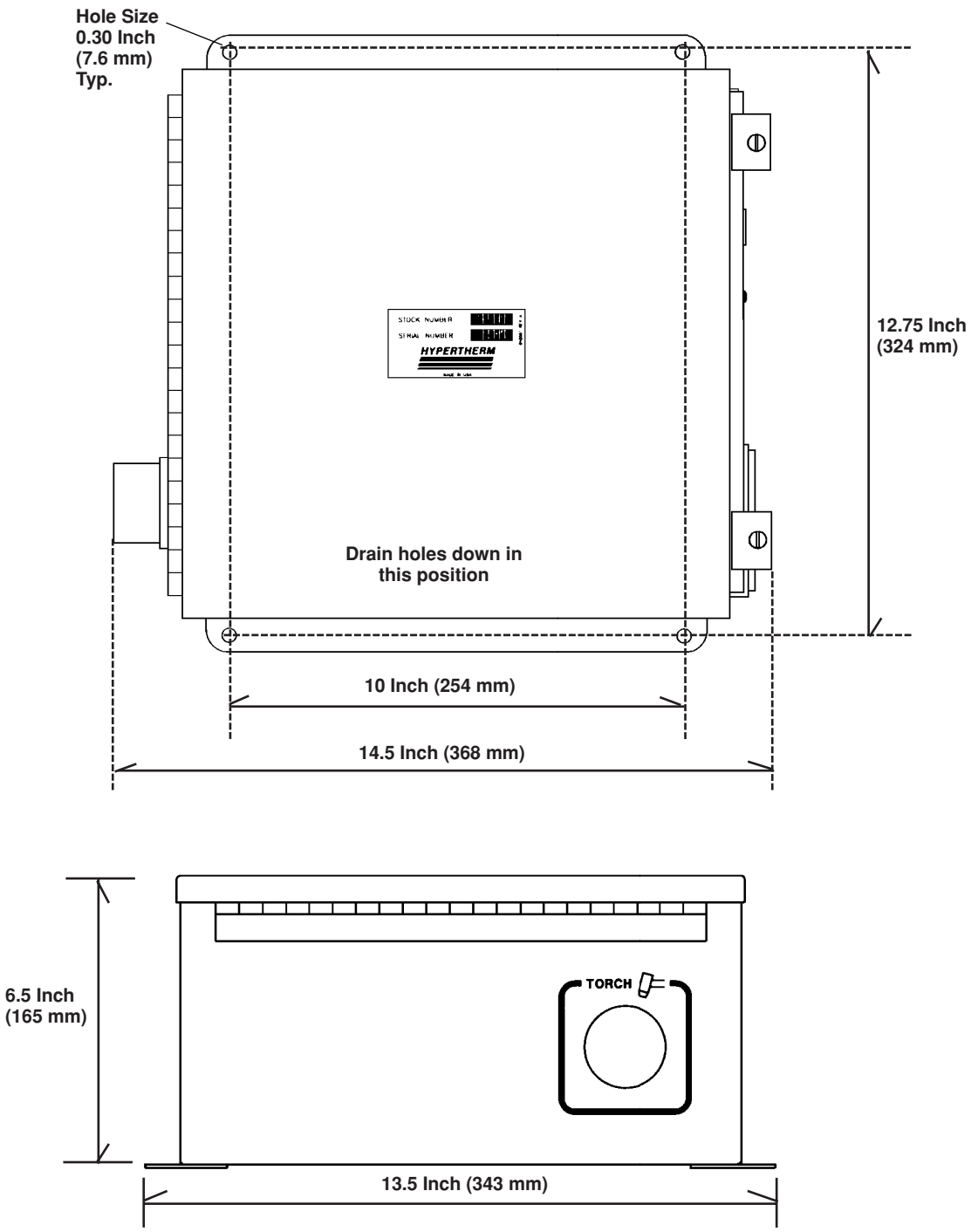


Figure 3-5 RHF Console Mounting Dimensions

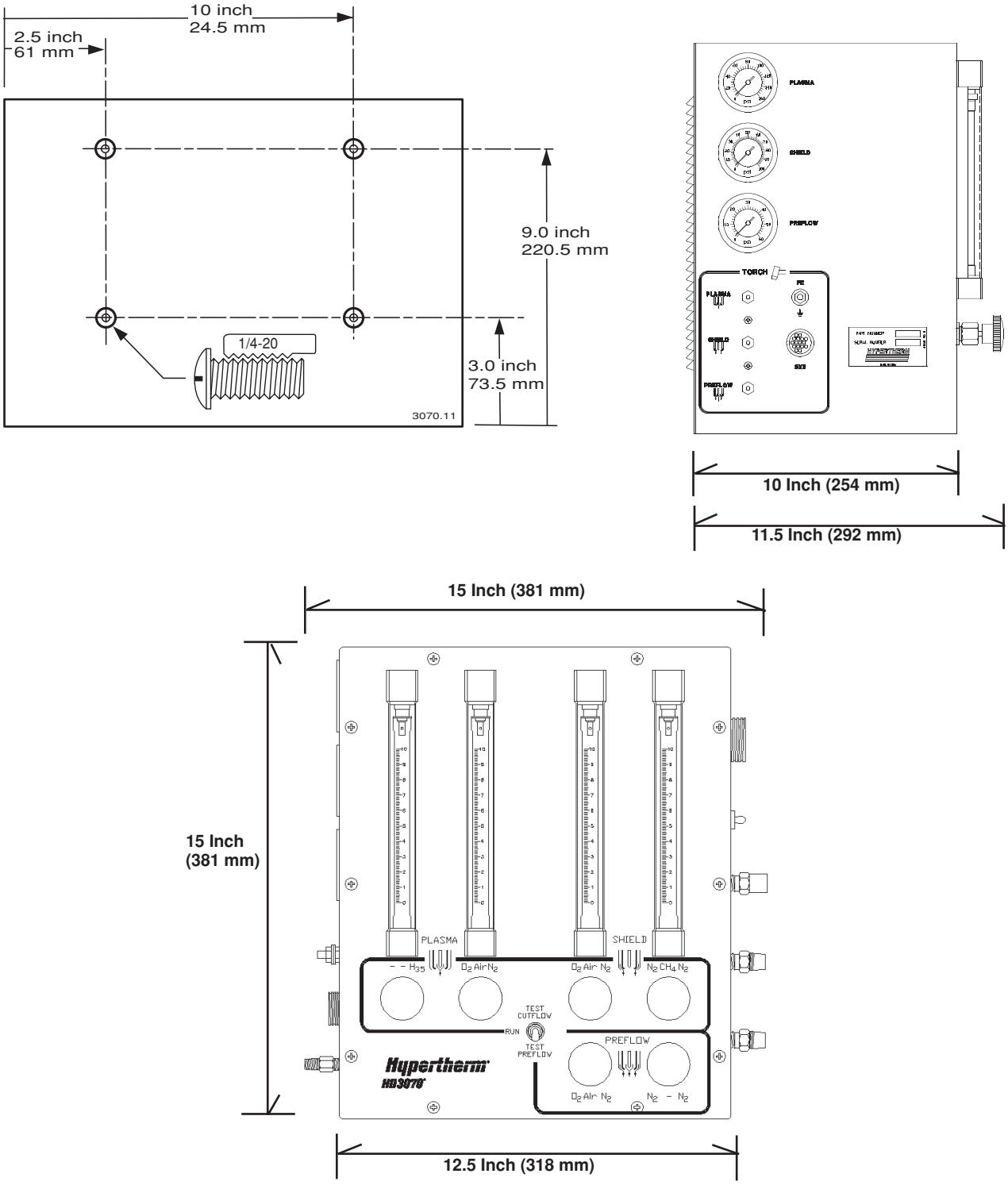


Figure 3-6 Gas Console Mounting Dimensions

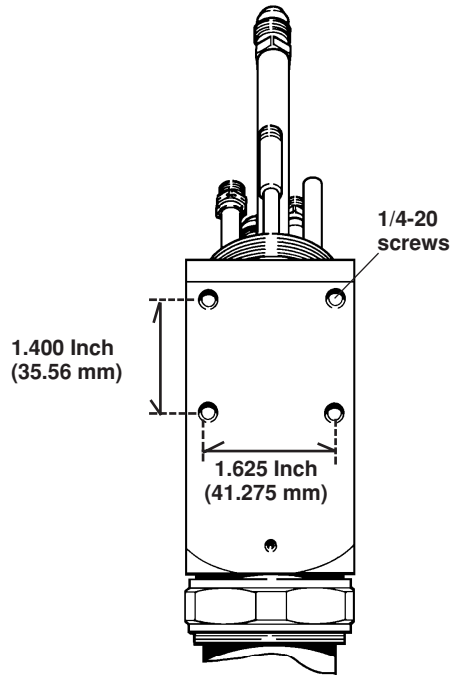


Figure 3-7 45° Torch Quick Disconnect Mounting Hole Dimensions

Cable, Hose & Lead Set Interconnections

The following cable, hose and lead set interconnecting procedures are supported by the system interconnection diagram, Figure 3-8. Also provided are illustrations of each unit showing where the connections are to be made and illustrations of the cables, hoses and lead sets.

Note that these procedures and supporting illustrations are cross referenced (①, ⑨, etc.) to ensure a safe and correct installation. Also note that the cross referencing numbers do not indicate a sequence for interconnecting. It is assumed that in most cases the interconnections will be routed through a power track or festoon system from one point to the other.

IMPORTANT

When interfacing with the CNC, optically isolated I/Os or ground floating interfaces are recommended to avoid ground shift and make the system more immune to EMI noises.

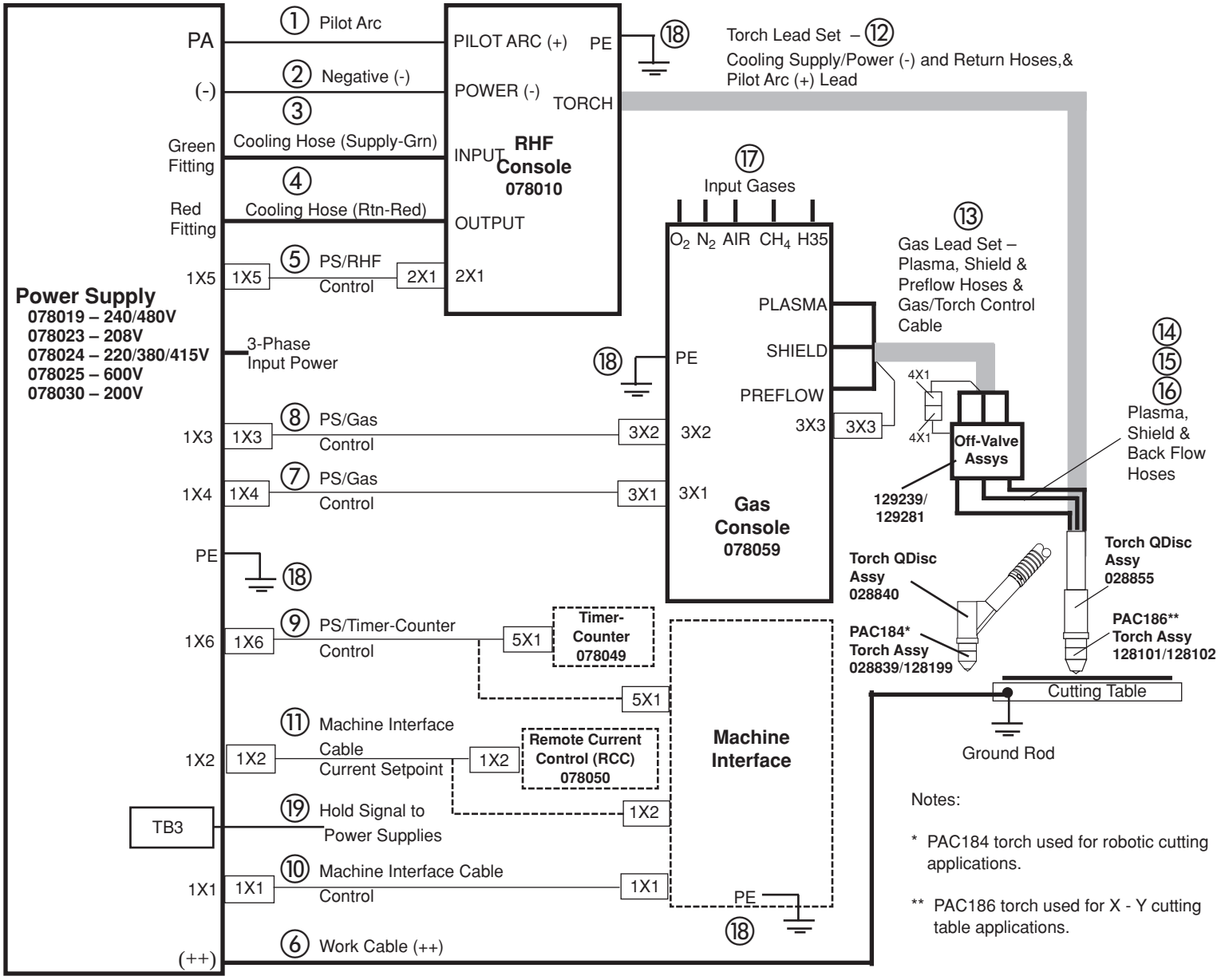


Figure 3-8 HD3070 System with Manual Gas Console Interconnect Diagram

Power Supply to RHF Console and Work Table Interconnections (Figure 3-9)

① Pilot Arc Lead (+) (Figure 3-10)

1. Route one end of the lead through the feed-thru on the rear of the power supply and connect to the pilot arc terminal.

2. Route the other end of the lead through the **PILOT ARC** strain relief on the RHF Console and connect to the pilot arc terminal on the I/O PC BD Assy.

② Negative Lead (-) (Figure 3-11)

1. Route one end of the lead through the feed-thru on the rear of the power supply and connect to the negative terminal.

2. Route the other end of the lead through the **POWER (-)** strain relief on the RHF Console and connect to the negative terminal on the I/O PC BD Assy.

③ Cooling Water Supply Hose /Power Lead (-) (Green) (Figure 3-12)

1. At the rear of the power supply connect the coolant supply hose (green band) to the check valve connector painted green.

2. Route the other end of the hose through the **IN** feed-thru on the RHF Console and connect to the manifold adapter painted green.

④ Cooling Water Return Hose (Red) (Figure 3-13)

1. At the rear of the power supply connect the coolant return hose (red band) to the check valve connector painted red.

2. Route the other end of the hose through the **OUT** feed-thru on the RHF Console and connect to the manifold adapter painted red.

⑤ Control Cable (Figure 3-14)

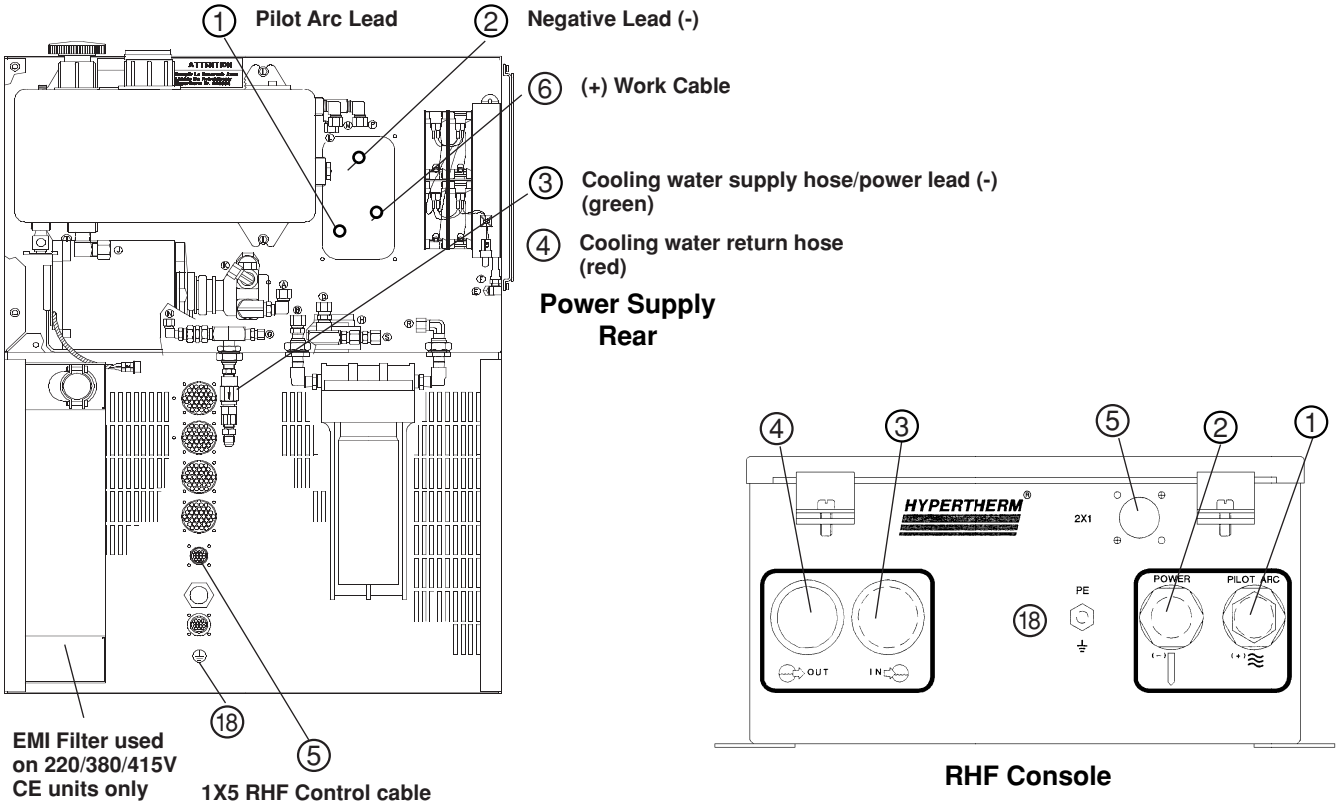
1. Connect the cable plug marked **1X5** to the receptacle marked **1X5** on the rear of the power supply.

2. Connect the other end of the cable marked **2X1** to the receptacle marked **2X1** on the RHF Console.

⑥ Work Cable (Figure 3-15)

1. Route one end of the cable through the feed-thru on the rear of the power supply and connect to the work (++) terminal (Figure 3-8).

2. Connect the other end of the cable to the work table ground rod or to the work table. Make sure that good metal-to-metal contact has been made (Figure 3-8).



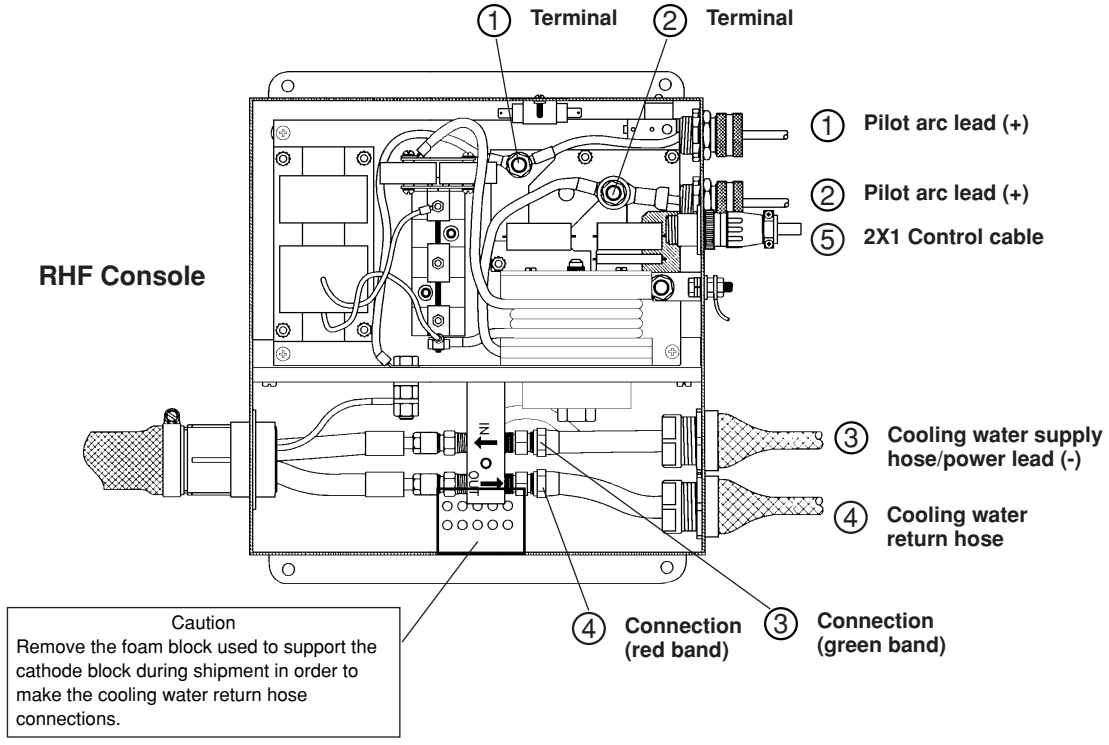


Figure 3-9 Power Supply to RHF Console Interconnections

①

Part Number	Length
023924	4 ft (1.2 m)
023569	15 ft (4.6 m)
023526	25 ft (7.6 m)
023527	50 ft (15.2 m)
023528	75 ft (23 m)
023529	100 ft (30.5m)
023730	115 ft (35 m)
023746	125 ft (38 m)

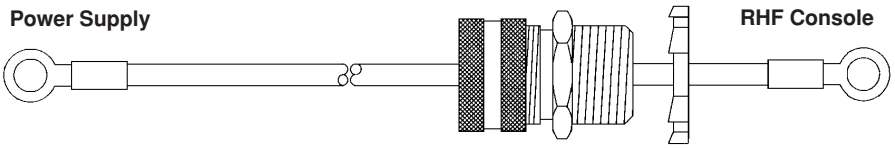


Figure 3-10 Pilot Arc Lead (+)

②

Part Number	Length
023925	4 ft (1.2 m)
023530	15 ft (4.6 m)
023531	25 ft (7.6 m)
023532	50 ft (15.2 m)
023533	75 ft (23 m)
023534	100 ft (30.5 m)
023731	115 ft (35 m)
023747	125 ft (38 m)

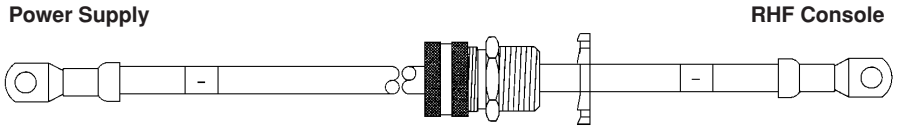


Figure 3-11 Negative Lead (-)

③

Part Number	Length
024421	4 ft (1.2 m)
024290	15 ft (4.6 m)
024291	25 ft (7.6 m)
024263	50 ft (15.2 m)
024264	75 ft (23 m)
024265	100 ft (30.5 m)
024385	115 ft (35 m)
024396	125 ft (38 m)
024459	150 ft (46 m)

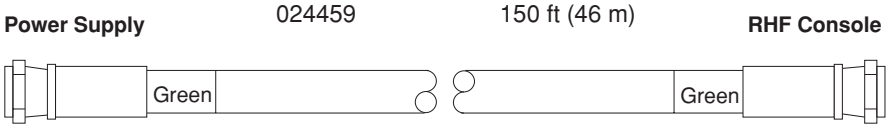


Figure 3-12 Cooling Supply Hose/Power Lead (-)

④

Part Number	Length
024422	4 ft (1.2 m)
024266	15 ft (4.6 m)
024267	25 ft (7.6 m)
024012	50 ft (15.2 m)
024269	75 ft (23 m)
024270	100 ft (30.5 m)
024386	115 ft (35 m)
024397	125 ft (38 m)
024460	150 ft (46 m)

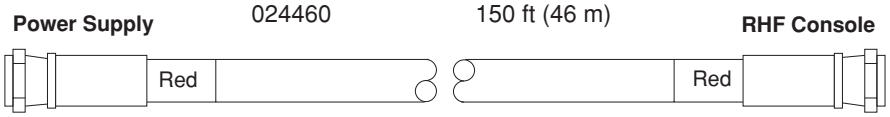
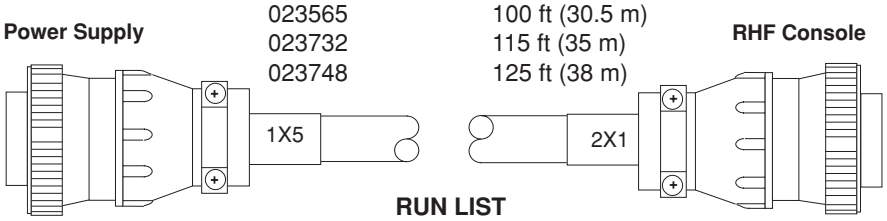


Figure 3-13 Cooling Return Hose

⑤

Part Number	Length
023926	4 ft (1.2 m)
023470	15 ft (4.6 m)
023562	25 ft (7.6 m)
023563	50 ft (15.2 m)
023564	75 ft (23 m)
023565	100 ft (30.5 m)
023732	115 ft (35 m)
023748	125 ft (38 m)



RUN LIST

SIGNAL	PLUG 1X5	COLOR	PLUG 2X1
Door Interlock	1	Black	1
	2	Red	2
Ground	5	Shield	Cut
HV Transformer	6	Red	6
	7	Black	7
Ground	3	Shield	Cut

Figure 3-14 PS/RHF Control Cable

⑥

Part Number	Length
023535	15 ft (4.6 m)
023536	25 ft (7.6 m)
023828	39.4 ft (12 m)
023537	50 ft (15.2 m)
023538	75 ft (23 m)
023539	100 ft (30.5 m)

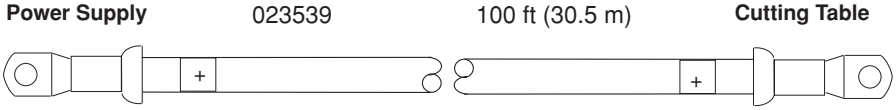


Figure 3-15 Work Cable (+)

Power Supply to Gas Console Interconnections (Figure 3-16)

⑦ Gas Console Cable (Figure 3-17)

1. Connect the cable plug marked **1X4** to the receptacle marked **1X4** on the rear of the power supply.
2. Connect the other end of the cable marked **3X1** to the receptacle marked **3X1** on the gas console.

⑧ Gas Console Control Cable (Figure 3-18)

1. Connect the cable plug marked **1X3** to the receptacle marked **1X3** on the rear of the power supply.
2. Connect the other end of the cable marked **3X2** to the receptacle marked **3X2** on the gas console.

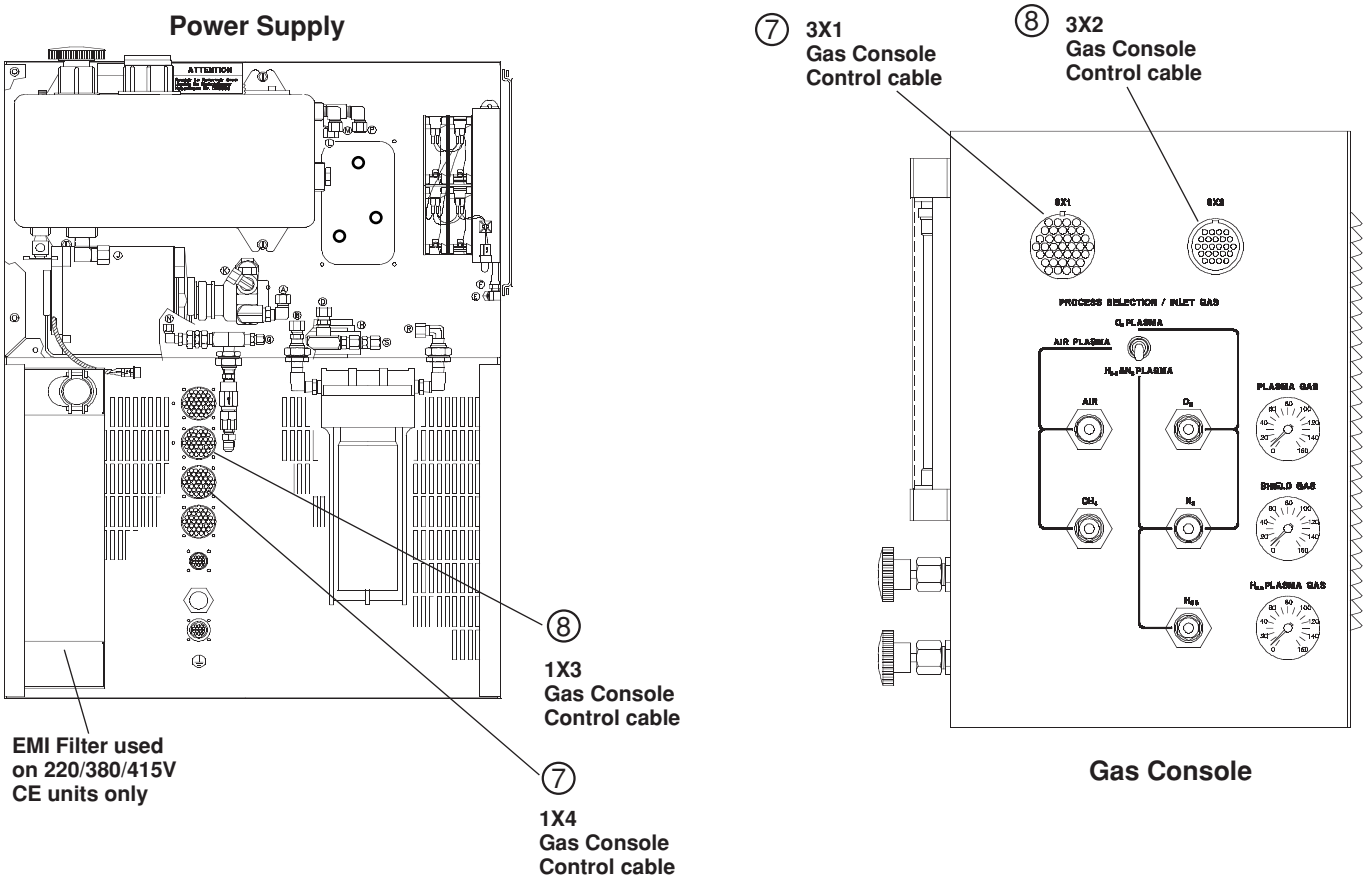
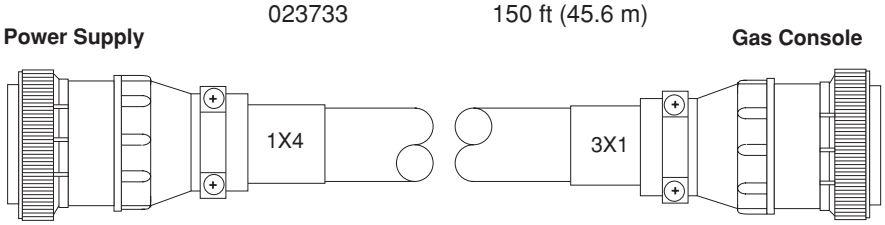


Figure 3-16 Power Supply to Gas Console Interconnections

⑦

Part Number	Length
023673	6 ft (1.8 m)
023558	10 ft (3 m)
023472	25 ft (7.6 m)
023556	50 ft 15 m)
023557	75 ft (23 m)
023760	100 ft (30.5 m)
023744	125 ft (38 m)
023733	150 ft (45.6 m)



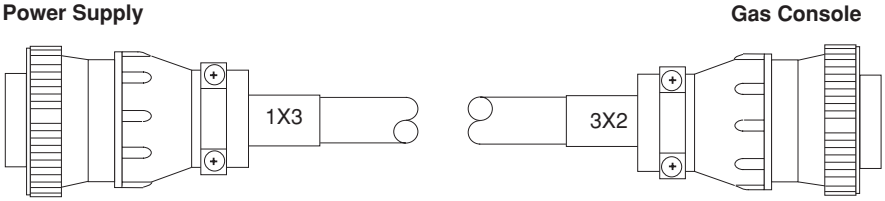
RUN LIST

SIGNAL	PLUG 1X4	COLOR	PLUG 3X1
Spare Valve # 1	14	Black	14
	15	Green	15
Gnd	9	Shield	9
Shield Operate	12	Black	12
	13	Yellow	13
Gnd	7	Shield	7
Air and CH_4	23	Black	23
	24	Blue	24
Gnd	29	Shield	29
Shield Preflow	10	Black	10
	11	Orange	11
Gnd	5	Shield	5
H35 and N_2	25	Black	25
	26	White	26
Gnd	31	Shield	31
Plasma On & Off	1	Black	1
	2	Brown	2
Gnd	6	Shield	6
O_2 and N_2	27	Red	27
	28	Brown	28
Gnd	33	Shield	33
Unassigned	3	Black	3
	4	Red	4
Gnd	8	Shield	8
Gas System Power	36	Red	36
	37	Brown	37
Gnd	32	Shield	32
Unassigned	34	Black	34
	35	Red	35
Gnd	30	Shield	30
Key	N/A	N/A	16

Figure 3-17 Gas Console Cable

⑧

Part Number	Length
023927	10 ft (3 m)
023672	25 ft (7.6 m)
023928	50 ft 15 m)
023929	75 ft (23 m)
023930	100 ft (30.5 m)
023931	125 ft (38 m)
023932	150 ft (45.6 m)



RUN LIST

SIGNAL	PLUG 1X3	COLOR	PLUG 3X2
DC On Light	23	White	23
	24	Black	24
Gnd	19	Shield	Cut & Key
O_2 Plasma Select	21	Blue	21
	22	Black	22
Gnd	17	Shield	Cut & Key
Test Preflow	12	Yellow	12
	13	Black	13
Gnd	7	Shield	Cut & Key
Test Operate	14	Green	14
	15	Black	15
Gnd	9	Shield	Cut & Key
H35 & N_2 Plasma Select	10	Red	10
	11	Brown	11
Gnd	5	Shield	Cut & Key
Jumper	3	Black	3
	4	Red	4
Gnd	8	Shield	Cut & Key
Gas Pressure	1	Gray	N/A
	2	Gray	N/A

Figure 3-18 Gas Console Control Cable

Power Supply to Machine Interface /Timer Counter/RCC Interconnections (Figure 3-19)

⑨ **Timer-Counter Control Cable (Figure 3-20)**

1. Connect the cable plug marked **1X6** to the receptacle marked **1X6** on the rear of the power supply.
2. Connect the other end of the cable to the machine interface or receptacle marked **5X1** on the rear of the timer-counter. (Figure 3-8)

⑩ **Machine Interface Control Cable (Figure 3-21)**

1. Connect the cable plug marked **1X1** to the receptacle marked **1X1** on the rear of the power supply.
2. Connect the other end of the cable to the machine interface. (Figure 3-8)

⑪ **Machine Interface Current Setpoint Cable (Figure 3-22)**

Do not connect this cable unless the external current set function is going to be initiated from the CNC or RCC.

1. Connect the cable plug marked **1X2** to the receptacle marked **1X2** on the rear of the power supply.
2. Connect the other end of the cable to the machine interface or receptacle marked **1X2** on the rear of the RCC. (Figure 3-8)

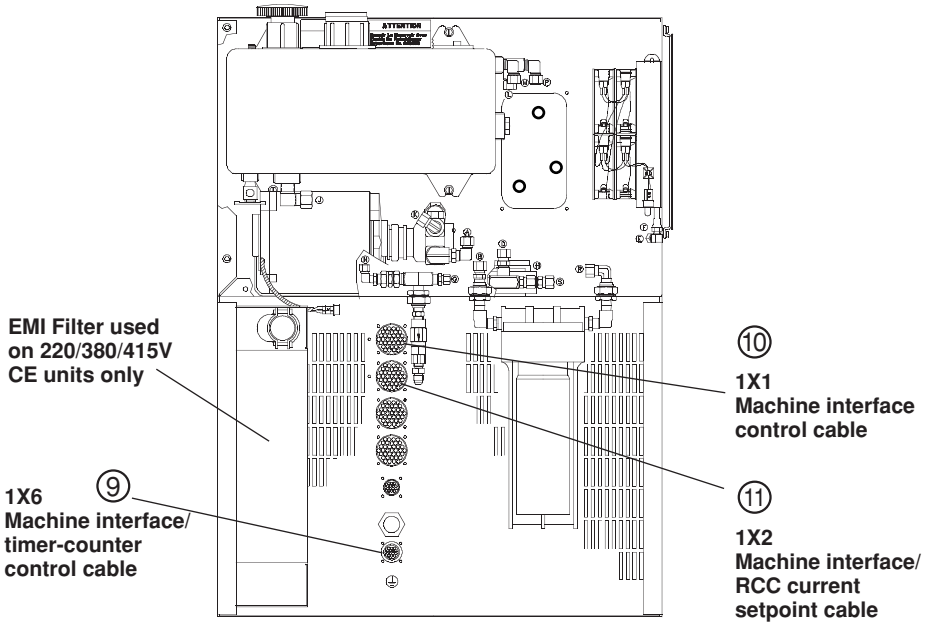
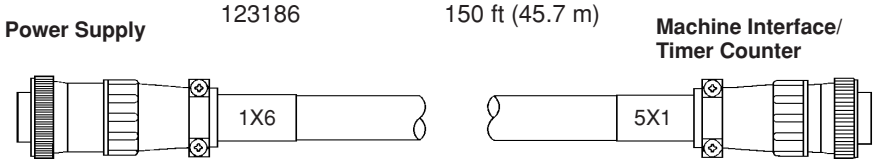


Figure 3-19 Power Supply to Machine Interface/Timer-Counter/RCC Interconnections

⑨

Part Number	Length
023946	3.5 ft (1.1 m)
023947	5.5 ft (1.7 m)
023948	6 ft (1.8 m)
023949	25 ft (7.6 m)
023721	28.3 ft (8.6 m)
023950	38 ft (11.6 m)
123111	50 ft (15.2 m)
123100	75 ft (23 m)
123328	100 ft (30.5 m)
123186	150 ft (45.7 m)



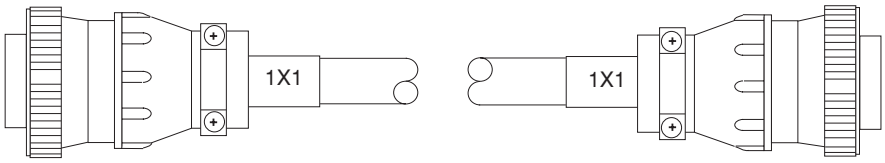
RUN LIST

SIGNAL	PLUG 1X3	COLOR	MACHINE INTERFACE/ TIMER-COUNTER
DC On Light	23	White	23
Starts & Arc Time	2	White	1
Starts & Arc Time	3	Black	2
Drain	4	Drain	Cut
Error Counter	5	Red	15
Error Counter	6	Black	16
Drain	7	Drain	Cut

Figure 3-20 PS/Machine Interface or Timer/Counter Control Cable

⑩

Part Number	Length
023707	25 ft (7.6 m)
023829	28.2 ft (8.6 m)
023933	50 ft (15.2 m)
023934	75 ft (23 m)
023935	100 ft (30.5 m)
023936	125 ft (38 m)
023937	150 ft (45.6 m)

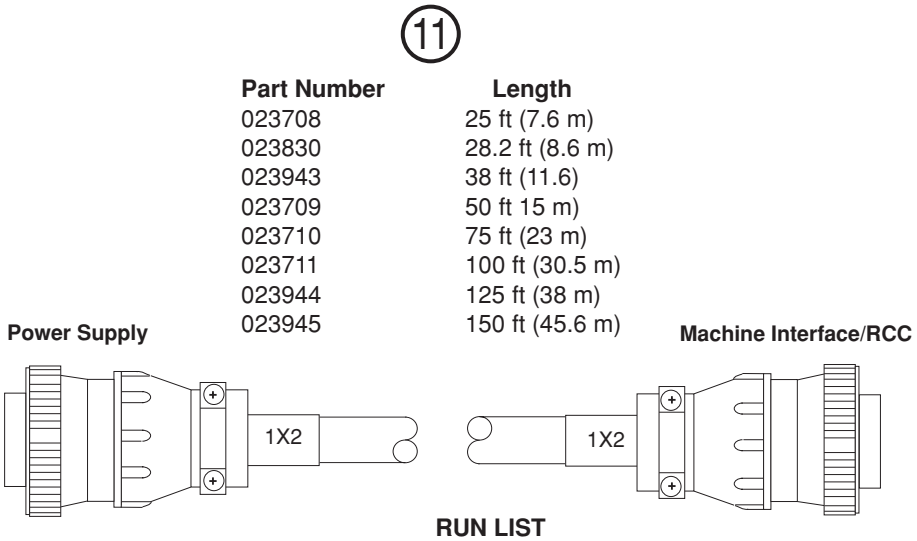


RUN LIST

SIGNAL	PLUG 1X1	COLOR	MACHINE INTERFACE/
Hold (Dry)	1	Black	1
Hold (Dry)	5	Red	5
-	10	Drain	10
Pierce Comp (Dry)	2	Black	2
Pierce Comp (Dry)	6	White	6
-	11	Drain	11

Torch Ignition Out (Dry)	3	Black	3
Torch Ignition Out (Dry)	7	Green	7
-	12	Drain	12
Power Off -	4	Black	4
Power Off +	8	Blue	8
-	13	Drain	13
Plasma On (Dry)	9	Black	9
Plasma On (Dry)	15	Yellow	15
-	14	Drain	14
Ext Inter CC (Dry)	16	Red	16
Ext Inter CC (Dry)	17	Blue	17
-	18	Drain	18
Power On Input +	29	Black	29
Power On Input -	34	Brown	34
-	23	Drain	23
1/50 Arc Voltage -	33	Red	33
1/50 Arc Voltage +	28	Green	28
-	27	Drain	27
Power Interlocks (Dry)	35	Red	35
Power Interlocks (Dry)	30	White	30
-	24	Drain	24
Transfer Out (Dry)	37	Black	37
Transfer Out (Dry)	32	Orange	32
-	26	Drain	26

Figure 3-21 PS/Machine Interface Control Cable



Part Number	Length
023708	25 ft (7.6 m)
023830	28.2 ft (8.6 m)
023943	38 ft (11.6)
023709	50 ft 15 m)
023710	75 ft (23 m)
023711	100 ft (30.5 m)
023944	125 ft (38 m)
023945	150 ft (45.6 m)

RUN LIST

SIGNAL	PLUG 1X2	COLOR	MACHINE INTERFACE/RCC
Shield	10	N/A	NC
1 Amp BCD	2	White	2
2 Amp BCD	3	Red	3
4 Amp BCD	4	Green	4
8 Amp BCD	5	Brown	5
10 Amp BCD	6	Blue	6
20 Amp BCD	7	Orange	7
40 Amp BCD	8	Yellow	8
80 Amp BCD	12	Gray	12
100 Amp BCD	13	Violet	13
Common	11	Black	11

Figure 3-22 PS/Machine Interface or RCC Current Setpoint Cable

RHF Console to Torch Quick Disconnect Interconnections (Figure 3-23)

(12) The torch lead set interconnections include connecting the torch lead set between the RHF console and the torch quick disconnect.

Torch Lead Set to RHF Console

Route the pilot arc lead and water hoses from the torch lead set through the brass feed-through on the RHF console marked **TORCH**.

(12A) **Pilot Arc Lead (+)**

- Route the ring end of the cable through the hole in the center section and connect to the pilot arc terminal on the I/O PC BD Assy.

(12B) **Cooling Water Hose Supply Hose /Power Lead (-) (Green)**

- Connect cooling supply hose (green band) to the manifold adapter (green).

(12C) **Cooling Water Return Hose (Red)**

- Connect cooling return hose (red band) to the manifold adapter (red).

Torch Lead Set to Torch Quick Disconnect

Route the other end of the torch lead set through the power track or festoon to connect to the torch quick disconnect. Wrap the hose and lead ends together with electrical tape, so that the ends do not catch while routing. Route torch lead set through strain relief and torch mounting sleeve.

Caution: Make sure the vent tube from the torch head is vented to atmosphere. If the vent tube is routed into a protective sleeve or power track a build up of Oxygen will occur. This build up can cause burning or explosion.

(12A) **Pilot Arc Lead (+)**

- Connect the pilot arc cable to the pilot pin fitting.

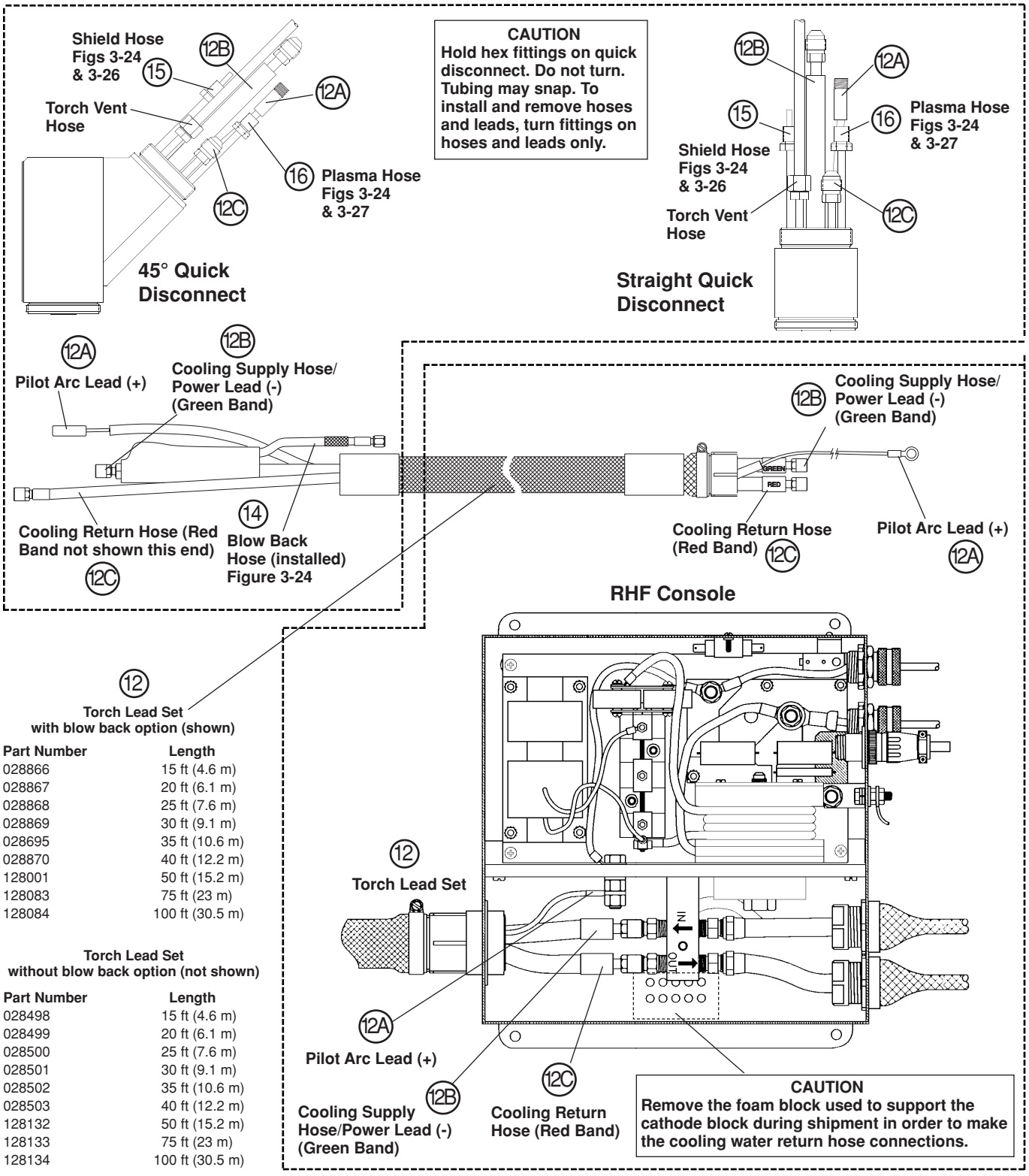
(12B) **Cooling Water Supply Hose /Power Lead (-) (Green)**

- Connect the cooling supply hose (green band) to the water inlet fitting (RH) at the center of the torch.

Caution: Hold hex fitting on inlet tube with wrench, the tube may snap. Turn fitting on torch lead set only.

(12C) **Cooling Water Return Hose (Red)**

- Connect the cooling return hose (red band) to the water outlet fitting (RH).



Part Number	Length
028866	15 ft (4.6 m)
028867	20 ft (6.1 m)
028868	25 ft (7.6 m)
028869	30 ft (9.1 m)
028695	35 ft (10.6 m)
028870	40 ft (12.2 m)
128001	50 ft (15.2 m)
128083	75 ft (23 m)
128084	100 ft (30.5 m)

Torch Lead Set
without blow back option (not shown)

Part Number	Length
028498	15 ft (4.6 m)
028499	20 ft (6.1 m)
028500	25 ft (7.6 m)
028501	30 ft (9.1 m)
028502	35 ft (10.6 m)
028503	40 ft (12.2 m)
128132	50 ft (15.2 m)
128133	75 ft (23 m)
128134	100 ft (30.5 m)

Figure 3-23 RHF Console to Torch Quick Disconnect Interconnections

Gas Console to Off-Valve Assembly Interconnections (Figure 3-24)

(13) The gas lead set interconnections include connecting the torch lead set between the gas console and the off-valve assembly.

Gas Lead Set to Gas Console

Connect the gas lead set to the three fittings and receptacle on the gas console marked **TORCH**.

(13A) **Plasma Gas Hose**

- Connect the hose (clear) to the blue **PLASMA** fitting (LH).

(13B) **Shield Gas Hose**

- Connect the hose (gray) to the green **SHIELD** fitting (RH).

(13C) **Preflow Gas Hose**

- Connect the hose (red) to the red **PREFLOW** fitting (RH).

(13D) **Control Cable**

- Connect the cable plug marked **3X3** to the receptacle marked **3X3.**

Gas Lead Set to Off Valve Assembly

Route the other end of the gas lead set through the power track or festoon to connect to the off-valve assembly. Wrap the hose and lead ends together with electrical tape, so that the ends do not catch while routing.

(13A) **Plasma Gas Hose**

- Connect the hose (clear) to the plasma gas inlet fitting (blue) (LH).

(13B) **Shield Gas Hose**

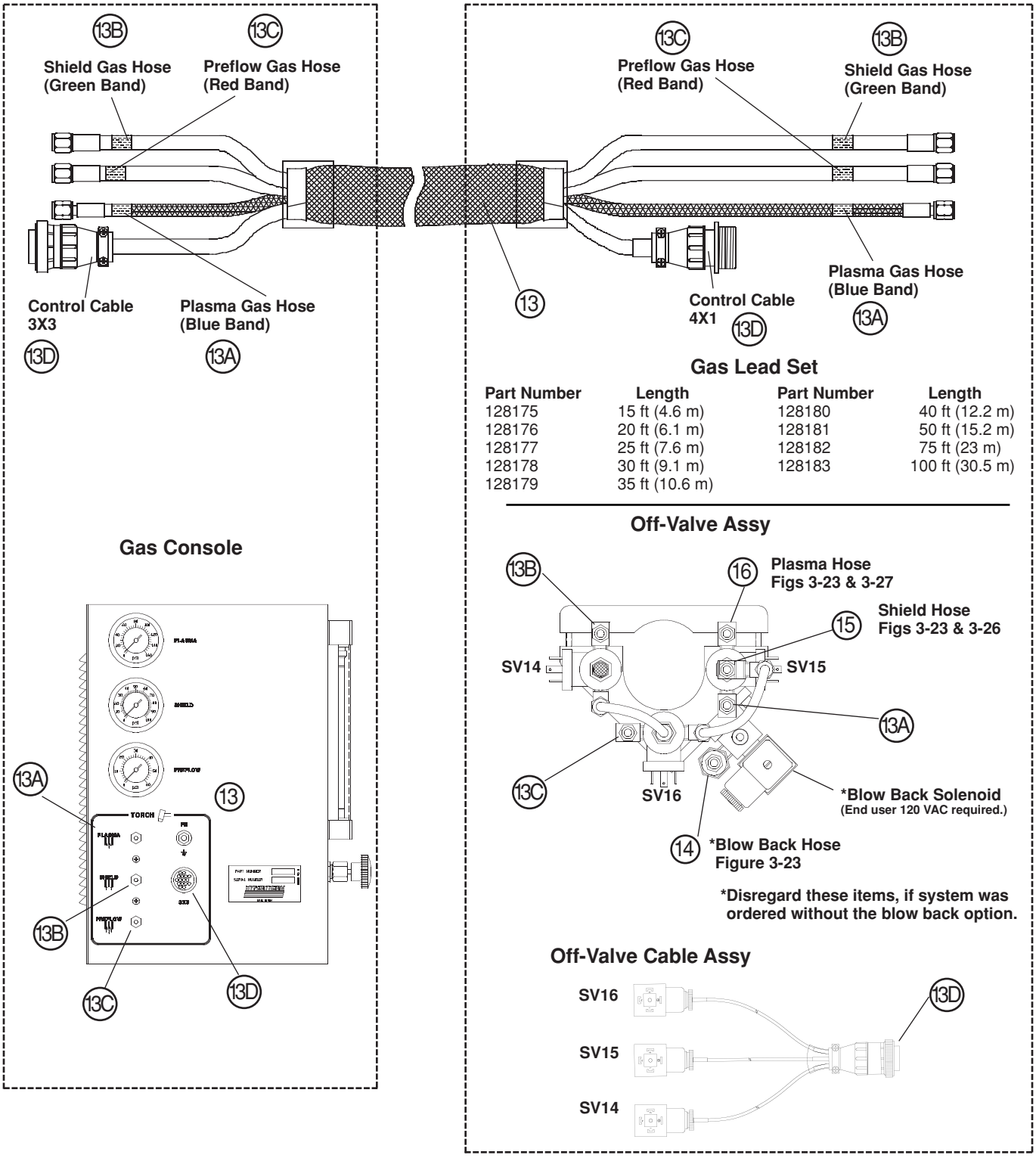
- Connect the hose (gray) to the shield gas inlet fitting (green) (RH).

(13C) **Preflow Gas Hose**

- Connect the hose (red) to the preflow gas inlet fitting (red) (RH).

(13D) **Control Cable**

- Connect the cable plug marked **4X1** to the receptacle marked **4X1**.



Part Number	Length	Part Number	Length
128175	15 ft (4.6 m)	128180	40 ft (12.2 m)
128176	20 ft (6.1 m)	128181	50 ft (15.2 m)
128177	25 ft (7.6 m)	128182	75 ft (23 m)
128178	30 ft (9.1 m)	128183	100 ft (30.5 m)
128179	35 ft (10.6 m)		

Figure 3-24 Gas Console to Off-Valve Assembly Interconnections

Off-Valve Assembly to Torch Quick Disconnect Interconnections (Figures 3-23 and 3-24)

After the torch lead set and gas lead set have been connected, connect the plasma and shield gas hoses and blow back hose between the off-valve assembly and torch quick disconnect. Route plasma and shield gas hoses and blow back hose through strain relief and torch mounting sleeve.

Off-Valve Assembly

⑭ ***Blow Back Hose (Figure 3-24)**

- Connect the blow back hose (from torch lead set) to blow back solenoid.

⑮ **Shield Gas Hose (Figure 3-26)**

- Connect the gray hose to the shield inlet fitting (RH).

⑯ **Plasma Gas Hose (Figure 3-27)**

- Connect the clear hose to the plasma inlet fitting (LH).

Torch Quick Disconnect

Slide the other hose ends through the torch sleeve and connect to torch quick disconnect.

⑮ **Shield Gas Hose**

- Connect the hose (gray) to the shield inlet fitting (RH).

⑯ **Plasma Gas Hose**

- Connect the hose (clear) to the plasma inlet fitting (LH).

Slide the torch sleeve to the torch quick disconnect, mate threaded ends and tighten.

* Not used, if system was ordered without the blow back option.

⑭

Part Number	Length
128491	43 in (1.1 m)

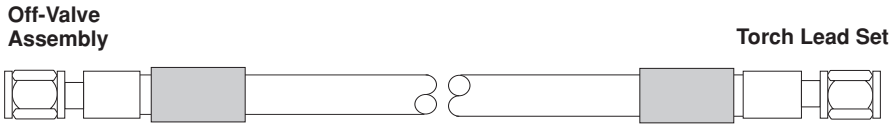


***Figure 3-25 Blow Back Hose Replacement Kit**

⑮

Part Number	Length
024429	4 ft (1.2 m)

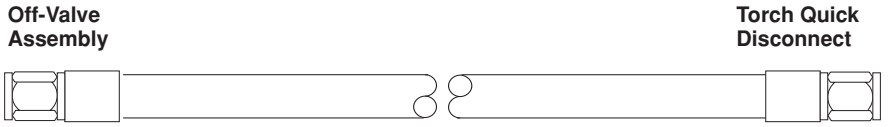


Figure 3-26 Shield Gas Hose Assembly, 3/16 Inch Gray RH "A"

⑯

Part Number	Length
024430	4 ft (1.2 m)

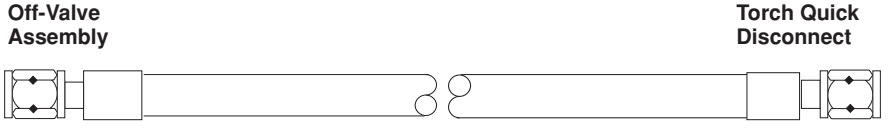


Figure 3-27 Plasma Gas Hose Assembly, LH "A"

* Not used, if system was ordered without the blow back option.

Gas Supply Hose Connections (Figure 3-28)

⑰ Gas Supply Hoses

The gas supply hoses are customer supplied.

- Connect the oxygen (O_2) and nitrogen (N_2) gas supplies from the high pressure regulators to the gas console fittings marked **O_2** and **N_2**.

The gas console fittings marked **AIR**, **CH_4**, and **H35** are for other required cutting gases.

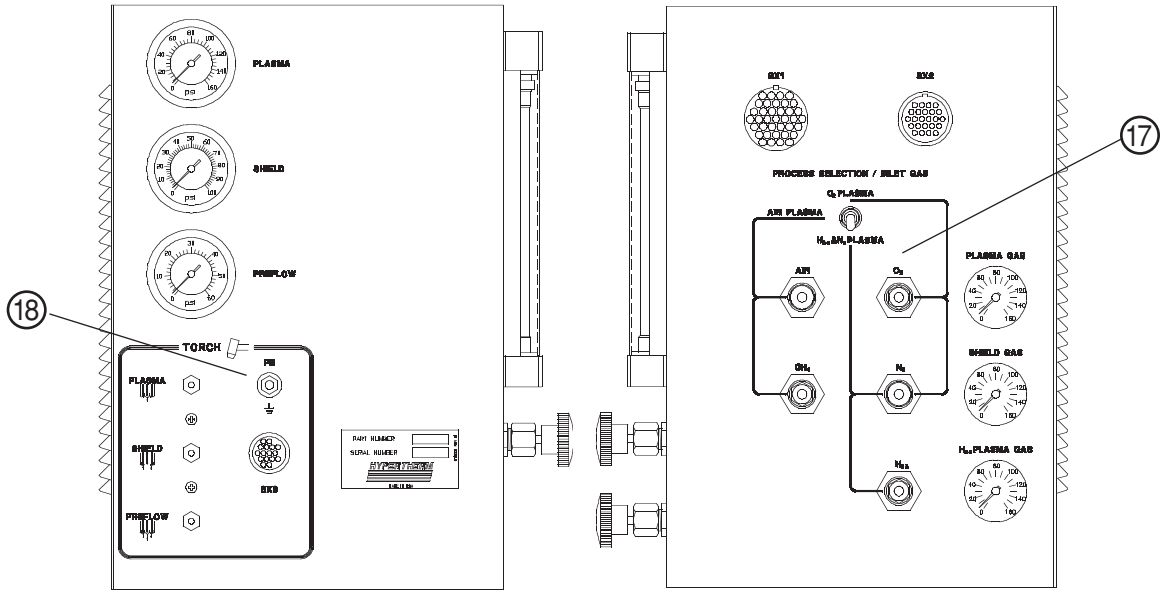


Figure 3-28 Gas Supply Hose and PE Ground Connections

PE Ground Cable Connections (Figures 3-8, 3-9 and 3-28)

⑱ PE Ground Cables

The PE ground cables are customer supplied. The power supply, RHF console and gas console provide connections for protective earth (PE) grounding. Each cable should be connected to the worktable earth ground. Refer to *Pre-Installation, Equipment Grounding* for cable specifications in the front of this section.

Hold Signal Connections (Figures 3-8 and 3-30)

⑲ Hold Signal Terminal Block TB3

The hold signal is used to synchronize the starting of two or more systems. The hold signal is available at TB3 or at the CNC through cable 1X1. Dry contact start. The hold signal cable is customer supplied.

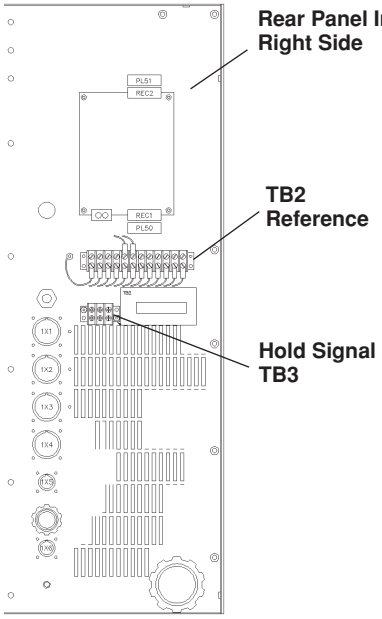


Figure 3-29 TB3 Hold Signal Connection Location

Mount PAC184/PAC186 Torch to Quick Disconnect

1. Align the PAC184 or PAC186 torch ports to the torch quick disconnect receptacle, then push into place. See Figure 3-30.

2. Turn the securing ring clockwise (cw) to lock torch into place.

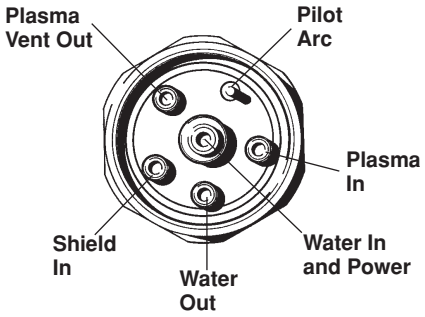


Figure 3-30 PAC184/PAC186 Torch Gas, Coolant and Pilot Arc Port Locations

Torch Coolant Requirements

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

Freezing torch coolant can result in a cracked torch head, leads, or other damage to the torch cooling system. For operating temperatures colder than +10° F (-12° C), the percentage of propylene glycol must be increased. See Figure 3-31.

Coolant will become more conductive the longer it is in service. If the conductivity of the coolant becomes too high, the coolant may conduct torch voltage, resulting in the torch misfiring and can be a shock hazard. Check coolant conductivity whenever the cooling system is serviced.

Conductivity of new coolant mixture should not exceed 10 µ Siemens/cm at 77° F (25° C). Every 6 months, flush the power supply of its torch coolant and replace with new coolant.

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

WARNING

Propylene glycol and benzotriazole are irritating to skin and eyes, and harmful or fatal if swallowed. Upon contact, flush skin or eyes with water. If swallowed drink water and call a physician immediately. Do not induce vomiting.

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

Always use purified water in the coolant mixture in order to prevent corrosion in the torch coolant system. The hardness of purified water should be between 0.206 and 8.5 ppm. If using a conductivity meter to measure water purity, the recommended level is between 0.5 and 18 µ Siemens/cm at 77° F (25° C).

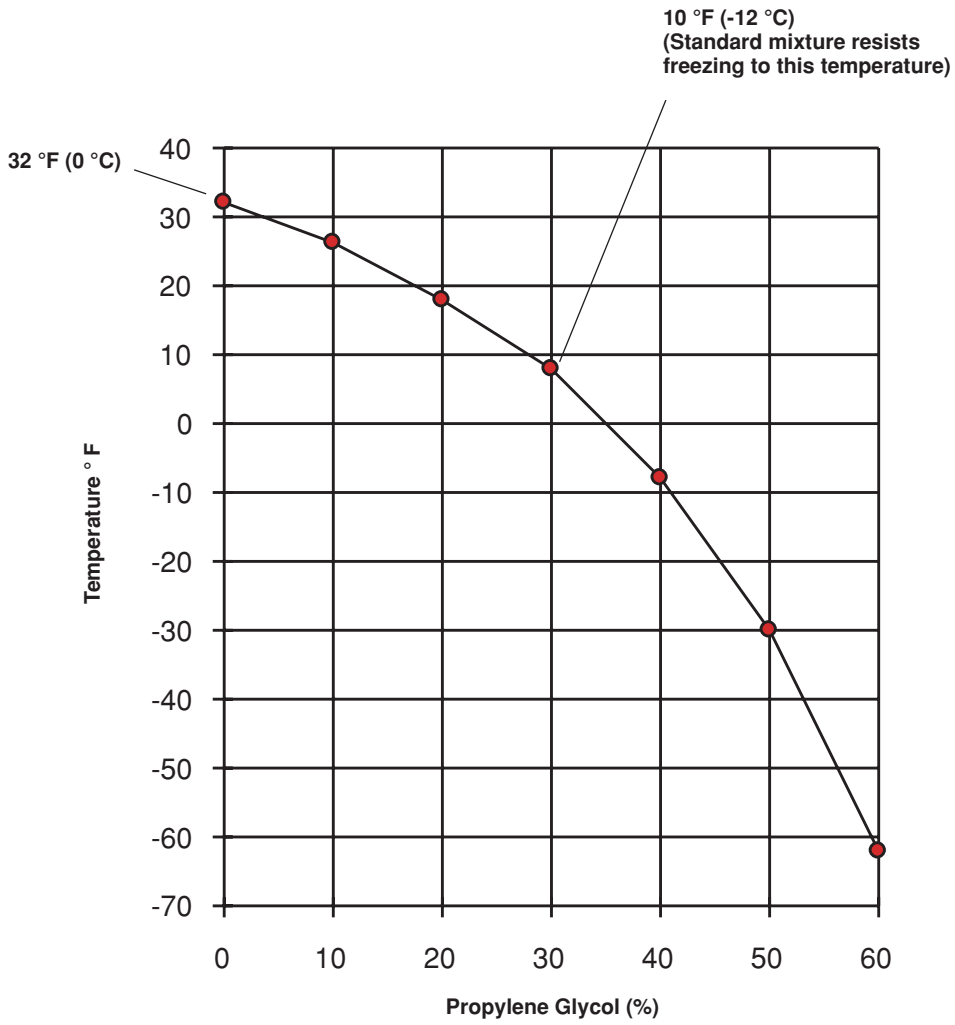


Figure 3-31 Freezing Points of a Mixture of Propylene Glycol (%) and Deionized Water

Filling Torch Coolant System

1. Before proceeding with filling the system with coolant:

   - Ensure that your cutting environment and clothing meet the safety requirements. Refer to *Safety,* Section 1 in this manual.

   - Ensure that all installation requirements in this manual have been met.

   Caution: Never turn the power supply on before filling the tank.

2. Turn on the inlet gas supplies to the gas console. Ensure the gases are available at 120 psi (8.2 bar).

3. At the rear of the power supply, ensure the coolant shutoff valve (1, Figure 3-32) is open and unscrew the filler/vent cap (3) on coolant tank (2). Fill tank with 8.5 quarts (8 liters) of coolant.

   Caution: Do not over fill the tank.

4. At the line voltage disconnect box, set the switch to **On**.

5. Turn on the power supply by depressing and holding the POWER ON (I) pushbutton switch/ indicator (PB1/LT1). The **COOLANT FLOW** LED will remain out until the coolant has pushed all of the air out of the torch cooling hoses and the coolant returns to the tank. This process may take up to 60 seconds.

6. Locate the red button (5, Figure 3-32) on top of the coolant filter (4) at the rear of the power supply. Press the button until a little coolant comes out and no air bubbles are seen in the clear filter housing.

7. When the **COOLANT FLOW** LED illuminates, release the **POWER ON (I)** pushbutton (PB1). The green **POWER ON** indicator (LT1) should light, indicating that the system is operating normally.

8. Observe that the coolant gauge indicates F (Full). Refill the tank when the gauge indicates 1/2 or a little under. Do not allow the coolant to get too low. Low coolant will overheat and cause shorter consumable life.

9. Check for coolant leaks at hose connections at the power supply, RHF console, and torch quick disconnect.

Post Installation

To checkout system operation, refer to Section 4 *Operation.*

LEGEND

(1) Shutoff Valve

(2) Coolant Tank

(3) Filler/Vent Cap

(4) Filter

(5) Pressure Release Button

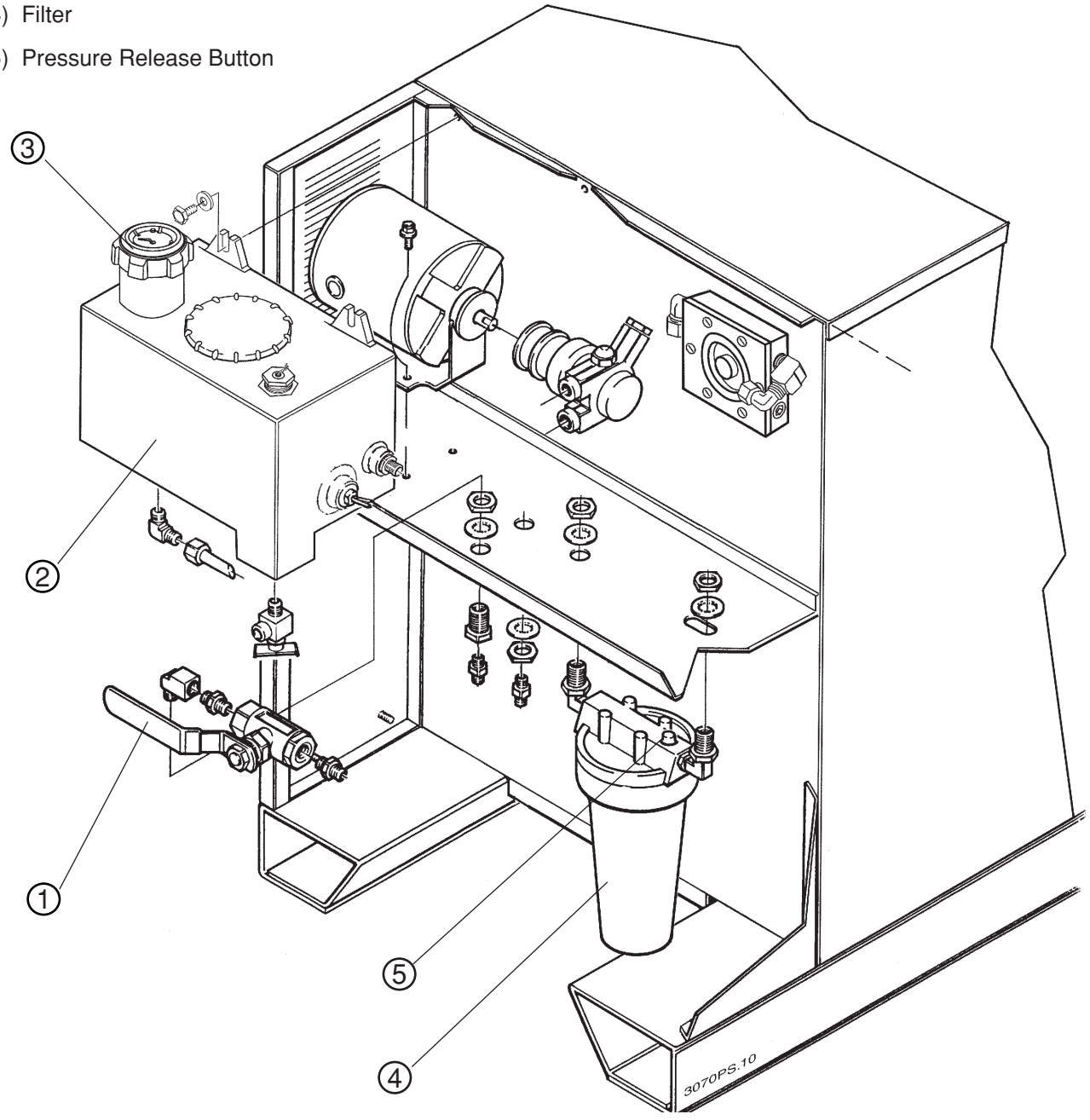


Figure 3-32 Filling Coolant System

Hypertherm

Section 4

OPERATION

In this section:

Controls and Indicators

Power Supply Control Panel (Fig. 4-1)

POWER

- **ON (I)** Pushbutton/indicator switch (PB1/LT1)
  Activates the power supply and its control circuits. Indicator lights when power up is complete.

- **OFF (O)** Pushbutton switch (PB2)
  Shuts the power supply down.

- **DC POWER ON** Indicator (LT2)
  Illuminates when main contactor closes, indicating DC power is being supplied to the torch.

STATUS*

- **RHF INTERLOCK** LED (LT3)
  Illuminates when RHF Console door is closed. Remains extinguished when door is open.

- **OVERTEMP** LED (LT4)
  Illuminates when power supply main transformer or chopper has overheated. Remains extinguished when transformer and chopper are operating within limits.

- **EXT INTERLOCK** LED (LT5)
  Illuminates when customer machine interlock (optional) is closed. Remains extinguished when interlock is open. If not used, the external interlock option must be jumpered (connector 1X1, pins 16 and 17), so that the plasma system will operate.

- **GAS SYSTEM** LED (LT6)
  Illuminates when gas system is operational. Remains extinguished due to gas system error.

- **GAS PRESSURE** LED (LT7)
  Illuminates when plasma and shield gas pressures are above the low level limit of 105 psi (7.2 bar). Remains extinguished when either the plasma or shield gas is below the limit.

- **COOLANT TEMP** LED (LT8)
  Illuminates when coolant temperature is normal. Remains extinguished when coolant temperature is too high.

- **COOLANT FLOW** LED (LT9)
  Illuminates when coolant flow is adequate. Remains extinguished when coolant flow is inadequate.

* All STATUS LEDs extinguish (except for OVERTEMP which illuminates) when the associated fault condition occurs. Most fault conditions will cause the system to shut down causing all STATUS LEDs to extinguish (except for OVERTEMP which illuminates). When this occurs the operator must depress and hold in the POWER ON (1) switch. The first STATUS LED that does not illuminate (except for OVERTEMP which illuminates) indicates the fault condition.

AMPS thumbwheel switch (S1)
Selects the desired cutting current.

PIERCE DELAY potentiometer (P1)
Delays ramp up of current.

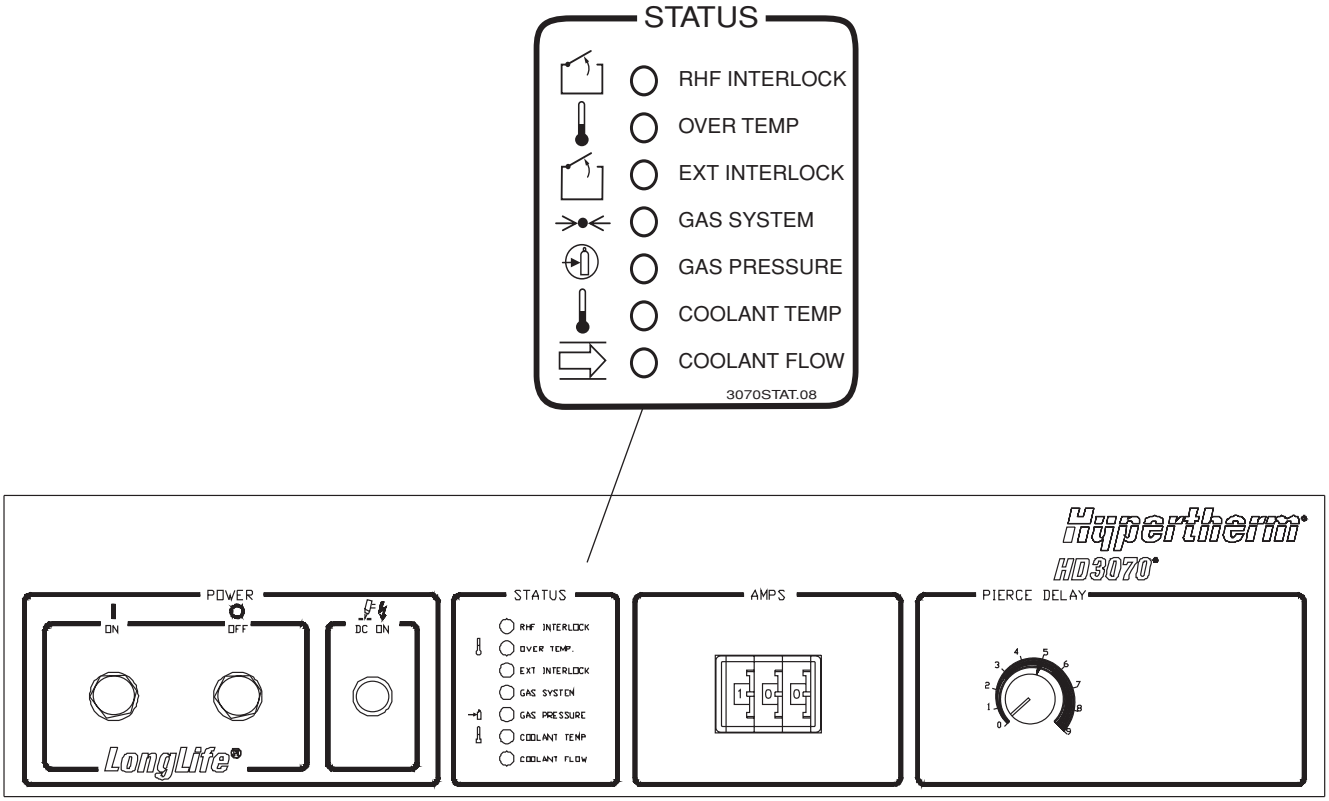


Figure 4-1 HD3070 Power Supply Controls and Indicators

Gas Console (Figure 4-2)

- **PLASMA GAS**, **SHIELD GAS**, and **H35 PLASMA GAS** pressure gauges

PG1 gauge indicates the **H35** gas inlet supply pressure.

PG2 gauge indicates the **O_2/AIR** gas inlet supply pressure.

PG3 gauge indicates the **N_2 /CH_4** gas inlet supply pressure.

- **PROCESS SELECTION/INLET GAS** toggle switch (S1)

S1 SWITCH POSITION	SELECTED PLASMA	SELECTED SHIELD
O2 PLASMA →	O_2	O_2/N_2
AIR PLASMA →	Air	Air/CH_4
H35 & N2 PLASMA →	H35/N_2	N_2

- **TEST PRE/RUN/TEST CUT** toggle switch (S2)

S2 SWITCH POSITION	The contactor is disabled, current is not delivered to the electrode and the arc cannot be fired.	Enables normal operation after the test preflow and test cut flowrates have been set.
TEST CUTFLOW →	Yes	No
RUN →	No	Yes
TEST PREFLOW →	Yes	No

This switch is used to set test preflow and test cut flowrates using the controls described below. Test preflow and test cut flowrates are specified in *Cut Charts* at the end of the section.

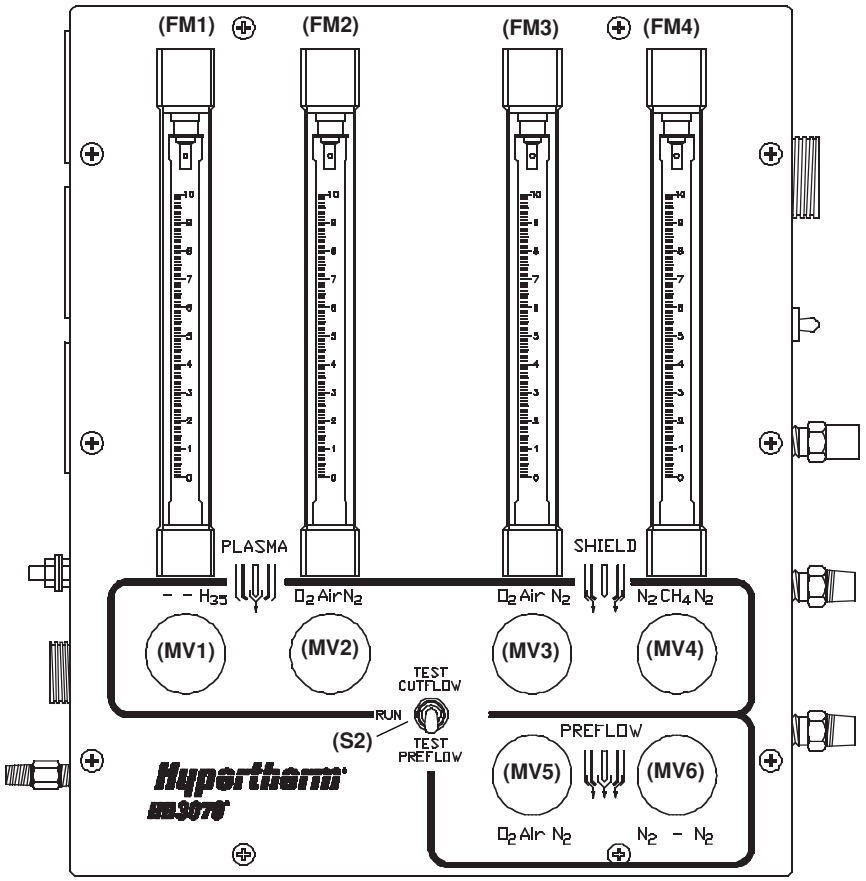
TEST CUT FLOW

- **PLASMA** metering valve (MV1) and **PLASMA** flowmeter (FM1) are used to set the test cut flowrates for H35 gases.
- **PLASMA** metering valve (MV2) and **PLASMA** flowmeter (FM2) are used to set the test cut flowrates for O_2, air, or N_2 gases.
- **PLASMA** pressure gauge (PG4) indicates the pressure of the set plasma gas test cut flowrate. If correct flowrate values cannot be obtained, check gauge and refer to Section 5, *Maintenance* to perform gas system back pressure checks.
- **SHIELD** metering valve (MV3) and flowmeter (FM3) are used to set the test cut flowrates for O_2, air, or N_2 gases.
- **SHIELD** metering valve (MV4) and flowmeter (FM4) are used to set the test cut flowrates for N_2 or CH_4 gases.

- **SHIELD** pressure gauge (PG5) indicates the pressure of the set shield gas test cut flowrates. If correct flowrate values cannot be obtained, check gauge and refer to Section 5, *Maintenance* to perform gas system back pressure checks.

TEST PRE FLOW

- **PREFLOW** metering valve (MV5) and flowmeter (FM3) are used to set the test preflow flowrates for O_2, air, or N_2 gases.
- **PREFLOW** metering valve (MV6) and flowmeter (FM4) are used to set the test preflow flowrates for N_2 gas.
- **PREFLOW** pressure gauge (PG6) indicates the pressure of the set test preflow flowrates. If correct flowrate values cannot be obtained, check gauge and refer to Section 5, *Maintenance* to perform gas system back pressure checks.



Front

Figure 4-2 Gas Console Controls and Indicators (1 of 2)

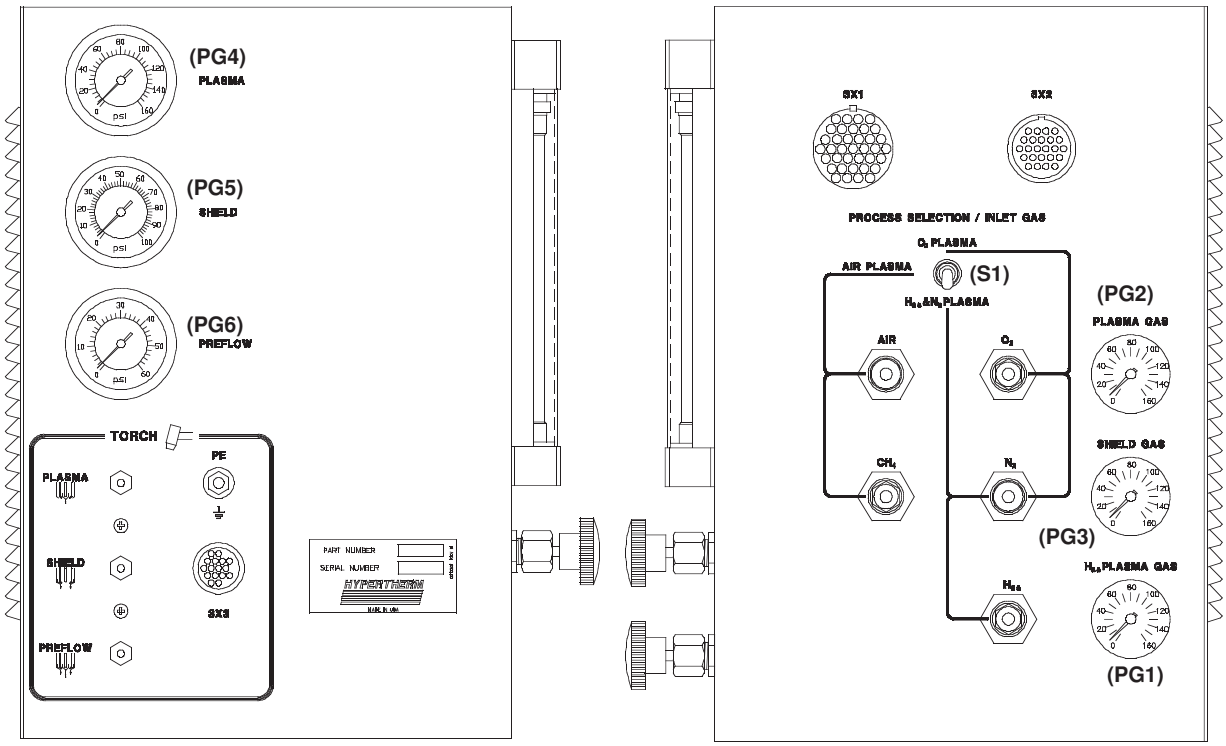


Figure 4-2 Gas Console Controls and Indicators (2 of 2)

Daily Start-Up Procedure

Prior to start-up, ensure that your cutting environment and that your clothing meet the safety requirements outlined in Section 1, *Safety.* If problems occur during start-up, refer to Section 3, *Installation* to check installation requirements and procedures. The daily start-up procedure involves setting up the system for cutting as follows:

1. Check that the consumable parts are not worn or damaged. Refer to *Changing Consumable Parts* in this section.

2. Select cutting current at the **AMPS** thumbwheel (S1).

   Always use the cutting current for which the consumables are rated. For example, do not select 25 or 35 amps for 30 amp consumables. Cutting at a current other than the rated current will cause excessive consumable wear and unpredictable cutting performance. It will also be more difficult to troubleshoot cutting faults, since baseline data does not exist for other than the 30 amp current.

3. Check that the torch is perpendicular to the workpiece to get a clean, vertical cut. Use a square to align the torch. The torch should be aligned at 0° and 90°.

4. Set initial torch height using the suggested initial height data from the *Cut Charts.*

   Torch initial height sensing should be accurate and consistent for good electrode and nozzle life. When the initial height is too high, the pilot arc is prevented or prolonged from transferring to the cutting arc. When the initial height is too low, pierce slag can build up on the shield increasing the chance for a double- arc on subsequent starts. If a pierce is made with the shield touching the workpiece, the molten slag will be forced between the nozzle and shield, rendering the shield gas useless and probably ruining the shield and nozzle.

5. Set arc voltage on torch height control unit (THC) using the suggested arc voltage data from the *Cut Charts.* One (1) arc volt equals approximately .005 inch (.127 mm).

   Arc voltage is typically how the torch height is maintained above the workpiece during a cut. A higher arc voltage will maintain a higher standoff between the torch and workpiece. The arc voltage potential is between the tip of the electrode (actually the bottom of the pit in the hafnium element) and the workpiece being cut. As the electrode tip wears, a pit is formed and the arc voltage may have to be increased to compensate for the longer distance that now exists between the bottom of the pit and the workpiece. For example, after a few hundred starts, the torch will ride closer to the workpiece causing an undercut cut edge. To correct the undercut, simply increase the arc voltage setting by a couple of arc volts. The torch standoff distance will increase, and cut quality will return.

6. Set the **PIERCE DELAY** potentiometer (P1) to the suggested pierce delay data on the *Cut Charts.*

7. Select the plasma gas with the **PROCESS SELECTION** toggle switch (S1) on the gas console right side panel.

8. Check that the gas inlet supplies are connected and available at 120 psi (8.2 bar) on the **inlet gas** pressure gauges (PG1, PG2, and PG3). **It is important to keep equal values of the pressures to obtain the correct mixtures of the gases.**

9. Set the main disconnect switch for the power supply to **On**.

10. Turn on the power supply by depressing the **POWER ON (1)** switch (PB1). Check that the green **POWER ON** indicator (LT1) lights. If not, check the **STATUS** LEDs. Refer to *Front Panel Controls and Indicators* in this section.

11. Establish plasma and shield gas flows for cutting as follows**.**

    • Set **TEST PRE**/**RUN**/**TEST CUT** toggle switch (S2) on the gas console to **TEST CUTFLOW**.

    Note: The metering valves normally turn hard. Do not loosen the packing nut around the valve stems to make the valves turn more easily. Loosening the packing nuts breaks the seals and allows gases to leak out around the valve stems.

    • Turn the **PLASMA** metering valves (MV1 and MV2) to set required flowrates on flowmeters (FM1 and FM2). See *Cut Charts* for required flowrates.

    • Turn the **SHIELD** metering valves (MV3 and MV4) to set required flowrates on flowmeters (FM3 and FM4). See *Cut Charts* for required flowrates.

12. Establish preflow gas flows as follows**.**

    • Set **TEST PRE**/**RUN**/**TEST CUT** toggle switch (S2) on the gas console to **TEST PREFLOW**.

    • Turn the **PREFLOW** metering valves (MV5 and MV6) to set the required flowrates on flowmeters (FM3 and FM4). See *Cut Charts* for required flowrates.

13. If correct flowrate values cannot be obtained, check the associated pressure gauges on the left side of the gas console to check the back pressure. Refer to the Section 5, *Maintenance,* to perform the gas system back pressure check.

14. Purge the gas lines by positioning the **TEST PRE**/**RUN**/**TEST CUT** toggle switch (S2) on the gas console to **TEST CUTFLOW** for 20 seconds and then position the switch to **TEST PREFLOW** for 20 seconds. After purging the gas lines, set the switch to **RUN**.

15. The system is now ready for operation.

Changing Consumable Parts

WARNING

Always disconnect the power supply from the main power source before inspecting or changing the torch parts.

Inspect torch consumable parts before cutting for wear and damage, and replaced when needed. The PAC184 and PAC186 torch consumable parts kits (refer to Section 6, *Parts List* contain tools for removal and inspection of the consumable parts. To remove, inspect and replace the consumables, proceed as follows. See Figures 4-3 – 4-6.

Removal and Inspection

1. Remove the shield cap and inspect shield for plugged holes or damage. To remove the shield, push on it until it releases. Check the O-ring for wear and damage.

2. Remove the inner cap and inspect for plugged holes or damage.

3. Remove the nozzle using the removal tool. Check for wear and arcing. Also check the O-rings for wear and damage.

4. Remove the electrode using the removal tool. The electrode should be inspected and replaced if there is a pit .040 inch (1 mm) deep. See Figure 4-6 in order to check the pit depth. Check the O-ring for wear and damage.

5. Remove the swirl ring using the removal tool. Insert the tool into the swirl ring until it catches on the lip and then pull back to remove swirl ring. Inspect the swirl ring for plugged holes or damage. Check the O-rings for wear and damage.

Replacement

Do not use an excessive amount of silicone grease when applying to any of the consumable O-rings. Excess grease can easily plug ports and holes, causing improper gas flow during operation. Only apply a light coat of silicone grease.

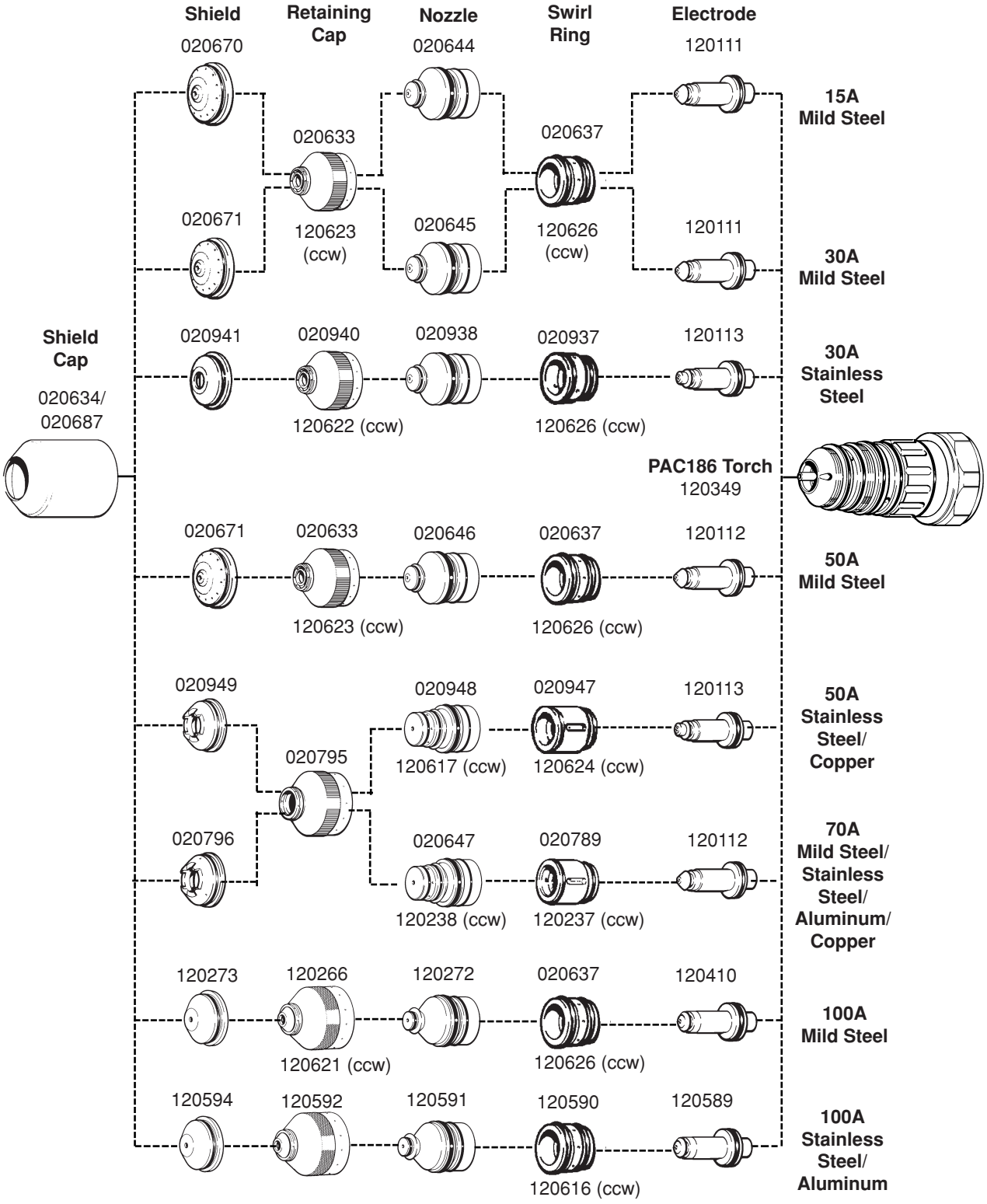
Avoid touching the tip of the electrode during installation as grease or dirt may affect starting reliability. Check the electrode tip and wipe clean if necessary.

1. Apply silicone to the electrode O-ring and then to both O-rings on the swirl ring.

2. Insert the electrode into the small diameter end of the swirl ring, then insert the swirl ring (large diameter end) into the nozzle. Apply silicone to the nozzle O-rings, then insert the nozzle into the torch and push it into place.

3. Inspect the threads on the torch main body, and clean threads if necessary. Apply silicone to the O-rings on the torch main body.

(Continued on page 4-12)



CCW (counter clockwise) consumables are available for mirror image cutting.

Figure 4-3 PAC186 Torch Consumable Parts

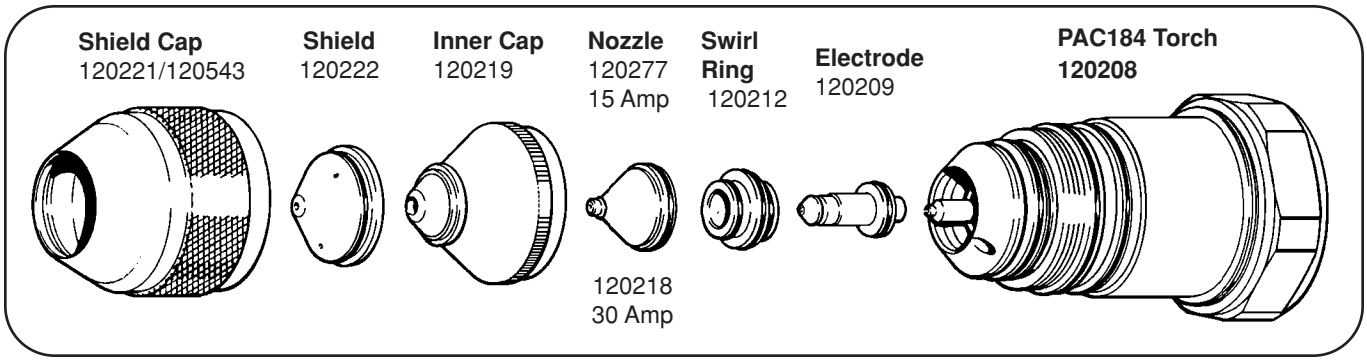


Figure 4-4 PAC184 Torch 15 and 30 Amp Mild Steel Consumable Parts

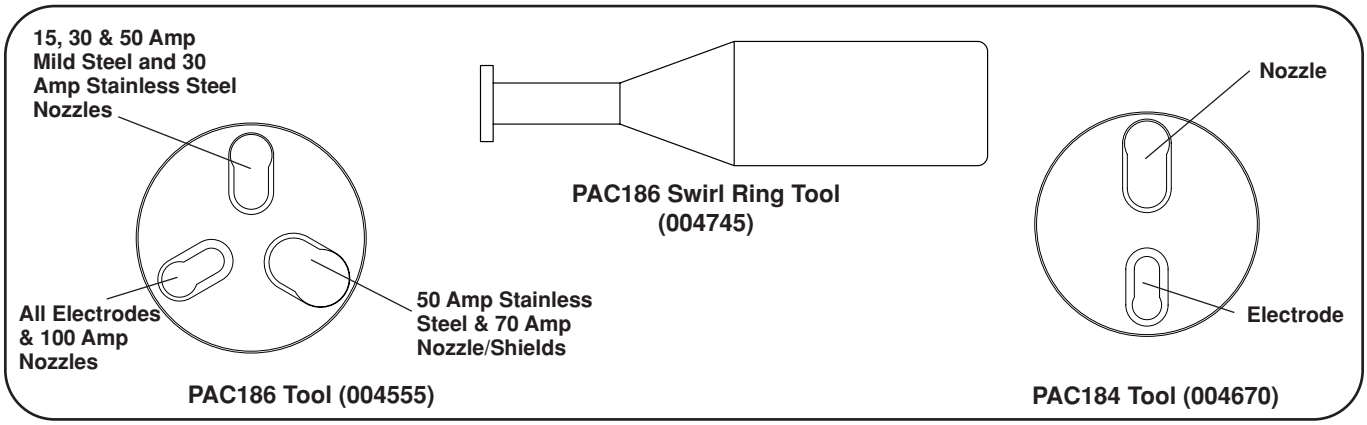
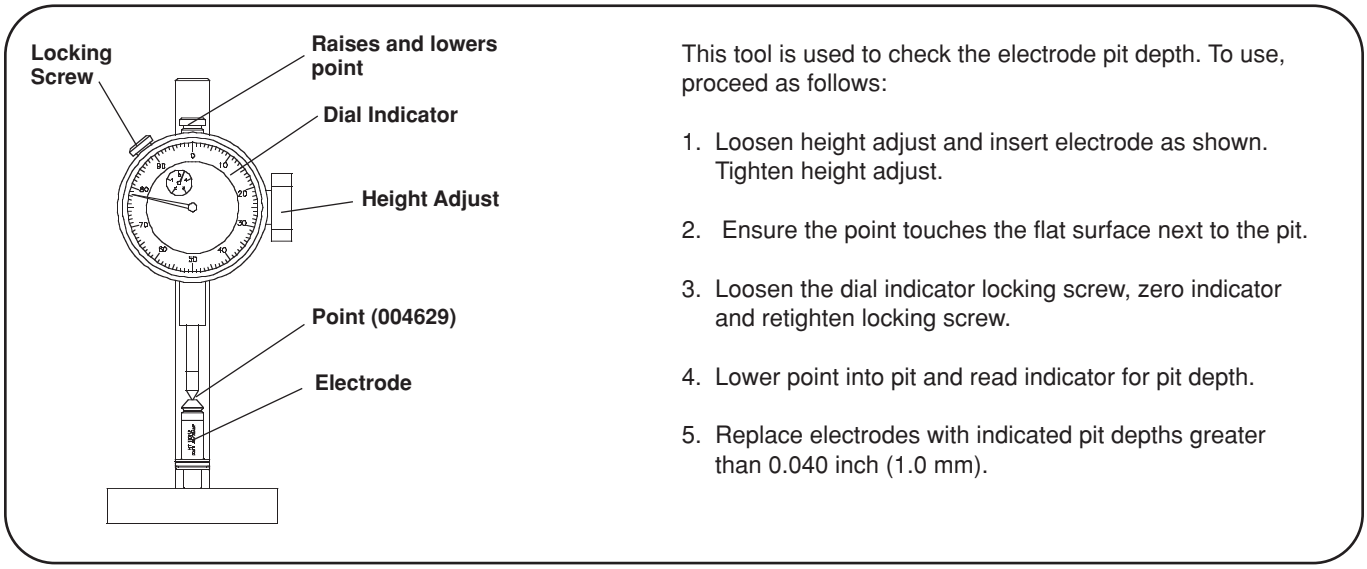


Figure 4-5 Consumable Removal Tools



This tool is used to check the electrode pit depth. To use, proceed as follows:

1. Loosen height adjust and insert electrode as shown. Tighten height adjust.
2. Ensure the point touches the flat surface next to the pit.
3. Loosen the dial indicator locking screw, zero indicator and retighten locking screw.
4. Lower point into pit and read indicator for pit depth.
5. Replace electrodes with indicated pit depths greater than 0.040 inch (1.0 mm).

Figure 4-6 Electrode Pit Depth Gauge (004630)

4. Install the inner cap on to the torch main body. **Hand tighten the inner cap snugly to ensure good electrical contact. Do not overtighten.**

5. Install the shield cap with the shield in place on to the torch main body. If the shield is not in place, apply silicone to the O-ring and insert the shield into the shield cap and push into place. **Hand tighten the shield cap snugly. Failure to tighten the shield cap snugly could result in poor electrical contact and water and gas leaks which will impair cut quality.**

Blow Back Option to Purge Coolant Hoses

Before removing the PAC184 or PAC186 torch, the operator may want to purge the torch coolant from the coolant hoses back into the coolant tank to minimize the coolant dripping when the torch is disconnected from the quick disconnect. After replacing the torch, the coolant hoses should be refilled with coolant. Refer to the procedures below.

Purge Coolant Hoses (Blow Back)

1. Shut the power supply down at the control panel or CNC.

2. At off-valve assembly (Fig. 4-7) connect 1/4-inch air hose to air inlet.

3. Connect 120 VAC power cable from CNC or other source to blow back solenoid valve.

4. Apply air at approximately 20 psi (1.4 bar) to the air inlet. **Air supply should be clean, dry and oil free in order not to contaminate the coolant.**

5. Apply 120 VAC signal for about 3 seconds to open the solenoid valve in order to purge the coolant from the hoses. I**t is not necessary to purge longer than 3 seconds.**

6. After the coolant hoses have been purged, disconnect the torch from the torch quick disconnect.

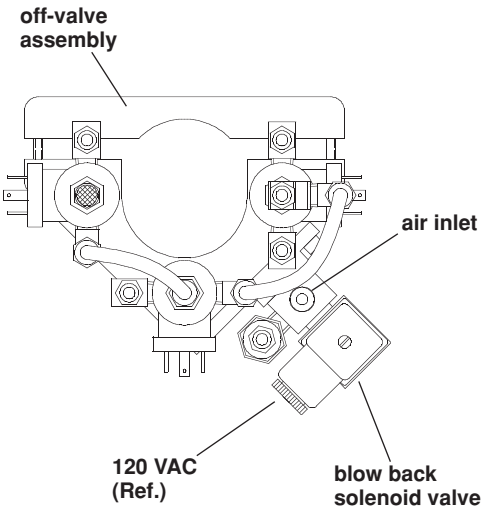


Figure 4-7 Coolant Purging Setup

Refill Coolant Hoses

1. Reconnect torch to the torch quick disconnect.

2. Apply power to the power supply at the control panel or from CNC.
   If at the power supply, depress and hold the **POWER ON** pushbutton switch until the **COOLANT FLOW** LED lights. If at the CNC, maintain the Power On signal until the **COOLANT FLOW** LED lights.

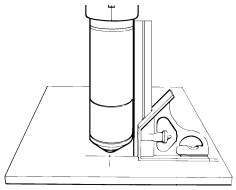
   When the **COOLANT FLOW** LED lights, release the **POWER ON** switch at the power supply or the Power On signal at the CNC. The green **POWER ON** indicator should remain on, indicating that the system is operating normally.

   (The **COOLANT FLOW** LED will remain out until the coolant has pushed all of the air out of the torch cooling hoses and the coolant returns to the tank. However, coolant hoses with too many bends can have air pockets even though the **COOLANT FLOW** LED lights and the system appears ready for operation. **The trapped air can cause the torch to lose cooling momentarily and potentially cause damage to the torch**.)

How to Optimize Cut Quality

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

Tips for Table and Torch



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

Plasma Set-Up Tips

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

Purge the gas lines before cutting.

Maximize the Life of Consumable Parts

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

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

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

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

Additional Factors of Cut Quality

Cut Angle

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

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

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

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

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

Dross

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

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

- Decrease the cutting speed.
- Decrease arc voltage, to decrease the torch-to-work distance.
- Increase O_2 in the shield gas to increase the range of dross-free cutting speeds. (Only HyDefinition and HT4400 systems can accommodate mixed-gas shield gases.)

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

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

Worn or damaged consumables may produce intermittent dross.

Straightness of the Cut Surface

A typical plasma cut surface is slightly concave.

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

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

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

Additional Improvements

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

Smoothness of Cut Surface (Surface Finish)

- (HyDefinition and HT4400 only) On mild steel, a higher concentration of N_2 in the O_2-N_2 shield mixture may produce a smoother cut surface.
  Trade-off: This may produce more dross.

- (HyDefinition and HT4400 only) On mild steel, a higher concentration of O_2 in the O_2-N_2 shield mixture may increase the cutting speed and produce less dross.
  Trade-off: This may produce a rougher cut surface.

Piercing

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

- A higher shield gas preflow may help blow the molten metal away during piercing.
  Trade-off: This may reduce starting reliability.

  Note: When piercing at maximum thicknesses, the ring of dross that forms during the pierce may be high enough to contact the torch when the torch begins to move after the pierce is complete. A “flying pierce,” which makes the pierce while the torch is moving, may eliminate the torch vibration that follows contact between the torch and the ring of dross.

How to Increase Cutting Speed

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

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

Technical Questions

Claims for defective merchandise – All units shipped from Hypertherm undergo quality control testing. However, if your system does not function correctly:

1. Recheck all pre-installation and installation and post-installation requirements and connections in Section 3, *Installation*.

2. If you are unable to solve the problem, call your distributor. They will be able to help you, or refer you to an authorized Hypertherm repair facility.

3. If you need assistance, call Customer Service or Technical Service listed in the front of this manual.

Operating Data (Cut) Charts

The *Cut Charts* on the following pages are optimized to provide the best cut angle, least dross and best cut surface finish. Keep in mind that these charts provide a good starting point and that optimum cutting must be tuned to the application and materials on site. Increasing cut speed, lowering the torch standoff, higher current consumables on thinner metals or increasing the oxygen ratio in the shield mix, for example, all present certain tradeoffs as mentioned in *How to Get Better Cut Quality*. Depending on the cutting application, it is up to the operator to determine if the tradeoffs are acceptable.

The cut charts also provide part numbers and illustrations of the consumables required to cut at specific amperages. For more detailed information, refer to the gas console control and indicator descriptions and the daily start-up procedure at the front of this section.

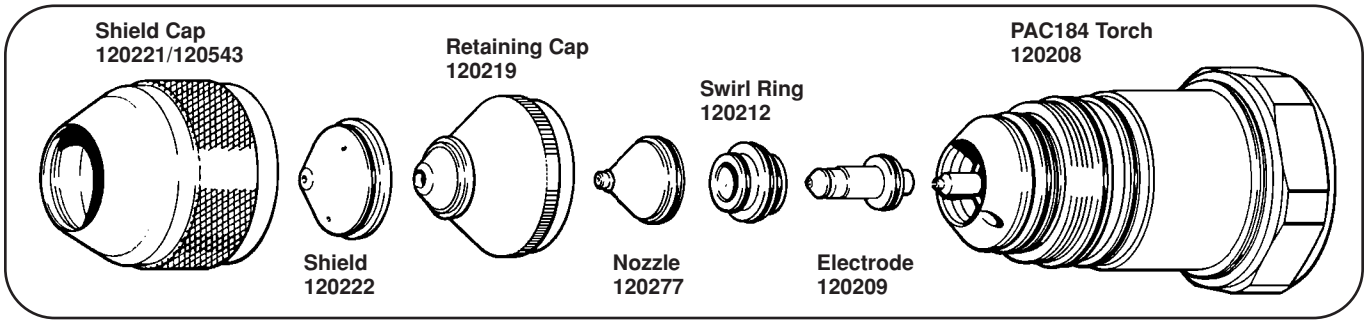
Cut Chart Index

PAC184

Mild Steel

O_2 Plasma / O_2 & N_2 Shield

15 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		(GA)	(in)	(mm)	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
						26	**0.018**	**0.5**	134	0.020	0.5	145	3.68	0.040	1.0	0	0.05
						24	**0.024**	**0.6**	135	0.020	0.5	129	3.28	0.040	1.0	0	0.05
						22	**0.030**	**0.8**	136	0.020	0.5	115	2.92	0.040	1.0	0	0.05
						20	**0.036**	**0.9**	136	0.020	0.5	100	2.54	0.040	1.0	0	0.05
—	40	30	10	5	75	**18**	**0.048**	**1.3**	137	0.020	0.5	85	2.16	0.040	1.0	0.5	0.16
						16	**0.060**	**1.5**	142	0.030	0.8	65	1.65	0.040	1.0	1	0.27
						14	**0.075**	**1.9**	144	0.040	1.0	45	1.14	0.060	1.5	1.5	0.37
						12	**0.105**	**2.7**	148	0.040	1.0	35	0.90	0.060	1.5	2	0.50
						10	**0.135**	**3.4**	151	0.040	1.0	25	0.64	0.060	1.5	2.5	0.60

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

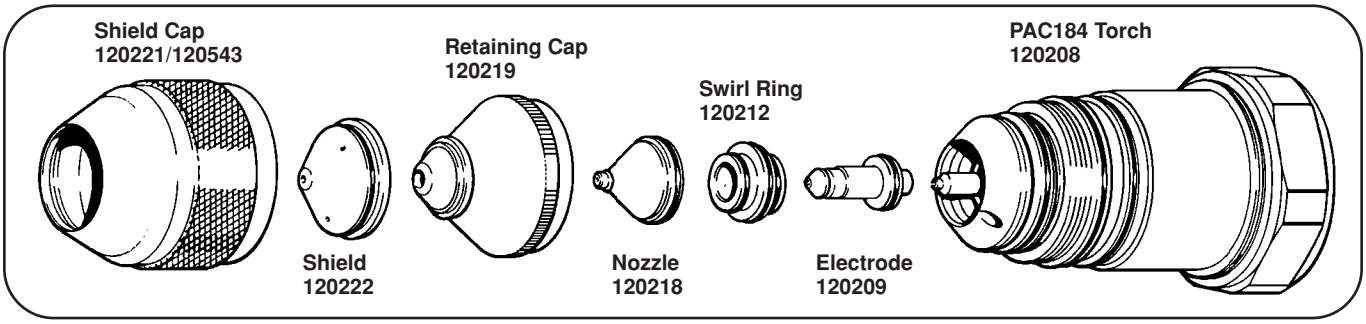
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC184

Mild Steel

O_2 Plasma / O_2 & N_2 Shield

30 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		**(GA)**	**(in)**	**(mm)**	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
						24	**0.024**	**0.6**	117	0.030	0.8	200	5.08	0.060	1.5	0	0.05
						22	**0.030**	**0.8**	121	0.030	0.8	170	4.32	0.060	1.5	0	0.05
						20	**0.036**	**0.9**	125	0.040	1.0	140	3.56	0.080	2.0	0	0.05
						18	**0.048**	**1.3**	128	0.040	1.0	110	2.80	0.080	2.0	0	0.05
—	46	15	5	5	75	**16**	**0.060**	**1.5**	128	0.040	1.0	80	2.03	0.080	2.0	0	0.05
						14	**0.075**	**1.9**	128	0.040	1.0	60	1.52	0.080	2.0	0.5	0.16
						12	**0.105**	**2.7**	135	0.060	1.5	50	1.27	0.100	2.5	1	0.27
						10	**0.135**	**3.4**	135	0.060	1.5	35	0.90	0.100	2.5	1.5	0.37
							3/16	**4.8**	135	0.060	1.5	32	0.81	0.100	2.5	2	0.50
		30	10				**1/4**	**6.4**	136	0.040	1.0	25	0.64	0.100	2.5	2.5	0.60

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

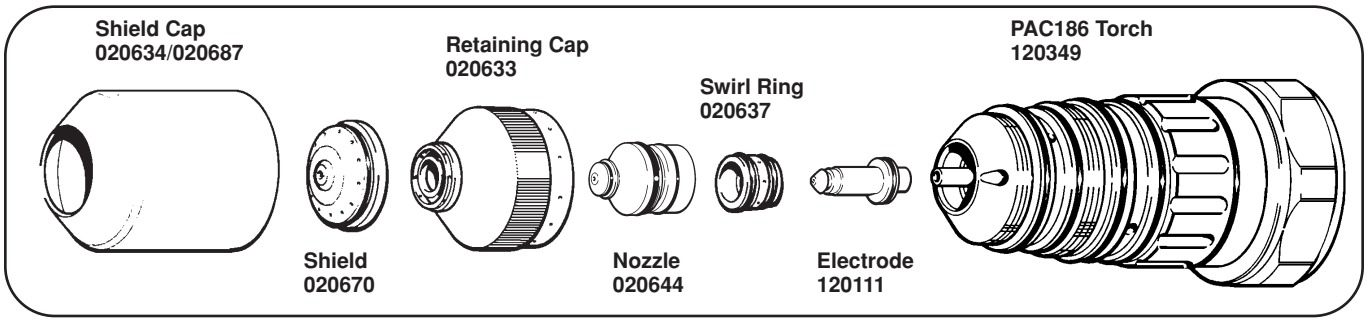
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Mild Steel

O_2 Plasma / O_2 & N_2 Shield

15 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage ***	Torch-to-Work Distance **, ***		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		**(GA)**	**(in)**	**(mm)**	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	40	30	10	5	75	**20**	**0.036**	**0.9**	120	0.020	0.5	100	2.54	0.040	1.0	0	0.1
						18	**0.048**	**1.3**	121	0.020	0.5	85	2.16	0.040	1.0	0	0.1
						16	**0.060**	**1.5**	124	0.030	0.8	65	1.65	0.040	1.0	.5	0.2
						14	**0.075**	**1.9**	130	0.040	1.0	45	1.14	0.060	1.5	1	0.3
						12	**0.150**	**2.7**	132	0.040	1.0	35	0.90	0.060	1.5	1.5	0.4
						10	**0.135**	**3.4**	134	0.040	1.0	25	0.64	0.060	1.5	2	0.50

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** To maintain the 0.020 inch (0.5 mm) torch standoff as the electrode wears, the arc voltage may have to be increased to avoid having the torch dive into the plate.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

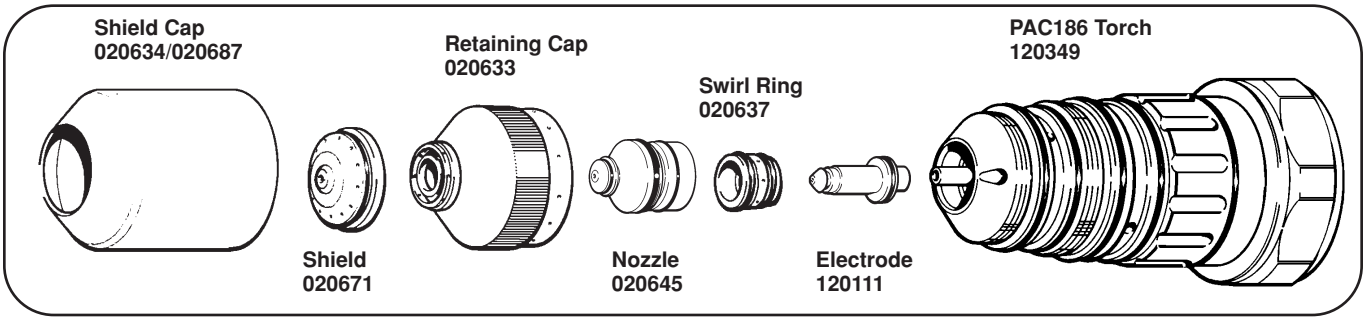
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Mild Steel

O_2 Plasma / O_2 & N_2 Shield

30 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		(GA)	(in)	(mm)	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
						24	**0.024**	**0.6**	103	0.030	0.8	200	5.08	0.040	1.0	0	0
						22	**0.030**	**0.8**	108	0.030	0.8	170	4.32	0.040	1.0	0	0
						20	**0.036**	**0.9**	110	0.040	1.0	140	3.56	0.060	1.5	0	0
						18	**0.048**	**1.3**	112	0.040	1.0	110	2.80	0.060	1.5	0	0
—	46	15	5	5	75	**16**	**0.060**	**1.5**	115	0.040	1.0	80	2.03	0.060	1.5	0	0.1
						14	**0.075**	**1.9**	118	0.040	1.0	60	1.52	0.060	1.5	0	0.1
						12	**0.105**	**2.7**	121	0.060	1.5	50	1.27	0.080	2.0	.5	0.2
						10	**0.135**	**3.4**	124	0.060	1.5	35	0.90	0.080	2.0	1	0.3
							3/16	**4.8**	125	0.060	1.5	32	0.81	0.080	2.0	1.5	0.4
		30	10				**1/4**	**6.4**	124	0.040	1.0	25	0.64	0.080	2.0	2	0.5

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

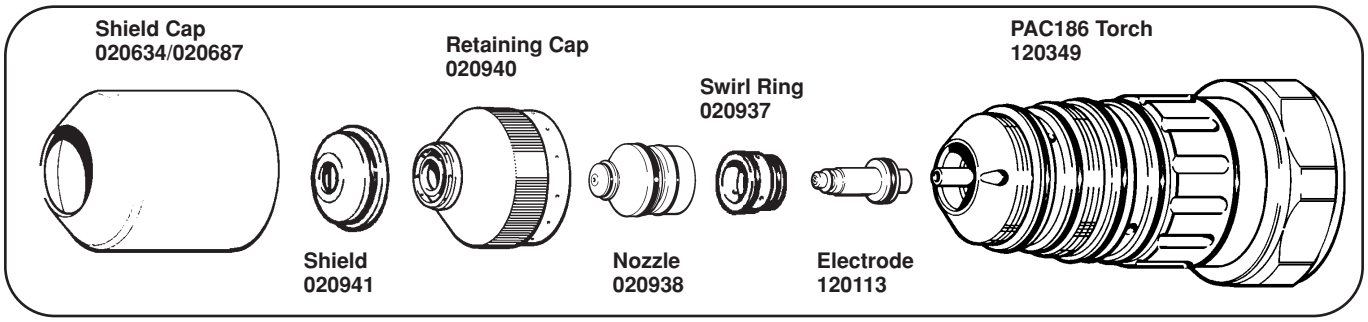
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Stainless Steel#

Air Plasma / Air Shield

30 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage ***	Torch-to-Work Distance ** *** ,		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
—	Air	Air	—	Air	—												
(White)		(White)		(White)		(GA)	(in)	(mm)	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	60	30	0	75	0	**27**	**0.016**	**0.4**	70-75	0.020	0.5	250	6.35	0.040	1.0	0	0
						24	**0.024**	**0.6**	70-75	0.020	0.5	220	5.59	0.040	1.0	0	0
						22	**0.030**	**0.8**	70-75	0.020	0.5	200	5.08	0.040	1.0	0	0.1
						20	**0.036**	**0.9**	70-75	0.020	0.5	180	4.57	0.040	1.0	0	0.1
						18	**0.048**	**1.3**	73-78	0.020	0.5	150	3.81	0.060	1.5	.5	0.2
						16	**0.060**	**1.5**	73-78	0.020	0.5	120	3.05	0.060	1.5	.5	0.2

Air inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Stainless steel plate sometimes comes with a protective plastic film. Remove film prior to cutting.

* Slightly increasing the test preflow Air flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** To maintain the 0.020 inch (0.5 mm) torch standoff as the electrode wears, the arc voltage may have to be increased to avoid having the torch dive into the plate.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

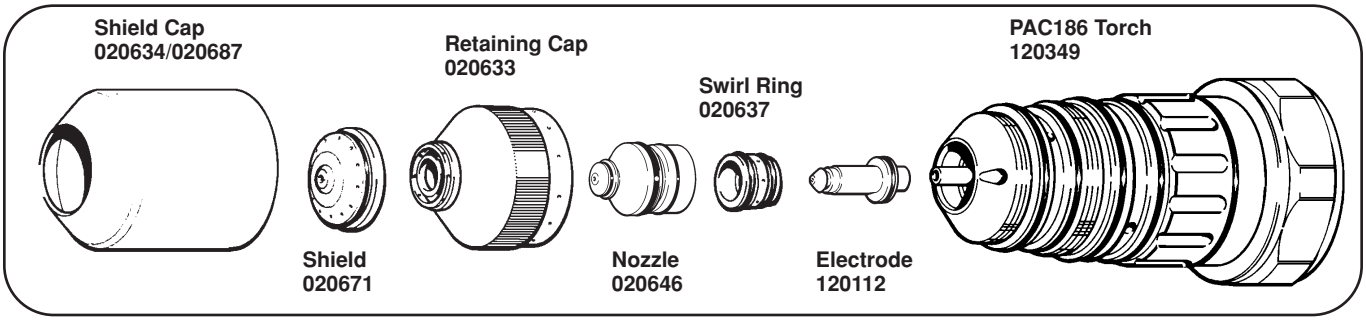
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Mild Steel

O_2 Plasma / O_2 & N_2 Shield

50 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		(GA)	(in)	(mm)	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	40	40	0	5	75	**22**	**0.030**	**0.8**	103	0.040	1.0	270	6.86	0.060	1.5	0	0
						20	**0.036**	**0.9**	103	0.040	1.0	210	5.33	0.060	1.5	0	0
						18	**0.048**	**1.3**	104	0.040	1.0	160	4.06	0.060	1.5	0	0
						16	**0.060**	**1.5**	109	0.050	1.3	120	3.05	0.080	2.0	0	0
						14	**0.075**	**1.9**	113	0.050	1.3	100	2.54	0.080	2.0	0	0
						12	**0.105**	**2.7**	119	0.050	1.3	75	1.91	0.100	2.5	0	0.1
						10	**0.135**	**3.4**	122	0.060	1.5	55	1.40	0.100	2.5	.5	0.2
							3/16	**4.8**	124	0.060	1.5	45	1.14	0.100	2.5	1	.03
	60	60					**1/4**	**6.4**	127	0.080	2.0	35	0.90	0.120	3.0	2	0.5

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

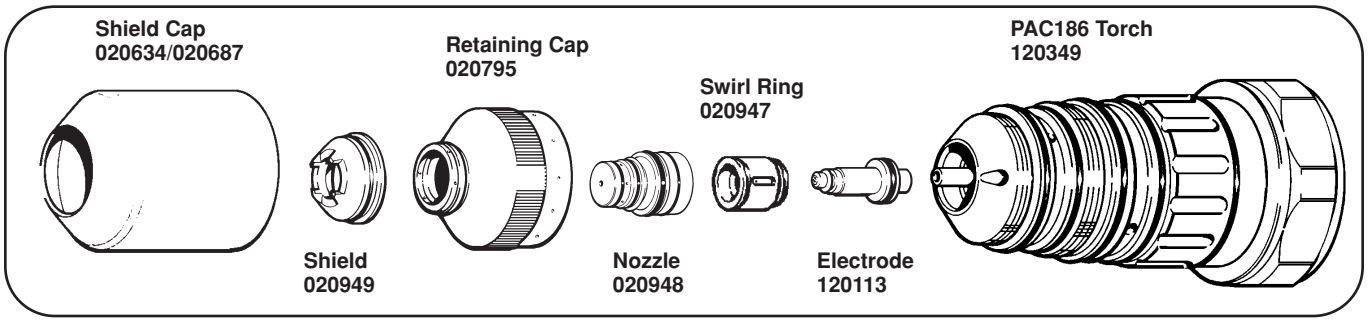
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Stainless Steel#

Air Plasma / Air Shield

50 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch-to-Work Distance**		Cutting Speed		Pierce Height ***		Pierce Delay	
Plasma		Shield		Preflow													
—	Air	Air	—	Air	—												
(White)		(White)		(White)		(GA)	(in)	(mm)	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
0	40	80	0	60	0	**14**	**0.075**	**1.9**	100	0.040	1.0	120	3.05	0.120	3.0	1	0.3
		80				**12**	**0.105**	**2.7**	100	0.040	1.0	80	2.03	0.120	3.0	1.5	0.4
		60				**10**	**0.135**	**3.4**	110	0.060	1.5	55	1.40	0.120	3.0	1.5	0.4
		50					**3/16**	**4.8**	115	0.080	2.0	40	1.02	0.160	4.0	2	0.5

Air inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Stainless steel plate sometimes comes with a protective plastic film. Remove film prior to cutting.

* Slightly increasing the test preflow Air flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020949.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

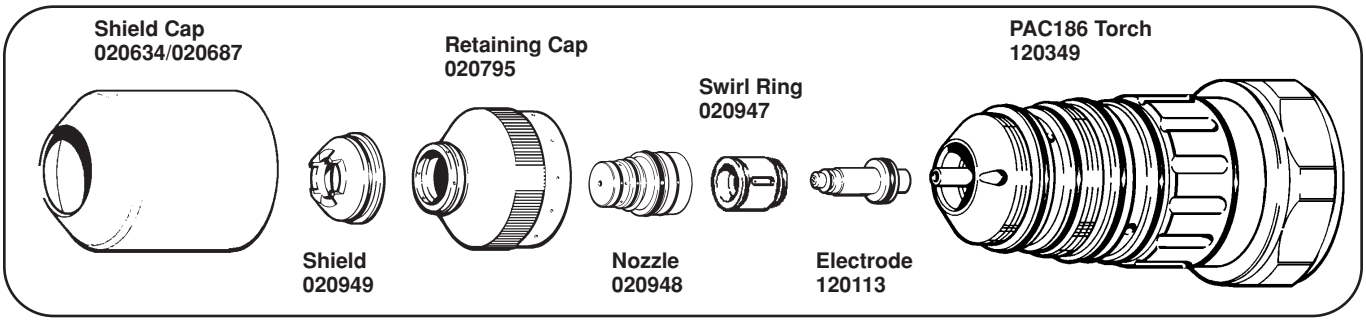
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Copper#

O_2 Plasma / O_2 & N_2 Shield

50 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch-to-Work Distance**		Cutting Speed		Pierce Height ***		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		**(GA)**	**(in)**	**(mm)**	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	40	20	10	35	40	**16**	**0.060**	**1.5**	92	0.080	2.0	70	1.78	0.100	2.5	4	1.0
						14	**0.075**	**1.9**	92	0.080	2.0	70	1.78	0.100	2.5	4	1.0
						12	**0.150**	**2.7**	94	0.080	2.0	65	1.65	0.100	2.5	7	1.5
						10	**0.135**	**3.4**	94	0.080	2.0	65	1.65	0.100	2.5	9	2.0

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Copper plate sometimes comes with a protective plastic film. Remove film prior to cutting.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020949.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

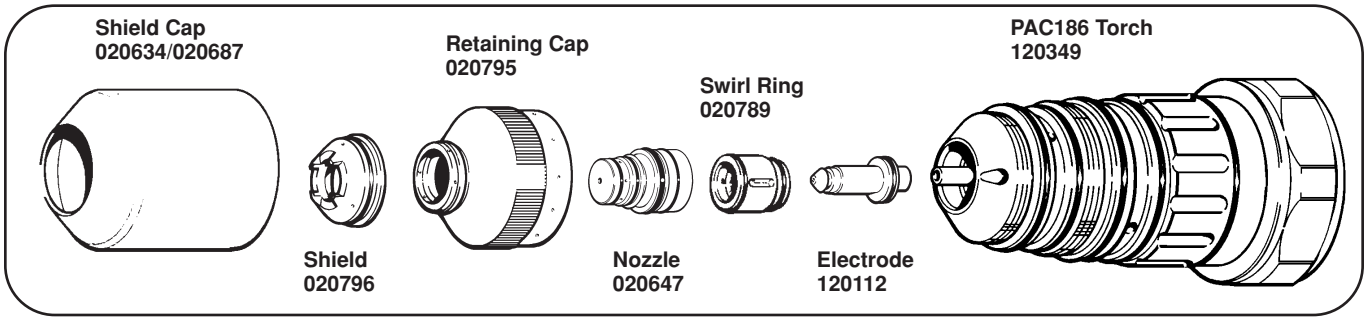
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Mild Steel

O_2 Plasma / O_2 & N_2 Shield

70 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height ***		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		**(GA)**	**(in)**	**(mm)**	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	25	0	100	5	75	**16**	**0.060**	**1.5**	107	0.060	1.5	280	7.11	0.100	2.5	0	0.1
						14	**0.075**	**1.9**	107	0.060	1.5	230	5.84	0.100	2.5	0	0.1
						12	**0.105**	**2.7**	109	0.080	2.0	185	4.70	0.120	3.0	0	0.1
						10	**0.135**	**3.4**	114	0.080	2.0	150	3.81	0.120	3.0	.5	0.2
							3/16	**4.8**	119	0.080	2.0	120	3.05	0.120	3.0	1	0.3
	40						**1/4**	**6.4**	129	0.080	2.0	100	2.54	0.120	3.0	2	0.5
							3/8	**9.5**	135	0.100	2.5	65	1.65	0.160	4.0	4	1.0

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020796.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

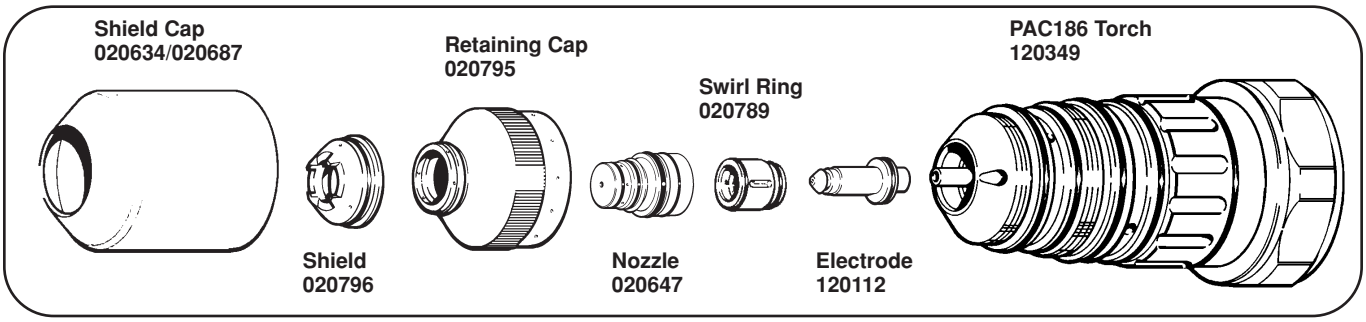
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Stainless Steel#

Air Plasma / Air & CH_4 Shield

70 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch-to-Work Distance**		Cutting Speed		Pierce Height ***		Pierce Delay	
Plasma		Shield		Preflow													
—	Air	Air	CH_4	Air	—												
(White)		(White)		(White)		(GA)	(in)	(mm)	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	35	100	0	75	0	**10**	**0.135**	**3.4**	134	0.060	1.5	100	2.54	0.140	3.5	1	0.3
		60	3				**3/16**	**4.8**	139	0.080	2.0	80	2.00	0.140	3.5	1.5	0.4
		30	10				**1/4**	**6.4**	149	0.140	3.5	55	1.40	0.180	4.5	2	0.5
		30	10				**3/8**	**9.5**	164	0.140	3.5	30	0.76	0.200	5.0	2	0.5
	50	40	20				**1/2**	**12.7**	189	0.250	6.3	25	0.64	****		****	

Air and CH_4 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Stainless steel plate sometimes comes with a protective plastic film. Remove film prior to cutting.

* Slightly increasing the test preflow Air flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020796.

**** Piercing 1/2 inch (12.7 mm) stainless steel is not recommended, it will shorten consumable life. Starting cuts at the edge of the metal is recommended.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

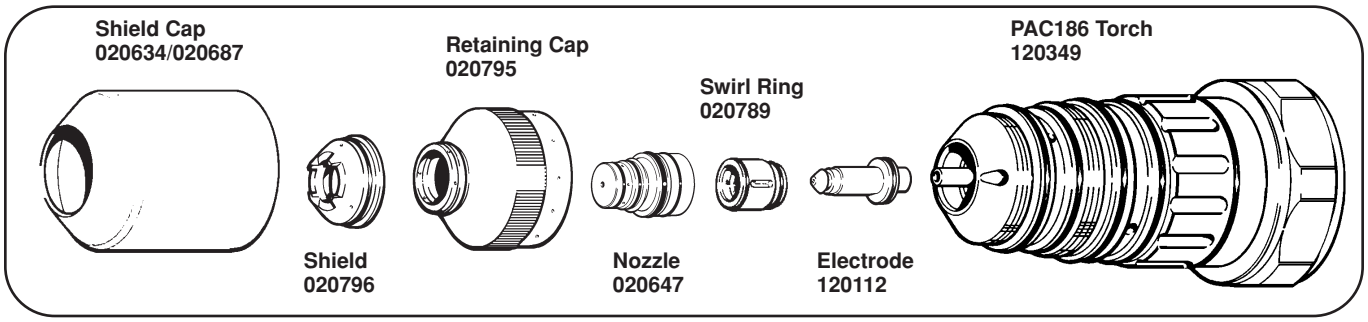
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Aluminum#

Air Plasma / CH_4 Shield

70 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch-to-Work Distance**		Cutting Speed		Pierce Height ***		Pierce Delay	
Plasma		Shield		Preflow													
—	Air	Air	CH_4	Air	—												
(White)		(White)		(White)		(GA)	(in)	(mm)	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	45	0	40	75	0	**18**	**0.048**	**1.2**	159	0.100	2.5	150	3.81	0.160	4.0	0	0.1
						16	**0.060**	**1.5**	159	0.100	2.5	125	3.18	0.160	4.0	0	0.1
						14	**0.075**	**1.9**	159	0.100	2.5	100	2.54	0.160	4.0	0	0.1
						12	**0.105**	**2.7**	159	0.100	2.5	85	2.16	0.160	4.0	.5	0.2
							1/8	**3.2**	179	0.180	4.5	70	1.78	0.200	5.0	.5	0.2
						10	**0.135**	**3.4**	179	0.180	4.5	65	1.65	0.200	5.0	.5	0.2
							1/4	**6.4**	179	0.180	4.5	45	1.14	0.200	5.0	1	0.3
							3/8	**9.5**	179	0.180	4.5	30	0.76	0.200	5.0	1	0.3

Air and CH_4 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

\# Aluminum plate sometimes comes with a protective plastic film. Remove film prior to cutting.

* Slightly increasing the test preflow Air flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020796.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

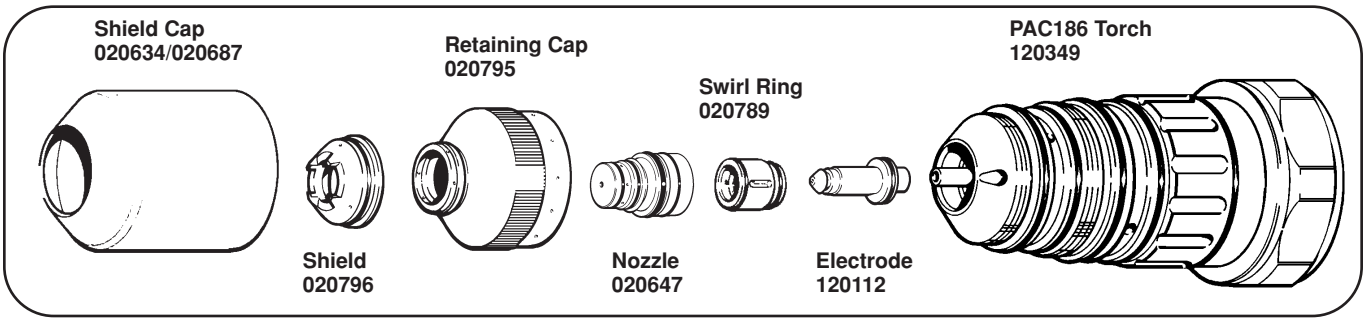
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Copper#

O_2 Plasma / O_2 & N_2 Shield

70 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height ***		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		**(GA)**	**(in)**	**(mm)**	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	50	75	50	5	75	**10**	**0.135**	**3.4**	133	0.120	3.0	60	1.52	0.160	4.0	9	2.0
							3/16	**4.8**	119	0.120	3.0	55	1.40	0.160	4.0	—	2.5
							1/4	**6.4**	123	0.120	3.0	55	1.40	0.160	4.0	—	3.0
							3/8	**9.5**	129	0.120	3.0	25	0.64	0.160	4.0	—	5.0

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

Copper plate sometimes comes with a protective plastic film. Remove film prior to cutting.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

*** Measured from tips of shield adapter 020796.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

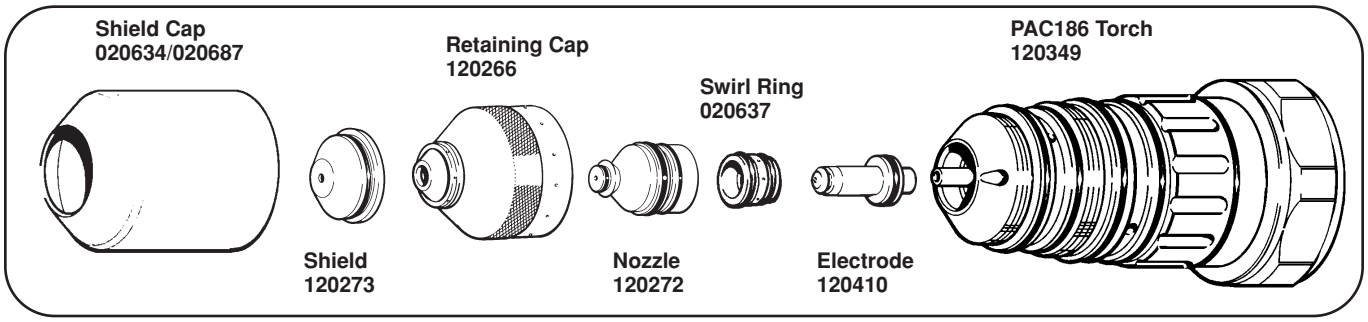
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Mild Steel

O_2 Plasma / O_2 & N_2 Shield

100 Amp Cutting



Test Cut Flowrates (%)				Test Preflow* Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
—	O_2	O_2	N_2	O_2	N_2												
(Red)		(Red)		(Red)		(GA)	(in)	(mm)	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
—	60	35	90	10	100		**1/8**	**3.2**	137	0.125	3.2	275	7.0	0.180	4.6	0	0.00
							1/4	**6.4**	141	0.125	3.2	135	3.43	0.300	7.6	0.4	0.22
							3/8	**9.5**	145	0.125	3.2	95	2.41	0.300	7.6	0.7	0.27
							1/2	**12.7**	147	0.125	3.2	64	1.62	0.300	7.7	1.0	0.37

O_2 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

* Slightly increasing the test preflow O_2 and N_2 flowrates may increase piercing capability on the thicker materials listed above. However, increasing the preflow flowrates too much may affect plasma starting reliability (misfiring).

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

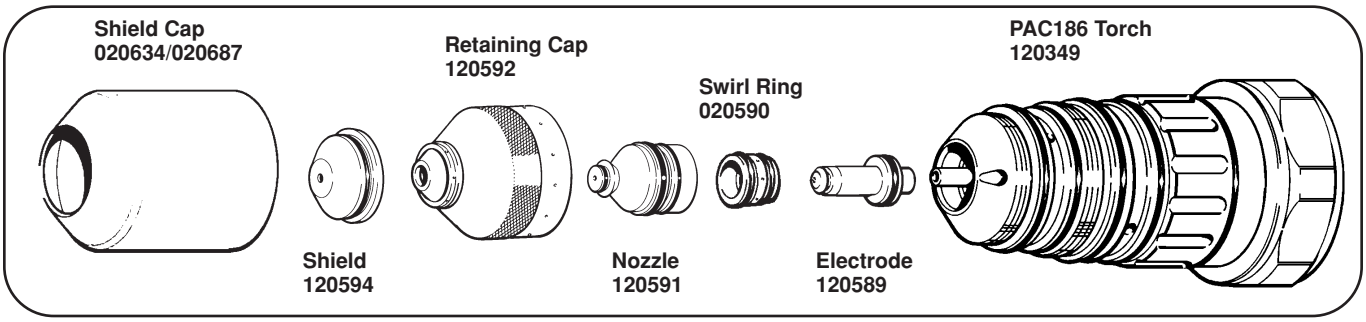
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Stainless Steel

H35 & N_2 Plasma / N_2 Shield

100 Amp Cutting



Test Cut Flowrates (%)				Test Preflow Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
H35	N_2	N_2	N_2	N_2	N_2												
(Blue)		(Blue)		(Blue)		**(GA)**	**(in)**	**(mm)**	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
30	30	60	60	45	45		**1/4**	**6.4**	134	0.120	3.0	75	1.9	0.200	5.1	0	0.1
							3/8	**9.5**	144	0.150	3.8	65	1.6	0.200	5.1	0.5	0.2
40	50						**1/2**	**12.7**	160	0.250	6.4	45	1.1	0.300	7.6	1	0.3

H35 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

H35 gas purity must be 99.995 % minimum.

H35 flowrate must be 85 scfh (2407 l/hr) at fullscale.

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

If the part is not completely cut away from the scrap, try modifying the leadout. Stop the cut 0.050 inch (1.3 mm) before the end of the part for 1/4 and 3/8 inch (6.4 and 9.5 mm) material and 0.100 inch (2.5 mm) for 1/2 inch (12.7 mm) material. The ramp down of the current and gases will complete the cut. If your program can not be modified, reduce cutting speed and use no leadout.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

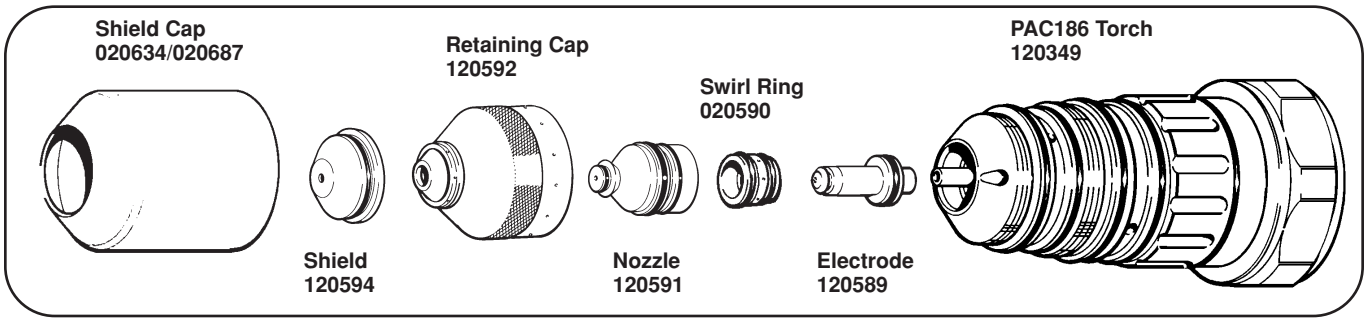
If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

PAC186

Aluminum

H35 & N_2 Plasma / N_2 Shield

100 Amp Cutting



Test Cut Flowrates (%)				Test Preflow Flowrates (%)		Material Thickness			Arc Voltage	Torch -to-Work Distance**		Cutting Speed		Pierce Height		Pierce Delay	
Plasma		Shield		Preflow													
H35	N_2	N_2	N_2	N_2	N_2												
(Blue)		(Blue)		(Blue)		**(GA)**	**(in)**	**(mm)**	(volts)	(in)	(mm)	(ipm)	(m/min)	(in)	(mm)	(dial)	(sec)
30	30	60	60	45	45		**1/4**	**6.4**	145	0.157	4.0	100	2.5	0.236	6.0	0	0.1
							3/8	**9.5**	149	0.157	4.0	70	1.8	0.236	6.0	0.5	0.2
							1/2	**12.7**	155	0.157	4.0	40	1.1	0.236	6.0	1	0.3

H35 and N_2 gas inlet pressures must be between 105 - 135 psi (7.2 - 9.2 bar) for all material thickness.

H35 flowrate must be 85 scfh (2407 l/hr) at fullscale.

** Torch standoff tolerances are ± 0.005 inch (± 0.125 mm). When using a THC, tolerances are ± 1 volt.

Counter clockwise (CCW) consumables are available for mirror image cutting. Refer to Section 6, *Parts List.*

If problems occur with the cutting process, and the flowrates are suspect, refer to Section 5, Maintenance, *Gas System Back Pressure Checks.*

Hypertherm

Section 5

MAINTENANCE

In this section:

Introduction

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

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

If you need additional assistance or need to order parts, call Customer Service at 1-800-643-0030 or Technical Service at 1-800-643-9878.

WARNING

SHOCK HAZARD: The large electrolytic capacitor(s) (blue-cased cylinder(s)) store large amounts of energy in the form of electric voltage. Even if the power is off, dangerous voltages exist at the capacitor terminals, on the chopper, and the diode heatsinks. Never discharge the capacitor(s) with a screwdriver or other implement…explosion, property damage and/or personal injury will result. Wait at least five minutes after turning the power supply off before touching the chopper or the capacitor(s).

Routine Maintenance

The HD3070 system is designed to require minimal regular maintenance under normal use. The following checks are suggested to keep your system in top running condition:

Power Supply

- Check the exterior for any damage. If there is damage, ensure it does not affect safe operation of the power supply.
- Remove power supply covers and inspect the interior.
  - Check wiring harnesses and connections for wear and damage. Check for loose connections and areas of discoloration due to overheating.
  - Check for dust and foreign matter inside the unit. Blow out the unit with compressed air. In an excessively dirty environment, do this weekly.
  - Blow out the fans and heat exchanger at rear of power supply. In an excessively dirty environment, do this weekly.
- At the rear of the power supply, inspect all interconnecting cables, hoses and leads for wear and damage. Check that connections are tight but do not overtighten.
- At the rear of the power supply, inspect the water filter element. A dirty filter element will be a brownish color. Replace the filter element when it gets dirty.
- Every 6 months, flush the power supply torch coolant and replace with new coolant. See Section 3, *Torch Coolant Requirements* and *Filling Torch Coolant System* for details.

RHF Console

- Check the exterior for any damage. If there is damage, ensure it does not affect safe operation of the console.
- Open the cover and inspect the interior. Check all cables and hoses for wear and damage. Check for loose connections, areas discoloration due to overheat- ing and plumbing leaks.
- Inspect the 2 spark gaps between the electrodes. If required, clean with emery cloth, align, and regap to 0.020 ± 0.001 inch (0.51 ± 0.03 mm). Check that the electrode surfaces between the gaps are flat. If the surfaces are rounded, replace and regap.
- Check for dust and foreign matter inside the unit. Blow out the unit with compressed air. In an excessively dirty environment, do this weekly.

Gas Console

- Check the exterior for any damage. Look for damaged gless tubes in the flowmeters and check the pressure gauges for damage.
- Inspect all interconnecting cables, hoses and leads for wear and damage. Check that connections are tight but do not overtighten.
- Remove cover and inspect the interior:
  - Check wiring harnesses and connections for wear and damage. Check for loose connections. The solenoid valves operate hot and discoloration is normal.
  - Check for dust and foreign matter inside the unit. Blow out the unit with compressed air. In an excessively dirty environment, do this weekly.

Torch, Quick Disconnect/Off-Valve and Torch Leads Inspection

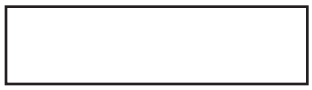
- Inspect the torch main body O-rings and replace, if necessary.
- The torch consumable parts and torch main body should always be inspected prior to cutting. Worn or damaged parts can cause gas and water leaks which can affect the cut quality. Check for pitting and burn marks on the consumable parts and replace, if necessary. Refer to Section 4, *Changing Consumable Parts.*
- Ensure that all connections are tight, but do not overtighten.
- Inspect the torch leads for cracking and damage. Replace if necessary.

Starting Sequence of HD3070

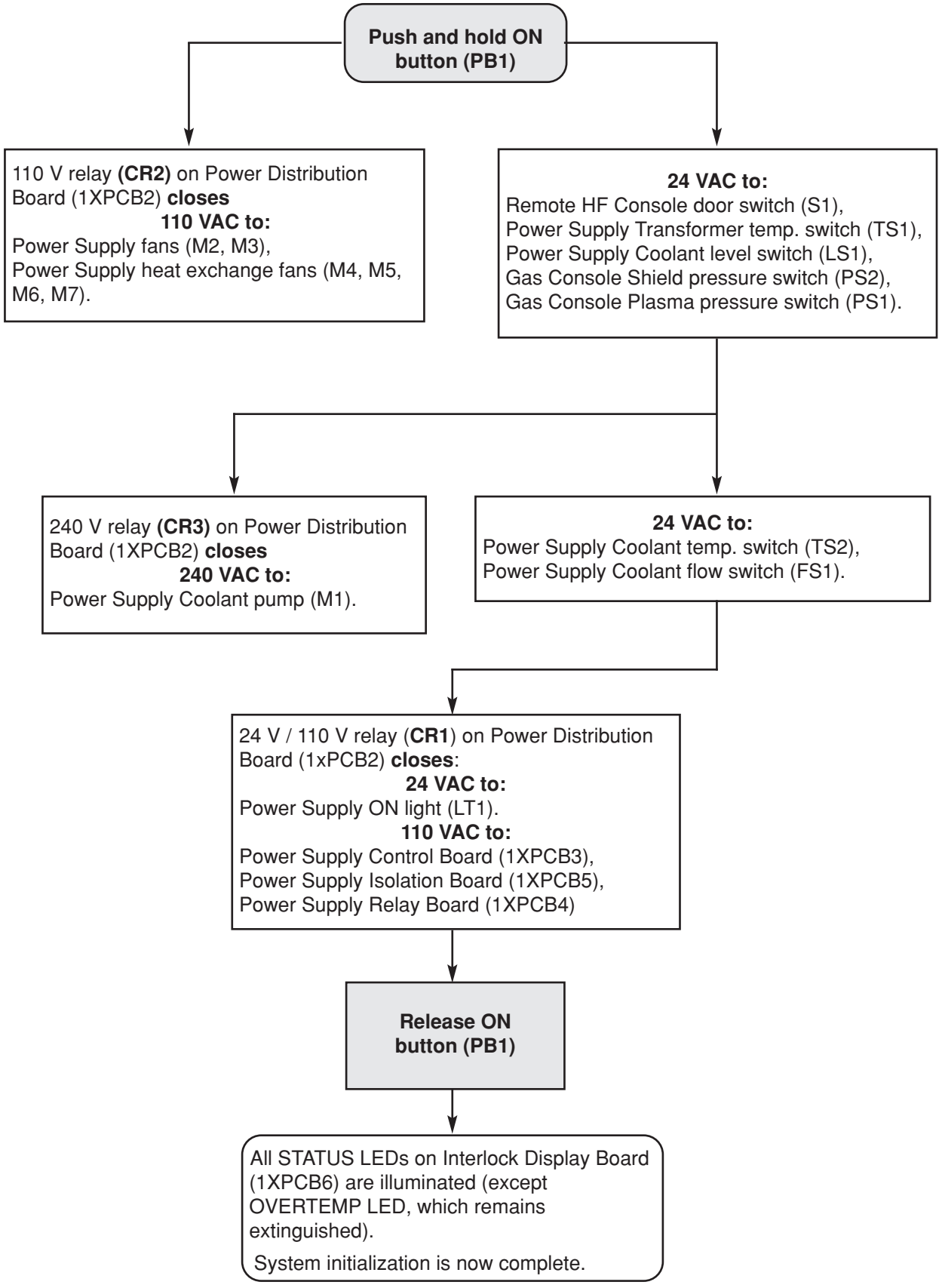
On the following page is a detailed flowchart outlining the starting sequence during proper HD3070 operation. Shaded boxes represent action taken by the operator.

The following symbols used in the flowchart are ANSI standard flowcharting symbols. Their names and definitions are as follows:

Terminus The terminus is used to indicate the beginning or ending point of a flowchart.



Task/Process Box The process or task box is used to indicate any process or task other than an input/output operation or a decision.


Push and hold ON button (PB1)
110 V relay (CR2) on Power Distribution Board (1XPCB2) closes
110 VAC to:
Power Supply fans (M2, M3),
Power Supply heat exchange fans (M4, M5, M6, M7).
24 VAC to:
Remote HF Console door switch (S1),
Power Supply Transformer temp. switch (TS1),
Power Supply Coolant level switch (LS1),
Gas Console Shield pressure switch (PS2),
Gas Console Plasma pressure switch (PS1).
240 V relay (CR3) on Power Distribution Board (1XPCB2) closes
240 VAC to:
Power Supply Coolant pump (M1).
24 VAC to:
Power Supply Coolant temp. switch (TS2),
Power Supply Coolant flow switch (FS1).
24 V / 110 V relay (CR1) on Power Distribution Board (1xPCB2) closes:
24 VAC to:
Power Supply ON light (LT1).
110 VAC to:
Power Supply Control Board (1XPCB3),
Power Supply Isolation Board (1XPCB5),
Power Supply Relay Board (1XPCB4)
Release ON button (PB1)
All STATUS LEDs on Interlock Display Board (1XPCB6) are illuminated (except OVERTEMP LED, which remains extinguished).
System initialization is now complete.

Initial Checks

Before tracking down specific problems, it is good practice to do a visual check, and verify proper voltages are present at the power source, transformer and power distribution board.

WARNING

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

1. Disconnect line power by turning main disconnect switch off.

2. Using a Phillips head screwdriver, remove top plate, two side plates, front plate, and rear plate.

3. Inspect interior of unit for discoloration on pc boards, or other apparent damage. If a component or module is obviously defective upon visual inspection, remove and replace it before doing any testing. Refer to the *Parts List* section to identify parts and part numbers.

4. If no damage is apparent, plug in the power supply unit, and apply power by turning on the main disconnect switch.

5. For a 200, 208, 240, 480, or 600- volt power supply measure the voltage at TB1 between L1 (U), L2 (V) and L3 (W). Refer to Figure 5-1 for detail of TB1. Also refer to wiring diagram 013-4-272 supplied with manual, if required. The voltage between any two of the three points at TB1 should be equal to the supply voltage (200, 208, 240, 480, or 600 VAC). If there is a problem at this point, disconnect main power and check connections, power cable, and fuses or circuit breaker at line disconnect switch. Repair and/or replace defective component(s) if necessary.

   For a 220/380/415- volt power supply measure the voltage at between the U, V and W studs on the EMI filter. Refer to Appendix D. Also refer to wiring diagram 013-4-272 supplied with manual, if required. The voltage between any two of the three studs should be equal to the supply voltage (220, 380, or 415 VAC). If there is a problem at this point, disconnect main power and check connections, power cable, and fuses or circuit breaker at line disconnect switch. Repair and/or replace defective component(s) if necessary.

(Continued on page 5-9)

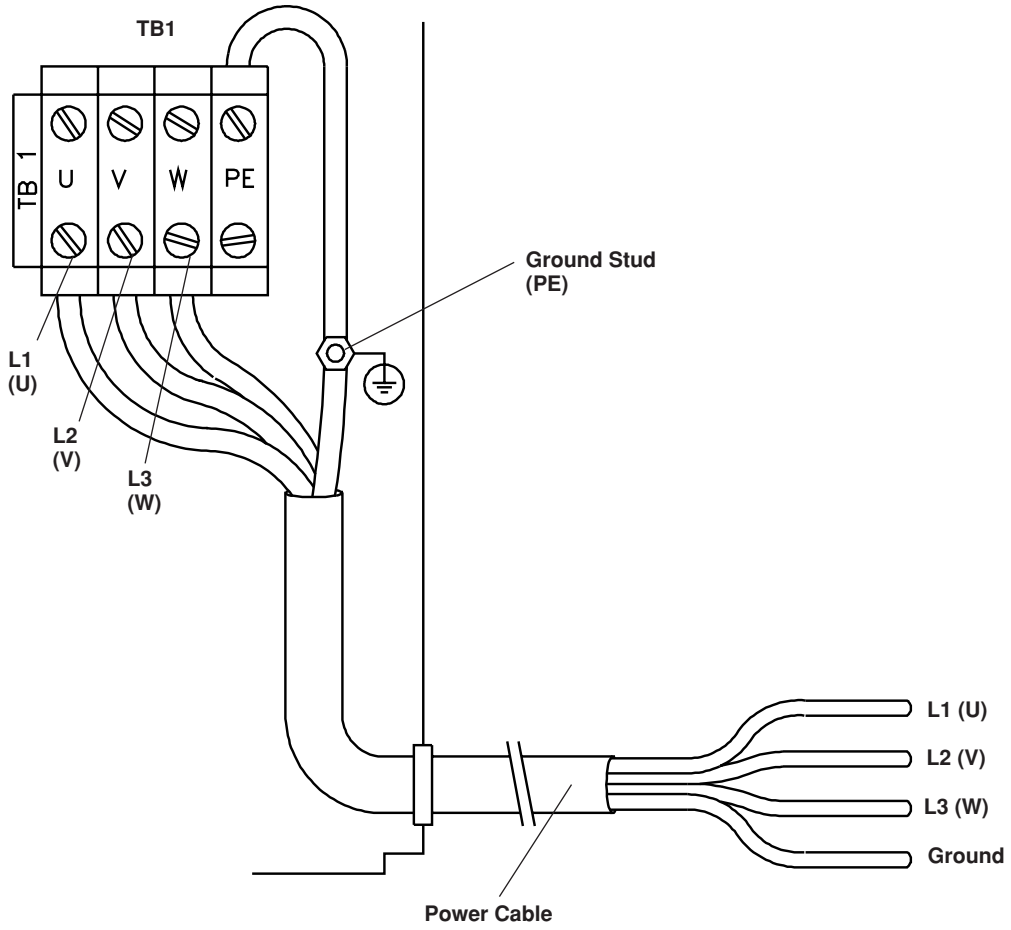


Figure 5-1 Power Supply Input Power Measurement Location

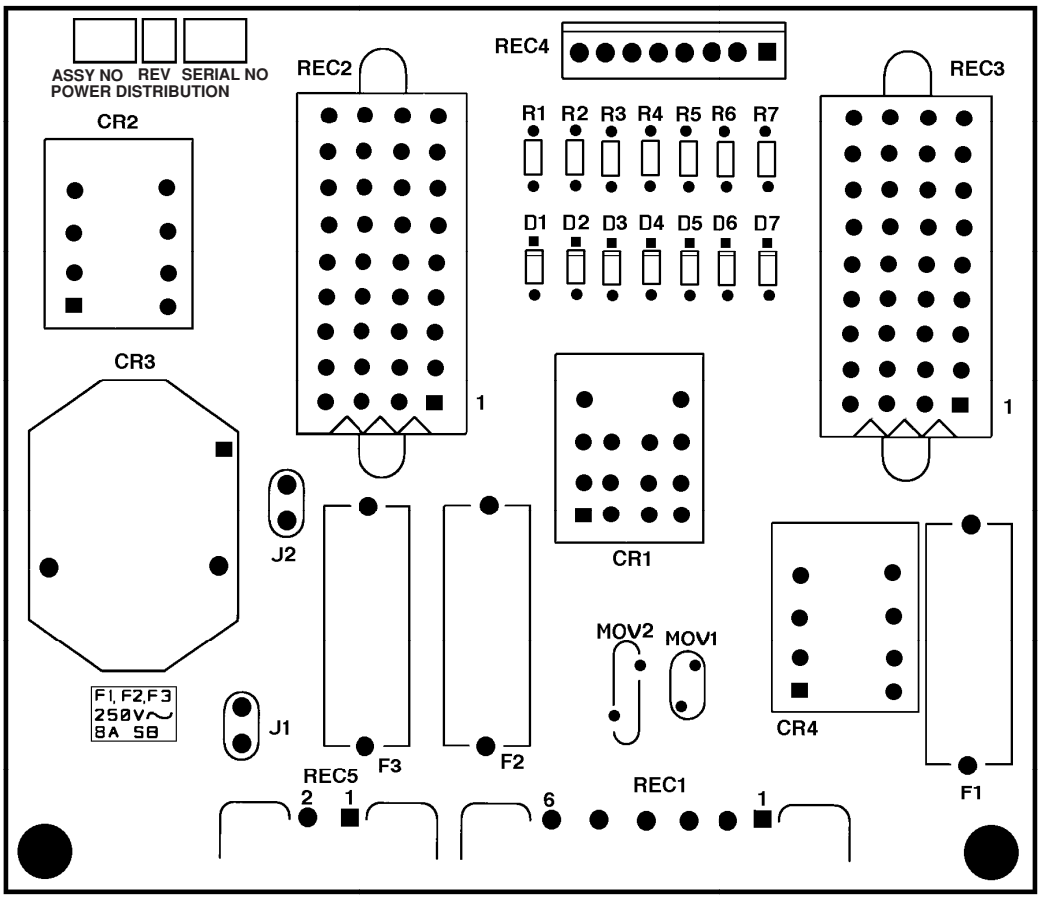


Figure 5-2 Power Distribution Board 1XPCB2

6. Measure voltage at Power Distribution Board 1XPCB2. Refer to Figure 5-2 for detail of 1XPCB2. Also refer to wiring diagram 013-4-272 supplied with manual. Locate fuses F1, F2, and F3 on board. Measurements between each fuse and chassis ground should be as follows:

   F1: 24VAC
   F2: 120VAC
   F3: 240VAC

If voltages are not present, or incorrect at one or more of these points, disconnect power and troubleshoot 1XPCB2 fuses and associated pins, connectors and wiring between power distribution board connector REC1 and transformer secondary T1. Refer to Figure 6-7 for location of T1.

Also, check main power fuses F1, F2, and F3 located in Figure 6-3, and associated wiring and connections between T1 and L1 and L2 (including linkboard).

Repair and/or replace defective component(s) if necessary.

Troubleshooting

The troubleshooting section is presented by following normal operational sequence.

Before troubleshooting for specific problems, be sure that unit passes *Initial Checks* as outlined earlier in this section.

WARNING

SHOCK HAZARD: Always use caution when servicing a power supply when the covers are removed. Dangerous voltages exist within the power supply which could cause injury or death. If questions or problems arise during servicing, call the Hypertherm Technical Services Department at 1-800-643-9878.

Problem	*Possible Causes* / Solutions
1. The green POWER ON - pushbutton switch PB1 is pressed, but the fans are not operating and the green POWER ON indicator does not light.	**1.1.** *The green POWER ON (1) PB1 push button is defective.* Check that switch is operating correctly, and that good contact is being made. The POWER ON switch is normally open. **1.2.** *The red POWER OFF (0) PB2 push button is defective.* Check that switch is operating correctly, and that good contact is being made. The POWER OFF switch is normally closed. **1.3.** *Associated wiring not making good contact.* Check wiring and repair or replace, if necessary.
2. The green POWER ON push-button switch PB1 is pressed, the POWER ON indicator lights, but the fans are not running.	**2.1.** *CR2 on the Power Distribution board is defective.* Check that CR2 switches when POWER ON push button is pressed. See Figure 5-2 for location of CR2. If CR2 is defective, unsolder CR2 and replace. **2.2.** *PL25 and REC20 located near the fans (see Figure 6-2 for location of fans) are not seated together securely and/or not getting 120VAC from Power Distribution Board.* • Check pins, connectors and associated wiring for good continuity. • Check for 120VAC at PL25.

Problem	*Possible Causes* / Solutions
	2.3. *PL2 and REC2 on Power Distribution board (see Figure 5-2 for location of REC2) are not seated well.* Check pins, connectors and associated wiring for good continuity. Repair or replace, if necessary.
3. The green POWER ON push-button switch PB1 is pressed, the fans are operating, but the green POWER ON indicator does not light.	**3.1.** *Push button PB1 was not held down long enough.* Press and hold PB1 for a minimum of five seconds. **3.2.** *Relay CR1 on the Power Distribution board is defective.* Check that CR1 switches when POWER ON push button is pressed. See Figure 5-2 for location of CR1. If CR1 is defective, unsolder CR1 and replace. **3.3.** *One or more of the green STATUS LEDs does not illuminate (except yellow OVERTEMP LED which illuminates indicating a fault condition.* To troubleshoot STATUS fault conditions, see *Status LED Troubleshooting* later in this section.
4. The green POWER ON indicator is lit, the START command is given and red DC ON indicator is lit, but there is no high frequency and no pilot arc.	**4.1.** *There is no spark between the spark gap electrodes.* Clean (with emery cloth), align, and/or regap (.020 inch per gap) the electrodes, if necessary. Ensure that the electrode surfaces between the gaps are flat. If surfaces are rounded, replace and regap. See Figure 6-11 for part number information. • Visually inspect the high voltage transformer T1 in the Remote HF console for leaking oil or overheating. See Figure 6-11 for location of T1. Replace T1 if leaking or overheating. • Check for 120VAC at filter (FL1) after START command is given. • If there is no 120VAC at FL1, use wiring diagram 013-4-272 and check pins, connectors and associated wiring from FL1 to REC3 of Relay Board 1XPCB4. If connections are O.K., there may be a problem with either 1XPCB4 or 1XPCB3. See *Relay Board*

Problem	*Possible Causes* / Solutions
	(1XPCB4) later in this section for location of relays and description of output signals. • If there <u>is</u> 120VAC at FL1, shut down system and remove capacitors C3 and C4. (See Figure 6-11 for location of C3 and C4.) Restart system and see if a faint spark is now observed across the gaps. • If a spark is <u>not</u> observed at the gaps, replace T1. If there <u>is</u> a spark, shut down system, and replace capacitors C3 and C4. **(Always replace the capacitors in pairs).** **4.2.** *There is no high frequency at the torch.* Check for a shorted torch, a damaged pilot arc lead, or loose lead connections. Replace the torch or pilot arc lead or tighten the lead connections.
5. The green POWER ON indicator is lit, the torch START command is given and the red DC ON indicator lights, and there is high frequency, but there is no pilot arc.	**5.1.** *Pilot arc relay CR1 is not closing (not getting 120VAC from the Relay Board 1XPCB4).* See if the CR1 relay contacts close after the START command is given. See Figure 6-7 for location of CR1. If CR1 does <u>not</u> close: • With an AC voltmeter across the relay, see if 120VAC is coming from 1XPCB4 after START command is given. • If there is no 120VAC, check connectors, terminals, pins, and associated wiring to REC3 of 1XPCB4. • If wiring is O.K., there is a problem either with 1XPCB4 or 1XPCB3. **5.2.** *Pilot arc relay CR1 is defective.* If there <u>is</u> 120VAC across the relay (see above steps), and CR1 does not close, replace CR1. **5.3.** *Main contactor (CON1) or 1XPCB4 is defective.* • With an AC voltmeter, see if contactor CON1 is getting 120VAC after START command is given. If there is no 120VAC, check pins, connectors and associated wiring from CON1 to pins 5&6 of REC3 of 1XPCB4.

Problem	*Possible Causes* / Solutions
	• If wiring is O.K., 1XPCB4 or 1XPCB3 may be defective. See *Relay Board (1XPCB4)* later in this section for location of relays and description of output signals. • If CON1 is getting 120VAC from the Relay Board as described above, measure the voltage between all terminals 1A, 1B and 1C of main transformer T2 after the START command is given. See Figure 6-7 for location of T2. The voltage between any two of the three points should be equal to 200 VAC. If there is no voltage at any of the above points, replace CON1. If there is voltage at some but not all of the above points, check wiring and connections to and from T2. If wiring checks out OK, return to *Initial Checks* section and repeat steps 1-5. **5.4.** *Chopper is defective or not functioning.* Refer to CH130 Chopper Module Test Procedure on page 5-31.
6. The unit stops cutting during cut, or cuts poorly.	**6.1.** *The work clamp is not connected or it is broken.* Connect or repair the work clamp. **6.2.** *Arc not transferring to workpiece.* Check work clamp and cable connecting clamp to workpiece. Good contact must be made in order for the arc to transfer to the workpiece. **6.3.** *There is insufficient air or gas pressure.* Check gas inlet pressure specifications under *Cut Charts* in **Operation**, Section 4. Check plasma and shield gas pressures in TEST and RUN modes as specified under *Cut Charts* in **Operation**, Section 4. **6.4.** *Torch is getting insufficient current.* Check the arc current setting for the type and thickness of metal you are cutting from the *Cut Charts* in **Operation**, Section 4.

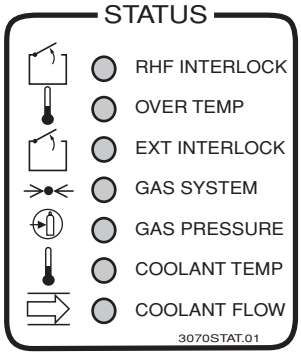
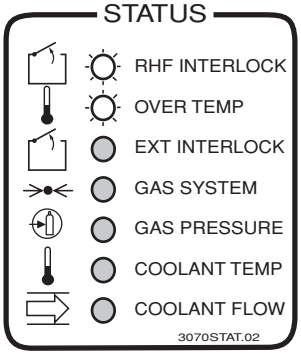
Problem	*Possible Causes* / Solutions
	6.5. *The power supply has overheated.* Shut down system and wait for unit to cool down. If unit will not restart, see *Status LED Troubleshooting* guide later in this section.
	6.6. *Chopper is defective or not functioning.* Refer to CH130 Chopper Module Test Procedure on page 5-31.

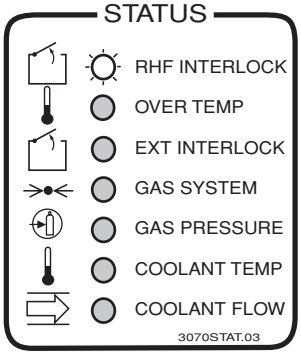
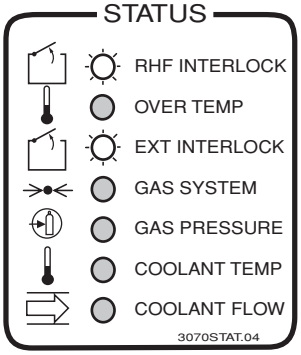
Status LED Troubleshooting

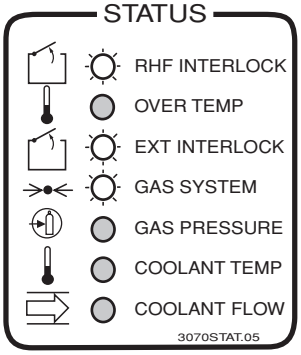
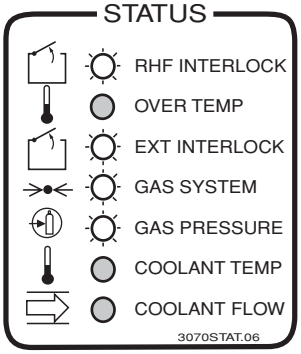
Be certain that the power supply has been through the Initial Checks as outlined earlier in this section before troubleshooting STATUS LEDs. When any one of the STATUS LEDs does not illuminate (except OVERTEMP illuminates) there is a fault condition that must be corrected in order for the HD3070 power supply to become operational. The LEDs are connected in series, so the upper-most LED that does not illuminate (except OVERTEMP does not extinguish) represents the first condition that must be corrected. Refer to the problems and probable causes and solutions and the troubleshooting flow diagrams below. See wiring diagrams and gas and cooling system schematics at back of manual for reference.

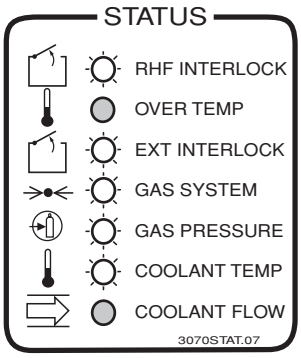
☼ LED illuminated

○ LED extinguished

Problem	*Possible Causes* / Solutions
1. RHF INTERLOCK LED extinguished: 	**1.1.** *Door to Remote HF console not completely shut.* This LED will illuminate when switch S1 located in the Remote HF console is closed. If door is closed, check pins, connectors and associated wiring for good continuity from receptacle 2X1 to 1X5. Repair and/or replace defective component(s), if necessary.
2. OVERTEMP LED illuminated: 	**2.1.** *Main Transformer T2 or chopper is overheating.* This LED will extinguish when the main transformer (T2) is operating in a normal temperature range((under 165° Ctr) and the chopper is operating in the normal temperature range (under 82° C). Temperature switch TS1 (transformer) or TSW1 (chopper) will open and will cause the LED to illuminate when overheating occurs. • Check temperature switches TS1 and TSW1 (normally closed). • Check pins, connectors and associated wiring to temperature switches. • Leave the fans running, and try restarting the unit after one hour. If the LED still illuminates the transformer or chopper may have to be replaced.

Problem	*Possible Causes* / Solutions
3. EXT INTERLOCK LED extinguished: 	**3.1.** *External interlock supplied for customer use.* **If not used, customer must jumper out signal at CNC machine.**
4. GAS SYSTEM LED extinguished: 	**4.1.** *Gas system malfunction.* This LED is not used. However it will illuminate when the plasma system has power applied and operating.

Problem	*Possible Causes* / Solutions
5. GAS PRESSURE LED extinguished: 	**5.1.** *Plasma or shield input gas pressure too low.* This LED will extinguish (go off) if the plasma or shield input gas pressure drops to 80 psi (5.5 bar). • Check that input plasma and shield gas pressures are 120 psi (8.2 bar).
6. COOLANT TEMP LED extinguished: 	**6.1**. *Coolant too hot*. This LED will extinguish (go off) when temperature switch TS2 senses that the temperature of coolant in the coolant reservoir is above 160°F. • Check to see if water coolant is above 160°F. If the temperature is 160°F or above, the LED will be extinguished – wait for the system to cool. • Disconnect PL24 (located in the rear of the power supply near the coolant reservoir) from REC24 and check to see if TS2 is open. TS2 is normally closed, and opens when a temperature above 160°F is reached. • Check pins, wires and connections from PL24 to REC3 of 1XPCB2. See power supply wiring diagram in the back of this manual. • Check for proper operation of cooling fans M4, M5, M6 and M7. Check that the heat exchanger air flow is not obstructed. Repair and/or replace defective component(s), if necessary.

Problem	*Possible Causes* / Solutions
7. COOLANT FLOW LED extinguished: 	**7.1.** *Coolant flow too slow.* This LED will illuminate when flowswitch (FS1) senses a coolant flow greater than 0.5 gpm to the torch. See Figure 6-10 for location of flowswitch FS1, motor M1, and pump P1. **7.2.** *Motor M1 not functioning.* • Check to see if 240VAC is available at PL21. PL21 is located near the pump. Note: The 240VAC relay (CR3) on 1XPCB2 will not close until the first 6 interlocks (STATUS indicators) are satisfied. (See *Starting Sequence of HD3070* flowchart) • Using the electrical schematic (in back of this manual), check pins, connections and associated wiring from PL21 to REC5 of 1XPCB2. If 240VAC is not available at REC5, CR3 may be defective. Replace 1XPCB2 if CR3 is defective. **7.3.** *Flow switch FS1 not functioning.* FS1 is a normally open switch that is closed when a flow greater than 0.5 gpm is sensed. When FS1 is closed, 24 VAC lights the COOLANT FLOW LED. • Check coolant hoses and connections for leaks. Repair and/or replace defective components, if necessary.

Power Supply Control Board Indicators

Error Code LED

The microcontroller on control board 1XPCB3 will alert the user when certain errors occur in the HD3070 system, by flashing the **ERROR CODE** LED on the control board. The power supply front cover must be removed to observe control board 1XPCB3 and the **ERROR CODE** LED (Figure 5-3).

The **ERROR CODE** LED will blink on for 0.5 second and off for 0.5 second with a 2 second gap before repeating the blinking sequence. The number of blinks between the 2-second gap will indicate 1 of the errors listed below. During the error code flashing, all outputs from the control board are turned off, and the power supply is in an idle mode. After the error is corrected, you may resume operation of the system.

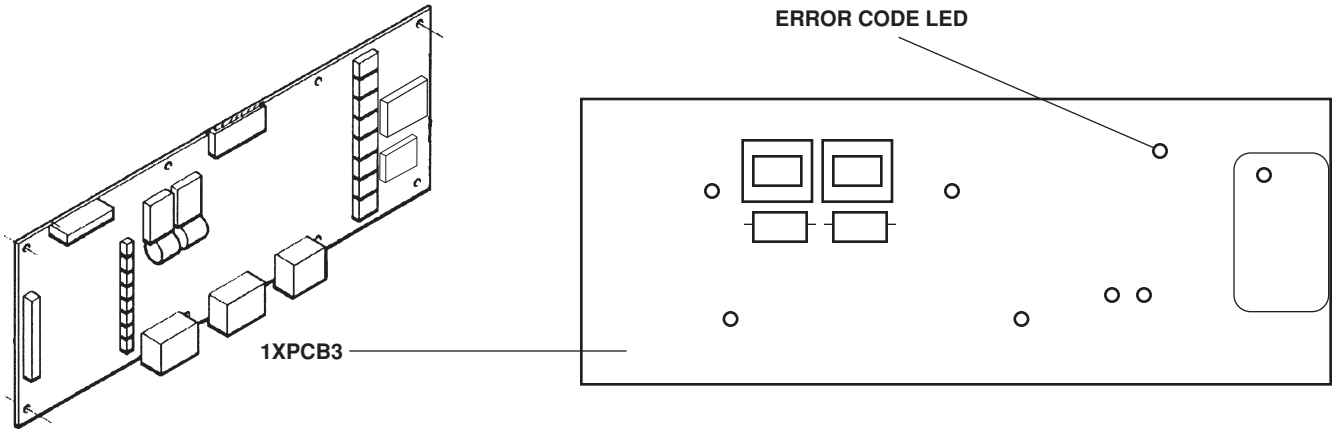


Figure 5-3 Power Supply Control Board Error Code LED Location

Power Supply Control Board Error Code Descriptions

Blinks	Explanation
on (not blinking)	Indicates that a microcontroller internal RAM or ROM self-check error has occurred (power supply will hang up). Replace microcontroller U9 or control PCB 1XPCB3.
1	Indicates that the coolant reservoir needs to have coolant added.
2**	Indicate that an “interlock” is not satisfied. Interlock failures are reported by the LEDs on the power supply front panel. Refer to Section 4, *Operation, Controls and Indicators* for LED descriptions.
3**	Indicates the HOLD input (for multi-torch systems) was not released within 10 seconds after the end of preflow.
4**	Indicates the high frequency was unable to ignite the pilot arc within 1 second. Check gas flows and corresponding pressures.

Power Supply Control Board Error Code Descriptions (continued)

Blinks	Explanation
5**	Indicates the PIERCE COMPLETE signal was not received within 4 seconds after the transfer signal.
6**	Indicates the transfer of the arc to the workpiece was not sensed within 2 seconds of torch ignition. Check ground clamp to workpiece. Initial torch height may be too high. This will reduce nozzle life.
7*	Indicates the arc was extinguished after current transferred to the workpiece, but before steady-state operation. The pierce delay may have been too long, and after arc transfer, too much metal was blown away before the X-Y machine moved leaving the arc no place to transfer to.
8*	Indicates the arc was lost during steady-state operation. Typically, this error is caused by running the torch off the edge of the plate or by having the cut piece fall out leaving the arc no metal to transfer to.
9*	Indicates that during steady-state operation the measured arc voltage exceeded the programmed maximum. The torch to work distance was too high during a cut, consequently the power supply terminated the arc. Check arc voltage setting and that the torch height control (THC) is working properly.
10*	Indicates the arc was lost during current ramp down, but before the programmed ramp down time has elapsed. After the start signal was removed from the power supply, it began to ramp down, but did not complete it. The most probable cause is by cutting parts that fall out, leaving the arc no metal to transfer to while the power supply is trying to ramp down. This problem can be improved, if not eliminated, by changing the CNC program. Try different leadouts for different shape cuts.
11	Indicates inlet plasma gas pressure was insufficient to maintain the pressure switch in the gas console. Note: 7,8,9, or 10 blinks in sequence indicate errors that can reduce consumable life, and cause cut quality to erode prematurely.
12**	Indicates that the software has an error. If this error occurs, there is a fatal error in the microprocessor chip and it must be replaced.
13	Indicates that the phase loss protection circuit has shutdown the system due to voltage phase loss or input voltage dropping below 80% of nominal. * These errors will also cause the error counter of the timer/counter to increment. ** These errors will also cause an error count output signal to the CNC.

Status Indicator LEDs

The control board 1XPCB3 provides LEDs to notify the user when certain voltages are present and when other certain functions occur in the HD3070 system as described below. The power supply front cover must be removed to observe control board and the LEDs (Figure 5-4).

- +5V LED1 – Lights to indicate that +5 volts is available to microprocessor.
- Transfer LED2 – Lights to indicate that arc current has transferred to workpiece.
- Start LED3 – Lights to indicate that a start/run command is active in the system.
- Lock LED4 – Lights to indicate that interlocks from power distribution board are okay.
- Error Code LED5 – Flashes to indicate an error, if any, in the last start-stop cycle. The flash is coded to indicate an error number. Refer to *Error Codes and Messages, Power Supply Control Board Error Codes* earlier in this section.
- +12D LED6 – Lights to indicate that +12 volts is applied to digital circuitry.
- +12A LED7 – Lights to indicate that +12 volts is applied to analog circuitry.
- Current LED8 – Lights to indicate that feedback current is at the input to the analog circuit.

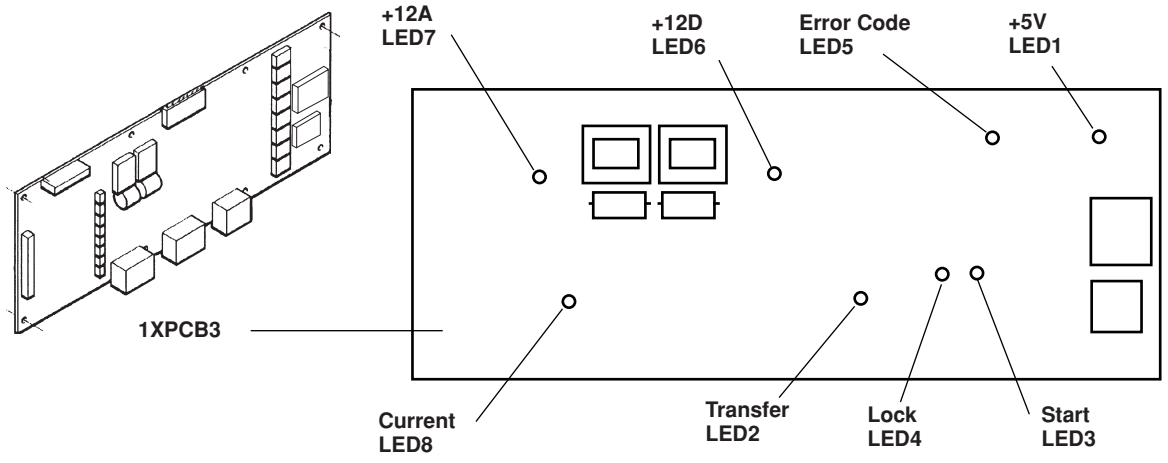


Figure 5-4 Power Supply Control Board LED Locations

Power Supply Relay Board Status Indicators

The relay board (1XPCB4) is an interface between solenoid valves, relays, the main contactor, and the control board (1XPCB3). An ON or OFF condition is sent from the control board through REC1 at the bottom of the relay board, which switches one of the relays on 1XPCB4 on or off. The corresponding solenoid or external device is then energized or deenergized (output is sent via REC3 or REC4 at the top of the relay board). Figure 5-5 shows the relay locations on 1XPCB4 as well as the LED status indicators. Figure 5-6 shows relay board LED on/off status during system test and run modes.

Listed below are the pin assignments for REC3 and REC4 of relay board 1XPCB4:

REC3 Pin #	Description
1 & 2	HV Transformer (T1 in Remote HF Console)
3 & 4	Pilot Arc Relay CR1
5 & 6	Main Contactor CON1
7 & 8	Surge Relay CR4
9 & 10	Extra Surge Relay CR5
11 & 12	Spare Relay
13 & 14	Blowout Counter
15 & 16	120 VAC (Input)
REC 4 Pin #	**Description**
1 & 2	O_2 & N_2 Select
3 & 4	H35 & N_2 Select
5 & 6	Air & CH_4 Select
7 & 8	Spare Valve 1
9 & 10	Shield Operate Valve
11 & 12	Shield Preflow Valve
13 & 14	Not used
15 & 16	Plasma On/Off Valve

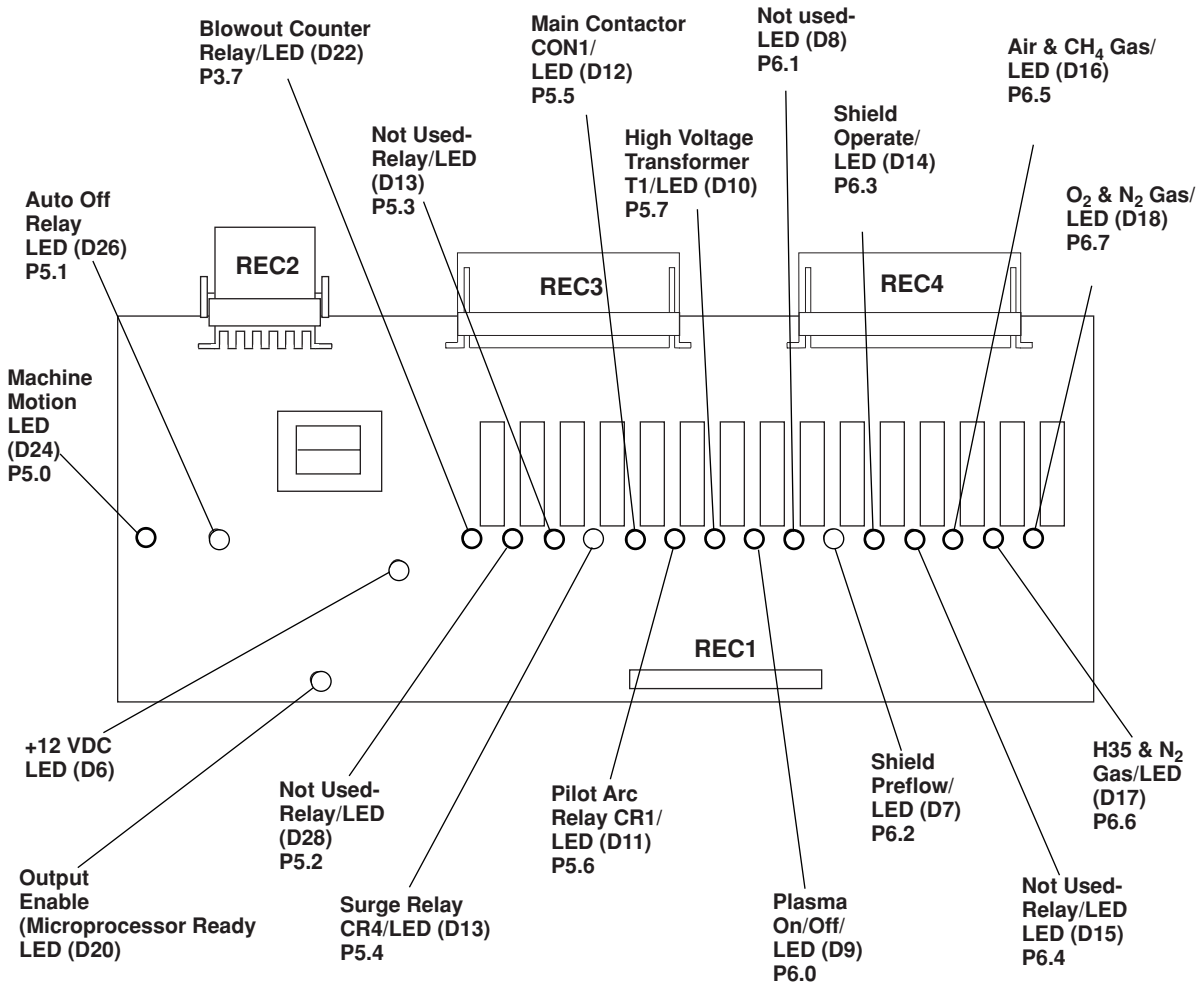


Figure 5-5 Power Supply Relay Board (1XPCB4)

Power Supply
Relay Board LED Status – Test Preflow

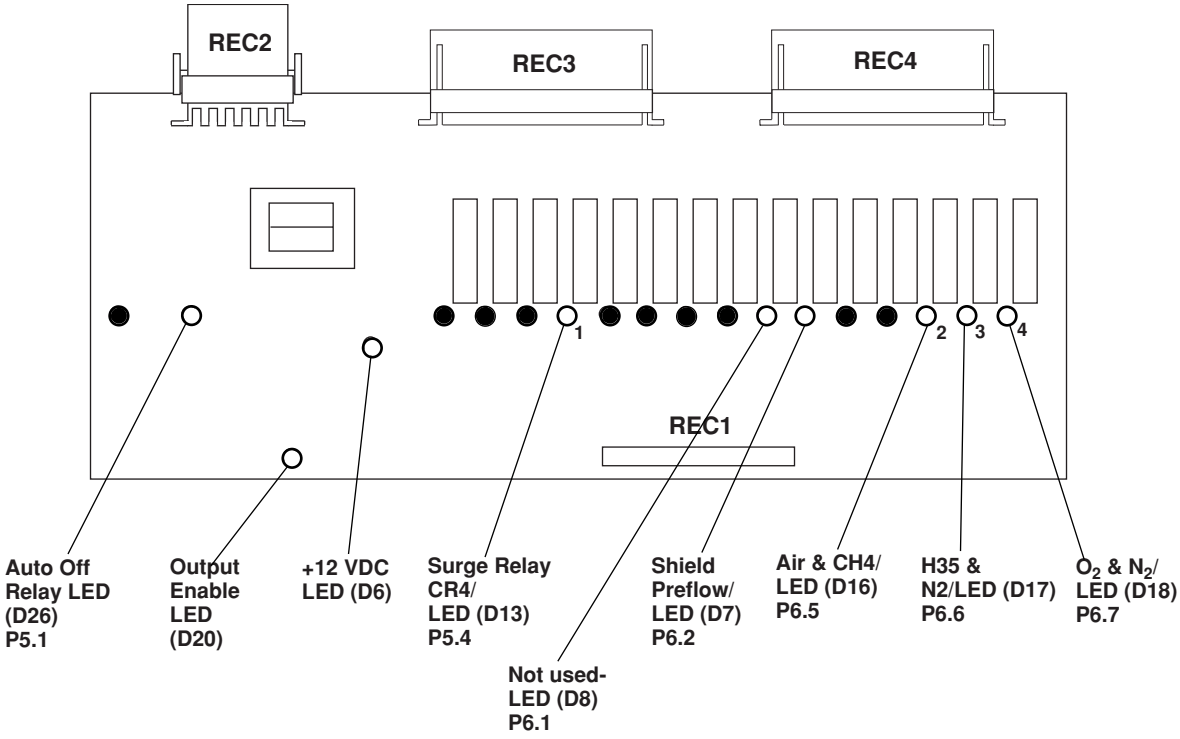


Figure 5-6 Power Supply Relay Board LED Status (1 of 4)

Power Supply
Relay Board LED Status – Test Cut Flow

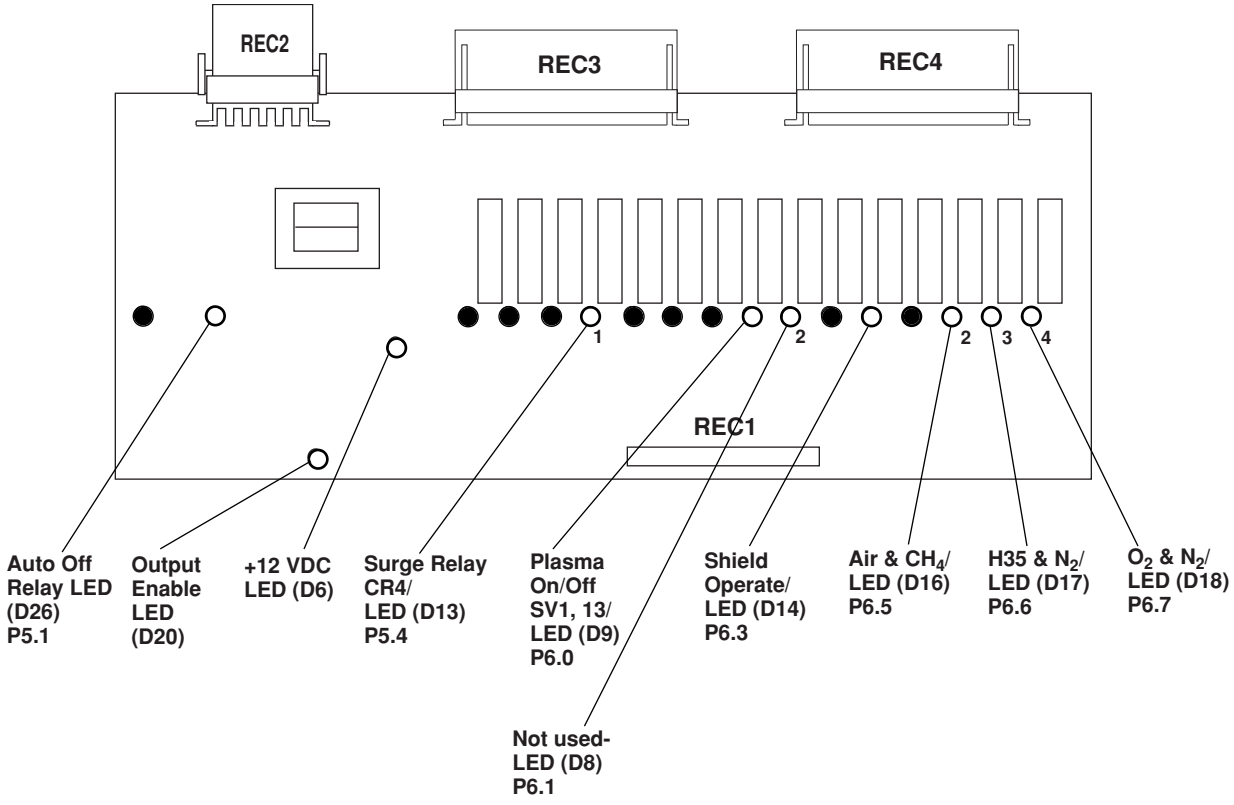
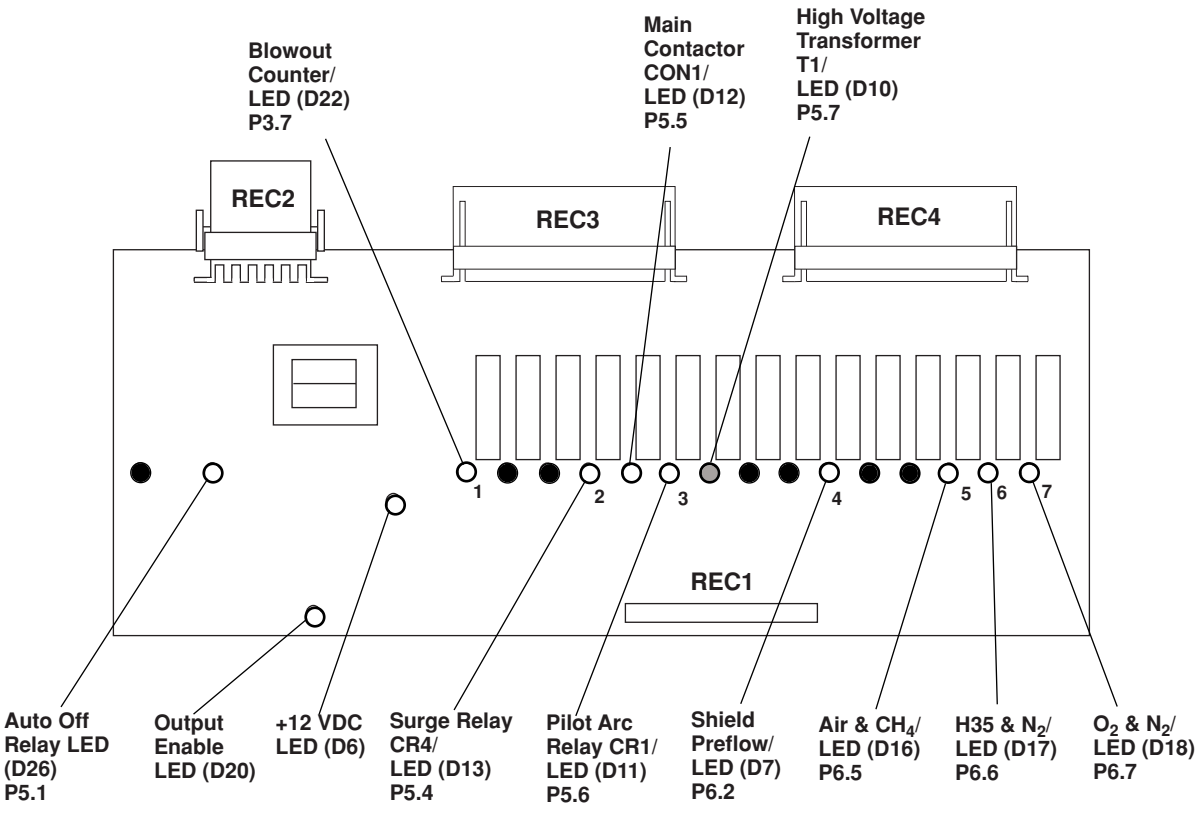


Figure 5-6 Power Supply Relay Board LED Status (2 of 4)

Power Supply
Relay Board LED Status – Run Preflow



LED On

LED Off

LED Momentarily On

1 – Illuminates when error 7, 8, 9, or 10 occur.

2 – Illuminates when using 50 amps and above.

3 – Illuminates at start; goes out after arc transfer.

4 – Illuminates until arc transfer; goes out after arc transfer.

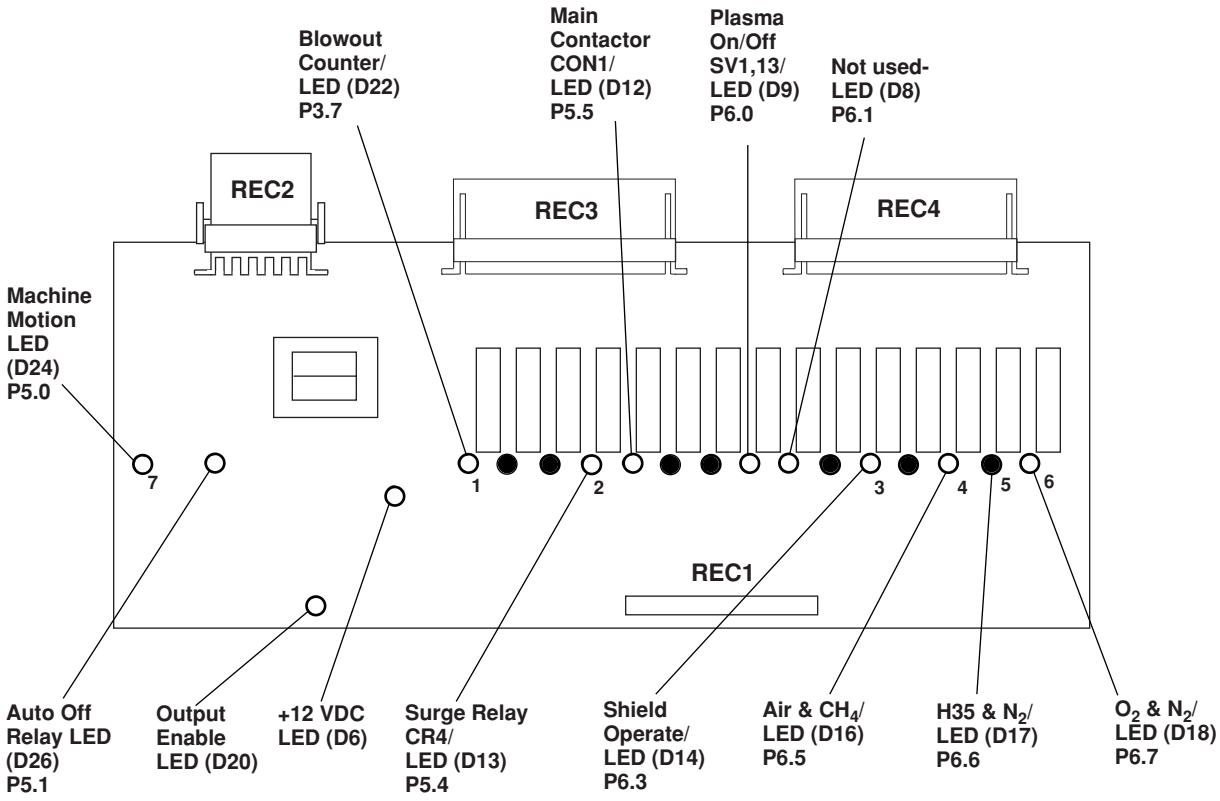
5 – Illuminates when Air & CH4 are used.

6 – Illuminates when H35 & N2 are used.

7 – Illuminates when O2 & N2 are used.

Figure 5-6 Power Supply Relay Board LED Status (3 of 4)

Power Supply
Relay Board LED Status – Run Cut Flow



LED On

LED Off

1 – Illuminates when error 7, 8, 9, or 10 occur.

2 – Illuminates when using 50 amps and above.

3 – Illuminates after arc transfer and stays on during cut cycle.

4 – Illuminates when Air & CH4 are used.

5 – Illuminates when H35 & N2 are used.

6 – Illuminates when O2 & N2 are used.

7 – Illuminates after arc transfer.

Figure 5-6 Power Supply Relay Board LED Status (4 of 4)

Gas System Back Pressure Checks

Use the back pressure checks to find leaks or restrictions in the gas lines and gas components such as valves. The checks can be done when the system is in the test cut or test preflow mode. In the **Test** modes, set the flowrates as indicated below and check the corresponding pressures (± 10% is allowable). The pressures in the **Run** mode are for reference only. **Back pressures in the Run mode may be different than those in the Test modes.** For a low pressure, check for a leak. For a high pressure, check for a restriction in the gas line or a consumable problem. Refer to Figure 4-2 to locate the flowrate set controls and pressure gauges on the gas console; *Cut Charts* in Section 4, Operation for additional information; and to the gas system schematic in back of manual.

PAC 184 Torch
Mild Steel – Oxygen Plasma – 15 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressure (psi/bar)	Flowrates (%)	
			PLASMA	SHIELD			PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test	70/4.8	17/1.2	40	30	10	27/1.9	5	75
Run	90/6.2	17/1.2				27/1.9		

PAC 184 Torch
Mild Steel – Oxygen Plasma – 30 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressure (psi/bar)	Flowrates (%)	
			PLASMA	SHIELD			PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test	75/5.2	7/0.5	46	15	5	29/2.0	5	75
Run	95/6.5	8/0.6				30/2.1		

PAC 186 Torch
Mild Steel – Oxygen Plasma – 15 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressure (psi/bar)	Flowrates (%)	
			PLASMA	SHIELD			PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test	85/5.9	15/1.0	40	30	10	25/1.7	5	75
Run	99/6.8	15/1.0				26/1.8		

PAC 186 Torch
Mild Steel – Oxygen Plasma – 30 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressure (psi/bar)	Flowrates (%)	
			PLASMA	SHIELD			PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test Run	77/5.3 95/6.5	9/0.6 10/0.7	46	15	5	27/1.9 26/1.8	5	75

PAC 186 Torch
Stainless Steel – Air Plasma – 30 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressure (psi/bar)	Flowrates (%)	
			PLASMA	SHIELD			PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test Run	47/3.2 64/4.4	6/0.4 7/0.5	60	30	–	17/1.2 19/1.3	72	–

TorchPAC 186 Torch
Mild Steel – Oxygen Plasma – 50 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressure (psi/bar)	Flowrates (%)	
			PLASMA	SHIELD			PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test Run	53/3.6 78/5.4	12/0.8 12/0.8	40	40	–	27/1.9 28/1.9	5	75

PAC 186 Torch
Stainless Steel – Air Plasma – 50 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressure (psi/bar)	Flowrates (%)	
			PLASMA	SHIELD			PREFLOW	
	PLASMA	SHIELD8	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test Run	70/4.8 100/6.9	59/4.0 60/4.1	40	80	–	30/2.1 30/2.1	60	–

PAC 186 Torch
Mild Steel – Oxygen Plasma – 70 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%)			Pressure (psi/bar)	Flowrates (%)	
			PLASMA	SHIELD			PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test Run	79/5.4 100/6.9	42/2.9 43/3.0	40	–	100	27/1.9 28/1.9	5	75

PAC 186 Torch
Stainless Steel – Air Plasma – 70 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%) PLASMA		SHIELD	Pressure (psi/bar)	Flowrates (%) PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test Run	64/4.4 97/6.7	13/0.9 16/1.1	35	40	5	30/2.1 30/2.1	75	–

PAC 186 Torch
Aluminum – Air Plasma – 70 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%) PLASMA		SHIELD	Pressure (psi/bar)	Flowrates (%) PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test Run	80/5.5 105/7.2	10/0.7 13/0.9	45	–	40	30/2.1 30/2.1	75	–

PAC 186 Torch
Mild Steel – Oxygen Plasma – 100 Amp Consumables

	Test Cut					Test Preflow		
	Pressures (psi/bar)		Flowrates (%) PLASMA		SHIELD	Pressure (psi/bar)	Flowrates (%) PREFLOW	
	PLASMA	SHIELD	O_2	O_2	N_2	PREFLOW	O_2	N_2
Test Run	74/5.1 99/6.8	57/3.9 58/4.0	60	35	90	37/2.5 38/2.6	10	100

PAC 186 Torch
Stainless Steel – H35 & N_2 Plasma – 100 Amp Consumables

	Test Cut						Test Preflow		
	Pressures (psi/bar)		Flowrates (%) PLASMA		SHIELD		Pressure (psi/bar)	Flowrates (%) PREFLOW	
	PLASMA	SHIELD	H35	N_2	N_2 &	N_2	PREFLOW	N_2	N_2
Test Run	78/5.3 95/6.6	49/3.4 50/3.4	30	30	60	60	22/1.5 24/1.7	45	45

CH130 Chopper Module Test Procedure

Use the following procedure as an aid in troubleshooting the chopper module. Refer to the power supply electrical schematic in the back of this manual.

WARNING

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

1. Turn all power to the HD3070 OFF.
   Disconnect mating receptacles in the RHF console to disable the high frequency transformer T1. See Figure 6-11 for location of T1.
   Note: RHF console door must be re-shut before attempting to start system.

2. Remove large fuse F4 and check for open. See Figure 6-6 for location of fuse.

3. Place the positive lead to the **+** side of the bridge and the negative lead to the **–** side of the bridge. See Figure 5-7. Note that actual connection points are hidden by the cap support bracket in Figure 5-7.

4. Turn power to the HD3070 ON, and start system up. After the START command has been given, check voltage. The input to the chopper at these points should be about +280 VDC.

   If the input is OK and fuse F4 was blown, replace the chopper module.

   If there is no +280 VDC input, check input to bridge for shorts. Also, check contactor (CON1), connections and associated wiring to the contactor. Repair and/or replace defective component(s) if necessary.

5. If voltage from step 4 is +280 VDC and corresponding fuse is not blown, check the chopper output at TB1 by placing the positive lead of the voltmeter at the (+) WORK terminal (#48A output cable) and the negative lead at the (-) TORCH terminal (#39A output cable). See Figure 5-7.

6. Turn the system on and press the START command. After the START command has been given, check the voltage. If the output from the chopper at these points is +280 VDC, the chopper is OK.

7. If the chopper does not output +280 VDC, check to see if LED1 logic power light is on. If LED1 is not on, check if 120V is going to JP6. If there is no 120V at JP6, check wiring back to power distribution board. Repair or replace defective component(s), if necessary.

   Also check to see if LED3 is turning green when enabled (normal condition). If LED1 is on and LED3 is red when enabled (fault condition), then make sure that JP9 is seated properly. If JP9 is connected, disconnect one side of the thermo switch wire (TS1) and try again. If voltage comes up and LED3 turns green, the unit is either too hot or thermo switch is shorted. Allow unit to cool and repeat test. If LED3 still turns green, replace chopper module.

8. If chopper still does not output 280V after completing step 7, there may be a problem with the control signal or the chopper module. The chopper drive signal comes from control board 1XPCB3 as an analog level from 0 to +8 VDC, which varies the duty cycle and subsequent output current of the chopper. These analog signals are on pins 5 & 6 of REC3 on control board 1XPCB3.

   To determine if there is a problem with the chopper module or control board 1XPCB3, proceed as follows:

   - Ensure that high frequency is still disabled (see step 1).
   - Place voltmeter across output terminals of chopper (positive lead to (+) WORK and negative lead to (-) TORCH and press the START command.
   - If the voltmeter reads +280 VDC, then replace control board 1XPCB3.
   - If the voltmeter reads 0 volts, then replace chopper module.

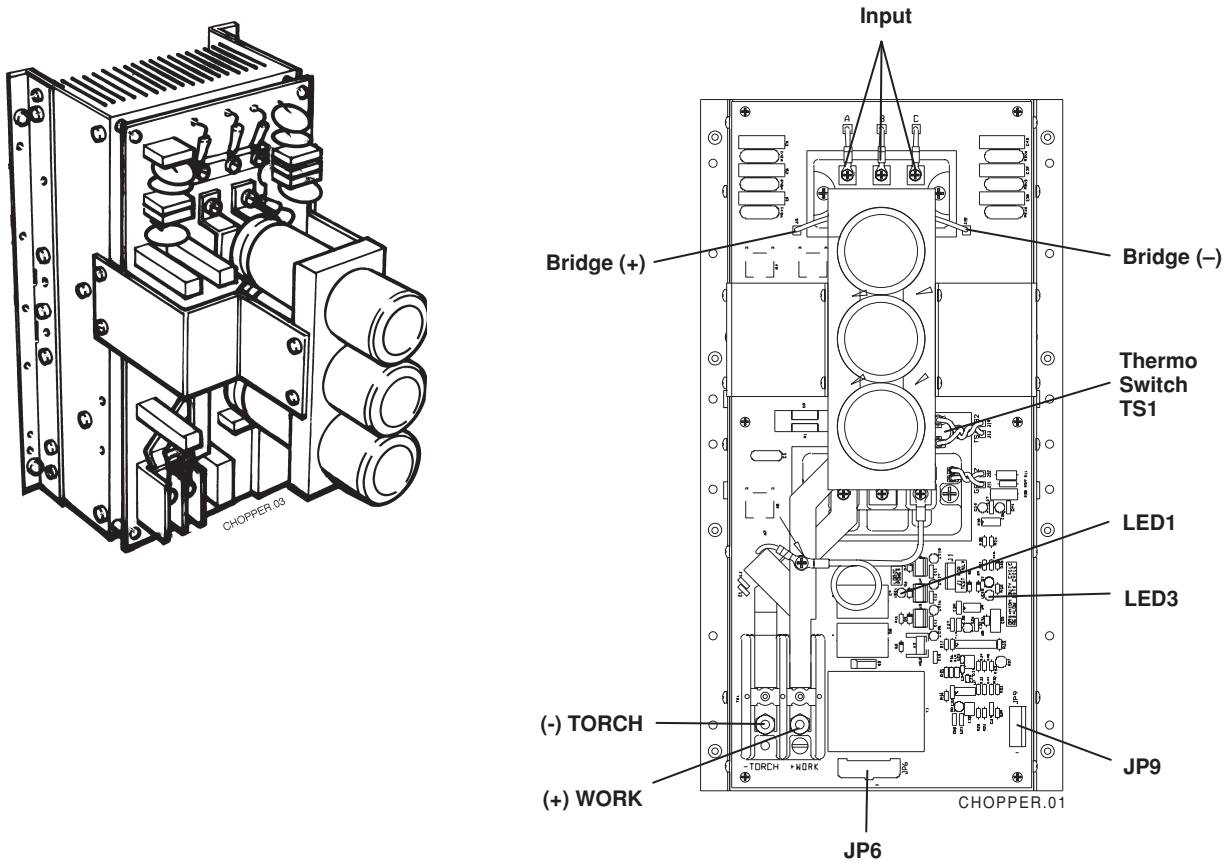


Figure 5-7 CH130 Chopper Module – Front View

PAC 186 Torch Maintenance

WARNING

Turn off all power to the HyDefinition system before working on the torch. Always press the power unit OFF (O) pushbutton switch and set the line disconnect switch to OFF. Lock-out and tag-out switch.

Water Tube Removal and Replacement

1. Use the nut driver (4.5 mm), located in consumable parts kit, to remove water tube from torch (Figure 5-8).

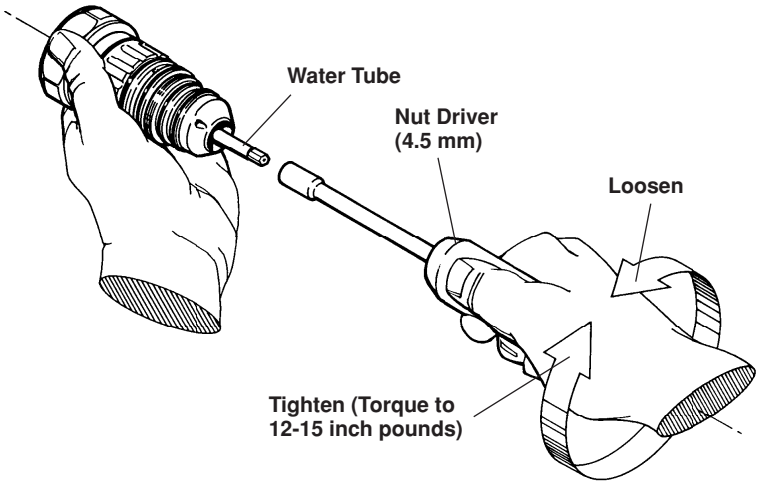
2. Carefully unscrew the water tube in a counterclockwise (ccw) direction.

Caution: While cleaning the inside of the torch in step 3. below, be very careful not to dislodge the gold band from the groove inside the torch. If this happens internal arcing damage will occur.

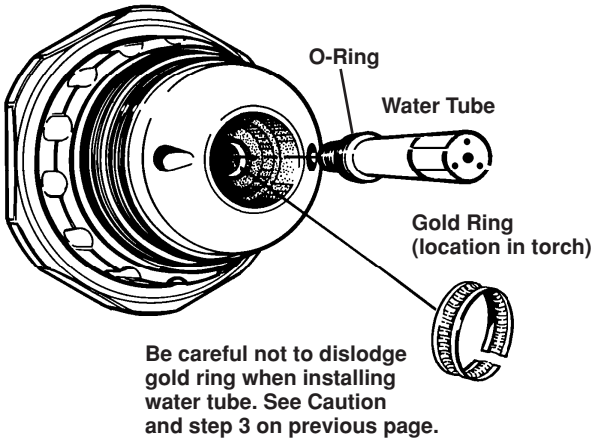
3. After the water tube has been removed, clean the inside of the torch using low pressure compressed air or water. Carefully clean out the seat area of the water tube of any residue using a cotton swab. Be careful not to dislodge the gold band from the groove. If the gold ring gets dislodged, reinstall it by referring to Figure 5-8.

4. Apply a light coat of silicone to the O-ring located at the base of the new water tube.

5. Screw the new water tube into the torch clockwise (cw) and tighten with nut driver. Torque to 12-15 inch pounds. **Do not over tighten.**



Loosening and Tightening Water Tube



Install New Water Tube

Figure 5-8 Install New Water Tube

Bullet Connector Removal and Replacement

1. If the bullet connector is not broken, use 9/32-inch nut driver to remove the connector (Figure 5-9).

2. If the bullet connector is broken off so that a nut driver cannot be used to remove the connector, use a three-sided file with a tapered end or a similar tool that will provide a grip.

3. Apply a light coat of silicone to the O-rings on the bullet connector.

4. Screw the replacement bullet connector into the receptacle and tighten with nut driver to **3 in - lbs (3.5 kg-cm). Do not over tighten.**

High Current Contact Removal and Replacement

1. Grab the high current contact with the tweezers and pull off stud (Figure 5-9).

2. Replace by pushing the high current contact into the slot on the stud.

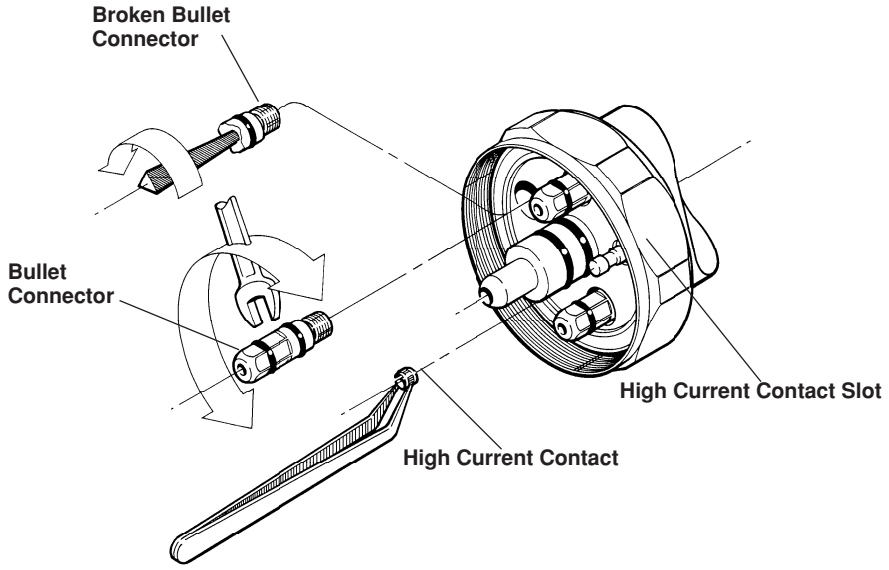


Figure 5-9 Bullet Connector and High Current Contact Removal and Replacement

Hypertherm

Section 6

PARTS LIST

In this section:

Introduction

In this section, a parts breakdown with supporting illustrations for the units which comprise the HD3070 system is given. Part numbers for cables, hoses, and lead sets are also given.

Power Supplies

078019 – 240/480 VAC, 3 Phase, 60 Hz
078023 – 208 VAC, 3 Phase, 60 Hz
078024 – 220/380/415 VAC, 3 Phase, 50/60 Hz
078025 – 600 VAC, 3 Phase, 60 Hz
078030 – 200 VAC, 3 Phase, 50/60 Hz

Power Supply – Control Panel

Item	Part Number	Description	Designator	Qty.
	029946	**HD3070 Enclosure SA**		**1**
1	001512	Panel, control		1
2	008786	Knob (used on item 11)		1
3	008787	Knob Lock, (used on item 11)		1
4	005088	Holder, lamp		1
5	005168	Bulb, 28VDC, .08 MA T3-1/4		1
6	005091	Cap, red		1
	029945	**Harness SA**		**1**
7	005122	Pushbutton, 2 NC, red, extended	PB2	1
8	005121	Pushbutton, 2 NO, green, illmn.	PB1/LT1	1
9	**041545**	**PC BD Assy, interlock display**	**1XPCB5**	**1**
	029977	**Thumbwheel SA, current**		**1**
10	005182	Switch, 3-position BCD	S1	1
	029394	**Potentiometer SA**		**1**
11	009604	Res, variable, 100KΩ, 2W 10% 1 turn	P1	1

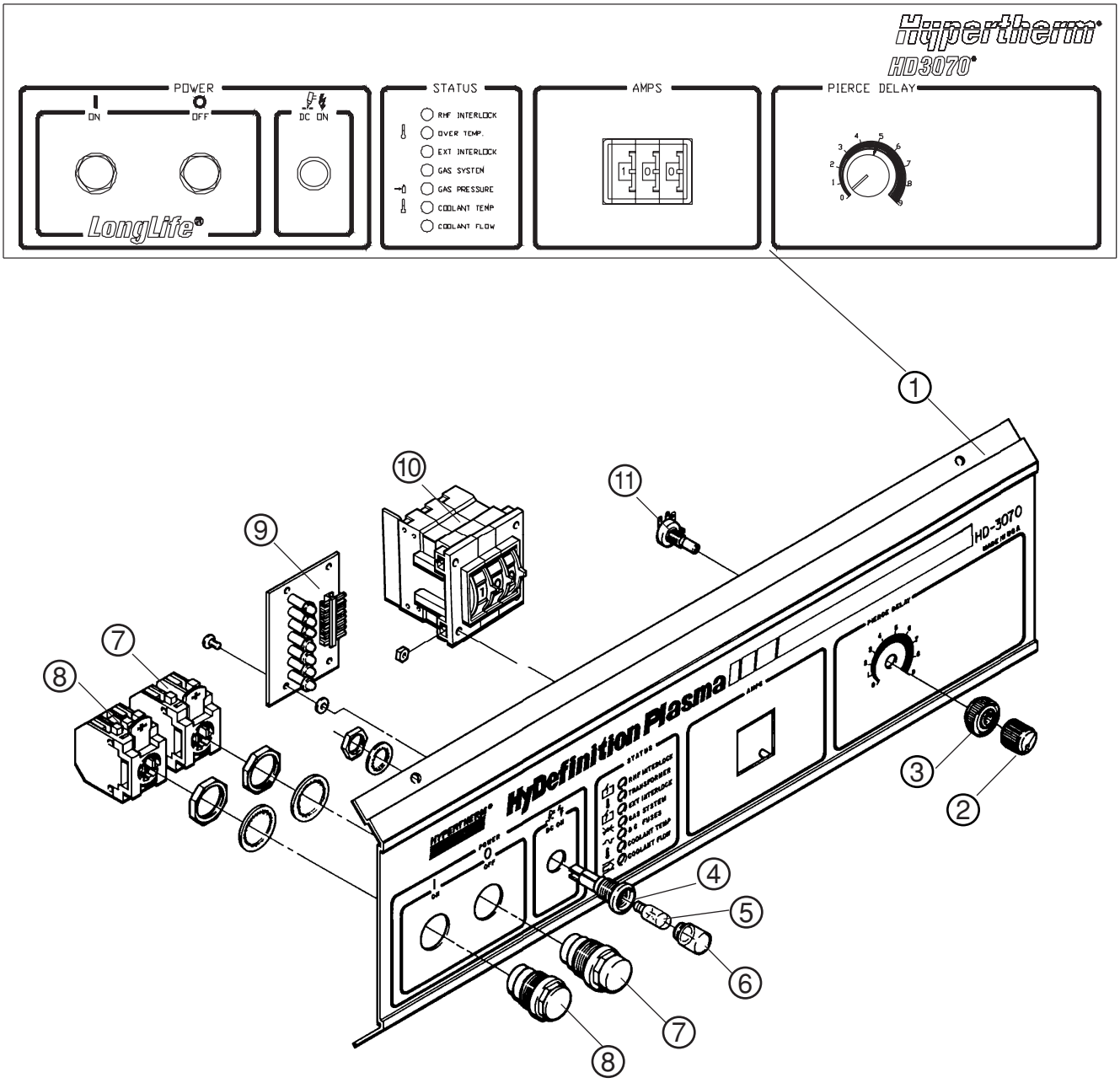


Figure 6-1 Power Supply – Control Panel

Power Supply – Front Exterior

Item	Part Number	Description	Designator	Qty.
	029946	**HD3070 Enclosure SA**		**1**
1	041246	PC BD assy, relay	1XPCB4	1
2	003113	Relay, DPDT, 12V Coil	CRE	1
3	003142	Relay, DPDT, 120 VAC	CRF, CRG	2
4	041349	Power source, 12V 2.1A		1
5	041753	PC BD assy, controller	1XPCB3	1
	081078	Firmware		1
	129307	**Fan Assembly**		**1**
6	027080	Fan, 225 CFM, 120 VAC, 50/60 Hz	M2	1
	027568	Fan Guard (not shown)		1
	129308	**Fan Assembly**		**1**
7	027079	Fan, 450-550 CFM, 120 VAC, 50/60 Hz	M4	1
	027567	Fan Guard (not shown)		1

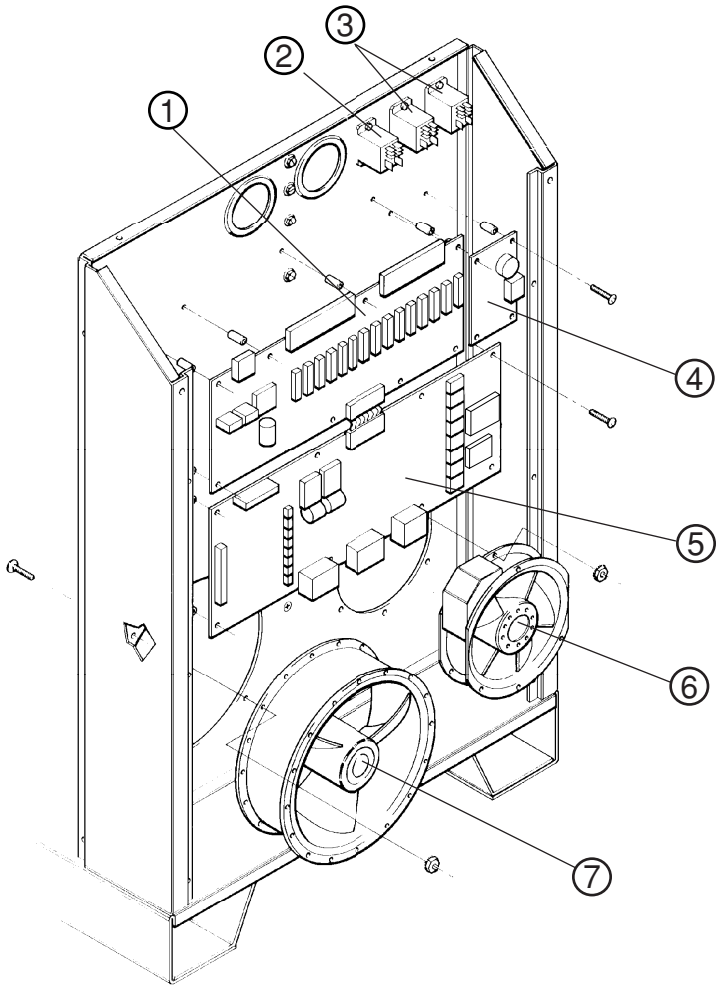
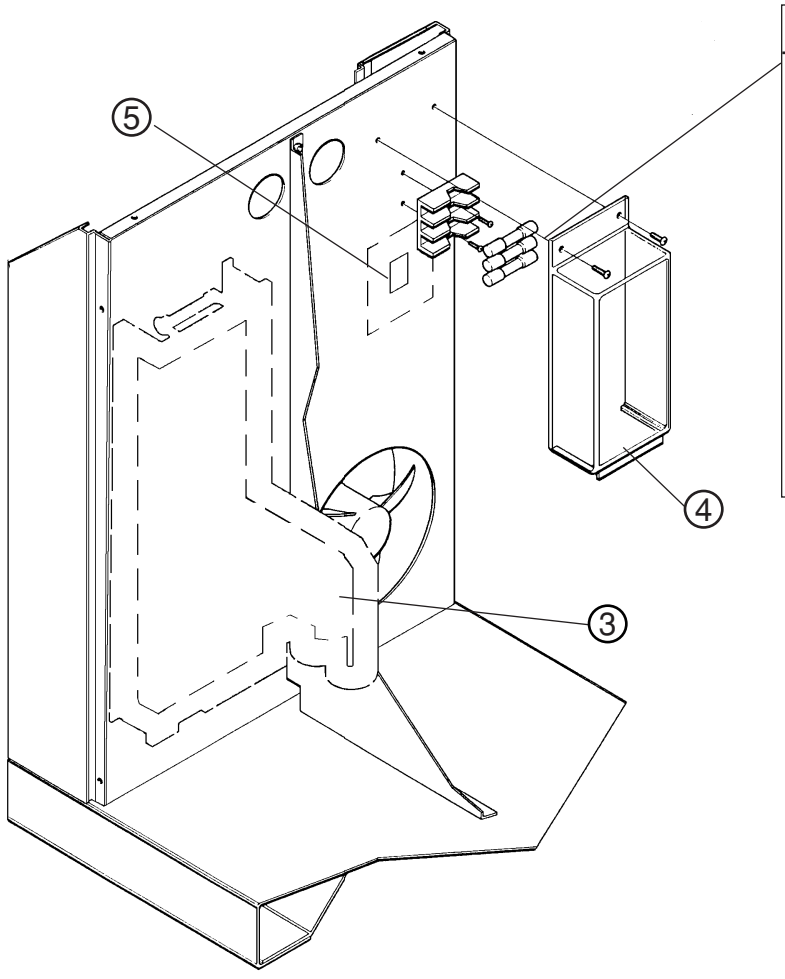


Figure 6-2 Power Supply – Front Exterior

Power Supply - Front Interior, Right and Left Sides

Item	Part Number	Description	Designator	Qty.
1	008709	Fuse, 20A 500V 13/32 X 1-1/2 slow blow	see chart below	
2	008551	Fuse, 7.5A 600V 13/32 X 1-1/2	see chart below	
	029946	**HD3070 Enclosure SA**		**1**
3	**129118**	**Chopper SA, CE/LVD 15KW (Fig 6-4)**	**CH130**	**1**
4	002217	Shield cover (used with item 5)		1
5	**029626**	**Linkboard SA, 240-480V (see Fig 6-5)**	**LB1**	**1**



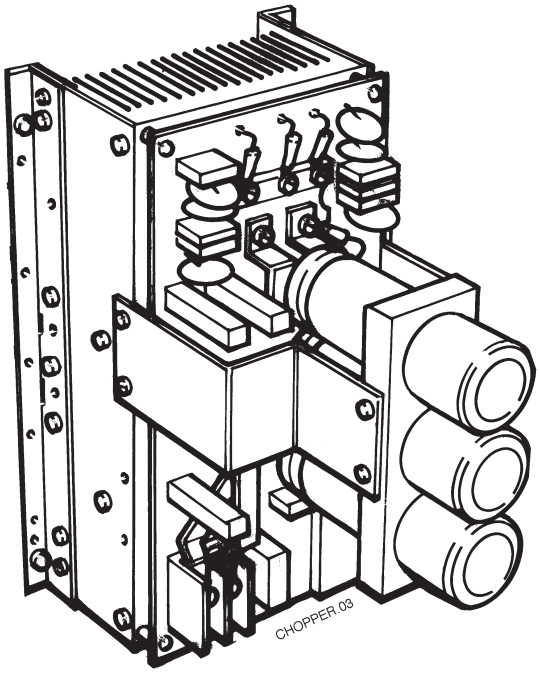
1, 2 Input Power Fuse Chart

Power Unit	F1	F2	F3
240/480V (078019)	20A	20A	7.5A
208V (078023)	20A	20A	
220/380/415V (078024)	20A	7.5A	7.5A
600V (078025)	7.5A	7.5A	
200V (078030)	20A	20A	

Figure 6-3 Power Supply – Front Interior, Right and Left Sides

Power Supply – CH130 Chopper Subassemblies

Item	Part Number	Description	Designator	Qty.
	029946	**HD3070 Enclosure SA**		**1**
	129118	**Chopper SA, CE/LVD 15KW**	**CH130**	**1**
1	005199	Switch, temperature 82° C	TSW1	1
2	041564	PC BD assy, phase loss protection		1



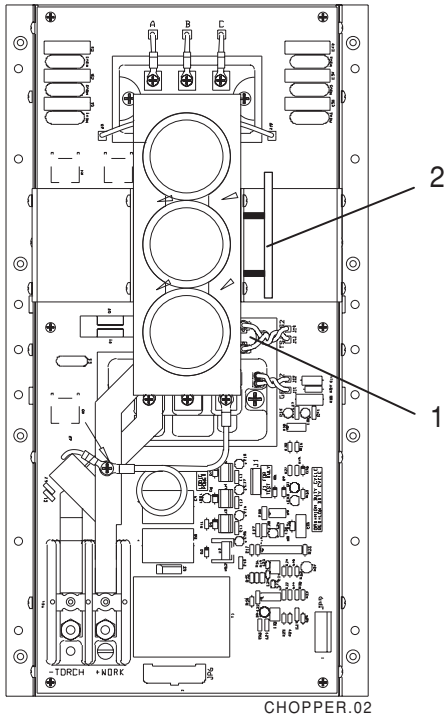
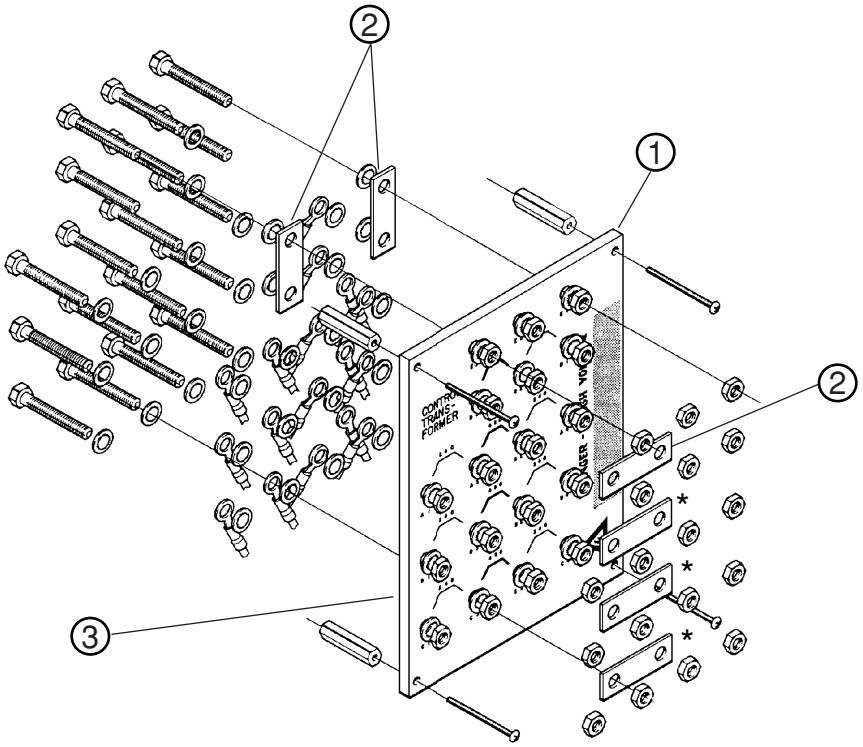


Figure 6-4 Power Supply – CH130 Chopper SA

Power Supply – Linkboard Subassemblies

240/480V Linkboard

Item	Part Number	Description	Designator	Qty.
	029626	**Linkboard SA, 240-480V**	**LB1**	**1**
1	004244	Linkboard, 240-480V		1
2	004245	Link, short		9
3	004246	Link, long (on rear of linkboard)		1



*** The linkboard is shipped with two links in each of the positions denoted by asterik.**

Figure 6-5 Power Supply – Linkboard Subassemblies (Sheet 1 of 2)

Power Supply – Linkboard Subassemblies

220/380/415V Linkboard

Item	Part Number	Description	Designator	Qty.
	029987	**Linkboard SA, 220/380/415V**	**LB1**	**1**
1	004683	Linkboard, 220/380/415V		1
2	004245	Link, short		8
3	004600	Link, MAX70		1
4	004684	Link, long (on back of linkboard		1

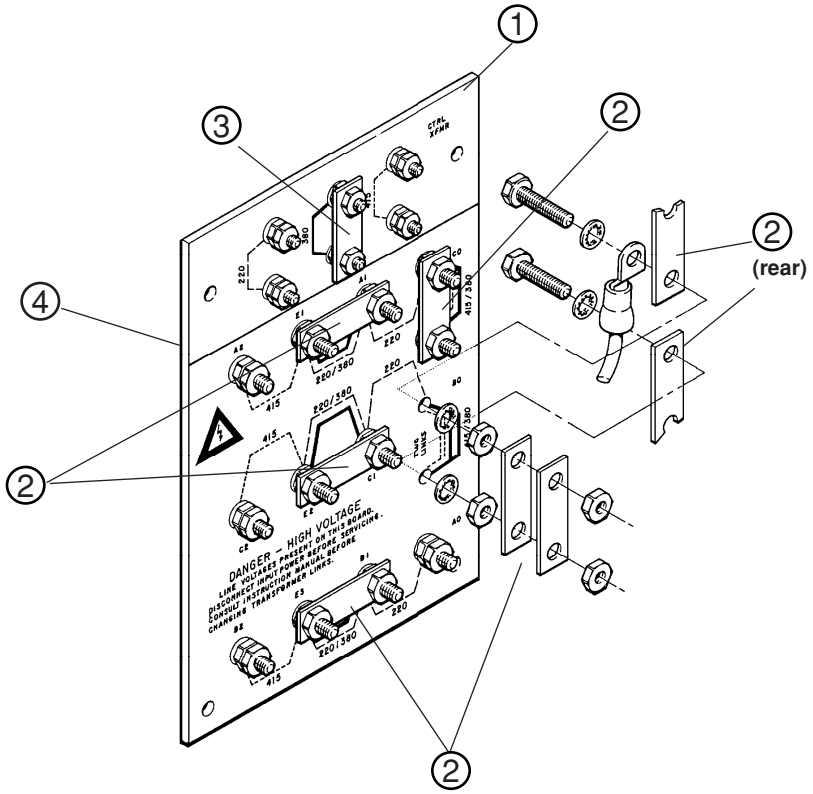


Figure 6-5 Power Supply – Linkboard Subassemblies (Sheet 2 of 2)

Power Supply – Center Panel and Bottom, Right Side

Item	Part Number	Description	Designator	Qty.
	029946	**HD3070 Enclosure SA**		**1**
1	**041544**	**PC BD assy, power distribution**	**1XPCB2**	**1**
2	003021	Relay, 120 VAC NO SPST	CR4	1
3	009685	Resistor, 15 ohms, 50W, 5%	R2A, R2B	2
4	003113	Relay, DPDT, 12V Coil	CRA, CRB	2
5	003074	Relay, DPDT, 24 VAC, 10A	CRC	1
6	003142	Relay, DPDT, 120 VAC	CRD	1
7	003133	Contactor, HD1070, 50A, 3Ph, 120V coil	CON1	1
	003065	Switch, contact aux, 4A NO		2
8	009296	Capacitor, Ele 100 uf 350 VDC	C1	1
9	009015	Resistor, 10K ohms, 10W, 5%	R1	1
10	008317	Fuse, 125A semiconductor	F4	1
11	**029316**	**Terminal Block SA, incoming power**	**TB1**	**1**
12	014043	Inductor, 4 mh, 100A DC	L1	1
13	007022	Shunt, 100A, 100 MV	R3	1

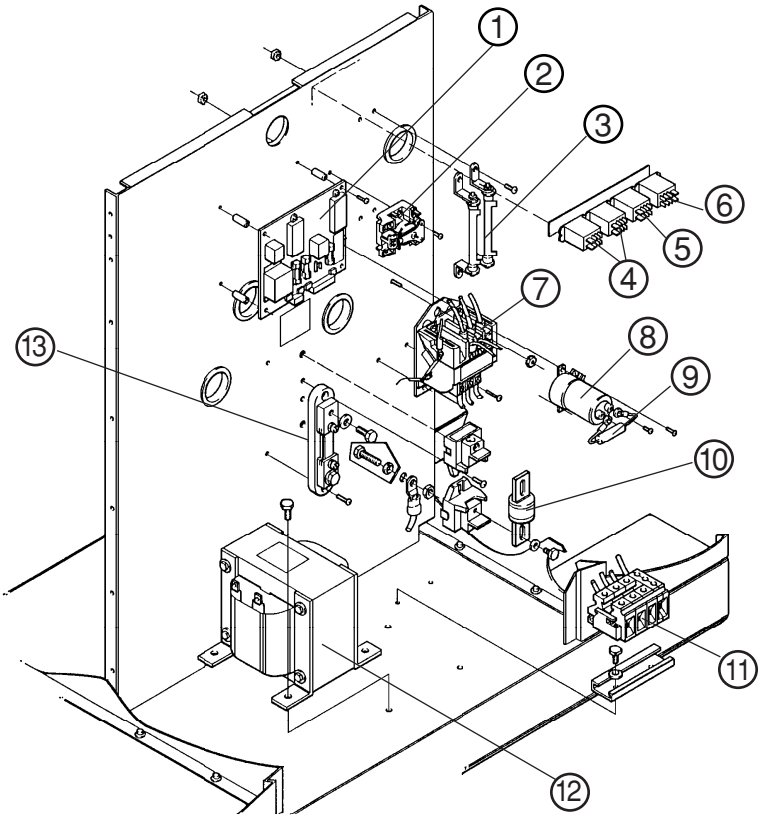


Figure 6-6 Power Supply – Center Panel and Bottom, Right Side

Power Supply – Center Panel and Bottom, Left Side

Item	Part Number	Description	Designator	Qty.
1	014068	Transformer, 15 KW, 240-480/3/60	T2	1
	014065	Transformer, 15 KW, 220-380-415/3/50		
	014069	Transformer, 15 KW, 200/3/50		
	014066	Transformer, 15 KW, 208/3/60		
	014067	Transformer, 15 KW, 600/3/60		
	029624	**Control Transformer SA, 240-480V**		
2	014079	Transformer, control 240-480V/60 Hz	T1	1
	029690	**Control Transformer SA, 220-380-415V**		
	014081	Transformer, control 220-380-415V/50 Hz		
	029671	**Control Transformer SA, 200V & 208V**		
	014110	Transformer, control 200V/50 Hz & 208/60 Hz		
	029711	**Control Transformer SA, 600V**		
	014083	Transformer, control 600V/60 Hz		
	029946	**HD3070 Enclosure SA**		
3	003021	Relay, 120 VAC NO SPST	CR1	1

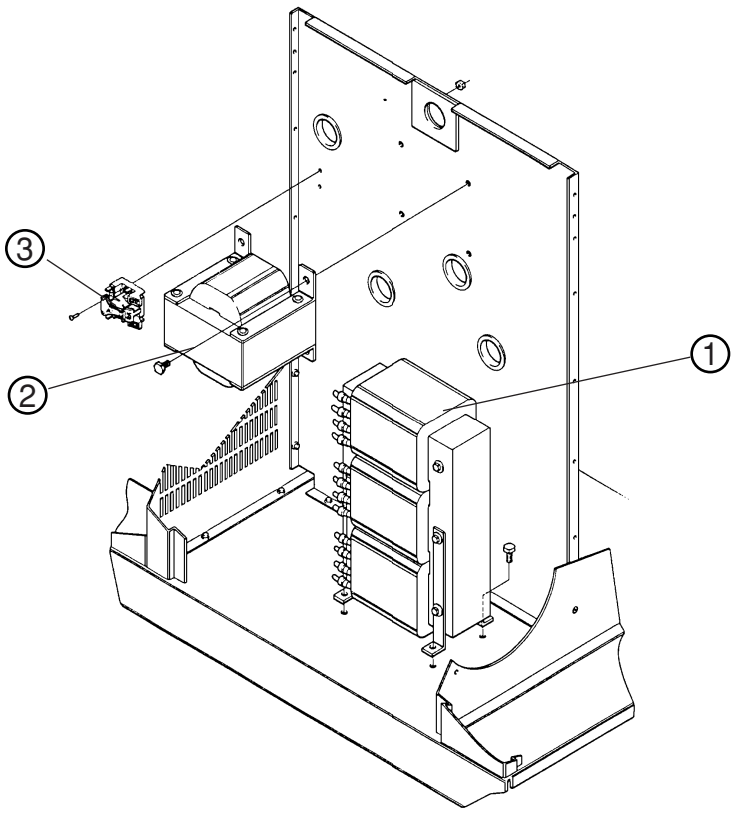


Figure 6-7 Power Supply – Center Panel and Bottom, Left Side

Power Supply - Rear Interior, Right and Left Sides

Item	Part Number	Description	Designator	Qty.
	029946	**HD3070 Enclosure SA**		**1**
1	041274	PC BD assy, ISO amp, HD-2070	1XPCB5	1
	129172	**Harness SA**		**1**
2	008079	Terminal board, 12 terminals	TB2	1
3	008063	Terminal board, 3 terminals	TB3	1
4	108049	Fuse, FLQ30 time delay, 30 amp	F5	1
5	129264	Assembly, pilot arc circuit		1
6	**029623**	**HF I/O Panel SA (see Fig 6-9)**		**1**

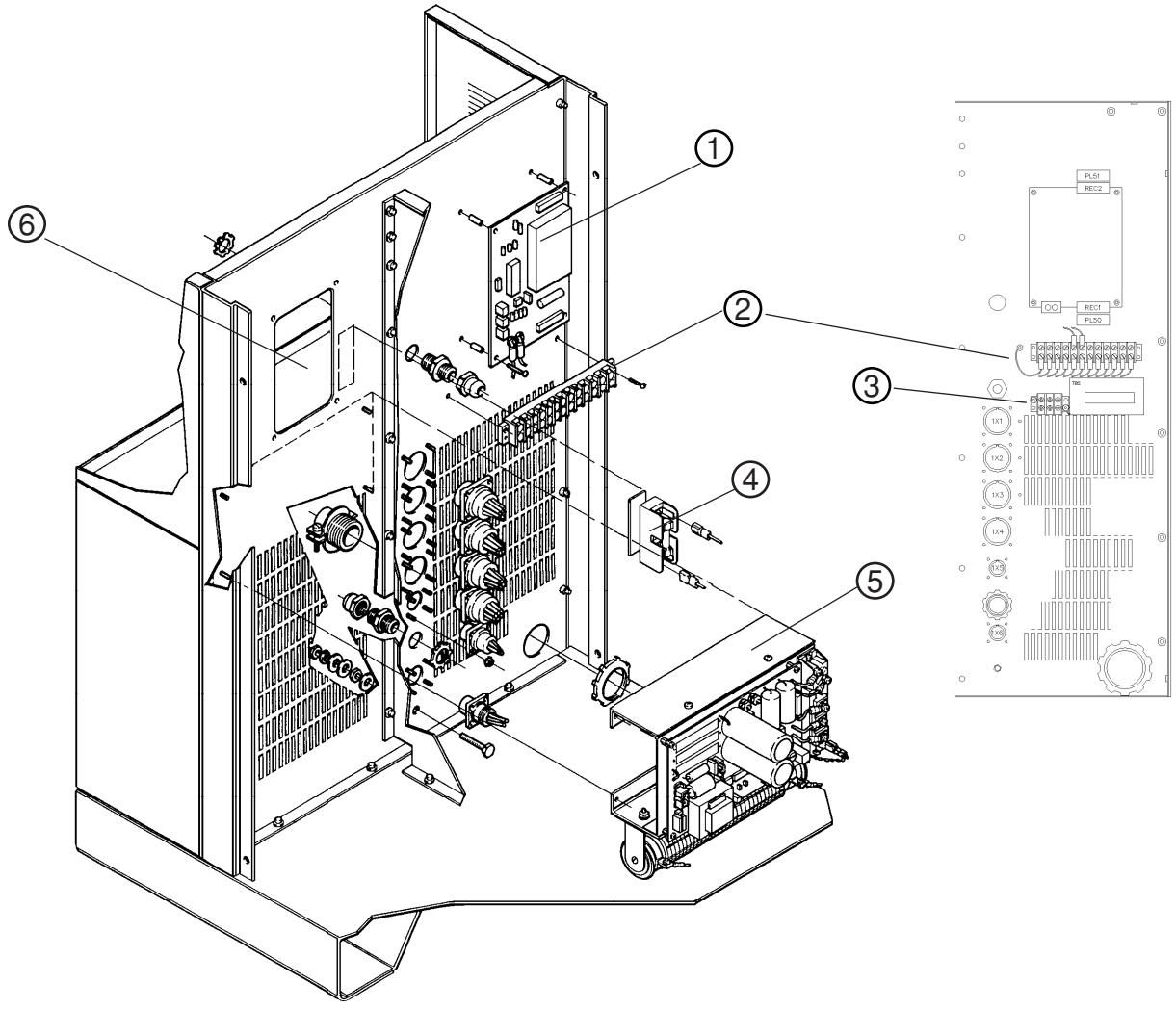


Figure 6-8 Power Supply – Rear Interior, Right and Left Sides

Power Supply – HF I/O Panel Subassembly

Item	Part Number	Description	Designator	Qty.
	029946	**HD3070 Enclosure SA**		**1**
	029623	**HF I/O Panel SA**		**1**
1	001350	Panel I/O		1
2	**041291**	**PC BD assy, I/O**	**1XPCB1**	**1**
3	108049	Fuse, FLQ30 time delay, 30 amp	F5	1
	029202	**Current Sensor SA**		**1**
4	009373	Current sensor	CS1	1

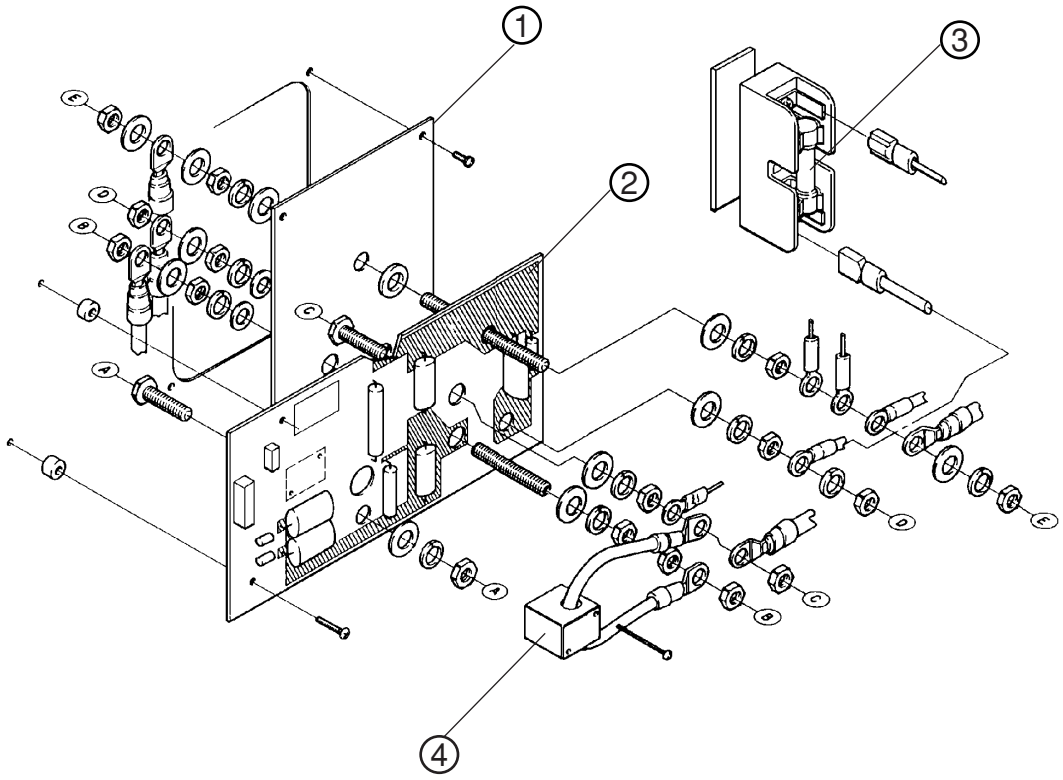


Figure 6-9 Power Supply – HF I/O Panel SA

Power Supply – Rear Exterior

Item	Part Number	Description	Designator	Qty.
	029946	**HD3070 Enclosure SA**		**1**
	029986	**HD3070 Enclosure SA (for 220/380/415V units)**		**1**
	129252	**Water Pump SA**		**1**
1	128385	Kit, Replacement motor, 1/3 HP	M1	1
2	128384	Kit, Replacement pump, 70 GPM	P1	1
3	031122	Drive coupling, Pump to motor		1
4	129474	Flow switch SA, 0.5 gpm	FS1	1
	029634	**Heat Exchanger SA**		**1**
5	027136	Heat exchanger water/air (includes four fans M4 - M7)	HX1	1
	129253	**Water Filter SA**		**1**
6	027139	Filter housing, 10" X 3/4 NPT		1
7	027005	Filter, element particulate		1
8	002304	Reservoir, coolant		1
9	022036	Gauge, liquid level		1
10	006099	Drain valve, 1/4 NPT		1
11	129618	Level Switch SA (w/ elec connector)	LS1	1
12	029323	Water Temp Switch SA (w/ elec connector)	TS2	1
	129251	**Shutoff Valve SA (includes fittings)**		**1**
13	006108	Shutoff valve, 1/4 FPT		1
14	006075	Check valve, 1/4 NPT		2

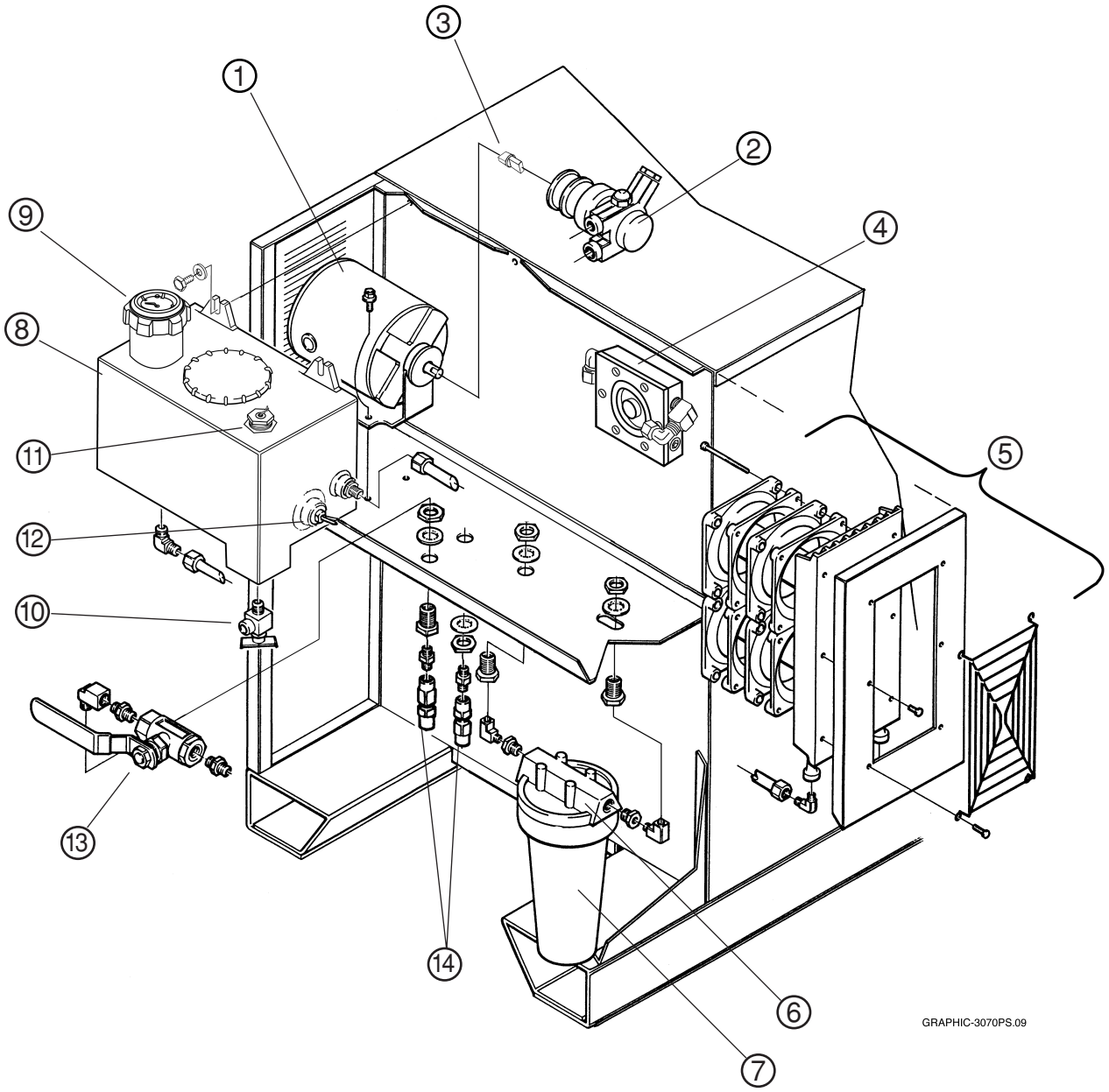
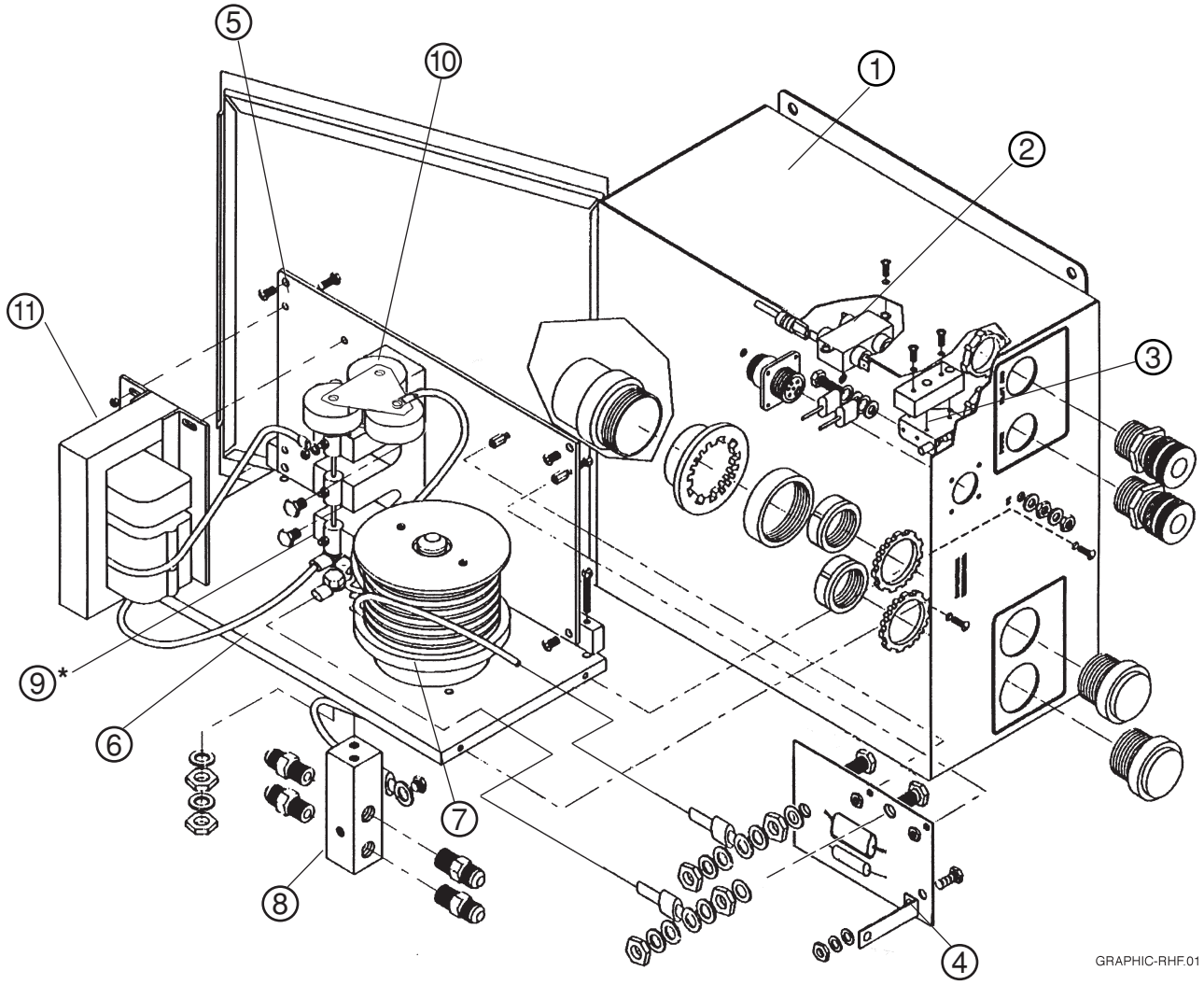


Figure 6-10 Power Supply - Rear Exterior

RHF Console

Item	Part Number	Description	Designator	Qty.
	078010	**Console, RHF**		**1**
1	002227	Enclosure, RHF console		1
2	009045	Filter, AC, 1 amp 1Bl	FL1	1
3	005100	Switch, limit door interlock	S1	1
4	**041578**	**PC BD assy, HD plasma**	**PCB1**	**1**
5	001447	Panel, RHF console		1
6	001429	Panel, RHF console enclosure		1
7	009756	Coil assy, HD plasma	T2	1
8	004502	Manifold, RHF cathode		1
	009979	**Spark Gap Assy**	**SG1**	**1**
9	004061	Electrode, spark gap 1/8 X 1.6		3
10	009995	Capacitor, 4000, 20 kV		3
11	129199	Transformer SA , 6 kV	T1	1



*** Set spark gap with clean feeler gauge to 0.020 ± 0.001 inch (0.51 ± 0.03 mm). Clean electrodes a with diamond file.**

Figure 6-11 RHF Console

Gas Console – Front Panel

Item	Part Number	Description	Designator	Qty.
	078059	**Console, gas**		**1**
1	001638	Panel, front, gas console		1
2	011051	Flowmeter, 0.100 gpm/0.45 cfh	FM1 Thru FM4	4
A	011029	Frame		1
B	044010	O-Ring		3
C	027652	Washer		2
D	011081	Outlet adapter		1
E	011013	Adapter clip		1
F	004872	Spacer		1
G	027653	Rubber washer		1
H	011007	Float		1
J	011061	Tube		1
K	011008	Shield		1
3	006062	Valve, metering 1/8 FPT 0.062 orifice	MV1 THRU MV6	6
4	005156	Switch, toggle SPDT maint on/off/on	S2	1
5	006106	Valve, solenoid 120V 1/8 FPT	SV7 Thru SV12	6
6	005243	Switch, pressure 0-80 psi 1/8 NPT	PS1, PS2, PS3	3

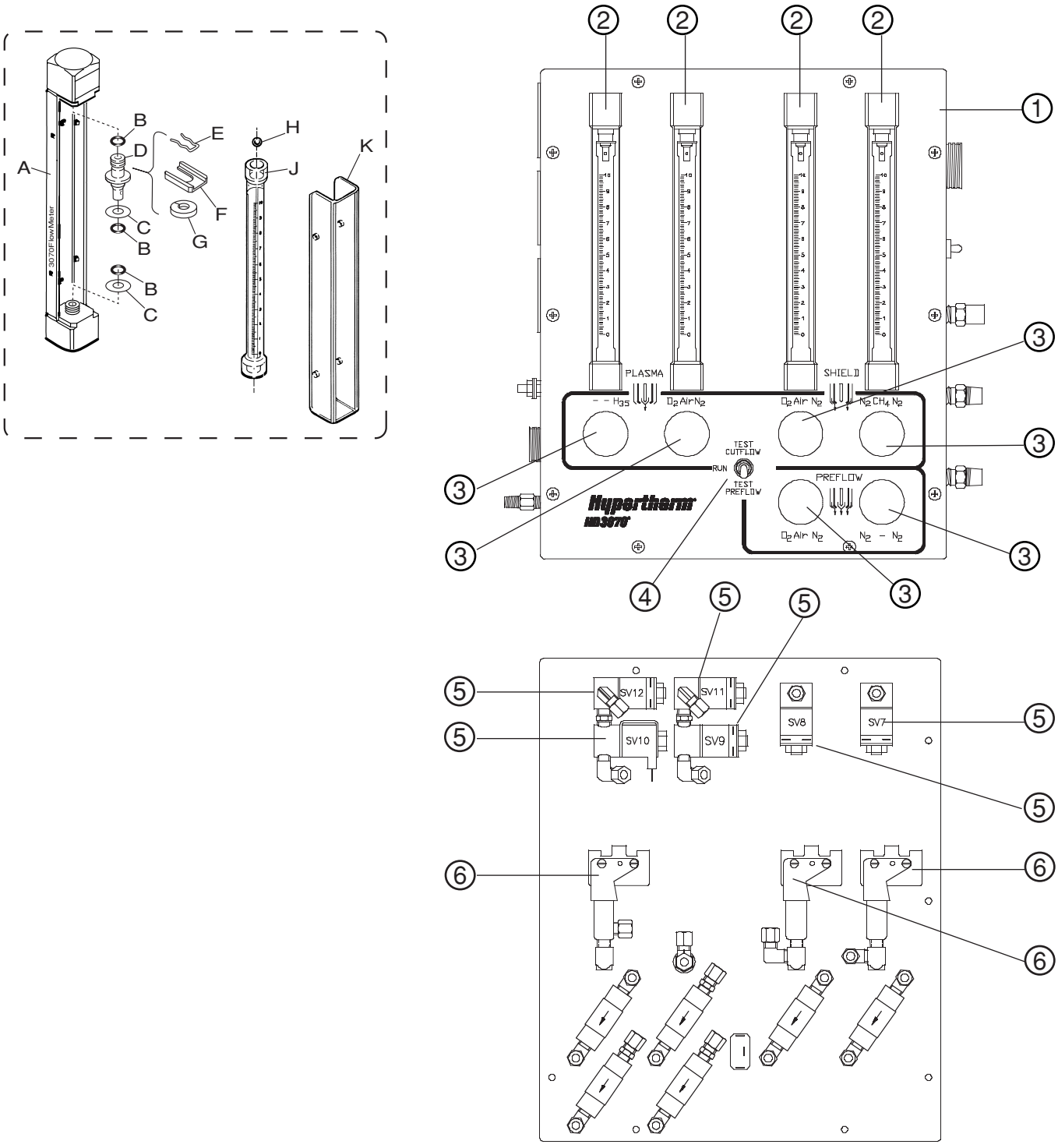


Figure 6-12A Gas Console – Front Panel

Gas Console – Right and Left Side

Item	Part Number	Description	Designator	Qty.
1	001639	Enclosure, gas console		1
2	001640	Cover, gas console		1
3	022020	Gauge, pressure, 160 psi/bar, pnl mt	PG4	1
4	022022	Gauge, pressure, 100 psi/bar, pnl mt	PG5	1
5	022023	Gauge, pressure, 60 psi/bar, pnl mt	PG6	1
6	006077	Valve, check 1/8 FPT		4
7	005213	Switch, toggle 2P 10A maint on/off/on	S1	1
8	022027	Gauge, pressure, 160 psi/bar	PG1, PG2, PG3	3
9	041553	PC board assy, gas valve distribution	PCB1	1
10	006106	Valve, solenoid 120V 1/8 FPT	SV1 Thru SV6	6

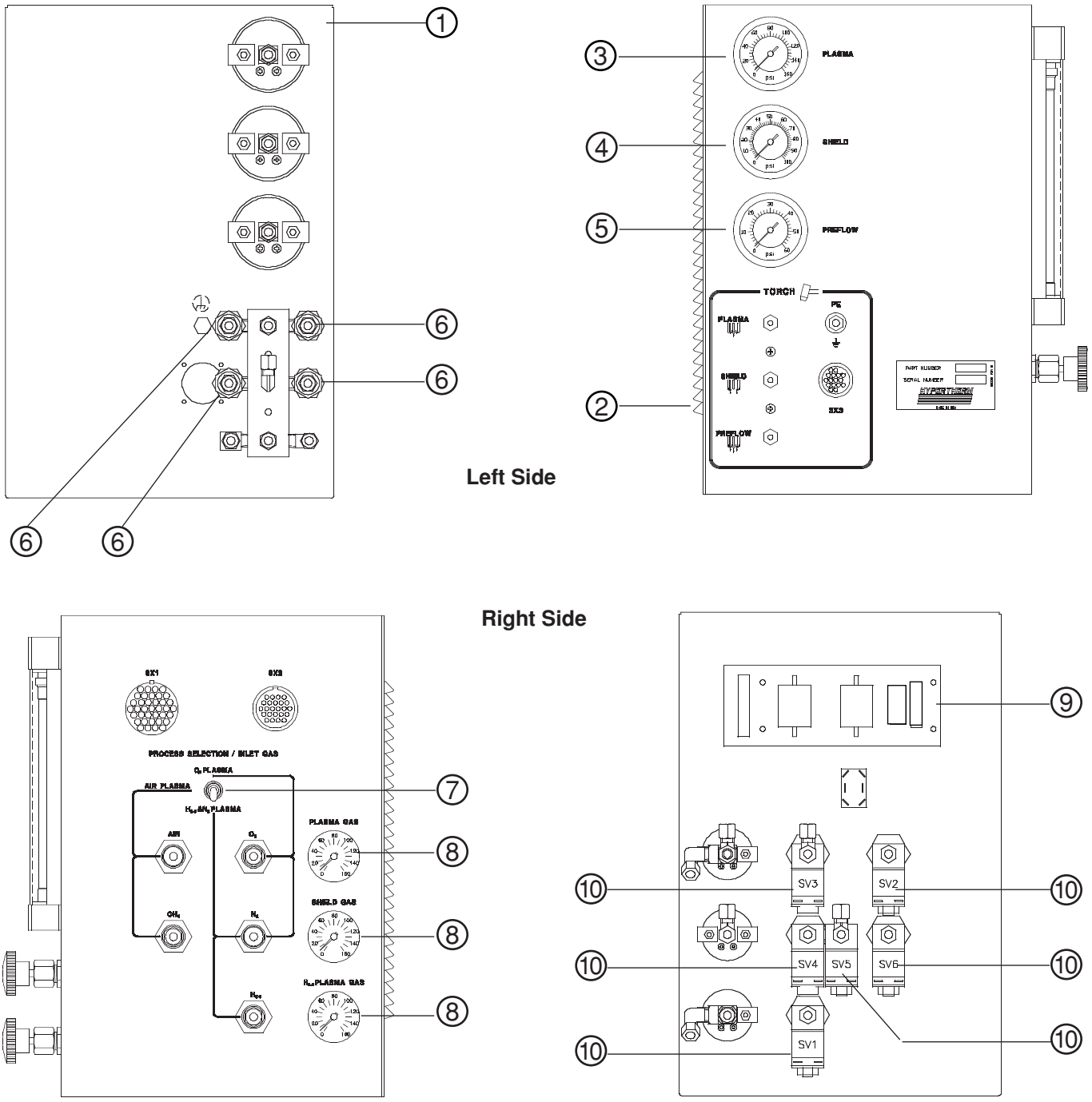


Figure 6-12B Gas Console – Left and Right Side

PAC184 Machine Torch Assemblies

Torch Assembly with IHS tab on Shield Cap (128199)*
Torch Assembly without IHS tab on Shield Cap (028839)**

Item	Part Number	Description	Designator	Qty.
1	120208	Torch Main Body		1
2	044507	O-Ring, Buna, 70 Duro 1.424 X .070		2
3	044025	O-Ring, Buna, 70 Duro 1.176 X .070		1
4	044012	O-Ring, Buna, 70 Duro 0.364 X .070		2
5	044508	O-Ring, Buna, 70 Duro 0.216 X .053		4
6	120204	Connector, Bullet Brass		4
6A	008890	Contact, high current		1
7	120209	Electrode, 15/30 amp		1
8	120212	Swirl Ring, 15/30 amp		1
9	120218	Nozzle, 30 amp		1
10	120219	Cap, inner nozzle, 15/30 amp		1
11	120222	Shield, 15/30 amp		1
12	120543	Shield Cap (with IHS tab)*		1
	120221	Shield Cap (without IHS tab)**		1

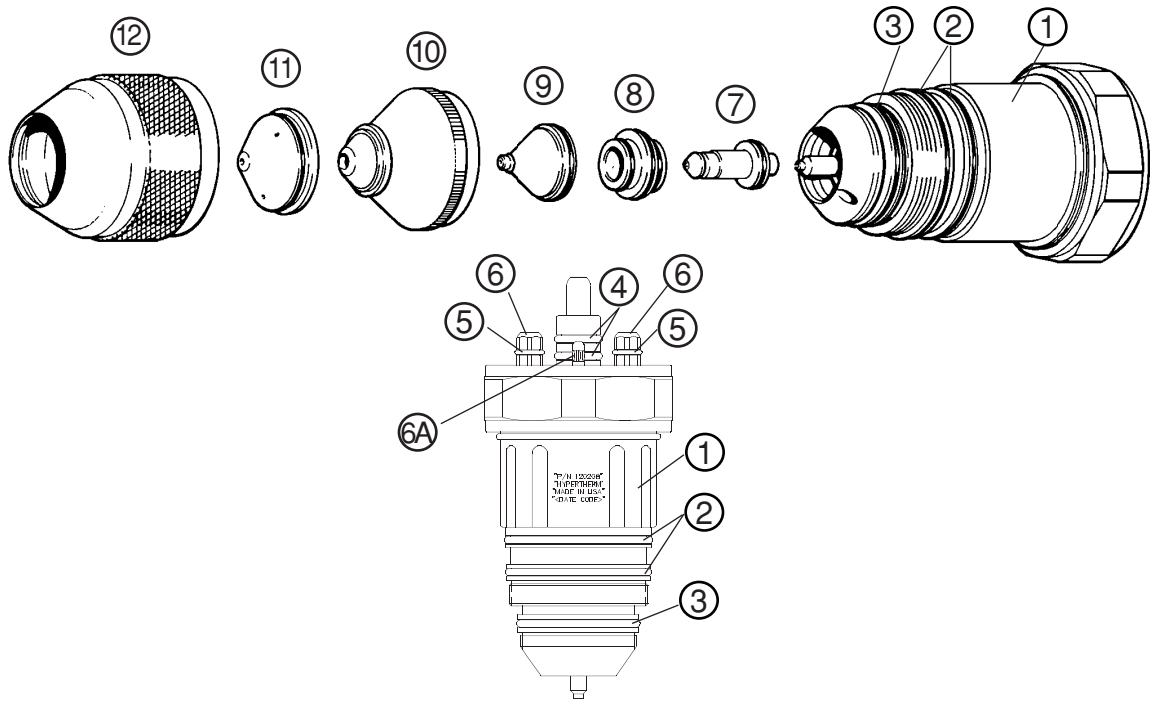


Figure 6-13 PAC184 Machine Torch Assembly

PAC186 Machine Torch Assemblies

Torch Assembly with IHS tab on Shield Cap (128101)*
Torch Assembly without IHS tab on Shield Cap (128102)**

Item	Part Number	Description	Designator	Qty.
1	120349	Torch Main Body		1
2	044507	O-Ring, Buna, 70 Duro 1.424 X .070		2
3	044026	O-Ring, Buna, 70 Duro 1.239 X .070		1
4	044025	O-Ring, Buna, 70 Duro 1.176 X .070		1
5	044012	O-Ring, Buna, 70 Duro 0.364 X .070		2
6	044508	O-Ring, Buna, 70 Duro 0.216 X .053		4
7	120204	Connector, Bullet Brass		4
7A	008890	Contact, high current		1
8	120377	Tube, Water Electrode Cooling		1
9	120111	Electrode		1
10	020637	Swirl Ring		1
11	020645	Nozzle, 30A		1
12	020633	Cap, inner nozzle retainer		1
13	020671	Shield, 30A		1
14	020687	Shield Cap (with IHS tab)*		1
	020634	Shield Cap (without IHS tab)**		1

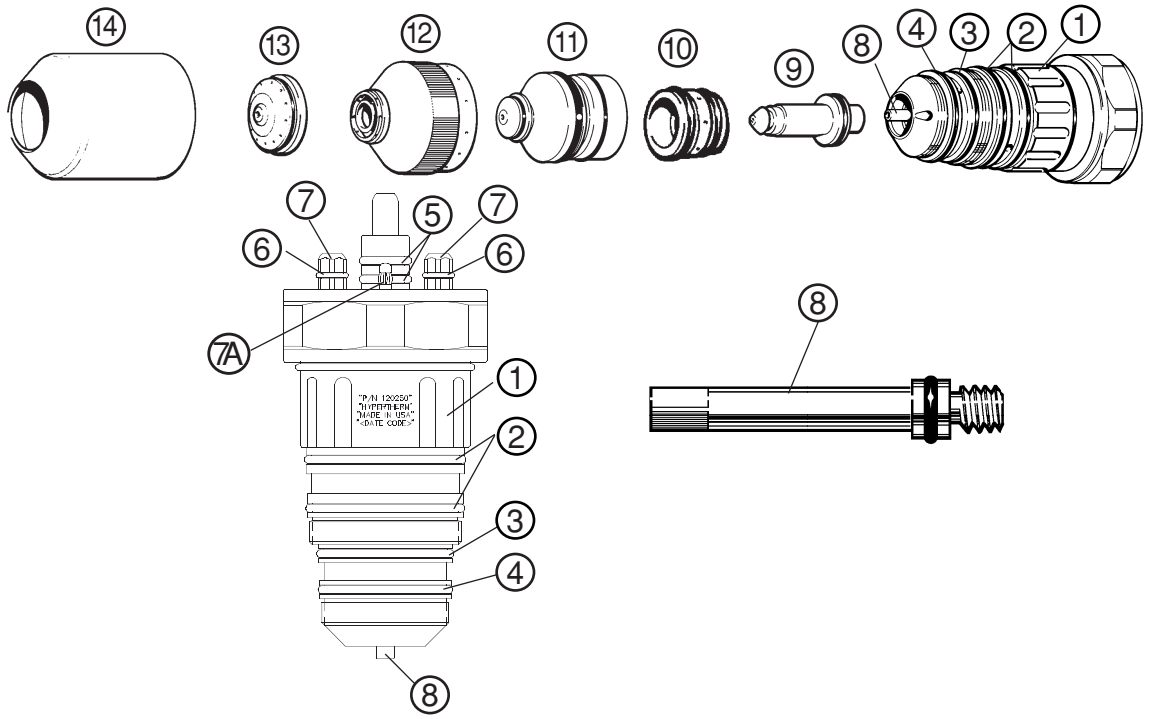


Figure 6-14 PAC186 Machine Torch Assembly

45° Torch Quick Disconnect Assembly, Mounting Sleeve and Torch Vent Hose

Item	Part Number	Description	Designator	Qty.
1	**028840**	Assy, 45° torch quick disconnect		1
2	120256	Sleeve, mounting		1
3	024485	Assembly, torch vent hose		1
4	015090	Hose clamp: 1-5/16 x 2-1/4		1
5	004908	Strain relief		1

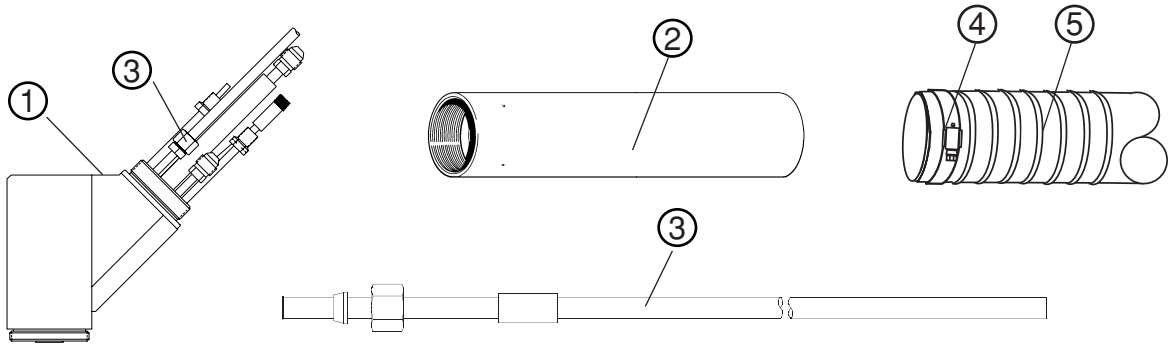


Figure 6-15 45° Torch Quick Disconnect Assembly, Mounting Sleeve and Torch Vent Hose

Straight Torch Quick Disconnect Assembly, Mounting Sleeve, Spacer and Torch Vent Hose

Item	Part Number	Description	Designator	Qty.
1	028855	Assembly, straight torch quick disconnect		1
2	020668	Sleeve, mounting		1
3	120317	Spacer, 2" ID/2-1/4" OD (for mounting off-valve to sleeve)		1
4	024485	Assembly, torch vent hose		1

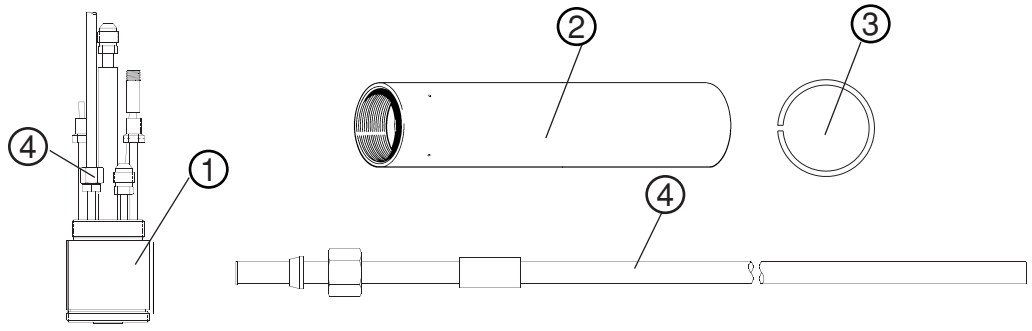


Figure 6-16 Straight Torch Quick Disconnect Assembly, Mounting Sleeve, Spacer and Torch Vent Hose

Off-Valve Assemblies

Item	Part Number	Description	Designator	Qty.
	129239	**Assembly, off-valve**		
	129281	**Assembly, off-valve (with blow back valve assy)**		
1	006107	Valve, solenoid 1/8 FPT 120V	SV14, 15, 16	3
2	120524	Bracket, torch valve mounting		1
3	046078	Tubing, 1/4" OD X .040 blk nyl		1.7 ft.
	123256	**Assembly, cable**		**1**
4	008192	Receptacle, shell, off-valve		1
5	008202	Plug, shell CPC 17-14 rvs sex		1
	008176	Pin, 24-20 Awg type lll + CRP		9
6	108025	Connector, din, 3p ra		3
	129282	**Assembly, blow back valve**		**1**
7	006100	Valve, solenoid 1/8 FPT 120V	SV17	1
8	108025	Connector, din, 3p ra		1
9	006077	Valve, check		1
10	120544	Bracket, blow back valve mounting		1

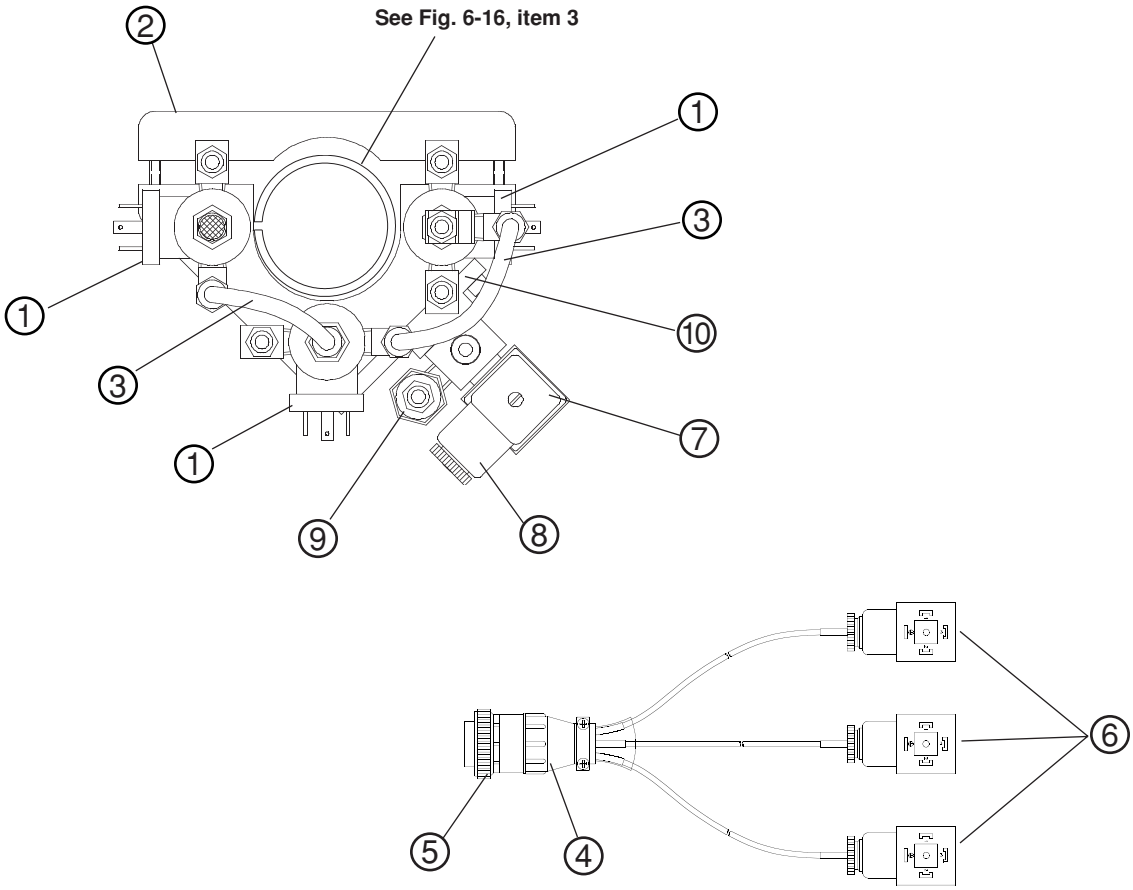


Figure 6-17 Off-Valve Assembly

PAC184 Torch Consumable Parts

15 and 30 Amp (Mild Steel)

Part Number	Description	Qty.
120543	Cap, shield (with IHS tab)	1
120221	Cap, shield (without IHS tab)	1
120222	Shield, 15/30 amp	1
120219	Cap, inner nozzle retainer, 15/30 amp	1
120277	Nozzle, 15 amp	1
120218	Nozzle, 30 amp	1
120212	Swirl ring, 15/30 amp	1
120209	Electrode, 15/30 amp	1

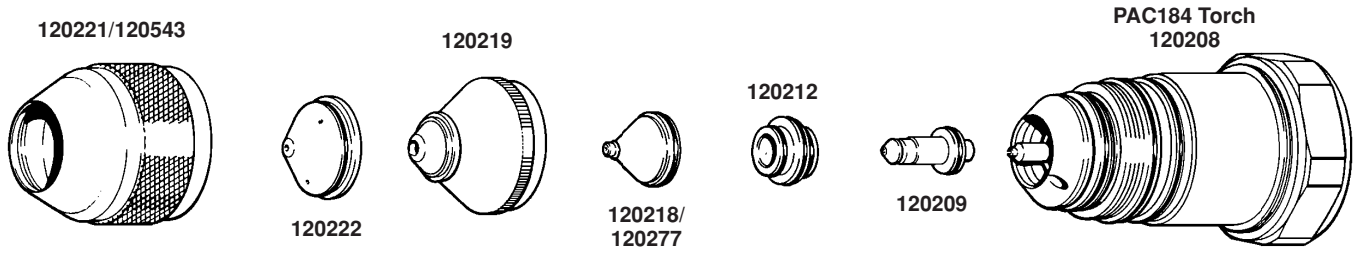
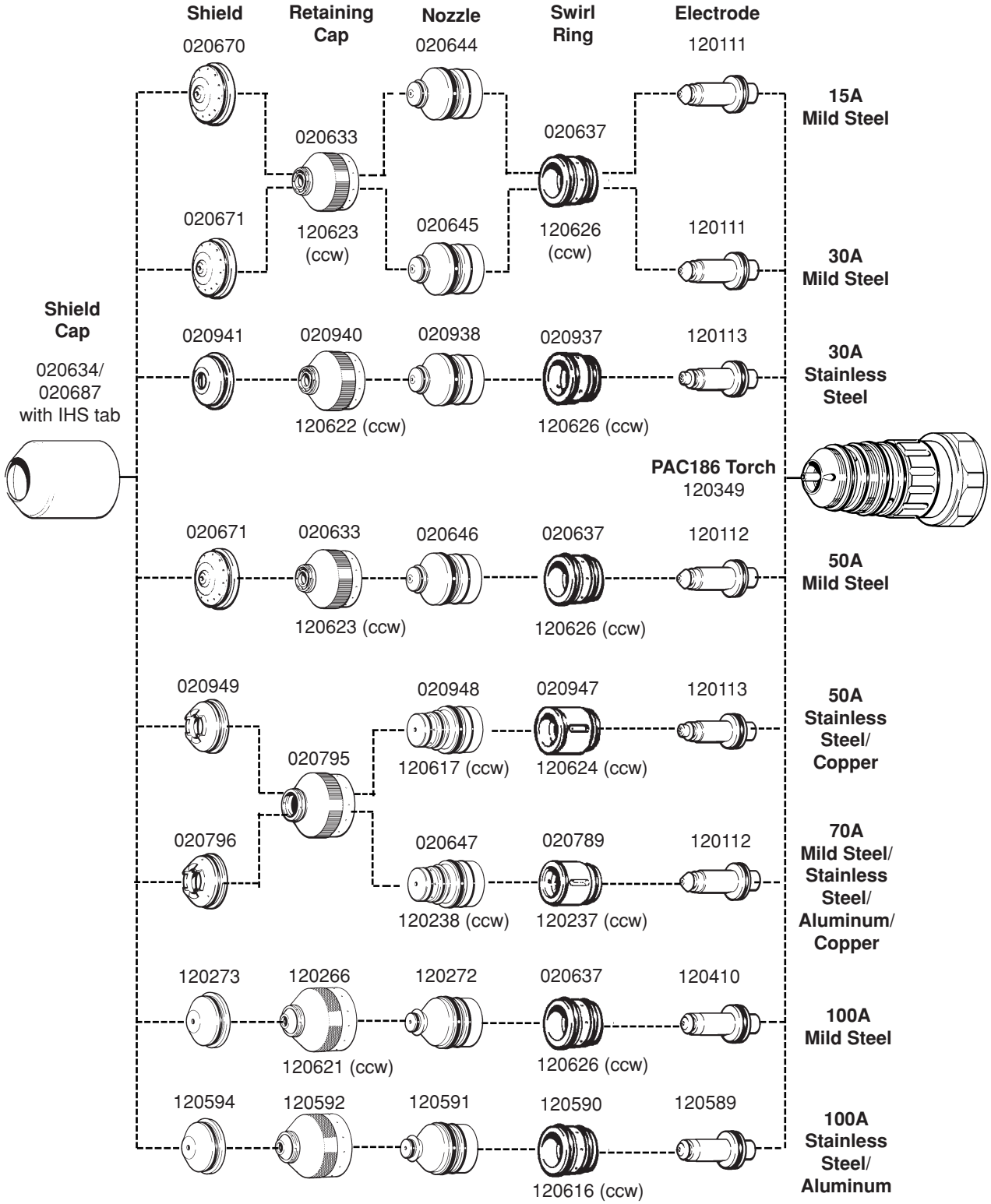


Figure 6-18 PAC184 Torch 15 and 30 Amp Mild Steel Consumable Parts

PAC184 Consumable Parts Kits

Part Number	Description	Qty.
028842	**Kit (includes spare PAC184 torch)**	**1**
028900	**Kit (less spare PAC184 torch)**	**1**
001579	Box, gray plastic	1
120208	Torch, PAC184 (028842 kit only)	1
120219	Cap, inner nozzle retainer, 15/30 amp	1
120212	Swirl ring, 15/30 amp	1
120209	Electrode, 15/30 amp	3
120277	Nozzle, 15 amp	3
120218	Nozzle, 30 amp	3
120222	Shield, 15/30 amp	3
026518	O-Ring, silicon cmpsn 1.176 X .070	1
044026	O-ring, Buna 70 Duro 1.239 X .070	1
044507	O-ring, Buna 70 Duro 1.424 X .070	2
004670	Tool, consumable parts	1
004630	Electrode gauge assembly	1
027343	Magnifier, loupe, 10X	1
027055	Lubricant, silicone 1/4 oz tube	1

PAC186 Consumable Parts



CCW (counter clockwise) consumables are available for mirror image cutting.

Figure 6-19 PAC186 Torch Consumable Parts

PAC186 Consumable Parts Kits

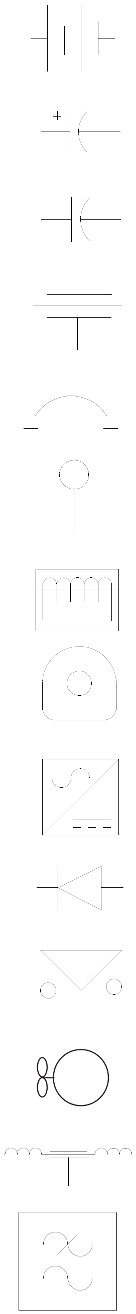
Part Number	Description	Qty.
128097	**Kit (includes spare PAC186 torch)**	**1**
128098	**Kit (less spare PAC186 torch)**	**1**
001579	Box, gray plastic	1
120349	Torch, PAC186 (Kit 128097 only)	1
020633	Cap, inner retaining, 15/30 amp	1
020637	Swirl ring, 15/30/50 amp mild steel	1
120111	Electrode, 15/30 amp mild steel	3
020644	Nozzle, 15 amp	1
020645	Nozzle, 30 amp	2
020646	Nozzle, 50 amp mild steel	2
020670	Shield, 15 amp	1
020671	Shield, 30/50 amp mild steel	2
020796	Adapter, shield, 70 amp	2
020795	Cap, inner retaining, 70 amp	1
020647	Assembly, nozzle/shield, 70 amp	2
020789	Swirl ring, 70 amp	1
120112	Electrode, 50 amp mild steel, 70 amp	3
120266	Cap, inner retaining, 100 amp mild steel	1
120410	Electrode, 100 amp mild steel	2
120272	Nozzle, 100 amp mild steel	2
120273	Shield, 100 amp mild steel	1
120589	Electrode, 100 amp	1
120590	Swirl ring, 100 amp	1
120591	Nozzle, 100 amp	1
120592	Cap, inner retaining, 100 amp	1
120594	Shield, 100 amp	1
044025	O-ring, Buna 70 Duro 1.176 X .070	1
044026	O-ring, Buna 70 Duro 1.239 X .070	1
044507	O-ring, Buna 70 Duro 1.424 X .070	1
120377	Tube, water electrode cooling	1
027055	Lubricant, silicone, 1/4 oz tube	1
004555	Tool, consumable parts	1
004745	Tool, swirl ring	1
004630	Electrode gauge assembly	1
027343	Magnifier, loupe, 10X	1
027503	Nut driver 4.5 mm	1

Hypertherm

Section 7

WIRING DIAGRAMS

In this section:



Battery

Cap, polarized

Cap, non-polarized

Cap, feed-thru

Circuit breaker

Coax shield

Current Sensor

Current sensor

DC supply

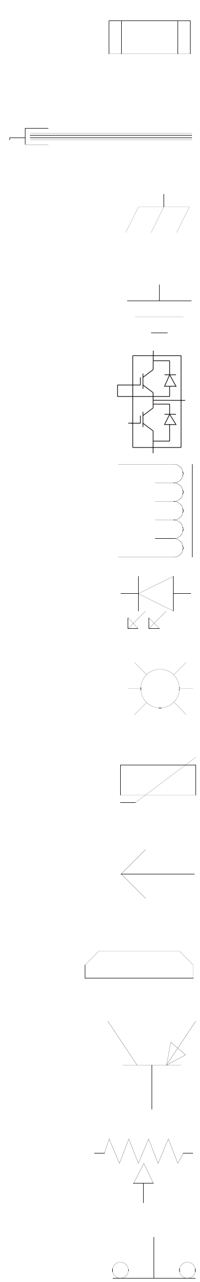
Diode

Door interlock

Fan

Feedthru LC

Filter, AC



Fuse

Ground Clamp

Ground, Chassis

Ground, Earth

IGBT

Inductor

LED

Light

MOV

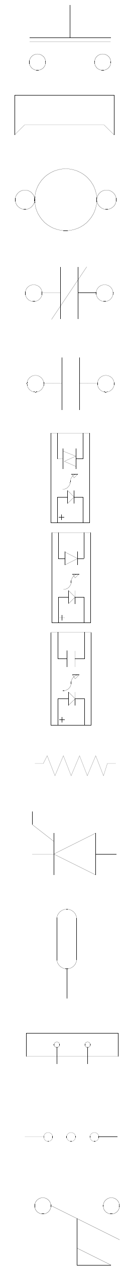
Pin

Plug

PNP Transistor

Potentiometer

Push Button, Normally Closed



Push Button, Normally Open

Receptacle

Relay, Coil

Relay, Normally Closed

Relay, Normally Open

Relay, Solid State, AC

Relay, Solid State, DC

Relay, Solid State, Dry

Resistor

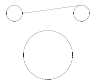
SCR

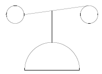
Shield

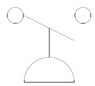
Shunt

Spark Gap

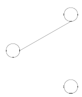
Switch, Flow

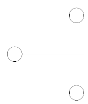

Switch, Level, Normally Closed

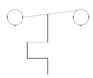

Switch, Pressure, Normally Closed

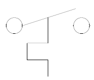

Switch, Pressure, Normally Open

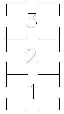

Switch, 1 Pole, 1 Throw


Switch, 1 Pole, 2 Throw

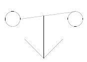

Switch, 1 Pole, 1 Throw, Center Off

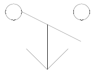

Switch, Temperature, Normally Closed

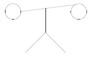

Switch, Temperature, Normally Open

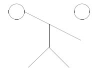


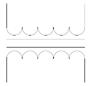
Terminal Block

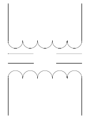

Time Delay Closed, NC/Off


Time Delay Open, NO/Off

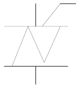

Time Delay Open, NC/On

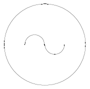

Time Delay Closed, NO/Off

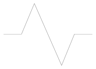

Transformer


Transformer, Air Core

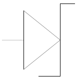

Transformer Coil


Triac

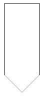

VAC Source

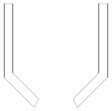

Valve, Solenoid

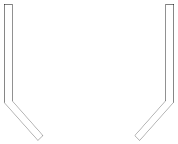

Voltage Source

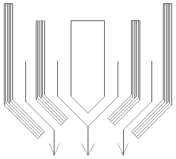

Zener Diode

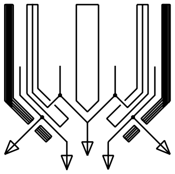
Torch Symbols

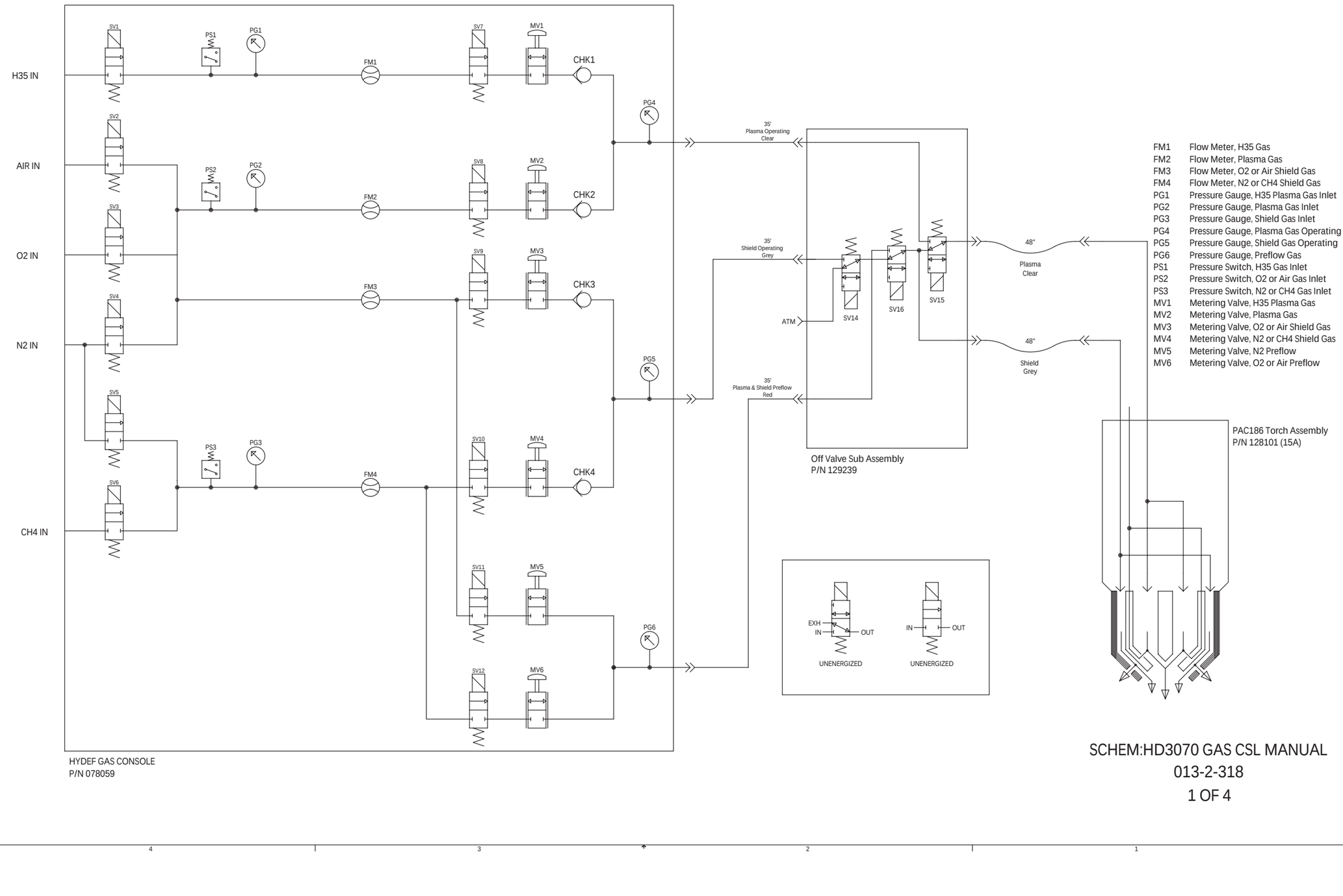

Electrode


Nozzle


Shield


Torch


Torch, HyDefinition™



FM1	Flow Meter, H35 Gas
FM2	Flow Meter, Plasma Gas
FM3	Flow Meter, O2 or Air Shield Gas
FM4	Flow Meter, N2 or CH4 Shield Gas
PG1	Pressure Gauge, H35 Plasma Gas Inlet
PG2	Pressure Gauge, Plasma Gas Inlet
PG3	Pressure Gauge, Shield Gas Inlet
PG4	Pressure Gauge, Plasma Gas Operating
PG5	Pressure Gauge, Shield Gas Operating
PG6	Pressure Gauge, Preflow Gas
PS1	Pressure Switch, H35 Gas Inlet
PS2	Pressure Switch, O2 or Air Gas Inlet
PS3	Pressure Switch, N2 or CH4 Gas Inlet
MV1	Metering Valve, H35 Plasma Gas
MV2	Metering Valve, Plasma Gas
MV3	Metering Valve, O2 or Air Shield Gas
MV4	Metering Valve, N2 or CH4 Shield Gas
MV5	Metering Valve, N2 Preflow
MV6	Metering Valve, O2 or Air Preflow

SCHEM:HD3070 GAS CSL MANUAL
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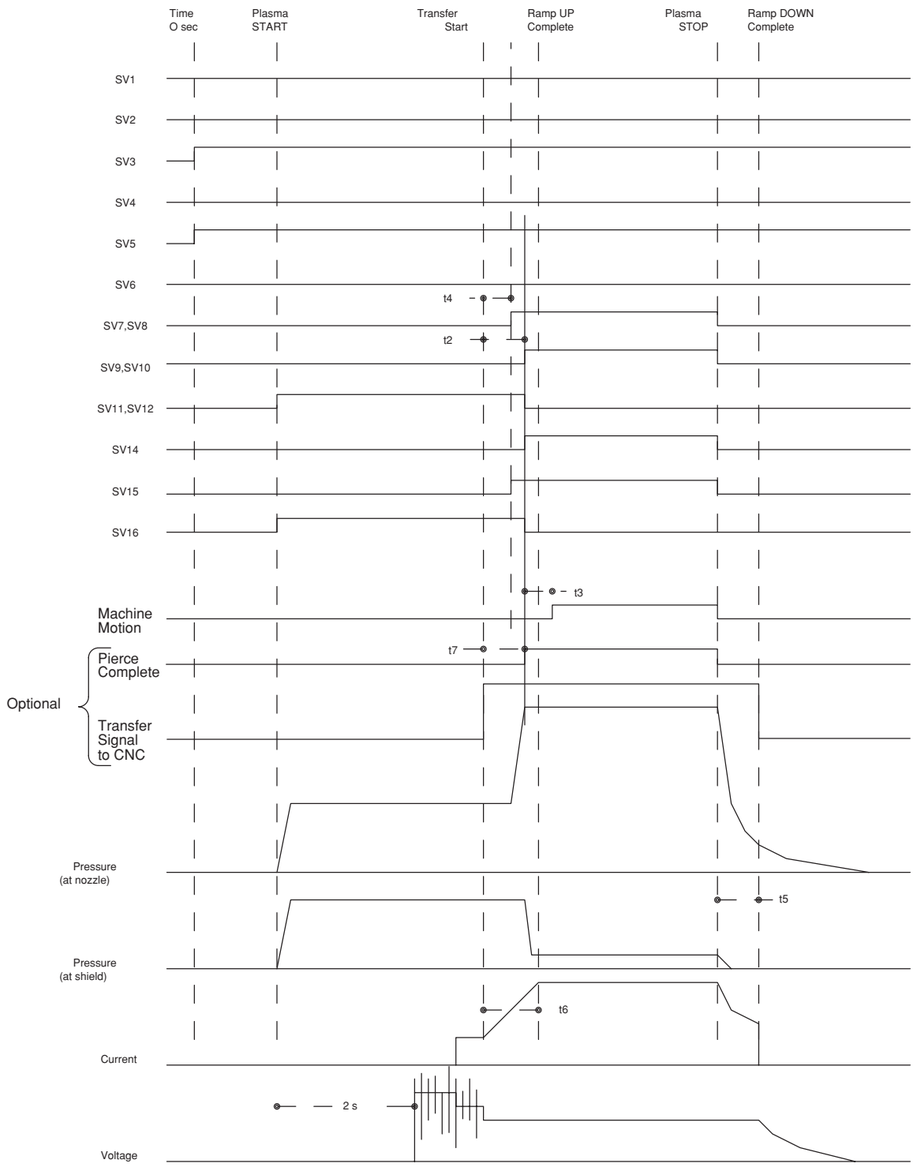
1 OF 4

A

TIMING DIAGRAM
(FOR O2 PLASMA GAS ONLY)

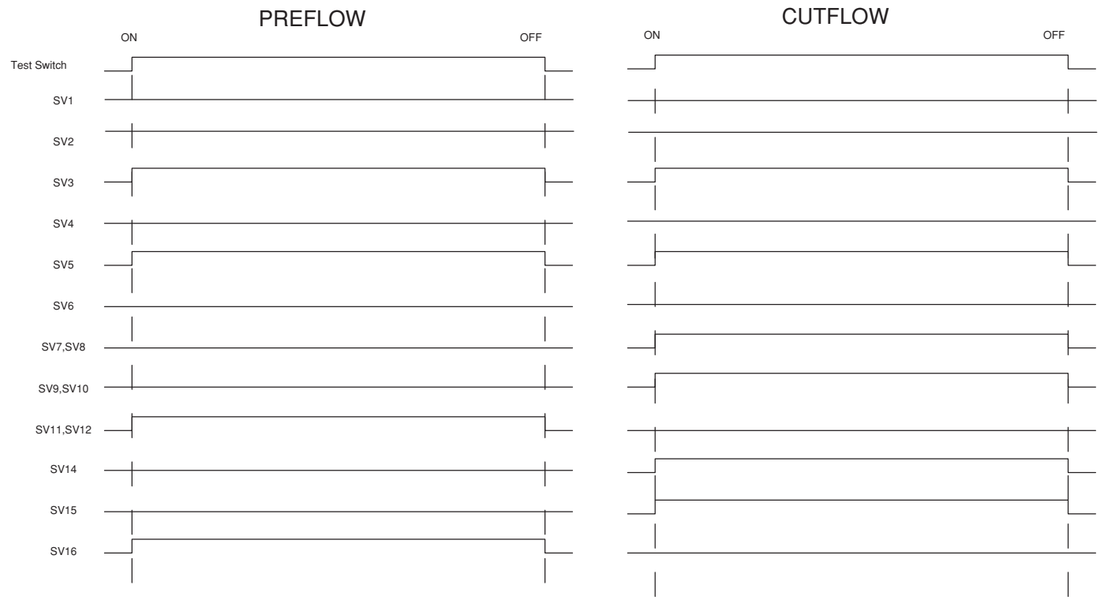
RUN

PREFLOW / OPERATE



Note: All "t" times are SET current dependent

TEST



t2 = Transfer to Shield Gas
t3 = Transfer to Machine Motion
t4 = Transfer to Plasma Gas
t5 = Torch Ramp-Down (Gas & Current)
t6 = Ramp-up of Current From Pilot to Operate Current
t7 = Optional Pierce Complete

SV1	Solenoid Valve, H35 Plasma Gas Select
SV2	Solenoid Valve, Air Gas Select
SV3	Solenoid Valve, O2 Gas Select
SV4	Solenoid Valve, N2 Plasma Gas Select
SV5	Solenoid Valve, N2 Shield Gas Select
SV6	Solenoid Valve, CH4 Shield Gas Select
SV7,SV8	Solenoid Valve, Plasma Gas Operate
SV9,SV10	Solenoid Valve, Shield Gas Operate
SV11,SV12	Solenoid Valve, Preflow Gas Operate
SV14	Solenoid Valve, Shield Gas Vent
SV15	Solenoid Valve, Palsma Preflow/Operate
SV16	Solenoid Valve, Shield Preflow/Operate

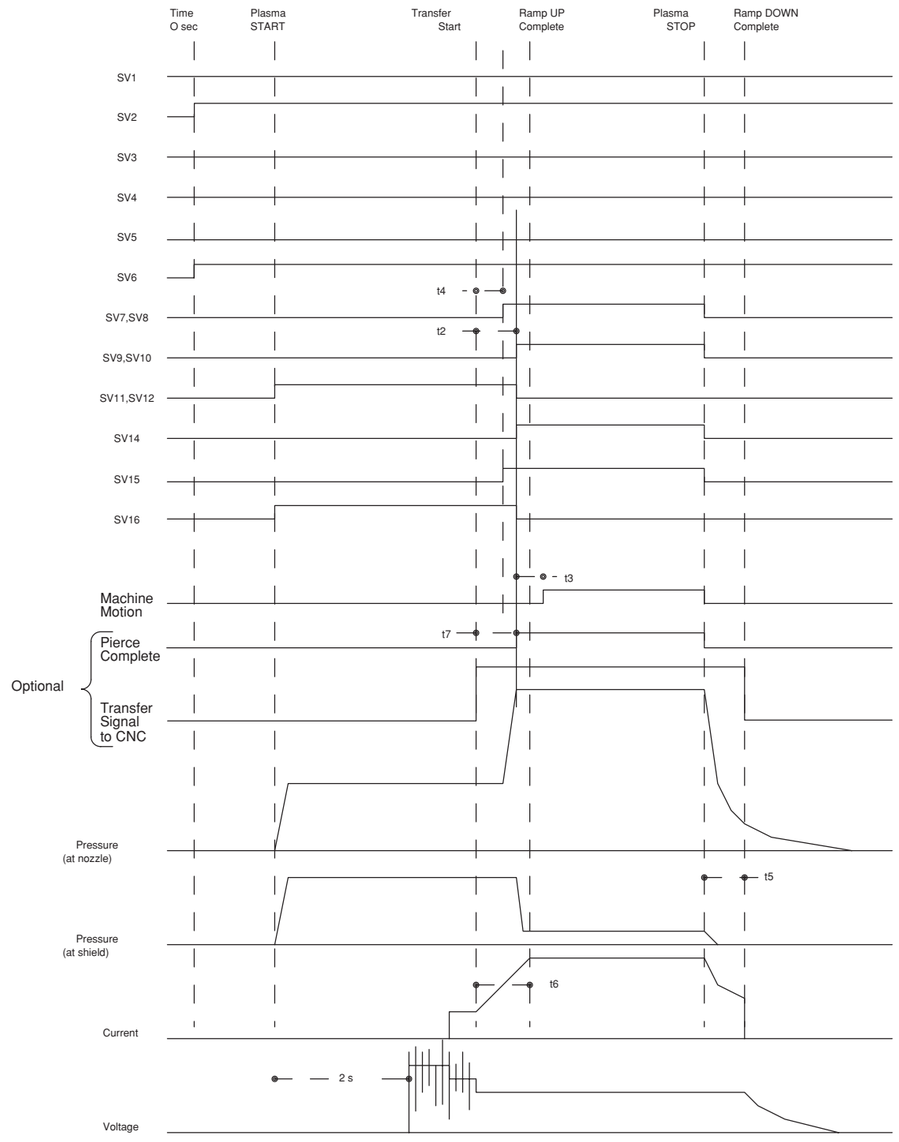
SCHEM:HD3070 GAS CSL MANUAL
013-2-318
2 OF 4

A

TIMING DIAGRAM
(FOR AIR PLASMA GAS ONLY)

RUN

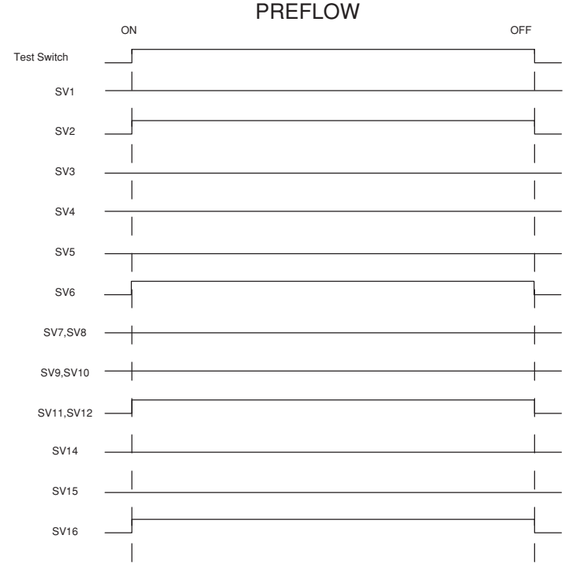
PREFLOW OPERATE



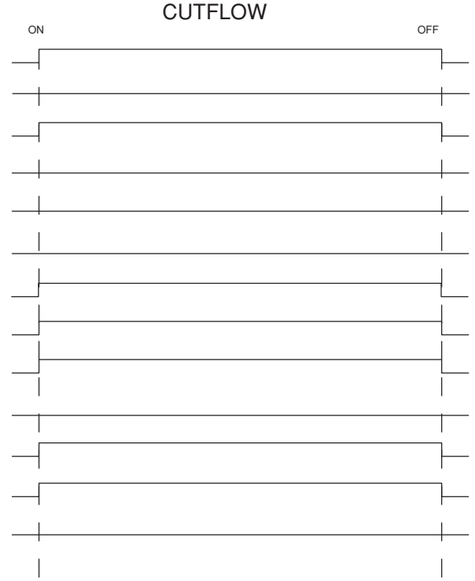
Note: All "t" times are SET current dependent

TEST

PREFLOW



CUTFLOW



t2 = Transfer to Shield Gas
t3 = Transfer to Machine Motion
t4 = Transfer to Plasma Gas
t5 = Torch Ramp-Down (Gas & Current)
t6 = Ramp-up of Current From Pilot to Operate Current
t7 = Optional Pierce Complete

SV1	Solenoid Valve, H35 Plasma Gas Select
SV2	Solenoid Valve, Air Gas Select
SV3	Solenoid Valve, O2 Gas Select
SV4	Solenoid Valve, N2 Plasma Gas Select
SV5	Solenoid Valve, N2 Shield Gas Select
SV6	Solenoid Valve, CH4 Shield Gas Select
SV7,SV8	Solenoid Valve, Plasma Gas Operate
SV9,SV10	Solenoid Valve, Shield Gas Operate
SV11,SV12	Solenoid Valve, Preflow Gas Operate
SV14	Solenoid Valve, Shield Gas Vent
SV15	Solenoid Valve, Palsma Preflow/Operate
SV16	Solenoid Valve, Shield Preflow/Operate

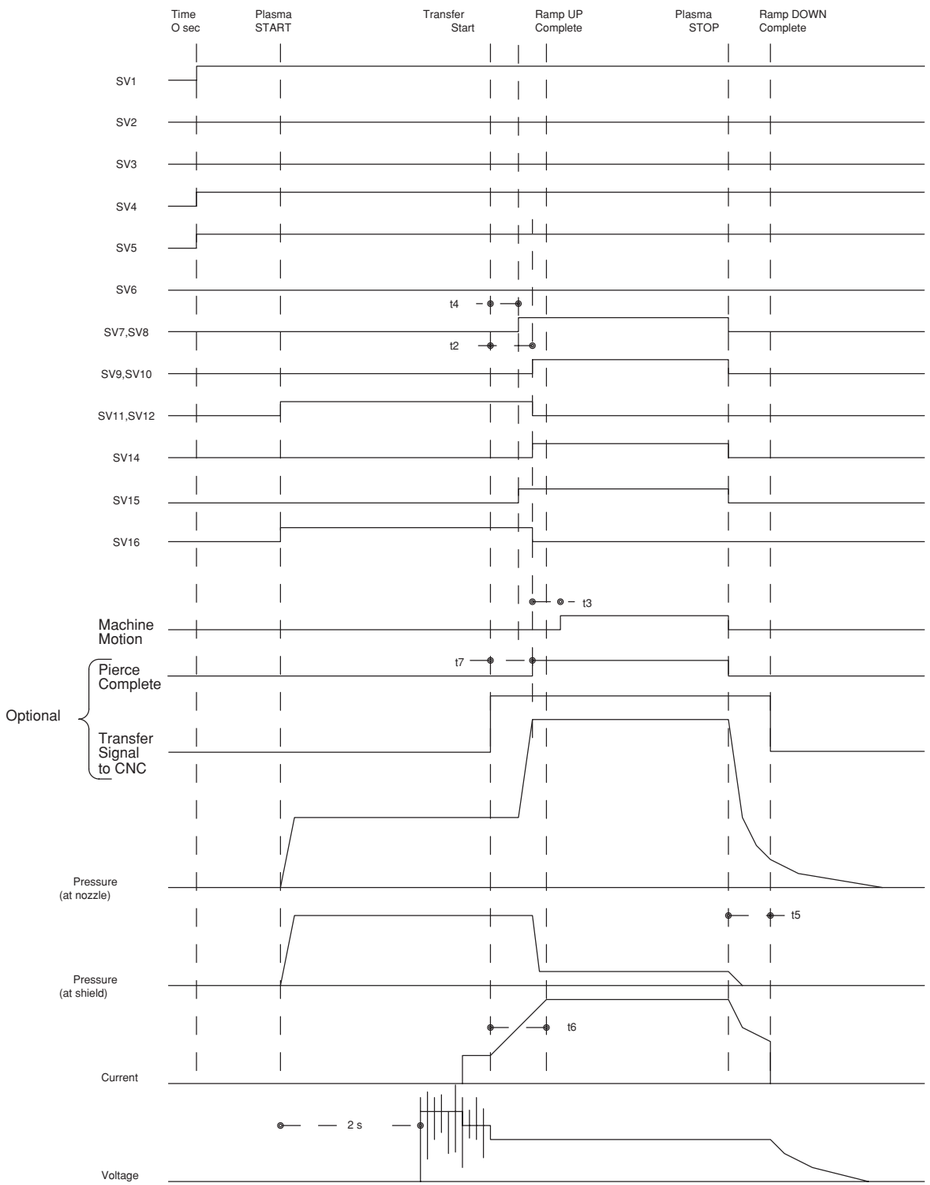
SCHEM:HD3070 GAS CSL MANUAL
013-2-318
3 OF 4

A

TIMING DIAGRAM
(FOR H35 & N2 PLASMA GAS ONLY)

RUN

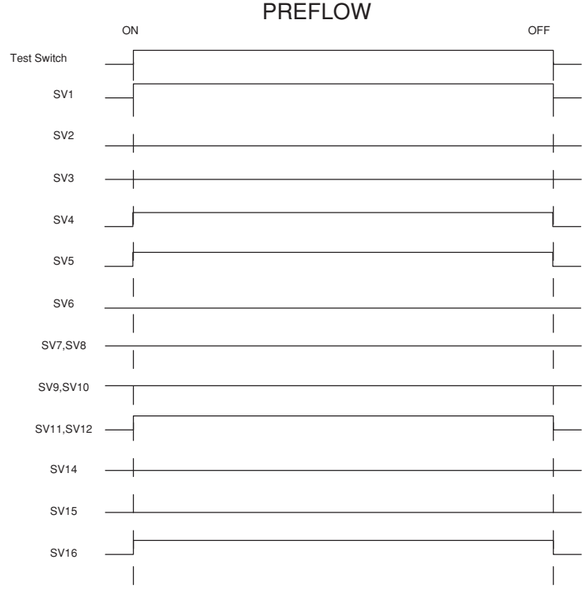
PREFLOW / OPERATE



Note: All "t" times are SET current dependent

TEST

PREFLOW



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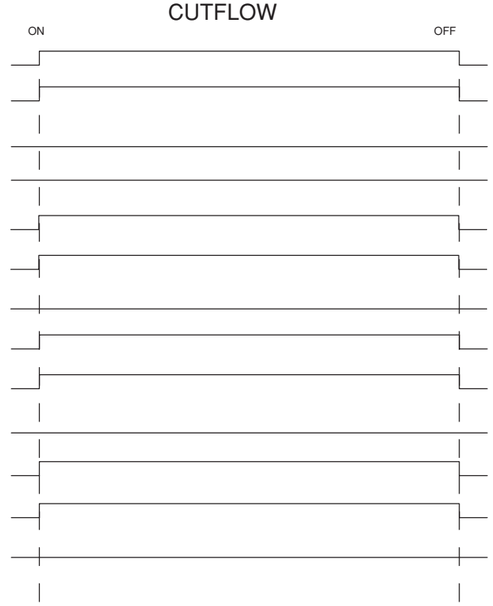

t2 = Transfer to Shield Gas
t3 = Transfer to Machine Motion
t4 = Transfer to Plasma Gas
t5 = Torch Ramp-Down (Gas & Current)
t6 = Ramp-up of Current From Pilot to Operate Current
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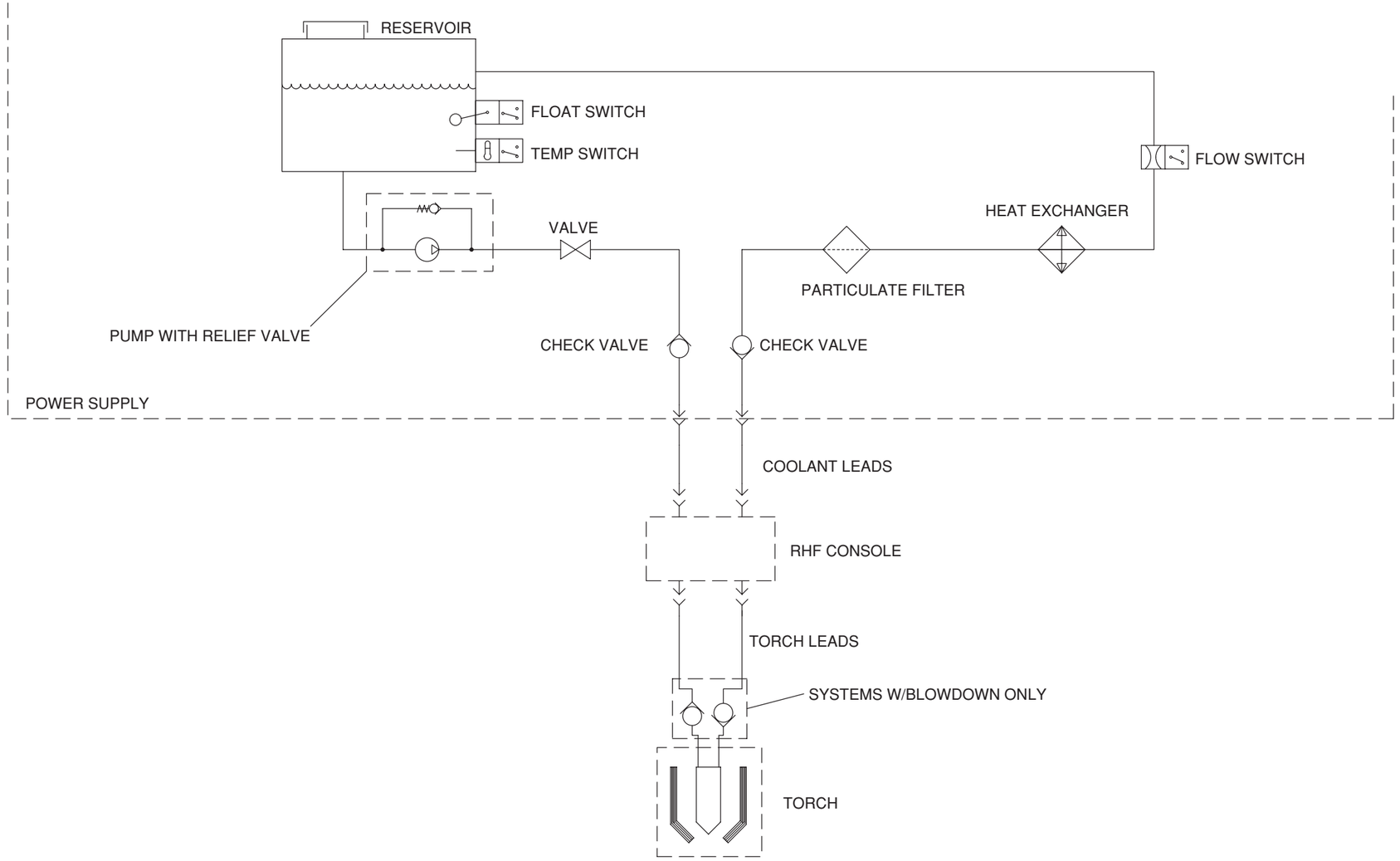
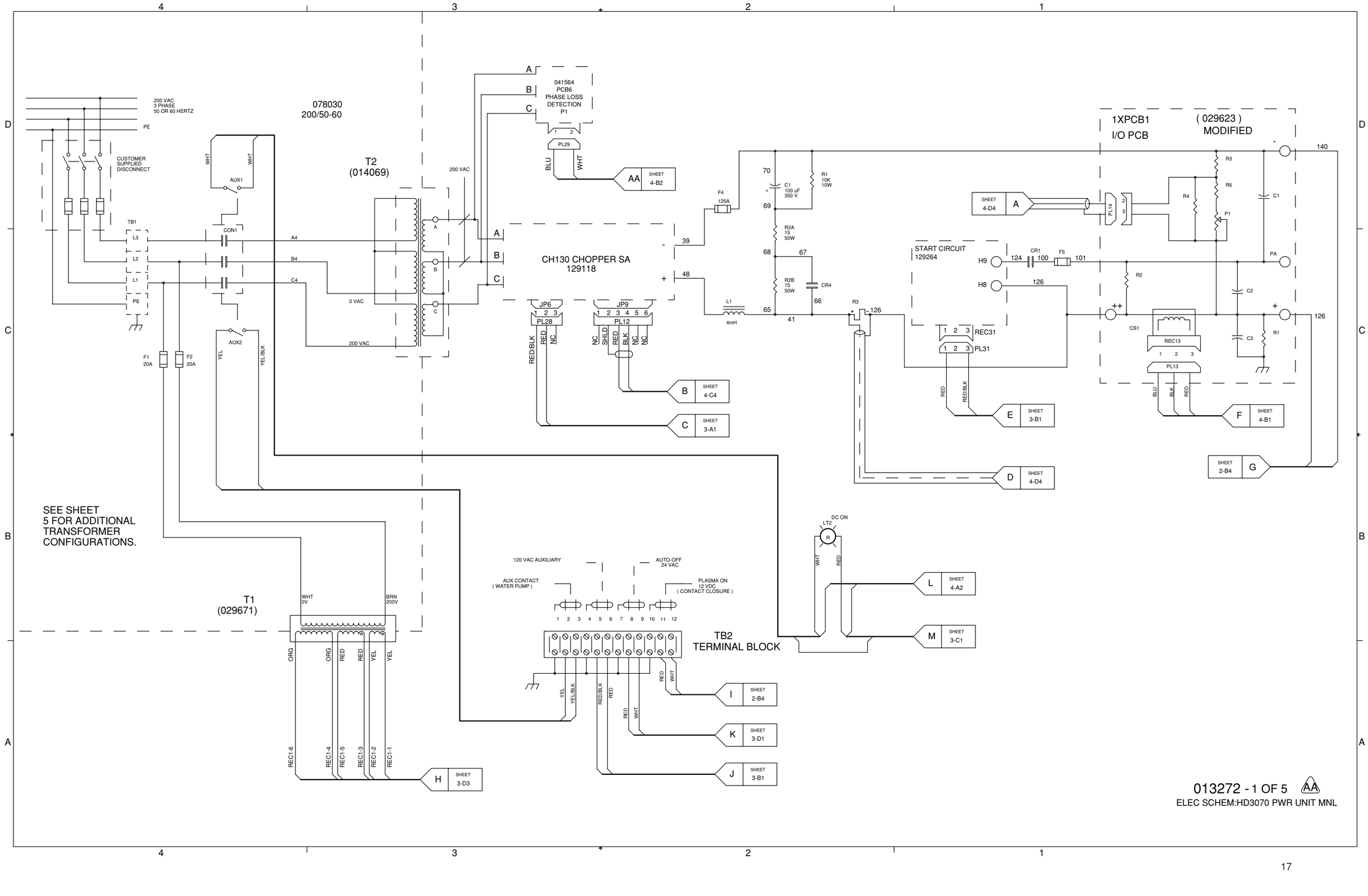
SV1	Solenoid Valve, H35 Plasma Gas Select
SV2	Solenoid Valve, Air Gas Select
SV3	Solenoid Valve, O2 Gas Select
SV4	Solenoid Valve, N2 Plasma Gas Select
SV5	Solenoid Valve, N2 Shield Gas Select
SV6	Solenoid Valve, CH4 Shield Gas Select
SV7,SV8	Solenoid Valve, Plasma Gas Operate
SV9,SV10	Solenoid Valve, Shield Gas Operate
SV11,SV12	Solenoid Valve, Preflow Gas Operate
SV14	Solenoid Valve, Shield Gas Vent
SV15	Solenoid Valve, Palsma Preflow/Operate
SV16	Solenoid Valve, Shield Preflow/Operate

SCHEM:HD3070 GAS CSL MANUAL
013-2-318
4 OF 4

A

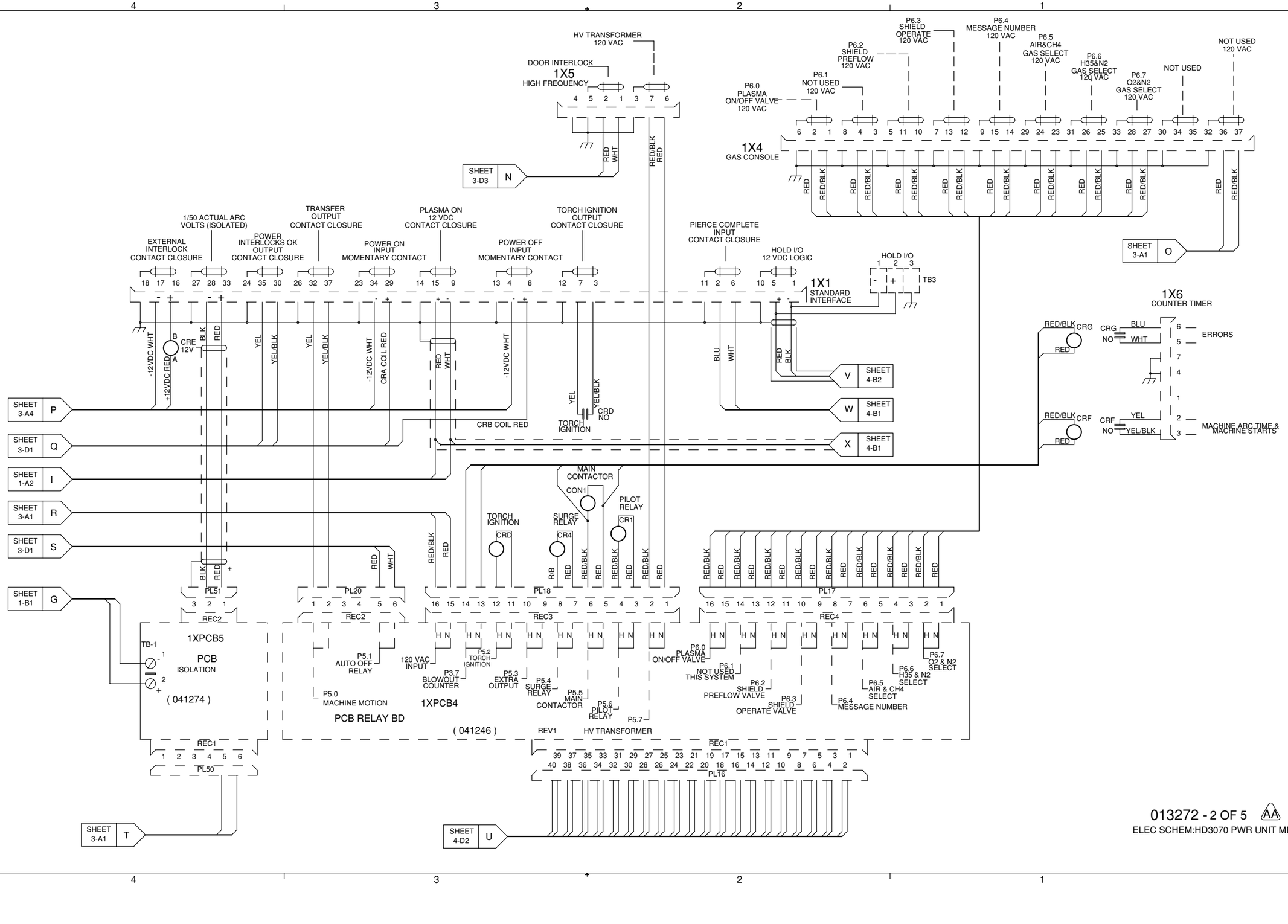


MATERIAL	DRAWN BY: BC	DATE: 6-23-97	Hypertherm Box-5010 Hanover, NH 03755-5010 603/643-3441
	CHECKED BY	DATE	
	APP. BY: EBH	DATE: 7-2-97	
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES WITHOUT PERMISSION FROM HYPERTHERM, INC.	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ARE: 2 PL DECIMAL ±.01 3 PL DECIMAL ±.005 FRACTIONS ±1/64 ANGULAR ±.5∞ PART MUST BE FREE OF BURRS AND SHARP EDGES. BREAK SHARP EDGES IF NECESSARY WITH CHAMFER OR RADIUS .015.		DESCRIPTION: COOLANT SA:HD3070 B ITEM NO.: 129255 — DRAWING NO.: 129-2-255 — FILE NAME: 129255B SCALE: N/A — MODEL: — SHEET: 1 OF 1



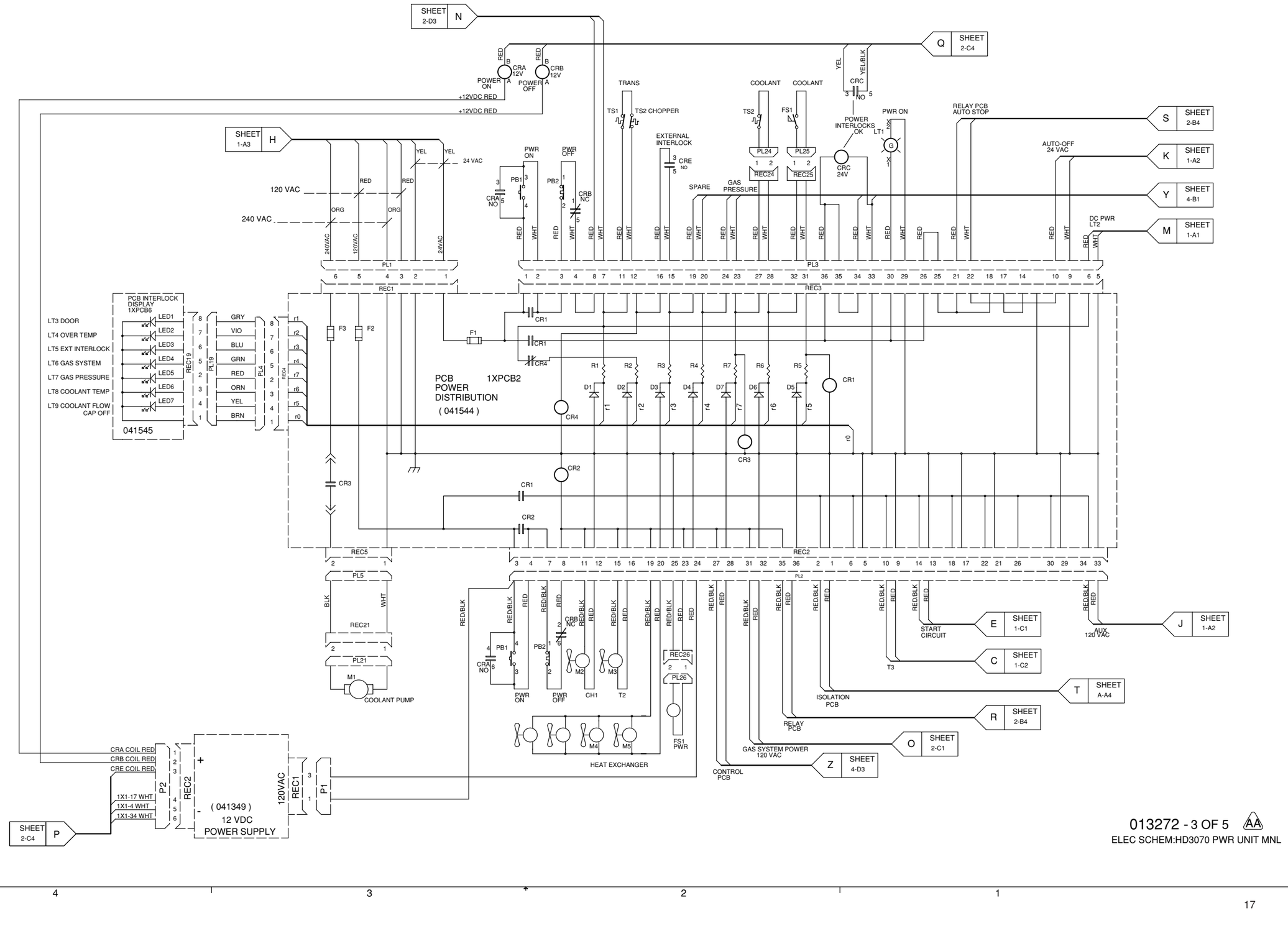
013272 - 1 OF 5 AA

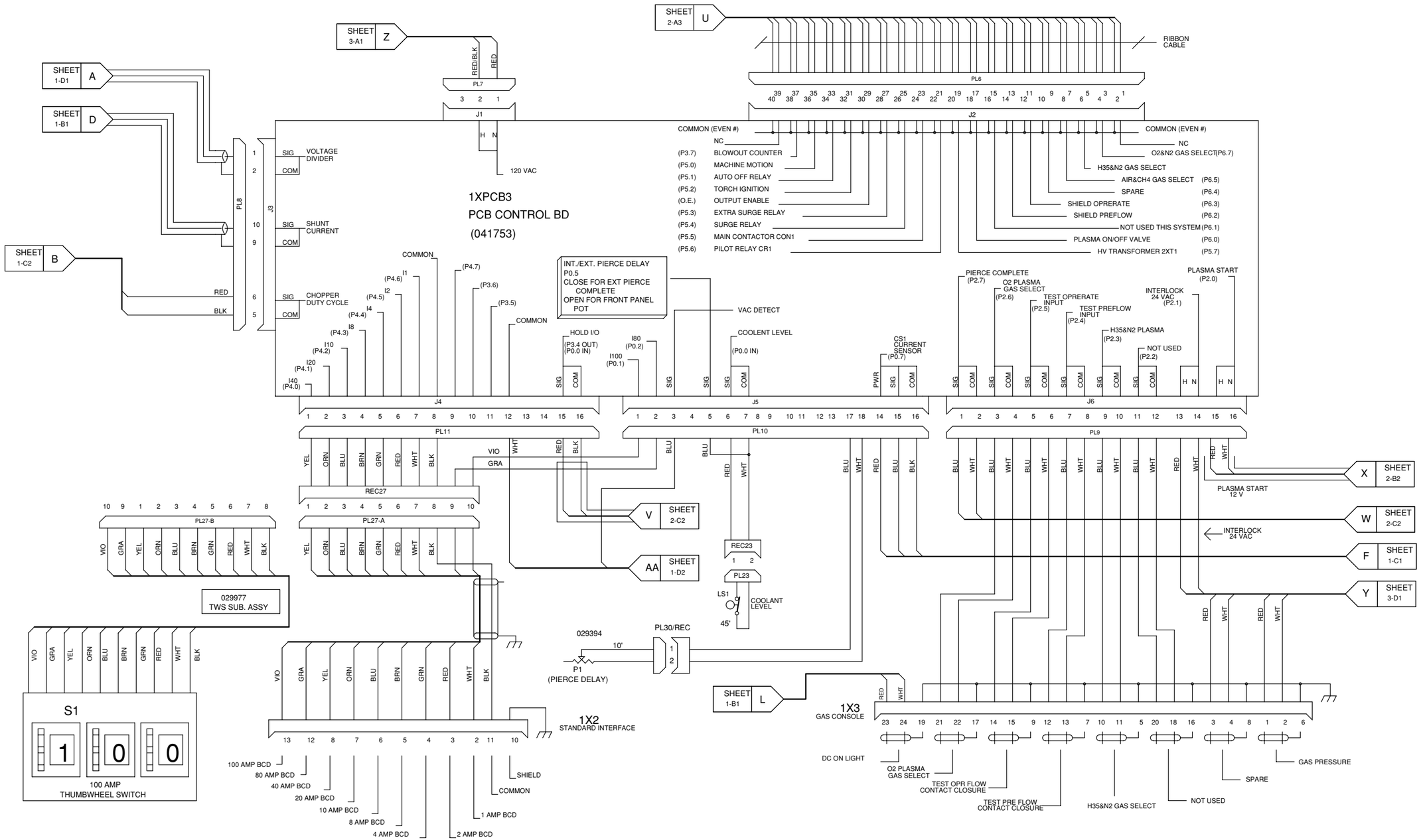
ELEC SCHEM:HD3070 PWR UNIT MNL



013272 - 2 OF 5 AA

ELEC SCHEM:HD3070 PWR UNIT MNL

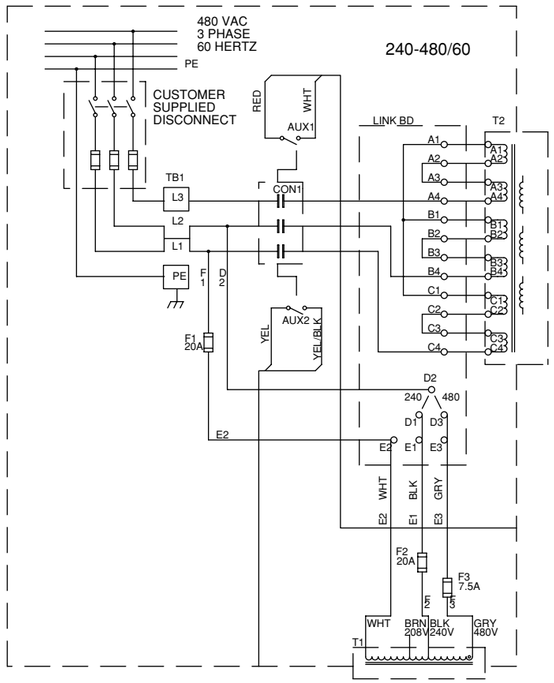

SHEET 2-D3 N
Q SHEET 2-C4
RED B CRA 12V A POWER ON
RED B CRB 12V A POWER OFF
+12VDC RED
+12VDC RED
YEL
YEL/BLK
CRC NO
TRANS
TS1
TS2 CHOPPER
COOLANT
TS2
PL24
REC24
COOLANT
FS1
PL25
REC25
POWER INTERLOCKS OK
CRC 24V
PWR ON
LT1
RELAY PCB AUTO STOP
S SHEET 2-B4
AUTO-OFF 24 VAC
K SHEET 1-A2
SHEET 1-A3 H
120 VAC
240 VAC
24 VAC
YEL
RED
ORG
240VAC
120VAC
24VAC
PWR ON
PB1
CRA NO
PWR OFF
PB2
CRB NC
EXTERNAL INTERLOCK
CRE NO
SPARE
GAS PRESSURE
Y SHEET 4-B1
DC PWR LT2
M SHEET 1-A1
WHT
PL1
PL3
REC1
REC3
PCB INTERLOCK DISPLAY 1XPCB6
LT3 DOOR
LT4 OVER TEMP
LT5 EXT INTERLOCK
LT6 GAS SYSTEM
LT7 GAS PRESSURE
LT8 COOLANT TEMP
LT9 COOLANT FLOW CAP OFF
LED1
LED2
LED3
LED4
LED5
LED6
LED7
041545
REC19
PL19
PL4
REC4
GRY
VIO
BLU
GRN
RED
ORN
YEL
BRN
F3
F2
F1
CR1
CR4
PCB POWER DISTRIBUTION (041544) 1XPCB2
R1
R2
R3
R4
R7
R6
R5
D1
D2
D3
D4
D7
D6
D5
r1
r2
r3
r4
r7
r6
r5
r0
CR3
CR2
CR1
CR2
REC5
PL5
BLK
WHT
REC21
PL21
M1
COOLANT PUMP
REC2
PL2
RED/BLK
RED
CRB NC
PB1
PB2
CRA NO
M2
M3
CH1
T2
PWR ON
PWR OFF
REC26
PL26
FS1 PWR
M4
M5
HEAT EXCHANGER
CONTROL PCB
START CIRCUIT
E SHEET 1-C1
AUX 120 VAC
J SHEET 1-A2
T3
C SHEET 1-C2
ISOLATION PCB
T SHEET A-A4
RELAY PCB
R SHEET 2-B4
GAS SYSTEM POWER 120 VAC
O SHEET 2-C1
Z SHEET 4-D3
CRA COIL RED
CRB COIL RED
CRE COIL RED
1X1-17 WHT
1X1-4 WHT
1X1-34 WHT
P2
REC2
(041349) 12 VDC POWER SUPPLY
120VAC
REC1
P1
SHEET 2-C4 P
013272 - 3 OF 5 AA
ELEC SCHEM:HD3070 PWR UNIT MNL



013272 - 4 OF 5 AA

ELEC SCHEM:HD3070 PWR UNIT MNL

078019



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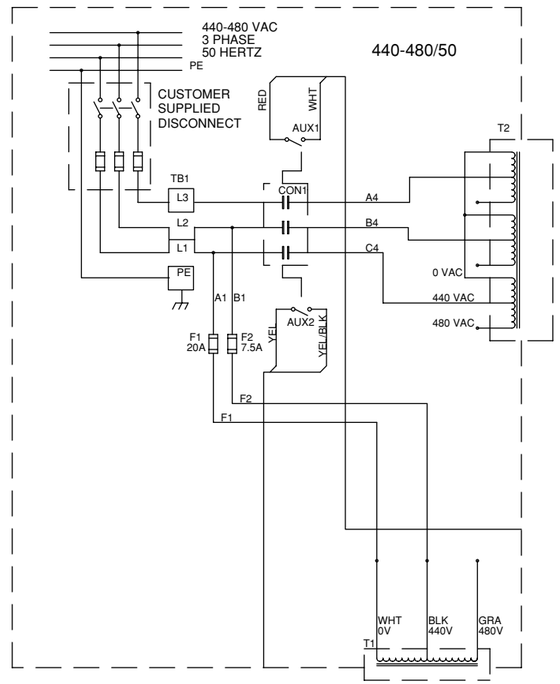

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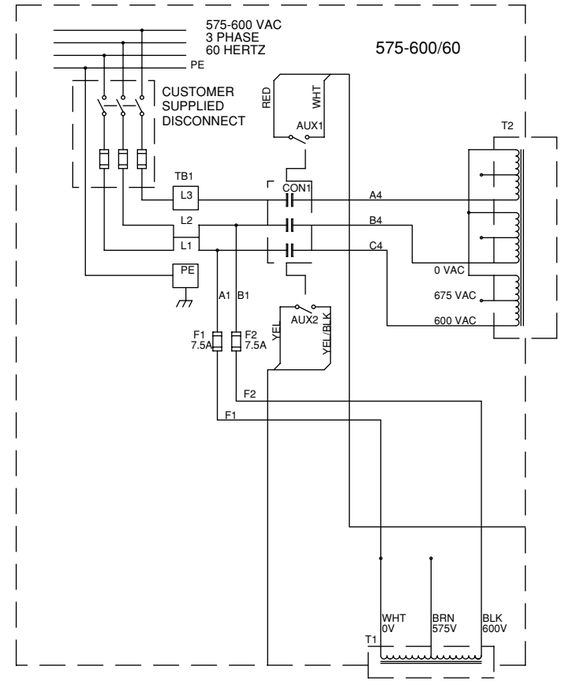

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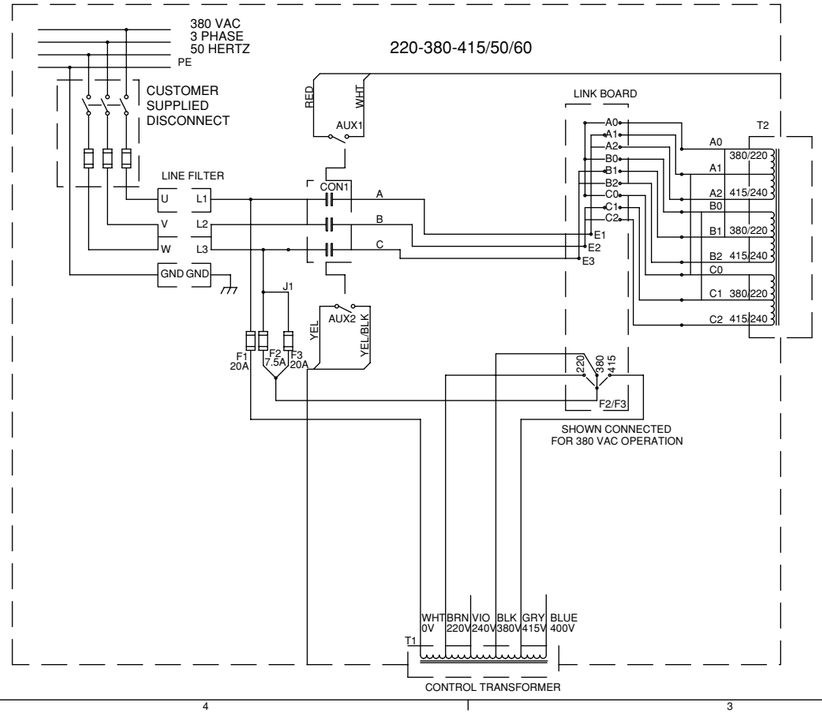

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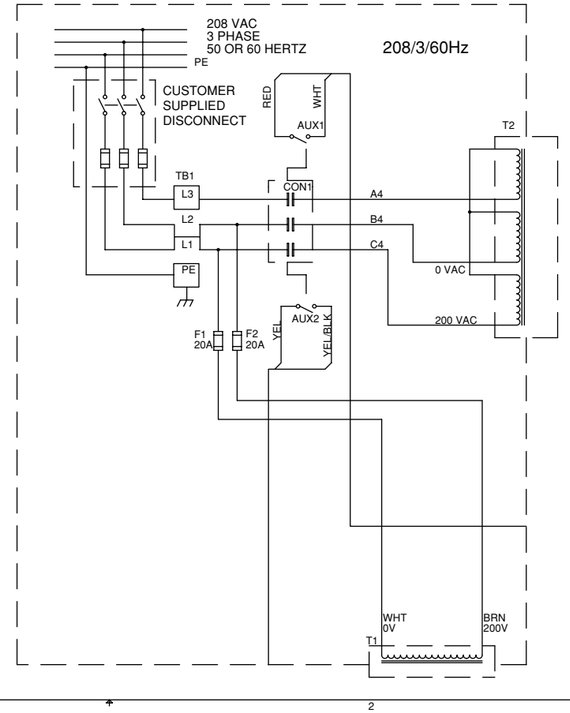
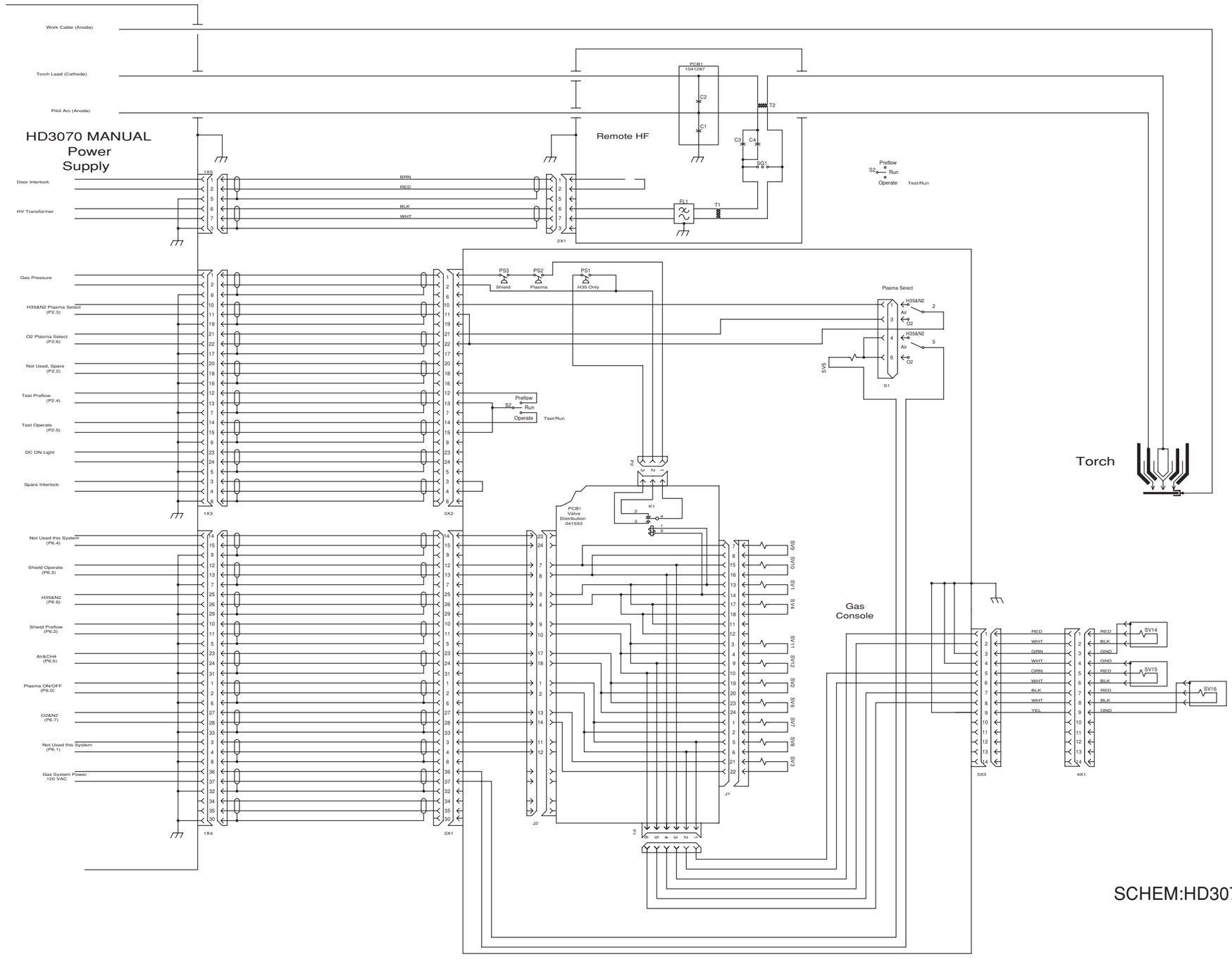


013272 - 5 OF 5 AA

ELEC SCHEM:HD3070 PWR UNIT MNL


HD3070 MANUAL
Power
Supply
Remote HF
Work Cable (Anode)
Torch Lead (Cathode)
Pilot Arc (Anode)
PCB1
1041287
C1
C2
C3
C4
T1
T2
SG1
FL1
Preflow
Run
Operate
Test/Run
S2
1X5
2X1
BRN
RED
BLK
WHT
Door Interlock
HV Transformer
Gas Pressure
H35&N2 Plasma Select
(P2.3)
O2 Plasma Select
(P2.6)
Not Used, Spare
(P2.2)
Test Preflow
(P2.4)
Test Operate
(P2.5)
DC ON Light
Spare Interlock
1X3
3X2
PS3
Shield
PS2
Plasma
PS1
H35 Only
Plasma Select
H35&N2
Air
O2
S1
SV5
Torch
PCB1
Valve
Distribution
041553
K1
J3
J4
J2
J1
SV9
SV10
SV1
SV4
SV11
SV12
SV2
SV6
SV7
SV8
SV3
Not Used this System
(P6.4)
Shield Operate
(P6.3)
H35&N2
(P6.6)
Shield Preflow
(P6.2)
Air&CH4
(P6.5)
Plasma ON/OFF
(P6.0)
O2&N2
(P6.7)
Not Used this System
(P6.1)
Gas System Power
120 VAC
1X4
3X1
Gas
Console
3X3
4X1
RED
WHT
GRN
CRN
BLK
YEL
GND
SV14
SV15
SV16
SCHEM:HD3070 RHF & GAS MANUAL
013-2-323
1 OF 1
A

Hypertherm

Appendix A

PROPYLENE GLYCOL SAFETY DATA
BENZOTRIAZOLE SAFETY DATA

In this section:

MATERIAL SAFETY DATA SHEET

SECTION 1 -- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME	HYPERTHERM TORCH COOLANT

PRODUCT CODE	

ISSUE DATE	11-22-96

EMERGENCY TELEPHONE NUMBERS

MANUFACTURER	**HYPERTHERM**	**Transportation: (703) 527-3887 ***
STREET ADDRESS	**Etna Rd.**	*** For spill, leak, fire or transport accident emergencies.**
CITY, STATE, ZIP	**Hanover, NH 03755**	**Product Information: (603) 643-5638**

SECTION 2 -- COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENT	CAS No.	% by wt.	EXPOSURE LIMITS OSHA PEL	ACGIH TLV	NIOSH REL
Propylene glycol	0057-55-6	< 50	None Established	None Established	None Established

SECTION 3 -- HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW	Can cause eye and skin irritation. Harmful if swallowed..

POTENTIAL HEALTH EFFECTS	
INGESTION	Can cause irritation, nausea, stomach distress, vomiting and diarrhea.
INHALATION	May cause mild irritation of nose, throat, and respiratory tract.
EYE CONTACT	Causes eye irritation.
SKIN CONTACT	Prolonged or repeated contact may cause skin irritation.

SECTION 4 -- FIRST AID MEASURES

INGESTION	DO NOT induce vomiting, but give one or two glasses of water to drink and get medical attention.
INHALATION	No specific treatment is necessary, since this material is not likely to be hazardous by inhalation.
EYE CONTACT	Immediately flush eye with cool running water for 15 minutes. If irritation persists, get medical attention.
SKIN CONTACT	Wash with soap and water. If irritation develops or persists, get medical attention.
NOTE TO PHYSICIAN	Treatment based on judgment of the physician in response to reactions of the patient.

SECTION 5 -- FIRE FIGHTING MEASURES

FLASH POINT / METHOD	None / N.A.	FLAMMABLE LIMITS	Not flammable or combustible
EXTINGUISHING MEDIA	If involved in a fire, use foam, carbon dioxide or dry chemical extinguisher. Water may cause frothing.		
SPECIAL FIRE FIGHTING PROCEDURES	None		
FIRE AND EXPLOSION HAZARDS	None		

SECTION 6 -- ACCIDENTAL RELEASE MEASURES

RESPONSE TO SPILLS	Small spills: Flush into a sanitary sewer. Mop up residue and rinse area thoroughly with water. Large spills: Dike or dam the spill. Pump into containers or soak up on inert absorbent.

SECTION 7 -- HANDLING AND STORAGE

HANDLING PRECAUTIONS	Keep container in upright position.
STORAGE PRECAUTIONS	Store in a cool dry place. Keep from freezing.

SECTION 8 -- EXPOSURE CONTROLS / PERSONAL PROTECTION

HYGIENIC PRACTICES	Normal procedures for good hygiene.
ENGINEERING CONTROLS	Good general ventilation should be sufficient to control airborne levels. Facilities using this product should be equipped with an eyewash station.

PERSONAL PROTECTIVE EQUIPMENT

X	**RESPIRATOR**	Recommended for prolonged use in confined areas with poor ventilation
X	**GOGGLES / FACE SHIELD**	Recommended; goggles should protect against chemical splash
	APRON	Not necessary
X	**GLOVES**	Recommended; PVC, Neoprene or Nitrile acceptable
	BOOTS	Not necessary

SECTION 9 -- PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Clear liquid	BOILING POINT	160 deg F
ODOR	Not Appreciable	FREEZING POINT	Not established
pH	4.6-5.0(100% concentrate)	VAPOR PRESSURE	Not applicable
SPECIFIC GRAVITY	1.0	VAPOR DENSITY	Not applicable
SOLUBILITY IN WATER	Complete	EVAPORATION RATE	Not determined

SECTION 10 -- STABILITY AND REACTIVITY

CHEMICAL STABILITY		**STABLE**	X		**UNSTABLE**	
CONDITIONS TO AVOID	No special precautions beyond standard safe industrial practices.					
INCOMPATIBILITY	Avoid contact with strong mineral acids and strong oxidizers, including chlorine bleach.					
HAZARDOUS PRODUCTS OF DECOMPOSITION	Carbon monoxide may be formed during combustion.					
POLYMERIZATION		**WILL NOT OCCUR**	X		**MAY OCCUR**	
CONDITIONS TO AVOID	Not applicable					

SECTION 11 -- TOXICOLOGICAL INFORMATION

CARCINOGENICITY

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

OTHER EFFECTS

ACUTE	Not determined
CHRONIC	Not determined

SECTION 12 -- ECOLOGICAL INFORMATION

BIODEGRADABILITY		CONSIDERED BIODEGRADABLE	X		NOT BIODEGRADABLE	
BOD / COD VALUE	Not established					
ECOTOXICITY	No data available					

SECTION 13 -- DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD	Product that cannot be used according to the label must be disposed of as a hazardous waste at an approved hazardous waste management facility. Empty containers may be triple rinsed, then offered for recycling or reconditioning; or puncture and dispose of in a sanitary landfill.								
RCRA CLASSIFICATION	NO								
RECYCLE CONTAINER		YES	X		CODE	2 - HDPE		NO	

SECTION 14 -- TRANSPORT INFORMATION

DOT CLASSIFICATION		HAZARDOUS			NOT HAZARDOUS	X
DESCRIPTION	Not applicable					

SECTION 15 -- REGULATORY INFORMATION

USA REGULATORY STATUS

	EPA REGISTERED (UNDER FIFRA)	
	FDA REGULATED	
	KOSHER	
	SARA TITLE III MATERIAL	
	USDA AUTHORIZED	

SECTION 16 -- OTHER INFORMATION

NFPA CLASSIFICATION

1	BLUE	HEALTH HAZARD
1	RED	FLAMMABILITY
0	YELLOW	REACTIVITY
--	WHITE	SPECIAL HAZARD

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

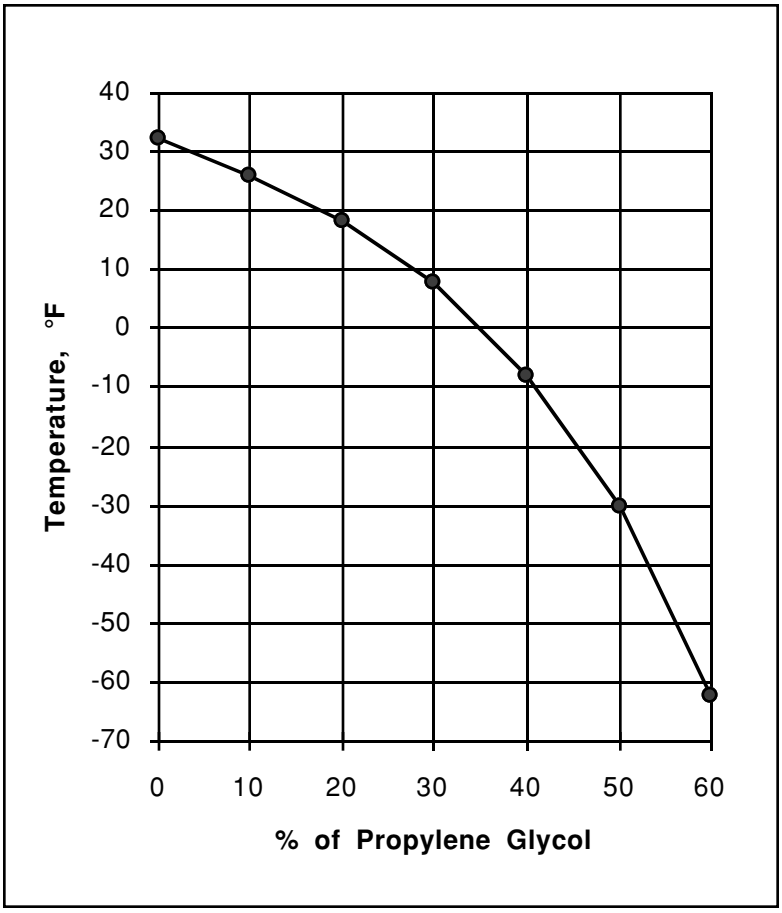


Figure a-1 Freezing Point of Propylene Glycol Solution

SECTION I

MANUFACTURER:	PMC SPECIALTIES GROUP, INC.
ADDRESS:	501 Murray Road Cincinnati, OH 45217
EMERGENCY TELEPHONE:	(513) 242-3300
FOR TRANSPORTATION EMERGENCY:	(800) 424-9300
CHEMICAL NAME AND SYNONYMS:	1-H Benzotriazole, Benzotriazole
TRADE NAMES AND SYNONYMS:	COBRATEC® 99 Powder
CHEMICAL FAMILY:	Triazole
FORMULA:	$C_6H_5N_3$
DOT SHIPPING DESCRIPTION:	Not Regulated (Benzotriazole)
PRODUCT NUMBER:	X18BT5585

NFPA BASED RATINGS: Health: 1, Flammability: 1, Reactivity: 0
HMIS RATINGS: Health: 2, Flammability: 0, Reactivity: 0, PPE: E
WHMIS CLASSIFICATION: D-2-(B)

SECTION II INGREDIENTS

Material	CAS No.	Wt. %	Exposure Limits
Benzotriazole	95-14-7	>99	None Established

SECTION III PHYSICAL DATA

BOILING POINT:	>350° C
FREEZING POINT:	94-99° C
SPECIFIC GRAVITY:	1.36 (solid)
VAPOR PRESSURE AT 20° C:	0.04 mm Hg
VAPOR DENSITY (air=1):	4.1 (calculated)
SOLUBILITY IN WATER % BY WT at 20° C:	2.0
% VOLATILES BY VOLUME:	None
EVAPORATION RATE (Butyl Acetate = 1):	Non-volatile
APPEARANCE AND ODOR:	Off white powder. Slight characteristic odor.

08/28/95

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:	340° F. (CC)
AUTOIGNITION TEMPERATURE:	Not Available
FLAMMABLE LIMITS IN AIR:	LOWER: Dust MEC. 0.03 oz/(cu. ft.) UPPER: Not Available

EXTINGUISHING MEDIA: Carbon Dioxide, Dry Chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES: Full protective equipment including self-contained breathing apparatus should be used. Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat. During emergency conditions, overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Get medical attention.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Airborne dust is rated a severe explosion hazard at a minimum concentration of 0.03 ounce per cubic feet (30 grams per cubic meter).

SECTION V HEALTH HAZARD DATA

OSHA AIR CONTAMINANTS: Due to its dusting nature during handling, exposure to dust must comply with OSHA's particulate not otherwise regulated limits for total and respirable dust.

EFFECTS OF OVEREXPOSURE: Contact with the eyes is likely to cause severe irritation. Detailed information about the effects of overexposure in the human being is unavailable. Experience thus far has not provided any example of obvious overexposure with resultant symptoms. Animal studies have indicated an effect on the central nervous system. An NCI bioassay showed no convincing evidence of carcinogenicity (NCI-CG-TR-88). Bacterial mutagenicity data exists. Experts consider the data inconclusive. (Environmental Mutagenesis, Vol. 7, Suppl. 5: 1-248 (1985) and references in RTECS #DM1225000).

EMERGENCY AND FIRST AID PROCEDURES: IF INHALED: If affected, remove from exposure. Restore breathing. Keep warm and quiet. IF ON SKIN: Wash affected area thoroughly with soap and water. IF IN EYES: Flush eyes with large amounts of water for 15 minutes. Get medical attention. IF SWALLOWED: Never give anything by mouth to an unconscious person. Give several glasses of water. If vomiting is not spontaneous, induce vomiting. Keep airway clear. Get medical attention.

TOXICITY DATA:

Oral LD_{50} (rat)	560 mg/Kg
Primary skin Irritation (rabbit)	Not a primary skin irritant
Dermal LD_{50}	>2000 mg/Kg
Eye irritation (rabbit)	caused severe eye irritation
Bluegill Sunfish (96 hr. Tlm)	28 mg/l
Minnow (96 hr. Tlm)	28 mg/l
Trout (96 hr. LC_{50})	39 mg/l
Algae (96 hr. EC_{50})	15.4 mg/l
Daphnia magna (48 hr. LC_{50})	141.6 mg/l

SECTION VI REACTIVITY DATA

STABILITY: Stable
INCOMPATIBILITY: Oxidizing Agents
HAZARDOUS DECOMPOSITION PRODUCTS: BY FIRE: Carbon Dioxide, Carbon Monoxide Nitrogen oxides, HCN in reducing atmospheres
HAZARDOUS POLYMERIZATION: Will Not occur

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED: If local high concentration of airborne dust occurs, dampen spill with water and ventilate to disperse dust laden air. Sweep up spill and reclaim or place in a covered waste disposal container.
WASTE DISPOSAL METHOD: Sanitary landfill or incinerate in approved facilities in accordance with local, state, and federal regulations. Do not heat or incinerate in closed containers.

SECTION VIII SPECIAL PROTECTIVE INFORMATION

RESPIRATORY PROTECTION: If personal exposure cannot be controlled below applicable exposure limits by ventilation, wear respiratory devices approved by NIOSH/MSHA for protection against organic vapors, dusts, and mists.

VENTILATION: Local exhaust recommended for dust control.
PROTECTIVE GLOVES: Recommended to avoid skin contact, Rubber, Vinyl
EYE PROTECTION: Use safety goggles where airborne dust is a problem.
OTHER PROTECTIVE EQUIPMENT: Safety shower, eye wash

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Store in a cool, dry area. Keep containers tightly closed when not in use. Avoid creating airborne dust concentrations which could constitute a potential dust explosion hazard. Avoid contact with skin, eyes, and clothing. Avoid inhalation of dust and vapor. DO NOT TAKE INTERNALLY. Clean up spills immediately.

SECTION X REGULATORY STATUS

Benzotriazole (CAS No. 95-14-7) is contained on the following chemical lists:

1. TSCA Section 8(a)/40CFR 712 Preliminary Assessment Information Rule
2. TSCA Section 8(d) Health and Safety Data Rule
3. NTP Testing Program
4. Massachusetts Substance List
5. Canadian Domestic Substance List
6. WHMIS Ingredient Disclosure List
7. TSCA Inventory List

PREPARED: August 28, 1995
SUPERSEDES: May 25, 1994

The information contained herein is based on the data available to us and is believed to be correct as of the date prepared; however, PMC SPECIALTIES GROUP, INC. makes no warranty, expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof.

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Appendix B

TIMER-COUNTER

In this section:

Introduction

This appendix will enable a technician to install the optional timer-counter to the HD3070 plasma cutting system. The timer-counter consists of the timer-counter and control cable.

WARNING

High Voltage!

Power supply must be disconnected before installation.

Installation

1. Mount the timer-counter for easy access, refer to Figure b-1 for dimensions. For fixed mounting of the timer-counter, four mounting holes are located on the bottom.

2. Interface the timer-counter to the power supply with the current setpoint cable by referring to Section 3, *Installation*, page 3-23 and Figure 3-19 and the current setpoint cable lengths and wire run list on Figure 3-20.

Operation

Controls and Indicators (Figure b-2)

Each LCD unit is self-powered by a three-volt lithium battery. When the battery weakens (three to five years) the unit will operate erratically. Replace the faulty LCD unit.

- **STARTS** LCD Counter (w/Reset)
  Indicates the number of arc starts.

- **ARC TIME** LCD Elasped Time Meter
  Indicates the cumlative time that the arc is on hours.

- **ERRORS** LCD Counter (w/Reset)
  Indicates the number of arc errors that have occured. Any of the following four error codes will cause the error counter to increment. Refer to Section 5, *Maintenance* for more information on the error codes.

  Lost Transferred Current During Ramp Up
  Arc was extinguished after the current transferred to the workpiece, but before steady-state operation.

  Lost Set Transferred Current
  Arc was lost during steady-state operation.

  Over Voltage During Steady-State Operation
  During steady-state operation the measured arc voltage exceeded the programmed maximum allowable arc voltage for the set current.

  Lost Current During Ramp Down
  Arc was lost during current ramp down, but before the programmed ramp down time had elapsed.

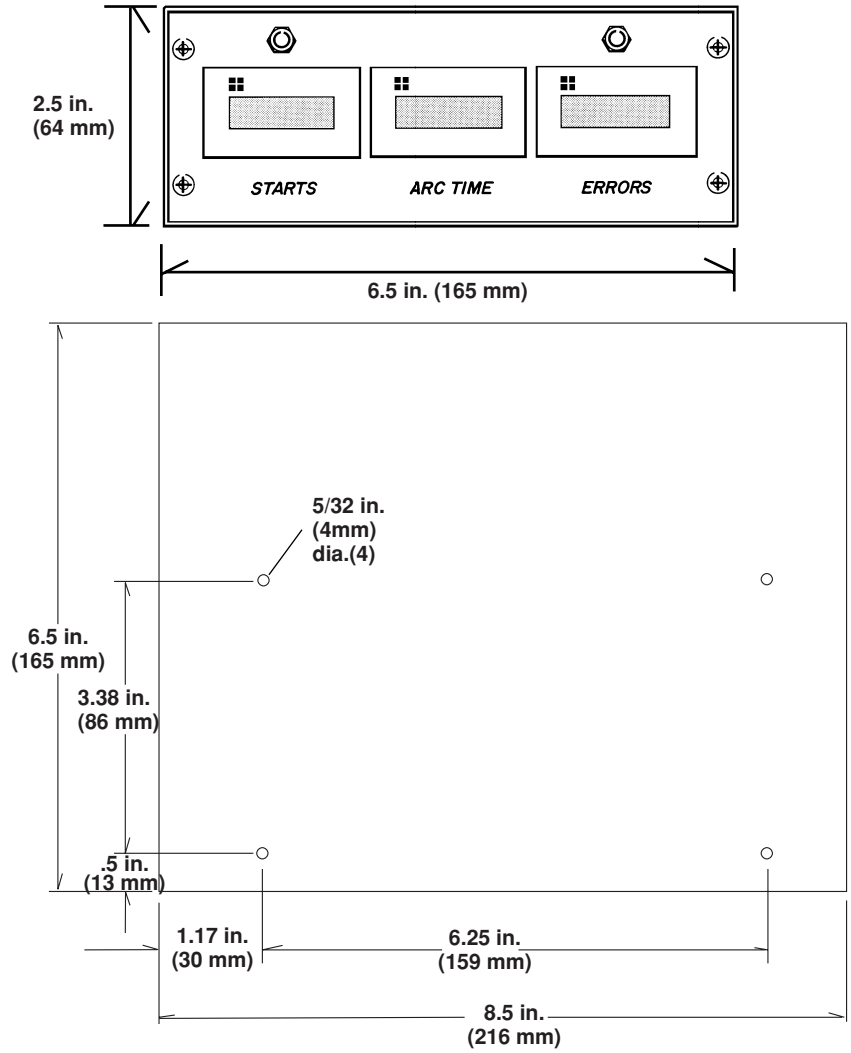

Figure b-1 Timer-Counter Dimensions and Mounting Holes

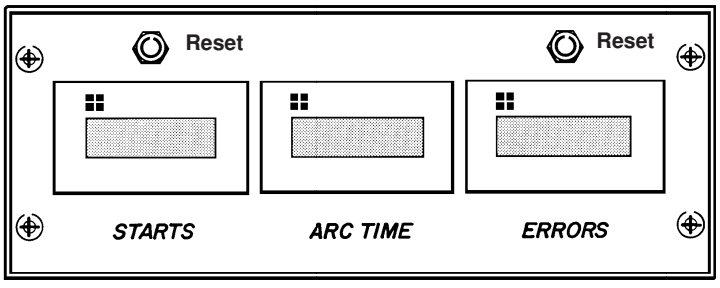

Figure b-2 Timer-Counter Controls and Indicators

Timer-Counter Internal Wiring

Refer to Figure b-3 for the timer-counter wiring between receptacle 5X1 and the ERROR counter, ARC TIME elasped time meter and STARTS counter.

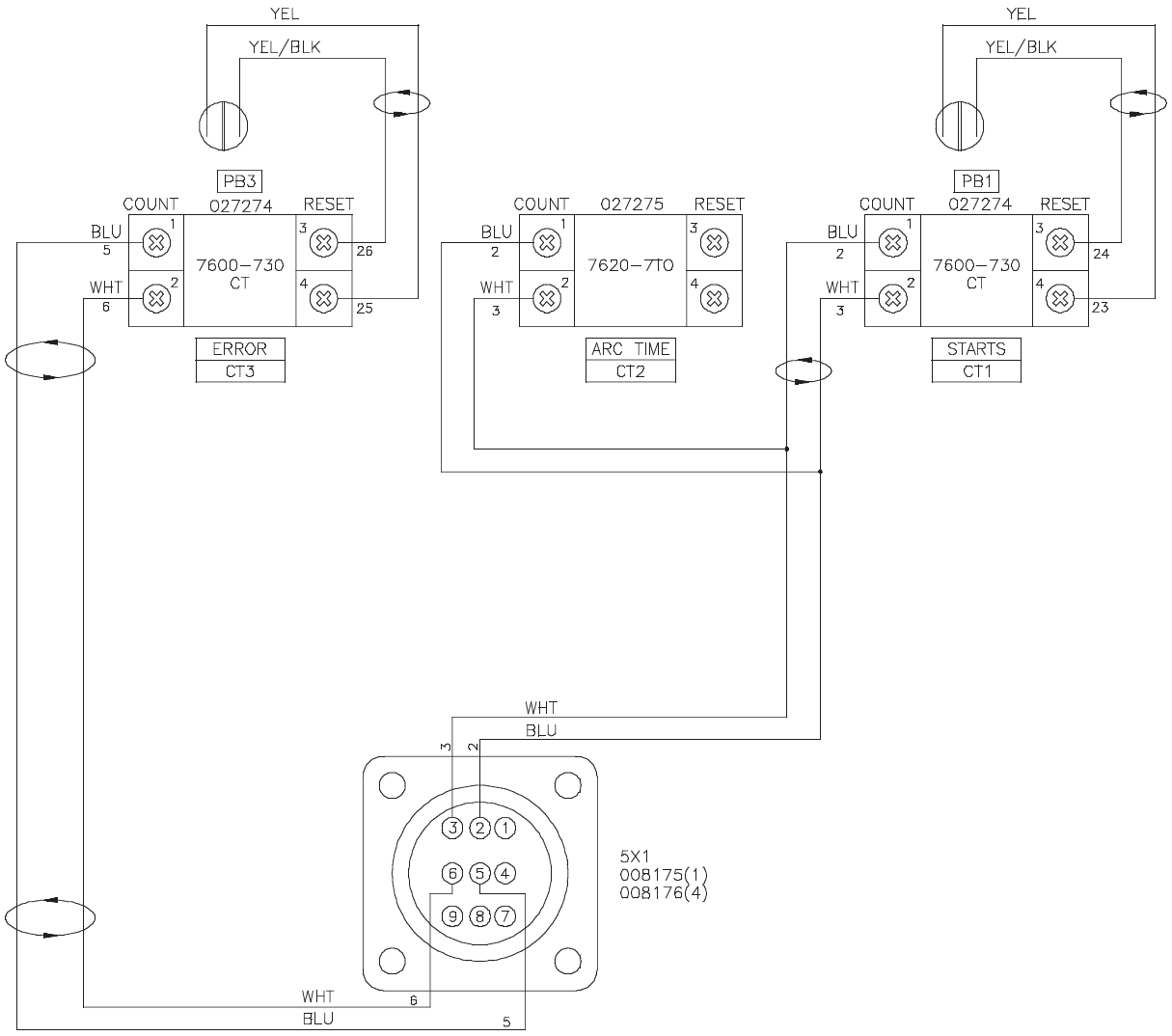

Figure b-3 Timer-Counter Internal Wiring

Parts List

Item	Part Number	Description	Designator	Qty.
	078049	**Assembly, timer-counter**		**1**
1	001391	Panel, front		1
2	027274	Counter, self powered LCD	CT3	1
3	027275	Meter, elapsed time, self powered LCD	CT2	1
4	027274	Counter, self powered LCD	CT1	1
5	005161	Switch, pushbutton, SPDT	PB3	1
6	005161	Switch, pushbutton, SPDT	PB1	1
7	001513	Panel, rear		1
8	008175	Receptacle, CPC 13-9 standard sex	5X1	1
8	008176	Pin, 24-20 AWG TYPE III + CRP		4
	001068	Enclosure, timer-counter (not shown)		1

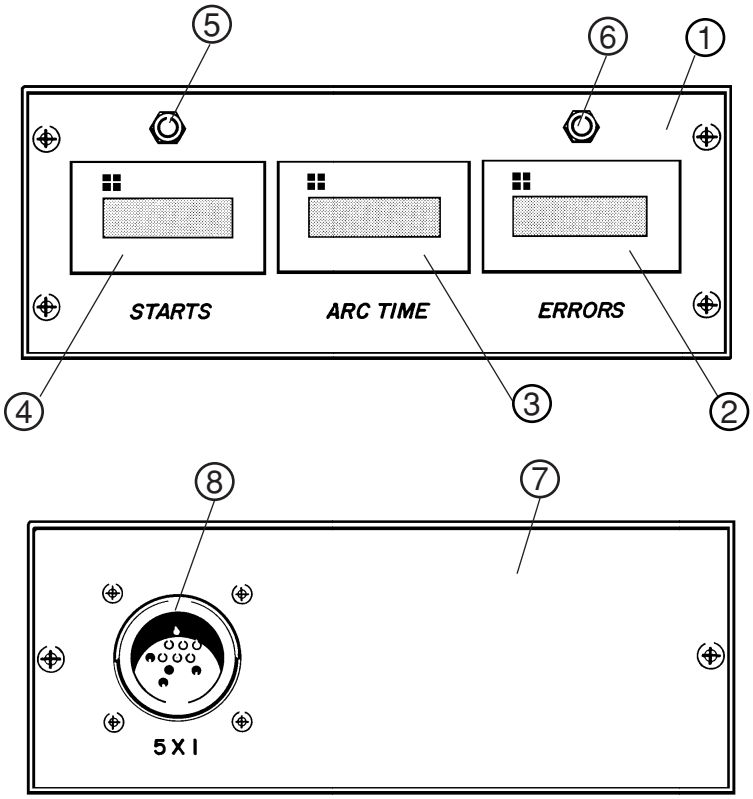

Figure b-4 Timer-Counter Component Locations

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Appendix C

REMOTE CURRENT CONTROL (RCC)

In this section:

Introduction

This appendix will enable a technician to install the optional remote current control (RCC) to the HD3070 plasma cutting system. The RCC has two basic components: the remote current control box (078050) and the current setpoint cable. The RCC is interfaced with the power supply with the current setpoint cable.

WARNING

High Voltage!

Power supply must be disconnected before installation.

Installation

1. Mount the RCC for easy access. For fixed mounting of the RCC, refer to Figure c-1.

2. Interface the RCC to the power supply with the current setpoint cable by referring to Section 3, *Installation,* page 3-23 and Figure 3-19 and the current setpoint cable lengths and wire run list in Figure 3-22.

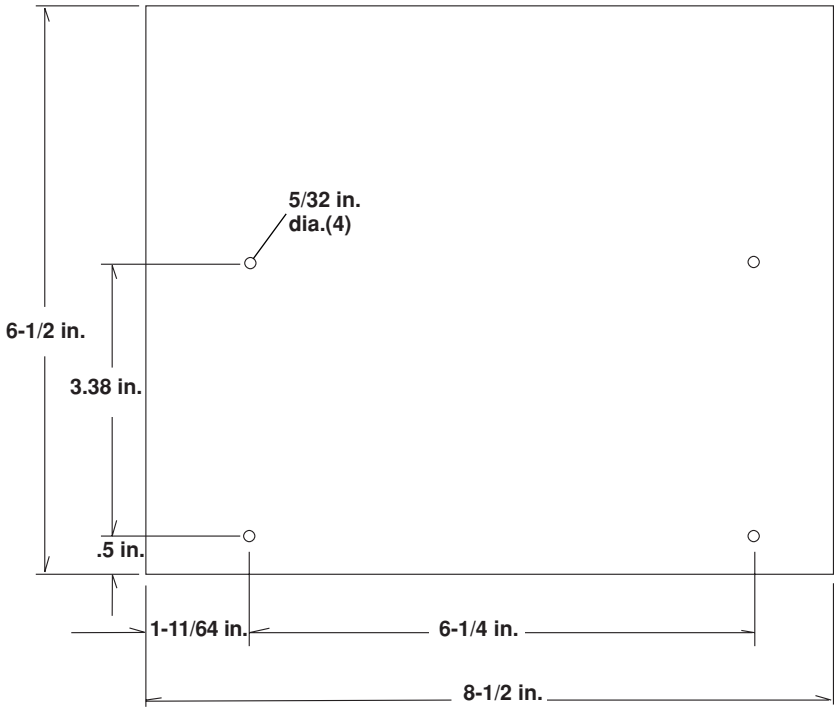

Figure c-1 RCC Mounting Dimensions

RCC 1X2 to Thumbwheel Switch Wiring Interface

Refer to Figure c-2 for wiring interface data between receptacle 1X2 and the thumbwheel switch.

From RCC 1X2 Pin	Color	Thumbwheel
8	Yellow	#1-4
7	Orange	#1-2
6	Blue	#1-1
5	Brown	#2-8
4	Green	#2-4
3	Red	#2-2
2	White	#2-1
11	Black	#2-Common
12	Gray	#2-8
13	Violet	#3-1

Figure c-2 RCC 1X2 to Thumbwheel Switch Wiring Interface

Operation

Set the desired current using the thumbwheel switch on the RCC. Refer to Section 4, *Operation*, for the Cut Chart data for current settings on the type and thickness of materials to be cut.

Parts List

Item	Part Number	Description	Designator	Qty.
	078050	**Remote Current Control, HD3070**		**1**
1	001514	Panel, RCC Front		1
2	005182	Switch, thumbwheel, 3-position BCD		1
3	001515	Panel, RCC Rear		1
4	008186	Socket, 24-20 AWG Type III + CRP		9
4	008208	Recptacle shell, CPC 23-37 reverse sex		1
	001068	Enclosure, RCC (not shown)		1

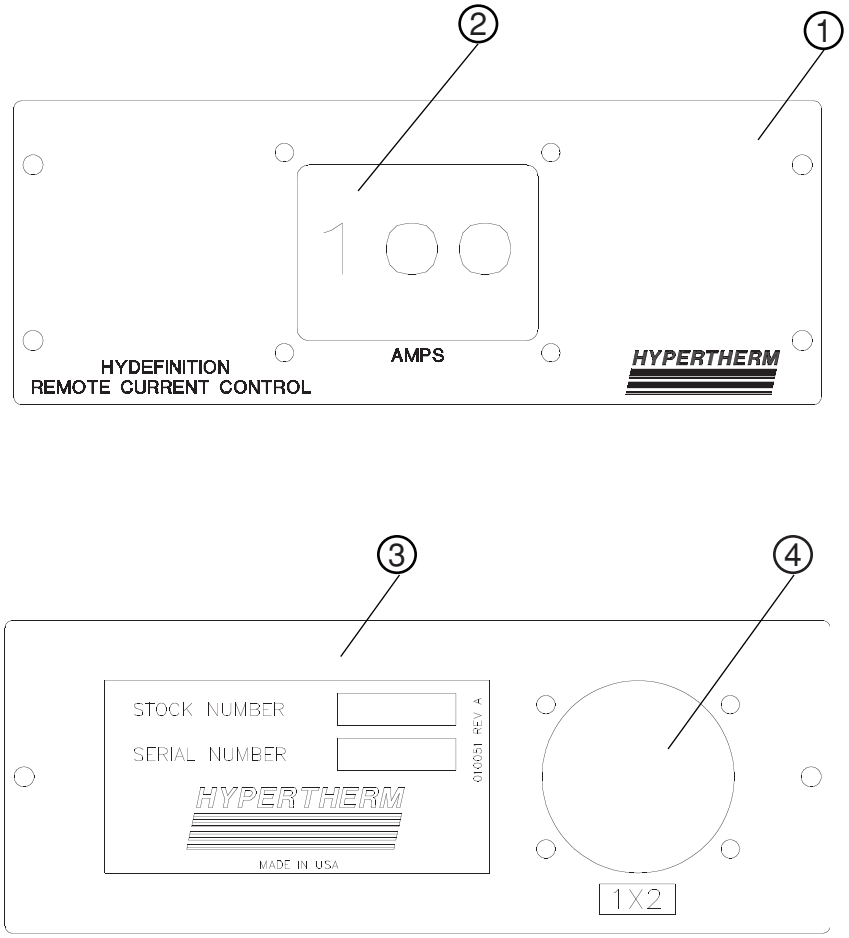

Figure c-3 RCC Component Locations

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Appendix D

ELECTROMAGNETIC COMPATIBILITY (EMC)

In this section:

EMC INTRODUCTION

This plasma cutting equipment has been built in compliance with standard EN50199. To ensure that the equipment works in a compatible manner with other radio and electronic systems, the equipment should be installed and used in accordance with the information below to achieve electromagnetic compatibility.

The limits required by EN50199 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 plasma equipment should be used only in an industrial environment. It may be difficult to ensure electromagnetic compatability in a domestic environment.

INSTALLATION AND USE

The user is responsible for installing and using the plasma equipment according to the manufacturers 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 Workpiece*. In other cases it could involve constructing an electromagnetic screen enclosing the power source and the work complete with associated input filters. In all cases electromagnetic disturbances must be reduced to the point where they are no longer troublesome.

ASSESSMENT OF AREA

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

a. Other supply cables, control cables, signalling 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 should be connected to the mains supply according to the manufacturers 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 should be routinely maintained according to the manufacturers 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 for those changes and adjustments covered in the manufacturers instructions. In particular, 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 at the same time. The operator should be insulated from all such bonded metallic components.

Earthing of 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 steelwork, a connection bonding the workpiece to earth may reduce emissions in some, but not all instances. Care should be taken to prevent the earthing of the workpiece increasing the risk of injury to users, or damage to other electrical equipment. Where necessary, the connection of the workpiece to earth should be made by a direct connection to the workpiece, but in some countries where direct connection is not permitted, the bonding should be achieved by suitable capacitances selected according to national regulations.

Note. The cutting circuit may or may not be earthed for safety reasons. Changing the earthing arrangements should only be authorized by a person who is competent to assess whether the changes will increase the risk of injury, for example, by allowing parallel cutting current return paths which may damage the earth circuits of other equipment. Further guidance is given in IEC TC26 (sec)94 and IEC TC26/108A/CD Arc Welding Equipment 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.

General

This appendix will enable a qualified electrician to install the power cable to the EMI filter on all CE 220/380/415 volt power supplies (078024).

Power Cable

The power cable is **customer supplied.** Refer to *Power Cables* on page 3-4 for cable information. Final specification and installation of the power cable should be made by a licensed electrician and according to national and local codes. Also, refer to *Mains Supply* on page d-2 for further power cable shielding recommendations.

Install Ring Terminals on to Power Cable Leads

1. Obtain four ring terminals that can be crimped on to the power cable leads. Terminal specifications are as follows:

   - Ring inner diameter 7.143 mm
   - Current rating of 60 amps or higher.

2. Crimp ring terminals on to leads.

	**WARNING** **High Voltage!**
Ensure ring terminals are securely crimped on to leads to reduce chance of arcing and shorting.	

Connect Power Cable

Connect the power cable to the EMI filter first and then connect it to the line disconnect switch.

Power Supply

1. Locate the EMI filter at the lower right rear of the power supply (see Figure d-1).

2. Remove two screws to remove cover to access input voltage stud connections.

3. Remove nuts and and top washers from studs.

4. Insert the power cable through the strain relief.

5. Connect the leads to the **U**, **V**, and **W** studs and secure using nuts and washers. Ensure that all electrical connections are tight to avoid excessive heating.

6. Connect the **ground lead** to the stud directly in front of ground symbol**.**

Line Disconnect Switch

Connecting the power cable to the disconnect switch must conform to national and local electrical codes. This work should be performed only by qualified, licensed personnel.

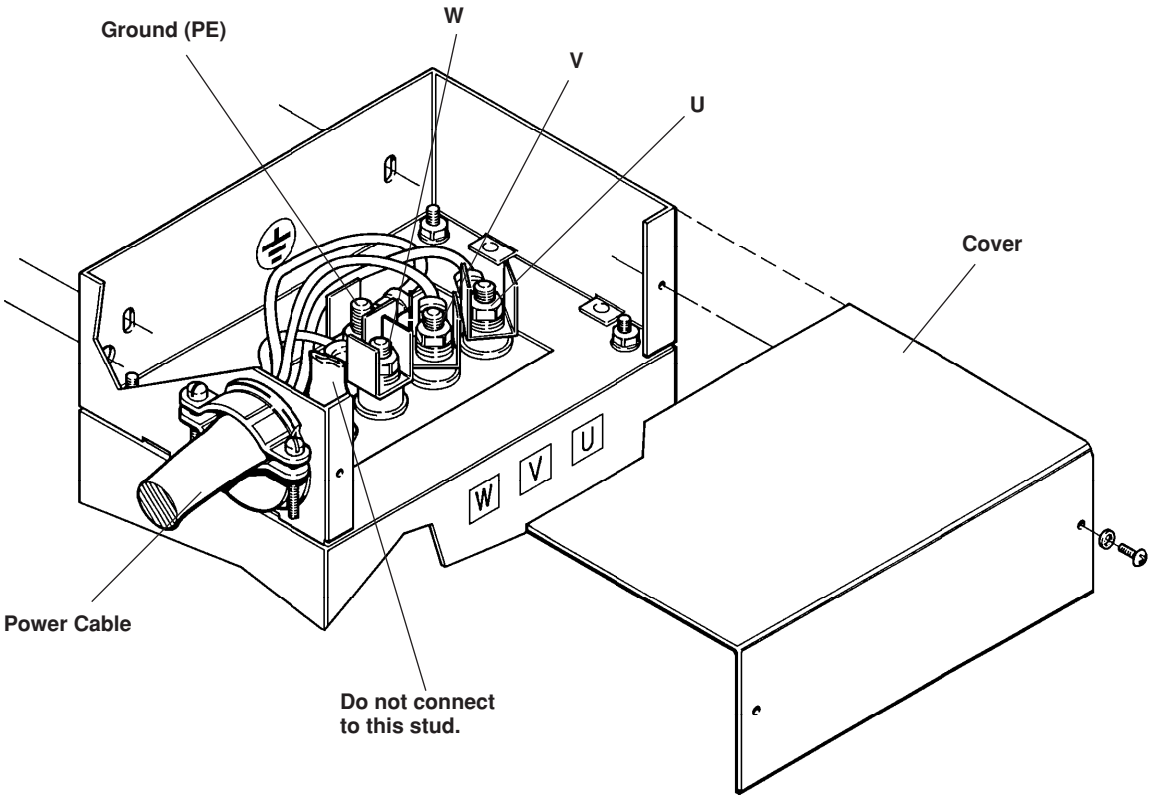

Figure d-1 Power Cable Connections to EMI Filter

EMI Filter Parts List

Item	Part Number	Description	Designator	Qty.
1	109036	Filter, 60A 2-stage AYT6C Elek		1
2	001526	Cap, end		2
3	001554	Cover, end cap		2
4	008318	Relief, strain		1

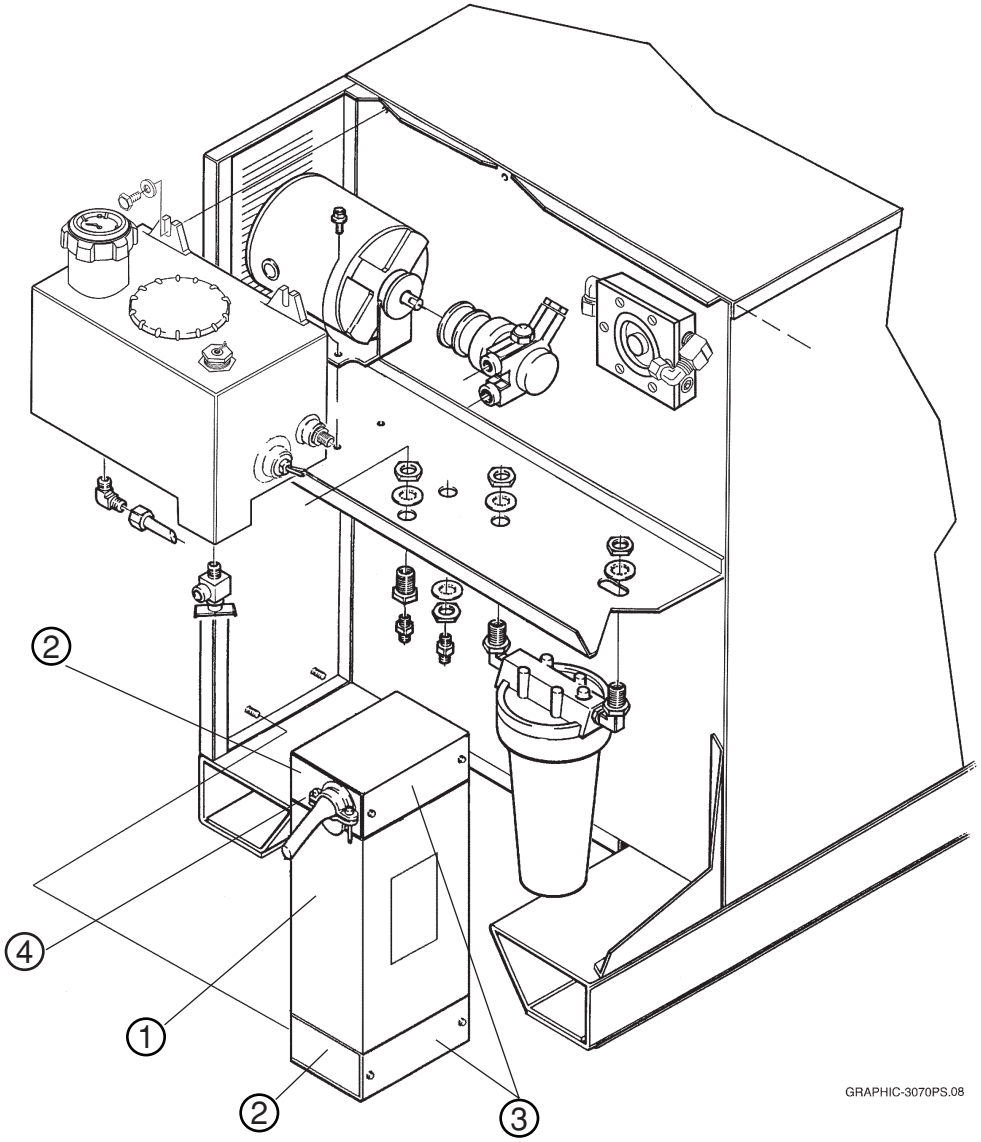

Figure d-2 EMI Filter Location

Appendix E

SYSTEM GROUNDING

System Grounding Requirements

The plasma system must be grounded for safety reasons and to suppress EMI:

- *Safety* The entire system – power supply, accessory enclosures, and worktable – must be grounded to protect it and the operator from a ground fault. The protective earth (PE) ground connections must be installed by a licensed electrician and conform to national or local codes.

- *EMI Suppression* If allowed by national or local codes, the ground system can also be used to suppress EMI (electromagnetic interference). Below is a guide to configure the plasma system for minimal EMI. See Electromagnetic Compatibility in this manual for additional information.

Suggested Ground Cable Routing

Power Supply

Connect the power supply to the PE ground terminal, using a properly sized color-coded conductor. This PE ground is connected to the service ground through the line disconnect switch. See the Installation section for further information on the power cord and the line disconnect switch.

Equipment Grounding

All accessory modules that receive power from the plasma power supply must also use the power supply's ground—either by connection to the PE terminal of the power supply, or by direct connection to the equipment ground conductor. Each module should have only one connection to ground to avoid ground loops and stray currents. If any enclosure is grounded to the work table, the work table must be grounded to the power supply.

Effective grounding for EMI reduction is highly dependent upon the installation configuration. Two acceptable configurations are shown in Figures e-1 and e-2.

The ignition console should be installed near the work table, and grounded directly to it. Other modules should be installed near the power supply, and grounded directly to it (Figure e-1).

All modules may also be installed near the work table, and grounded directly to it (Figure e-2). Do not ground the ignition console directly to the power supply.

The customer must furnish all conductors for equipment grounding. Grounding conductors may be purchased through Hypertherm in any length specified by the customer (Part No. 047058). The conductor may also be purchased locally, using a minimum 8 AWG UL Type MTW cable (USA specification) or the appropriate cable specified by national and local codes.

Consult the appropriate manufacturer's instructions to ground equipment that does not receive power from the power supply.

Work Table Grounding

If a supplementary ground rod is installed near the worktable to reduce EMI, it must be connected directly to the PE ground of the building structure, connected to the service ground; or to earth, providing the resistance between the ground rod and the service ground meets national or local codes. Place the supplementary ground rod within 20 ft (6 m) of the worktable according to national or local codes.

If any module is grounded to the work table, the work table must be grounded to the power supply, or the configuration must be changed to comply with applicable national and local electrical codes.

A ferrite choke can be placed in the conductor between the work table ground rod and the PE ground, with a number of turns through the choke to isolate the safety ground (at 60 Hz) from any electromagnetic interference (frequencies above 150 Khz). The more turns the better. A suitable ferrite choke can be made by wrapping 10 turns or more of the ground lead through Magnetics part number 77109-A7, Fair-Rite part number 59-77011101, or other equivalent ferrite choke. Locate the choke as close as possible to the plasma power supply.

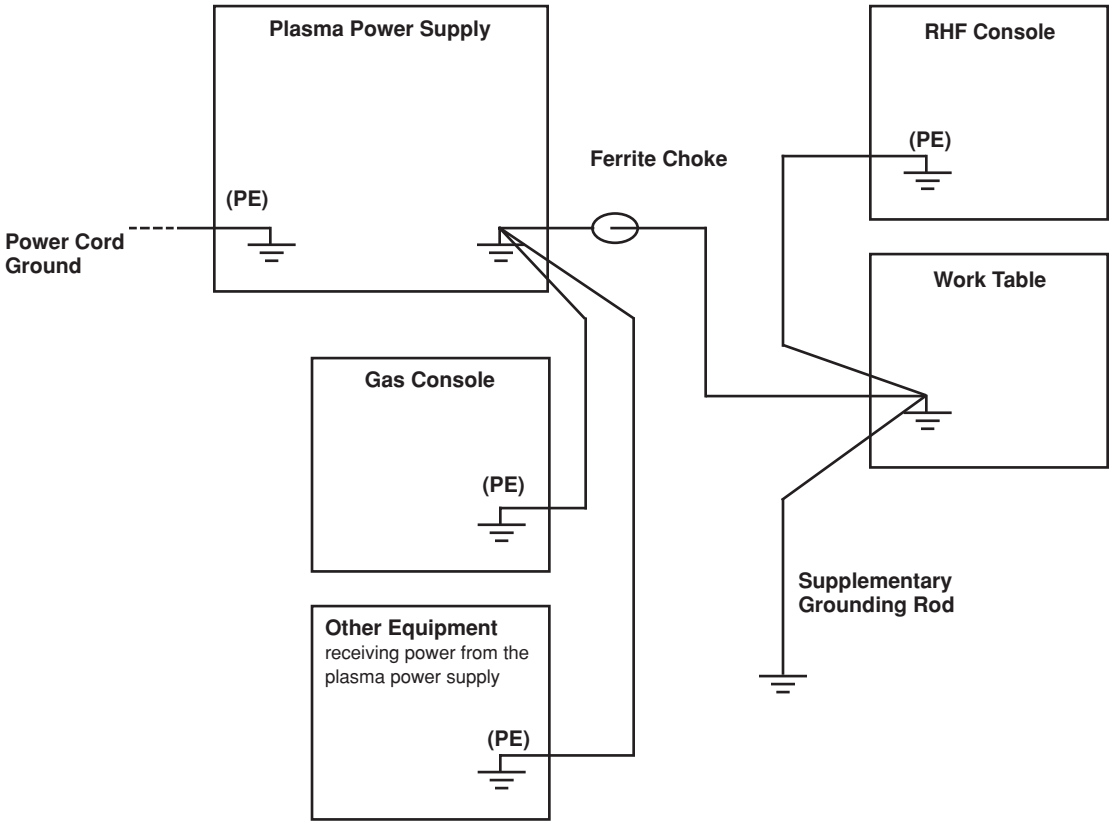

Figure e-1 Recommended Ground Connection Configuration

Note: Configuration may vary for each installation and may require a different ground scheme.

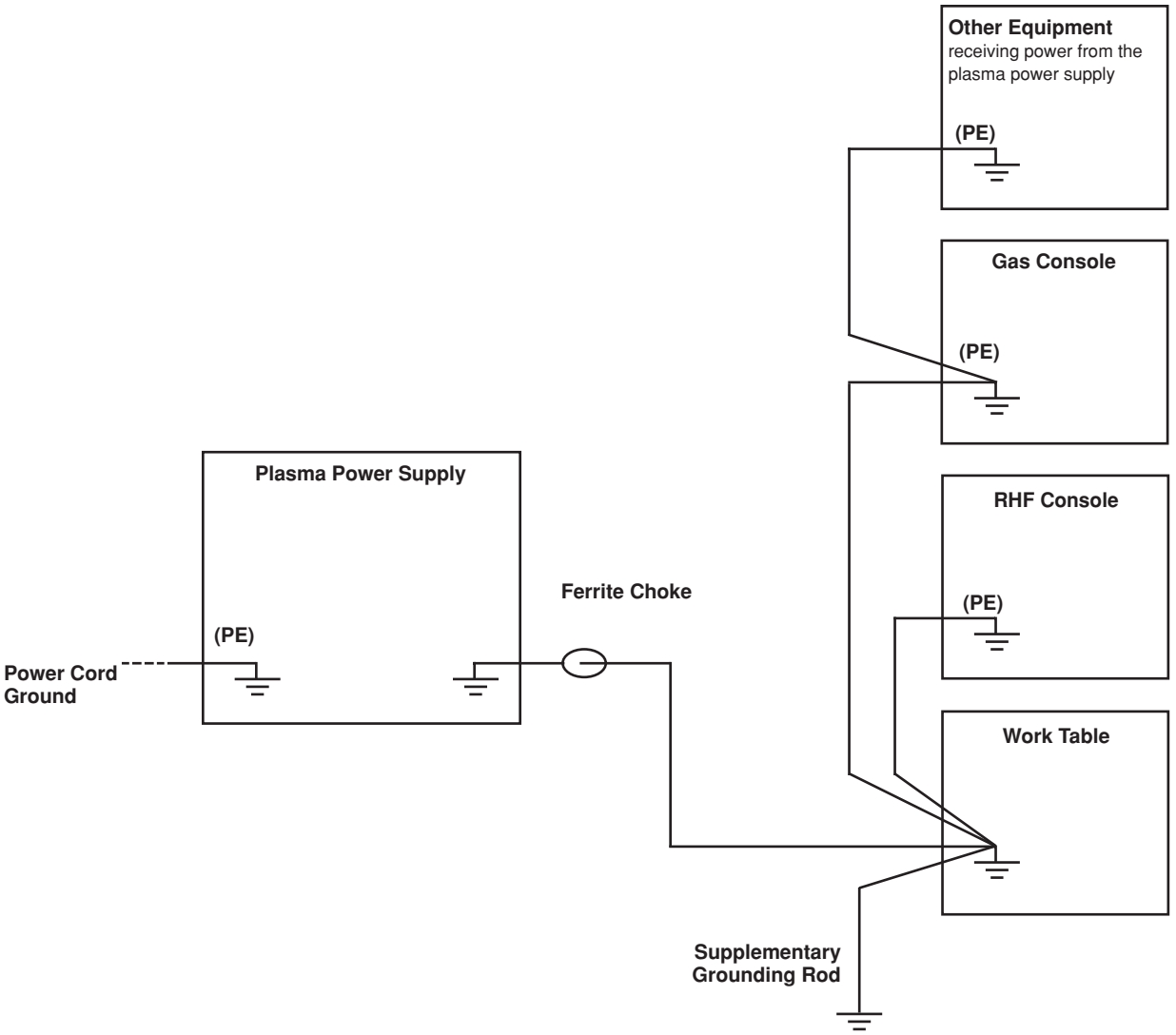

Figure e-2 Alternate Ground Connection Configuration

The preferred cable routing for this configuration is as shown, but it is acceptable to “daisy-chain” the grounds for the gas console and other equipment to the RHF console. The RHF console should NOT be daisy-chained through the other components to the work table.