MAX200®

Machine Torch Plasma Arc Cutting System

Instruction Manual
800980 – Revision 16

CE
EN50199
EN60974-1

Hypertherm®
The world leader in plasma cutting technology™

Changed Page	Description	800980 Rev 14 to 15 5/10/02
3.21	Added part numbers for cable lengths 25 ft-200 ft	
3.27	Call-outs for ends of cable changed. Power supply end was 1X4, changed to 1X2. DR/PR end was 5X1, changed to 5X2.	
4.6 & 4.14	Added SilverPlus information. Electrode P/N 220083	
4.10, 4.13, 4.19, 4.26, 4.31-4.46	Retaining cap part number changed from 120837 to 020423. Ohmic contact does not work with 40Amp,under water, beveling or gouging processes.	
Sections 5 & 6	The maintenance section is now section 5 (was 6). Standard components is now the parts list, section 6. This matches our other manuals.	
6.2	Updated art. Old picture lost.	
6.4	Updated art. Old picture lost.	
6.10	Updated art to show current chopper. Renumbered call-outs.	
6.11	Renumbered items. Removed references to obsolete chopper (P/N 029320). Removed art for chopper # 129118 from bottom of page.	
6.12	Updated art to show current chopper. Renumbered call-outs.	
6.13	Renumbered items. Removed references to obsolete chopper (P/N 029320). Removed art for chopper # 129118 from bottom of page.	
6.15	Item # 14 corrected. Was 029618 now 129618.	
6.16	Part # corrected. Filter, coolant, deionizing - was 027137 now 027005.	
6.17	Part # corrected. Torch main body was 020470, changed to 120584. Removed revision reference, it said revision 1 next to P/N in parentheses.	
6.18	Retaining cap part number changed from 120837 to 020423. Ohmic contact does not work with 40Amp,under water, beveling or gouging processes.	
6.19	Retaining cap part number 020423 and art added to cutting section.	
6.20 & 6.22	Retaining cap part number changed from 120837 to 020423, For Consumable Parts Kit # 028429 (6.20) & machine torch assembly part # 128365.	
Section 7/Wiring diagrams	013179 drawings uprev'd from U to V. Sheet 9 of 9 is the only one that changed. Timing chart and gas system designators updated. Format change (all pages) from 8.5X11" pages to 11X17" pages folded to fit.	

Changed Page	Description	800980 Rev 13 to 14 5/01
4.11-4.41	Electrode part# change from 120667 to 220021. Cap part 3 changed from 020423 to 120837 (art changed)	
4.18, 25, 39, 43	Changed Electrode part# to 120547 (100A air/air)	
5.7	Revised item 8 and 10 part numbers	
5.9	Revised item 2 part number	
5.13	Revised item 14 part number	
5.15	Item # 14 P/N 029618 changed to 129618	
5.18-5.23	Electrode part# change from 120667 to 220021. Cap part 3 changed from 020423 to 120837 (art changed)	
5.26	Part # correction 50' plasma gas lead was 024194 changed to 024195	
5.27 & 28	Added note about extended leads causing start problems: not recommended	

Changed Page	Description	800980 Rev 12 to 13
		7/99

Cover	New Revision
Title Page	New Revision
i	Added plumbing/electrical code statement to warranty page
1.1-1.6	New safety section
1a.1-1a.6	New French safety section
3.3	Added pre-installation for plumbing/electrical codes
3.4	Added hard plumbing statement
3.5	Shifted text from page 3-4
3.6	Revised coolant mixture
3.22	Added P/N 128404, DC relay
4.13	Part number correction
4.19	Part number correction
4.20	General correction
4.21	General correction
4.26	Part number correction
4.11-4.46	Added production cutting recommendation to applicable cut charts.
5.1	General correction
5.14 & 5.15	New Coolant tank
5.21	New 120894 sleeve
5.22	Added diameter to torch sleeve
5.23	Spelling correction
6.7	Removed page number reference
7	Deleted section 7. Standards included in section 1.
Diagrams	Revised 013179 sheet 7
Diagrams	Revised 013179 sheet 8

Page Changed **Description** **800980 Rev 11 to 12**

Cover	New Revision
Title Page	New Revision
2.2	Revised duty cycle rating
2.3	Added 073036 & 073039 power supply
3.31	Removed P/N reference
3.33	Removed P/N reference
3.41	Revised water muffler install options
4.10-4.46	Added 120667 electrode, revised motion delay and notes
5.5	General correction
5.11	Corrected 007022 shunt rating
5.13	Corrected item 9 P/N and description
5.14&5.15	Revised coolant pump and motor listing
5.18-5.20	Added 120667 electrode
5.21-5.23	Added new machine torch and optional torches
5.24-5.28	Page number shift
6.6	Removed P/N reference
b.1	Spelling correction
diagrams	Spelling correction

Changed Page **Description** **800980 Rev 10 to 11**

Cover	New Revision
Title Page	New Revision
2.3	General Correction, PS P/N
5.14	Revise Figure 5-73, New Solenoid valve subassembly
5.15	New Solenoid valve subassembly
Ap. B	New Coolant MSDS
Diagrams	013179, Added sheet 9

Changed Page **Description** **800980 Rev 9 to 10**

Cover	Uprevved manual
Title Page	Uprevved manual
4.9	General Correction
4.12	Added new Electrode
4.15	Added new Electrode
4.35	Added new Electrode
4.37	Added new Electrode
5.18	Added new Electrode
5.19	Added new Electrode
5.20	Revised Kit contents
5.21	Added torch assembly P/N

Changed Page	Description	800980 Rev 8 to 9
Cover	Uprevved manual due to LVD compliance	
Title Page	Uprevved manual due to LVD compliance	
0.01	Changed reference from 220-380-415V CE to 400V CE	
0.03	updated table of contents	
0.04	updated table of contents	
0.05	updated table of contents	
0.06	updated table of contents	
1.01	New Safety section	
1.02	New Safety section	
1.03	New Safety section	
1.04	New Safety section	
1a.01	New French Safety section	
1a.02	New French Safety section	
1a.03	New French Safety section	
1a.04	New French Safety section	
2.02	Changed reference from 220-380-415V CE to 400V CE	
2.04	Changed reference from 220-380-415V CE to 400V CE	
3.01	Changed reference from 220-380-415V to 220-380-400-415V	
3.06	Changed warning on propylene glycol to not induce vomiting.	
3.08	Added specs for 400V	
3.10	Changed figures of transformers to show new configurations	
3.11	Changed figures of transformers to show new configurations	
3.12	Changed reference from 220-380-415V CE to 400V CE	
3.13	Changed figure to show new designations	
3.14	Changed figure to show new designations	
3.15	Changed figure to show new designations	
3.33	Changed figure to show new designations	
4.01	Added STATUS indicators Before Startup to Sect. 4 TOC	
4.02	Added new STATUS logic. Added STATUS indicators Before Startup	
4.04	Added "See Status Indicators Before Startup" to step 5.	
5.03	Changed part nos. of items 1 &10	
5.07	Changed reference from 220-380-415V to 220-380-400-415V	
5.07	Changed part nos. of items 11 &12. Added temp sw.	
5.09	Changed reference from 220-380-415V to 220-380-400-415V	
5.09	Changed part nos. of items 18 &20. Added temp sw.	
5.11	Changed reference from 220-380-415V to 220-380-400-415V	
5.11	Changed part no. of chopper. Added temp sw.	
5.13	Changed reference from 220-380-415V to 220-380-400-415V	
5.13	Changed part no. of chopper. Added temp sw.	
5.15	New coolant reservoir part no.; added part nos. for gauge, drain valve.	
5.16	Changed part nos. in Recommended Spare Parts	
6.03	Changed troubleshooting (second problem)	
6.04	Removed word "red" in second & third problem descriptions	
6.05	Removed word "red" in first problem description	
d.03	Changed reference from 220-380-415V CE to 400V CE	
8 sheets	MAX200 wiring diagram format change 013-2-179 Rev K	

MAX200

Machine Torch

Instruction Manual

for Serial Numbers
beginning with
200-003654

Revision 16 – 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, LLC
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 (S) Pte Ltd
No. 19 Kaki Bukit Road 2
K.B. Warehouse Complex
Singapore 417847, Republic of Singapore
65 6 841 2489 Tel
65 6 841 2490 Fax
65 6 841 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
00 800 3324 9737 Tel
00 800 4973 7329 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 Europe B.V.
Vaartveld 9
4704 SE Roosendaal, Nederland
31 165 596908 Tel
31 165 596901 Fax
Technical Service:
00 800 49 73 7843 – toll-free in Europe
31 165 596900 Tel

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

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

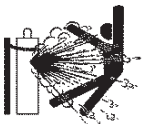
Work Cable Attach the work cable securely to the workpiece or the work table with good metal-to-metal contact. Do not connect it to the piece that will fall away when the cut is complete.

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

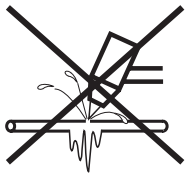
Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.

- 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. The numbered text corresponds to the numbered boxes on the label.

1. Cutting sparks can cause explosion or fire.

1.1 Keep flammables away from cutting.

1.2 Keep a fire extinguisher nearby, and have a watchperson ready to use it.

1.3 Do not cut on any closed containers.

2. The plasma arc can cause injury and burns.

2.1 Turn off power before disassembling torch.

2.2 Do not hold the material near cutting path.

2.3 Wear complete body protection.

3. Electric shock from torch or wiring can kill. Protect yourself from electric shock.

3.1 Wear insulating gloves. Do not wear wet or damaged gloves.

3.2 Insulate yourself from work and ground.

3.3 Disconnect input plug or power before working on machine.

4. Breathing cutting fumes can be hazardous to your health.

4.1 Keep your head out of the fumes.

4.2 Use forced ventilation or local exhaust to remove the fumes.

4.3 Use ventilating fan to remove the fumes.

5. Arc rays can burn eyes and injure skin.

5.1 Wear hat and safety glasses. Use ear protection and button shirt collar. Use welding helmet with correct shade of filter. Wear complete body protection.

6. Become trained and read the instructions before working on the machine or cutting.

7. Do not remove or paint over (cover) warning labels.

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.

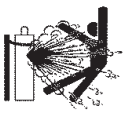
Table de travail Raccorder la table de travail à la terre, conformément aux codes de sécurité locaux ou nationaux appropriés.

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

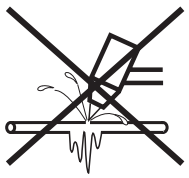
Les bouteilles de gaz contiennent du gaz à haute pression. Si une bouteille est endommagée, elle peut exploser.

- 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

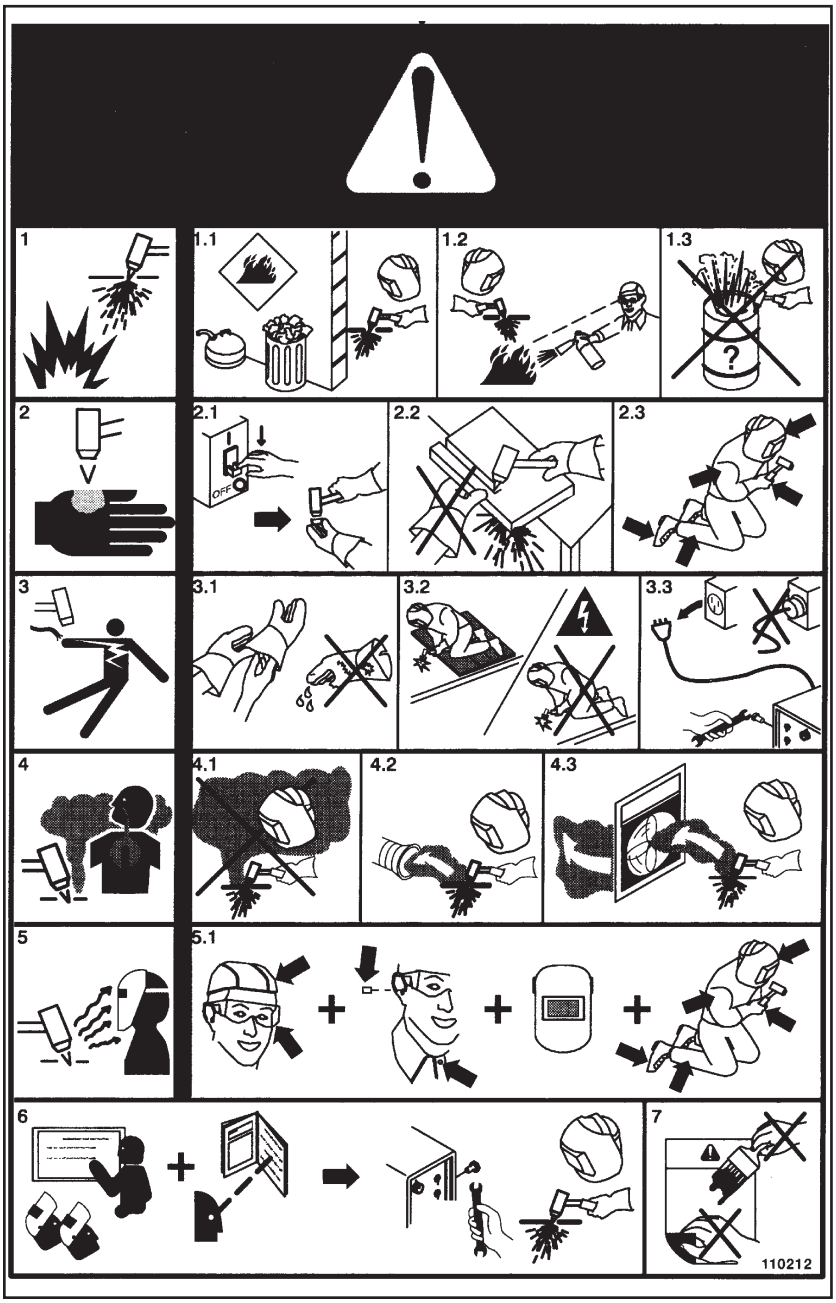
Les champs magnétiques produits par les courants à haute tension peuvent affecter le fonctionnement des prothèses auditives et des pacemakers. Les personnes portant ce type d'appareil doivent consulter un médecin avant de s'approcher d'un lieu où s'effectue le coupage ou le gougeage plasma.

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. Les numéros de la liste correspondent aux numéros des images.



1. Les étincelles produites par le coupage peuvent provoquer une explosion ou un incendie.

1.1 Pendant le coupage, éloigner toute matière inflammable.

1.2 Conserver un extincteur à proximité et s'assurer qu'une personne soit prête à l'utiliser.

1.3 Ne jamais couper de récipients fermés.

2. L'arc plasma peut provoquer des blessures et des brûlures.

2.1 Couper l'alimentation avant de démonter la torche.

2.2 Ne pas tenir la surface à couper près de la trajectoire de coupe.

2.3 Porter des vêtements de protection couvrant tout le corps.

3. Un choc électrique causé par la torche ou les câbles peut être fatal. Se protéger contre les risques de chocs électriques.

3.1 Porter des gants isolants. Ne pas porter de gants mouillés ou abîmés.

3.2 S'isoler de la surface de travail et du sol.

3.3 Débrancher la prise ou la source de courant avant de manipuler l'équipement.

4. L'inhalation des vapeurs produites par le coupage peut être dangereuse pour la santé.

4.1 Garder le visage à l'écart des vapeurs.

4.2 Utiliser un système de ventilation par aspiration ou d'échappement localisé pour dissiper les vapeurs.

4.3 Utiliser un ventilateur pour dissiper les vapeurs.

5. Les rayons de l'arc peuvent brûler les yeux et provoquer des lésions de la peau.

5.1 Porter un casque et des lunettes de sécurité. Se protéger les oreilles et porter une chemise dont le col peut être déboutonné. Porter un casque de soudure dont la protection filtrante est suffisante. Porter des vêtements protecteurs couvrant la totalité du corps.

6. Se former à la technique du coupage et lire les instructions avant de manipuler l'équipement ou de procéder au coupage.

7. Ne pas retirer ou peindre (recouvrir) les étiquettes de sécurité.

Hypertherm

Section 2

SPECIFICATIONS

In this section:

General

MAX200s are normally shipped from the factory (configured for mild steel cutting) with air supplied to both the plasma and shield gas inlets from a single pressure/filter regulator. The regulator ensures that the correct air pressure is supplied to the system at the proper quality.

For better cut quality on metals such as stainless steel, aluminum, and other non-ferrous materials, either nitrogen or argon/hydrogen (Hypertherm recommends a mixture of 35% hydrogen and 65% argon) can be used as the plasma gas. When cutting mild steel, oxygen can also be used as the plasma gas. Shield gases other than air which can be used are nitrogen and carbon dioxide.

An EMI filter, standard with all 400V CE power supplies (073200 and 073213) meets the CE requirement for filtering incoming power. Refer to Appendix D to connect incoming power to the filter and for part numbers specific to the CE power supplies.

Product Specifications

MAX200 Power Supplies

The MAX200 is a constant current, secondary converter chopper power supply providing continuously variable amperage from 40 amps to 200 amps. It conforms to the following specifications:

Maximum OCV .....280 VDC
Output Current .....40-200 amps
Output Voltage .....150 VDC
Duty Cycle Rating .....100% up to 30 kw

Input Power:
073002* .....240/480 VAC, 3Ø, 60 Hz, 90/45 amps
073020**

073003* .....600 VAC, 3Ø, 60Hz, 36 amps
073021**

073004* .....208 VAC, 3Ø, 60Hz, 104 amps
073022**

073005* .....220/380/415 VAC, 3Ø, 50 Hz,
073023** .....98/57/52 amps

073026* .....200 VAC, 3Ø, 50 Hz, 108 amps
073024**

073036* .....500 VAC, 3Ø, 50 Hz, 43 amps
073039**

Dimensions:

Width	28-1/4" (71 cm)
Height	35-1/2" (90 cm) w/o casters 43" (109 cm) w/casters
Depth	41-1/4" (104 cm) w/o handle 50" (127 cm) w/handle
Weight	780 pounds

Cooling ..... Forced Air (Class F)

* MAX200 Power Supply – Machine Torch w/o THC Configuration
** MAX200 Power Supply – Machine Torch w/THC Configuration

Gas Requirements:

Gas Type/Quality	Air (compressed)/clean, dry, oil-free Oxygen (liquid)/99.5% Nitrogen (liquid)/99.995% Carbon Dioxide (compressed or liquid)/ 99.5%
Plasma Gases	Air, Oxygen (O_2), Nitrogen (N_2), Argon/Hydrogen (H35 = 35% Hydrogen/65% Argon)
Shield Gases	Air, Carbon Dioxide (CO_2), Nitrogen (N_2)
Plasma Gas Flow	66 scfh (Air), 60 scfh (N_2), 70 scfh (H35), 72 scfh (O_2)
Shield Gas Flow	220 scfh (CO_2), 280 scfh (Air), 290 scfh (N_2)
Plasma Gas Inlet Pressure	90/120 psi dynamic (flowing)
Shield Gas Inlet Pressure	90 psi dynamic (flowing)
Plasma Gas Pressure (Test/Run)	13/48, 22/48 psi (Air); 13/44, 15/48 psi (O_2); 15/35, 17/37 psi (N_2); 23/56 psi (H35)
Shield Gas Pressure	70 psi
Torch Coolant Tank Capacity	2.9 gallons (11 liters); refer to Section 3, *Torch Coolant System*, for coolant specifications, warning, and cautions

CE Power Supplies

The specifications specific to the 400V CE, 3 Ph, 50 Hz power supplies (073200 and 073213) are listed below. These CE power supplies conform to all other non CE power suppy specifictions as listed above. Refer to Appendix D for EMC requirements, power cable connections, and parts information specific to the MAX200 CE power supplies.

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

# 073200 (without THC)	400 VAC, 3Ø, 50 Hz, 56 amps
# 073213 (with THC)	400 VAC, 3Ø, 50 Hz, 56 amps

Dimensions:

Height	40-3/4" (104 cm) w/o casters 48-1/4" (122 cm) w/casters
Weight	800 pounds (363 kg)

MAX200 Machine Torch

The MAX200 machine torch conforms to the following specifications:

Maximum cutting thickness .....2 inches
Maximum current at 100% duty cycle .....200 amps
Plasma Gas Flow .....66 scfh (Air), 60 scfh (N_2), 70 scfh (H35), 72 scfh (O_2)
Shield Gas Flow .....220 scfh (CO_2), 280 scfh (Air), 290 scfh (N_2)
Water Coolant Flow Rate .....0.8 gpm
Weight .....2-1/2 lbs. (1.13 kg)

Hypertherm

Section 3

SETUP

In this section:

Upon Receipt

The MAX200 power supply is shipped mounted to a skid and protected by a heavy carton cover. Before unpacking the unit, inspect the carton for evidence of damage during shipment.

1. Remove all packing material and discard and remove the power supply from the shipping skid.

2. Verify that the MAX200 torch standard system configuration items and parts listed below are included. Also, ensure all the required options are included.

   Alert your distributor if any of the items or parts are missing. All communications regarding this equipment must include the model number and serial number (located on the back of the MAX200). See the *Claims and Technical Questions* in this section for details.

   MAX200 System – Machine Torch Configuration

   - MAX200 Power Supply
   - MAX200 machine torch and torch lead assembly
   - 25-foot work cable (ground) with clamp
   - Consumable spare parts kit
   - Torch coolant – four gallons
   - Instruction manual 800980

   Options:

   - Torch Height Control (THC)
   - Remote Module
     - Switch Remote (SR)
     - Digital Remote (DR)
     - Program Remote (PR)
   - Initial Height Sensor (IHS)
   - Remote Start/Stop Switch
   - Water Muffler (refer to manual IM-97)

Claims and Technical Questions

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.

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

1. Read the *Troubleshooting* section of this manual. You may find the problem is quite easy to fix, such a loose connection.

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

3. If you need additional assistance, call Technical Service listed in the front of this manual or your authorized Hypertherm distributor.

Pre-Installation

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.

Air and Gas Supply Requirements

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.

Air Supply

Two different sources of air can be used to supply the plasma and shield gas requirements of the MAX200: cylinder compressed air or shop compressed air. Use an inert gas hose to connect the air supply to the input connection on the filter/pressure regulator mounted on the rear of the power supply.

WARNING

Do not exceed 150 psi to the filter/pressure regulator when using cylinder compressed air or shop compressed air. The plastic filter bowl may explode if this pressure is exceeded, causing serious injury. See the warning label on the filter bowl for other safety warnings.

Cylinder Compressed Air

The cylinder air supply must be clean, dry and oil-free. A high-pressure regulator on the cylinder must be used and must be capable of delivering air at a pressure of between 110 and 130 psi to the filter/pressure regulator on the power supply. The filter/pressure regulator must be set for a 90 psi input to the power supply (refer to the procedure below). Refer to Section 4, *Cut Charts* for detailed information.

Shop Compressed Air

The shop air supply must be clean, dry and oil-free. Shop air must capable of delivering air at a pressure of between 110 and 130 psi to the filter/pressure regulator on the power supply. The filter/pressure regulator must be set for a 90 psi input to the power supply (refer to the procedure below). Refer to Section 4, *Cut Charts* for detailed information.

Adjusting the Filter/Pressure Regulator

To adjust the filter/pressure regulator for the required air pressure (90 psi) to the power supply:

1. Turn the Lock Knob, which secures the Adjusting Knob, counter clockwise (ccw).

2. Set the Adjusting Knob until the pressure gauge indicates 90 psi.

3. Turn the Lock Knob clockwise (cw) to secure the Adjusting Knob.

Additional Air Filtration

When site conditions introduce moisture, oil, or other contaminants into the air line, additional filtration is required. Refer to *Appendix A* for filtration components and mounting sequence.

Gas Supply

Use inert gas hoses to connect the plasma and shield gas supplies to the gas input connectors on the rear of the power supply.

Plasma Gas

To use liquid nitrogen, liquid oxygen, or argon/hydrogen as the plasma gas, it must be supplied to the MAX200 at these purities: nitrogen, 99.995% and oxygen, 99.5%. The gas supply source can be compressed gas cylinders or liquid containers. It must be capable of delivering the required gas at a delivery pressure of 120 psi to the power supply. Refer to Section 4, *Cut Charts* for detailed information.

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

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

Shield Gas

To use liquid nitrogen or carbon dioxide (compressed or liquid) as the shield gas, it must be supplied to the MAX200 at these purities: nitrogen, 99.995% and carbon dioxide, 99.5%. The gas supply source can be compressed gas cylinders or liquid containers. It must be capable of delivering the required gas at a delivery pressure of 90 psi to the power supply. Refer to Section 4, *Cut Charts* for detailed information.

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 0.1% benzotriazole 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 one-gallon containers by ordering 028872. 100% propylene glycol is available by ordering 028873.

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

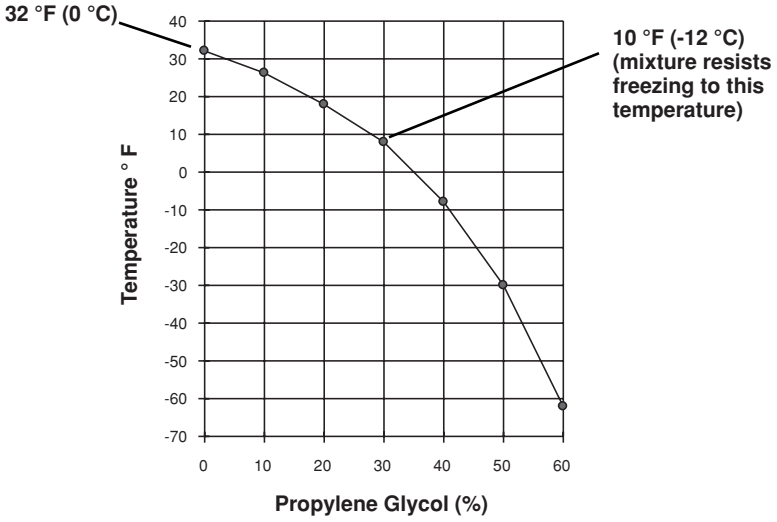
Observe the warning and cautions below. Refer to the Material Safety Data Sheets in Appendix B for data on safety, handling, and storage of propylene glycol and benzotriazole.

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. Anti-freeze contains corrosion inhibitors that 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 .206 and 8.5 ppm. If using a conductivity meter to measure water purity, the recommended level is between .5 and 18 µSiemens/cm at 77° F (25° C).



Filling the System

To fill the torch coolant tank prior to initial startup:

1. Ensure the torch lead is connected. Refer to *Connect the Torch Lead* in this section.

   Note: Always add coolant with the MAX200 system off.

2. Fill the tank with coolant until the level reaches the bottom of the neck, approximately 2.9 gallons (11liters).

Power Supply Placement

Prior to positioning the power supply, route the torch lead to the cutting machine. Once the torch lead has been routed to the cutting machine, the power supply can be positioned, so that the torch lead and other system interconnecting cables can be connected. This also allows the line disconnect switch box to be placed close to the power supply for safety purposes. Placement of the power supply should also include the following criteria:

- Place the power supply in an area that is free of excessive moisture, has proper ventilation, and is relatively clean.
- 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.

Routing the Torch Lead

When routing the torch lead to the cutting machine, you will generally need to route the torch lead through a festoon or a power track. Before routing the lead using either method, remove the torch from the torch lead. Once the torch lead has been routed, replace the torch; it is now ready to be mounted to the torch mounting bracket. Refer to the *Maintenance* section for the torch removal and replacement procedures.

Caution: Do not route the torch lead with the torch connected. Damage to the torch could result from dropping, banging, or scraping.

Power Requirements

A separate line disconnect switch should be provided for each MAX200 power supply. The disconnect box should be sized to the following requirements:

Input Voltage	Phase	Rated Input Current @ 30 kw Output	Recommended Fuse Size
200 VAC	3	108 amps	150 amps
208 VAC	3	104 amps	150 amps
220 VAC	3	98 amps	150 amps
380 VAC	3	57 amps	80 amps
400 VAC	3	56 amps	80 amps
415 VAC	3	52 amps	70 amps
480 VAC	3	45 amps	60 amps
600 VAC	3	36 amps	50 amps

Line Disconnect Switch

- Use a primary line disconnect switch for each power supply. This disconnect switch allows you to turn the power supply off quickly in an emergency situation. The switch should be located on a wall near the power supply, and should be easily accessible to the operator. The interrupt level of the switch must be equal to or exceed the continuous rating of the fuses. Refer to *Power Requirements* listed above.

Power Cables

- Use AWG wire sizes as outlined by applicable local electrical codes. Wire sizes vary based on the distance of the receptacle from the main box.

- Use a 4-conductor Type SO input power cable with a conductor temperature rating of 60°C (140°F) according to the following requirements:

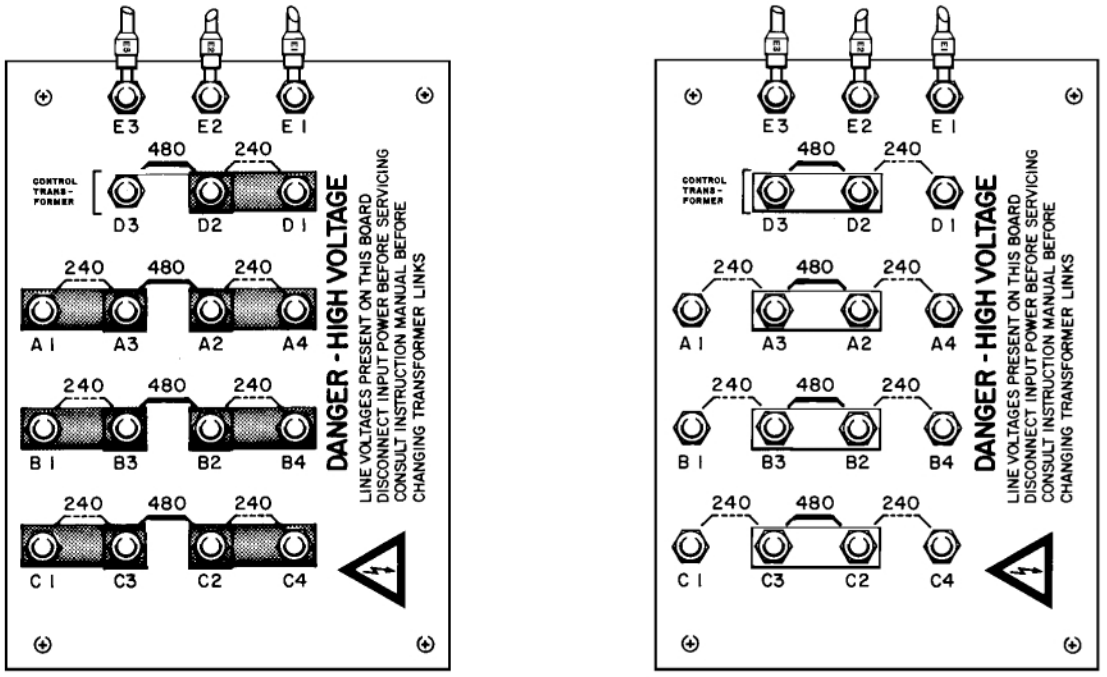
Input Voltage	Cable Size	Current Rating
200 VAC	1/4	107 amps
208 VAC	1/4	107 amps
220 VAC	1/4	107 amps
380 VAC	4/4	69 amps
400 VAC	4/4	69 amps
415 VAC	4/4	69 amps
480 VAC	6/4	52 amps
600 VAC	8/4	39 amp

240/480V Linkboard Configurations

- The 240/480-volt unit (# 073002 and # 073020) is shipped from the factory linked for 480-volt operation. The links must be moved for 240-volt operation. Ensure that the linkboard is configured properly to the appropriate voltage line (see Figure 3-1).

WARNING

Danger: High Voltage. Line voltage may be present on this linkboard. Disconnect input power before servicing.



240-Volt Configuration **480-Volt Configuration**

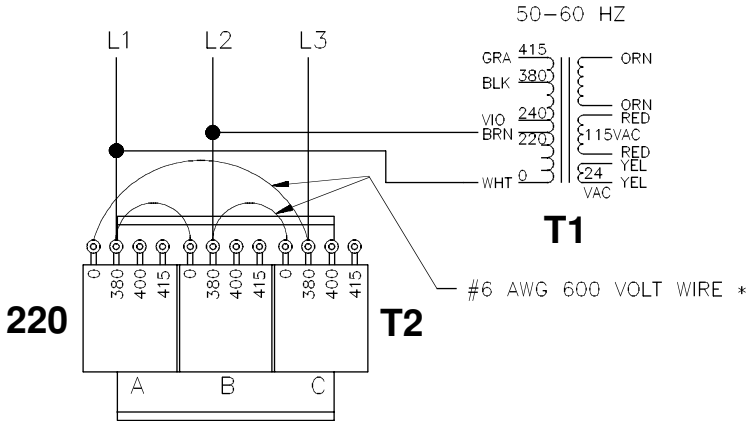
Figure 3-1 Dual Voltage 240/480-Volt Linkboard Configurations

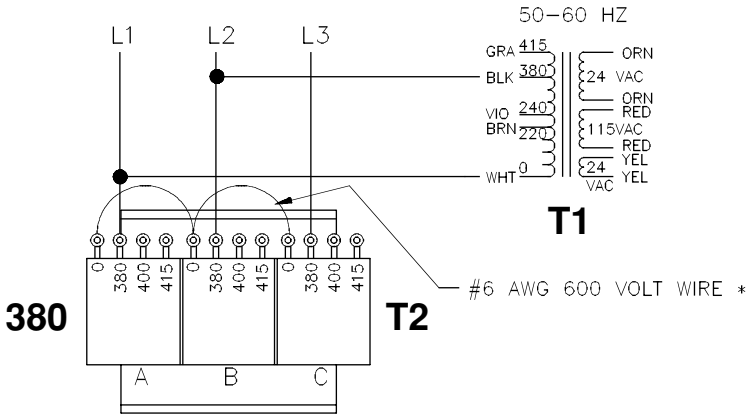
220/380/400/415V Transformer T1 and T2 Configurations

- The 220/380/400/415-volt, 3Ø, 50 Hz power supply is normally shipped from the factory set up for 380-volt operation, unless otherwise specified. To change the power supply to a different voltage, control transformer T1 and 30 kw transformer T2 must be reconfigured (see Figure 3-2)

WARNING

Danger: High Voltage. Line voltage is present in the power supply unless disconnected. Always disconnect input power at the line disconnect switch before servicing.





*** A long # 6 wire is shipped with every unit.**

Figure 3-2 220/380/400/415V Transformer T1 and T2 Configurations (1 of 2)

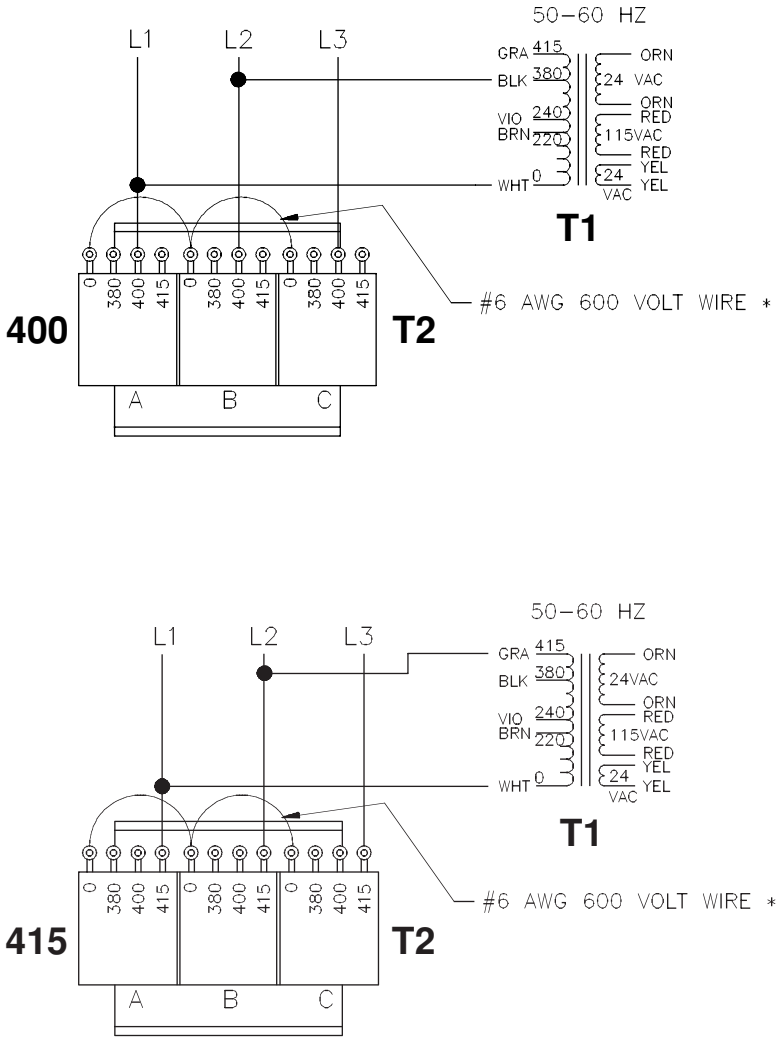


Figure 3-2 220/380/400/415V Transformer T1 and T2 Configurations (2 of 2)

Power, Gas, and Torch Lead Connections

Connect the Power Cable

To connect the power cable to the 400V CE power supplies (073200 and 073213), refer to Appendix D. For other power supply voltages use the procedure below.

To connect the power cable to the MAX200, proceed as follows (see Figure 3-3):

1. Insert the power cable through the strain relief at the rear of the MAX200. Connect the power cable leads to TB1 located at the rear center panel of the right side.

2. Connect the power leads to the L1, L2, and L3 terminals of TB1.

3. Connect the ground lead to the yellow/green terminal of TB1.

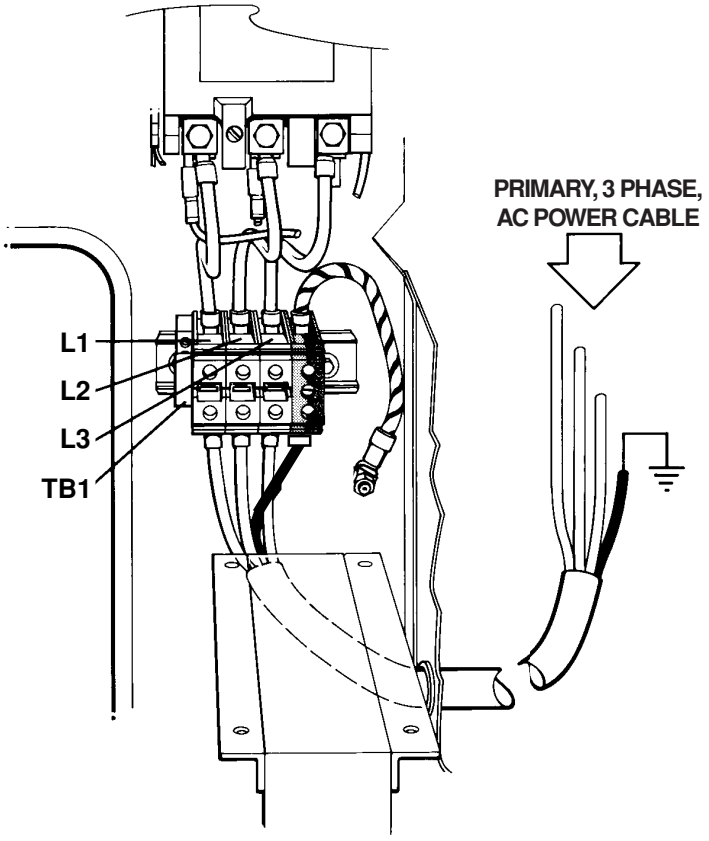


Figure 3-3 Power Cable Connections

Connect the Air and Gas Hoses

When connecting pipeline shop air or compressed gas cylinders, use inert gas hoses for the plasma and shield connections to the MAX200.

Plasma (Air) and Shield (Air) Hoses

MAX200 systems are normally shipped from the factory configured, so that air is supplied to both the **PLASMA** and **SHIELD GAS** inlets from a single filter/pressure regulator. The filter is used to maintain a high air purity level. All moisture, oil, and other contaminants must be removed. If the air hoses must be re-connected, proceed as follows (see Figure 3-4):

1. Connect the plasma air hose from the regulator to the **PLASMA** gas inlet.

2. Connect the shield air hose from the regulator to the **SHIELD** gas inlet.

3. Connect the shop-supplied or cylinder-supplied air hose to the input of the filter/pressure regulator.

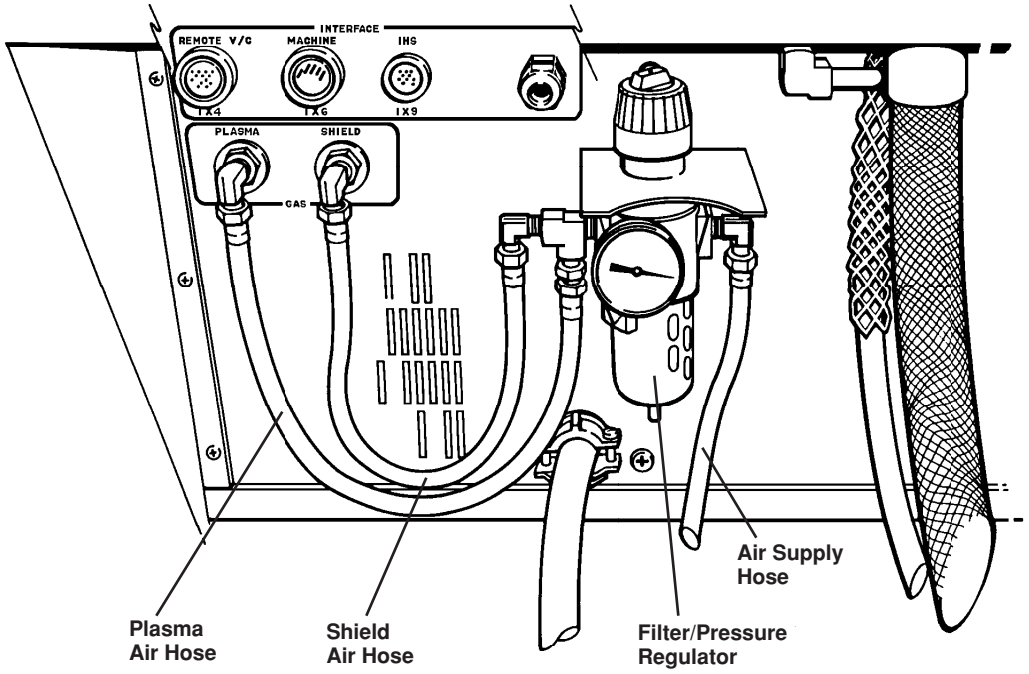


Figure 3-4 Plasma Air and Shield Air Connections

Plasma (Gas) and Shield (Air) Hoses

When the plasma required is a gas other than air and the shield gas required is air, connect the hoses as follows (see Figure 3-5):

1. Connect the plasma gas supply hose to the **PLASMA** gas inlet.

2. Connect the shield air hose from the regulator to the **SHIELD** gas inlet.

   Note: In this configuration, the **plasma air hose** must be disconnected from the regulator and replaced by a supplied **# 6 JIC cap**. The cap is required to stop the discharge of air from the regulator plasma output in order to keep the shield air pressure within specification.

3. Connect the shop-supplied or cylinder-supplied air hose to the input of the filter pressure regulator.

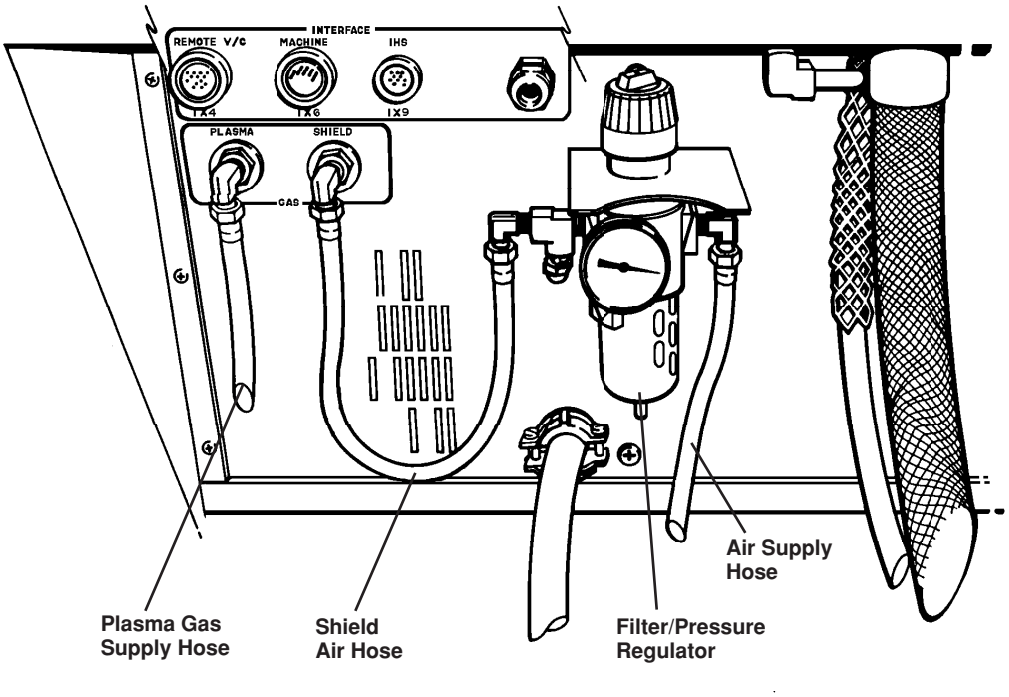


Figure 3-5 Plasma Gas and Shield Air Connections

Plasma (Gas) and Shield (Gas) Hoses

When gases other than air are used, connect the liquid or compressed bottled gases to the MAX200 as follows (see Figure 3-6):

1. Connect the plasma gas supply hose to the **PLASMA** gas inlet.

2. Connect the shield gas supply hose to the **SHIELD** gas inlet.

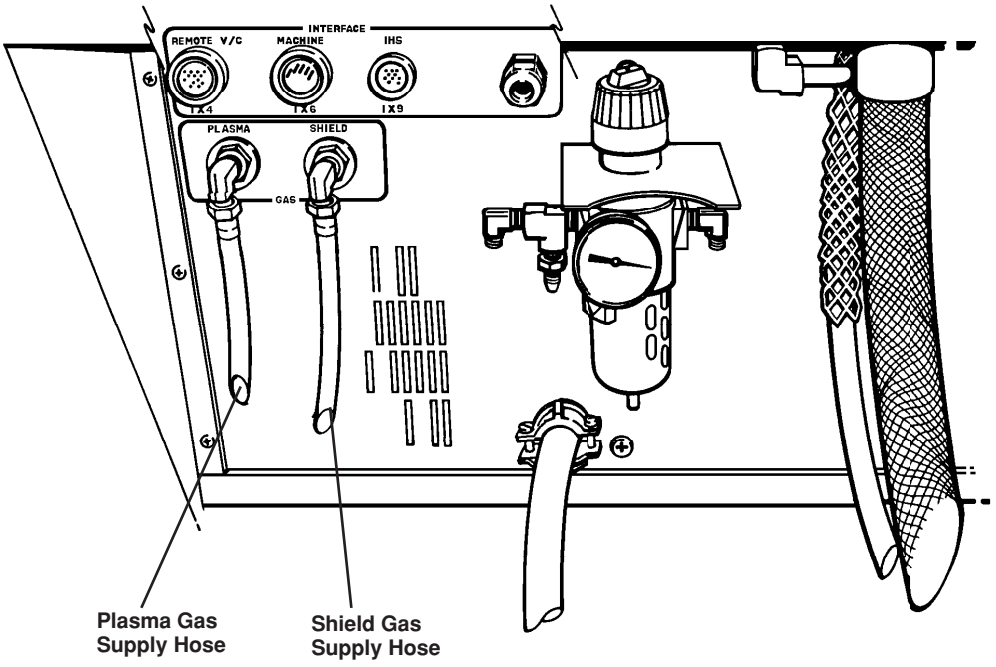


Figure 3-6 Plasma Gas and Shield Gas Connections

Connect the Torch Lead

To connect the machine torch lead to the MAX200, proceed as follows (see Figure 3-7):

1. Connect the torch coolant return hose (blue-w/red band) to the bulkhead adapter.
2. Connect the torch coolant supply hose (blue-w/green band) to the bulkhead adapter.
3. Connect the pilot (shield) gas hose (blue) to the bulkhead adapter.
4. Connect the plasma gas hose (red) to the adapter. This connection is left hand-threaded; it tightens in a counter-clockwise (ccw) direction.
5. Connect the cap sensor hose (gray) to the adapter.

Connect the Work Cable

To connect the work cable to the MAX200, connect the work cable (black) to the bulkhead adapter. (See Figure 3-7.)

Grounding

To ensure proper operation, personal safety, and to reduce emission of radio frequency interference, the properly ground the MAX200 as follows:

Work Table

Connect the work table to a high-quality earth ground within 20 feet of the table. A suitable ground consists of a solid copper rod of at least 1/2-inch diameter driven to a depth of at least 8 feet into the earth below the permanent moisture level.

Work Clamp

1. Attach the work clamp to the workpiece or to the work table. Make sure that the work clamp and the workpiece or work table make good metal-to-metal contact.
2. Do not attach the work clamp to the portion of the workpiece being cut away (see Figure 3-8).
3. For more information, refer to the National Electrical Code, Article 250, Section H, *Grounding Electrode System* or other appropriate code.

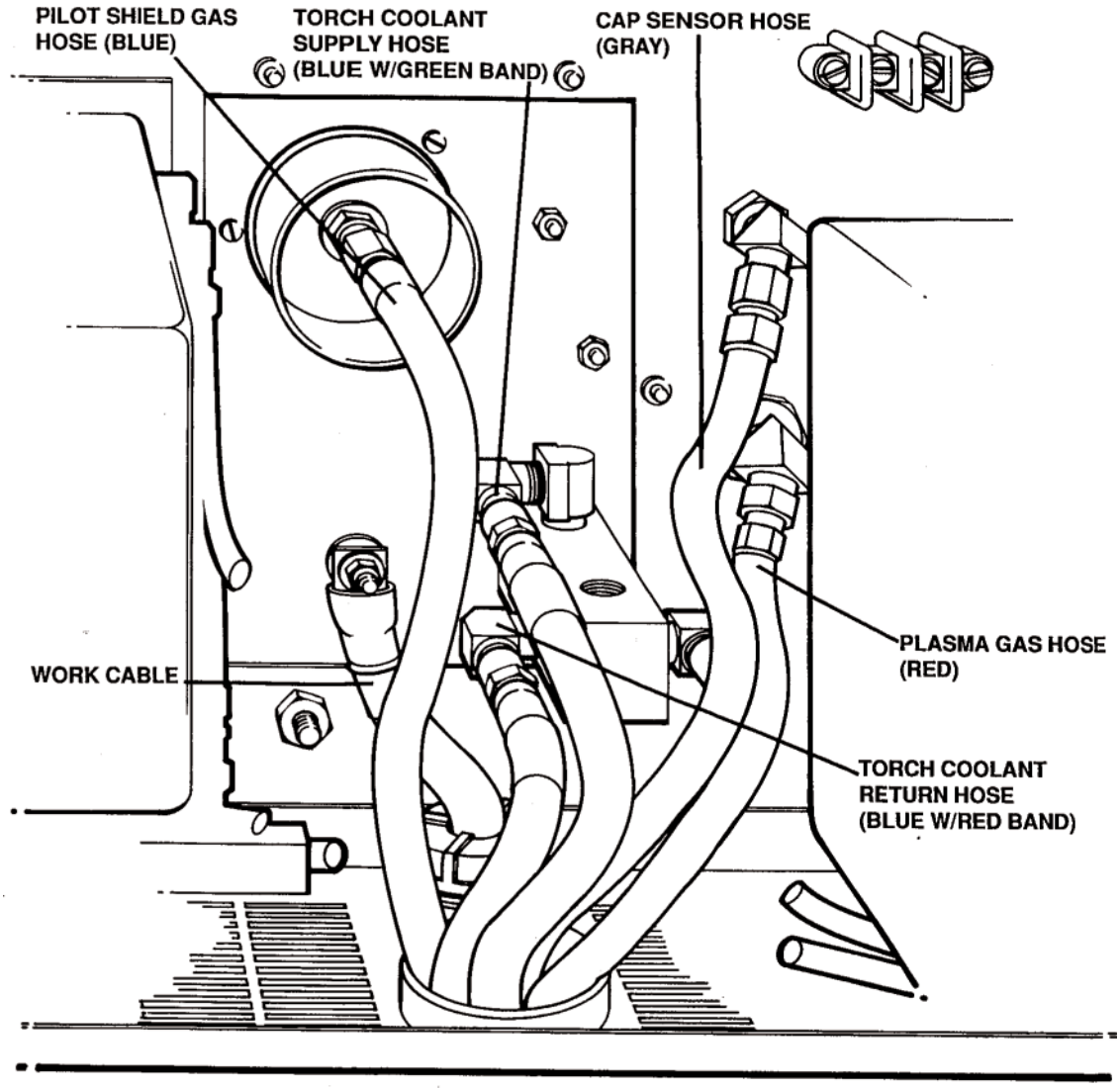


Figure 3-7 Machine Torch Lead Connections to MAX200

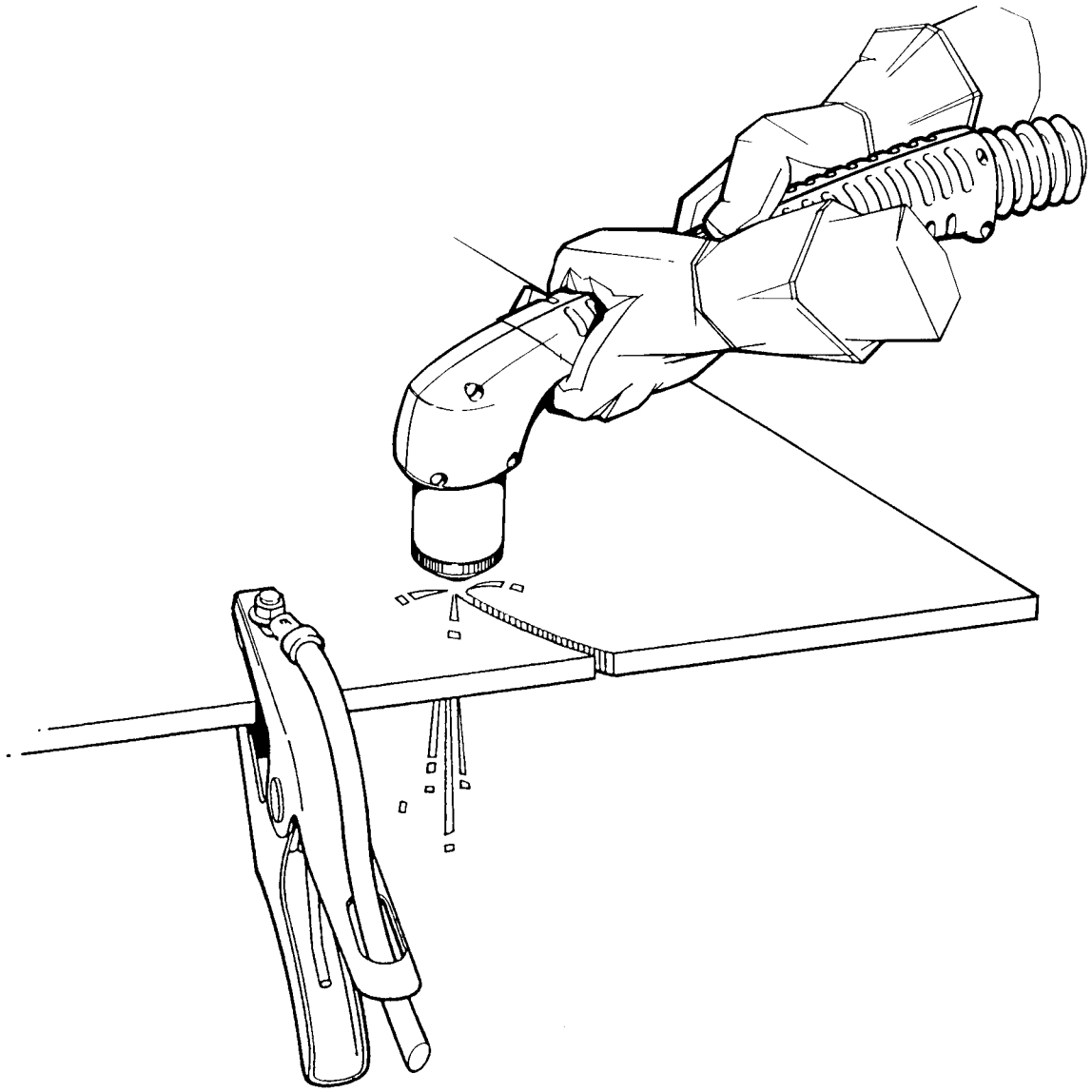


Figure 3-8 Proper Work Clamp Connection

Machine Torch System Installations

The MAX200 machine torch system can be installed in any of the following system configurations, depending on the options selected.

- MAX200 without a Torch Height Control (THC)
- MAX200 with a THC
- MAX200 with an Initial Height Sensor (IHS)

Refer to the following procedures in order to install a machine torch system.

Install the MAX200 without THC Option

Installing the MAX200 without the THC option requires the user to connect the MAX200 to the cutting machine and to connect the Remote Switch. See Figure 3-9 to make interconnections.

Connect the Cutting Machine to the MAX200

Connect the interface cable from the **MACHINE -1X6** receptacle on the MAX200 to the cutting machine interface. See Figure 3-10 for cable layout, cable part numbers and lengths, socket pin configurations, and wire colors and signal names.

Connect the Remote Switch to the MAX200

1. Remove the right side cover of the power supply.

2. Feed the remote switch cable through the feed-through at the rear of the power supply. Locate terminal strips TB3 and TB4 on the inside rear panel, right side. Connect the remote switch cable pairs as follows (see Figure 3-9):

Cable leads	TB3	Signal Name
Black Red	82 83	Plasma Start Plasma Start
	TB4	
Black White	76 77	24 VAC Hot 24 VAC Neut

3. Replace and secure the right side cover.

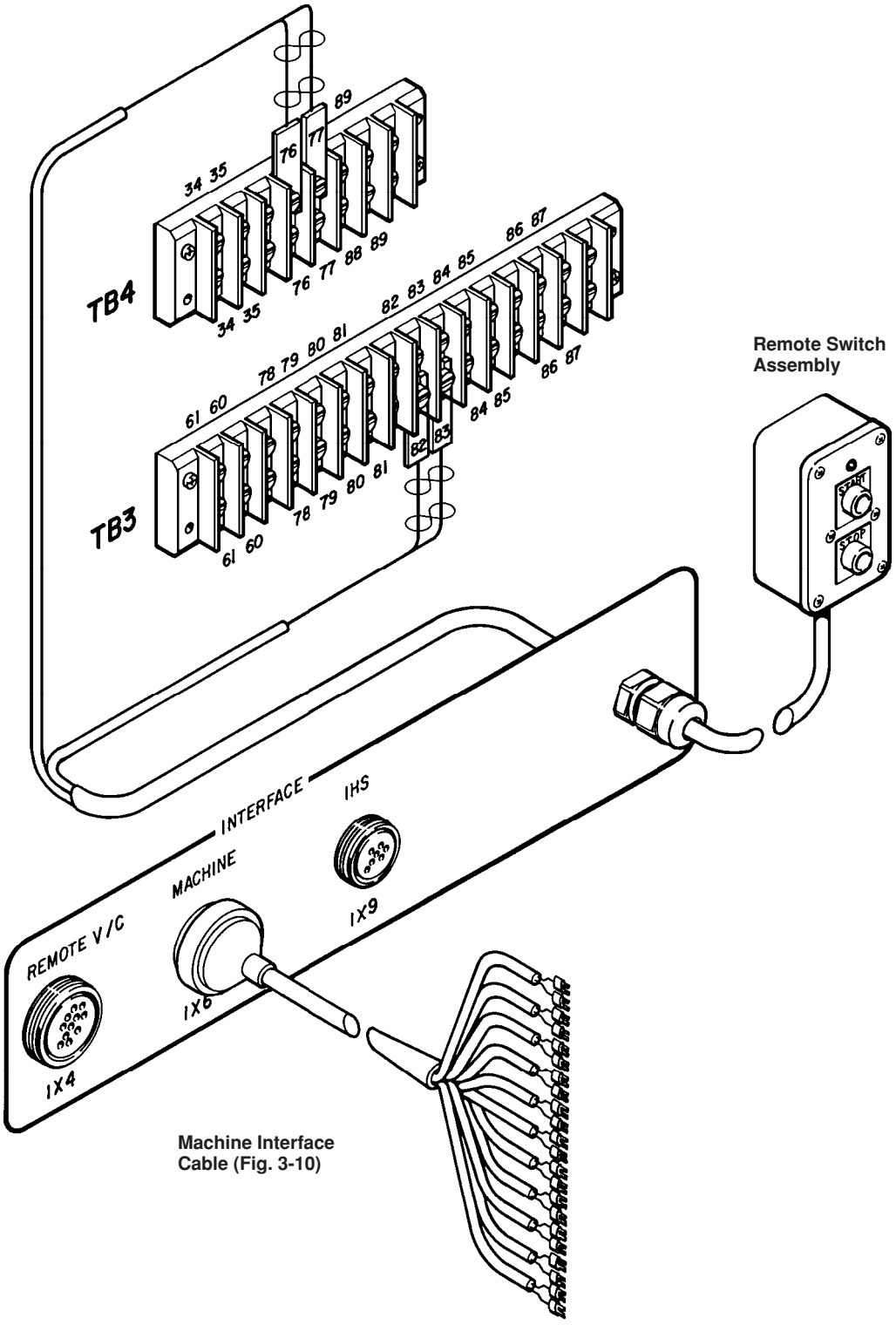


Figure 3-9 Machine Torch System Interconnection Diagram without THC Option

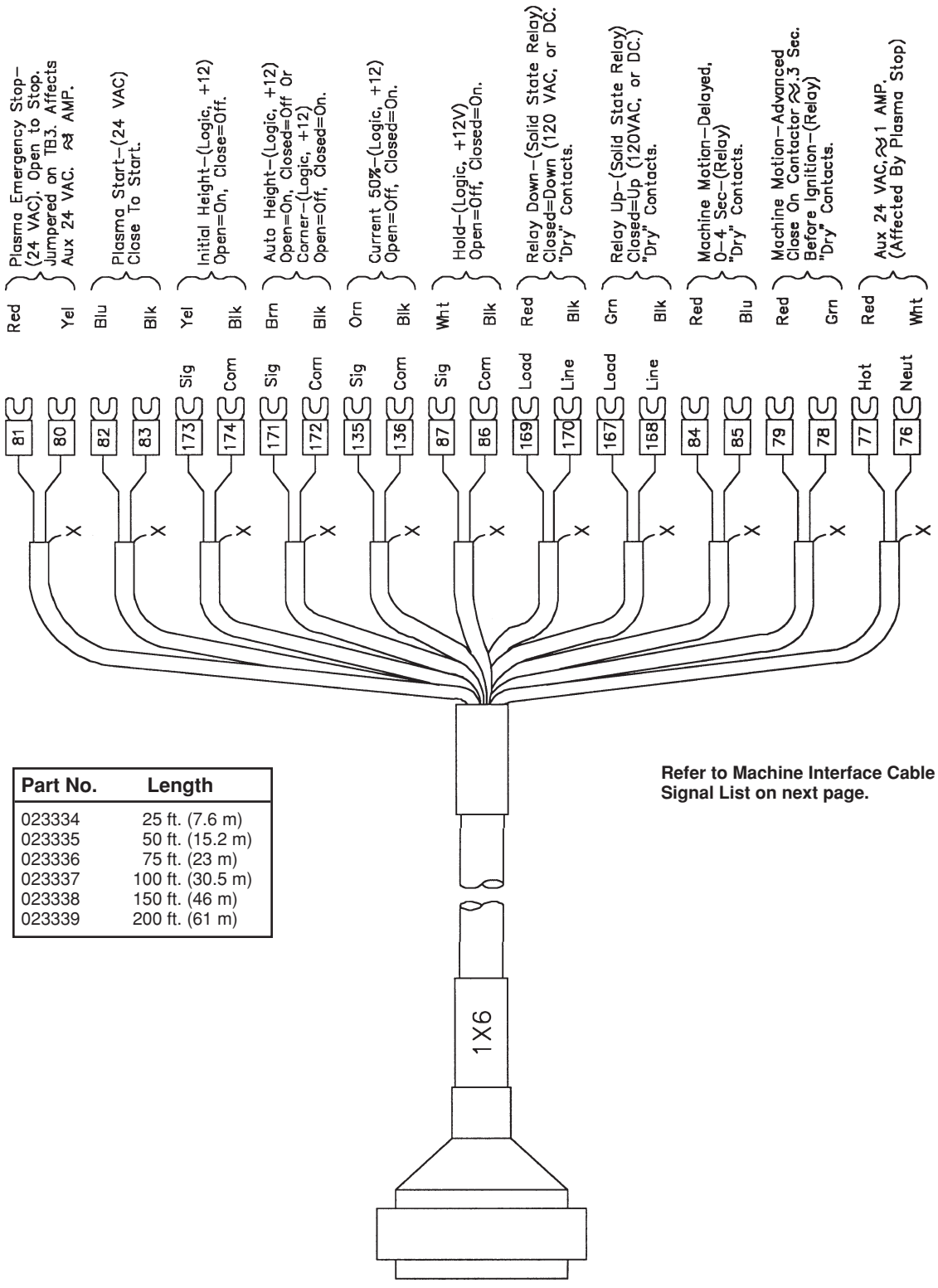


Figure 3-10 MAX200 to Machine Interface Cable Diagram (1 of 2)

Machine Interface Cable Signal List

FUNCTION	COLOR	1X6	MACH
HOLD-SIG	WHT	1	87
HOLD-COM	BLK	5	86
SHIELD	N/A	10	
INITIAL HEIGHT-SIG	YEL	2	173
INITIAL HEIGHT-COM	BLK	6	174
SHIELD	N/A	11	
AUTOHEIGHT-SIG	BRN	3	171
AUTOHEIGHT-COM	BLK	7	172
SHIELD	N/A	12	
CURRENT 50%-SIG	ORN	4	135
CURRENT 50%-COM	BLK	8	136
SHIELD	N/A	13	
PLASMA START-SIG	BLU	9	82
PLASMA START-SIG	BLK	15	83
SHIELD	N/A	14	
KEY	008190	19	—
24VAC, NEUTRAL	WHT	21	76
24VAC, HOT	RED	22	77
SHIELD	N/A	20	
DOWN RELAY-LINE	BLK	29	170
DOWN RELAY-LOAD*	RED	34	169
SHIELD	N/A	23	
UP RELAY-LINE	BLK	30	168
UP RELAY-LOAD*	GRN	35	167
SHIELD	N/A	24	
MACHINE MOTION DELAYED-SIG	BLU	31	85
MACHINE MOTION DELAYED-SIG	RED	36	84
SHIELD	N/A	25	
MACHINE MOTION ADVANCED-SIG	GRN	32	78
MACHINE MOTION ADVANCED-SIG	RED	37	79
SHIELD	N/A	26	
PLASMA STOP-SIG	YEL	28	80
PLASMA STOP-SIG	RED	33	81
SHIELD	N/A	27	

* Signals are AC relays. DC relays are available as an option from Hypertherm by ordering kit # 128404.

Figure 3-10 MAX200 to Machine Interface Cable Diagram (2 von 2)

Install the MAX200 with THC Option

The THC option consists of:

- The THC Subassembly (located in the MAX200)
- The Remote Control Station
- The MAX200 to Remote Control Station interconnection cable.

To install the Remote Control Station and then connect it to the MAX200, perform the following procedures. See Figure 3-11 to make interconnections.

Mount the Remote Control Station

Mount the required Remote Control Station adjacent to the guidance machinery controls, so that the operator has convenient access to this unit when operating the system. After mounting the Remote Control Station, the unit is ready to be connected.

Connect the Remote Control Station to the MAX200

Connect the interface cable from either the Switch Remote (SR), Digital Remote (DR), or Programmable Remote (PR) receptacle at the rear to the **REMOTE V/C - 1X4** receptacle at the rear of MAX200. See Figures 3-12 through 3-14 for cable layouts, cable part numbers and lengths, socket pin configurations, and wire colors and signal names.

Connect the Programmable Remote to the Computer

If the Programmable Remote is used, connect the computer interface cable from the right rear receptacle to the computer (see Figure 3-14).

Connect the Cutting Machine to the MAX200

Connect the interface cable from the **MACHINE -1X6** receptacle on the MAX200 to the cutting machine interface. See Figure 3-10 for cable layouts, cable part numbers and lengths, socket pin configurations, and wire colors and signal names.

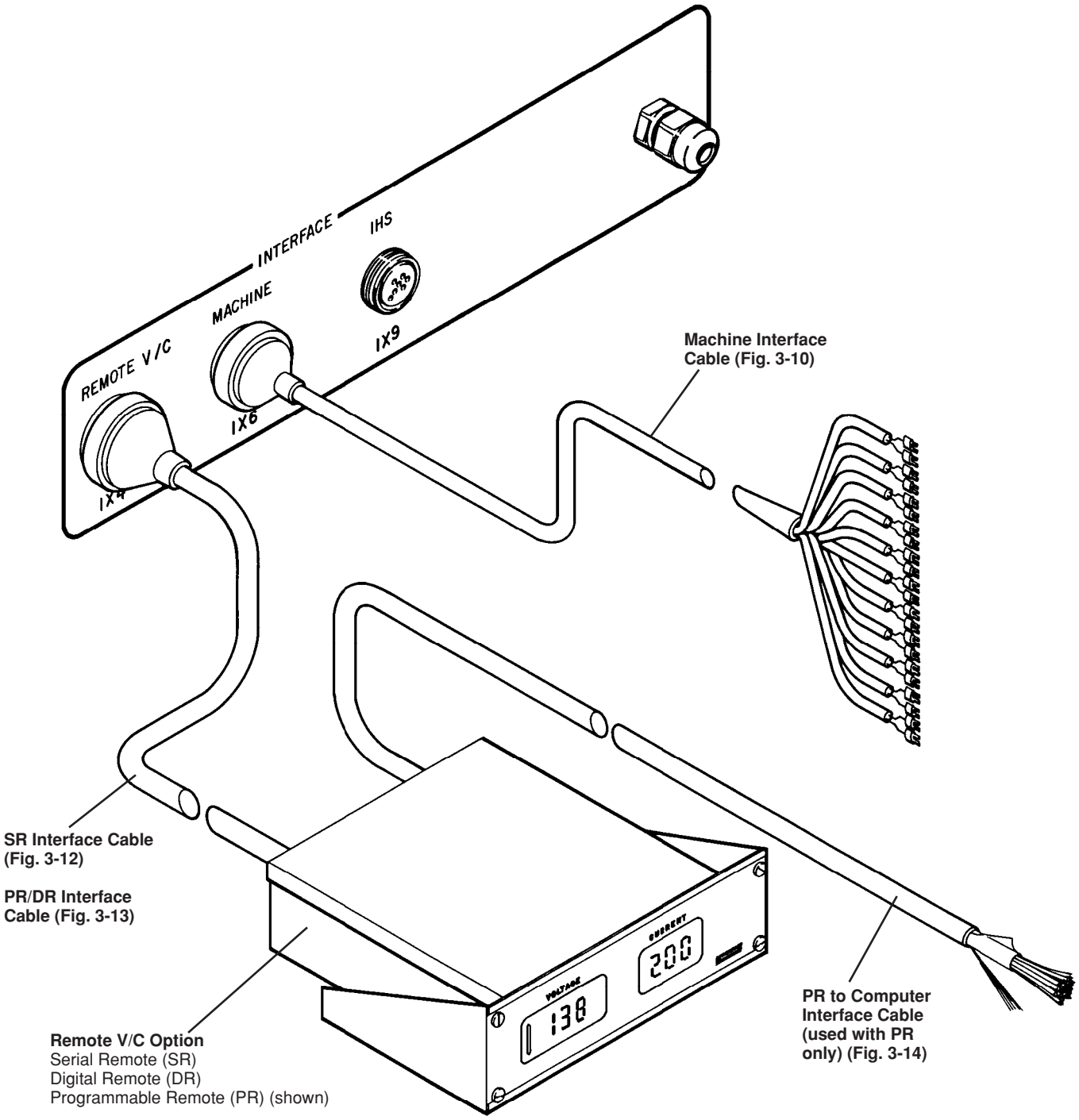
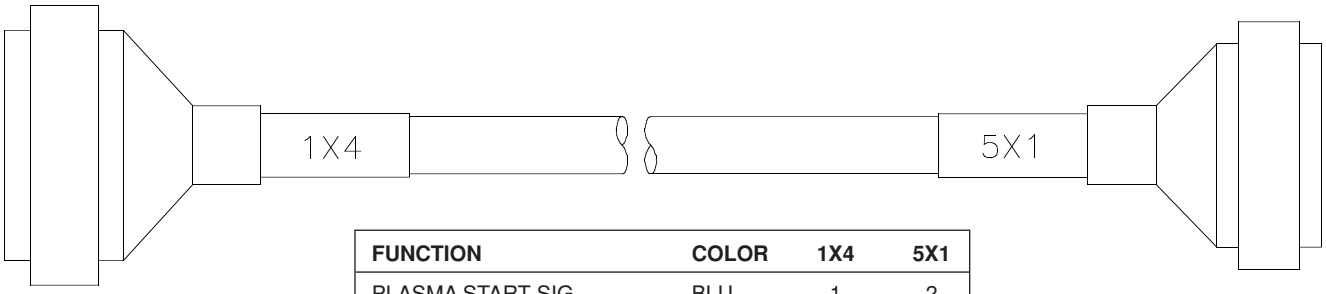


Figure 3-11 Machine Torch System Interconnection Diagram with THC Option

Power Supply **SR Remote**

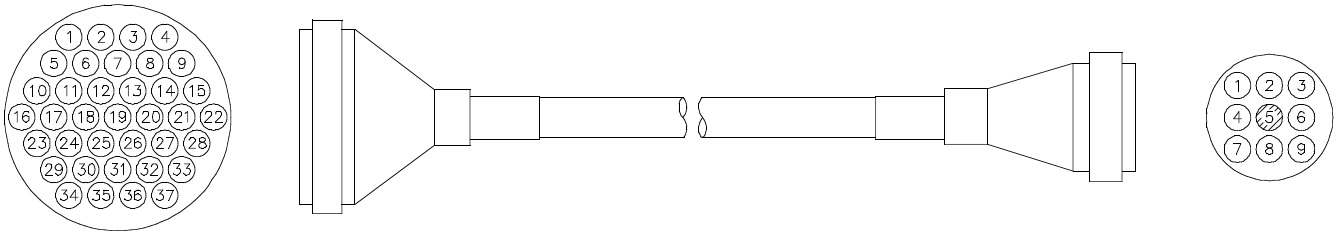


FUNCTION	COLOR	1X4	5X1
PLASMA START-SIG	BLU	1	2
PLASMA START-COM	BLK	5	4
SHIELD	N/A	10	—
INITIAL HEIGHT-SIG	YEL	2	1
INITIAL HEIGHT-COM	BLK	6	3
SHIELD	N/A	11	—
AUTO HEIGHT-SIG	BRN	3	6
AUTO HEIGHT-COM	BLK	7	5
SHIELD	N/A	12	—
SERIAL INPUT DATA-SIG	GRN	4	9
SERIAL INPUT DATA-COM	BLK	8	10
SHIELD	N/A	13	—
SERIAL OUTPUT DATA-SIG	RED	9	7
SERIAL OUTPUT DATA-COM	BLK	15	8
SHIELD	N/A	14	—
	RED		—
UNUSED	WHT	19	—
	N/A		—
	RED		—
UNUSED	GRN	20	—
	N/A		—
24 VAC AUX-HOT	ORN	29	11
24 VAC AUX-NEUT	BLK	23	12
SHIELD	N/A	24	—
120 VAC-NEUT	WHT	35	16
120 VAC-HOT	BLK	36	15
SHIELD	N/A	31	—
KEY (BLANK)	—	22	—

Part No.	Length
023319	25 ft. (7.6 m)
023328	50 ft. (15.2 m)
023329	75 ft. (23 m)
023330	100 ft. (30.5 m)
023331	150 ft. (46 m)
023332	200 ft. (61 m)

Figure 3-12 MAX200 to Switch Remote Interface Cable Diagram

Power Supply – 1X2 **DR/PR Remote – 5X2**

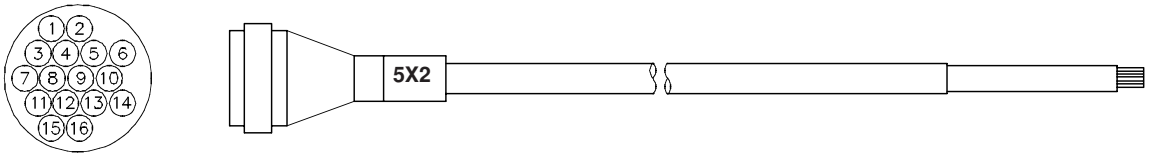


LEGEND – POWER SUPPLY END									LEGEND – DR/PR REMOTE END		
PIN	COLOR	FUNCTION	PIN	COLOR		PIN	COLOR		SOCKET	COLOR	FUNCTION
1			14		SHIELD–RED/BLK	27			1	GRN	SID DATA INPUT TO PS–THC
2			15	BLK	SOD COMMON	28			2	BLK	SID COMMON
3			16			29			3	RED	SOD DATA OUTPUT FROM PS–THC
4	GRN	SID DATA INPUT DATA TO THC	17			30			4		
5			18			31		SHIELD (AC PWR) WHT/BLK	5		KEY
6			19			32			6	BLK	SOD COMMON
7			20			33			7	WHT	AC POWER
8	BLK	SID COMMON	21			34			8	BLK	AC POWER
9	RED	SOD DATA OUTPUT FROM THC	22	008176	KEY (BLANK)	35	WHT	AC POWER	9		
10			23			36	BLK	AC POWER			
11			24			37					
12			25								
13		SHIELD-GRN/BLK	26								

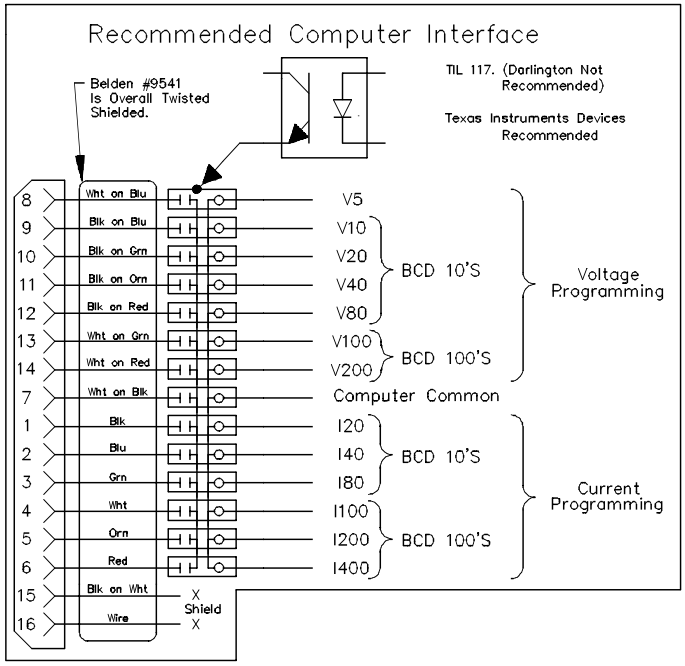
] INDICATES PAIRS.

Part No.	Length
023346	25 ft (7.6 m)
023347	50 ft (15 m)
023348	75 ft (23 m)
023349	100 ft (30.5 m)
023742	125 ft (38.1 m)
023350	150 ft (46 m)
023351	200 ft (61 m)
023813	250 ft (76 m)
023577	275 ft (83.6 m)
023818	300 ft (91.5 m)

Figure 3-13 MAX200/Digital Remote and Programmable Remote Interface Cable



LEGEND – DR/PR REMOTE END			
SOCKET	COLOR	FUNCTION	
1	Blk	Current Program	I20
2	Blu	" "	I40
3	Grn	" "	I80
4	Wht	" "	I100
5	Orn	" "	I200
6	Red	" "	I400
7	Wht on Blk	Common (Remote Chassis)	
8	Wht on Blk	Voltage Program	V5
9	Blk on Blu	" "	V10
10	Blk on Grn	" "	V20
11	Blk on Orn	" "	V40
12	Blk on Red	" "	V80
13	Wht on Grn	" "	V100
14	Wht on Red	" "	V200
15	Blk on Wht	Spare (Remote Chassis)	
16	Shield Wire	Shield (Remot Chassis	



Part No.	Length
023098	10 ft (3 m)
023099	25 ft (7.6 m)
023100	50 ft (15.2 m)

Figure 3-14 Programmable Remote to Computer Interface Cable Diagram

Install the MAX200 with IHS Option

The IHS option can only be used when the THC option has been installed as described above. The IHS option consists of:

- The Inductive IHS Control Module
- The Torch Mounting Subassembly

To install the IHS option, perform the following procedures. See Figure 3-15 to make interconnections.

Mount the IHS Control Module

Mount the IHS Control Module on to the cutting machine frame. It must be located within 40 feet of the torch. After mounting the IHS Control Module, the unit is ready to be connected to the MAX200 and the shop air supply.

Connect to the MAX200

Connect the interface cable from the receptacle at the IHS Control Module to the **IHS - 1X9** receptacle at the rear of MAX200 (see Figure 3-15). Also see Figure 3-16 for the cable layout, cable part numbers and lengths, socket pin configurations, and wire colors and signal names.

Connect to the Shop Air Supply

1. The customer must supply the 20 psig regulated shop air and the air hose. A #4 swivel fitting (# 015006) is provided.
2. Attach the swivel fitting to the air hose. Connect this fitting to the air inlet fitting on the IHS Control Module (see Figure 3-15).
3. Attach the other end of the air hose to the regulated shop air supply.

Mount the Torch Mounting Subassembly

1. Mount the Torch Mounting Subassembly on to the torch lifter of the cutting machine.
2. Mount the machine torch, connect the inductor sensors to the IHS Control Module, and connect the air hose from the Torch Mounting Subassembly to the IHS Control Module as follows:

Mount the Machine Torch

1. Install the machine torch (with torch lead attached) in the bracket of the Torch Mounting Subassembly (see Figure 3-15).

2. Position the torch until the torch body extends all the way through the bracket, so that the bracket is now around the plastic torch sleeve. Tighten the bracket.

3. The final torch position adjustment is described on page 3-40.

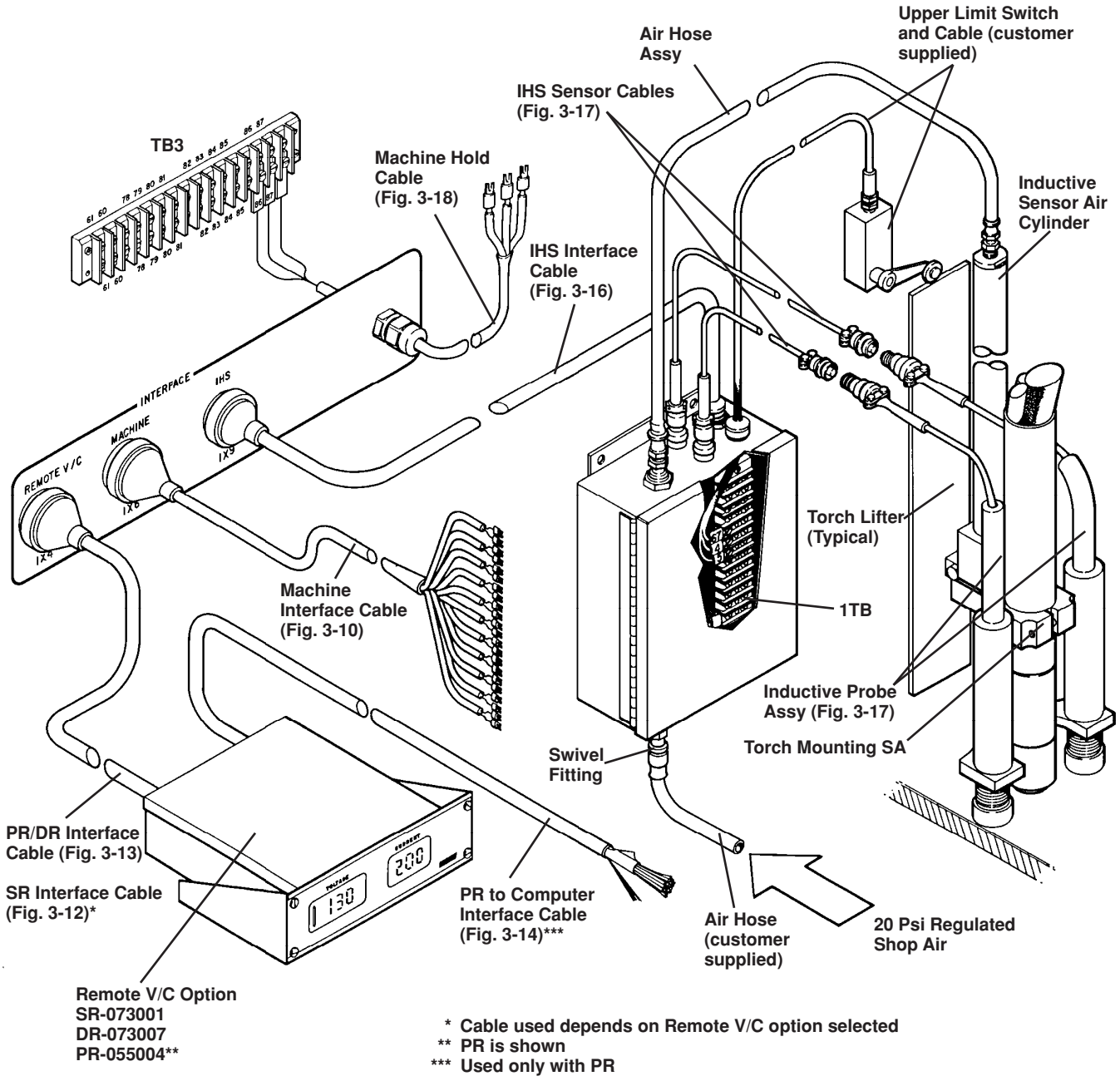
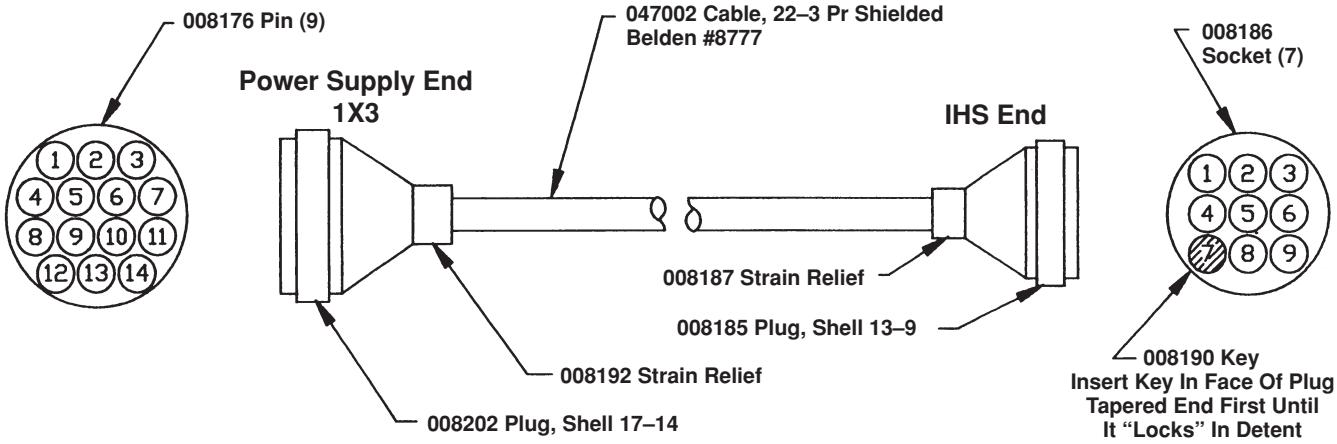


Figure 3-15 Machine Torch System Interconnection Diagram with IHS Option

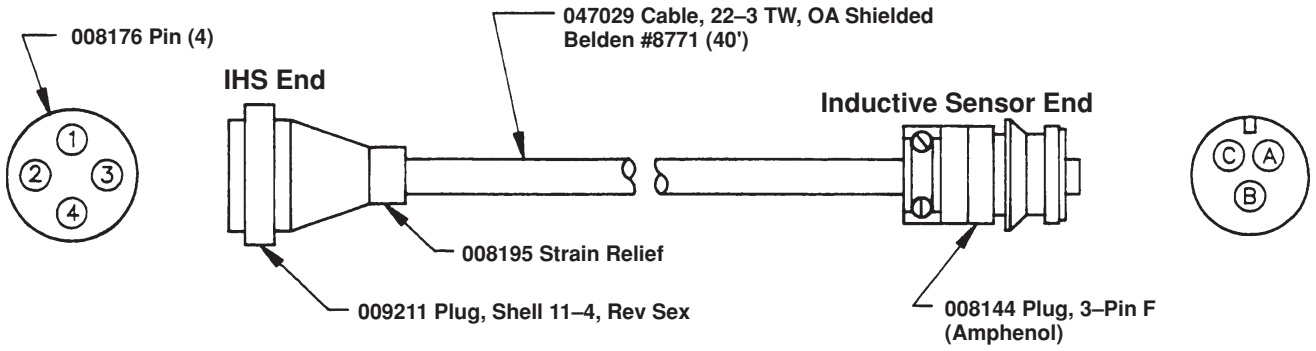


LEGEND – POWER SUPPLY END – 1X3			LEGEND – IHS END			
PIN	COLOR	FUNCTION	SOCKET	COLOR	FUNCTION	] Indicates Pairs.
1	Red	IHS Complete Sig.	1	Red	IHS Complete Sig	
2	Grn	Upper Limit Sw. Sig.	2	Grn	Upper Limit Sw. Sig	
3			3	Blk	Upper Limit Sw. Com	
4	Blk	IHS Complete Com	4	Blk	IHS Complete Com	
5	Blk	Upper Limit Sw Com	5	Drain	Shield – Grn/Blk	
6			6			
7	Drain	Shield – Wht/Blk	7		Key	
8	Drain	Shield – Red/Blk	8	Wht	AC Power	
9	Drain	Shield – Grn/Blk	9	Blk	AC Power	
10						
11	Blk	AC Power				
12						
13						
14	Wht	AC Power				

NOTE: On IHS End, Cut Red/Black Shield & White/Black Shield Wires

Part No.	Length
023111	25 ft (7.6 m)
023112	50 ft (15 m)
023155	75 ft (23 m)
023113	100 ft (30.5 m)
023114	150 ft (46 m)
023284	200 ft (61 m)

Figure 3-16 MAX200 to IHS Interface Cable

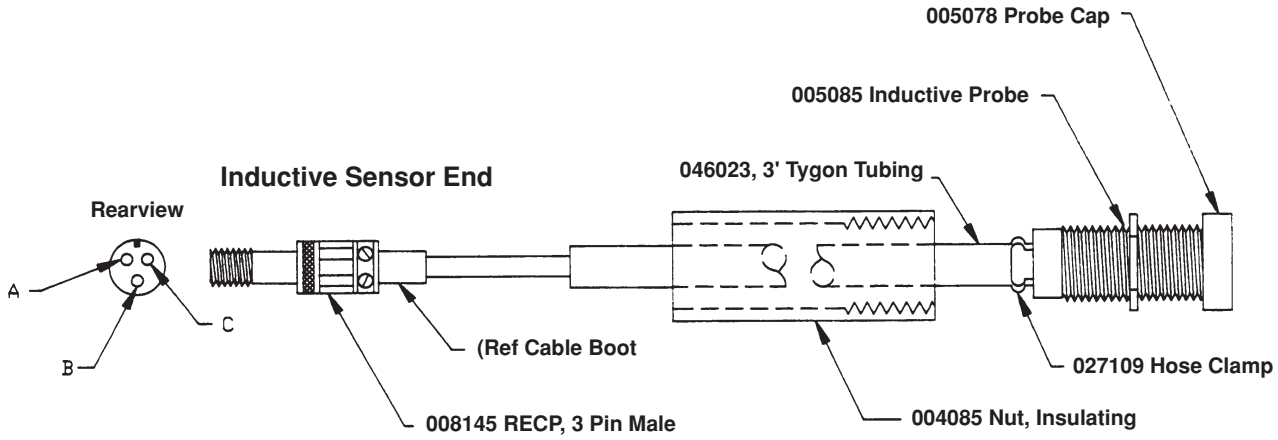


LEGEND – IHS END			LEGEND – INDUCTIVE SENSOR END		
PIN	COLOR	FUNCTION	SOCKET	COLOR	FUNCTION
1	Clear	Signal	A	Red	Power (+15 VDC)
2	Blk	Common	B	Blk	Common
3	Braid	Shield	C	Clear	Signal
4	Red	Power (+15 VDC)			

NOTE: Cut Shield Sensor End.

Part No.	Length
023111	40 ft (12.2 m)

IHS/Sensor Cable



LEGEND – INDUCTIVE SENSOR END		
SOCKET	COLOR	FUNCTION
A	Brn	Power (+15 VDC)
B	Blu	Common
C	Blk	Signal

Part No.
005074

Inductive Probe Assembly

Figure 3-17 IHS Control Module to Inductive Probe Assembly Interface Cables

Connect to the Inductor Sensor Assembly

1. At the Torch Mounting Subassembly, connect the two (2) 40-foot IHS/Sensor cables to the two (2) 3-pin connectors of the inductor probe assemblies (see Figure 3-15). Also see Figure 3-17 for the cable layout, cable part numbers and lengths, socket pin configurations and wire colors and signal names.

2. Route the two (2) IHS/Senor cables to the IHS Control Module and connect to 4- pin receptacles (see Figure 3-15).

Connect the Air Hose Assembly

1. At the Torch Mounting Subassembly, connect the air hose (# 024144) to the air cylinder adapter (# 027024) (see Figure 3-15).

2. Route the air hose to the air outlet fittng (same side as the inductor sensor connections) on the IHS Control Module.

Install the Upper Limit Switch and Cable (customer-supplied)

Install the upper limit switch on to the torch lifter. This switch is to be normally closed. It opens when the torch is fully retracted. The required operating specifications are +12 VDC @ 1.2 mA. Gold-type contacts are preferred.

Connect the Upper Limit Switch to the IHS Control Module

Caution:	**To avoid electromagnetic interference problems caused by the close proximity of the upper limit switch cable to the torch lead set, follow the cable installation procedure.**

1. Use a shielded, twisted pair of 22-24 gauge wire (stranded). Belden # 8761 is recommended.

2. At the upper limit switch, connect the **common wire (black**) and **signal wire (clear)** to the upper limit switch. Cut the shield drain wire (uninsulated). Wrap the cut end with tape to ensure the cut end does not contact the cutting machine frame (see Figure 3-15).

3. At the IHS Control Module, loosen the two (2) latches and open the front cover.

4. Route the cable in through the strain relief in order to connect the cable wires to 1TB.

5. Connect the **shield drain wire (uninsulated)** to **1TB-10 (#S)**. Be sure the drain wire does not contact the IHS Control Module case. Note that the cable shield is now electrically connected to the MAX200 frame.

6. Connect the **common wire (black)** to **1TB-11 (#4)**.

7. Connect the **signal wire (clear)** to **1TB-12 (#67).**

Note: If the upper limit switch signal comes from an interface on the cutting machine, exactly the same wiring (using twisted shielded pair) must be provided from the limit switch. This shield must be electrically isolated from other shields in other cables. A separate cable is recommended to avoid ground – loop problems.

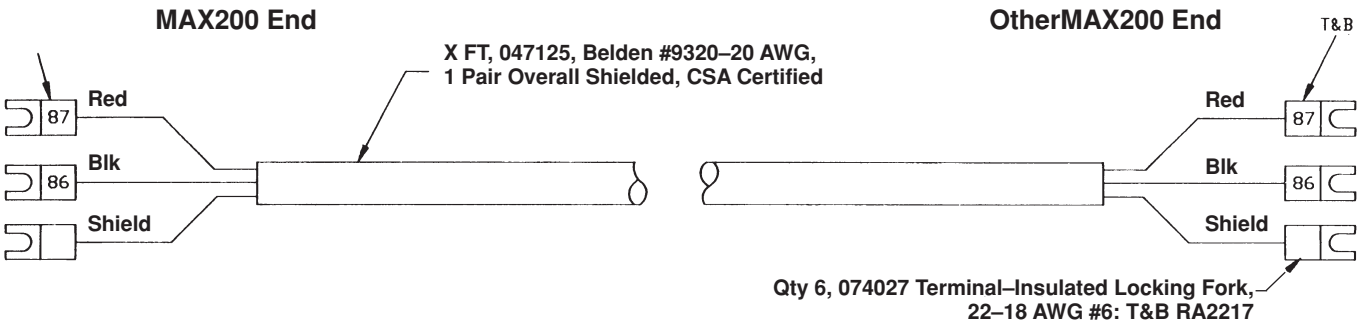
Connect the MAX200 Machines Together with Machine Hold Cables

To connect MAX200 machines with the IHS option together with hold interconnecting cables:

1. Pass the hold interconnection cable through the feed-through at the rear of the MAX200. See Figure 3-18 for the cable layout, cable part numbers and lengths, socket pin configurations and wire colors and signal names.

2. Connect lead 87 (red) to TB3-87 (+12 VDC), lead 86 (black) to TB3-86 (neutral) and shield lead to shield terminal. See Figure 3-15.

3. Repeat Steps 1 and 2 to connect the hold cable at the other MAX200s.



LEGEND – MAX200 END		
WIRE #	COLOR	FUNCTION
86	Blk	Hold Signal
87	Red	Hold Common
Shield	Shld	Hold Shield

LEGEND – OTHER MAX200 END		
WIRE #	COLOR	FUNCTION
86	Blk	Hold Signal
87	Red	Hold Common
Shield	Shld	Hold Shield

Part No.	Length
023340	15 ft (4.6 m)
023341	25 ft (7.6 m)
023342	50 ft (15 m)
023343	100 ft (30.5 m)
023344	150 ft (46 m)

Figure 3-18 Machine Hold Interconnection Cable

Adjust the Torch Position

Before using the machine torch system, the torch must be adjusted for the torch-to-work distance for the metal to be cut. To adjust the torch, perform the following procedure.

WARNING

Disconnect all power to the MAX200 before adjusting the torch. Failure to do so could result in eye or bodily injury due to accidental firing or movement of the torch.

Note: Two people may be required to perform the torch position adjustment.

1. Retract the torch from the work at least 3-4 inches.
2. Manually extend probes fully by pulling down on the plastic mounting yoke.
3. Adjust the position of the torch in the mounting bracket by loosening the securing bolt and positioning the torch so that the torch shield is within 1/16 to 1/8 inch of the extended probe plastic caps. Use a straight edge to determine this (see Figure 3-19). Secure the torch in the mounting bracket by tightening the securing bolt.

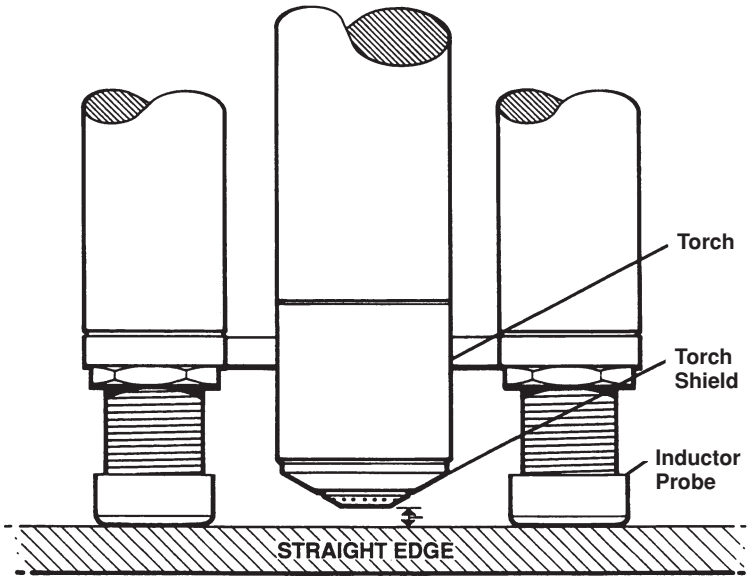


Figure 3-19 Torch Standoff Adjustment Setup

Install the Water Muffler Option

The Water Muffler option can be used with the 1.75 inch (44.5 mm) diameter torch bodies only. The 2 inch (51 mm) diameter torch body can not support the Water Muffler option.

To install the Water Muffler option, refer to the MAX200 Water Muffler Instruction Manual IM-205 (P/N 802050).

Hypertherm

Section 4

OPERATION

In this section:

Front Panel Controls

Power

- **ON (1)** pusbutton/indicator switch
  Activates the power supply and its control circuits.

- **OFF (0)** pushbutton switch
  Shuts the power supply down.

- **DC ON** LED
  Illuminates when main contactor closes, indicating that DC power is present at the torch.

- **AMPS** thumbwheel switch (supplied on units w/o THC)
  Adjusts output current.

- **MACHINE DELAY** dial
  Adjusts the machine motion delay from 0.1 seconds to 6.0 seconds.

Status

The STATUS indicators are all extinguished during normal operation.

- **INTERLOCK** LED (Spare interlock for future use)
  When illuminated, indicates that the interlock jumper on TB4-34 & 35 has been removed. For assistance in reinstalling the jumper, refer to *Claims and Technical Questions* later in this section.

- **TRANSFORMER** LED
  When illuminated, indicates that either the main transformer or one of the choppers has overheated.

- **COOLANT LEVEL** LED
  When illuminated, indicates the coolant level is too low.

- **SHIELD GAS/CAP** LED
  When illuminated, indicates the shield gas pressure is too low or the cap is not installed properly on the torch.

- **PLASMA GAS** LED
  When illuminated, indicates that the plasma gas pressure is too low.

- **COOLANT TEMP** LED
  When illuminated, indicates that the torch coolant temperature is too high (above 70° C, 160° F).

- **COOLANT FLOW** LED
  When illuminated, indicates that the coolant flow from the torch is inadequate.

Status Indicators Before Startup

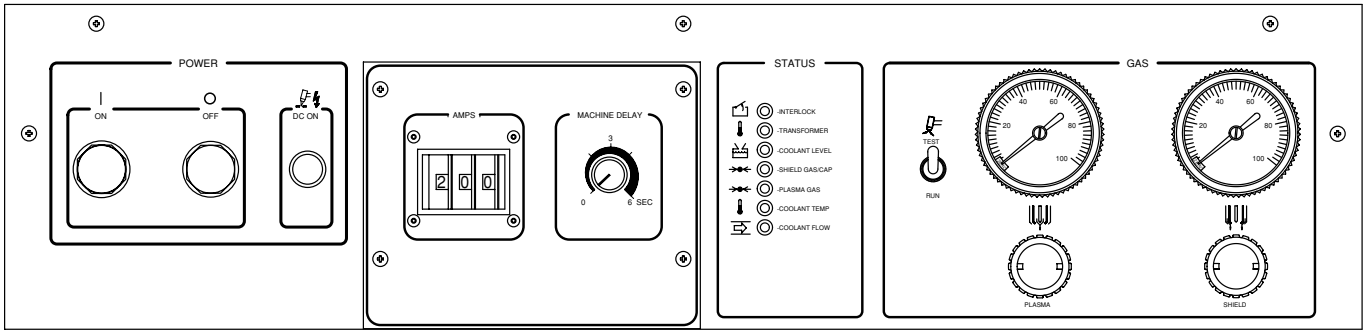
When power is applied from the line disconnect switch and before the POWER ON (I) button is pushed, the COOLANT FLOW LED will be illuminated. Once the POWER ON button is pushed, this LED will extinguish if the system is in the proper working condition. Other fault conditions may also be indicated when the line power is switched on. Correct any other fault conditions before pressing the the POWER ON (I) button. See Troubleshooting in Section 3 of MAX200 Service Manual, IM-162 (801620).

Gas

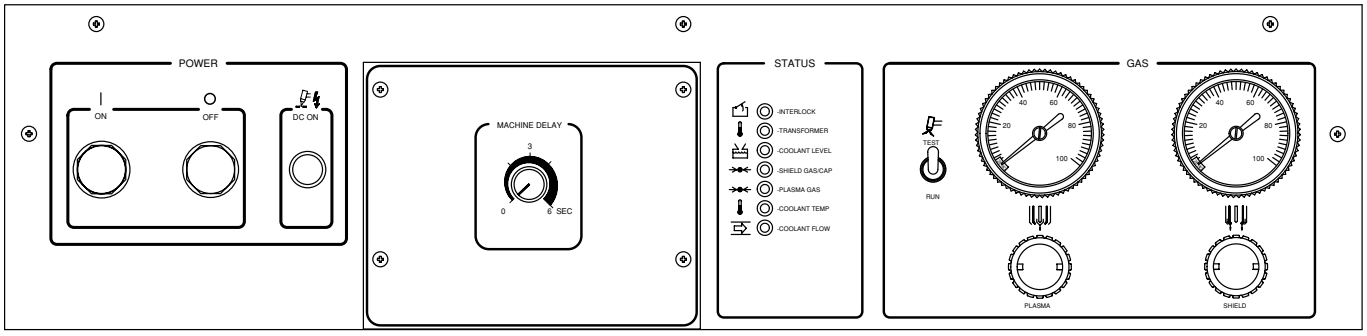
- **TEST**/**RUN** switch
  Sets dynamic (flowing) gas flow.

- **PLASMA** pressure gauge/plasma gas needle valve
  Adjusts and displays the plasma gas flow pressure.

- **SHIELD** pressure gauge/shield gas needle valve
  Adjusts and displays the shield gas flow pressure.



Machine System without THC



Machine System with THC

Figure 4-1 Front Panel Controls

Pre-operation

1. Ensure that your cutting environment and your clothing meet the safety requirements outlined in the *Safety* section.

2. Refer to *Cut Charts* (page 4-10) for the type and width of material you plan to cut. Select the gas combination that will create the desired results. Ensure the gas supplies are adequate for the amount of cutting to be done and are input to the power supply at the proper pressure.

> **Caution: Input gas pressures below 60 psi (plasma) and 70 psi (shield/cap will cause the safety interlock circuit to shut down the power supply. If the low pressure interlocks are bypassed for any reason and low gas pressures occur, the consumables and torch can burn out.**

3. Select the proper torch parts from the *Cut Chart*. Install the parts in the torch. (See *Changing Consumable Parts* for proper installation, page 4-5.)

4. Attach the MAX200 work clamp to the workpiece. Do not attach work clamp to the section of the workpiece that will drop off. Make sure that there is good metal-to-metal contact between the work clamp and the workpiece.

5. Apply power to the MAX200 power supply via the wall disconnect switch. See Status Indicators Before Startup earlier in this section.

Operation

Note: When using the MAX200 machine torch with extended torch leads (100, 125 or 150 feet) be aware that the **40A consumable parts cannot be used.** There is also a slight chance that the following conditions could occur during cutting with extended torch leads over 75 feet:

- High ambient operating temperature or high volume production cutting may increase the heat load on the torch cooling system enough to cause the system to shutdown. If this occurs, allow the system to cool down. Reduce the ambient temperature, if possible or the cutting “arc on” time.

- The gas pressure response time will increase at the torch at preflow, plasma on and plasma off. The user may have to increase the lead in of the cut and/or increase the time between successive cuts.

- There may be a slight incidence of the torch misfiring due to the high frequency energy from the start circuit being dissipated.

1. Refer to the cutting charts (page 4-10) to find the required operating parameters for the metal you plan to cut.
2. If you are using a machine torch system without a THC, set the torch-to-work distance and set the AMPS thumbwheel switch on the power supply (arc current) according to the charts.
3. When using a machine torch system with a THC, set the torch-to-work distance and set the arc voltage and current on the remote control according to the charts.
4. Select the proper travel speed from the charts and adjust the cutting machine speed accordingly.
5. Adjust the MACHINE DELAY on the power supply to meet the recommended motion delay time in the charts.
6. Square the torch with the workpiece if you are straight cutting, or angle the torch as required to accomplish your cut.

Operating Tips

Changing Consumable Parts

	**WARNING**
Always unplug the power supply before inspecting or changing the torch parts.	

The consumable parts in the torch need to be monitored periodically for signs of wear. A good rule of thumb is to check the parts after every 150 starts.

To remove the consumables:

1. Unscrew the retaining cap. First bring the torch to the edge of the machine, with the lifter raised to its highest point. Positioning the torch in this way prevents the danger of dropping the consumables into the water in the water table.
2. Remove the retaining cap.
3. Check the shield for external signs of wear. The shield should be clean and clear of metal debris. The gas holes along the edge of the shield should not be blocked with debris. The center hole should not have any nicks or gouges, and should show no signs of arcing activity.

4. Using the 7/8" side of the wrench (supplied in the spare parts kit), remove the shield. Inspect the gas holes from the inside. The holes should be clear of metal or other debris which will cause arcing. If the shield is still good, screw it back on to the retaining cap and tighten it with the wrench. Replace ifdamaged.

5. Inspect the two O-rings on the torch. They should be lubricated and undamaged. If they are dry, lubricate them lightly with a very thin film of the lubricant provided in the spare parts kit. If they are damaged, replace them.

6. Remove the nozzle with the 3/4" side of the wrench. Inspect it for damage or signs of wear. The inside of the nozzle should be clean and bright, with no deposits from the electrode. You can clean the inside of the nozzle with steel wool, but be sure to remove any remnants of the steel wool afterward. The hole in the nozzle should not be worn or oval-shaped.

7. Remove the electrode with the center hole in the wrench and inspect it. An all copper electrode should be replaced when the pit depth exceeds .040 inch (1 mm). A SilverPlus electrode should be replaced when the pit depth exceeds approximately two times the recommended depth of an all copper electrode. If the electrode is still good, inspect its O-ring – it should be lubricated and undamaged. If it is dry, lubricate it lightly with a very thin film of lubricant provided in the spare parts kit. If it is damaged, replace it.

8. Remove the swirl ring from the electrode and inspect it. It should be clean, and the holes on the top and sides should not be plugged. If the swirl ring is still good, inspect its O-ring. It should be lubricated and undamaged. If it is dry, lubricate it lightly with a very thin film of lubricant provided in the spare parts kit. If it is damaged, replace it.

9. Inspect the inside of the torch body by using a mirror, or by looking carefully inside. The inside of the torch body should be clean and undamaged. Check for loose or damaged water tube. A loose or damaged tube can cause:

   - shortened electrode life
   - the flow switch interlock to shut the system down
   - humming or rattling sound to come from the torch

   Use the water tube removal tool (027347) to loosen or replace the water tube.
   When installing the water tube, do not overtighten! Snug down by hand only.

10. Replace the electrode and tighten it with the wrench. **Do not overtighten.**

11. Install the swirl ring with the bottom O-ring facing the inside of the torch – it won't fit in properly if it is installed in the wrong direction. Push it into place. Hold the swirl ring in place until the nozzle is installed to avoid dropping it into the water.

12. Install nozzle until finger-tight, then tighten with wrench. **Do not overtighten.**

13. Replace the retaining cap. Make sure that it is tightened snugly; if it is loose, it can affect the shield gas flow.

Cutting Techniques

Torch Alignment

Prior to cutting with a machine torch, ensure that the torch is at right angles to the workpiece to get a clean, vertical cut. Use a square to align the torch. The torch should be aligned at 90° increments (0°, 90°, 180°, and 270°). See Figure 4-2.

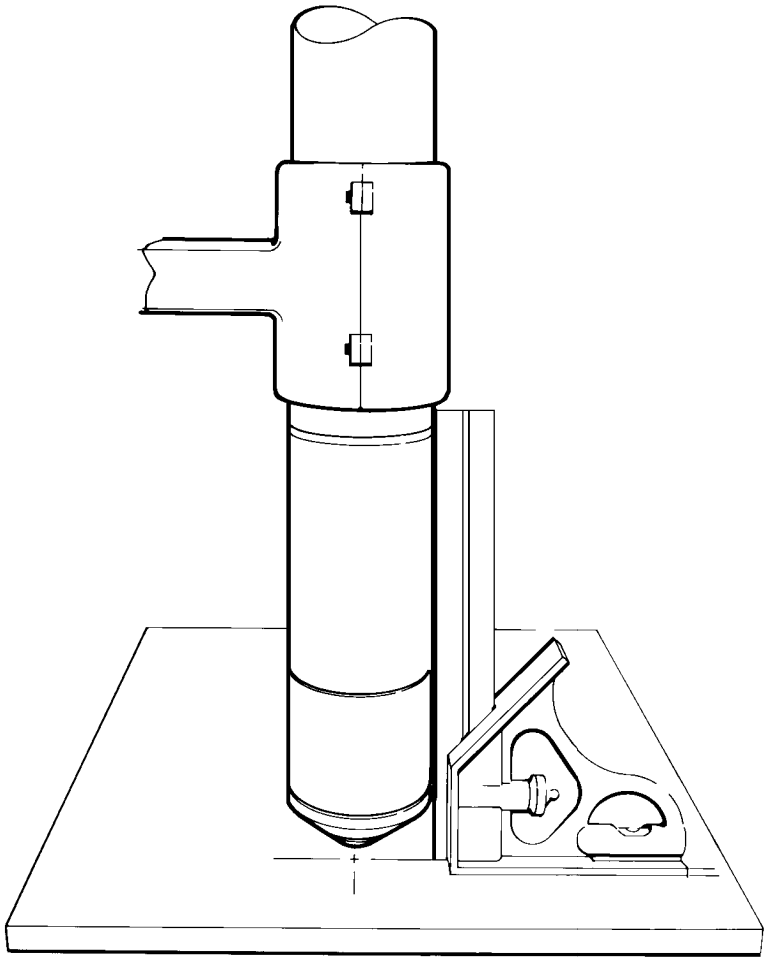


Figure 4-2 Torch Alignment

Cutting

- Start cutting from the edge of the workpiece, unless you must pierce. For tips on piercing, refer to the *Piercing* section.
- When cutting, make sure that the sparks are coming out of the bottom of the workpiece. If not, check for the following:
  - If the sparks are spraying on top of the workpiece, the torch may be moving too fast. Check the Cut Charts for the correct travel speeds. The optimum travel speed is generally just slightly under the speed that causes the arc to “rooster tail” off of the workpiece.
  - If there is not sufficient power to fully penetrate the workpiece, reduce the travel speed. If this does not work, stop cutting and re-check the cutting chart specifications.

Piercing

Note: The MAX200 can pierce metals up to a thickness of one (1) inch.

- Set the torch-to-work distance (standoff) so that the shield cap is 1/8 inch or more away from the workpiece. (Refer to the *Adjust the Torch Position* procedure, page 3-40.)
- Ensure the MACHINE DELAY on the power supply is set to the recommended motion time delay (refer to cutting charts) in order for the metal to be pierced completely before the travel motion begins.
- Position the torch directly over the workpiece juncture/cut line to be pierced.
- The workpiece can now be pierced.

Common Cutting Faults

- The workpiece is not totally penetrated. Causes can be:

  – The current is too low.
  – The cut speed is too high.
  – The torch parts are worn.
  – The metal being cut is too thick.

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

  – The cutting speed is too slow or too fast.
  – The torch parts are worn.

Duty Cycle

The duty cycle is reduced if:

- The input line voltage is less than nominal, due to a long power cord, poor utility supply, etc.
- You are cutting material greater than two inches thick.
- The work clamp is not making a good electrical contact to the workpiece due to paint, rust, etc.
- Arc voltage is greater than 150 volts (at 200 amps).

Claims and Technical Questions

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.

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

1. Read the *Troubleshooting* section of this manual. ou may find the problem is quite easy to fix, such as a loose connection.
2. If you are unable to solve the problem, call your distributor. He will be able to help you, or refer you to an authorized Hypertherm repair facility.
3. If you need additional assistance, call our Customer Service or Field Service group at 1-800-643-0030.

Cut Charts

The following *Cut Charts* provide the necessary information in order for the operator using the MAX200 machine torch system to be successful in plasma arc cutting. The Cut Charts are divided into two areas: (1) above water cutting (pages 4-11 through 4-33) and (2) under water cutting, where the water table water is 3" above the top surface of the workpiece (pages 4-34 through 4-45).

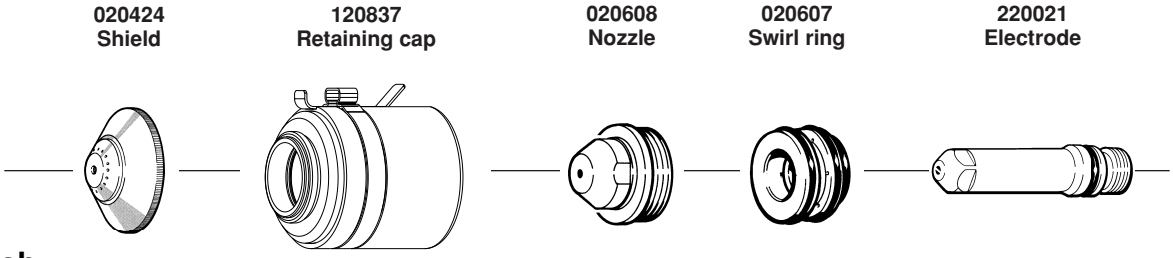
The following table provides the operator with a quick reference of the consumables used for all cutting and gouging applications with the MAX200 machine torch. Also listed are the consumables used with the water-muffler.

MAX200 Machine Torch Consumables

		Part Numbers				
Plasma Gas/ Shield Gas	**Nozzle Type (Amps)**	**Shield**	**Retaining Cap**	**Nozzle**	**Swirl Ring**	**Electrode**
Air/Air	**200** **100** **40** **200 gouging**	020424 020448 020688 020485	120837 120837 020423 020423	020608 020611 020689 020615	020607 020607 020613 020607	220021 120547 220021 220021
O_2/Air	**200** **100**	020424 020448	120837 120837	020605 020616	020604 020617	220021 120547
H35/N_2	**200** **100** **200 gouging**	020602 020448 020485	120837 120837 020423	020608 020611 020615	020607 020607 020607	020415 020415 020415
N_2/CO_2	**200**	020424	120837	020608	020607	020415
N_2/Air	**200**	020424	120837	020608	020607	020415
		Beveling Consumables				
O_2/Air	**200 beveling**	120260	020423	120259 Water Tube 120257	120833	120258
		Consumables Used with MAX200 Water-Muffler				
Air/Air	**200** **100**	020566 020618	020423 020423	020608 020611	020607 020607	220021 120547
O_2/Air	**200** **100**	020566 020618	020423 020423	020605 020616	020604 020617	220021 120547
N_2/CO_2	**200**	020566	020423	020608	020607	020415
N_2/Air	**200**	020566	020423	020608	020607	020415

Mild Steel – Above Water
200 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriting can occur.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
66	44-48	58-62	270	60	**3/16**	1/8	3	130	200	5080	0.0
					1/4	1/8	3	130	135	3400	0.5
					3/8	1/8	3	135	100	2540	1.0
					1/2	.16	4	140	80	2030	2.0
					5/8	.16	4	145	60	1520	2.0
					3/4	3/16	5	150	45	1140	2.5
					7/8	1/4	6	155	30	760	2.5
					1	1/4	6	160	25	635	2.5
					1-1/4	1/4	6	165	15	380	*
					1-1/2	1/4	6	170	10	250	*
					1-3/4	5/16	8	180	7	180	*
					2	5/16	8	185	5	130	*

Metric

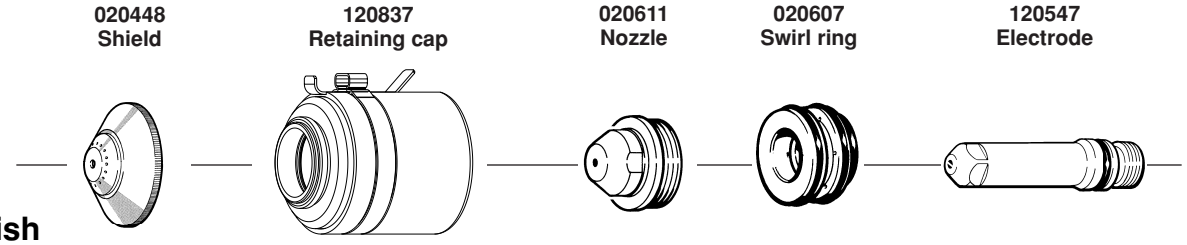
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
31	3.0-3.3	4.0-4.3	127	4.0	**6**	3	1/8	130	3400	135	0.5
					8	3	1/8	135	2900	115	0.5
					10	3	1/8	135	2540	100	1.0
					12	4	.16	140	2030	80	2.0
					15	4	.16	145	1520	60	2.0
					20	5	3/16	150	1140	45	2.5
					25	6	1/4	160	635	25	2.5
					32	6	1/4	165	380	15	*
					50	8	5/16	185	130	5	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 1 inch (25 mm) not recommended.

Mild Steel – Above Water

100 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross level and is very economical. Some surface nitriting can occur. While this process may be used on thicker materials, optimal recommended range is to 3/8 inch (10 mm).



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
37	22-26	54-58	270	60	**1/8**	3/32	2.5	125	185	4700	0.5
					3/16	1/8	3	125	175	4450	0.5
					1/4	1/8	3	130	125	3175	0.5
					3/8	1/8	3	135	50	1270	1.0
					1/2	1/8	3	140	35	890	*
					5/8	.16	4	145	25	635	*
					3/4	3/16	5	150	20	510	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
17	1.5-1.8	3.7-4.0	127	4.0	**3**	2.5	3/32	125	4700	185	0.5
					5	3	1/8	125	4450	175	0.5
					6	3	1/8	130	3175	125	0.5
					10	3	1/8	135	1270	50	1.0
					12	3	1/8	140	890	35	*
					15	4	.16	145	635	25	*
					20	5	3/16	150	510	20	*

Metric – 80 amps • Air Plasma / Air Shield

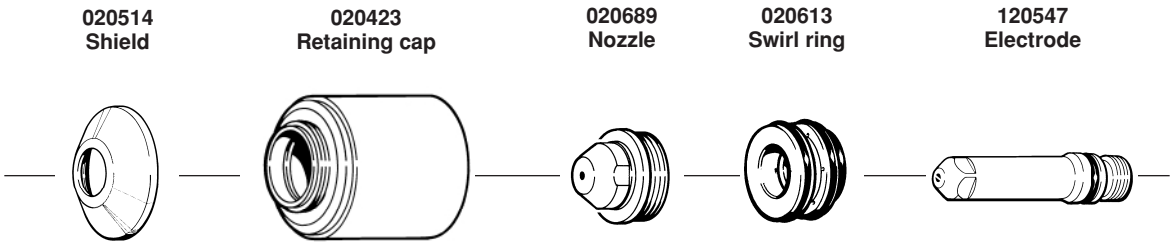
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
17	1.5-1.8	3.3-3.6	127	4.0	**2**	2.5	3/32	120	6050		0.0

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Mild Steel – Above Water

40 amps • Air Plasma / Air Shield

This gas combination gives good cut speeds, low dross levels and is very economical. Some surface nitriting can occur.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
25	16-20	56-60	275	60	**.050 (18GA.)**	3/32	2.5	110	320	8100	0.0
					1/16	3/32	2.5	110	300	7600	0.0
					.075	3/32	2.5	110	220	5600	0.0
					1/8	3/32	2.5	110	140	3550	0.5
					.158	3/32	2.5	115	120	3050	*
					.197	3/32	2.5	115	50	1250	*
					1/4	3/32	2.5	120	35	850	*
					3/8	3/32	2.5	125	20	500	*

Metric

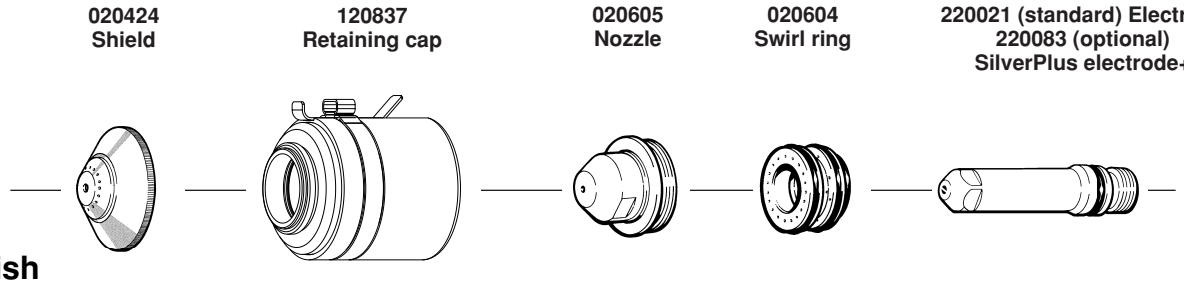
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
12	1.1-1.4	3.9-4.1	129	4.0	**2**	2.5	3/32	110	5600	220	0.0
					3	2.5	3/32	110	3550	140	0.5
					4	2.5	3/32	115	3050	120	*
					5	2.5	3/32	115	1250	50	*
					6	2.5	3/32	120	850	35	*
					10	2.5	3/32	125	500	20	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 1/8 inch (3 mm) not recommended.

Mild Steel – Above Water

200 amps • O_2 Plasma / Air Shield

This gas combination gives superior cut speed, minimum dross, minimum amount of surface nitriting and excellent weldability.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
72	48-52	64-68	270	60	**1/4**	1/8	3	120	160	4060	0.5
					3/8	1/8	3	125	100	2540	1.0
					1/2	.16	4	125	80	2030	2.0
					5/8	.16	4	130	70	1780	2.0
					3/4	3/16	5	135	55	1400	2.5
					7/8	1/4	6	135	45	1140	2.5
					1	1/4	6	140	35	890	2.5
					1-1/4	1/4	6	150	22	560	*
					1-1/2	1/4	6	155	15	380	*
					1-3/4	5/16	8	165	10	250	*
					2	5/16	8	170	7	180	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
34	3.3-3.6	4.4-4.7	127	4.0	**6**	3	1/8	120	4060	160	0.5
					8	3	1/8	125	3000	120	0.5
					10	3	1/8	125	2540	100	1.0
					12	4	.16	125	2030	80	2.0
					15	4	.16	130	1780	70	2.0
					20	5	3/16	135	1400	55	2.5
					25	6	1/4	140	890	35	2.5
					32	6	1/4	150	560	22	*
					50	8	5/16	170	180	7	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)

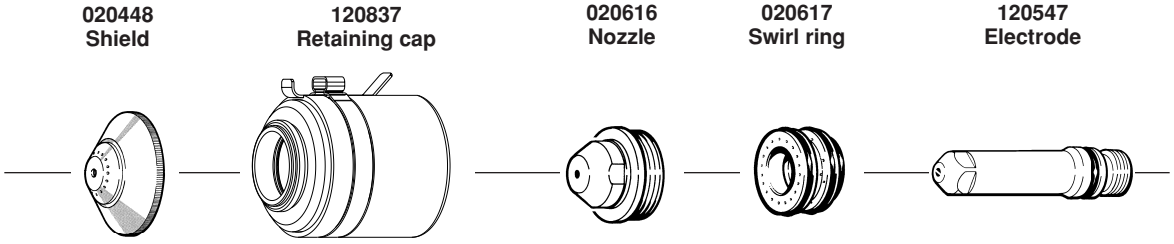
+ SilverPlus provides increased life to high duty cycle users in most applications. The hafnium wears to approximately two times the depth of a standard electrode (220021). Arc voltage may need to be increased by 5-10 volts throughout the electrode life to maintain proper cut height parameters.

If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
Production cutting above 1 inch (25 mm) not recommended.

Mild Steel – Above Water

100 amps • O_2 Plasma / Air Shield

This gas combination gives good cut speed, low dross level and is very economical. Some surface nitriting can occur. While this process may be used on thicker materials, optimal recommended range is to 3/8 inch (10 mm).



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
40	12-16	52-56	270	60	**1/8**	3/32	2.5	105	240	6100	0.0
					3/16	1/8	3	110	180	4550	0.0
					1/4	1/8	3	110	110	3050	0.5
					3/8	1/8	3	115	70	1780	0.5
					1/2	1/8	3	115	50	1270	*
					5/8	.16	4	125	40	1020	*
					3/4	3/16	5	130	30	760	*

Metric

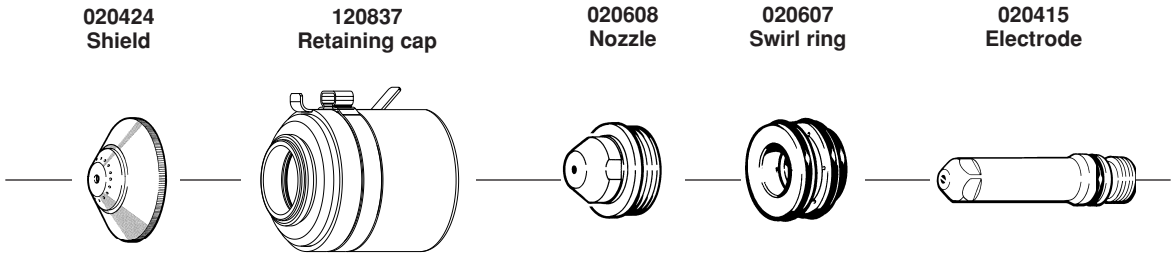
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
19	0.8-1.1	3.6-3.9	127	4.0	**3**	2.5	3/32	105	6100	240	0.0
					5	3	1/8	110	4550	180	0.0
					6	3	1/8	110	3050	110	0.5
					10	3	1/8	115	1780	70	0.5
					12	3	1/8	115	1270	50	*
					15	4	.16	125	1020	40	*
					20	5	3/16	130	760	30	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Mild Steel – Above Water

200 amps • N_2 Plasma / CO_2 Shield

This gas combination is used when cut edge quality and surface nitriting are less important. Electrode life is extended when this combination is used.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	36-40	52-56	210	60	**3/16**	1/8	3	120	130	3300	0.5
					1/4	1/8	3	125	110	2800	1.0
					3/8	1/8	3	130	85	2160	1.5
					1/2	1/8	3	130	55	1400	2.0
					5/8	.16	4	135	45	1140	2.0
					3/4	3/16	5	145	25	635	2.5
					7/8	1/4	6	150	20	510	3.0
					1	1/4	6	160	15	380	3.0
					1-1/4	1/4	6	165	10	250	*
					1-1/2	1/4	6	175	5	130	*

Metric

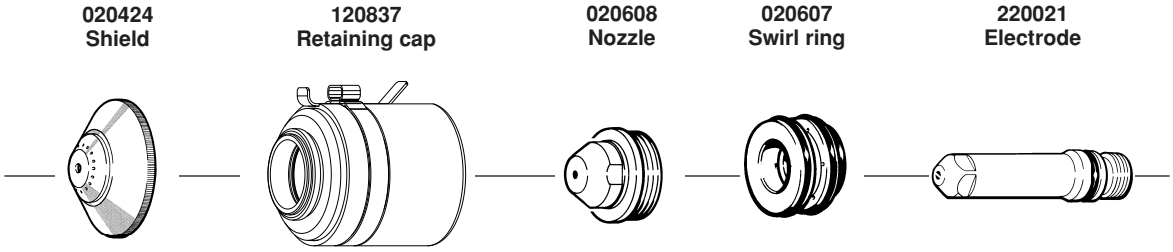
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.5-2.8	3.6-3.9	99	4.0	**5**	3	1/8	120	3300	130	0.5
					6	3	1/8	125	2800	110	1.0
					10	3	1/8	130	2160	85	1.5
					12	3	.16	130	1400	55	2.0
					15	4	.16	135	1140	45	2.0
					20	5	3/16	145	635	25	2.5
					25	6	1/4	160	380	15	3.0
					32	6	1/4	165	250	10	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 1 inch (25 mm) not recommended.

Stainless Steel – Above Water

200 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriting and surface oxidation of alloying elements can occur.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
66	44-48	58-62	270	60	**3/16**	1/8	3	125	220	5600	0.0
					1/4	1/8	3	130	195	5000	0.5
					3/8	1/8	3	130	145	3700	1.0
					1/2	1/8	3	135	105	2700	2.0
					5/8	.16	4	140	75	1900	2.0
					3/4	3/16	5	140	55	1400	2.5
					7/8	1/4	6	145	40	1000	3.0
					1	1/4	6	150	30	760	*
					1-1/4	1/4	6	160	15	380	*
					1-1/2	1/4	6	170	10	250	*

Metric

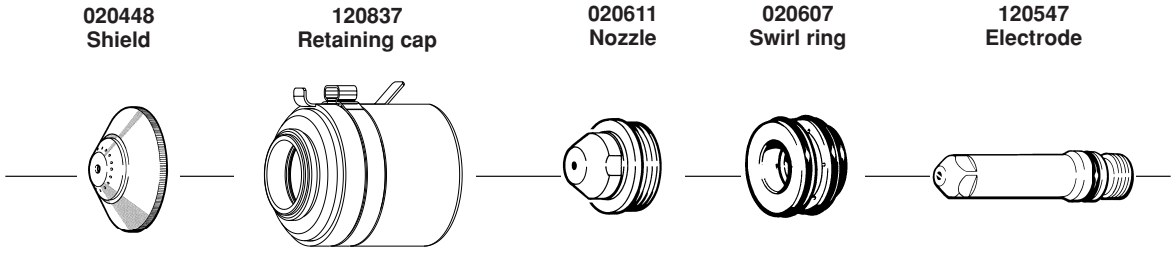
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
31	3.0-3.3	4.0-4.3	127	4.0	**5**	3	1/8	125	5600	220	0.0
					6	3	1/8	130	5000	195	0.5
					10	3	1/8	130	3700	145	1.0
					12	3	.16	135	2700	105	2.0
					15	4	.16	140	1900	75	2.0
					20	5	3/16	140	1400	55	2.5
					25	6	1/4	150	760	30	*
					32	6	1/4	160	380	15	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 7/8 inch (21 mm) not recommended.

Stainless Steel – Above Water

100 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriting and surface oxidation of alloying elements can occur.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
37	22-26	54-58	270	60	**1/8**	3/32	2.5	125	140	3560	0.0
					3/16	1/8	3	130	110	2800	0.5
					1/4	1/8	3	130	80	2030	0.5
					3/8	1/8	3	135	55	1400	0.5
					1/2	1/8	3	140	35	890	*
					5/8	.16	4	145	25	635	*
					3/4	3/16	5	150	20	510	*

Metric

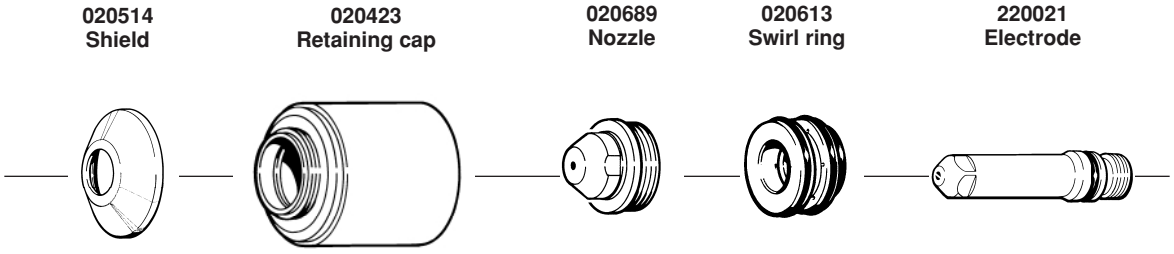
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
17	1.5-1.8	3.7-4.0	127	4.0	**3**	2.5	3/32	125	3560	140	0.0
					5	3	1/8	130	2800	110	0.5
					6	3	1/8	130	2030	80	0.5
					10	3	1/8	135	1400	55	0.5
					12	3	1/8	140	890	35	*
					15	4	.16	145	635	25	*
					20	5	3/16	150	510	20	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Stainless Steel – Above Water

40 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriting and surface oxidation of alloying elements can occur.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
25	16-20	56-60	275	60	**.050 (18GA.)**	3/32	2.5	120	145	3700	0.0
					1/16	3/32	2.5	120	120	3050	0.0
					1/8	3/32	2.5	125	75	1900	0.5
					1/4	1/8	3	135	30	750	*
					3/8	1/8	3	140	12	300	*

Metric

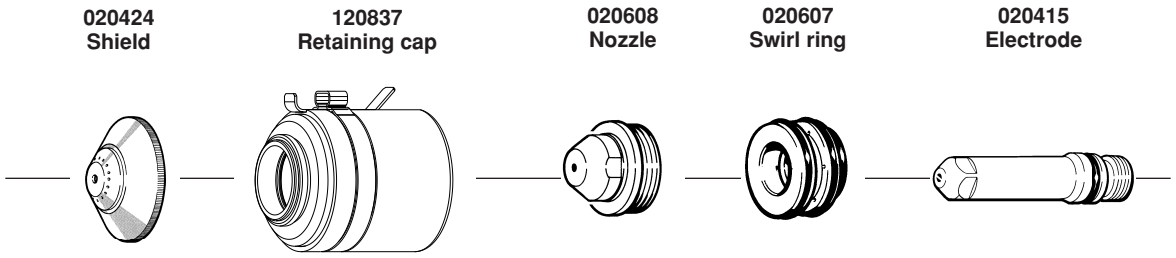
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
12	1.1-1.4	3.9-4.1	129	4.0	**3**	2.5	3/32	125	1900	75	0.5
					6	3	1/8	135	750	30	*
					10	3	1/8	140	300	12	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Stainless Steel – Above Water

200 amps • N_2 Plasma / Air Shield

This gas combination is used when cut edge quality, surface nitriting and surface oxidation of alloying elements are less important. Electrode life is extended when this combination is used.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	34-38	50-54	270	60	**3/16**	1/8	3	125	135	3430	0.0
					1/4	1/8	3	130	120	3050	0.5
					3/8	1/8	3	130	100	2540	1.0
					1/2	1/8	3	135	75	1900	2.0
					5/8	.16	4	140	60	1520	2.0
					3/4	3/16	5	140	45	1140	2.5
					7/8	1/4	6	145	35	890	2.5
					1	1/4	6	150	20	510	*
					1-1/4	1/4	6	160	15	380	*
					1-1/2	1/4	6	160	10	250	*

Metric

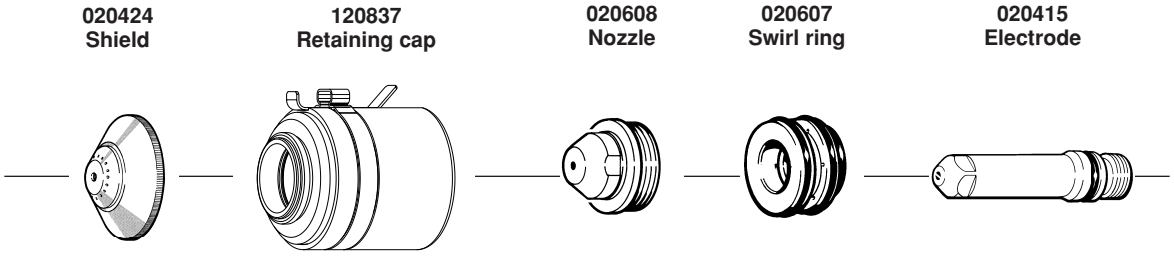
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.3-2.6	3.4-3.7	127	4.0	**5**	3	1/8	125	3430	135	0.0
					6	3	1/8	130	3050	120	0.5
					10	3	1/8	130	2540	100	1.0
					12	3	.16	135	1900	75	2.0
					15	4	.16	140	1520	60	2.0
					20	5	3/16	140	1140	45	2.5
					25	6	1/4	150	510	20	*
					32	6	1/4	160	380	15	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 7/8 inch (21 mm) not recommended.

Stainless Steel – Above Water

200 amps • N_2 Plasma / CO_2 Shield

This gas combination is used when surface nitriting and surface oxidation of alloying elements is less important. Electrode life is extended when using this gas combination.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	36-40	52-56	210	60	**3/16**	1/8	3	125	190	4800	0.5
					1/4	1/8	3	130	170	4300	1.0
					3/8	1/8	3	130	125	3200	1.5
					1/2	1/8	3	135	95	2400	2.0
					5/8	.16	4	140	70	1800	2.0
					3/4	3/16	5	140	50	1250	2.5
					7/8	1/4	6	145	40	1000	3.0
					1	1/4	6	150	30	760	*
					1-1/4	1/4	6	160	15	380	*
					1-1/2	1/4	6	170	10	250	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.5-2.8	3.6-3.9	99	4.0	**5**	3	1/8	125	4800	190	0.5
					6	3	1/8	130	4300	170	1.0
					10	3	1/8	130	3200	125	1.5
					12	3	.16	135	2400	95	2.0
					15	4	.16	140	1800	70	2.0
					20	5	3/16	140	1250	50	2.5
					25	6	1/4	150	760	30	*
					32	6	1/4	160	380	15	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 7/8 inch (21 mm) not recommended.

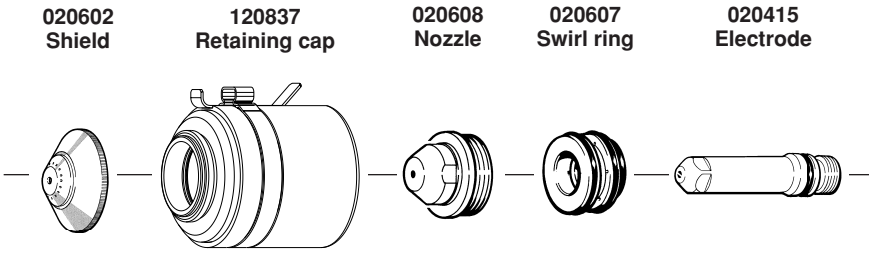
Stainless Steel – Above Water

200 amps • H35 Plasma / N_2 Shield

This gas combination (Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas) gives maximum thickness cutting capability, minimum dross levels, minimum amount of surface contamination, excellent weldability and excellent cut quality on thicknesses greater than 1/2". On thicknesses less than 1/2", excessive dross levels may be experienced. Electrode life is extended when this combination is used.

WARNING

Do not use water muffler when cutting with argon-hydrogen!



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
70	36-40	62-66	275	60	**1/4**	3/16	5	135	62	1600	1.0
					3/8	3/16	5	140	52	1300	1.0
					1/2	3/16	5	140	42	1100	2.0
					5/8	1/4	6	145	37	940	2.0
					3/4	1/4	6	150	32	810	2.5
					7/8	5/16	8	155	27	690	2.5
					1	5/16	8	155	22	560	*
					1-1/4	5/16	8	165	16	400	*
					1-1/2	5/16	8	170	11	280	*
					1-3/4	5/16	8	180	8	200	*
					2	5/16	8	185	6	150	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
33	2.5-2.8	4.3-4.5	129	4.0	**6**	5	3/16	135	1600	62	1.0
					10	5	3/16	140	1300	52	1.0
					12	5	3/16	140	1100	42	2.0
					15	6	1/4	145	940	37	2.0
					20	6	1/4	150	810	32	2.5
					25	8	5/16	155	560	22	*
					32	8	5/16	165	400	16	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)

Set shield gas inlet pressure to 90 psi (6.2 bar)

Note: Maximum piercing thickness 3/4" (20 mm) and IHS recommended.

If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

* Production cutting above 7/8 inch (21 mm) not recommended.

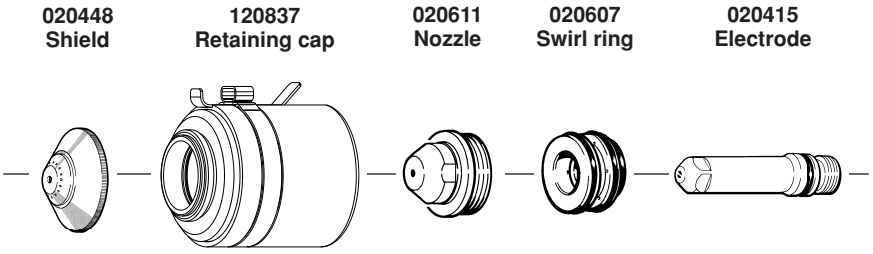
Stainless Steel – Above Water

100 amps • H35 Plasma / N_2 Shield

This gas combination gives good cut speed, but may result in severe dross. Some surface nitriting and surface oxidation of alloying elements can occur.

WARNING

Do not use water muffler when cutting with argon-hydrogen!



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
20	32-36	56-60	270	60	**1/8**	3/32	2.5	130	50	1260	0.0
					3/16	1/8	3	135	40	1060	0.5
					1/4	1/8	3	140	35	890	0.5
					3/8	1/8	3	140	30	750	0.5
					1/2	1/8	3	145	25	630	*

Metric

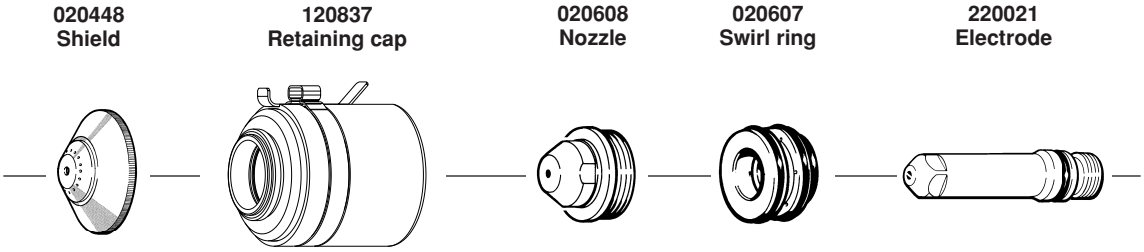
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
9	2.2-2.5	3.9-4.1	127	4.0	**3**	2.5	3/32	130	1260	50	0.0
					5	3	1/8	135	1060	40	0.5
					6	3	1/8	140	890	35	0.5
					10	3	1/8	140	750	30	0.5
					12	3	1/8	145	630	25	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
Note: Maximum piercing thickness 3/8-inch (10 mm) and IHS recommended.
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Aluminum – Above Water

200 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
66	44-48	58-62	270	60	**3/16**	1/8	3	130	220	5600	0.5
					1/4	1/8	3	140	190	4800	1.0
					3/8	1/8	3	140	145	3700	2.0
					1/2	1/8	3	145	110	2800	2.5
					5/8	.16	4	150	85	2200	2.5
					3/4	3/16	5	155	65	1650	2.5
					7/8	1/4	6	160	50	1300	2.5
					1	1/4	6	165	35	900	*
					1-1/4	1/4	6	170	20	500	*
					1-1/2	1/4	6	175	12	300	*

Metric

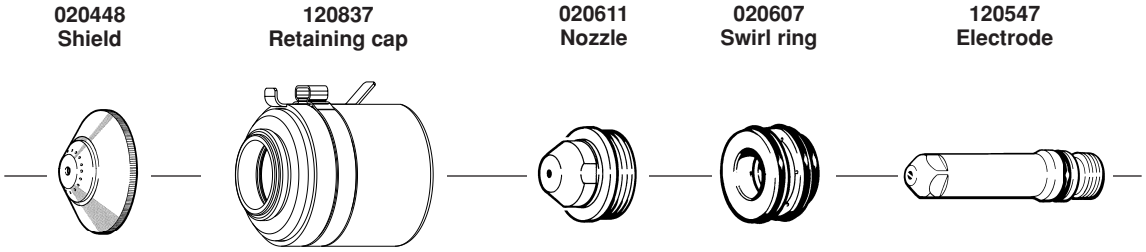
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
31	3.0-3.3	4.0-4.3	127	4.0	**5**	3	1/8	130	5600	220	0.5
					6	3	1/8	140	4800	190	1.0
					10	3	1/8	140	3700	145	2.0
					12	3	.16	145	2800	110	2.5
					15	4	.16	150	2200	85	2.5
					20	5	3/16	155	1650	65	2.5
					25	6	1/4	165	900	35	*
					32	6	1/4	170	500	20	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 7/8 inch (21 mm) not recommended.

Aluminum – Above Water

100 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
37	22-26	54-58	270	60	**1/8**	3/32	2.5	135	110	2800	0.0
					3/16	1/8	3	140	90	2290	0.5
					1/4	1/8	3	145	70	1780	0.5
					3/8	1/8	3	145	50	1270	0.5
					1/2	1/8	3	150	40	1010	*
					5/8	.16	4	155	30	760	*
					3/4	3/16	5	160	25	635	*

Metric

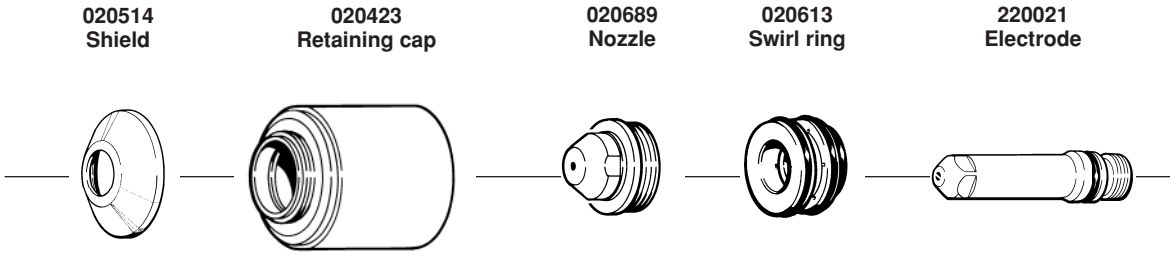
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
17	1.5-1.8	3.7-4.0	127	4.0	**3**	2.5	3/32	135	2800	110	0.0
					5	3	1/8	140	2290	90	0.5
					6	3	1/8	145	1780	70	0.5
					10	3	1/8	145	1270	50	0.5
					12	3	1/8	150	1010	40	*
					15	4	.16	155	760	30	*
					20	5	3/16	160	635	25	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Aluminum – Above Water

40 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
25	16-20	56-60	275	60	**3/32**	3/32	2.5	120	140	3550	0.0
					1/8	3/32	2.5	130	100	2550	0.5
					1/4	1/8	3	140	35	900	*
					3/8	1/8	3	150	15	350	*

Metric

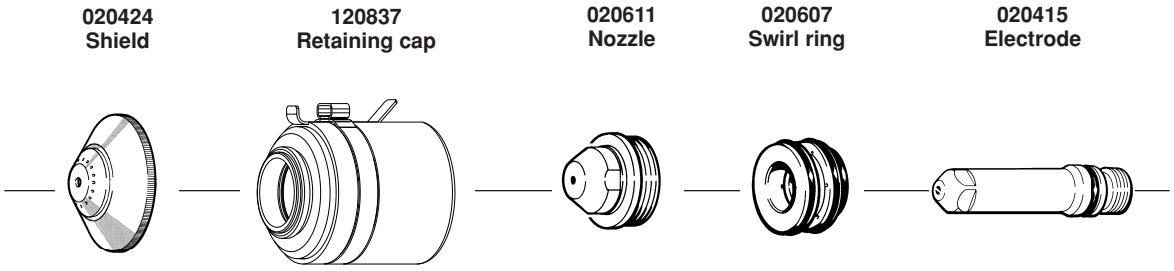
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
12	1.1-1.4	3.9-4.1	129	4.0	**3**	2.5	3/32	130	2550	100	0.5
					6	3	1/8	140	900	35	*
					10	3	1/8	150	350	15	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 1/8 inch (3 mm) not recommended.

Aluminum – Above Water

200 amps • N_2 Plasma / Air Shield

This gas combination is used when cut edge quality is less important. Electrode life is extended when this combination is used.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	34-38	54-54	270	60	**3/16**	1/8	3	130	180	4570	0.5
					1/4	1/8	3	135	160	4060	1.0
					3/8	1/8	3	135	120	3050	1.5
					1/2	1/8	3	140	80	2030	2.0
					5/8	.16	4	140	70	1780	2.0
					3/4	3/16	5	150	50	1270	2.5
					7/8	1/4	6	160	35	890	2.5
					1	1/4	6	165	25	635	*
					1-1/4	1/4	6	175	20	510	*
					1-1/2	1/4	6	185	10	250	*

Metric

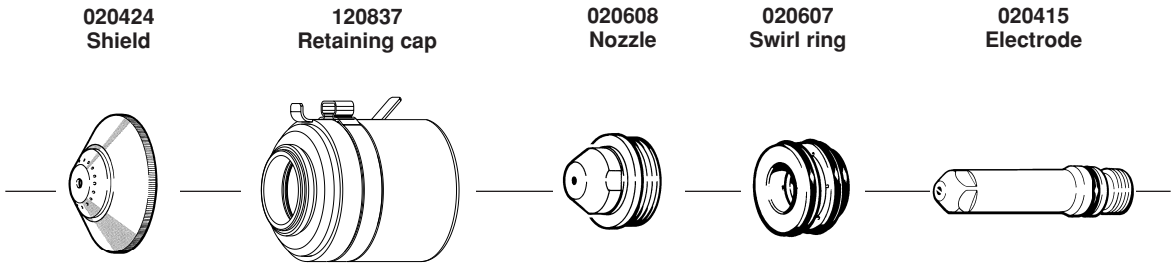
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.3-2.6	3.7-3.7	127	4.0	**5**	3	1/8	130	4570	180	0.5
					6	3	1/8	135	4060	160	1.0
					10	3	1/8	135	3050	120	1.5
					12	3	.16	140	2030	80	2.0
					15	4	.16	140	1780	70	2.0
					20	5	3/16	150	1270	50	2.5
					25	6	1/4	165	635	25	*
					32	6	1/4	175	510	20	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 7/8 inch (21 mm) not recommended.

Aluminum – Above Water

200 amps • N_2 Plasma / CO_2 Shield

This gas combination is used when cut edge quality is less important. Electrode life is extended when this combination is used.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	36-40	52-56	210	60	**3/16**	1/8	3	130	185	4700	0.5
					1/4	1/8	3	135	160	4050	1.0
					3/8	1/8	3	135	120	3050	2.0
					1/2	1/8	3	140	95	2400	2.5
					5/8	.16	4	140	70	1800	2.5
					3/4	3/16	5	150	55	1400	3.0
					7/8	1/4	6	160	42	10580	3.0
					1	1/4	6	165	33	840	*
					1-1/4	1/4	6	175	20	510	*
					1-1/2	5/16	8	185	11	280	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.5-2.8	3.6-3.9	99	4.0	**5**	3	1/8	130	4700	185	0.5
					6	3	1/8	135	4050	160	1.0
					10	3	1/8	135	3050	120	2.0
					12	3	.16	140	2400	95	2.5
					15	4	.16	140	1800	70	2.5
					20	5	3/16	150	1400	55	3.0
					25	6	1/4	165	840	33	*
					32	6	1/4	175	510	20	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 7/8 inch (21 mm) not recommended.

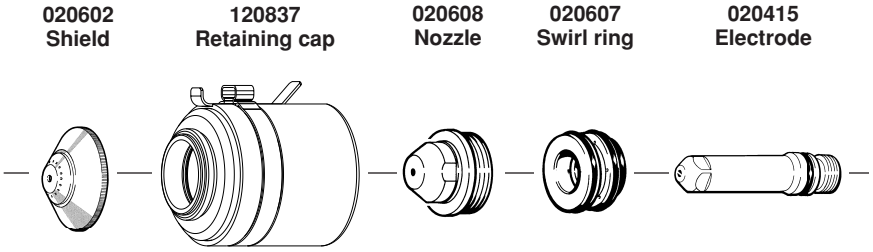
Aluminum – Above Water

200 amps • H35 Plasma / N_2 Shield

This gas combination (Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas) gives maximum thickness cutting capability, excellent cut quality and excellent weldability. Electrode life is extended when this combination is used.

WARNING

Do not use water muffler when cutting with argon-hydrogen!



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
70	36-40	62-66	275	60	**3/16**	3/16	5	130	170	4300	0.5
					1/4	3/16	5	130	155	4000	1.0
					3/8	1/4	6	135	120	3000	2.0
					1/2	1/4	6	140	100	2550	2.0
					5/8	1/4	6	145	80	2000	2.5
					3/4	5/16	8	150	60	1500	2.5
					7/8	5/16	8	155	50	1250	2.5
					1	5/16	8	155	40	1000	*
					1-1/4	5/16	8	165	26	660	*
					1-1/2	5/16	8	170	18	460	*
					1-3/4	5/16	8	180	12	300	*
					2	5/16	8	185	7	180	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
33	2.5-2.8	4.3-4.5	129	4.0	**6**	5	3/16	130	4000	155	1.0
					10	6	1/4	135	3000	120	2.0
					12	6	1/4	140	2550	100	2.0
					15	6	1/4	145	2000	80	2.5
					20	6	5/16	150	1500	60	2.5
					25	8	5/16	155	1000	40	*
					32	8	5/16	165	660	26	*
					50	8	5/16	185	180	7	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)

Set shield gas inlet pressure to 90 psi (6.2 bar)

If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

* Production cutting above 7/8 inch (21 mm) not recommended.

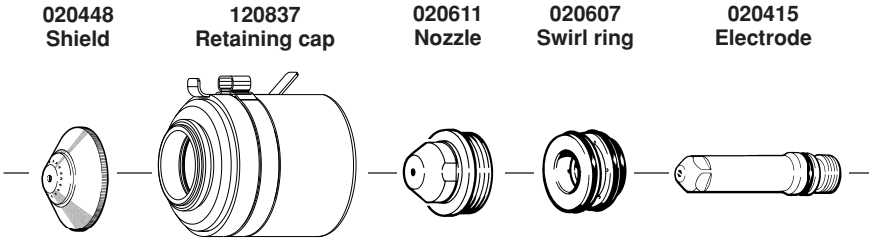
Aluminum – Above Water

100 amps • H35 Plasma / N_2 Shield

This gas combination gives good cut speed, low dross levels and is very economical.

WARNING

Do not use water muffler when cutting with argon-hydrogen!



English

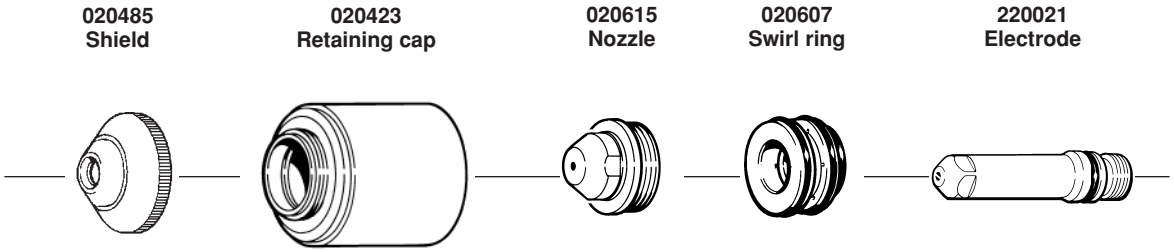
Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
20	32-36	56-60	270	60	**1/8**	3/32	2.5	135	95	2440	0.0
					3/16	1/8	3	140	85	2200	0.5
					1/4	1/8	3	145	80	1980	0.5
					3/8	1/8	3	145	60	1530	0.5
					1/2	1/8	3	150	50	1280	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
9	2.2-2.5	3.9-4.1	127	4.0	**3**	2.5	3/32	135	2440	95	0.0
					5	3	1/8	140	2200	85	0.5
					6	3	1/8	145	1980	80	0.5
					10	3	1/8	145	1530	60	0.5
					12	3	1/8	150	1280	50	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Mild Steel – Gouging
200 amps • Air Plasma / Air Shield



English

Plasma Gas Pressure		Shield Gas Pressure (psi)	Plasma Gas Inlet Pressure (psi)	Shield Gas Inlet Pressure (psi)
TEST (psi)	RUN (psi)			
49-51	50-52	50	90	90

Metric

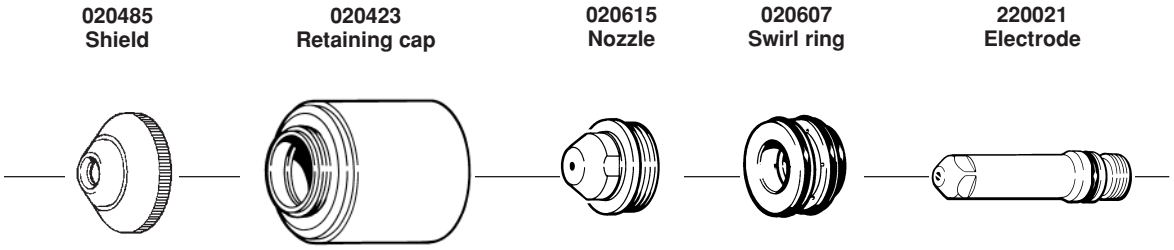
Plasma Gas Pressure		Shield Gas Pressure (bar)	Plasma Gas Inlet Pressure (bar)	Shield Gas Inlet Pressure (bar)
TEST (bar)	RUN (bar)			
3.4-3.5	3.4-3.6	3.4	6.2	6.2

If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Stainless Steel – Gouging

200 amps • H35 Plasma / N_2 Shield

Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas.



English

Plasma Gas Pressure		Shield Gas Pressure (psi)	Plasma Gas Inlet Pressure (psi)	Shield Gas Inlet Pressure (psi)
TEST (psi)	RUN (psi)			
49-51	50-52	50	120	120

Metric

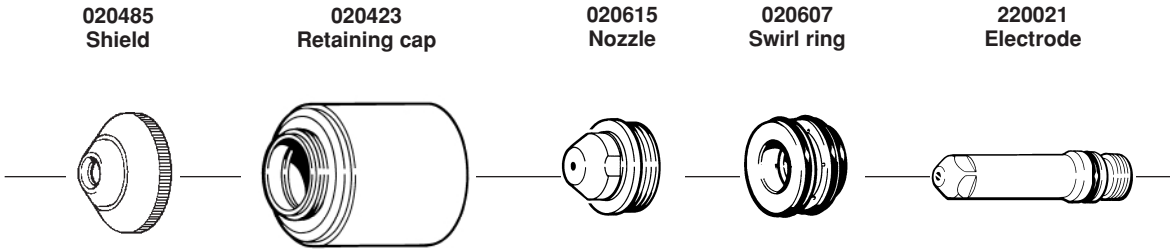
Plasma Gas Pressure		Shield Gas Pressure (bar)	Plasma Gas Inlet Pressure (bar)	Shield Gas Inlet Pressure (bar)
TEST (bar)	RUN (bar)			
3.4-3.5	3.4-3.6	3.4	8.3	8.3

If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Aluminum – Gouging

200 amps • H35 Plasma / N_2 Shield

Hypertherm recommends a mixture of 35% hydrogen and 65% argon for the plasma gas.



English

Plasma Gas Pressure		Shield Gas Pressure (psi)	Plasma Gas Inlet Pressure (psi)	Shield Gas Inlet Pressure (psi)
TEST (psi)	RUN (psi)			
49-51	50-52	50	120	120

Metric

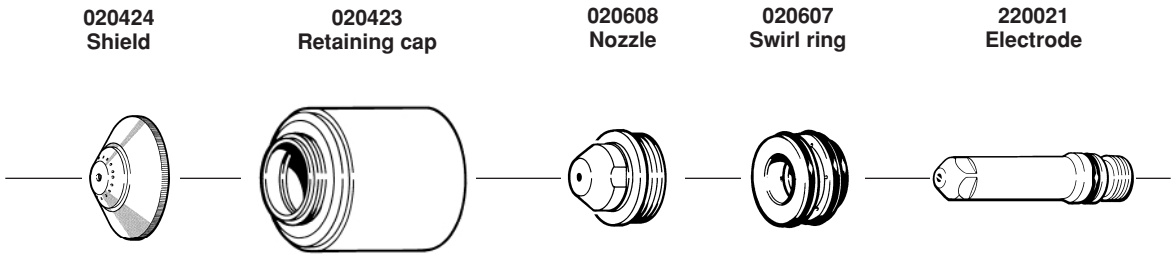
Plasma Gas Pressure		Shield Gas Pressure (bar)	Plasma Gas Inlet Pressure (bar)	Shield Gas Inlet Pressure (bar)
TEST (bar)	RUN (bar)			
3.4-3.5	3.4-3.6	3.4	8.3	8.3

If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Mild Steel – 3" Under Water

200 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriting can occur.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
66	44-48	58-62	280	70	**1/4**	1/8	3	130	130	3300	0.5
					3/8	1/8	3	135	95	2400	1.0
					1/2	1/8	3	140	75	1900	2.0
					5/8	.16	4	145	50	1200	2.0
					3/4	3/16	5	150	35	850	2.5
					7/8	1/4	6	155	20	530	3.0
					1	1/4	6	165	15	400	3.0

Metric

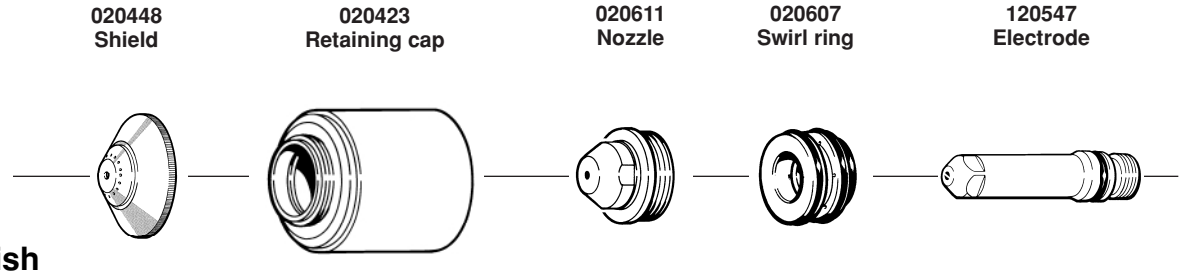
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
31	3.0-3.3	4.0-4.3	132	4.8	**6**	3	1/8	130	3300	130	0.5
					8	3	1/8	135	2700	110	0.5
					10	3	1/8	135	2400	95	1.0
					12	3	1/8	140	1900	75	2.0
					15	4	.16	145	1200	50	2.0
					20	5	3/16	150	850	35	2.5
					25	6	1/4	165	400	15	3.0

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Mild Steel – 3" Under Water

100 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross level and is very economical. Some surface nitriting can occur. While this process may be used on thicker materials, optimal recommended range is to 3/8 inch (10 mm).



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
37	22-26	54-58	280	70	**1/8**	5/64	2	130	120	3050	0.0
					3/16	1/8	3	135	90	2300	0.5
					1/4	1/8	3	140	70	1730	0.5
					3/8	1/8	3	145	42	1050	0.5
					1/2	1/8	3	145	28	700	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
17	1.5-1.8	3.7-4.0	132	4.8	**3**	2	5/64	130	3050	120	0.0
					5	3	1/8	135	2300	90	0.5
					6	3	1/8	140	1730	70	0.5
					10	3	1/8	145	1050	42	0.5
					12	3	1/8	145	700	28	*

Metric – 80 amps • Air Plasma / Air Shield

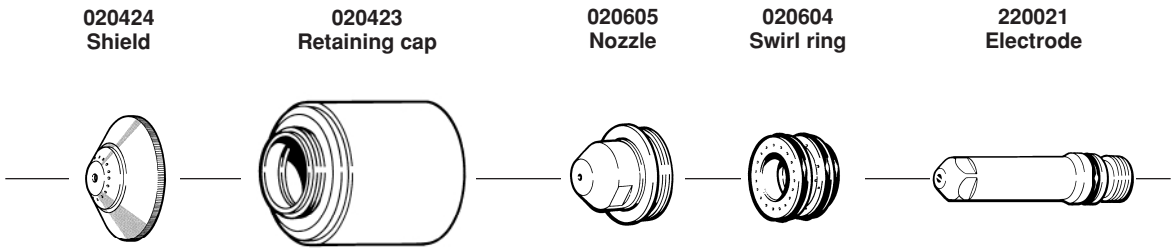
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
17	1.5-1.8	3.3-3.6	132	4.8	**2**	2	5/64	120	6050	240	0.0

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Mild Steel – 3" Under Water

200 amps • O_2 Plasma / Air Shield

This gas combination gives superior cut speed, minimum dross, minimum amount of surface nitriting and excellent weldability.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
72	48-52	64-68	280	70	**1/4**	1/8	3	125	145	3700	0.5
					3/8	1/8	3	130	80	2000	1.0
					1/2	1/8	3	130	70	1800	2.0
					5/8	.16	4	135	60	1500	2.0
					3/4	3/16	5	140	48	1200	2.5
					7/8	1/4	6	140	38	950	3.0
					1	1/4	6	145	25	680	3.0

Metric

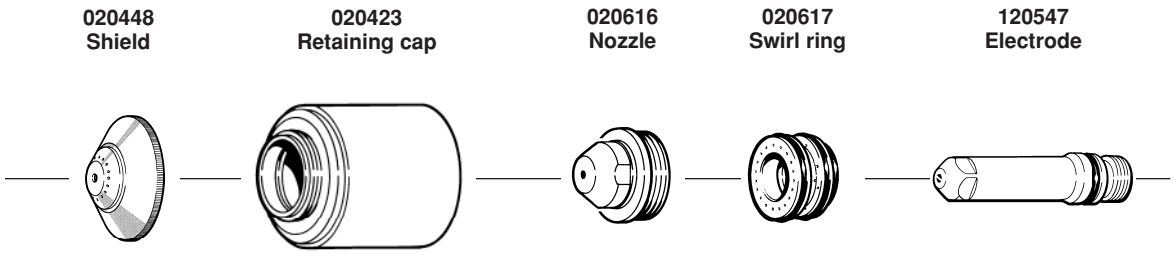
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
34	3.33-3.6	4.4-4.7	132	4.8	**6**	3	1/8	125	3700	145	0.5
					8	3	1/8	125	2800	110	0.5
					10	3	1/8	130	2000	80	1.0
					12	3	1/8	130	1800	70	2.0
					15	4	.16	135	1500	60	2.0
					20	5	3/16	140	1200	48	2.5
					25	6	1/4	145	680	25	3.0

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Mild Steel – 3" Under Water

100 amps • O_2 Plasma / Air Shield

This gas combination gives good cut speed, low dross level, and is very economical. Some surface nitriting can occur. While this process may be used on thicker materials, optimal recommended range is to 3/8 inch (10 mm).



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
40	20-24	60-64	280	70	**1/8**	5/64	2	115	200	5080	0.0
					3/16	1/8	3	120	125	3175	0.5
					1/4	1/8	3	120	90	2280	0.5
					3/8	1/8	3	125	70	1780	0.5
					1/2	1/8	3	125	55	1400	*

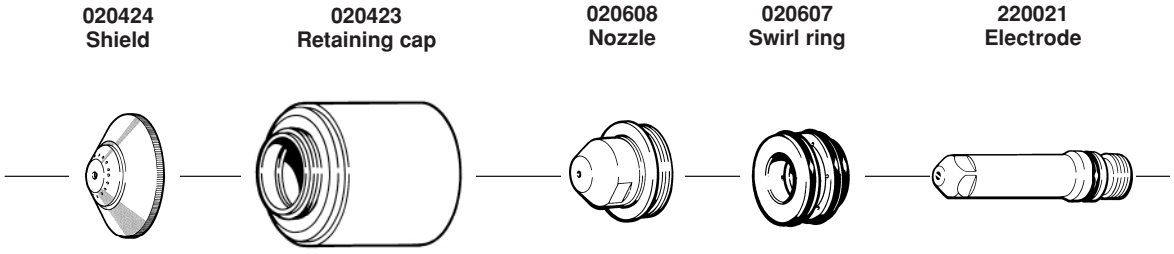
Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
19	1.4-1.6	4.1-4.4	132	4.8	**3**	2	5/64	115	5080	200	0.0
					5	3	1/8	120	3175	125	0.5
					6	3	1/8	120	2280	90	0.5
					10	3	1/8	125	1780	70	0.5
					12	3	1/8	125	1400	55	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Stainless Steel – 3" Under Water
200 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriting and surface oxidation of alloying elements can occur.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
66	44-48	58-62	280	70	**3/16**	1/8	3	125	210	5320	0.0
					1/4	1/8	3	130	180	4500	0.5
					3/8	1/8	3	135	125	3150	1.0
					1/2	1/8	3	140	90	2300	2.0
					5/8	.16	4	145	60	1520	2.0
					3/4	3/16	5	145	45	1150	2.5
					7/8	1/4	6	150	30	750	3.0
					1	1/4	6	155	22	570	*

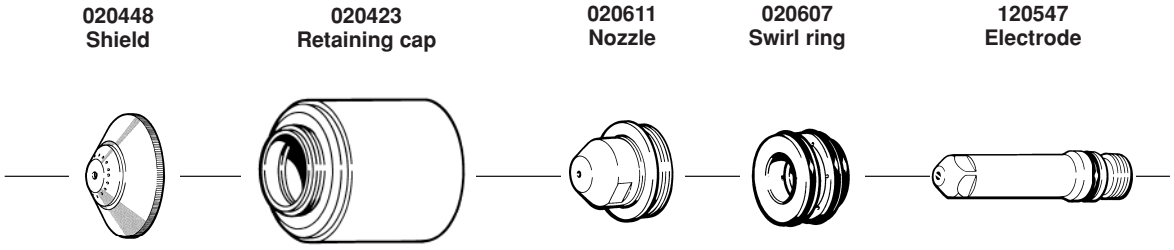
Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
31	3.0-3.3	4.0-4.3	132	4.8	**5**	3	1/8	125	5320	210	0.0
					6	3	1/8	130	4500	180	0.5
					10	3	1/8	135	3150	125	1.0
					12	3	1/8	140	2300	90	2.0
					15	4	.16	145	1520	60	2.0
					20	5	3/16	145	1150	45	2.5
					25	6	1/4	155	570	22	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 7/8 inch (21 mm) not recommended.

Stainless Steel – 3" Under Water
100 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical. Some surface nitriting and surface oxidation of alloying elements can occur.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
37	22-26	54-58	280	70	**1/8**	5/64	2	125	135	3400	0.0
					3/16	1/8	3	130	100	2520	0.5
					1/4	1/8	3	135	65	1720	0.5
					3/8	1/8	3	140	45	1120	0.5
					1/2	1/8	3	145	25	670	*

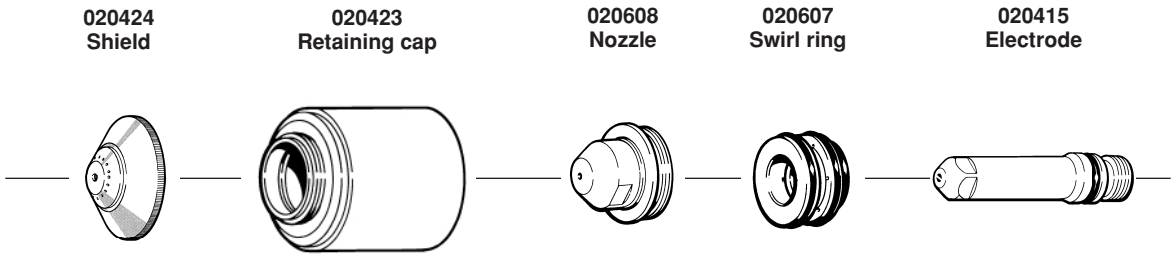
Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
17	1.5-1.8	3.7-4.0	132	4.8	**3**	2	5/64	125	3400	135	0.0
					5	3	1/8	130	2520	100	0.5
					6	3	1/8	135	1720	65	0.5
					10	3	1/8	140	1120	45	0.5
					12	3	1/8	145	670	25	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Stainless Steel – 3" Under Water
200 amps • N_2 Plasma / Air Shield

This gas combination is used when cut edge quality, surface nitriting and surface oxidation of alloying elements are less important. Electrode life is extended when this combination is used.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	34-38	50-54	280	70	**3/16**	1/8	3	125	130	3250	0.0
					1/4	1/8	3	130	110	2750	0.5
					3/8	1/8	3	135	85	2160	1.0
					1/2	1/8	3	140	60	1520	2.0
					5/8	.16	4	145	45	1140	2.0
					3/4	3/16	5	145	30	800	2.5

Metric

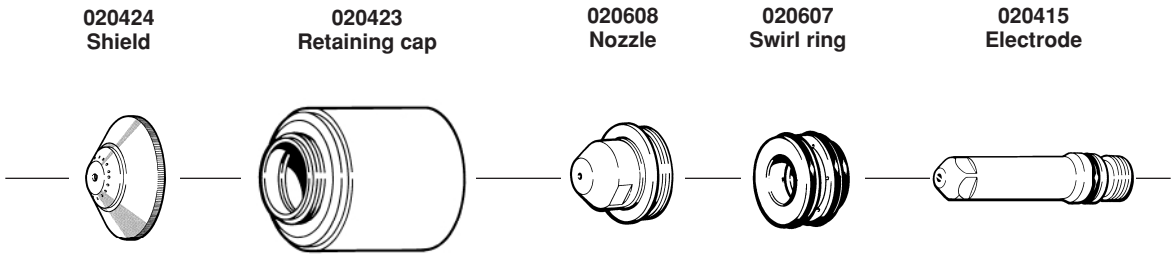
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.3-2.6	3.5-3.7	132	4.8	**5**	3	1/8	125	3250	130	0.0
					6	3	1/8	130	2750	110	0.5
					10	3	1/8	135	2160	85	1.0
					12	3	1/8	140	1520	60	2.0
					15	4	.16	145	1140	45	2.0
					20	5	3/16	145	800	30	2.5

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Stainless Steel – 3" Under Water

200 amps • N_2 Plasma / CO_2 Shield

This gas combination is used when surface nitriting and surface oxidation of alloying elements is less important. Electrode life is extended when using this gas combination.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	36-40	52-56	210	70	**3/16**	1/8	3	125	180	4550	0.5
					1/4	1/8	3	130	150	3850	1.0
					3/8	1/8	3	135	110	2700	1.5
					1/2	1/8	3	140	75	1920	2.0
					5/8	.16	4	145	50	1350	2.0
					3/4	3/16	5	145	38	950	2.5
					7/8	1/4	5	150	28	700	3.0

Metric

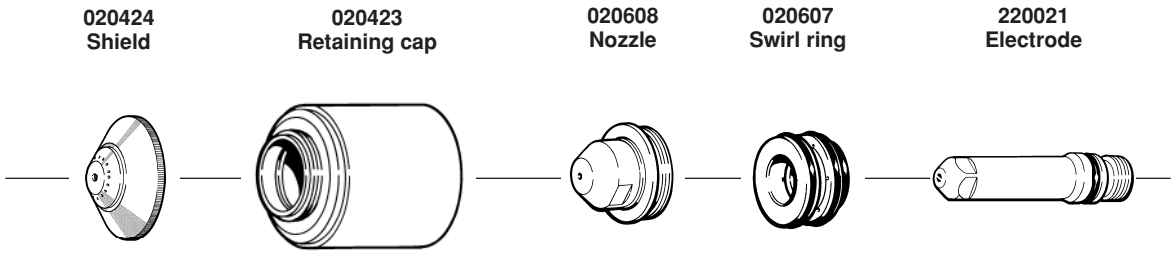
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.5-2.8	3.6-3.9	99	4.8	**5**	3	1/8	125	4550	180	0.5
					6	3	1/8	130	3850	150	1.0
					10	3	1/8	135	2700	110	1.5
					12	3	1/8	140	1920	75	2.0
					15	4	.16	145	1350	50	2.0
					20	5	3/16	145	950	38	2.5

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Aluminum – 3" Under Water

200 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
66	44-48	58-62	280	70	**3/16**	1/8	3	135	210	5300	0.5
					1/4	1/8	3	140	170	4300	1.0
					3/8	1/8	3	145	125	3150	2.0
					1/2	1/8	3	150	90	2240	2.5
					5/8	.16	4	155	65	1650	3.0
					3/4	3/16	5	160	45	1150	3.0

Metric

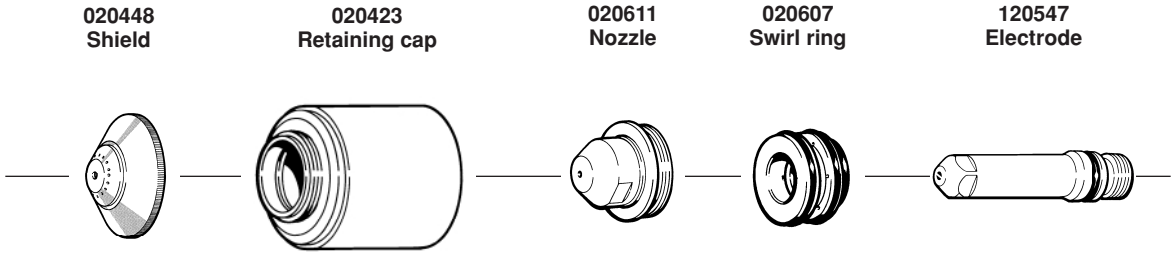
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
31	3.0-3.3	4.0-4.3	132	4.8	**5**	3	1/8	135	5300	210	0.5
					6	3	1/8	140	4300	170	1.0
					10	3	1/8	145	3150	125	2.0
					12	3	1/8	150	2240	90	2.5
					15	4	.16	155	1650	65	3.0
					20	5	3/16	160	1150	45	3.0

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Aluminum – 3" Under Water

100 amps • Air Plasma / Air Shield

This gas combination gives good cut speed, low dross levels and is very economical.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
37	22-26	54-58	280	70	**1/8**	5/64	2	135	100	2650	0.0
					3/16	1/8	3	140	80	2050	0.5
					1/4	1/8	3	145	60	1510	0.5
					3/8	1/8	3	150	40	1000	0.5
					1/2	1/8	3	155	30	750	*

Metric

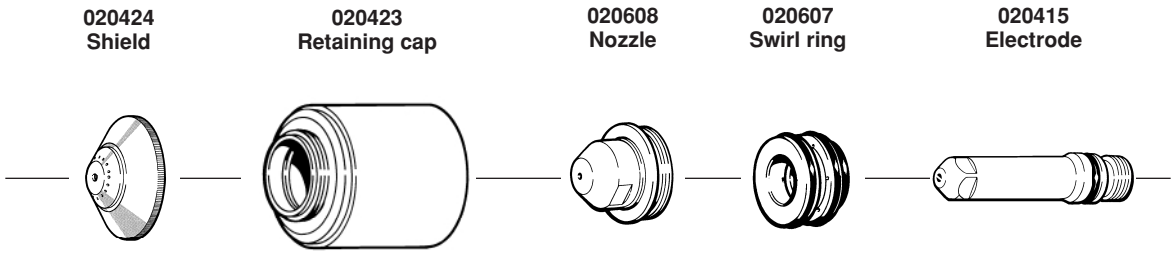
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
17	1.5-1.8	3.7-4.0	132	4.8	**3**	2	5/64	135	2650	100	0.0
					5	3	1/8	140	2050	80	0.5
					6	3	1/8	145	1510	60	0.5
					10	3	1/8	150	1000	40	0.5
					12	3	1/8	155	750	30	*

Set plasma gas inlet pressure to 90 psi (6.2 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 3/8 inch (10 mm) not recommended.

Aluminum – 3" Under Water

200 amps • N_2 Plasma / Air Shield

This gas combination is used when cut edge quality is less important. Electrode life is extended when this combination is used.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	34-38	50-54	280	70	**3/16**	1/8	3	135	170	4350	0.5
					1/4	1/8	3	140	140	3650	1.0
					3/8	1/8	3	140	100	2600	1.5
					1/2	1/8	3	145	65	1620	2.0
					5/8	.16	4	145	55	1350	2.5
					3/4	3/16	5	155	35	890	3.0
					7/8	1/4	5	165	25	620	3.0

Metric

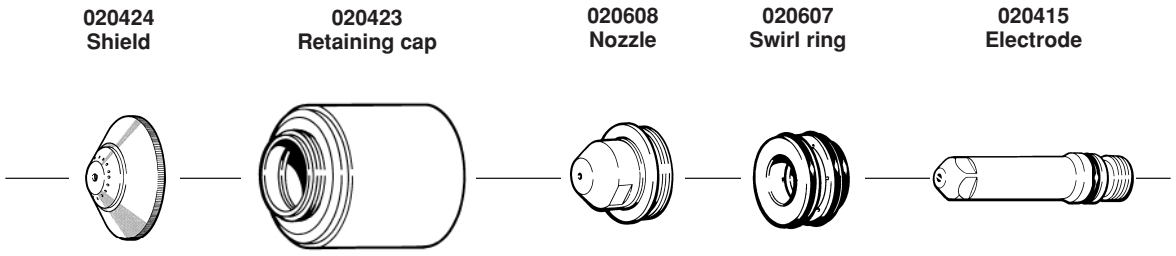
Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.3-2.6	3.4-3.7	132	4.8	**5**	3	1/8	135	4350	170	0.5
					6	3	1/8	140	3650	140	1.0
					10	3	1/8	140	2600	100	1.5
					12	3	1/8	145	1620	65	2.0
					15	4	.16	145	1350	55	2.5
					20	5	3/16	155	890	35	3.0

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Aluminum – 3" Under Water

200 amps • N_2 Plasma / CO_2 Shield

This gas combination is used when cut edge quality is less important. Electrode life is extended when this combination is used.



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
60	36-40	52-56	220	70	**3/16**	1/8	3	130	175	4450	0.5
					1/4	1/8	3	135	145	3650	1.0
					3/8	1/8	3	140	100	2600	2.0
					1/2	1/8	3	145	75	1820	2.5
					5/8	.16	4	145	55	1350	2.5
					3/4	3/16	5	155	40	980	3.0
					7/8	1/4	5	165	30	750	3.0

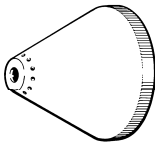
Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
28	2.5-2.8	3.6-3.9	103	4.8	**5**	3	1/8	130	4450	175	0.5
					6	3	1/8	135	3650	145	1.0
					10	3	1/8	140	2600	100	2.0
					12	3	1/8	145	1820	75	2.5
					15	4	.16	145	1350	55	2.5
					20	5	3/16	155	980	40	3.0

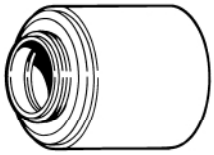
Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.

Mild Steel – Beveling Consumables
200 amps • O_2 Plasma / Air Shield

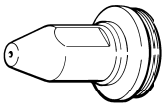
120260
Shield



020423
Retaining cap



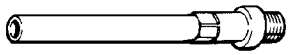
120259
Nozzle



120833
Swirl ring

120258
Electrode

120257
Water Tube



English

Plasma Gas Flowrate (SCFH)	Plasma Gas Pressure		Shield Gas Flowrate (SCFH)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (psi)	Run (psi)		(psi)	**(Inches)**	(Inches)	(mm)	(Volts)	(ipm)	(mm/min)	(sec)
72	48-52	64-68	270	60	**1/4**	1/8	3	120	160	4060	0.5
					3/8	1/8	3	125	100	2540	1.0
					1/2	.16	4	125	80	2030	2.0
					5/8	.16	4	130	70	1780	2.0
					3/4	3/16	5	135	55	1400	2.5
					7/8	1/4	6	135	45	1140	2.5
					1	1/4	6	140	35	890	2.5
					1-1/4	1/4	6	150	22	560	*
					1-1/2	1/4	6	155	15	380	*
					1-3/4	5/16	8	165	10	250	*
					2	5/16	8	170	7	180	*

Metric

Plasma Gas Flowrate (l/min)	Plasma Gas Pressure		Shield Gas Flowrate (l/min)	Shield Gas Pressure	**Material Thickness**	Torch-to-Work Distance		Arc Voltage Setting	Travel Speed		Approx. Motion Delay Time
	Test (bar)	Run (bar)		(bar)	**(mm)**	(mm)	(Inches)	(Volts)	(mm/min)	(ipm)	(sec)
34	3.3-3.6	4.4-4.7	127	4.0	**6**	3	1/8	120	4060	160	0.5
					8	3	1/8	125	3000	120	0.5
					10	3	1/8	125	2540	100	1.0
					12	4	.16	125	2030	80	2.0
					15	4	.16	130	1780	70	2.0
					20	5	3/16	135	1400	55	2.5
					25	6	1/4	140	890	35	2.5
					32	6	1/4	150	560	22	*
					50	8	5/16	170	180	7	*

Set plasma gas inlet pressure to 120 psi (8.3 bar)
Set shield gas inlet pressure to 90 psi (6.2 bar)
If leads are greater than 50 feet, increase TEST pressure 5 psi for every extra 50 feet of torch lead length.
* Production cutting above 1 inch (25 mm) not recommended.

Hypertherm

Section 5

MAINTENANCE

In this section:

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 MAX200 system is designed to require very little regular maintenance under normal use. Refer to MAX200 Service Manual, IM-162 (#801620) for torch, torch leads, torch coolant and power supply routine maintenance checks to keep your system in top running condition.

Troubleshooting

Becoming familiar with the contents of this manual will aid in safely troubleshooting the MAX200 power supply and torch should the need arise. The following procedures will show the user how to locate the most common problems. Refer to the electrical schematic for additional information. Also, **Section 6**, *Parts List* will help you locate the components when using these troubleshooting procedures. For more in-depth troubleshooting information, see IM162 (#801620) MAX200 Service manual.

If you need additional assistance, call our Technical Service Group at 1-800-643-9878

Problem: **The green POWER ON pushbutton switch PB1 is pressed, but the fans are not operating and the green POWER ON indicator does not illuminate.**

Cause: Main power is not on available to the power supply.
Solution: Turn on power at the main power panel or at the line disconnect switch box.

Cause: The fuse(s) inside the line disconnect switch box are blown.
Solution: Verify the fuse(s) are sized correctly. Replace the fuse(s).

Cause: Fuse F1 or F2 are blown.
Solution: Verify the fuse(s) are sized correctly. Replace the fuse(s).

Cause: Control transformer T1 is defective.
Solution: Replace transformer T1.

Cause: The green POWER ON (1) pushbutton switch PB1, the red POWER OFF (0) pushbutton switch PB2, or the associated switch wiring is not making good contact or is defective.
Solution: Replace the defective switch or correct or replace the switch wiring as required.

Problem: **The green POWER ON pushbutton switch PB1 is pressed, the fans are operating, but the green POWER ON indicator does not illuminate.**

Cause: Pushbutton switch PB1 was not held down long enough.
Solution: Press and hold PB1 for a minimum of five seconds.

Cause: One or more of the STATUS LED(s) remains illuminated indicating a fault condition(s).
Solution: Refer to Section 4, Operation, *Front Panel Controls* for interlock indicator descriptions and *Status Indicators Before Startup*.

Cause: Fuse F1 on the power distribution board PCB6 is blown.
Solution: Replace fuse F1.

Cause: Relay CR1 on the power distribution board PCB6 is defective.
Solution: Replace relay CR1.

Problem: **The green POWER ON pushbutton switch PB1 is pressed, the green POWER ON indicator illuminates, but the fans are not operating.**

Cause: Fuse F2 on the power distribution board PCB6 is blown.
Solution: Replace fuse F2.

Cause: Relay CR2 on the power distribution board is defective.
Solution: Replace relay CR2.

Problem: **The fans are operating, the green POWER ON indicator is illuminated, and the torch switch is pressed, but the DC ON indicator does not illuminate.**

Cause: The torch switch or the switch connections are defective.
Solution: Check the torch switch connections on TB2 for loose or broken wiring.
Replace the torch start switch.

Cause: The contactor CON1 is defective.
Solution: Replace contactor CON1

Cause: The control board PCB7 is defective.
Solution: Replace control board PCB7.

Problem: **The green POWER ON indicator is illuminated, the torch switch is pressed and DC ON indicator illuminates, but there is no high frequency and no pilot arc.**

Cause: There is no spark between the spark gap electrodes.
Solution: Clean (with emery cloth), align, and/or regap (.020" per gap) the electrodes if necessary. Ensure the electrode surfaces between the gaps are flat. If they are rounded, replace and regap. The two outside electrode assemblies are part no. 004061; the inside electrode assembly is part no. 004089.

Solution: Visually inspect the high voltage transformer T5 for leaking oil or overheating. If either of these conditions exist, replace T5.

Solution: Visually inspect the electrical connections at connectors PL26/REC26 (T5), TB3-60 and 61, and pins 3 and 4 at connectors PL6/REC2 (PCB7). Repair or replace any defective connectors or wires.

Solution: Disconnect the PL26/REC26 connectors and connect an external 120 VAC power source to REC26 connector pins. If a spark is observed across the spark gaps, replace control board PCB7.

If a spark is not observed across the gaps, remove capacitors C7 and C8. If a faint spark is now observed across the gaps, replace T5 and reconnect the capacitors. If a spark is not observed replace C7 and C8. **(Always replace the capacitors in pairs).**

Problem: **The green POWER ON indicator is illuminated, the torch switch is pressed and the DC ON indicator illuminates, and there is high frequency, but there is no pilot arc.**

Cause: There is no high frequency at the torch.
Solution: 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.

Cause: The pilot arc relay CR1 is defective.
Solution: Replace relay CR1.

Cause: Control board PCB7 is defective.
Solution: Replace board PCB7.

Problem: **The unit shuts itself off after it is turned on.**

Cause: The unit has overheated
Solution: Wait for the unit to cool down.

Cause: There is insufficient air or gas pressure.
Solution: Check the gauge on the back panel. Increase the air or gas pressure to the unit.

Cause: Auxilliary switches on the safety contactor are loose.
Solution: Tighten the switches.

Problem: **The unit is not cutting well.**

Cause: The work clamp is not connected or it is broken.
Solution: Connect or repair the work clamp.

Cause: The torch is cracked.
Solution: Replace the torch.

Cause: The pilot arc relay CR1 is defective. Check for contacts that are welded shut
Solution: Replace relay CR1.

Removal and Replacement of Torch

To remove and replace the torch main body from the torch lead, perform the following procedure and see Figure 5-1. Refer to the *Machine Torch Lead Assembly* Parts list, page 6-22.

Removal

1. Unscrew the insulating sleeve from the torch main body and slide the sleeve out of the way in order to expose the torch lead fittings.

2. On the larger leads, use a 3/8" open-end wrench to hold the torch body fittings and a 1/2" open-end wrench to turn the torch lead fittings. On the smaller leads, use a 5/16" open-end wrench to hold the torch body fittings and a 7/16" open-end wrench to turn the torch lead fittings. Turn the torch lead fittings counterclockwise (ccw) to loosen the connections. Note that the red lead fitting is reverse threaded and must be turned in the opposite direction.

3. Remove the torch main body.

Replacement

1. Connect the torch leads to the replacement torch main body. Thread the torch main body fittings and the torch lead fittings together clockwise (cw). Use the size wrenches called out in the *Removal* procedure above. Note that the red lead fitting is reverse threaded and must be turned in the opposite direction.

2. Ensure the lead insulator is positioned over the pilot/shield gas lead fitting.

3. Slide the insulating sleeve to the torch main body and screw together.

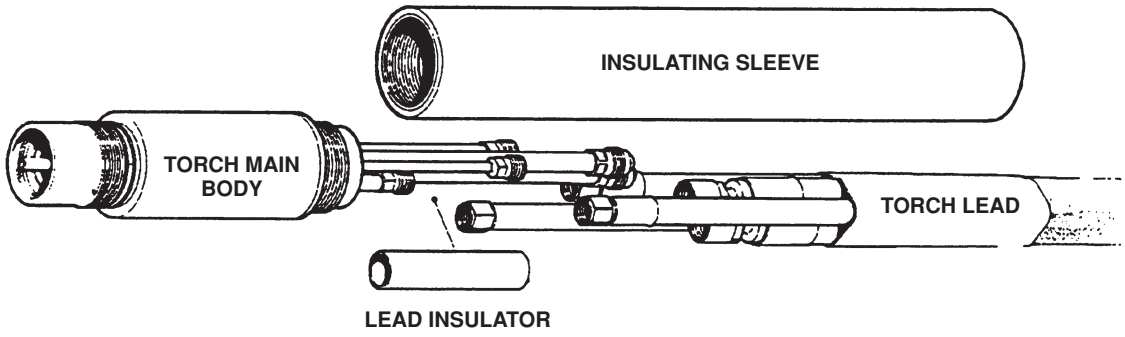


Figure 5-1 Machine Torch Assembly

Removal and Replacement of Torch Lead

To remove and replace the torch lead, perform the following procedures.

Removal

1. Disconnect the torch lead from the power supply by reversing the *Connect the Torch Lead* procedure on page 3-16.

2. Disconnect the torch from the torch lead as described in the *Torch Removal* procedure on page 5-6.

Replacement

1. Connect the torch lead to the power supply by referring to the *Connect the Torch Lead* procedure on page 3-16.

2. Connect the torch lead to the torch referring to the *Torch Replacement* procedure on page 5-6.

Removal and Replacement of Individual Torch Leads

To remove and replace individual torch leads, perform the following procedure and see Figure 5-2. Refer to the *Machine Torch Lead Assembly* Parts list.

Removal

1. Disconnect the torch lead from the power supply by reversing the *Connect the Torch Lead* procedure on page 3-16.

2. Disconnect the torch from the torch lead as described in the *Torch Removal* procedure on page 5-6.

3. Lay the torch lead on the floor and stretch it out completely.

4. Cut away the heat shrink (7) and any tape underneath at both ends.

5. Remove the hose clamp (11), shield collar (10), and compression ring (9) from the torch lead at the other end. Cut away any tape under the compression ring.

6. Holding one end of the the torch lead, pull the shield braid (8) off of the torch lead.

7. Cut the tape (every 18 inches) that holds the torch leads together.

8 Remove the lead (1-5) requiring repair or replacement.

Replacement

1. Replace the repaired or replacement lead(s) with the other leads.
2. Ensure the lead lengths (1-5) at both ends are in accordance with those called out in Figure 5-2.
3. Tape the leads together every 18 inches.
4. Slide the shield braid (8) over the torch lead ends and pull the sheath until it approximates the length requirements called out in Figure 5-2.
5. Tape both ends of the shield braid to the torch lead.
6. Slide the shrink tubing (7) over the torch end of the shield braid. Heat the shrink tubing until it tightly bonds around the shield braid and torch lead.
7. Replace the compression ring (9), shield collar (10), and hose clamp (11) over the power supply end of the shield braid. Tighten the hose clamp.
8. Connect the torch lead to the power supply. Refer to the *Connect the Torch Lead* procedure on page 3-16.
9. Connect the torch lead to the torch. Refer to the *Torch Replacement* procedure on page 5-6.

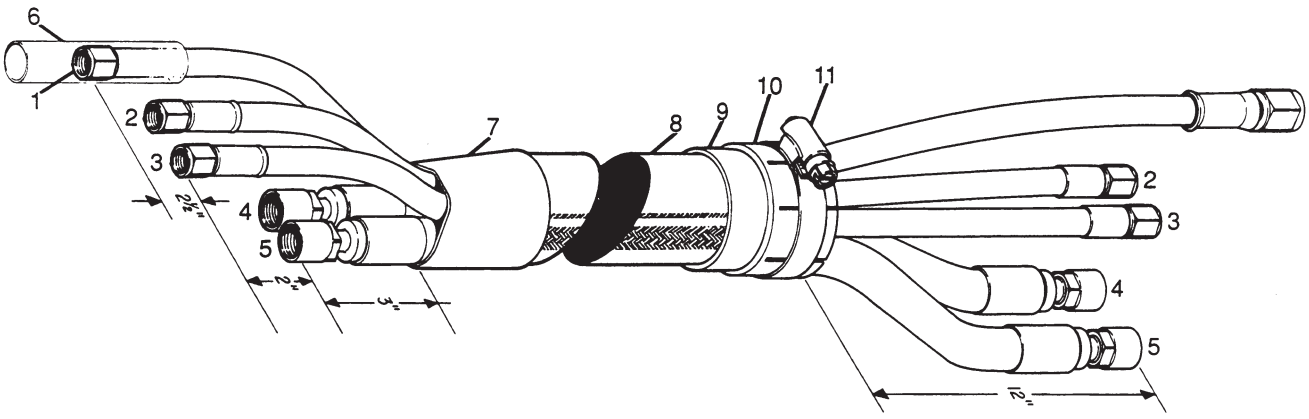


Figure 5-2 Machine Torch Lead Assembly

Hypertherm

Section 6

PARTS LIST

In this section:

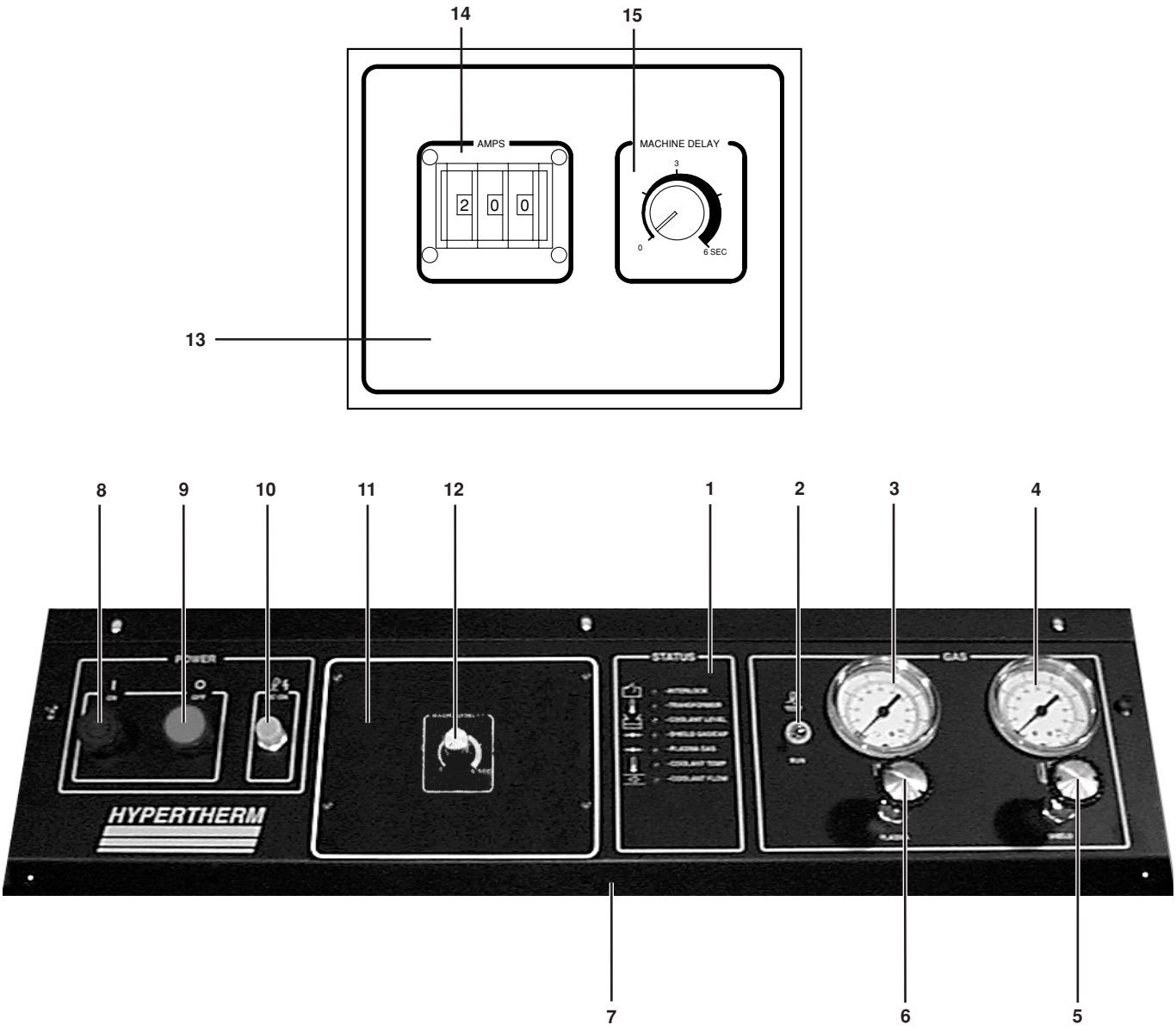


Figure 6-1 Power Supply – Control Panel SA, Front

Item	Part Number	Description	Designator	Qty.
	029319	**Panel, Control SA**		
1	041536	PCB, interlock display SA		1
	009063	Diode, LED, amber	LED 1-7	7
2	005041	Switch, toggle DPDT	S1	1
3	022008	Gauge, pressure 0-100 psi	PG1	1
4	022008	Gauge, pressure 0-100 psi	PG2	1
5	006038	Valve, needle .188 orifice	V6	1
6	006027	Valve, needle .125 orifice	V5	1
7	001222	Panel, control		1
8	005121	Pushbutton, green, illmn.	PB1	1
9	005122	Pushbutton, red, extended	PB2	1
10	005088	Holder, lamp		1
	005168	Bulb, 28VDC		1
	005089	Lens, white for 005088		1
11*	001250	Panel, machine delay		1
12*	009604	Resistor, variable, 100 K, 1 turn	R9	1
13**	029360	Panel, thumbwheel/machine delay SA		1
14**	005123	Thumbwheel	S3	1
15**	009604	Resistor, variable, 100 K, 1 turn	R9	1

* Power Supplies with THC – 073020, 073021, 073022, 073023, 073024 and 073213 (CE)

** Power Supplies without THC – 073002, 073003, 073004, 073005, 073026 and 073200 (CE)

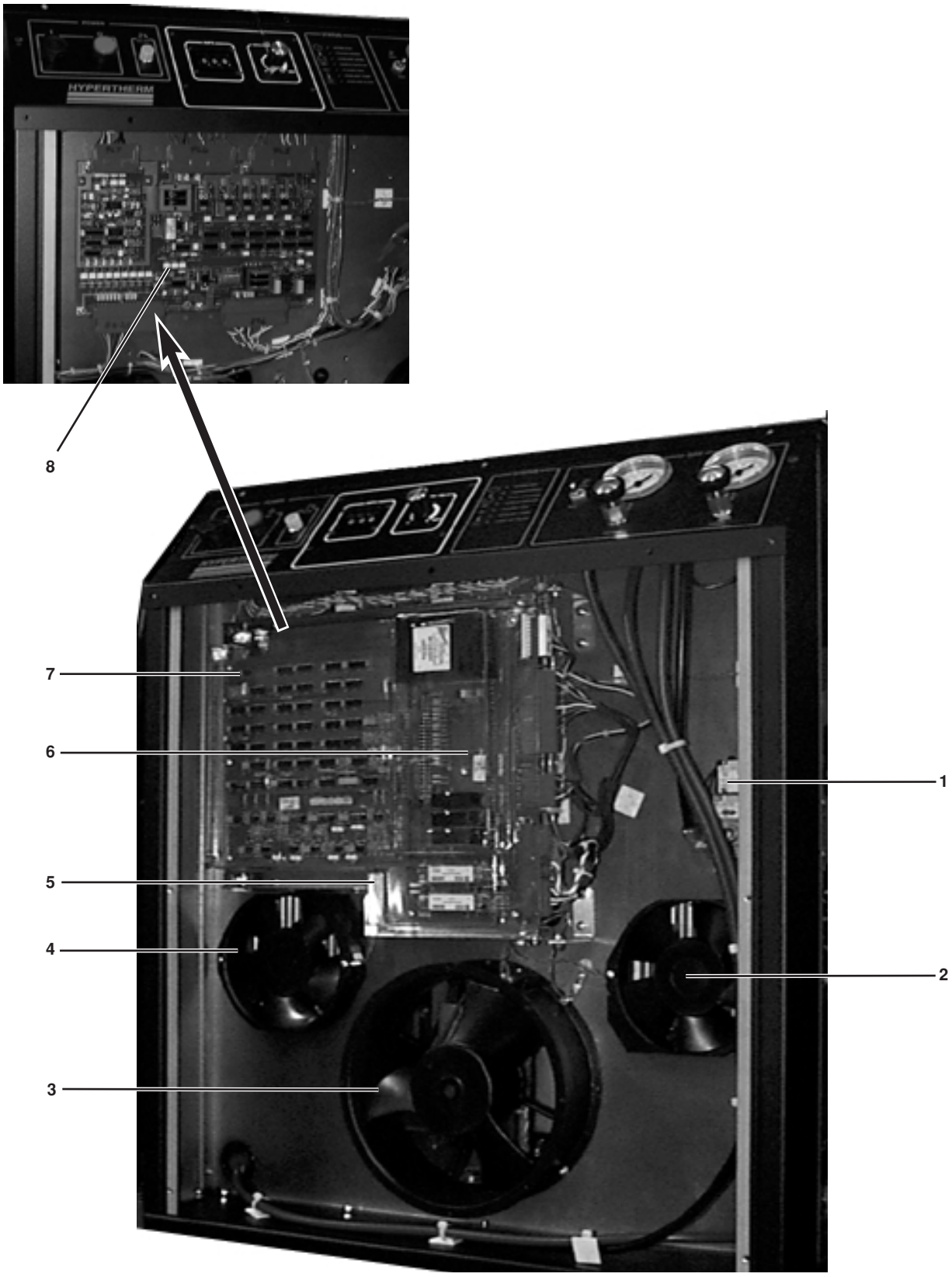


Figure 6-2 Power Supply – Front View

Item	Part Number	Description	Designator	Qty.
	029315	**P/O Shield Gas Supply SA**		
1	006032	Valve, solenoid, shield gas	V2	1
	*, **	**P/O Power Supply Assy**		
2	027080	Fan, 225 CFM, 120 VAC, 50/60 Hz	M2	1
3	027079	Fan, 450-550 CFM, 120 VAC, 50/60 Hz	M4	1
4	027080	Fan, 225 CFM, 120 VAC, 50/60 Hz	M3	1
5	029303*	**P/O THC SA**		1
6	041151*	PCB, THC motherboard	PCB9	1
7	041186*	PCB, SA-THC	PCB10	1
	*, **	**P/O Power Supply Assy**		
8	041143	PCB, control	PCB7	1
	001566***	Panel, MAX200 front filter		1
	001567***	Cover, MAX200 front filter panel		1
	027441***	Filter, 24 X 24 X 2 fiberglass air		1

* Power Supplies with THC – 073020, 073021, 073022, 073023, 073024 and 073213 (CE)

** Power Supplies without THC – 073002, 073003, 073004, 073005, 073026 and 073200 (CE)

*** Items not shown in Figure 6-2. Refer to MAX200 Service Manual IM-162 (801620), Section 3, *Routine Maintenance* to check and replace filter.

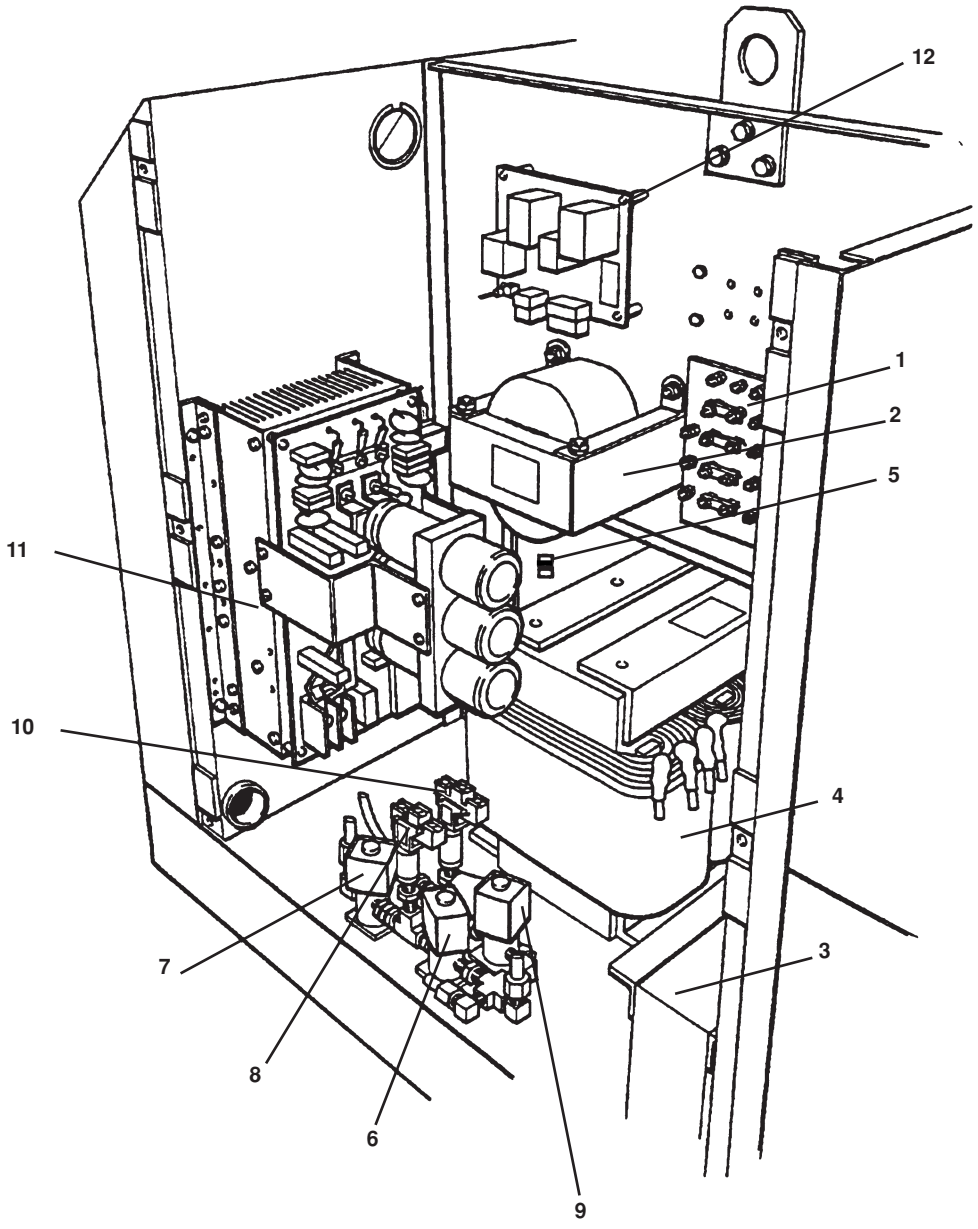


Figure 6-3 Power Supply – Right Side, Front View

Item	Part Number	Description	Designator	Qty.
	*, **	**P/O Power Supply Assy**		
1	029359	Linkboard SA (240/480V models only)	LB1	1
2	014079	Trans, control, 208/240/480V, 1Ø, 60 Hz	T1	1
	014081	Trans, control, 220/380/400/415V, 3Ø, 50 Hz	T1	1
	014083	Trans, control, 600V, 3Ø, 60 Hz	T1	1
	014101	Trans, control, 200V, 3Ø, 60 Hz	T1	1
3	014080	Inductor, 4 mh, 100 Amps, DC	L1	1
4	014078	Trans, 30 kw, 240/480V, 3Ø, 60 Hz	T2	1
	014088	Trans, 30 kw, 220/380/400/415V, 3Ø, 50 Hz	T2	1
	014082	Trans, 30 kw, 600V, 3Ø, 60 Hz	T2	1
	014097	Trans, 30 kw, 208V, 3Ø, 60 Hz	T2	1
	014100	Trans, 30 kw, 200V, 3Ø, 60 Hz	T2	1
◊5	005102	Thermostat, 160°C, 6 Amp	TS1	1
	029314	**P/O Plasma Gas Supply SA**		
6	006014	Valve, solenoid	V3	1
7	006014	Valve, solenoid	V1	1
8	005235	Switch, pressure, 0-90 psi	PS1	1
9	006014	Valve, solenoid	V9	1
10	005239	Switch, pressure, 0-90 psi	PS4	1
11	129118	**Chopper SA, CH130 CE/LVD**	CH1	**1**
	005199	Switch, temperature 82° C	TSW1	1
	*, **	**P/O Power Supply Assy**		
12	041534	PCB, power distribution	PCB6	1
	008322	Fuse, Amp., 250 VAC		1

◊ Connector to thermostat is shown. Thermostat is in transformer.

* Power Supplies with THC – 073020, 073021, 073022, 073023, 073024 and 073213 (CE)

** Power Supplies without THC – 073002, 073003, 073004, 073005, 073026 and 073200 (CE)

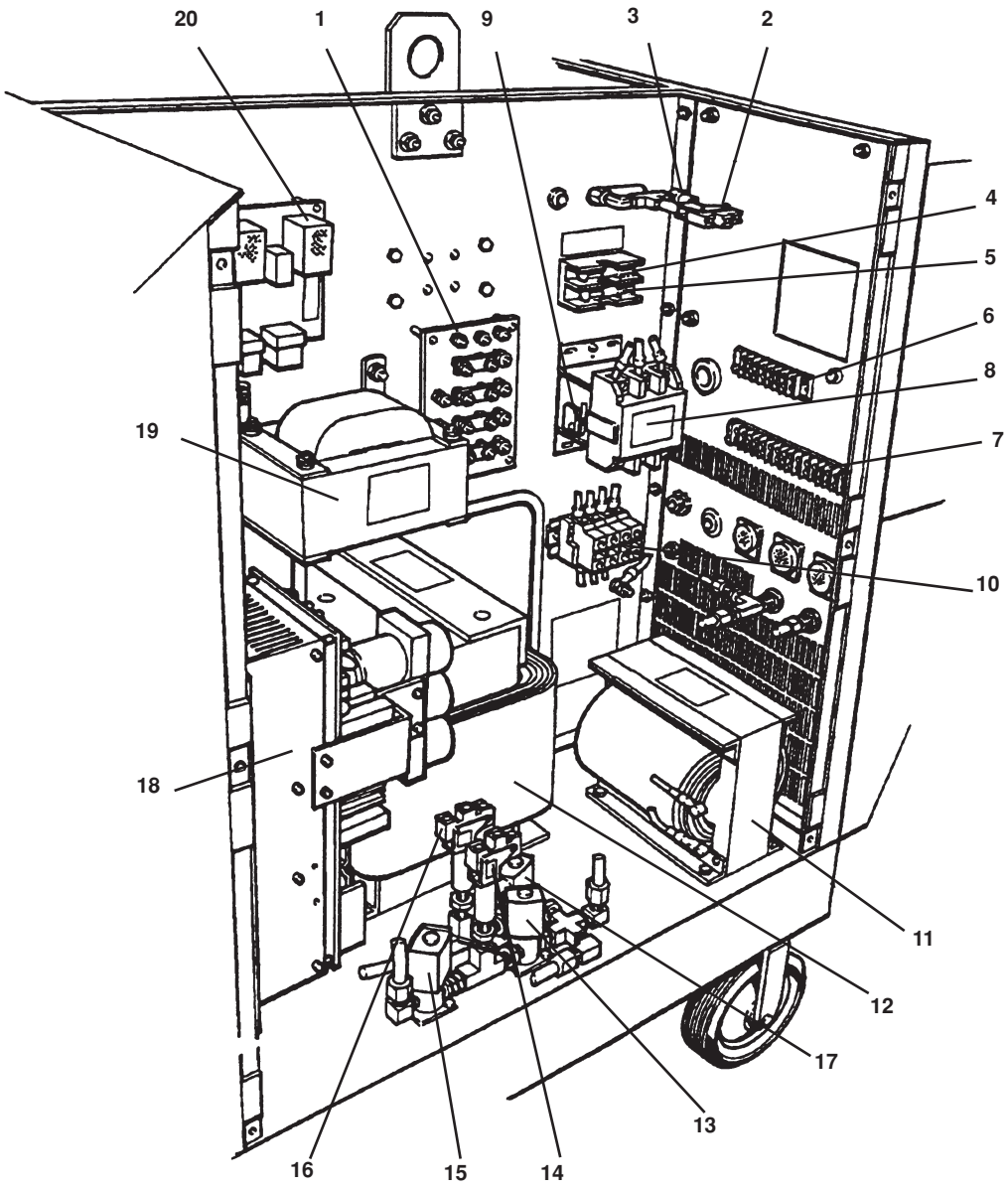


Figure 6-4 Power Supply – Right Side, Rear View

Item	Part Number	Description	Designator	Qty.
	*, **	**P/O Power Supply Assy**		
1	029359	Linkboard SA (240/480V models only**)**	LB1	1
	029315	**P/O Shield Gas Supply SA**		
2	005233	Switch, pressure, 0-90 psi	PS2	1
3	006037	Valve, solenoid	V4	1
	*, **	**P/O Power Supply Assy**		
4	008551	Fuse, 7.5 Amp, 600V	F1	1
5	008551	Fuse, 7.5 Amp, 600V	F2	1
6	008073	Terminal strip (8)	TB4	1
7	008134	Terminal strip (16)	TB3	1
8	003092	Contactor, 90 Amp, 3-pole, 24 VAC	CON1	1
9	003093	Switch, aux contactor	SW2	1
10	029316	Terminal block, power SA	TB1	1
11	014080	Inductor, 4 mh, 100 Amps, DC	L1	1
12	014078	Trans, 30 kw, 240/480V, 3Ø, 60 Hz	T2	1
	014088	Trans, 30 kw, 220/380/400/415V, 3Ø, 50 Hz	T2	1
	014082	Trans, 30 kw, 600V, 3Ø, 60 Hz	T2	1
	014097	Trans, 30 kw, 208V, 3Ø, 60 Hz	T2	1
	014100	Trans, 30 kw, 200V, 3Ø, 60 Hz	T2	1
	029314	**P/O Plasma Gas Supply SA**		
13				
14				
15		**See Figure 6-3.**		
16				
17				
18	129118	**Chopper SA, CH130 CE/LVD**	CH1	**1**
	005199	Switch, temperature 82° C	TSW1	1
	*, **	**P/O Power Supply Assy**		
19	014079	Trans, control, 208/240/480V, 1Ø, 60 Hz	T1	1
	014081	Trans, control, 220/380/400/415V, 3Ø, 50 Hz	T1	1
	014083	Trans, control, 600V, 3Ø, 60 Hz	T1	1
	014101	Trans, control, 200V, 3Ø, 60 Hz	T1	1
20	041534	PCB, power distribution	PCB6	1
	008322	Fuse, Amp., 250 VAC		1

* Power Supplies with THC – 073020, 073021, 073022, 073023, 073024 and 073213 (CE)

** Power Supplies without THC – 073002, 073003, 073004, 073005, 073026 and 073200 (CE)

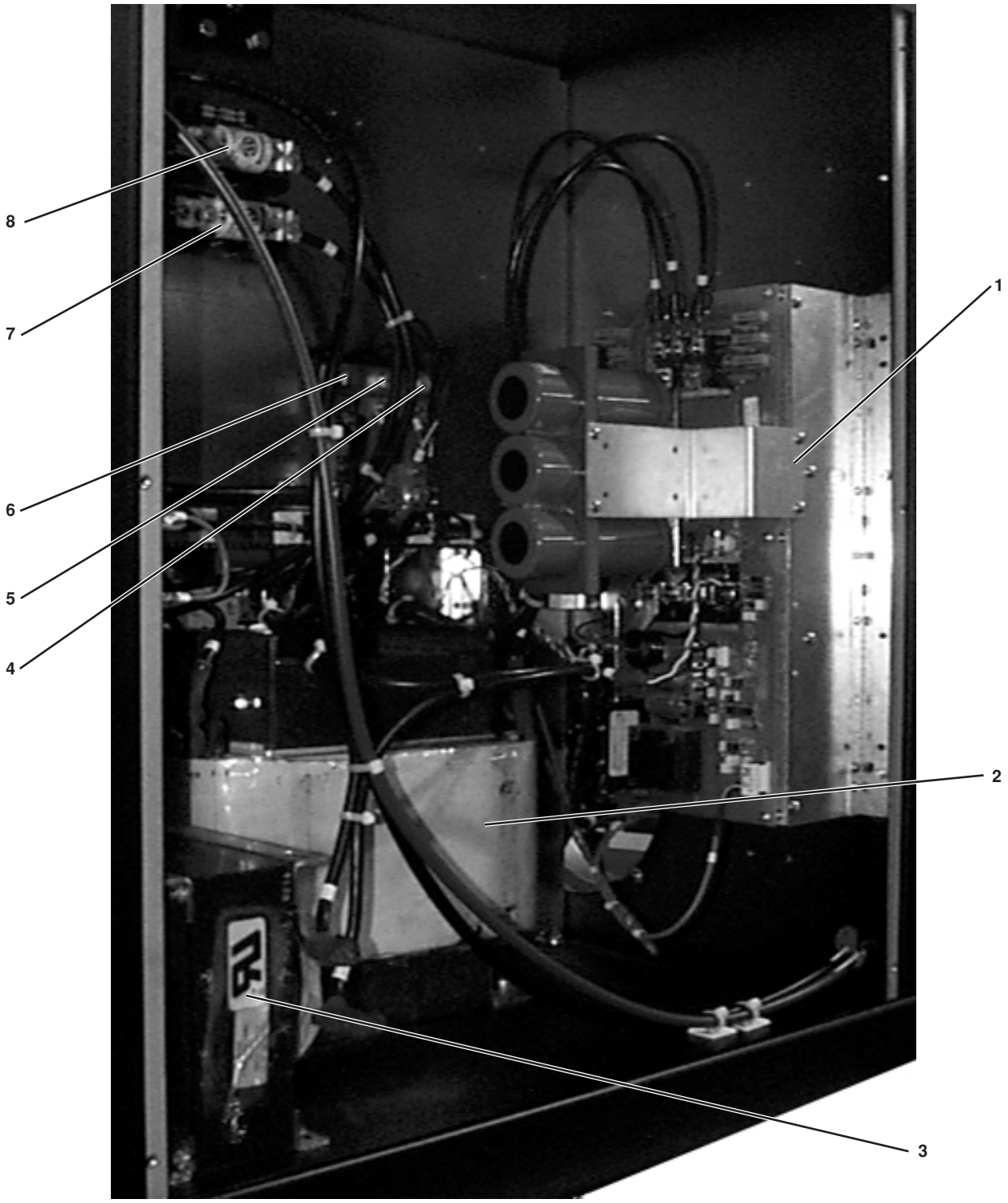


Figure 6-5 Power Supply – Left Side, Front View

Item	Part Number	Description	Designator	Qty.
1	129118	**Chopper SA, CH130 CE/LVD**	CH2	**1**
	005199	Switch, temperature 82° C	TSW2	1
	*, **	**P/O Power Supply Assy**		
	005102	Thermostat, 160°C, 6 Amp	TS1	1
2	014078	Trans, 30 kw, 240/480V, 3Ø, 60 Hz	T2	1
	014088	Trans, 30 kw, 220/380/400/415V, 3Ø, 50 Hz	T2	1
	014082	Trans, 30 kw, 600V, 3Ø, 60 Hz	T2	1
	014097	Trans, 30 kw, 208V, 3Ø, 60 Hz	T2	1
	014100	Trans, 30 kw, 200V, 3Ø, 60 Hz	T2	1
3	014080	Inductor, 4 mh, 100 Amps, DC	L2	1
4	007022	Shunt, 100 Amp, 100 mv	R2	1
5	007022	Shunt, 100 Amp, 100 mv	R1	1
6	007024	Shunt, 200 Amp, 100 mv	R3	1
7	008317	Fuse, semiconductor, 125 Amp, 250 V	F4	1
8	008317	Fuse, semiconductor, 125 Amp, 250 V	F3	1
	128236	Phase loss detection upgrade kit		1

* Power Supplies with THC – 073020, 073021, 073022, 073023, 073024 and 073213 (CE)

** Power Supplies without THC – 073002, 073003, 073004, 073005, 073026 and 073200 (CE)

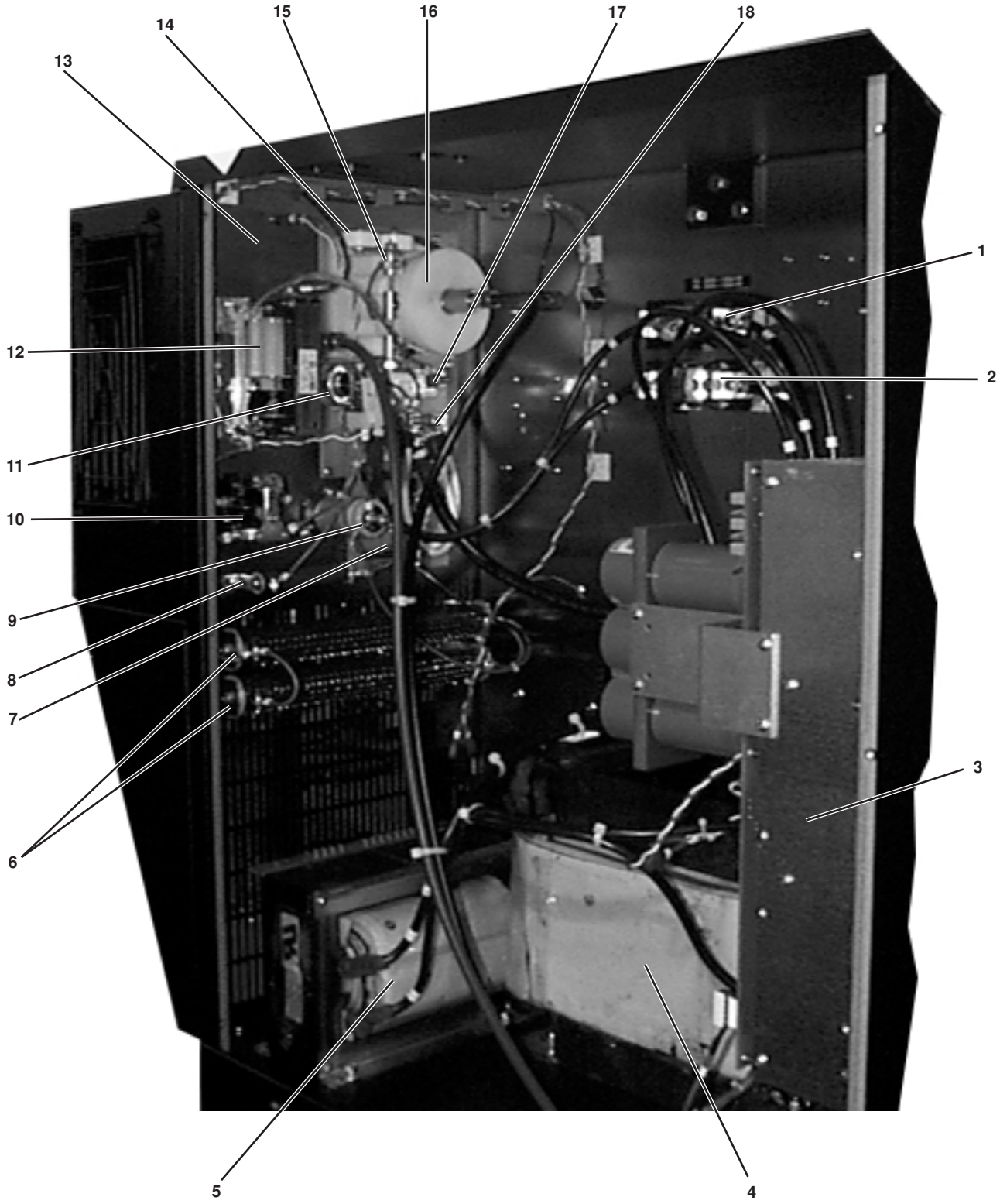


Figure 6-6 Power Supply – Left Side, Rear View

Item	Part Number	Description	Designator	Qty.
	*, **	**P/O Power Supply Assy**		
1	008317	Fuse, semiconductor, 125 Amp, 250 V	F3	1
2	008317	Fuse, semiconductor, 125 Amp, 250 V	F4	1
3	129118	**Chopper SA, CH130 CE/LVD**	CH2	**1**
	005199	Switch, temperature 82° C	TSW2	1
	*, **	**P/O Power Supply Assy**		
4	014078	Trans, 30 kw, 240/480V, 3Ø, 60 Hz	T2	1
	014088	Trans, 30 kw, 220/380/400/415V, 3Ø, 50 Hz	T2	1
	014082	Trans, 30 kw, 600V, 3Ø, 60 Hz	T2	1
	014097	Trans, 30 kw, 208V, 3Ø, 60 Hz	T2	1
	014100	Trans, 30 kw, 200V, 3Ø, 60 Hz	T2	1
5	014080	Inductor, 4 mh, 100 Amps, DC	L2	1
6	009684	Resistor, 4 Ohm, 420 W	R6	2
7	009015	Resistor, 10 K Ohm, 10 W	R5	1
8	009438	Resistor, 5 Ohm, 50 W	R4	1
9	009506	Capacitor, elec, 250 uf, 350 VDC	C9	1
10	003021	Relay, 120 VAC	CR1	1
	029314	**P/O Plasma Gas Supply SA**		
11	005228	Switch, pressure, SPDT, 0-15 psi	PS3	1
	*, **	**P/O Power Supply Assy**		
12	029317	Transformer, High Voltage SA	T5	1
13	008479	Terminal strip, quick connect	TB2	1
14	029312	**High Freq Input/Output Panel SA**		1
15	009350	Assembly, spark gap	SG1	1
16	009349	Assembly, coil, high frequency	T6	1
17	041145	PCB, input/output	PCB5	1
18	029202	Sensor, current	CS1	1

* Power Supplies with THC – 073020, 073021, 073022, 073023, 073024 and 073213 (CE)

** Power Supplies without THC – 073002, 073003, 073004, 073005, 073026 and 073200 (CE)

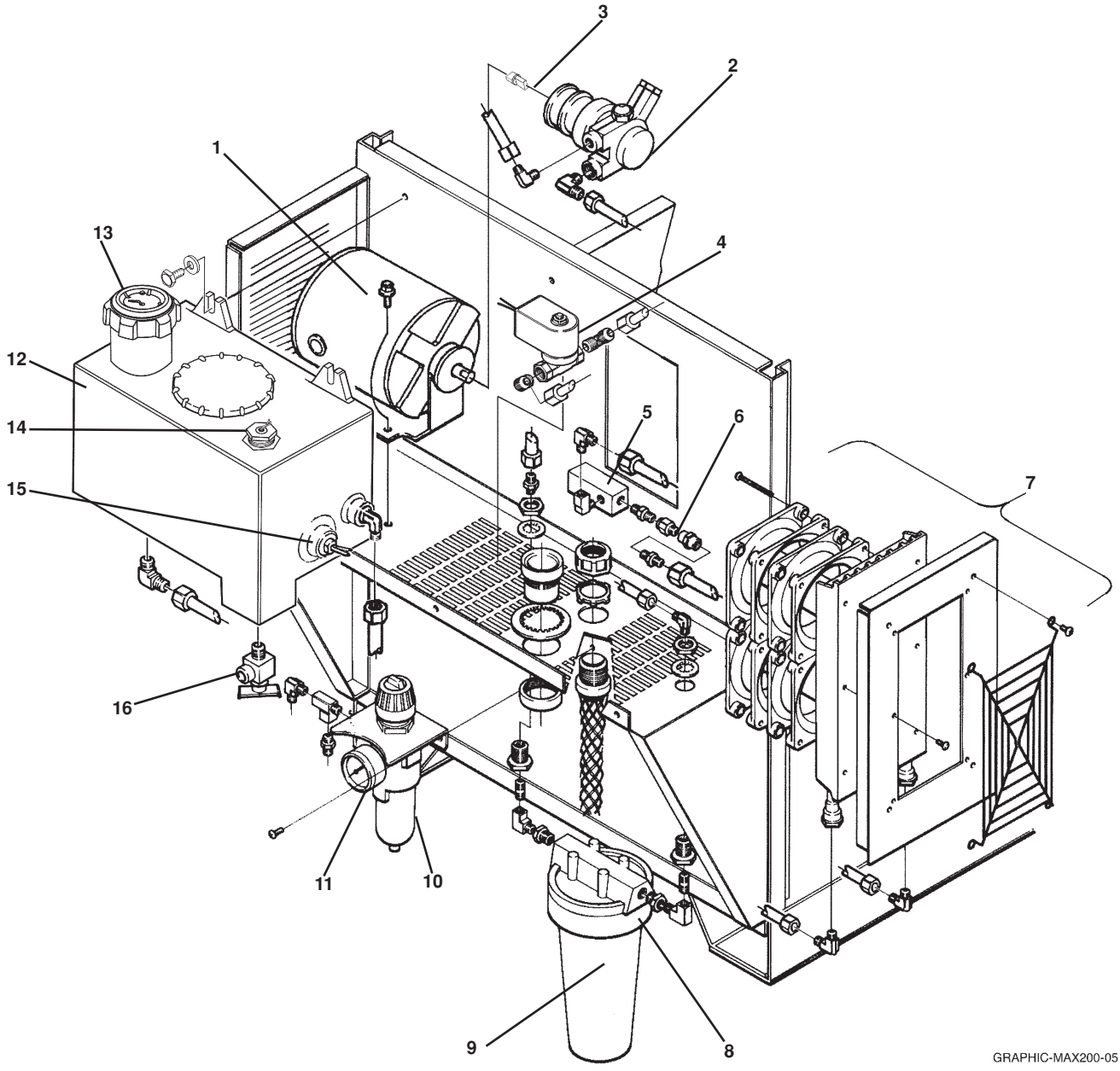


Figure 6-7 Power Supply – Rear View

Item	Part Number	Description	Designator	Qty.
	129252	**Pump Motor Subassembly**		**1**
1	128385	Kit, Replacement Motor, 1/3 HP	M1	1
2	128384	Kit, Replacement Pump, 70 GPH		1
3	031122	Drive Coupling, Pump to motor		1
	129383	**Valve Subassembly (w/ elec connectors)**		**1**
4	006046	Valve, Sol 240V 3/8 NPT NC	V7	1
	029361	**Flowswitch Subassembly (w/ elec connector)**		**1**
5	005119	Flowswitch, 0.5 GPM	FS1	1
6	006053	Valve, Check 1/3 PSI, 1/4 NPTM		1
7	027136	Heat Exchanger, Water/Air	MX1	1
8	027139	Filter Housing, 10" X 3/8 NPT		1
9	027005	Filter, Element		1
10	011025	Filter Regulator		1
11	011027	Gauge, High Press (for 011025)		1
12	002304	Reservoir, coolant		1
13	022036	Gauge, liquid level		1
14	129618	Level Switch Subassembly, 1/2 NPT	LS1	1
15	029323	Temp Switch Subassembly, 162 Deg F	TS2	1
16	006099	Bib drain valve 1/4 NPT		1

Recommended Spare Parts

Power Supply

Part Number	Description	Designator
005044	Switch, toggle SPDT	S1
005121	Pushbutton, green, illmn.	PB1
005122	Pushbutton, red, extended	PB2
005088	Holder, lamp	-
005168	Bulb, 28VDC	-
005089	Lens, white	-
009604	Resistor, variable, 100 K, 1 turn	R9
027080	Fan, 225 CFM, 120 VAC, 50/60 Hz	M2
027079	Fan, 450-550 CFM, 120 VAC, 50/60 Hz	M4
027080	Fan, 225 CFM, 120 VAC, 50/60 Hz	M3
041151*	PCB, THC motherboard	PCB10
041186*	PCB, SA-THC	PCB9
041143	PCB, Control	PCB7
005102	Thermostat, 160°C, 6 Amp	TS1
006014	Valve, solenoid	V1
005093	Switch, pressure, 0-90 psi	PS1
129118	Chopper SA, CH130 CE/LVD	CH1/CH2
009384	Diode, 85 Amp, 1000V, fwd polarity	D1, D2, D3
009385	Diode, 85 Amp, 1000V, rev polarity	D4, D5, D6
041534	PCB, power distribution	PCB6
008322	Fuse, Amp., 250 VAC	-
008317	Fuse, semiconductor, 125 Amp, 250 V	F3, F4
003021	Relay, 120 VAC	CR1
005130	Switch, pressure, SPDT, 0-15 psi	PS3
029317	Transformer, High Voltage SA	T5
029202	Sensor, current	CS1
006045	Valve, solenoid, coolant return	V8
027005	Filter, coolant, deionizing	-
011025	Filter/regulator	FR1
011031	Filter Element (used with 011025)	
011027	Gauge, high pressure	-
029325	Coolant Pump SA	-
029323	Switch, water temperature, 162°F	TS2
029326	Switch, level	LS1
029361	Switch, flow, 0.5 gpm	FS1
028872	Coolant, propylene glycol 30%/ deionized water 70% (standard mixture)	
028873	Coolant, propylene glycol 100%	

* Power Supplies with THC

Recommended Spare Parts (cont.)

Machine Torch and Torch Leads

Part Number	Description	Designator
120584	Torch Main Body	-
028454	Shielded torch lead, 10 ft.	-
028455	Shielded torch lead, 15 ft.	-
028456	Shielded torch lead, 20 ft.	-
028383	Shielded torch lead, 25 ft.	-
028457	Shielded torch lead, 30 ft.	-
028458	Shielded torch lead, 35 ft.	-
028459	Shielded torch lead, 40 ft.	-
028460	Shielded torch lead, 45 ft.	-
028384	Shielded torch lead, 50 ft.	-
028773	Shielded torch lead, 60 ft.	-
028599	Shielded torch lead, 75 ft.	-
028781	Shielded torch lead, 100 ft.	-
028782	Shielded torch lead, 125 ft.	-
028783	Shielded torch lead, 150 ft.	-

MAX200 Consumables, Torch Assembly and Torch Leads

MAX200 Machine Torch Consumables (see figure 6-8)

		Part Numbers				
Plasma Gas/ Shield Gas	**Nozzle Type (Amps)**	**Shield**	**Retaining Cap**	**Nozzle**	**Swirl Ring**	**Electrode**
Air/Air	**200**	020424	120837	020608	020607	220021
	100	020448	120837	020611	020607	120547
	40	020688	020423	020689	020613	220021
	200 gouging	020485	020423	020615	020607	220021
O_2/Air	**200**	020424	120837	020605	020604	220021
	100	020448	120837	020616	020617	120547
H35/N_2	**200**	020602	120837	020608	020607	020415
	100	020448	120837	020611	020607	020415
	200 gouging	020485	020423	020615	020607	020415
N_2/CO_2	**200**	020424	120837	020608	020607	020415
N_2/Air	**200**	020424	120837	020608	020607	020415
		Beveling Consumables				
O_2/Air	**200 beveling**	120260	020423	120259	120833	120258
				Water Tube 120257		
		Consumables Used with MAX200 Water-Muffler				
Air/Air	**200**	020566	020423	020608	020607	220021
	100	020618	020423	020611	020607	120547
O_2/Air	**200**	020566	020423	020605	020604	220021
	100	020618	020423	020616	020617	120547
N_2/CO_2	**200**	020566	020423	020608	020607	020415
N_2/Air	**200**	020566	020423	020608	020607	020415

Consumable Configurations

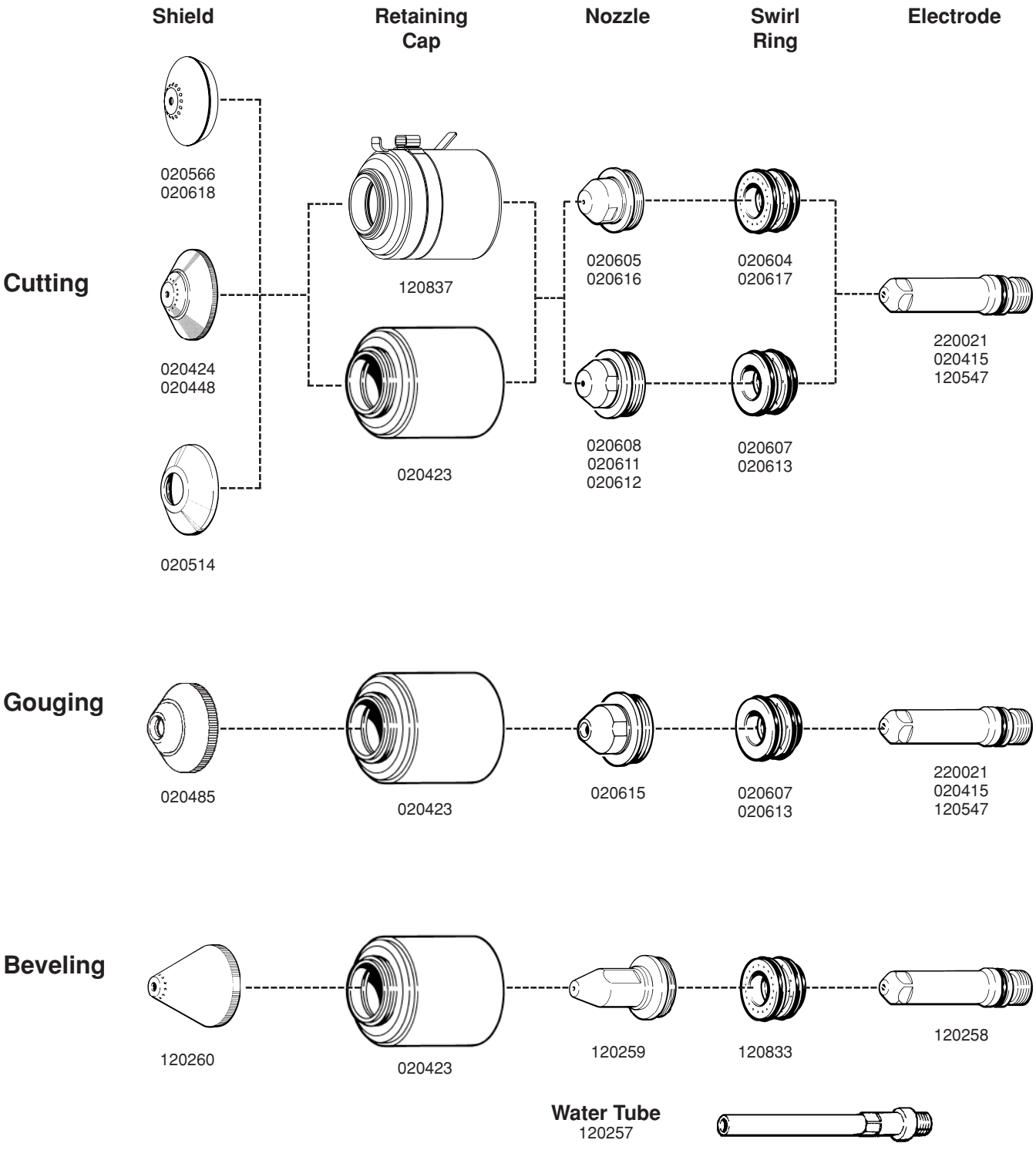


Figure 6-8 MAX200 Machine Torch Consumable Parts

Consumable Parts Kits

Consumable Parts Kit (028392)

Part #	Description	Quantity
001067	Enclosure, Consumable Parts Kit	1
015015	Adapter 90, 1/4 NPT x #6	1
015193	Cap, #6 JIC	1
220021	Electrode, Air/Oxygen	5
020415	Electrode, Nitrogen/H35	5
120837	Cap, Shield	1
020424	Shield, Machine 200A	1
020448	Shield, Machine 100A	1
020605	Nozzle, Shield Oxygen, .082	5
020607	Swirl Ring, Air/ Nitrogen/H35	1
020608	Nozzle, Shield 200A, .086 Air/ Nitrogen/H35	5
020604	Swirl Ring, Oxygen	1
020611	Nozzle, Shield 100A, .059 Air	3
020616	Nozzle, 100A, .055 Oxygen	3
020617	Swirl Ring, 100A, Oxygen	1
027055	Lubricant, Silicon, 1/4 Oz. Tube	1
027194	Wrench, Nozzle, 3/4"	1
044027	O-Ring	2
027347	Tool, Water Tube Removal	1
120547	Electrode,Air/Oxygen	3
020963	Tube, Water	1

Consumable Parts Kit, International (028429)

Part #	Description	Quantity
001067	Enclosure, Consumable Parts Kit	1
015015	Adapter 90, 1/4 NPT x #6	1
220021	Electrode, Air/Oxygen	5
020415	Electrode, Nitrogen/H35	5
020423	Cap, Shield	1
020424	Shield, Machine 200A	1
020448	Shield, Machine 100A	1
020605	Nozzle, Shield Oxygen, .082	5
020607	Swirl Ring, Air/ Nitrogen	1
020608	Nozzle, Shield 200A, .086	5
020604	Swirl Ring, Oxygen	1
020611	Nozzle, Shield 100A, .059	3
020613	Swirl Ring, 40A	1
020688	Shield, MAX200/HT2000 40A	1
020689	Nozzle, MAX200/HT2000 40A	5
027055	Lubricant, Silicon, 1/4 Oz. Tube	1
027194	Wrench, Nozzle, 3/4"	1
044027	O-Ring	2
027347	Tool, Water Tube Removal	1
120547	Electrode,Air/Oxygen	3

MAX200 Machine Torch Assembly with 1.75" diameter Torch Body and 2" diameter Sleeve (Standard)

Item	Part Number	Description	Qty.
	128380	**MAX200 Machine Torch Assembly**	**1**
1	120894	Sleeve, Insul, MAX200 Mach, 2.0" diameter	1
2	**120584**	**MAX200 Machine Torch Main Body**	**1**
3	020536	Lead insulator 9/16 X 2.5 Tef	1
4	044027	O-ring, Buna-N	1

The following consumables are part of the MAX200 Machine Torch Assembly.
See Figure 6-8 for details.

020424	Shield, MAX200 Mch 200A	1
120837	Cap, Nozzle Retaining, MAX200	1
020608	Nozzle MAX200 200A .086 Air/N2/H35	1
020607	Swirl ring, MAX200 Air/N2/H35	1
220021	Electrode, MAX200 Air O/2	1

* 020407 Adapter not required if using 020431 1.75" diameter sleeve.

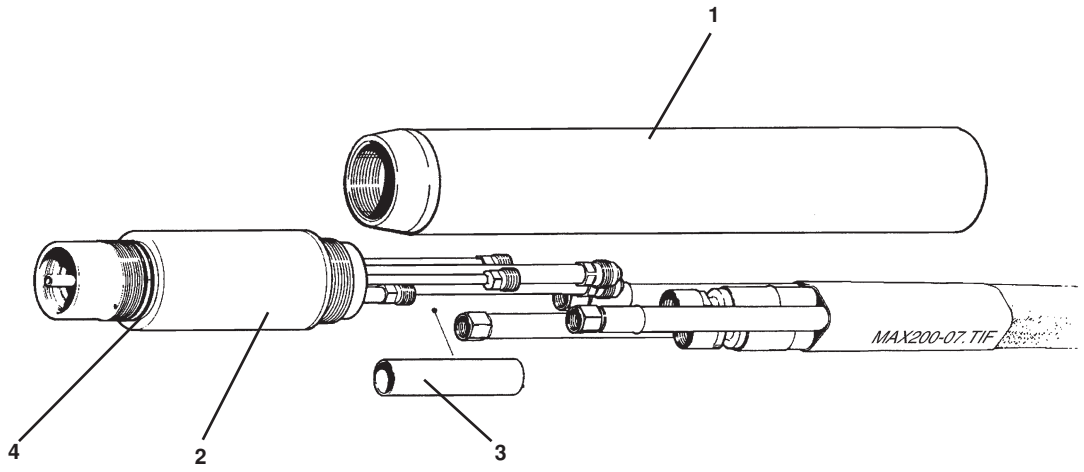


Figure 6-9 MAX200 Machine Torch Assembly (Standard)

MAX200 Machine Torch Assembly with 2" Stainless Steel Torch Body and 2" diameter Sleeve (Optional)

Item	Part Number	Description	Qty.
	128365	**MAX200 Machine Torch Assembly**	**1**
1	020041	Sleeve, Insul, MAX200 Mach, 2.0" diameter	1
2	**120356**	**MAX200 Machine Torch Main Body**	**1**
3	020536	Lead insulator 9/16 X 2.5 Tef	1
4	044027	O-ring, Buna-N	1

The following consumables are part of the MAX200 Machine Torch Assembly.
See Figure 6-8 for details.

020424	Shield, MAX200 Mch 200A	1
020423	Cap, Nozzle Retaining, MAX200	1
020608	Nozzle MAX200 200A .086 Air/N2/H35	1
020607	Swirl ring, MAX200 Air/N2/H35	1
220021	Electrode, MAX200 Air O/2	1

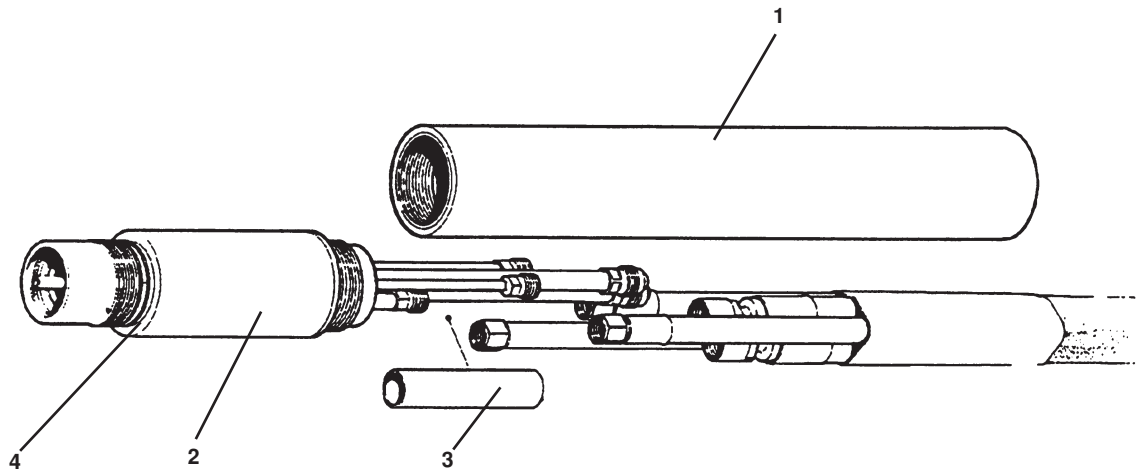


Figure 6-9.1 MAX200 Machine Torch Assembly (Optional)

MAX200 Machine Torch Assembly with 1.75" diameter Torch Body and 1.75" diameter Sleeve (Optional)

Item	Part Number	Description	Qty.
	128364	**MAX200 Machine Torch Assembly**	**1**
1	020431	Sleeve, Insul, MAX200 Mach, 1.75" diameter	1
2	**120584**	**MAX200 Machine Torch Main Body**	**1**
3	020536	Lead insulator 9/16 X 2.5 Tef	1
4	044027	O-ring, Buna-N	1

The following consumables are part of the MAX200 Machine Torch Assembly.
See Figure 6-8 for details.

020424	Shield, MAX200 Mch 200A	1
120837	Cap, Nozzle Retaining, MAX200	1
020608	Nozzle MAX200 200A .086 Air/N2/H35	1
020607	Swirl ring, MAX200 Air/N2/H35	1
220021	Electrode, MAX200 Air O/2	1

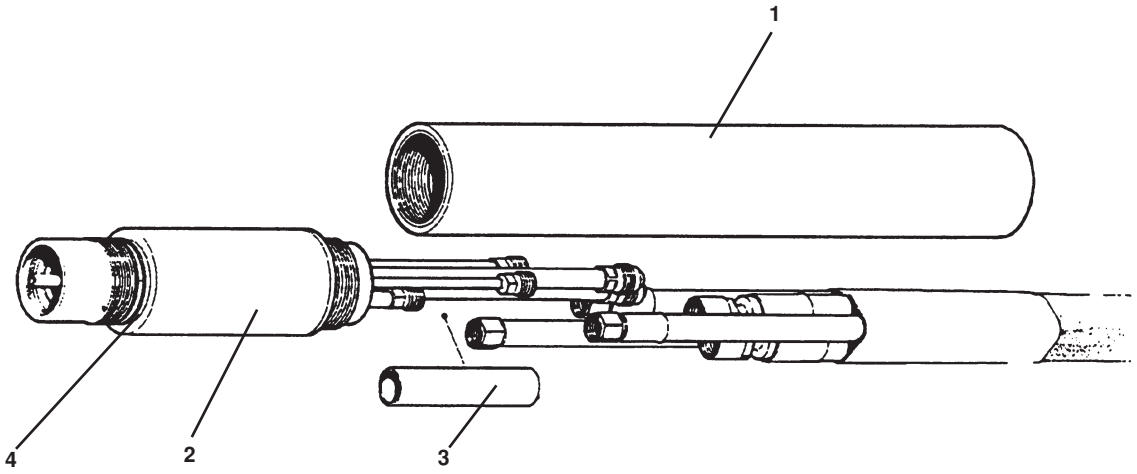


Figure 6-9.2 MAX200 Machine Torch Assembly (Optional)

Machine Torch Lead Assemblies

See Figure 6-10

Part Item	Number	Description	Qty.
	028454	**Shield Torch Lead, 10 Ft.**	1
1	023429	Lead Pilot, Shield Gas, 10 Ft. (blue)	1
2	024216	Lead, Plasma Gas, 10 Ft. (red)	1
3	024221	Lead, Cap Sensor, 10 Ft. (gray)	1
4	023032	Cable, Water Cooled, 10 Ft. (blue- red band)	1
5	023032	Cable, Water Cooled, 10 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4"	1
	028455	**Shield Torch Lead, 15 Ft.**	1
1	023430	Lead Pilot, Shield Gas, 15 Ft. (blue)	1
2	024217	Lead, Plasma Gas, 15 Ft. (red)	1
3	024222	Lead, Cap Sensor, 15 Ft. (gray)	1
4	023034	Cable, Water Cooled, 15 Ft. (blue- red band)	1
5	023034	Cable, Water Cooled, 15 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1
	028456	**Shield Torch Lead, 20 Ft.**	1
1	023431	Lead Pilot, Shield Gas, 20 Ft. (blue)	1
2	024228	Lead, Plasma Gas, 20 Ft. (red)	1
3	024223	Lead, Cap Sensor, 20 Ft. (gray)	1
4	023012	Cable, Water Cooled, 20 Ft. (blue- red band)	1
5	023012	Cable, Water Cooled, 20 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Machine Torch Lead Assemblies (continued)

See Figure 6-10

Part Item	Number	Description	Qty.
	028383	**Shield Torch Lead, 25 Ft.**	1
1	023326	Lead Pilot, Shield Gas, 25 Ft. (blue)	1
2	024194	Lead, Plasma Gas, 25 Ft. (red)	1
3	024192	Lead, Cap Sensor, 25 Ft. (gray)	1
4	023013	Cable, Water Cooled, 25 Ft. (blue- red band)	1
5	023013	Cable, Water Cooled, 25 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4"	1
	028457	**Shield Torch Lead, 30 Ft.**	1
1	023432	Lead Pilot, Shield Gas, 30 Ft. (blue)	1
2	024229	Lead, Plasma Gas, 30 Ft. (red)	1
3	024224	Lead, Cap Sensor, 30 Ft. (gray)	1
4	023014	Cable, Water Cooled, 30 Ft. (blue- red band)	1
5	023014	Cable, Water Cooled, 30 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1
	028458	**Shield Torch Lead, 35 Ft.**	1
1	023433	Lead Pilot, Shield Gas, 35 Ft. (blue)	1
2	024218	Lead, Plasma Gas, 35 Ft. (red)	1
3	024225	Lead, Cap Sensor, 35 Ft. (gray)	1
4	023015	Cable, Water Cooled, 35 Ft. (blue- red band)	1
5	023015	Cable, Water Cooled, 35 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Machine Torch Lead Assemblies (continued)

See Figure 6-10

Part Item	Number	Description	Qty.
	028459	**Shield Torch Lead, 40 Ft.**	1
1	023434	Lead Pilot, Shield Gas, 40 Ft. (blue)	1
2	024230	Lead, Plasma Gas, 40 Ft. (red)	1
3	024226	Lead, Cap Sensor, 40 Ft. (gray)	1
4	023016	Cable, Water Cooled, 40 Ft. (blue- red band)	1
5	023016	Cable, Water Cooled, 40 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4"	1
	028460	**Shield Torch Lead, 45 Ft.**	1
1	023435	Lead Pilot, Shield Gas, 45 Ft. (blue)	1
2	024231	Lead, Plasma Gas, 45 Ft. (red)	1
3	024227	Lead, Cap Sensor, 45 Ft. (gray)	1
4	023387	Cable, Water Cooled, 45 Ft. (blue- red band)	1
5	023387	Cable, Water Cooled, 45 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1
	028384	**Shield Torch Lead, 50 Ft.**	1
1	023327	Lead Pilot, Shield Gas, 50 Ft. (blue)	1
2	024195	Lead, Plasma Gas, 50 Ft. (red)	1
3	024193	Lead, Cap Sensor, 50 Ft. (gray)	1
4	023199	Cable, Water Cooled, 50 Ft. (blue- red band)	1
5	023199	Cable, Water Cooled, 50 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Machine Torch Lead Assemblies (continued)

See Figure 6-10

Part Item	Number	Description	Qty.
	028773	**Shield Torch Lead, 60 Ft.**	1
1	023515	Lead Pilot, Shield Gas, 60 Ft. (blue)	1
2	024260	Lead, Plasma Gas, 60 Ft. (red)	1
3	024259	Lead, Cap Sensor, 60 Ft. (gray)	1
4	023052	Cable, Water Cooled, 60 Ft. (blue- red band)	1
5	023052	Cable, Water Cooled, 60 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4"	1
	028599	**Shield Torch Lead, 75 Ft.**	1
1	023622	Lead Pilot, Shield Gas, 75 Ft. (blue)	1
2	024319	Lead, Plasma Gas, 75 Ft. (red)	1
3	024318	Lead, Cap Sensor, 75 Ft. (gray)	1
4	023262	Cable, Water Cooled, 75 Ft. (blue- red band)	1
5	023262	Cable, Water Cooled, 75 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Note: Hypertherm does not recommend using torch leads longer than 75 Feet. 100 Ft, 125 Ft. and 150 Ft. leads will cause problems with starting.

	028781	**Shield Torch Lead, 100 Ft.**	1
1	023808	Lead Pilot, Shield Gas, 100 Ft. (blue)	1
2	024416	Lead, Plasma Gas, 100 Ft. (red)	1
3	024413	Lead, Cap Sensor, 100 Ft. (gray)	1
4	023805	Cable, Water Cooled, 100 Ft. (blue- red band)	1
5	023805	Cable, Water Cooled, 100 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

Machine Torch Lead Assemblies (continued)

Note: Hypertherm does not recommend using torch leads longer than 75 Feet. 100 Ft, 125 Ft. and 150 Ft. leads will cause problems with starting.

Part Item	Number	Description	Qty.
	028782	**Shield Torch Lead, 125 Ft.**	1
1	023809	Lead Pilot, Shield Gas, 125 Ft. (blue)	1
2	024417	Lead, Plasma Gas, 125 Ft. (red)	1
3	024414	Lead, Cap Sensor, 125 Ft. (gray)	1
4	023806	Cable, Water Cooled, 125 Ft. (blue- red band)	1
5	023806	Cable, Water Cooled, 125 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1
	028783	**Shield Torch Lead, 150 Ft.**	1
1	023810	Lead Pilot, Shield Gas, 150 Ft. (blue)	1
2	024418	Lead, Plasma Gas, 150 Ft. (red)	1
3	024415	Lead, Cap Sensor, 150 Ft. (gray)	1
4	023807	Cable, Water Cooled, 150 Ft. (blue- red band)	1
5	023807	Cable, Water Cooled, 150 Ft. (blue- green band)	1
6	020536	Lead Insulator, 9/16" ID x 2-1/2"	1
7	046026	Tubing, 1-1/2" ID Shrink Black	1
8	046061	2" ID Tinned Braid	1
9	027015	Ring Compress, Shield Torch Lead	1
10	004080	Collar, Shield Torch Leads	1
11	015090	Clamp, Hose, 1-5/16 - 2-1/4	1

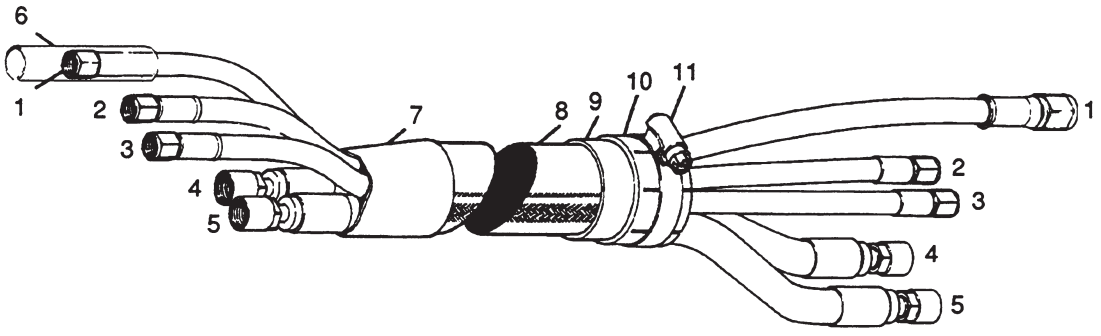


Figure 6-10 Machine Torch Lead Assemblies

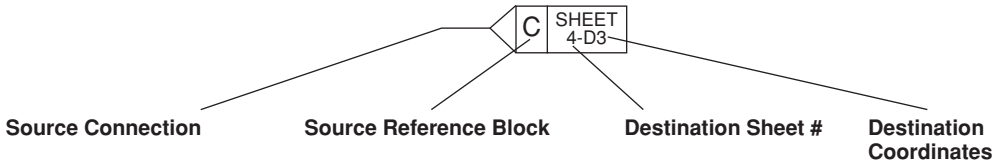
Section 7

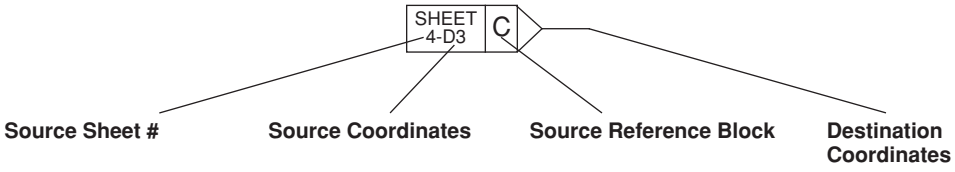
WIRING DIAGRAMS

Introduction

This section contains the wiring diagrams for the MAX200 system. When tracing a signal path or referencing with the **Parts List** or **Troubleshooting** sections, please be aware of the following format to assist you in understanding the wiring diagrams' organization:

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

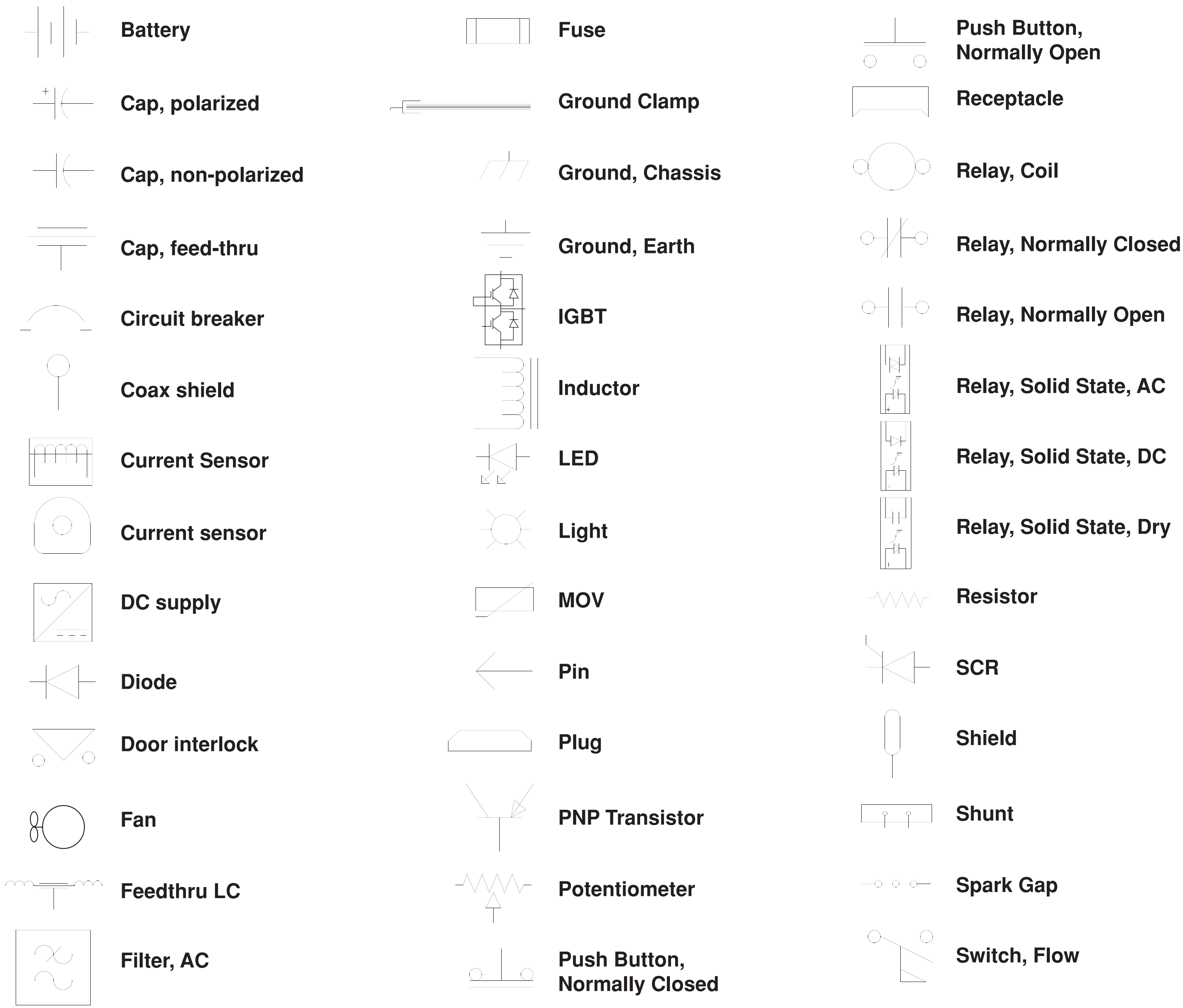


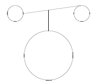


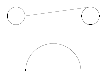
Destination and **Source Coordinates** refer to letters A-D on the Y-axis of each sheet and numbers 1-4 on the X-axis of each sheet. Lining up the coordinates will bring you to the source or destination blocks (similar to a road map).

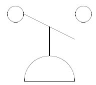
Wiring Diagram Symbols

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

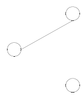

Battery
Cap, polarized
Cap, non-polarized
Cap, feed-thru
Circuit breaker
Coax shield
Current Sensor
Current sensor
DC supply
Diode
Door interlock
Fan
Feedthru LC
Filter, AC
Fuse
Ground Clamp
Ground, Chassis
Ground, Earth
IGBT
Inductor
LED
Light
MOV
Pin
Plug
PNP Transistor
Potentiometer
Push Button, Normally 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

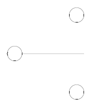

Switch, Level, Normally Closed

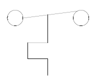

Switch, Pressure, Normally Closed

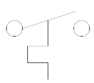

Switch, Pressure, Normally Open

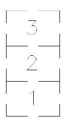

Switch, 1 Pole, 1 Throw


Switch, 1 Pole, 2 Throw

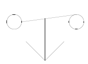

Switch, 1 Pole, 1 Throw, Center Off

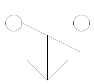

Switch, Temperature, Normally Closed

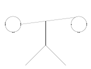

Switch, Temperature, Normally Open

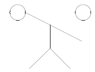


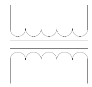
Terminal Block

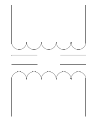

Time Delay Closed, NC/Off

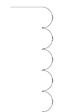

Time Delay Open, NO/Off

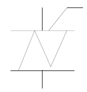

Time Delay Open, NC/On

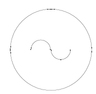

Time Delay Closed, NO/Off

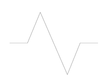

Transformer

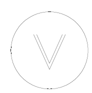

Transformer, Air Core

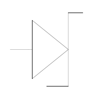

Transformer Coil


Triac

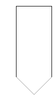

VAC Source

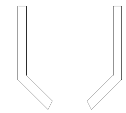

Valve, Solenoid

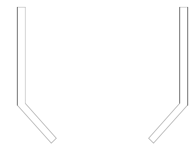

Voltage Source

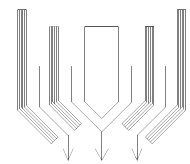

Zener Diode

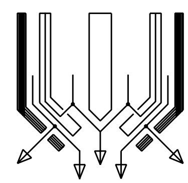
Torch Symbols

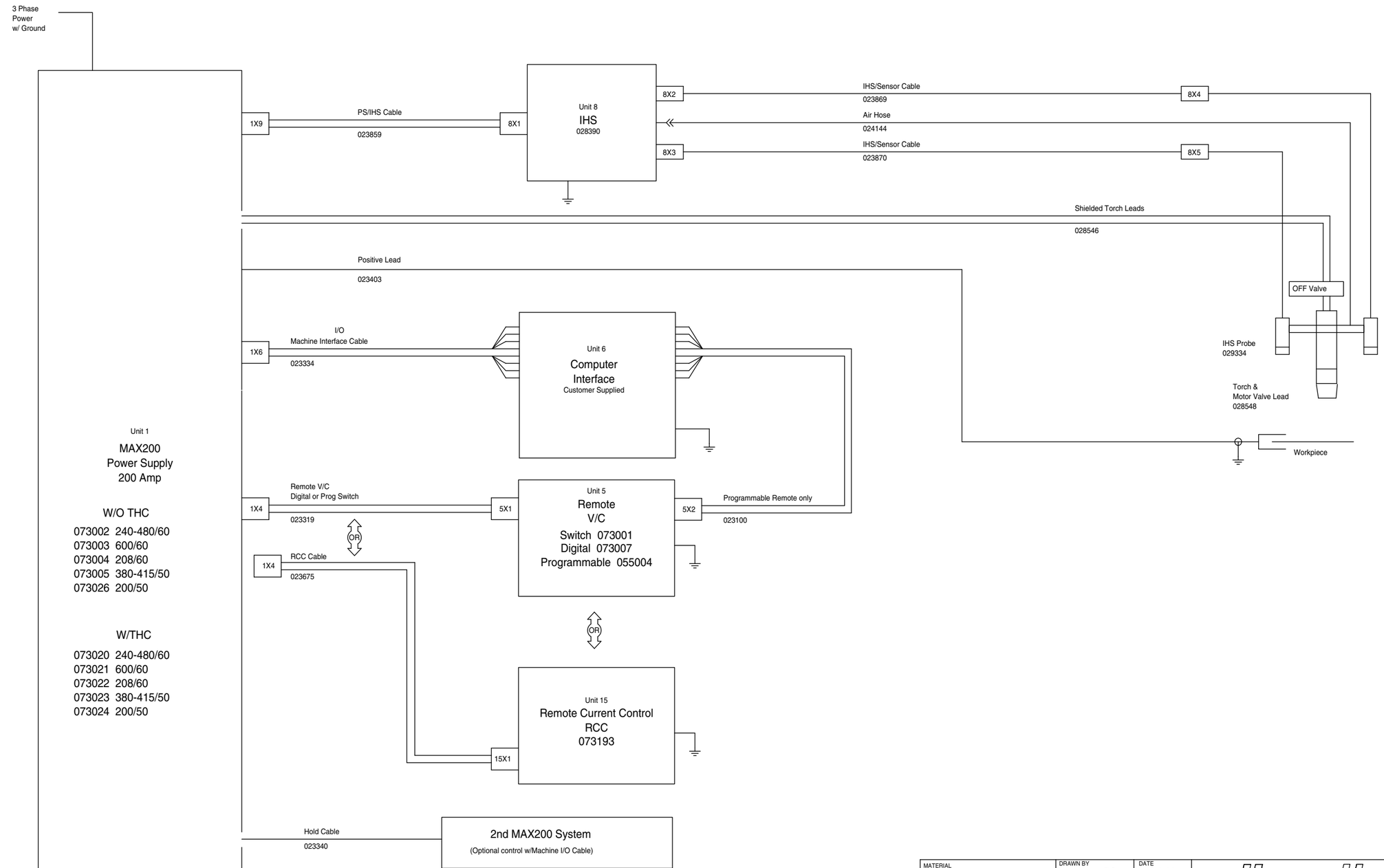

Electrode


Nozzle

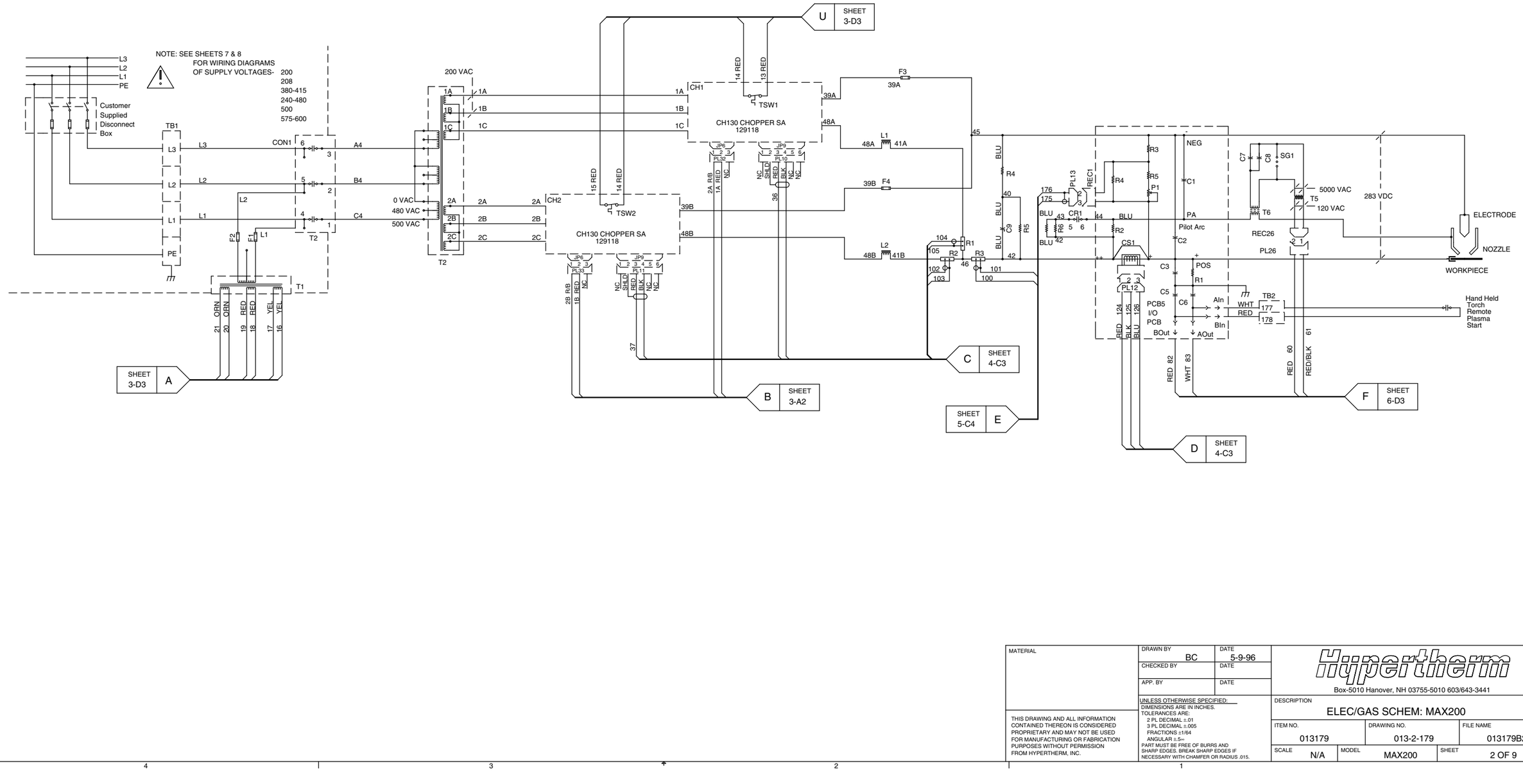

Shield


Torch

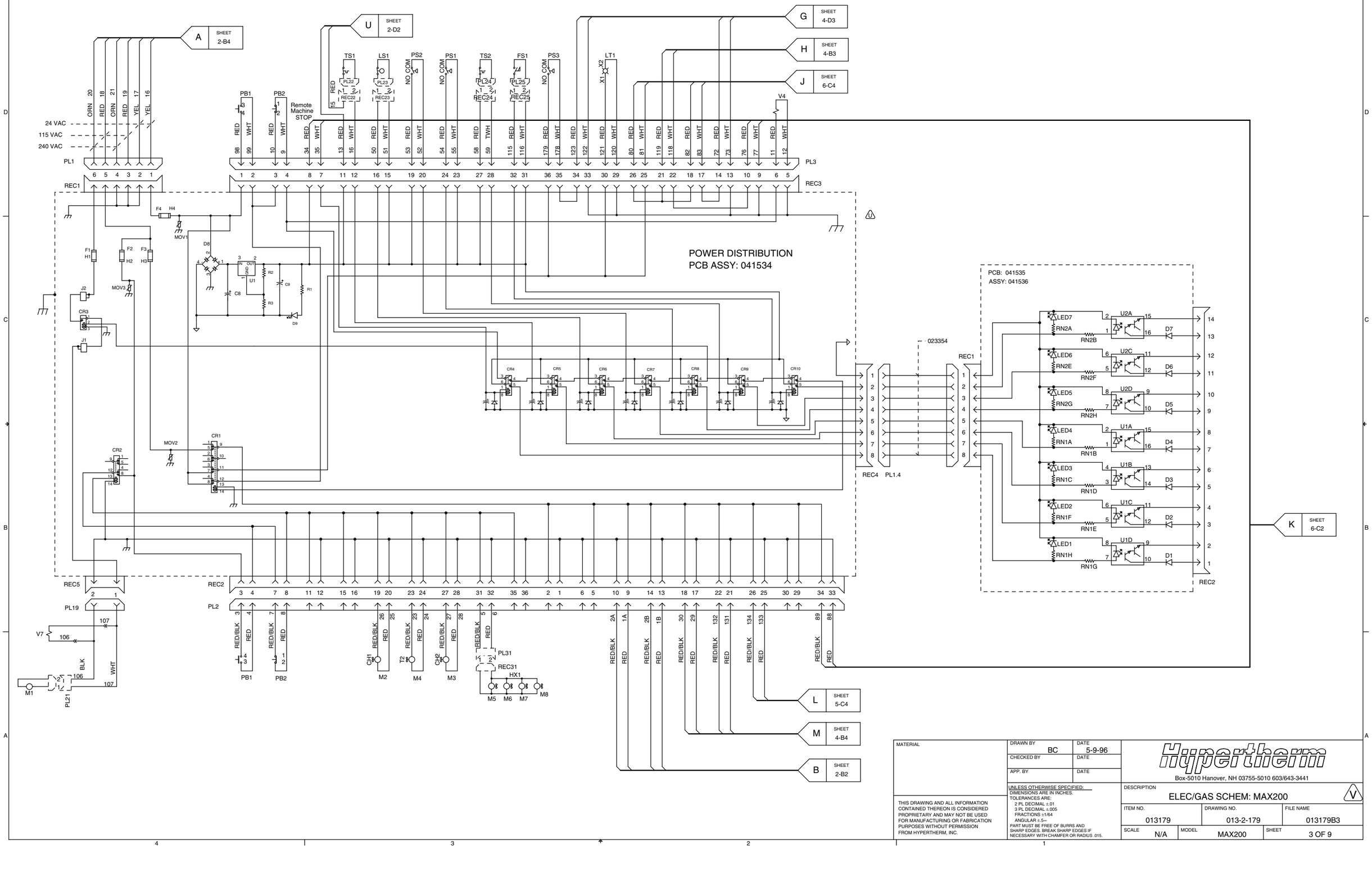

Torch, HyDefinition™



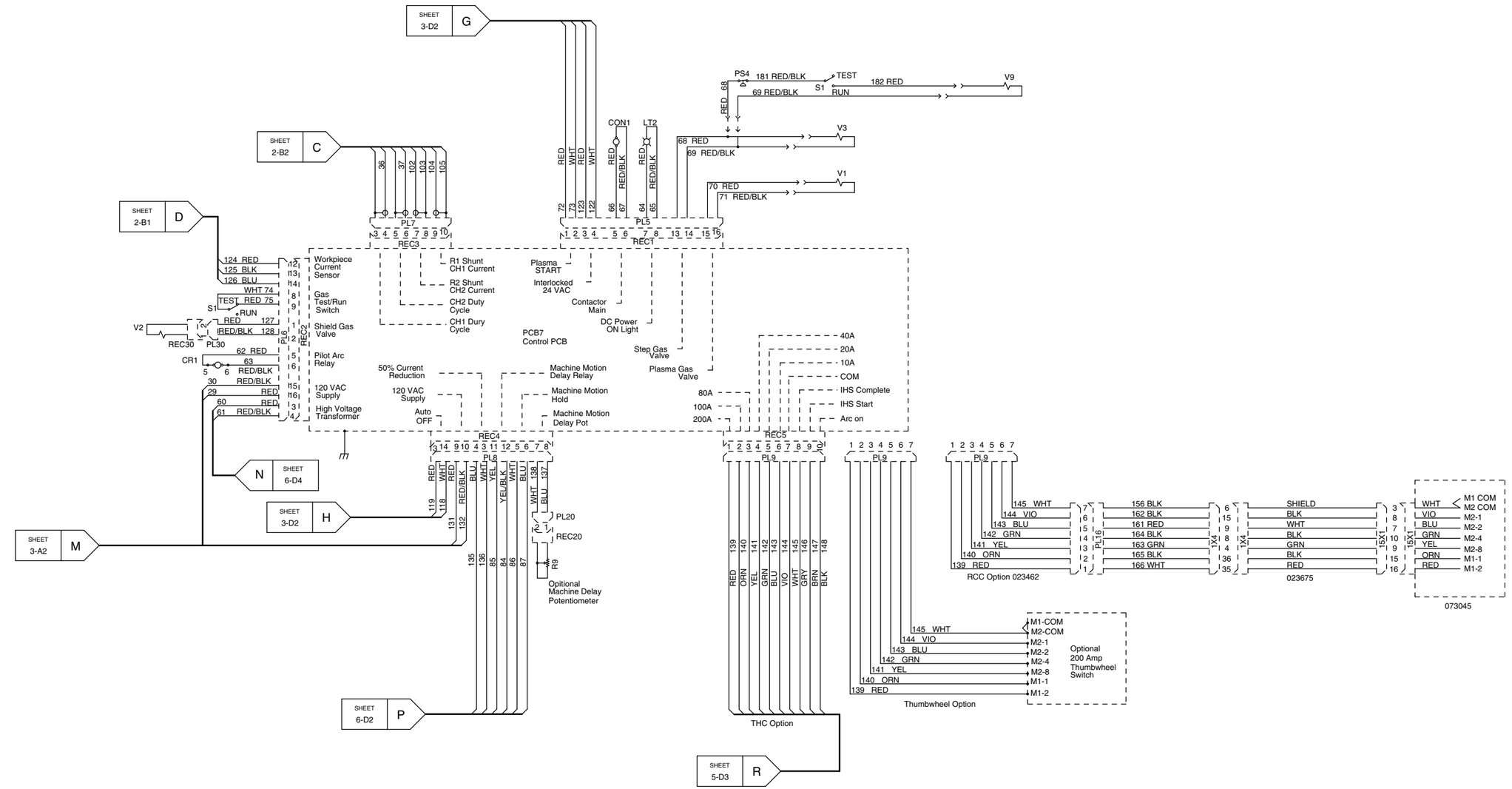
MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES WITHOUT PERMISSION FROM HYPERTHERM, INC.	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: ELEC/GAS SCHEM: MAX200 (V)	
	ITEM NO.: 013179	DRAWING NO.: 013-2-179	FILE NAME: 013179B1
	SCALE: N/A	MODEL: MAX200	SHEET: 1 OF 9



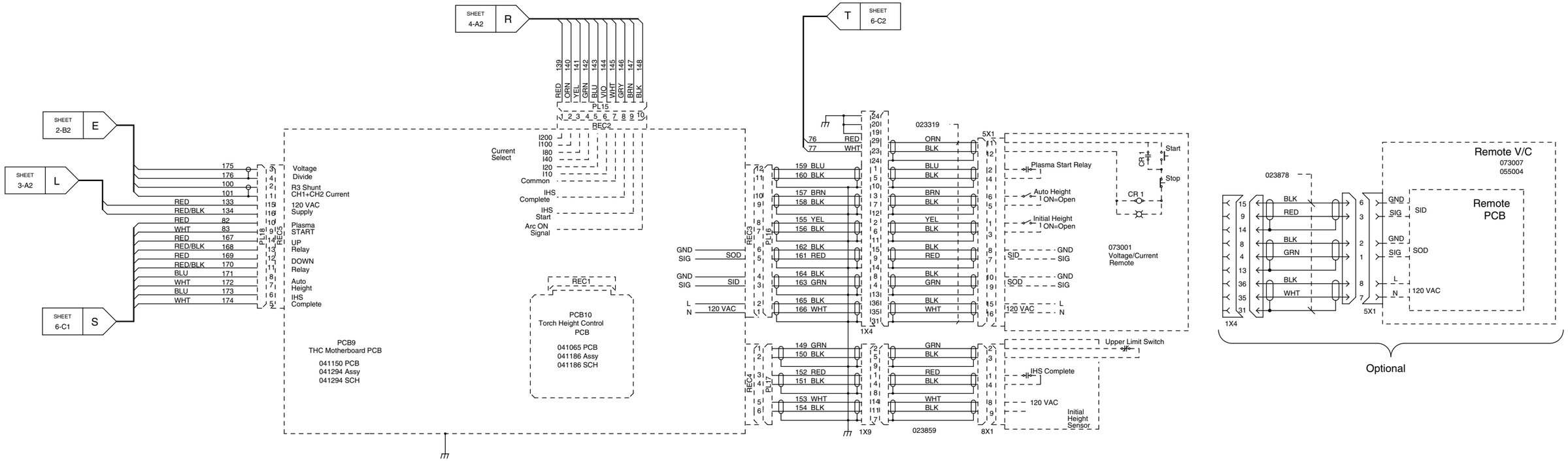
MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES 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.		ITEM NO.: 013179 · DRAWING NO.: 013-2-179 · FILE NAME: 013179B2 · SCALE: N/A · MODEL: MAX200 · SHEET: 2 OF 9



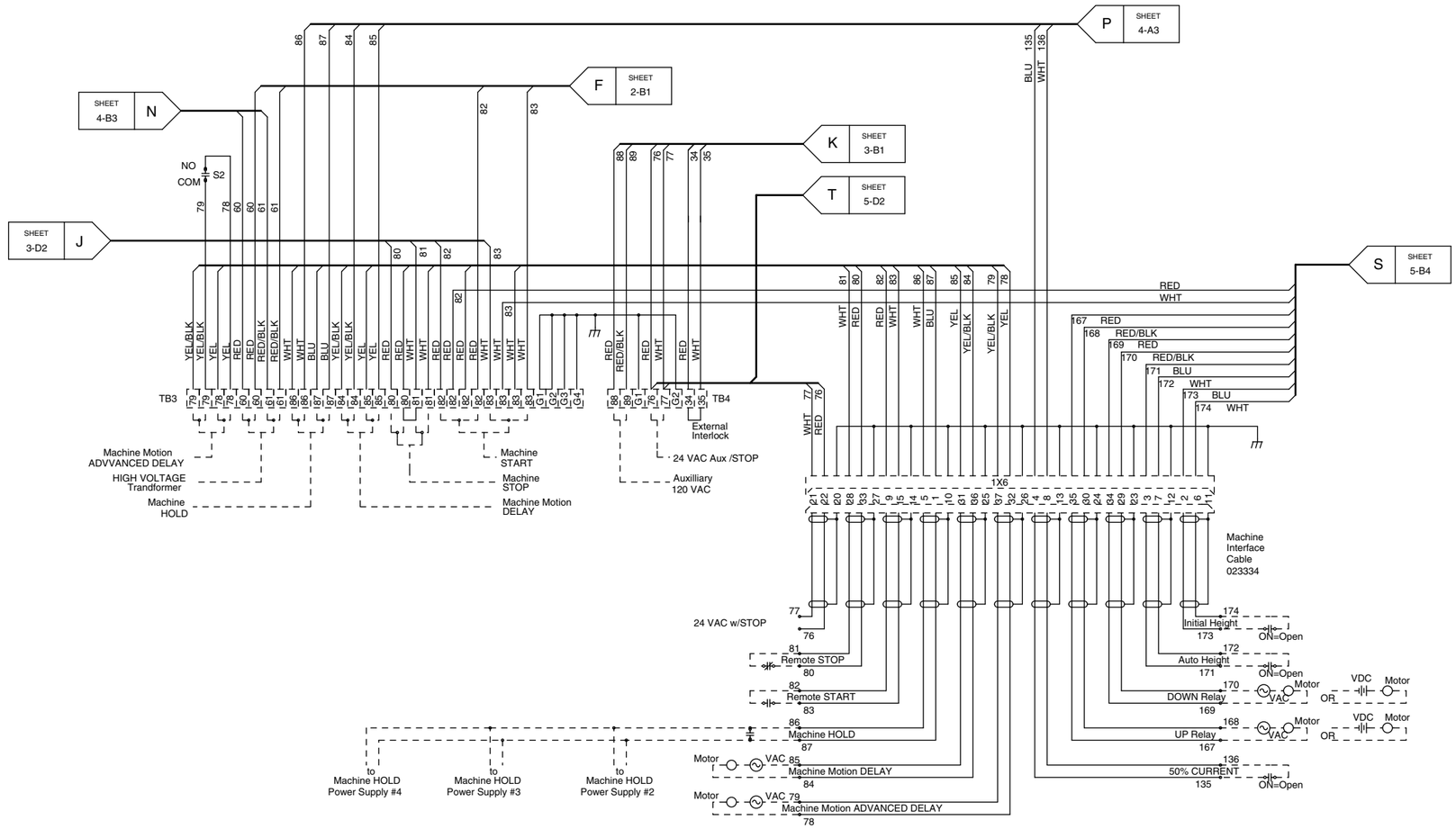
MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES 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.		ITEM NO.: 013179 | DRAWING NO.: 013-2-179 | FILE NAME: 013179B3 | SCALE: N/A | MODEL: MAX200 | SHEET: 3 OF 9



MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)
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.		ITEM NO.: 013179 · DRAWING NO.: 013-2-179 · FILE NAME: 013179B4 · SCALE: N/A · MODEL: MAX200 · SHEET: 4 OF 9

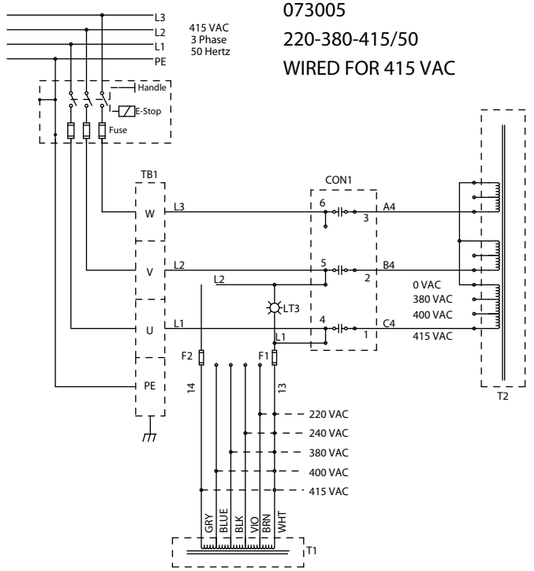


MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES 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.		ITEM NO.: 013179 | DRAWING NO.: 013-2-179 | FILE NAME: 013179B5 | SCALE: N/A | MODEL: MAX200 | SHEET: 5 OF 9

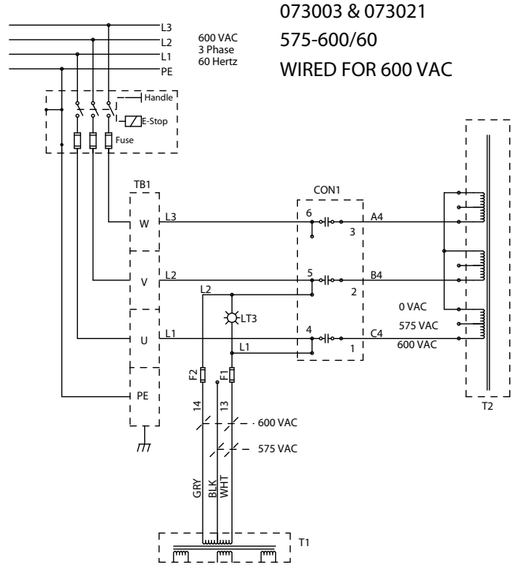


MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES 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.		ITEM NO.: 013179 | DRAWING NO.: 013-2-179 | FILE NAME: 013179B6 | SCALE: N/A | MODEL: MAX200 | SHEET: 6 OF 9

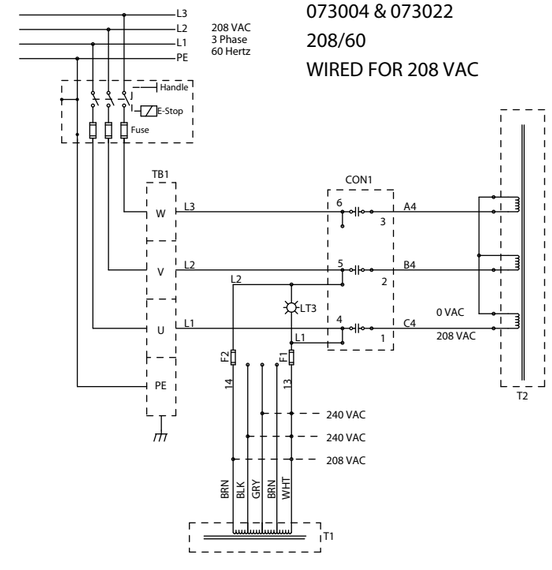
073005
220-380-415/50
WIRED FOR 415 VAC



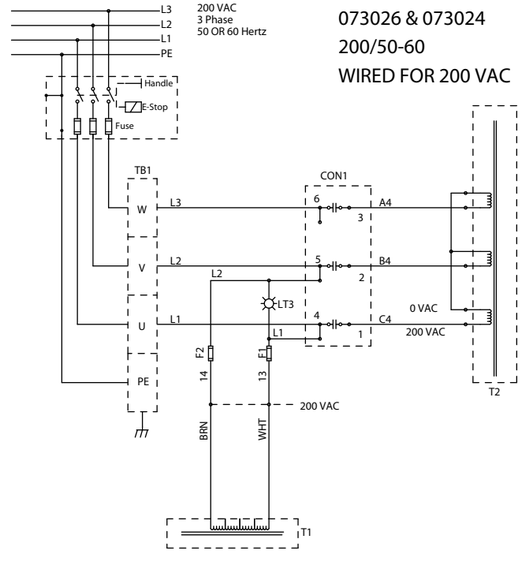
073003 & 073021
575-600/60
WIRED FOR 600 VAC



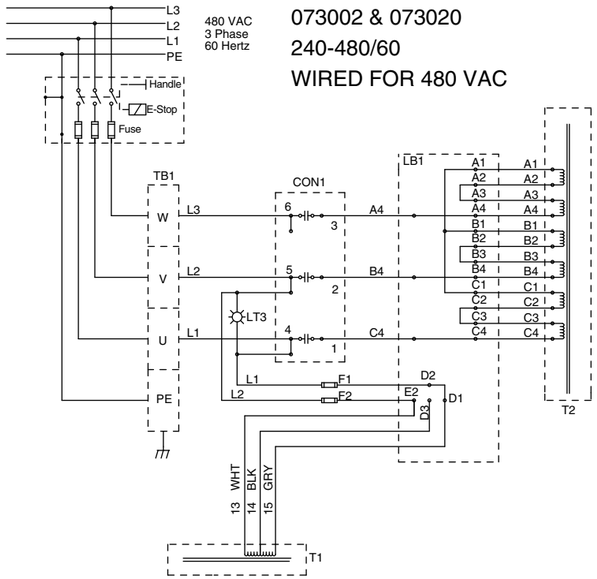
073004 & 073022
208/60
WIRED FOR 208 VAC



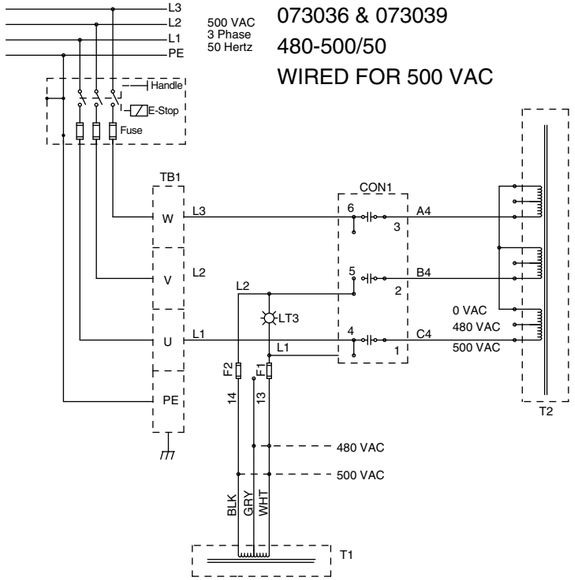
073026 & 073024
200/50-60
WIRED FOR 200 VAC



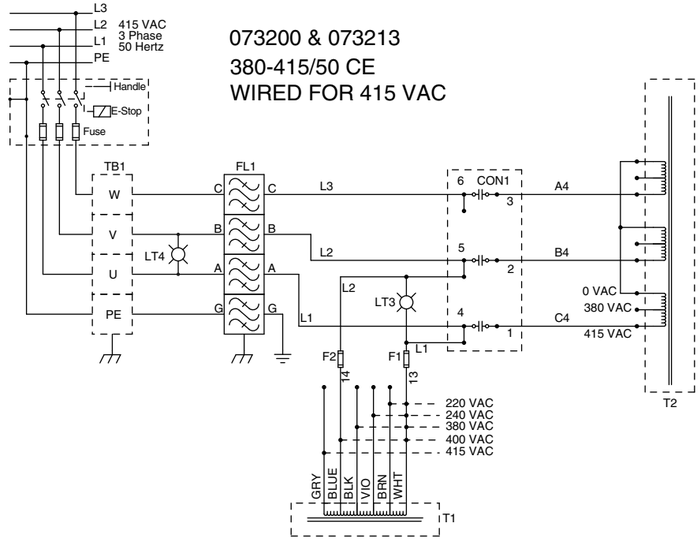
MATERIAL	DRAWN BY: BC	DATE: 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)
THIS DRAWING AND ALL INFORMATION CONTAINED THEREON IS CONSIDERED PROPRIETARY AND MAY NOT BE USED FOR MANUFACTURING OR FABRICATION PURPOSES 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.		ITEM NO.: 013179 | DRAWING NO.: 013-2-179 | FILE NAME: 013179B7
			SCALE: N/A | MODEL: MAX200 | SHEET: 7 OF 9



073002 & 073020
240-480/60
WIRED FOR 480 VAC



073036 & 073039
480-500/50
WIRED FOR 500 VAC



073200 & 073213
380-415/50 CE
WIRED FOR 415 VAC

MATERIAL

DRAWN BY	BC	DATE	5-9-96
CHECKED BY		DATE	
APP. BY		DATE	

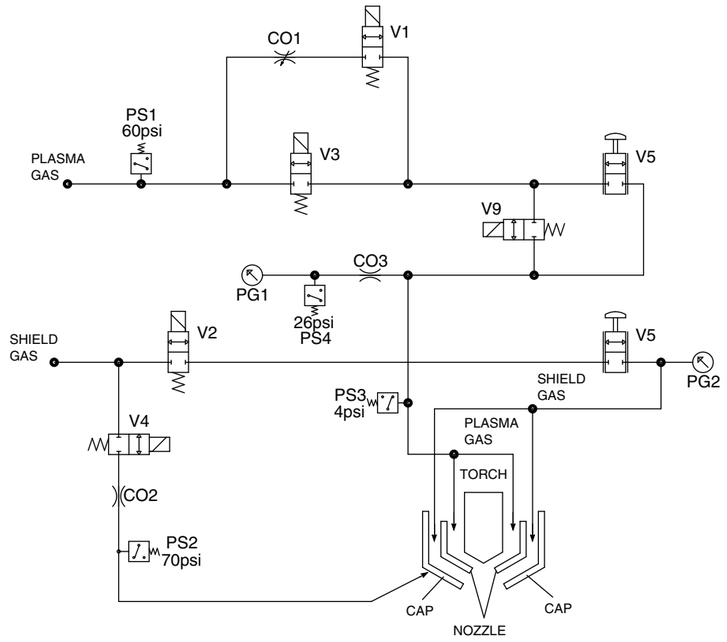
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES.
TOLERANCES ARE:
2 PL DECIMAL ±.01
3 PL DECIMAL ±.005
FRACTIONS ±1/64
ANGULAR ±.5=
PART MUST BE FREE OF BURRS AND SHARP EDGES. BREAK SHARP EDGES IF NECESSARY WITH CHAMFER OR RADIUS .015.

Hypertherm
Box-5010 Hanover, NH 03755-5010 603/643-3441

DESCRIPTION: ELEC/GAS SCHEM: MAX200 (V)

ITEM NO.	DRAWING NO.	FILE NAME
013179	013-2-179	013179B8

SCALE	MODEL	SHEET
N/A	MAX200	8 OF 9

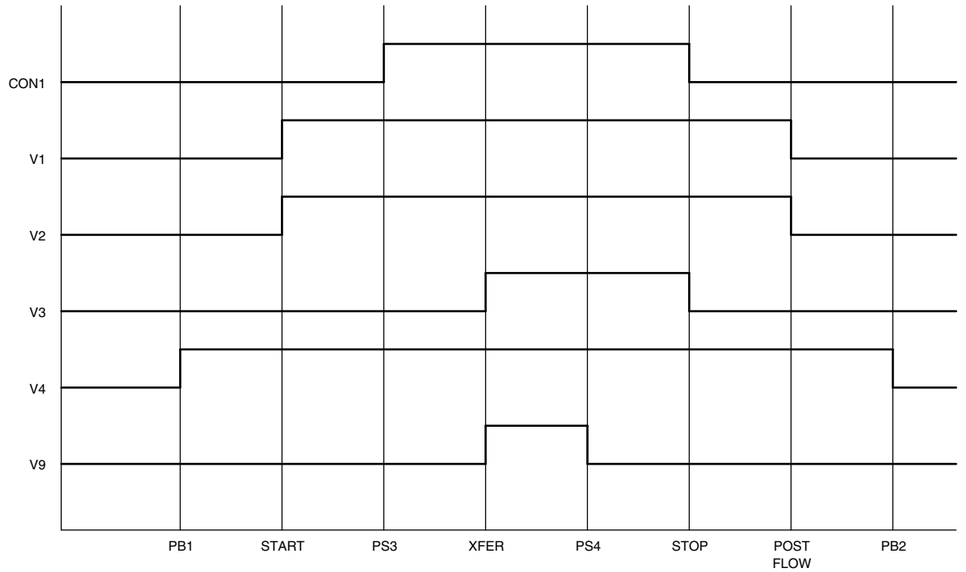


GAS FLOW DIAGRAM

MAX200 TIMING CHART	
CON1	MAIN CONTACTOR
V1	PLASMA PRE/POST FLOW SOLENOID VALVE
V2	SHIELD GAS SOLENOID
V3	PLASMA STEP GAS SOLENOID VALVE
V4	CAP-ON-SENSE SOLENOID VALVE
V9	PLASMA CHARGING VALVE
PB1	POWER ON SWITCH
PB2	POWER OFF SWITCH
PS3	PLASMA GAS OUTLET PRESSURE SWITCH. N.O. SWITCH THAT CLOSES WHEN THE PLASMA GAS PRESSURE EXCEEDS 3 psi
PS4	QUICK CHARGE PRESSURE SWITCH. N.C. SWITCH THAT OPENS WHEN PLASMA GAS REACHES 26 psi
START	PLASMA START SIGNAL FROM CNC
STOP	PLASMA STOP SIGNAL FROM CNC
XFER	ARC TRANSFER
POST-FLOW	1 SECOND GAS FLOW AT END OF CYCLE

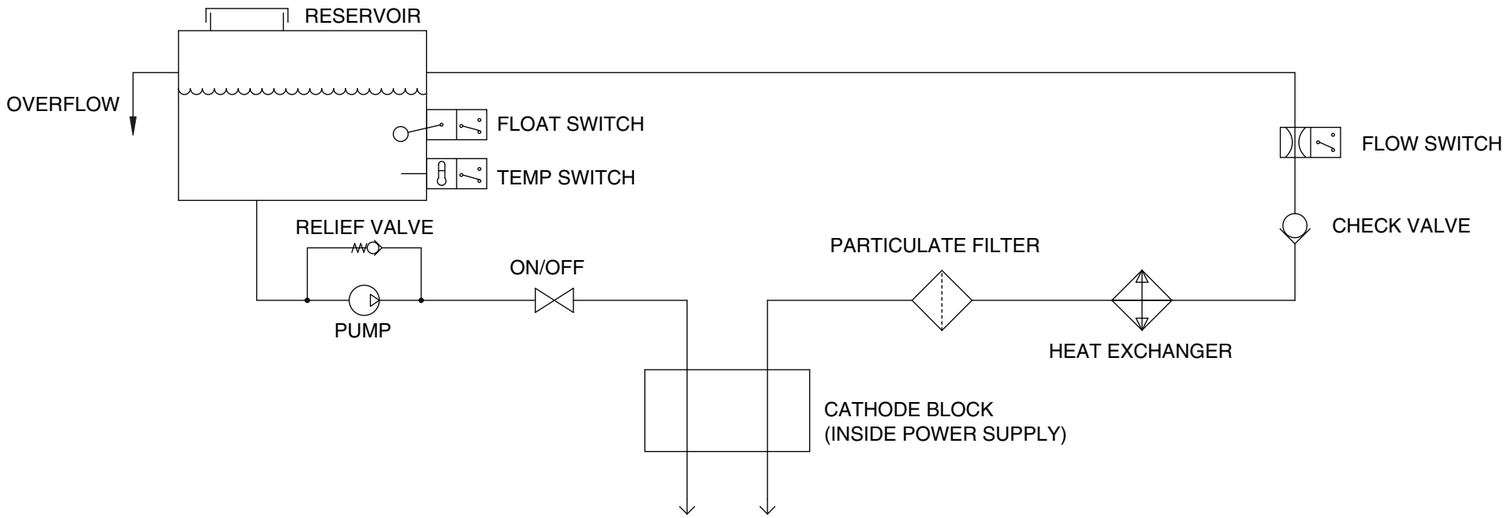
NOTES:
1. IN TEST MODE, V1, V2, AND V3 ARE THE ONLY VALVES THAT ARE ACTIVE.
2. WHEN V1 BECOMES ACTIVE AFTER START, 10 TO 15 psi WILL BE REGISTERED AT PG1.
3. THE HV TRANSFORMER IS ACTIVATED 2 SECONDS AFTER THE PLASMA START SIGNAL. IT WILL STAY ACTIVE FOR 5 SECONDS OR UNTIL THE ARC TRANSFERS TO THE WORK PIECE, WHICH EVER HAPPENS FIRST.

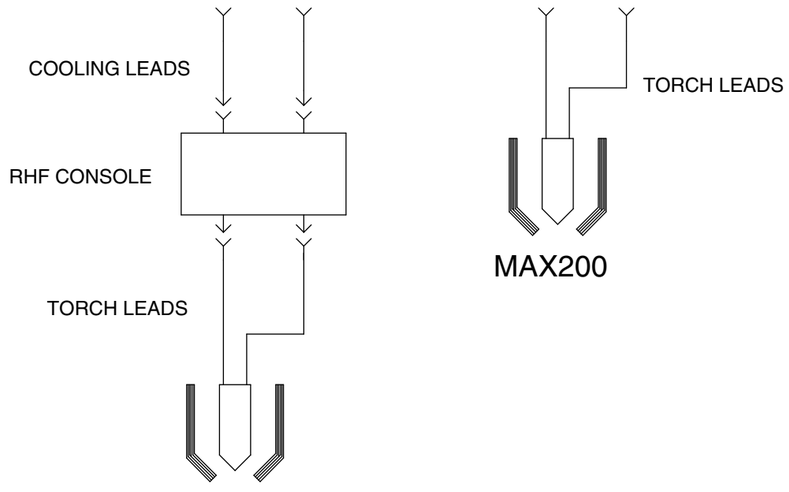
GAS SYSTEM DESIGNATOR



TIMING CHART MAX200

MATERIAL	DRAWN BY BC	DATE 5-9-96	Hypertherm
	CHECKED BY	DATE	Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY	DATE	DESCRIPTION ELEC/GAS SCHEM: MAX200 V
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.		ITEM NO. 013179 / DRAWING NO. 013-2-179 / FILE NAME 013179B9 / SCALE N/A / MODEL MAX200 / SHEET 9 OF 9





MATERIAL	DRAWN BY: BMD	DATE: 8-13-90	Hypertherm Box-5010 Hanover, NH 03755-5010 603/643-3441
	CHECKED BY: MER	DATE: 10-10-91	
	APP. BY: WVB	DATE:	DESCRIPTION: RSVR SA:MAX200/HT2000 PWR SPLY (X)
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.		ITEM NO.: 029313 · DRAWING NO.: 029-2-313 · FILE NAME: 029313B4 SCALE: N/A · MODEL: · SHEET:

Hypertherm

Appendix A

FILTERS

In this section:

HANKISON®
CENTRIFLEX®
Compressed Air Separator/Filter

DESIGNED FOR PERFORMANCE BUILT TO LAST

Efficient Separation and 3 Micron Filtration in One Compact Housing

SEPARATION—

The First Stage

A unique stainless steel separator core, using the principles of centrifugal force and impaction, is 99% efficient in removing particles 10 microns in size and larger.

The reusable cartridge type separator is completely removable for easy cleaning.

FILTRATION—

The Second Stage

A replacement filter sleeve, which fits over the separator core, assures absolute removal of solids and liquids 3 microns and larger in size.

Solids removal — finer filtration at less cost

The filter sleeve, constructed of an in-depth arrangement of glass fibers, has a high percentage of void spaces, allowing it to accumulate 3 to 4 times more particulates than coarser surface (pore) type filter element materials such as porous metal and plastic. Also the in-depth arrangement of fibers resists clogging due to gummy residues and sticky lacquers which are frequently present in compressed air systems and readily adhere to and foul surface type filters. This ability to accumulate large amounts of solid particles and resist clogging means that there is only a gradual increase in pressure drop across the filter, resulting in a long operating life and less operating cost.

Liquids removal — higher efficiencies from no flow to full flow

By using coalescence to force small droplets to form into larger droplets, the filter media continually collects all liquid droplets 3 microns in size and larger, as well as a portion of smaller droplets. This means that 99% of water droplets and 40% of oil aerosols are collected and discharged from the system.

The combination of filter sleeve and separator core ensures high efficiency liquid separation over a full range of flows. There is no reduction in efficiency at less than rated flows, a common occurrence in purely centrifugal separators.

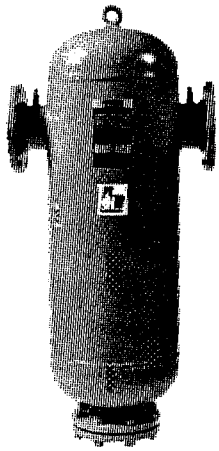
FEATURES:

- High efficiency separation — removes 99% of water droplets, 40% of oil aerosols.
- Combination of separator core and filter sleeve maintain high efficiency from no flow to full flow.
- Replaceable filter sleeve removes 100% of particles 3 microns and larger in size — while giving long sleeve life.

Housing design — features easy installation and maintenance

The in-line, inlet and outlet connection design reduces installation time and expense. Additional piping to maintain alignment is not required. Cartridge replacement is made easy by removable bowls for models C15 through C300 and by use of a convenient bottom access for models C400 and larger.

MODEL C150



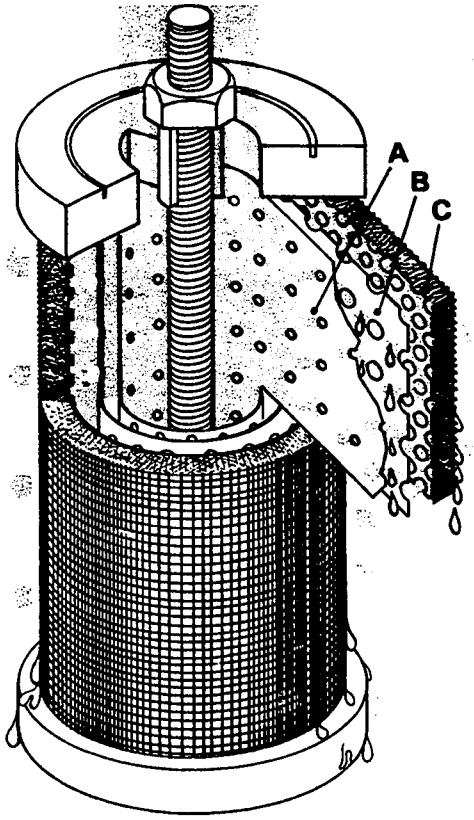
MODEL C6600

OPERATION

Air enters the top of the Centriflex separator/filter and flows down through the center of the separator core and radially outward. The air is subjected to a strong centrifugal force as it passes through the separator core which is constructed of a pair of stainless steel perforated tubes. The orifices in the first tube (**A**) are staggered in relation to those in the second (**B**). This causes particles 10 microns and larger to continue in a straight course after leaving the inner tube, impacting and impinging on the inside of the outer tube where they form a film which drains to the bottom of the separator core.

The air then passes into the filter sleeve (**C**) which is composed of an in-depth bed of resin impregnated glass fibers. Solid particles (to 3 microns absolute) are captured and retained here. Liquid aerosols are coalesced on the glass fibers forming large droplets which move downward to the bottom of the cartridge where they drain by gravity into the filter housing and are removed from the air system.

This combination of separation and coalescence allows the Centriflex separator/filter to handle large inlet liquid loads (up to 25,000 ppm w/w) while removing 99% of water droplets and 40% of oil aerosols over a full range of flow conditions.



OPERATING CONDITIONS

Flow: maximum air flow for the various models at 100 psig is indicated in Table 1. To determine maximum air flows at inlet pressures other than 100 psig, multiply flow from Table 1 by multiplier from Table 2 that corresponds to the minimum operating pressure at the inlet of the filter.

EXAMPLE:

Choose a Centriflex® separator/filter to handle 705 scfm at 150 psig. From Table 1 pick a C600 with an air flow of 600 scfm @ 100 psig. Multiply 600 scfm by the correction factor 1.43 for 150 psig from Table 2 (600 x 1.43 = 858). A C600 has ample capacity for this requirement.

CAUTION:

Do not select filters by pipe size. Make selection by flow rate and operating pressure only.

Pressure Drop:

Initial pressure drop (dry) is less than 1 psi. Increases in pressure drop above this point occur as the cartridge is loaded with solid contaminants. It is recommended that filter cartridge(s) be replaced when pressure drop exceeds 10 psi.

OPTIONS

Automatic Drains

Hankison drains automatically discharge liquids collected in the filter sump from the compressed air system. They are available with the drain mechanism mounted internally on smaller models or in their own housings for external mounting on larger models.

Differential Pressure Alarms

(Optional on models C15 thru C600; standard on models C1200 and larger.) The Hankison differential pressure alarm signals both audibly and visually when a 10 psi differential pressure has been reached, indicating the need for cartridge replacement.

Stainless Steel Cartridges

Cartridges may be ordered with stainless steel materials for use in systems where corrosive fumes are present in the compressed air system.

TABLE 1
Maximum Air Flow (scfm*) @ 100 psig

MODEL	C15	C35	C55	C100	C150	C200	C300	C400	C600	C1200	C1800	C2400	C3000	C4800	C6600	C8400	C11400
FLOW	15	35	55	100	150	200	300	400	600	1200	1800	2400	3000	4800	6600	8400	11400

*Convert scfm to metric units as follows: 1 scfm = 1.736 m^3_n/h

TABLE 2
Air Flow Correction Factor

Minimum inlet pressure (psig)	20	30	40	60	80	100	120	150	200	250	300
Multiplier	0.30	0.39	0.48	0.65	0.82	1.00	1.17	1.43	1.87	2.31	2.74

PHYSICAL DESCRIPTION

Model Number		Housing Type	Maximum Operating Pressure (psig)		Maximum Operating Temperature	Air Inlet/ Outlet Conn.	Width (Inlet to Outlet) and Height (in.)	Wt. (lb.)	Replacement Filter Cartridge	
with Manual Drain	with Internal Auto Drain		with Manual Drain	with Internal Auto Drain					No.	Qty. Reqd.
C15-03F-8P	—	8 oz. polycarbonate (2)	150	—	120°F	3/8" NPTF	3 1/4 x 6 1/4	1 5/8	0734-1	1
C15-03F-16P	C15-03F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0734-1	1
C15-03F-16M	C15-03F-16M-D	16 oz. metal	300	175	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0734-1	1
C15-04F-16P	C15-04F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0734-1	1
C15-04F-16M	C15-04F-16M-D	16 oz. metal	300	175	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0734-1	1
C35-03F-16P	C35-03F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0734-2	1
C35-03F-16M	C35-03F-16M-D	16 oz. metal	300	175	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0734-2	1
C35-04F-16P	C35-04F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0734-2	1
C35-04F-16M	C35-04F-16M-D	16 oz. metal	300	175	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0734-2	1
C55-08F-48	C55-08F-48-D	48 oz. metal	300	175	120°F	1" NPTF	4 9/16 x 13 9/16	5 7/8	0734-3	1
C100-08F-48	C100-08F-48-D	48 oz. metal	300	175	120°F	1" NPTF	4 9/16 x 13 9/16	5 7/8	0734-3	1
C150-12F-100	(1)	100 oz. metal	300	—	120°F	1 1/2" NPTF	5 1/4 x 23 1/4	13 1/4	0734-4	1
C200-12F-205	(1)	205 oz. metal	300	—	120°F	1 1/2" NPTF	5 1/4 x 30 5/8	21	0734-5	1
C300-12F-205	(1)	205 oz. metal	300	—	120°F	1 1/2" NPTF	5 1/4 x 30 5/8	21	0734-6	1
C400-16M-5L	(1)	5" pressure vessel	300 (3)	300 (3)	120°F	2" NPTM (4)	10 1/4 x 40 7/8	36	0734-7	1
C600-24M-5L	(1)	5" pressure vessel	300 (3)	300 (3)	120°F	3" NPTM (4)	10 1/4 x 40 7/8	37	0734-7	1
C1200-24M-8L	(1)	8" pressure vessel	225 (3)	—	120°F	3" NPTM (4)	16 x 48	86	0734-7	2
C1800-24M-10L	(1)	10" pressure vessel	225 (3)	—	120°F	3" NPTM (4)	16 1/4 x 49	131	0734-7	3
C2400-4FL-12L	(1)	12" pressure vessel	225 (3)	—	120°F	4" flange (5)	20 x 52 1/4	179	0734-7	4
C3000-4FL-12L	(1)	12" pressure vessel	225 (3)	—	120°F	4" flange (5)	20 x 52 1/4	182	0734-7	5
C4800-6FL-16L	(1)	16" pressure vessel	225 (3)	—	120°F	6" flange (5)	24 x 54 5/8	271	0734-7	8
C6600-6FL-20L	(1)	20" pressure vessel	225 (3)	—	120°F	6" flange (5)	28 x 62 9/16	518	0734-7	11
C8400-6FL-20L	(1)	20" pressure vessel	225 (3)	—	120°F	6" flange (5)	28 x 62 9/16	527	0734-7	14
C11400-8FL-24L	(1)	24" pressure vessel	225 (3)	—	120°F	8" flange (5)	33 x 69 1/8	709	0734-7	19

(1) Drain port is provided. Use externally mounted Hankison® automatic drain. For models C150 thru C600 use a model 505 Trip-L-Trap®. For models C1200 and larger use a model 506 Trip-L-Trap. Models C400 and C600 may also be supplied with an internal drain.
(2) Polycarbonate bowls are furnished with bowl guards. Do not use polycarbonate bowls when synthetic lubricants are present.
(3) Units with higher maximum working pressures are available. Models C1200 and larger are ASME code constructed and stamped.
(4) Flanges and couplings are available.
(5) Optional flange sizes are available.

HANKISON DIVISION OF HANSEN INC.
CANONSBURG, PA 15317 U.S.A. TEL.: (412) 745-1555
PRICE AND ORDERING INFORMATION FROM

HANKISON®
3400-4

Energy Machinery
10 RESERVOIR PARK DRIVE
P.O. BOX 363
ROCKLAND, MA 02370

COMPRESSED AIR AND GAS INSTITUTE CAGI
PRINTED IN U.S.A.

HANKISON®
AEROLESCER®
Coalescing Type Oil Removal Filters

99.999+% efficient in removing oil aerosols from compressed air lines.

Why remove oil?

Compressor oil downstream — it can contaminate the end product, decrease the efficiency of the production process by ruining paint jobs, gumming up air tools, motors, etc., or clog the tiny orifices in instruments or fluid logic components. Oil from a lubricated compressor is subjected to high temperatures during the compression cycle. This alters its characteristics so that it does not adequately lubricate downstream pneumatic components. It's best to take this oil out of the system and add the proper lubricant at the point of use.

Are special filters required to remove oil?

In a typical 90 psig air system 72% by weight of the oil aerosols present are less than 5 microns in size. 50% are below 1 micron in size. Droplets of this size blow right through a mechanical separator. Air line filters (particulate filters e.g. a 5 micron filter) can't trap the bulk of the aerosols either. To adequately remove oil, a special filter is required. The Hankison Aerolescer filter has been designed to remove oil by means of coalescence.

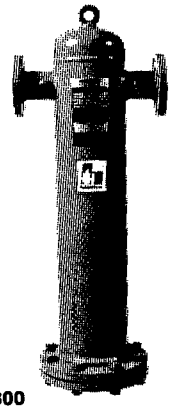
The result — an oil free compressed air system

The Hankison Aerolescer filter, when used within its rated design conditions, will eliminate the oil aerosols contained in a compressed air stream. Exhaustive tests verify a liquid oil removal efficiency of 99.999+%. In most instances, this means that the filtered air will contain less than .1 ppm of oil by weight. It assures virtually oil free air without the expense and maintenance headaches of non-lubricated compressors.

Features:

- Unique continuously stabilized filter media plus outer foam sleeve ensures 99.999+% efficiency for the life of the cartridge
- Removes: 100% of particles .025 micron and larger in size; some particles as small as .01 micron
- Cartridge replacement made easy by removable bowls or convenient bottom flange opening
- Rugged thru-bolt cartridge construction

MODELS from 10 SCFM to 6000 SCFM



MODEL A300

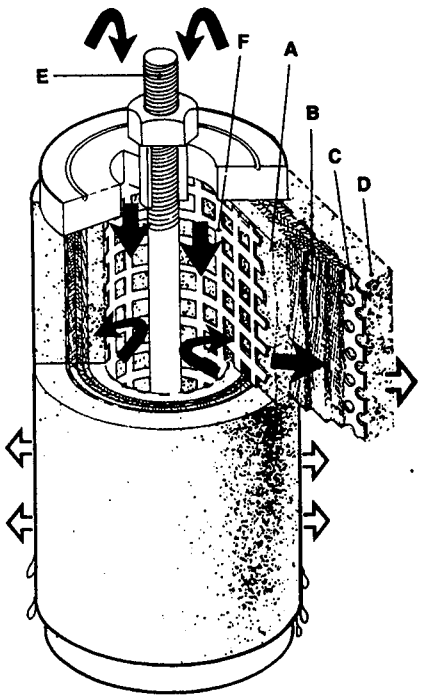
MODEL A900

The Patented* AEROLESCER Cartridge — designed for 99.999+% efficiency and long life

OPERATION

Oil aerosols moving through the filtering media (B), a maze of submicronic glass fibers with specific densities and diameters, are concentrated and coalesced into large droplets. High efficiency is achieved by stabilizing the filtering media between a rigid perforated cylinder (C) and an inner foam sleeve (A), which compensates for fluctuating flow rate and aerosol concentration. This design assures uniform distribution of oil aerosols which prevents liquid pocketing, fiber clotting, and subsequent air channelling. The coalesced oil droplets are collected by the outer foam sleeve (D). Having an enormous non-absorbing surface area, this sleeve allows oil droplets to drain to the bottom of the sleeve and then drop to the bottom of the housing for removal from the air system. When removing oil the life of the cartridge is indefinite.** The cartridge continuously coalesces and separates oil aerosols from your system.

Thru bolt construction (E) assures structural strength and prevents liquid bypassing of the filter media. There is no reliance on adhesives to hold the unit together. An inside support (F) offers positive protection in case flow is accidentally reversed through the cartridge.



*U.S. Patent No. 3,802,160

**Excessive solid matter accumulation will limit life. Prefilters are available to prolong life. Request Bulletin 3100 covering HANKISON 3100 Series Air Line Filters.

Operating Conditions

Flow: maximum air flow for the various models at 100 psig is indicated in Table 1. To determine maximum air flows at inlet pressures other than 100 psig, multiply flow from Table 1 by multiplier from Table 2 that corresponds to the minimum operating pressure at the inlet of the filter.

EXAMPLE:

Choose an Aerolescer filter to handle 705 scfm at 150 psig. From Table 1 pick an A500 with an air flow of 500 scfm @ 100 psig. Multiply 500 scfm by the correction factor 1.43 for 150 psig from Table 2 (500 x 1.43 = 715). An A500 has ample capacity for this requirement.

CAUTION:

Do not select filters by pipe size. Make selection by flow rate and operating pressure only.

Pressure Drop:

Initial pressure drop (dry) is less than 1 psi. As the cartridge collects and coalesces liquid droplets a working pressure drop of 3 to 5 psi will develop. Increases in pressure drop above this point occur as the cartridge is loaded with solid contaminants. It is recommended that filter cartridge(s) be replaced when pressure drop exceeds 10 psi.

OPTIONS

Automatic Drains

Hankison drains automatically discharge liquids collected in the filter sump from the compressed air system. They are available with the drain mechanism mounted internally on smaller models or in their own housings for external mounting on larger models.

Differential Pressure Alarms

(Optional on models A10 thru A320; standard on models A500 and larger.) The Hankison differential pressure alarm signals both audibly and visually when a 10 psi differential pressure has been reached, indicating the need for cartridge replacement.

Stainless Steel Cartridges

Cartridges may be ordered with stainless steel materials for use in systems where corrosive fumes are present in the compressed air system.

TABLE 1
Maximum Air Flow (scfm*) @ 100 psig

MODEL	A10	A20	A50	A100	A200	A250	A300	A320	A500	A600	A900	A1300	A1600	A2500	A3500	A4400	A6000
FLOW	10	20	50	100	200	250	300	320	500	632	948	1264	1580	2528	3476	4424	6004

*Convert scfm to metric units as follows: 1 scfm = 1.736m^3_n/h

TABLE 2
Air Flow Correction Factor

Minimum inlet pressure (psig)	20	30	40	60	80	100	120	150	200	250	300
Multiplier	0.30	0.39	0.48	0.65	0.82	1.00	1.17	1.43	1.87	2.31	2.74

PHYSICAL DESCRIPTION

Model Number		Housing Type	Maximum Operating Pressure (psig)		Maximum Operating Temperature	Air Inlet/ Outlet Conn.	Width (Inlet to Outlet) and Height (in.)	Wt. (lb.)	Replacement Filter Cartridge	
with Manual Drain	with Internal Auto Drain		with Manual Drain	with Internal Auto Drain					No.	Qty. Reqd.
A10-03F-8P		8 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 6 1/4	1 5/8	0713-2	1
A10-03F-16P	A10-03F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0713-2	1
A10-03F-16M	A10-03F-16M-D	16 oz. metal	300	175	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0713-2	1
A10-04F-16P	A10-04F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0713-2	1
A10-04F-16M	A10-04F-16M-D	16 oz. metal	300	175	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0713-2	1
A20-03F-16P	A20-03F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0713-3	1
A20-03F-16M	A20-03F-16M-D	16 oz. metal	300	175	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0713-3	1
A20-04F-16P	A20-04F-16P-D	16 oz. polycarbonate (2)	150	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0713-3	1
A20-04F-16M	A20-04F-16M-D	16 oz. metal	300	175	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0713-3	1
A50-08F-48	A50-08F-48-D	48 oz. metal	300	175	120°F	1" NPTF	4 9/16 x 13 9/16	5 7/8	0713-4	1
A100-08F-100	(1)	100 oz. metal	300		120°F	1" NPTF	4 9/16 x 23 1/4	13 1/4	0713-5	1
A200-12F-205	(1)	205 oz. metal	300		120°F	1 1/2" NPTF	5 1/4 x 30 5/8	21	0713-6	1
A300-12F-381	(1)	381 oz. metal	300		120°F	1 1/2" NPTF	5 1/4 x 36 3/8	29 1/4	0713-7	1
A250-16M-5L	(1)	5" pressure vessel	300 (3)		120°F	2" NPTM (4)	10 1/4 x 40 7/8	36	0713-12	1
A320-16M-5L	(1)	5" pressure vessel	300 (3)		120°F	2" NPTM (4)	10 1/4 x 40 7/8	37	0713-11	1
A500-24M-8L	(1)	8" pressure vessel	225 (3)		120°F	3" NPTM (4)	16 x 48	86	0713-12	2
A600-24M-8L	(1)	8" pressure vessel	225 (3)		120°F	3" NPTM (4)	16 x 48	86	0713-11	2
A900-24M-10L	(1)	10" pressure vessel	225 (3)		120°F	3" NPTM (4)	16 1/4 x 49	131	0713-11	3
A1300-4FL-12L	(1)	12" pressure vessel	225 (3)		120°F	4" flange (5)	20 x 52 1/4	179	0713-11	4
A1600-4FL-12L	(1)	12" pressure vessel	225 (3)		120°F	4" flange (5)	20 x 52 1/4	182	0713-11	5
A2500-6FL-16L	(1)	16" pressure vessel	225 (3)		120°F	6" flange (5)	24 x 54 5/8	271	0713-11	8
A3500-6FL-20L	(1)	20" pressure vessel	225 (3)		120°F	6" flange (5)	28 x 62 9/16	518	0713-11	11
A4400-6FL-20L	(1)	20" pressure vessel	225 (3)		120°F	6" flange (5)	28 x 62 9/16	527	0713-11	14
A6000-8FL-24L	(1)	24" pressure vessel	225 (3)		120°F	8" flange (5)	33 x 69 1/8	709	0713-11	19

(1) Drain port is provided. Use externally mounted Hankison automatic drain. For models A100 thru A1600 use a model 504 Snap-Trap® (175 psig MWP); for models A2500 thru A6000 use a model 505 Trip-L-Trap®. Models A250 and A320 may also be supplied with an internal drain.
(2) Polycarbonate bowls are furnished with bowl guards. Do not use polycarbonate bowls when synthetic lubricants are present.
(3) Units with higher maximum working pressures are available. Models A500 and larger are ASME code constructed and stamped.
(4) Flanges and couplings are available.
(5) Optional flange sizes are available.

HANKISON®
HYPERSORB®
Activated Carbon Adsorbent Filters

Eliminates undesirable oily smell/taste from compressed air. Removes oil vapor. Ends product contamination.

The final step in oil free air.

The Hypersorb filter is a final stage filter which adsorbs oil vapor (gaseous oil) present in compressed air. The Hypersorb filter will also remove various other gaseous hydrocarbons normally adsorbable by activated carbon. It is designed to be used after a coalescing filter (Hankison Aerolescer®) which removes liquid oil aerosols. The liquid oil aerosols must be removed from the air stream before the air enters the Hypersorb in order to prevent saturating of the activated carbon and premature reduction of the adsorptive capacity of the filter.

How oil free is air that has been filtered by an Aerolescer/Hypersorb Filter System?

At rated flow conditions and reasonable filtration temperatures (50°F to 100°F), the oil concentration in your air system, after being filtered, will be less than .01 ppm w/w. This means that the amount of oil left in your system is lower than the saturation level of oil vapor in atmospheric air (expanded condition) so that even a large drop in temperature downstream will not cause oil vapor to condense and foul your product.

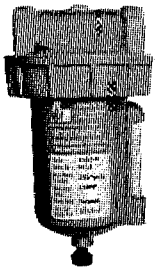
These low concentrations of oil vapor are well below the level where they can be detected by smell or taste.

Designed for long life.

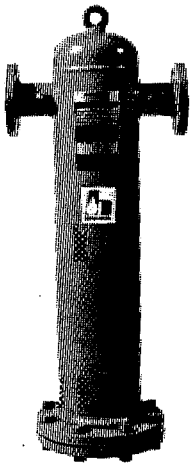
In contrast to most carbon filters that contain only a bed of carbon particles, the Hypersorb filter contains both a bed of finely divided activated carbon particles and a secondary section of multi-layered fibers to which microfine activated carbon particles are bonded. It is designed to operate for a minimum of 1500 hours at rated capacity without requiring replacement of the cartridge.

FEATURES:

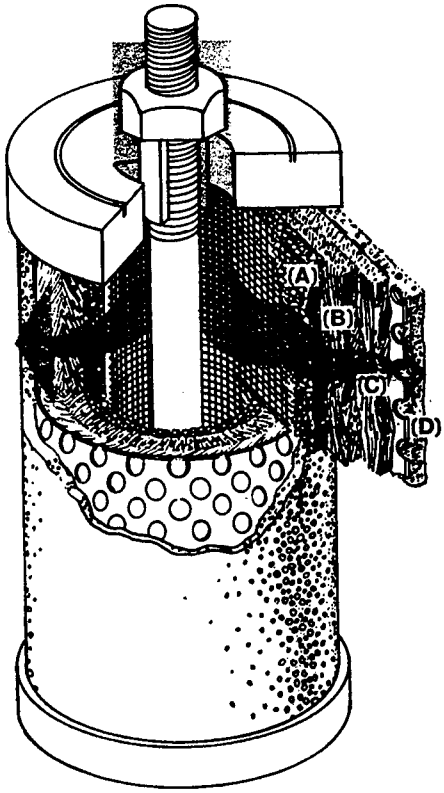
- Protects end processes from gaseous oil contamination and rids compressed air exhausted into worker environments of offensive oily smell
- Removes hydrocarbons for analytical instrument use
- Fine filter media traps 100% of any carbon dust or other particles as small as .025 micron — Ideal as an afterfilter for desiccant dryers
- Cartridge replacement made easy by removable bowls or convenient bottom access.



MODEL H10



MODEL H600



Elimination of carbon dust carryover.

Layers of microglass fibers prevent any possible carryover of carbon dust or other fine particulate matter and subsequent product contamination. Also, an outer porous foam sleeve provides protection against filter fiber migration.

Rugged construction resists vibration, prevents in-line failure.

A thru bolt and rigid metal perforated cylinder provide solid cartridge design that does **not** rely on an adhesive for structural strength. This minimizes the possibility of the filter media being by-passed.

OPERATION

Compressed air which has been treated by an air dryer and filtered to remove liquid contaminants enters the inner core of the Hypersorb filter cartridge and moves radially outward. It first passes through a bed of finely divided activated carbon particles (**A**) where 95% of the oil vapor contained in the air is adsorbed. The air then moves through layers of fibers (**B**) to which microfine activated carbon particles are bonded by a patented process and the remaining oil vapor is adsorbed. The virtually oil free air then continues through layers of microglass fibers (**C**) where all solid particles .025 microns in size and larger are captured. This prevents any possible carry over of carbon dust or other fine particulate matter. Finally the air exits through a porous foam outer sleeve (**D**) which provides protection against fiber migration.

OPERATING CONDITIONS

Flow: maximum air flow for the various models at 100 psig is indicated in Table 1. To determine maximum air flows at inlet pressures other than 100 psig, multiply flow from Table 1 by multiplier from Table 2 that corresponds to the minimum operating pressure at the inlet of the filter.

EXAMPLE:
Choose a Hypersorb filter to handle 705 scfm at 150 psig. From Table 1 pick an H500 with an air flow of 500 scfm @ 100 psig. Multiply 500 scfm by the correction factor 1.43 for 150 psig from Table 2 (500 x 1.43 = 715). An H500 has ample capacity for this requirement.

CAUTION:
Do not select filters by pipe size. Make selection by flow rate and operating pressure only.

Pressure Drop:

The Hypersorb® filter has an initial nominal pressure drop of 1 psi (0.07 bar) which should not change appreciably during the life of the cartridge.

Cartridge Replacement:

Periodic checks of filtered air should be conducted. A detectable odor indicates that the cartridge should be replaced. The Hypersorb is designed to give a minimum life of 1500 hours of continuous operation at rated capacity.

OPTIONS

Stainless Steel Cartridges
Cartridges may be ordered with all stainless steel materials for use where harmful vapors are present in the compressed air system. To order, add -S to unit or cartridge model number.

TABLE 1
Maximum Air Flow (scfm*) @ 100 psig

MODEL	H10	H20	H50	H100	H200	H250	H300	H320	H500	H600	H900	H1300	H1600	H2500	H3500	H4400	H6000
FLOW	10	20	50	100	200	250	300	320	500	632	948	1264	1580	2528	3476	4424	6004

*Convert scfm to metric units as follows: 1 scfm = 1.736 m^3_n/h

TABLE 2
Air Flow Correction Factor

Minimum inlet pressure (psig)	20	30	40	60	80	100	120	150	200	250	300
Multiplier	0.30	0.39	0.48	0.65	0.82	1.00	1.17	1.43	1.87	2.31	2.74

PHYSICAL DESCRIPTION

Model Number	Housing Type	Maximum Operating Pressure (psig)	Maximum Operating Temperature	Air Inlet/ Outlet Conn.	Width (Inlet to Outlet) and Height (in.)	Wt. (lb.)	Replacement Filter Cartridge No.	Replacement Filter Cartridge Qty. Reqd.
H10-03F-8P	8 oz. polycarbonate (1)	150	120°F	3/8" NPTF	3 1/4 x 6 1/4	1 5/8	0715-2	1
H10-03F-16P	16 oz. polycarbonate (1)	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0715-2	1
H10-03F-16M	16 oz. metal	300	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0715-2	1
H10-04F-16P	16 oz. polycarbonate (1)	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0715-2	1
H10-04F-16M	16 oz. metal	300	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0715-2	1
H20-03F-16P	16 oz. polycarbonate (1)	150	120°F	3/8" NPTF	3 1/4 x 10 1/4	2 1/2	0715-3	1
H20-03F-16M	16 oz. metal	300	120°F	3/8" NPTF	3 1/4 x 9 7/8	3 1/8	0715-3	1
H20-04F-16P	16 oz. polycarbonate (1)	150	120°F	1/2" NPTF	3 1/4 x 10 1/4	2 1/2	0715-3	1
H20-04F-16M	16 oz. metal	300	120°F	1/2" NPTF	3 1/4 x 9 7/8	3 1/8	0715-3	1
H50-08F-48	48 oz. metal	300	120°F	1" NPTF	4 9/16 x 13 9/16	5 7/8	0715-4	1
H100-08F-100	100 oz. metal	300	120°F	1" NPTF	4 9/16 x 23 1/4	13 1/4	0715-5	1
H200-12F-205	205 oz. metal	300	120°F	1 1/2" NPTF	5 1/4 x 30 5/8	21	0715-6	1
H300-12F-381	381 oz. metal	300	120°F	1 1/2" NPTF	5 1/4 x 36 3/8	29 1/4	0715-7	1
H250-16M-5L	5" pressure vessel	300 (2)	120°F	2" NPTM (3)	10 1/4 x 40 7/8	36	0715-12	1
H320-16M-5L	5" pressure vessel	300 (2)	120°F	2" NPTM (3)	10 1/4 x 40 7/8	37	0715-11	1
H500-24M-8L	8" pressure vessel	225 (2)	120°F	3" NPTM (3)	16 x 48	86	0715-12	2
H600-24M-8L	8" pressure vessel	225 (2)	120°F	3" NPTM (3)	16 x 48	86	0715-11	2
H900-24M-10L	10" pressure vessel	225 (2)	120°F	3" NPTM (3)	16 1/4 x 49	131	0715-11	3
H1300-4FL-12L	12" pressure vessel	225 (2)	120°F	4" flange (4)	20 x 52 1/4	179	0715-11	4
H1600-4FL-12L	12" pressure vessel	225 (2)	120°F	4" flange (4)	20 x 52 1/4	182	0715-11	5
H2500-6FL-16L	16" pressure vessel	225 (2)	120°F	6" flange (4)	24 x 54 5/8	271	0715-11	8
H3500-6FL-20L	20" pressure vessel	225 (2)	120°F	6" flange (4)	28 x 62 9/16	518	0715-11	11
H4400-6FL-20L	20" pressure vessel	225 (2)	120°F	6" flange (4)	28 x 62 9/16	527	0715-11	14
H6000-8FL-24L	24" pressure vessel	225 (2)	120°F	8" flange (4)	33 x 69 1/8	709	0715-11	19

(1) Polycarbonate bowls are furnished with bowl guards. Do not use polycarbonate bowls when synthetic lubricants are present.
(2) Units with higher maximum working pressures are available. Models H500 and larger are ASME code constructed and stamped.
(3) Flanges and couplings are available.
(4) Optional flange sizes are available.

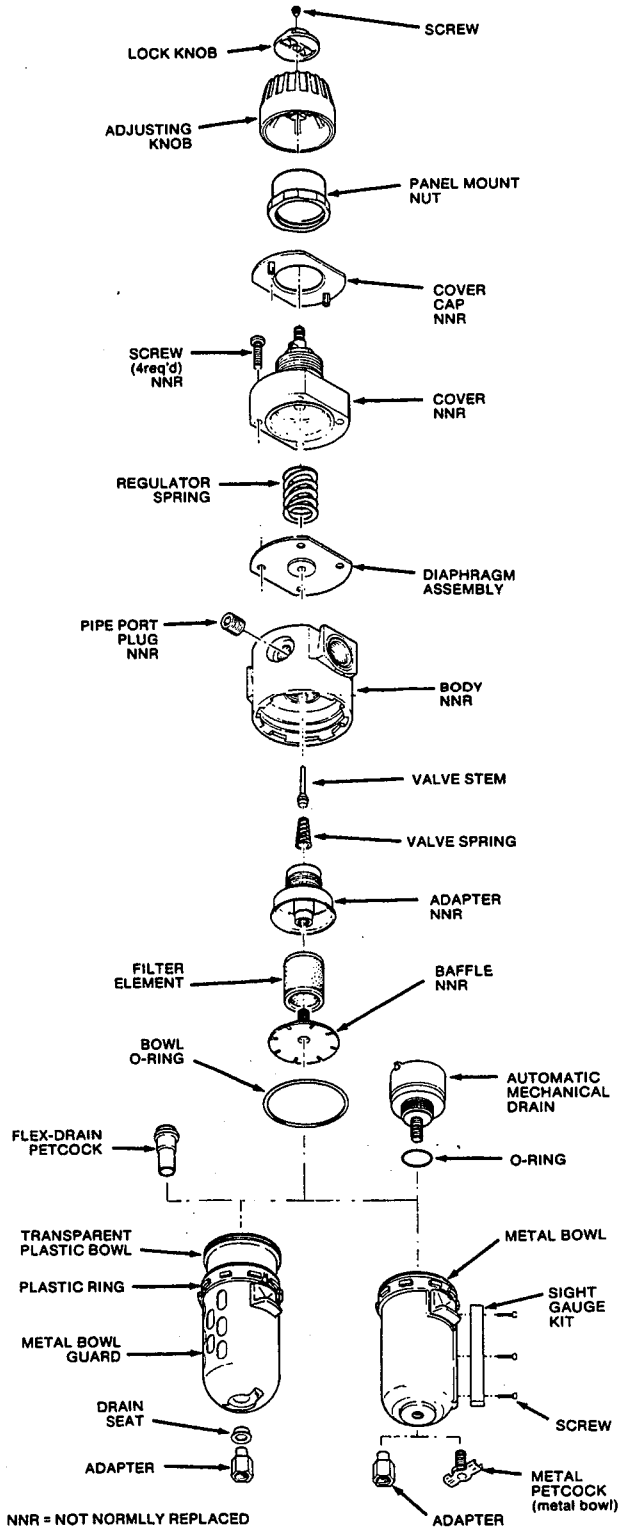
HANKISON DIVISION OF HANSEN INC.
CANONSBURG, PA 15317 U.S.A. TEL.: (412) 745-1555
PRICE AND ORDERING INFORMATION FROM

Energy Machinery
10 RESERVOIR PARK DRIVE
P.O. BOX 363
ROCKLAND, MA 02370

HANKISON®
1500-7

WILKERSON®
CORPORATION • ENGLEWOOD, CO 80150

PRECISION AIR PRESSURE REGULATOR TYPE PC6 FILTER/REGULATOR



INSTALLATION

Install the Filter/Regulator as close as possible to the application. The inlet port is marked with an arrow cast into the body to indicate the direction of flow. Gauge ports (¼") are provided in either side of the body for installation of a gauge or use as an additional outlet port. Plug unused port(s). System piping should be same size as regulator porting. In systems with a cyclic demand, the regulator should be located upstream of cycling device.

OPERATION

Maximum pressure and temperature ratings are: for transparent plastic bowls, 150 psig (10 bar) and 125°F (52°C); and for metal bowls, 250 psig (17 bar) and 175 °F (79°C).

Before turning on the supply air pressure, turn the adjusting knob counterclockwise until there is no load on the regulating spring. Turn on the supply air pressure and then turn the adjusting knob clockwise until the desired secondary pressure is reached. To avoid minor readjustment after making a change in pressure setting, always approach the desired pressure from a lower pressure. When reducing from a higher to a lower setting, first reduce to some pressure less than that desired and then increase to the desired pressure.

CAUTION

EXCEPT as otherwise specified by manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication and manufacturer assumes no responsibility for any resulting loss.

The relief flow capacity of relieving type regulators is limited. Under some operating conditions, the secondary (outlet) pressure could increase above the initial setting. If over-pressure conditions could cause malfunction or failure of downstream equipment, additional external pressure relief devices of suitable capacity must be installed.

Before using with fluids other than air for non-industrial applications or for life support systems, consult Wilkerson Corporation for approval.

SEE REVERSE SIDE FOR LIST OF MATERIALS
UNSUITABLE FOR USE WITH POLYCARBONATE BOWLS

MAINTENANCE

1. The regulator can be disassembled for servicing without removal from line.
2. DEPRESSURIZE UNIT BEFORE REMOVING GUARD AND/OR BOWL.
3. TO DISASSEMBLE: shut off air to unit and vent air line on both sides of unit. Turn adjusting screw counterclockwise to relieve spring compression. Remove knob, cover cap, screws, cover, and spring. Diaphragm assembly can now be removed.
4. To remove valve from bottom of unit, remove bowl. Remove baffle and filter element exposing hex nut on adapter assembly. Remove adapter assembly, valve and spring.
5. If it is a plastic bowl unit, inspect daily to detect crazing, cracking, damage, or other deterioration. Immediately replace any crazed, cracked, damaged, or deteriorated bowl with a metal bowl or a new plastic bowl and metal bowl guard.
6. a. If unit has a rigid (felt) filter element, clean periodically by removing from filter, tapping on surface, and blowing off with air blow gun.

   1b. If unit has soft cloth element, replace with a new one at least every six months, or sooner if it looks dirty or causes excessive pressure drop (10 psi or more at rated flow).

(continued on reverse side)

Printed in U.S.A.

7. a. If unit is equipped with a manual petcock, drain bowl at least once per work shift.
   b. If unit is equipped with a float in the bowl, clean the bowl each time the element is cleaned or changed by turning the bowl upside down and tapping onto tabletop. Blow clean with blow gun.
8. If bowl is crazed, cracked, or otherwise damaged or deteriorated, replace bowl and use manufacturer's approved bowl seal.
9. IF UNIT WILL NOT REGULATE TO REQUIRED PRESSURE, OR IF PRESSURE BECOMES EXCESSIVE follow instructions (see 4.) for removal of valve. Remove valve and spring. Clean and check valve stem and valve seat for wear or damage and replace if required.
10. Before placing unit is service, make sure that bowl and bowl guard are reinstalled and securely locked in place.

REPAIR KITS AND REPLACEMENT PARTS

SELF-RELIEVING REPAIR KIT (includes self-relieving diaphragm assy, valve stem, valve spring, filter element, and bowl o-ring)	**PRP-95-025**
Regulating Springs:	
0-30 psi	**RRP-95-916**
0-50 psi	**RRP-95-222**
0-120 psi	**RRP-95-224**
Self-Relieving Diaphragm Kit	**PRP-95-960**
Valve Assembly (valve stem, valve spring)	**PRP-95-959**
Filter Element Assembly (includes element and bowl o-ring)	**FRP-95-034**
Transparent Bowl Assemblies:	
with flexible drain	**FRP-95-017**
with bowl guard, Auto Drain	**FRP-95-015**
with bowl guard, flexible drain	**FRP-95-014**
Bowl O-Ring Kit (10 per kit)	**GRP-95-009**
Bowl Guard Kit	**GRP-95-013**
Metal Bowl Assemblies:	
with metal petcock	**FRP-95-178**
with Sight Gauge, metal petcock (for units with "G" in model no.)	**GRP-95-133**
Drains:	
Auto Drain Kit (includes o-ring, spacer, nut)	**GRP-95-714**
Brass Petcock (for metal bowls)	**GRP-95-182**
Flex Drain Kit (for plastic bowls)	**FRP-95-610**
Adjusting Knob Kit	**RRP-95-007**

NOTE: All bowl kits include bowl o-ring

ACCESSORIES

Wall Mounting Bracket with Panel Mount Nut	**GPA-95-011**
Wall Mounting Bracket	**GPA-95-012**
Panel Mount Nut	**GPA-95-032**
Tamper Resistant Kit	**RPA-95-006**
Viton Valve Assembly	**PPA-95-067**
Gauges:	
0-30 psig	**PPA-95-107**
0-60 psig	**PPA-95-106**
0-120 psig	**PPA-95-108**

WARNING: IF YOUR UNIT HAS A PLASTIC BOWL

1. **DO NOT** use plastic bowl units without a metal bowl guard installed. Plastic bowl units are sold only with metal bowl guards to minimize the danger of flying fragments in the event of bowl failure.
2. **DO NOT** install the unit where it will be subjected to temperatures higher than 125°F (51 ,7°C).
3. **DO NOT** install the unit where it will be subjected to pressure higher than 150 psig (10,3 bar).
4. **CAUTION:**
   Certain compressor oils, household cleaners, chemicals, solvents, paints and fumes will attack plastic bowls and can cause plastic-bowl failure. See manufacturer's list below. Do not use near these materials.
5. **WHEN BOWL** becomes dirty, replace bowl or wipe only with a clean, dry cloth.
6. **DO NOT** install on a compressed air line where the compressor is lubricated with, or the air contains, a material that will attack plastic bowls.
7. **DO** inspect plastic bowls daily to detect crazing, cracking damage, or other deterioration. Immediately replace any crazed, cracked, damaged, or deteriorated bowl with a metal bowl or a new plastic bowl and metal bowl guard.

WARNING: IF YOUR UNIT HAS A METAL BOWL

1. **DO NOT** install unit where it will be subjected to temperatures higher than 175°(80°C).
2. **DO NOT** install the unit where it will be subjected to pressure higher than 250 psi (17 bar).

SOME OF THE MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS

Acetaldehyde	Chlorobenzene	Methylene chloride
Acetic acid (conc.)	Chloroform	Methylene salicylate
Acetone	Cresol	Milk of lime (CaOH)
Acrylonitrile	Cyclohexanol	Nitric acid (conc.)
Ammonia	Cyclohexanone	Nitrobenzene
Ammonium fluoride	Cyclohexene	Nitrocellulose lacquer
Ammonium hydroxide	Dimethyl formamide	Phenol
Ammonium sulfide	Dioxane	Phosphorous hydroxy chloride
Anaerobic adhesives & sealants	Ethane tetrachloride	Phosphorous trichloride
Antifreeze	Ethyl acetate	Propionic acid
Benzene	Ethyl ether	Pyridine
Benzoic acid	Ethylamine	Sodium hydroxide
Benzyl alcohol	Ethylene chlorohydrin	Sodium sulfide
Brake fluids	Ethlene dichloride	Styrene
Bromobenzene	Ethlene glycol	Sulfuric acid (conc.)
Butyric acid	Formic acid (conc.)	Sulphural chloride
Carbolic acid	Freon (refrigerant & propellant)	Tetrahydronaphthalene
Carbon disulfide	Gasoline (high aromatic)	Thiophene
Carbon tetrachloride	Hydrazine	Toluene
Caustic potash solution	Hydrochloric acid (conc.)	Turpentine
Caustic soda solution	Lacquer thinner	Xylene
	Methyl alcohol	Perchlorethylene and others

TRADE NAMES OF SOME COMPRESSOR OILS, RUBBER COMPOUNDS AND OTHER MATERIALS THAT WILL ATTACK POLYCARBONATE PLASTIC BOWLS

Atlas "Perma-Guard"	National Compound #N11
Buna N	"Nylock" VC-3
Cellulube #150 and #220	Parco #1306 Neoprene
Crylex #5 cement	* Permabond 910
* Eastman 910	Petron PD287
Garlock #98403 (polyurethane)	Prestone
Haskel #568-023	Pydraul AC
Hilgard Co.'s hil phene	Sears Regular Motor Oil
Houghton & Co. oil #1120, #1130 and #1055	Sinclair oil "Lily White"
Houosafe 1000	Stauffer Chemical FYROUEL #150
Kano Kroil	Stillman #SR 269-75 (polyurethane)
Keystone penetrating oil #2	Stillman #SR 513-70 (neoprene)
* Loctite 271	Tannergas
* Loctite 290	Telar
* Loctite 601	Tenneco anderol #495 and #500 oils
* Loctite Teflon-Sealant	Titon
Marvel Mystery Oil	* Vibra-tite
Minn. Rubber 366Y	Zerex

* When in raw liquid form

WE CANNOT POSSIBLY LIST ALL HARMFUL SUBSTANCES. SO CHECK WITH A MOBAY CHEMICAL OR GENERAL ELECTRIC OFFICE FOR FURTHER INFORMATION ON POLYCARBONATE PLASTIC.

Hypertherm

Appendix B

PROPYLENE GLYCOL SAFETY DATA
BENZOTRIAZOLE SAFETY DATA

In this appendix:

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.

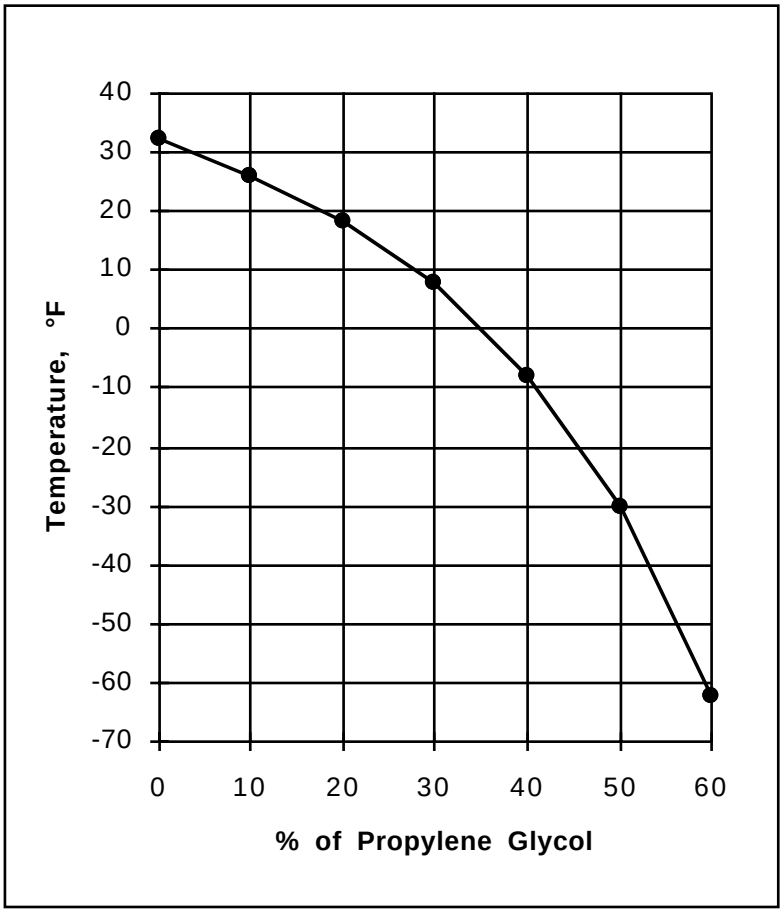


Figure b-1 Freezing Point of Propylene Glycol Solution

MATERIAL SAFETY DATA SHEET COBRATEC™ 99 Powder

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.

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

Hypertherm

Appendix C

AERATION MANIFOLD

In this section:

Aeration Manifold for Plasma Cutting Aluminum

Introduction

When plasma arc cutting aluminum, free hydrogen gas may be generated by the cutting process. The high temperature of the plasma process causes disassociation of oxygen and hydrogen from the water in the water table. The hot aluminum, which has a high affinity for oxygen, then combines with the oxygen leaving free hydrogen.

An effective means of avoiding free hydrogen buildup is to install an aeration manifold on the floor of the water table to replenish the oxygen content of the water.

Making an Aeration Manifold – Figure c-1

Make an **Aeration Manifold** with two-inch (50 mm) PVC tubing with one-inch (25 mm) **Distribution Lines** connected to it. Drill 1/8 inch (3 mm) holes every six inches (150 mm) in the distribution lines. Cap the ends of the distribution lines and install the lines so that oxygen is delivered to all parts of the cutting area.

Connect the manifold to a shop air line. Set a pressure regulator to obtain a steady stream of bubbles.

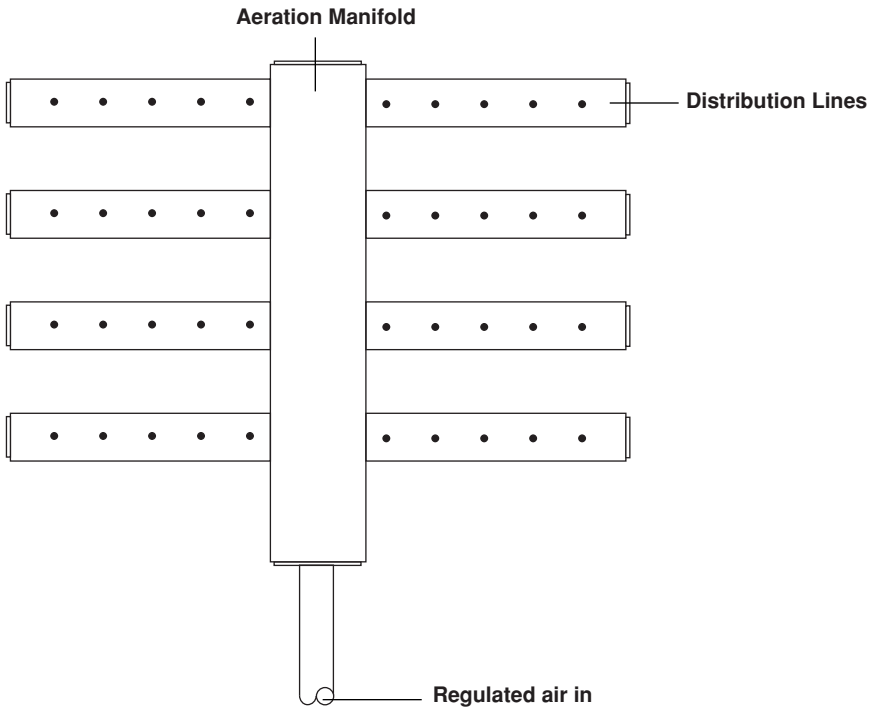


Figure c-1 Aeration Manifold

Hypertherm

Appendix D

ELECTROMAGNETIC COMPABILITY (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 compatibility in a domestic 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 should 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 should 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.

General

This appendix will enable a qualified electrician to install the power cable to the EMI filter on 400V CE power supplies 073200 (without THC) and 073213 (with THC) for machine torch systems.

Power Cable

The power cable is **customer supplied**. See *Power Cable* on pages 3-8 for recommended cable sizes. Final specification and installation of the power cord should be made by a licensed electrician and according to applicable national or local codes. See also *Mains Supply* on page d-2 for further power (supply) cable shielding recommendations.

Connect power cable

Connect one end of the power cable to the EMI filter first and then connect the other end to the line disconnect switch.

Power Supply

1. Locate the EMI filter on the top rear of the power supply (see Figure d-1).

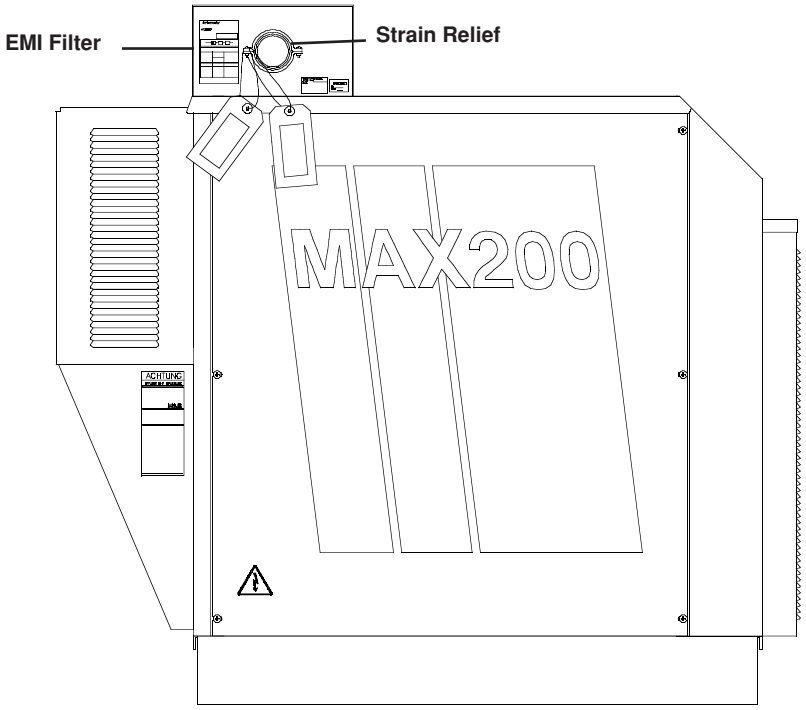


Figure d-1 MAX200 Power Supply with EMI Filter – Side View

2. Unscrew the four filter cover screws and remove cover to access input voltage connections at TB1 (see Figure d-2).

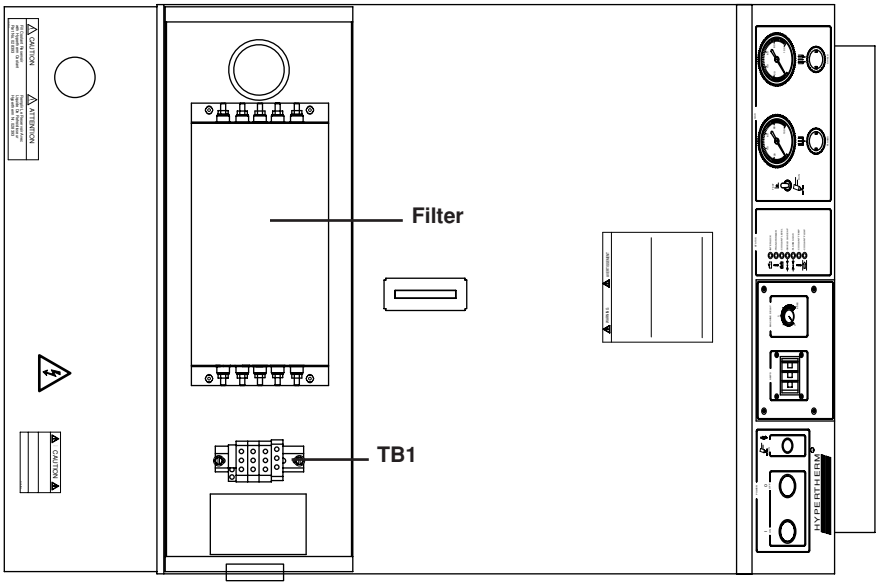


Figure d-2 MAX200 Power Supply with EMI Filter Cover Off – Top View

3. Insert the power cable through the strain relief (see Figure d-1).

4. Connect leads L1 to U, L2 to V, and L3 to W terminals of TB1 (see Figure d-3). Ensure that all connections are tight to avoid excessive heating.

5. Connect the ground lead to terminal marked PE at TB1 (see Figure d-3).

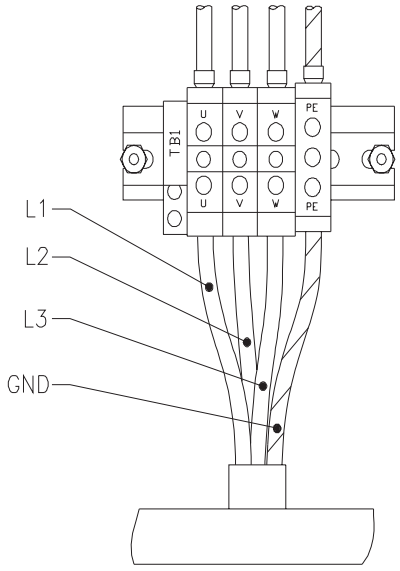


Figure d-3 Power Cable Connections to TB1

WARNING

The neon light attached to the line filter will turn ON as soon as the line disconnect switch is ON. This indicator is a warning that there is line voltage at the filter even if the ON (1) pushbutton on the MAX200 power supply has not been pressed. As a common safety practice, ALWAYS verify that the line disconnect switch is in the OFF position before installing, disconnecting or servicing in this area.

Line Disconnect Switch

Connecting the power cable to the line disconnect switch must conform to national or local electrical codes. This work should be performed only by qualified, licensed personnel. See *Power Requirements* and *Line Disconnect Switch* on page 3-8.

EMI Filter Parts List

Item	Part Number	Description	Qty.
	001557	Cover: 200/2000-CE Electronic Filter Enclosure	1
1	001558	Enclosure: 200/2000-CE Electronic Filter	1
2	001559	Cover: 200/2000-CE Top	1
3	008489	Bushing: 1.97 ID X 2.5 Hole Black-Snap	1
4	008610	Strain Relief: 1-1/2NPT 1.5ID 2-Screw	1
5	029316	TB1 Input-Power SA: 200/2000/4X00/HD	1
6	109036	Filter: 60A 440VAC 3PH 2-Stage Electronic	1
7	109040	Filter Mounting Bracket for 109036	1

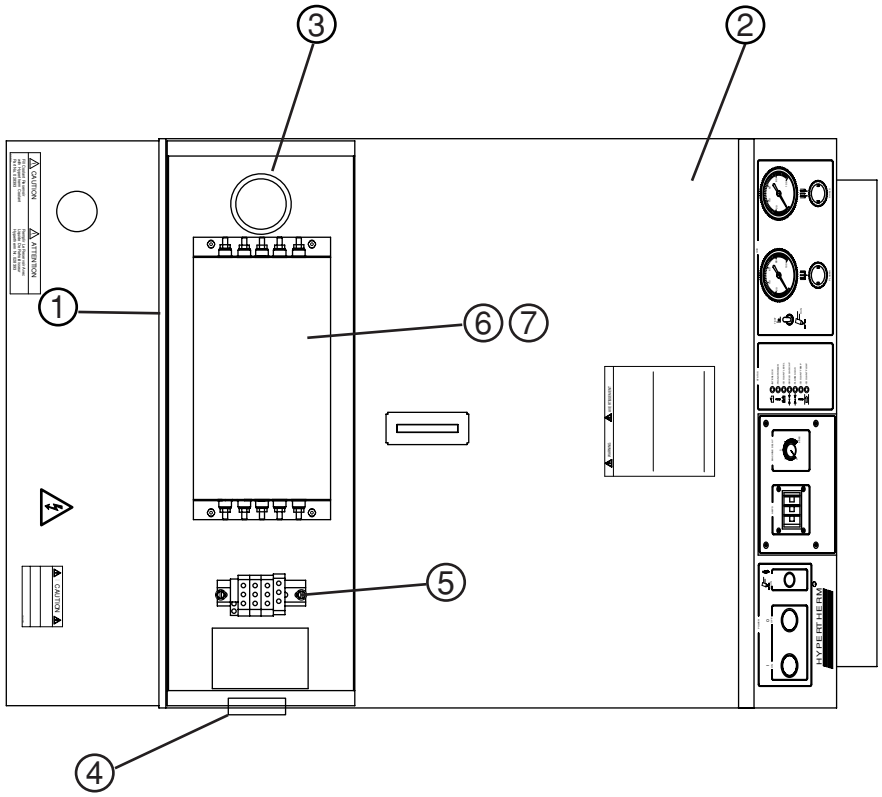


Figure d-4 MAX200 EMI Filter Parts