HT4001®

Plasma Arc Cutting System -
Gas Panel and High Frequency Console

Instruction Manual
802970 - Revision 2

Integrated Plasma System
For use with the TITAN™

Hypertherm
The world leader in plasma cutting technology

MESSER
MG Systems & Welding, Inc.

NOTICE

Use the HT4001 instruction manual, 802000, as well as this manual, 802970, to install, operate and maintain the HT4001 with Titan system.

- This manual contains information to install and operate the HT4001 with Titan system. A parts list for the gas panel and high frequency console is also included.
- See the 802000 manual for general maintenance and information relevant to the HT4001 power supply, slave and accessories.

0.01	uprevved because of customer request
2.02	added gas console to water inlet pressure spec.
4.10	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.11	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.12	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.13	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.14	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.15	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.16	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.17	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.18	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.19	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.20	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info
4.21	added gas console to water inlet pressure spec.,removed water chiller outlet pressure info

0.01	uprevved because of ECN 10128
4.09	changed index to cut chart and consumables to include new 340A electrodes
4.10	updated cut charts with new electrode
4.15	updated cut charts with new electrode

HT4001

Gas Panel and High Frequency Console for *TITAN*™

Plasma Arc Cutting System

Instruction Manual
IM-297
(P/N 802970)

Revision 2 December, 1999

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Genuine Hypertherm parts are the factory-recommended replacement parts for your Hypertherm system. Use of other than genuine parts may be cause for invalidation of the Hypertherm warranty.

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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 incidental or consequential injury to persons or property damage by reason of any code violation or poor work practices.

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Section 1 SAFETY

In this section:

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Before using this plasma arc system. . . .

Each person who will operate this equipment, perform service or maintenance, or supervise its use must read the safety instructions and warnings in this manual and the labels on the equipment.

About Notes, Cautions and Warnings

Notes: Throughout this manual, useful information for operating the plasma system is presented in "notes", such as shown in this paragraph.

Cautions: Information in bold type and surrounded by a box describes a situation that may cause damage to the plasma system.

WARNINGS

Warnings describe situations that present a physical danger to the operator, and advice to avoid or correct the situation. Each type of warning includes applicable danger symbols, such as a hand burn, electrical shock, fire, explosion, etc.

WARNING — Instant-On Torches

Instant-on torches produce a plasma arc immediately after the torch switch is pushed.

Always hold a hand torch away from your body as a precaution against accidental torch firing. Be aware of this hazard, which has potential for serious bodily injury.

WARNING — Electric Shock

- **Never touch the torch body, workpiece or the water in a water table when operating the plasma system.**
- **When using a water table, be sure that it is correctly connected to earth ground.**
- **Operating the plasma system completes an electrical circuit between the torch and the workpiece and anything touching the workpiece. The workpiece is part of the electrical circuit.**

Eye Protection

- Wear dark safety glasses or goggles with side shields, or a welding helmet, in accordance with applicable national or local codes, to protect eyes against the plasma 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

- Replace the glasses, goggles or helmet when the lens becomes pitted or broken.
- Warn other people in the area not to look directly at the arc unless they are wearing glasses, goggles or a helmet.
- Prepare the cutting area in a manner that reduces the reflection and transmission of ultraviolet light:
  - Paint walls and other surfaces with dark colors to reduce reflection.
  - Install protective screens or curtains to reduce ultraviolet transmission.

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 which covers all exposed areas.
  - Cuffless trousers to prevent entry of sparks and slag.

Toxic Fume Prevention

- Keep the cutting area well ventilated.
- Remove all chlorinated solvents from the cutting area before cutting. Certain chlorinated solvents decompose when exposed to ultraviolet radiation to form phosgene gas.
- Wear proper breathing mask and use proper ventilation when cutting galvanized metal.
- Do not cut containers with toxic materials inside. Clean containers that have held toxic materials thoroughly before cutting.

WARNING — Toxic Fumes

Do not cut metal or painted metals containing zinc, lead, cadmium or beryllium unless the operator, or anyone else subjected to the fumes, wears respiratory equipment or an air-supplied helmet.

Fire Prevention

- Make fire extinguishers available in the cutting area.
- Remove all combustible materials from the immediate cutting area to a distance of at least 35 feet (10 m).
- Quench freshly cut metal or allow metal to cool before handling it or bringing it into contact with combustible materials.
- Never use a plasma system to cut containers with potentially flammable materials inside. Such containers must be thoroughly cleaned prior to cutting.
- Ventilate potentially flammable atmospheres before cutting with a plasma system. When cutting with oxygen as the plasma gas, an exhaust ventilation system is required.
- Never operate the plasma system in an atmosphere which contains heavy concentrations of dust, flammable gas or combustible liquid vapors unless properly vented.

Electric Shock Prevention

All Hypertherm plasma systems use high voltage (up to 300 VDC) to initiate the plasma arc. Take the following precautions when operating the plasma system:

- Wear insulated gloves and boots, and keep body and clothing dry.
- Do not stand, sit or lie on—or touch—any wet surface when using the plasma system.
- Maintain proper insulation against electrical shock. If you must work in or near a damp area, use extreme caution.
- Provide a wall-mounted disconnect switch with properly sized fuses close to the power supply. This switch allows the operator to turn the power supply off quickly in an emergency situation.
- Conform to all local electrical codes for primary wiring sizes and types.
- Inspect the primary power cord frequently for damage or cracking of the cover. Bare wiring can kill. Do not use a system with a damaged power cord. Replace a damaged power cord immediately.
- Inspect the torch leads. Replace if frayed or damaged.
- 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.

Electric Shock Prevention (continued)

- Before changing the torch parts, disconnect the main power or unplug the power supply. After changing torch parts and replacing the retaining cap, plug in the power supply again.
- Never bypass or shortcut the safety interlocks.
- Before removing a power supply cover for maintenance, disconnect the main power at the wall disconnect switch or unplug the power supply. To avoid exposure to severe electrical hazard, wait five minutes after disconnecting the main power to allow capacitors to discharge.
- Never operate the plasma system unless the power supply unit covers are in place. Exposed power supply connections present a severe electrical hazard.

Explosion Prevention

WARNING — Compressed Gas

The plasma system uses compressed gas. Observe proper precautions when handling and using compressed gas equipment and cylinders.

- Do not use the plasma system if explosive dust or vapors may be present.
- Do not cut pressurized cylinders or any closed container.

WARNING — Hydrogen Explosion Hazard

If your system uses hydrogen, remember that this is a flammable gas that presents an explosion hazard. Keep flames away from cylinders containing hydrogen mixtures and hoses that carry hydrogen mixtures. Also, keep flames and sparks away from the torch when using argon-hydrogen as the plasma gas.

Compressed Gas Cylinders

Handle and use compressed gas cylinders in accordance with safety standards published by the U.S. Compressed Gas Association (CGA), American Welding Society (AWS), Canadian Standards Association (CSA) or applicable national or local codes.

- Never use a cylinder that leaks or is physically damaged.
- Never use a cylinder that is not upright and secured in place.
- Never move or transport a cylinder without its protective valve cover in place.
- Never use a gas cylinder or its contents for any purpose other than that for which it is intended.
- Never lubricate cylinder valves with oil or grease.
- Never allow electrical contact between the plasma arc and a cylinder.
- Never expose cylinders to excessive heat, sparks, slag or open flame.
- Never use hammers, wrenches or other tools to open stuck cylinder valves.

Pressure Regulators

- Be certain that all pressure regulators are in proper working condition.
- Never use a regulator for any gas other than that for which it is intended.
- Never use a regulator that leaks, creeps excessively or is physically damaged in any way.
- Never attempt to lubricate a regulator with oil or grease.

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.

Installing an aeration manifold on the floor of the water table is an effective way to eliminate the possibility of hydrogen detonation when cutting aluminum. Refer to the Appendix section of this manual for instructions on how to fabricate an aeration manifold.

Hoses

- Label and color-code all gas hoses in order to clearly identify the type of gas in each hose. Consult applicable national or local codes.
- Never use the oxygen hose for any gas other than oxygen.
- Examine hoses at regular intervals for leaks, wear, loose connections or other hazard.
- Replace hose that is damaged in any way.

Hoses (continued)

- Keep hose lengths to a minimum to prevent damage, reduce pressure drop and to prevent possible flow restrictions.
- Prevent kinking by laying out hoses as straight as possible between termination points.
- Coil any excess hose and place it out of the way to prevent damage and to eliminate the danger of tripping.

Noise Protection

The plasma cutting process can generate high levels of noise. Depending on the arc current, material being cut, acoustics and size of the cutting room, distance from the torch and other factors, acceptable noise levels as defined by national or local codes may be exceeded by your plasma system.

- Always wear proper ear protection when cutting or gouging with the plasma system.

Grounding

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 properly connect the power cord ground wire. Conform to Canadian Standards Association (CSA) standards by placing the power cord 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.

Work Cable

- Attach the work cable securely to the workpiece or the work table by making 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 a high-quality earth ground, in accordance with the U.S. National Electrical Code, Article 250, Section H, Grounding Electrode System, or other appropriate national or local codes.

Safety Reminders

- Never bypass or shortcut the safety interlocks on any of the plasma system units.
- Except in Hypertherm's largest mechanized systems, all Hypertherm torches are designed with a safety interlock that prevents firing of the plasma arc when the retaining cap is loosened.
- 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 potentially dangerous situation to the operator and any personnel in the area. Hypertherm's warranty does not cover problems caused by the use of torches not made by Hypertherm.
- Use only consumable parts and replacement parts made by Hypertherm. Hypertherm's warranty does not cover problems caused by the use of parts not made by Hypertherm.
- Never operate the plasma system with any of its covers not in place. This would be hazardous to the operator and other people in the area, and prevents the proper cooling of the equipment.

Electronic Health Support Equipment

Plasma arc cutting and gouging systems create electric and magnetic fields that may interfere with the correct operation of electronic health support equipment, such as pacemakers or hearing aids. Any person who wears a pacemaker or hearing aid should consult a doctor before operating or being near any plasma system when it is in use. To minimize exposure to EMF:

- Keep both the work cable and the torch lead on one side of your body. Keep your body from coming in between the torch lead and the work cable.
- Route torch leads as close as possible to work cable.
- Do not wrap the torch lead or work cable around your body.
- Stay as far away from the power supply as possible.

Section 2

SPECIFICATIONS

SYSTEM COMPONENTS

See the block diagram in **Section 3** for details of the system interconnections.

HT4001 Power Supply

The power supply houses four 100-amp, 15kHz choppers and an optional Torch Height Control (THC). The power supply can be connected to the H-401 or H-601 slave power supply to output up to 750 amps.

HT4001 Machine Torch

The HT4001 machine torch is a water-injection torch capable of cutting most metals from gauge to 3-inch (76 mm) thickness. To achieve consumable long life, all cuts must begin and end on the plate surface.

Remote High Frequency&Motor Valve Console (also called "High Frequency Console")

The remote high frequency and motor valve console houses the high frequency starting circuit, two water flow switches, a motorized metering valve and plasma solenoid valves that switch to allow plasma gas flow for both preflow and operation modes. Note: This console is mounted approximately 25 feet (7.6 m) from the torch.

Gas Panel

The gas panel holds metering and solenoid valves for the plasma gases, flow meters, pressure gauges for plasma gases, and a pressure gauge and flowmeter for the water supply.

Timer/Counter - Optional

The timer/counter allows the operator to monitor the number of arc starts and the cumulative time that the arc is on in hours. The arc starts can be reset.

Water Muffler - Optional

The water muffler for the HT4001 Titan system is an option which greatly improves cutting safety and pollution control capabilities. The water muffler can be used to cut above, below and at the water line. The water muffler requires an air supply and a water supply. Refer to the Water Muffler instruction manual 801730 for more detailed information.

H-401 Slave Power Supply - Optional

This unit can function as a "slave" when paralleled with the HT4001 power supply, providing up to 750 amps of current for the HT4001 system. Refer to the H-401 & H-601 instruction manual 800410 for more detailed information.

SPECIFICATIONS

Water Chiller - Optional

The water chiller for the HT4001 with Titan system is a refrigeration unit capable of reducing the water supply temperature and increasing the water pressure to the RHF&MV console. The water chiller requires a water supply and may also require a water softener. See *Water Supply Requirements* in the **Pre-Installation** section of the HT4001 instruction manual 802000. Refer also to Water Chiller Model D Instruction Manual 802410.

SPECIFICATIONS

System Requirements

Power Requirements:
Refer to HT4001 Power Supply specifications below:

Gas Requirements:
Plasma Gas Types ..... Oxygen, Nitrogen

Gas Quality:
Oxygen 99.5%
Nitrogen 99.995%

Oxygen Gas Inlet Pressure ..... 120 psi +/- 10 psi (8.3 bar +/- 0.7 bar)
Nitrogen Gas Inlet Pressure ..... 150 psi +/- 10 psi (10.3 bar +/- 0.7 bar)
Air Gas Inlet Pressure (for Water Muffler) ..... 120 psi (8.3 bar)

Water Requirements:
Water Flow ..... 2.5 gpm (9.5 l/m) to RHF&MV console
Water Inlet Pressure ..... 150 psi (10.3 bar) to RHF, gas console &MV console

HT4001 Power Supply

Maximum OCV (U_0) ..... 361 VDC
Maximum Output Current (I_2) ..... 400 A
Output Voltage (U_2) ..... 80-200 VDC
Duty Cycle Rating (X) ..... 100% @ 40°C at 400 A and 200 V
Ambient Temperatures/Duty Cycle ..... Power supplies will operate between +14° and 104°F (-10° and +40°C).
Power supplies operated in an ambient temperature above 86°F (30°C) may show some decrease in duty cycle.
Power Factor ($\cos\varphi$) 0.94
Cooling ..... Forced Air (Class F)

HT4001 Power Supply Input Power: (U_1 - Input voltage; I_1 - Input current)

077002 with THC / **077016** without THC ..... 200 VAC (U_1), 3Ø, 50-60 Hz @ 257A (I_1)
220 VAC (U_1), 3Ø, 50-60 Hz @ 234A (I_1)
077003 with THC / **077017** without THC ..... 380 VAC (U_1), 3Ø, 50-60 Hz @ 135A (I_1)
415 VAC (U_1), 3Ø, 50-60 Hz @ 124A (I_1)
077004 with THC / **077018** without THC ..... 240 VAC (U_1), 3Ø, 60 Hz @ 214A (I_1)
480 VAC (U_1), 3Ø, 60 Hz @ 107A (I_1)
077005 with THC / **077019** without THC ..... 575 VAC (U_1), 3Ø, 60 Hz @ 89A (I_1)
600 VAC (U_1), 3Ø, 60 Hz @ 86A (I_1)

Dimensions and Weight:
Width ..... 34" (863 mm)
Maximum Height ..... 51" (1295 mm); 63" (1600 mm) on 200/220V units
Maximum Depth ..... 48-11/16" (1236 mm)
Weight ..... 1800 lbs (817 kg)

HT4001 Power Supply - with Slave

Maximum OCV (U_0) ..... 400 VDC
Maximum Output Current (I_2) ..... 760 A
Output Voltage (U_2) ..... 80-200 VDC
Duty Cycle Rating (X) ..... 100% @ 40°C at 760 A and 200 V

See the H-401 & H-601 instruction manual 800410 for further specifications on the slave power supply.

PAC620 Machine Torches

Maximum cutting thickness ..... See Cut Charts for details.
Maximum current at 100% duty cycle ..... 760 A

Plasma Gas Flow ..... Oxygen - 114 scfh (54 l/min)
Nitrogen - 223 scfh (105 l/min)
Injection Water Flow Rate ..... 0.38 to 0.48 gpm (1.4 to 1.8 l/min)
Water coolant flow rate (max.) ..... 1.7 gpm (6.4 l/min)

Dimensions and Weight:
Diameter ..... 2" (50 mm)
Length ..... 17.15" (435 mm) standard; 15.37" (390 mm) bevel
Weight ..... 3-1/2 lbs (1.58 kg)

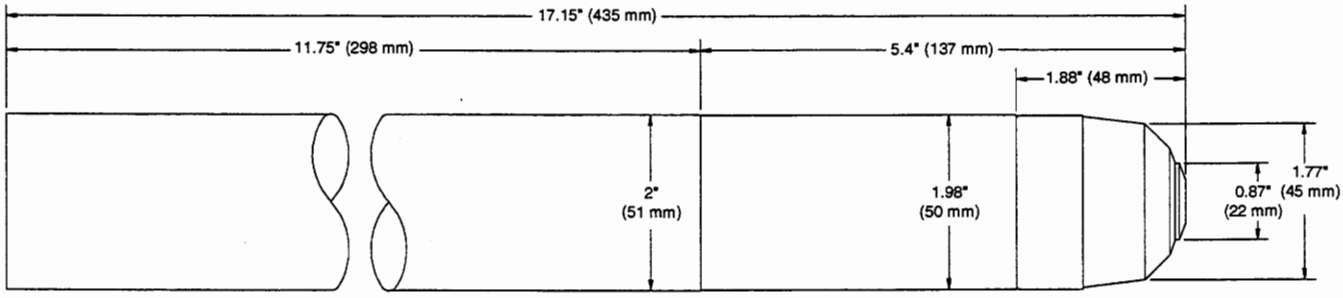


Figure 2-1 PAC620 Standard Torch Assembly with Dimensions

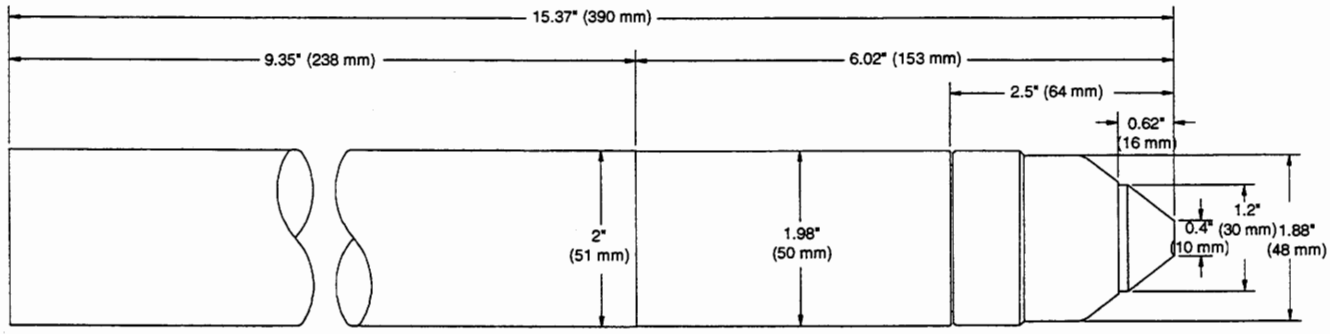


Figure 2-2 PAC620 Bevel Torch Assembly with Dimensions

Remote High Frequency & Motor Valve (RHF&MV) Console

Dimensions and Weight:

Width ..... 20" (508 mm)
Height ..... 16" (406 mm)
Depth ..... 8.8" (223 mm)
Weight ..... 60 lbs (27 kg)

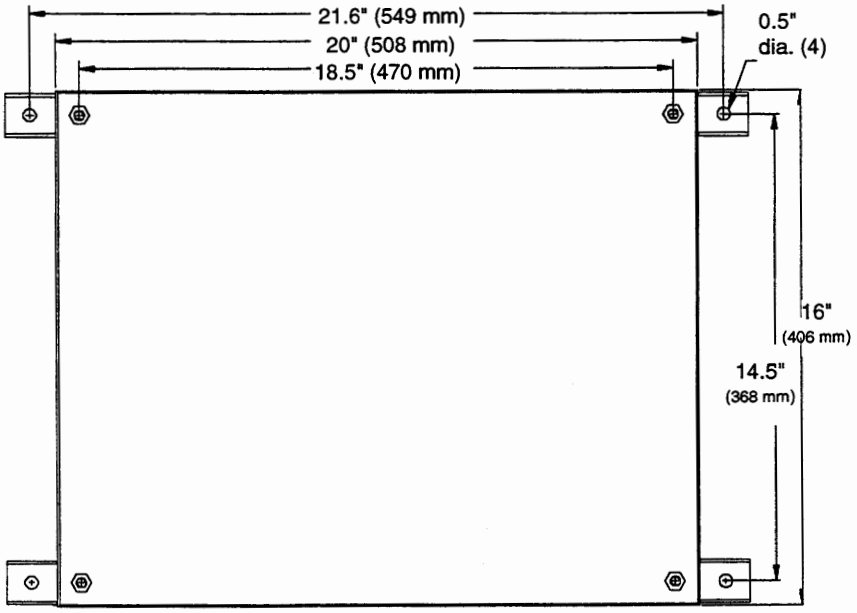


Figure 2-3 Mounting Dimensions - RHF&MV Console

Gas Panel

Dimensions and Weight:

Width ..... 9" (228 mm)
Height ..... 34" (864 mm)
Depth ..... 6" (150 mm)
Weight ..... 24 lbs (11 kg)

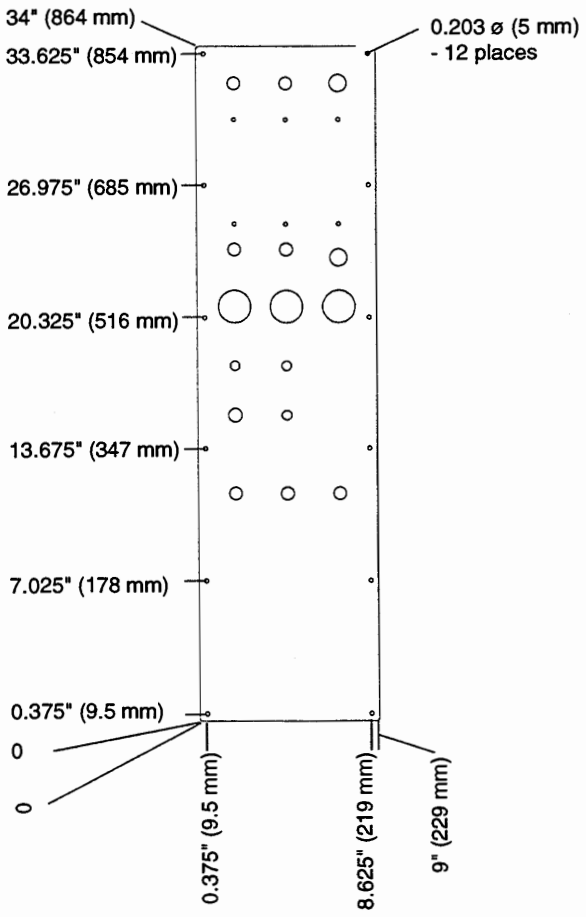


Figure 2-4 Mounting Dimensions - Gas Panel

Timer/Counter - Optional

Dimensions and Weight:

Width ..... 6-1/2" (16.5 cm)
Height ..... 2-1/2" (6.4 cm)
Depth ..... 8-5/8" (21.9 cm)
Weight ..... 3 lbs (1 kg)

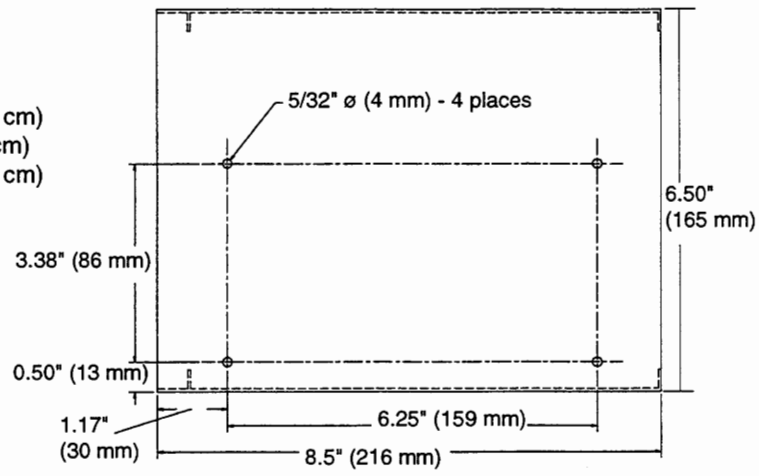


Figure 2-5 Mounting Dimensions - Timer/Counter

Water Muffler - Optional

Refer to the Water Muffler Instruction Manual 801730.

Water Chiller - Optional

Refer to the Water Chiller Instruction Manual 802410.

Hypertherm

Section 3

INSTALLATION

PRE-INSTALLATION

See the HT4001 instruction manual 802000 **Pre-installation** section for system requirements.

SYSTEM UNITS PLACEMENT

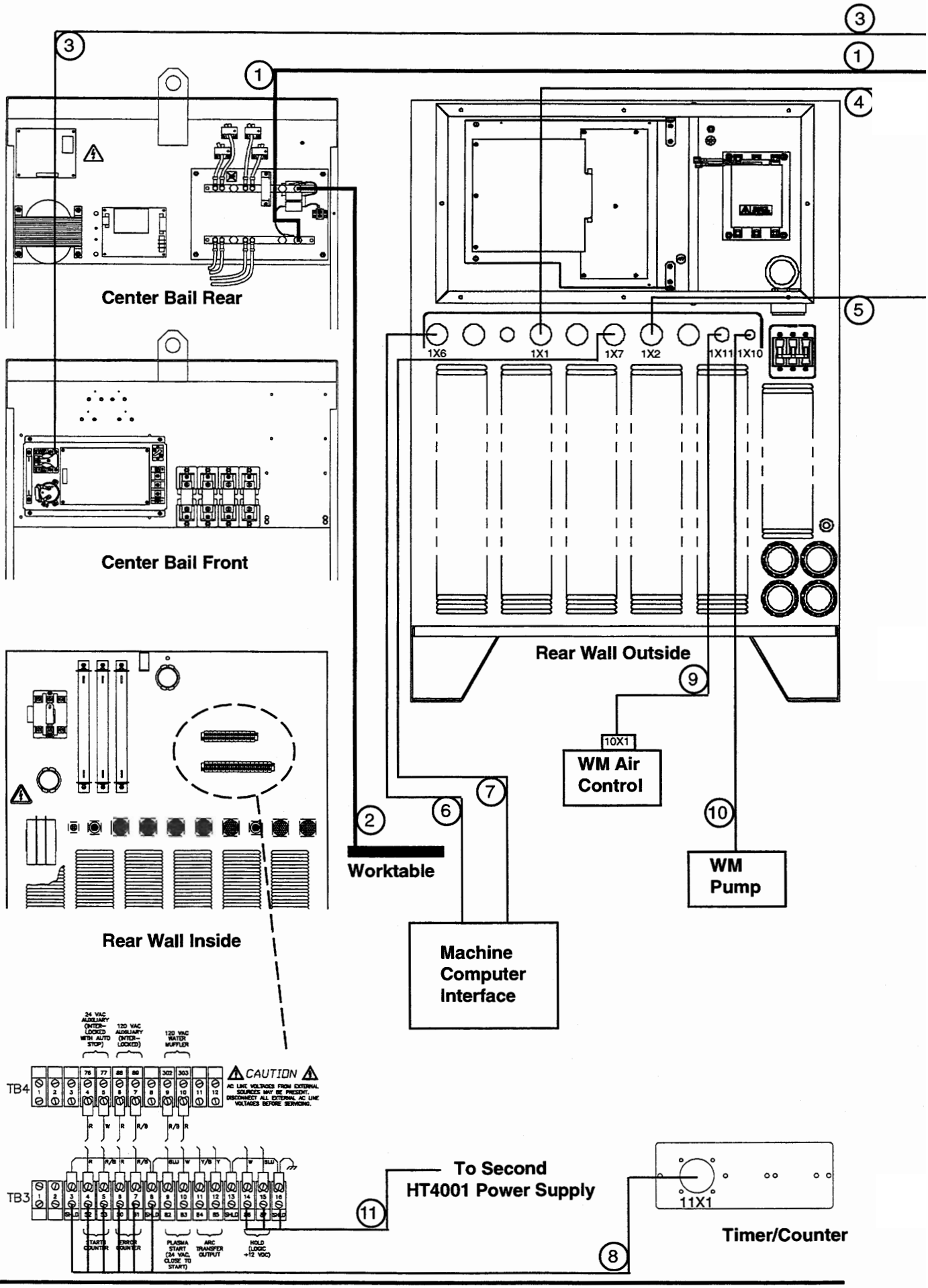
- Position all required units prior to making electrical, gas and interface connections.
- Ground all external modules in the HT4001 with Titan system to earth.
- To prevent leaks in the system, tighten all gas and water connections to the following specifications:

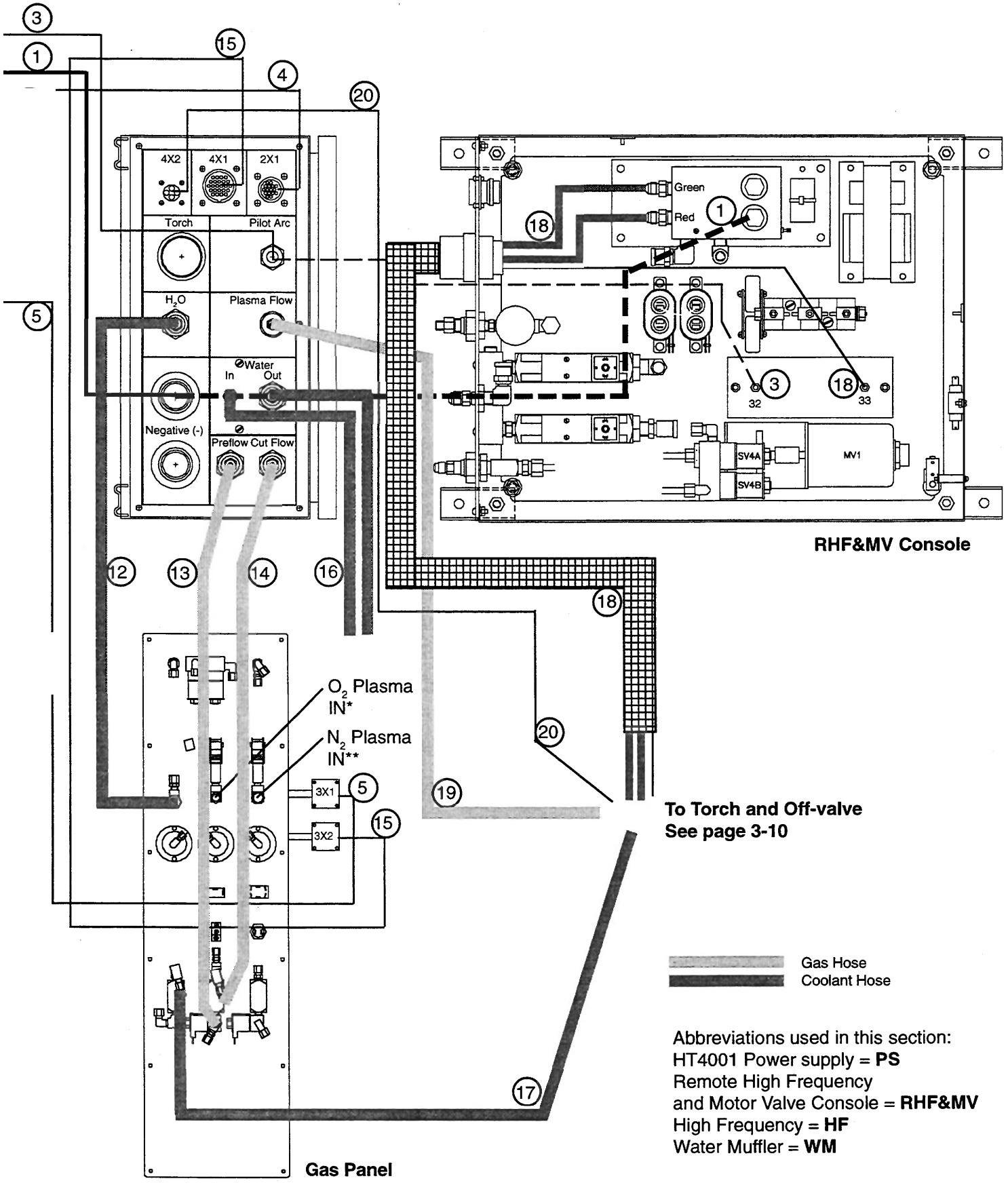
Gas or water hose size	Torque Specification		
	lbf-in	lbf-ft	kgf-cm
up to 3/8" (10 mm)	75-85	6.25-7	86-98
1/2" (13 mm)	360-480	30-40	415-550

Use 2 wrenches when tightening to prevent damage to the mating component.

Use the diagram on the following 2 pages to make system interconnections. Follow the number guide on the diagram to find out specific information on each cable, hose or connection. The numbered items are detailed on the pages following the interconnection diagram.

See the HT4001 instruction manual 802000 for H-401 slave connections.


3
1
4
5
Center Bail Rear
Center Bail Front
1X6
1X1
1X7
1X2
1X11
1X10
Rear Wall Outside
9
10X1
WM Air Control
7
6
2
Worktable
10
WM Pump
Rear Wall Inside
Machine Computer Interface
24 VAC AUXILIARY (INTER-LOCKED WITH AUTO STOP)
120 VAC AUXILIARY (INTER-LOCKED)
120 VAC WATER MUFFLER
CAUTION
AC LINE VOLTAGES FROM EXTERNAL SOURCES MAY BE PRESENT. DISCONNECT ALL EXTERNAL AC LINE VOLTAGES BEFORE SERVICING.
TB4
TB3
To Second HT4001 Power Supply
11
11X1
Timer/Counter
8



* 1/8 NPT male adapter provided for plasma supply hose
** 1/8 NPT inert adapter provided for plasma supply hose

Figure 3-1 HT4001 with Titan Interconnection Diagram

POWER SUPPLY CONNECTIONS

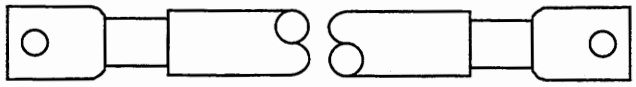
Note: All leads between the power supply and the RHF&MV console can be ordered as a 60-foot (18.3 m) package under one number - 128222.

(1) *Negative Lead - Power Supply (PS) to RHF&MV Console*

(1)

Part No.	Length
123316	60 ft (18.3 m)

Note: Two negative leads are needed when using the slave power supply.
See Appendix A in instruction manual 802000 for connections and information.

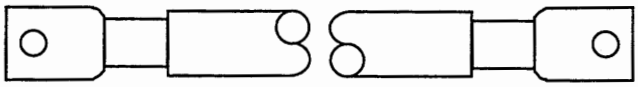


(2) *Positive Lead - PS to Work Table*

(2)

Part No.	Length
023382	15 ft (4.6 m)
023136	20 ft (6.1 m)
023078	25 ft (7.6 m)
023101	30 ft (9.2 m)
023135	40 ft (12.2 m)
023079	50 ft (15 m)
123316	60 ft (18.3 m)

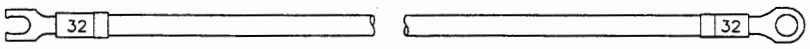
Note: Two positive leads are needed when using the slave power supply.
See Appendix A in instruction manual 802000 for connections and information.



(3) *Nozzle Lead - PS to RHF&MV Console*

(3)

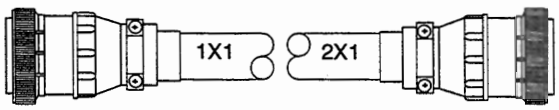
Part No.	Length
123327	60 ft (18.3 m)



(4) *RHF Cable - PS to RHF&MV Console*

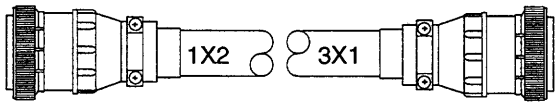
(4)

Part No.	Length
123314	60 ft (18.3 m)



From 1X1	To 2X1	Signal	From 1X1	To 2X1	Signal
34	1	Door Interlock	10	10	FS2 Injection Water
35	4	Door Interlock	11	13	FS2 Injection Water
36		Shield	12		Shield
4	2	SV6 Injection Water	1	12	FL1 to T1 / HV Xfrmer
8	5	SV6 Injection Water	2	15	FL1 to T1 / HV Xfrmer
9		Shield	3		Shield
23	7	FS1 Cooling Water			
24	8	FS1 Cooling Water			
25		Shield			

(5) *Gas Panel Cable - PS to Gas Panel*

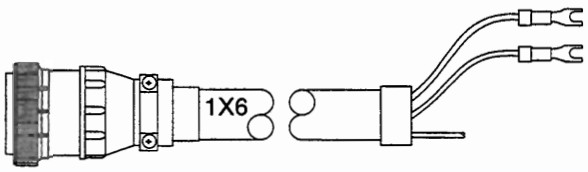


(5)

Part No.	Length
023496	50 ft (15 m)
023497	75 ft (23 m)
023498	100 ft (30.5)
123067	110 ft (33.6 m)
123087	125 ft (38.1 m)
023499	150 ft (46 m)
123031	170 ft (51.9 m)
023500	200 ft (62 m)
023812	250 ft (76.3 m)
023819	300 ft (91.5 m)
023576	350 ft (106.8 m)

From 1X2	To 3X1	Signal
29	29	SV5/Plasma OFF
30	30	SV5/Plasma OFF
34	34	Gnd
5	5	S1/O_2,N_2 Select
6	6	S1/O_2,N_2 Select
1	1	Gnd
2	2	S2/Test Preflow
3	3	S2/Test Preflow
7	7	Gnd
8	8	S2/Test Cut Flow
9	9	S2/Test Cut Flow
4	4	Gnd
16	16	SV4A/Cut Flow
17	17	SV4A/Cut Flow
10	10	Gnd
23	23	SV4B/Preflow
24	24	SV4B/Preflow
25	25	Gnd
11	11	SV2, SV3/O_2 N_2 Preflow
12	12	SV2, SV3/O_2 N_2 Preflow
18	18	Gnd
35	35	SV1A/Plasma O_2 Cut Flow
36	36	SV1A/Plasma O_2 Cut Flow
31	31	Gnd
19	19	SV1B/Plasma N_2 Cut Flow
20	20	SV1B/Plasma N_2 Cut Flow
13	13	Gnd
14	14	PS1, PS2/Plasma Pressure
15	15	PS1, PS2/Plasma Pressure
21	21	Gnd
26	26	S3, Increase/Decrease
27	27	S3. Increase/Decrease
28	28	Gnd
32	32	LT1 DC On
33	33	LT1 DC On
37	37	Gnd

⑥ *Machine I/O Interface Cable - PS to Machine Interface*



⑥

Part No.	Length	Part No.	Length
023892	25 ft (7.5 m)	123089	125 ft (38.1 m)
023893	50 ft (15 m)	023896	150 ft (46 m)
023894	75 ft (23 m)	123033	170 ft (51.9 m)
023895	100 ft (30.5 m)	023897	200 ft (61 m)
123069	110 ft (33.6 m)		

From 1X6	COLOR	To Mach. End Terminal	Description and Comments
1	Wht	87	Hold (12VDC) Signal. Synchronizes starting of 2 or more systems. Closed=ON; Open=OFF
5	Blk	86	Hold - Common
10	Shield	Cut	Hold - Shield
2	Yel	173	Initial Height (12VDC) Signal. Closed=OFF ; Open=ON
6	Blk	174	Initial Height - Common
11	Shield	Cut	Initial Height - Shield.
3	Brn	171	Auto Height (12VDC) Signal. Closed=OFF; Open=ON or Comer (12VDC)
7	Blk	172	Auto Height - Common
12	Shield	Cut	Auto Height - Shield
9	Blu	82	Plasma Start (24VAC) - Signal. Close=Start
15	Blk	83	Plasma Start - Signal.
14	Shield	Cut	Plasma Start - Shield.
22	Red	77	Upper Limit Switch, Hot. Normally closed. Open when fully retracted.
21	Wht	76	Upper Limit Switch, Neutral.
20	Shield	Cut	Upper Limit Switch, Shield.
28	Yel	80	Plasma Emergency Stop (24VAC) Signal. Closed =stop.
33	Red	81	Plasma Emergency Stop - Signal
27	Shield	Cut	Plasma Emergency Stop - Shld
34	Red	169	†Down Relay, Load (Solid state, rated to switch 24 to 120VAC, 1amp. DC relay optional) Closed=Down
29	Blk	170	Down Relay, Line
23	Shield	Cut	Down Relay, Shield
35	Grn	167	†Up Relay, Load (Solid state, rated to switch 24 to 120VAC, 1amp. DC relay optional) Closed=Up
30	Blk	168	Up Relay, Line
24	Shield	Cut	Up Relay, Shield
36	Red	84	†*Arc Xfer Output - Signal Contact closes after arc transfer and time delay. Dry contact relay.
31	Blu	85	*Arc Xfer Output - Signal
25	Shield	Cut	*Arc Xfer Output - Shield
37	Red	79	**Arc Voltage Isolated + Divided (1/100) Signal
32	Grn	78	**Arc Voltage Isolated + Divided (1/100) Sig
26	Shield		**Arc Voltage Isolated + Divided (1/100),Shld

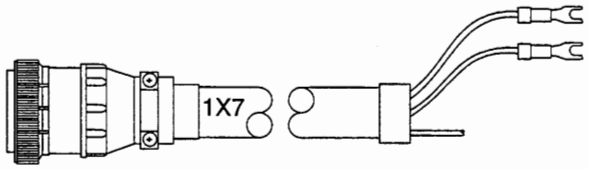
Notes: * Note on the µP PCB that resistor R150 and capacitor C78 are connected in series across the contacts. In some cases one lead of R150 must be cut from the control PC board as the R-C circuit may provide enough current flow to maintain machine motion input to cutting machine.

** Note on the µP PCB that resistor R155 and capacitor C79 are connected in series across the contacts. In some cases one lead of R155 must be cut from the control PC board as the R-C circuit may provide enough current flow to maintain machine motion input to cutting machine.

†WARNING

When installing or servicing the HT4001, AC or DC line voltages may be present on the UP, DOWN and TRANSFER signals even if the power supply line disconnect switch is OFF. Make certain that all line disconnect switches relating to the HT4001 system are OFF during installation and when servicing.

(7) *Machine V/C Interface Cable - PS to Machine Interface*



(7)

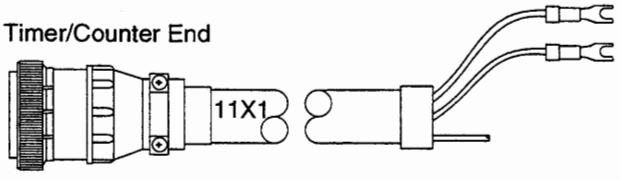
Part No.	Length	Part No.	Length
023902	6 ft (1.8 m)	023855	75 ft (23 m)
023851	15 ft (4.5 m)	023856	100 ft (30.5 m)
023852	25 ft (7.5 m)	023903	125 ft (38 m)
023853	35 ft (10.6 m)	023857	150 ft (46 m)
023854	50 ft (15 m)	023858	200 ft (61 m)

From 1X7	COLOR	Description
1	Black	Current 5
2	Wht	Current 10
3	Red	Current 20
4	Green	Current 40
5	Orange	Current 80
6	Blue	Current 100
7	White/Black	Current 200
8	Red/Black	Current 400
9	Green/Black	Current 800
10	Shield	Shield
11	Blue/Black	Current ICom
12	Black/White	spare
13	Red/White	spare
14	Green/White	Voltage V1.25
15	Blue/White	Voltage V2.5
16	Black/Red	Voltage V5
17	White/Red	Voltage V10
18	Orange/Red	Voltage V20
19	Blue/Red	Voltage V40
20	Red/Green	Voltage V80
21	Orange/Green	Voltage V100
22	Black/White/Red	Voltage V200
23	White/Black/Red	Voltage VCom

(8) *Timer/Counter Cable - PS to Timer/Counter*

Pass the timer/counter cable through one of the 2" bushings in the lower rear of the HT4001 power supply and connect to TB3. TB3 is located on the inside rear wall of the power supply.

Timer/Counter End



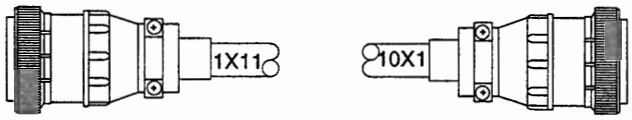
(8)

Part No.	Length
023789	10 ft (3 m)
023790	25 ft (7.5 m)
023791	50 ft (15 m)
023792	75 ft (23 m)
023793	100 ft (30.5 m)
123063	110 ft (33.6 m)
123083	125 ft (38.1 m)
023794	150 ft (46 m)
123027	170 ft (51.9 m)

From PS TB3	Color	To Timer/Cntr 11X1	Description
53	Wht	1	Starts & Arc Time
52	Black	2	Starts & Arc Time
8	Drain	3	Drain
50	Red	15	Error Counter
51	Black	16	Error Counter
3	Drain	12	Drain

(9) *Water Muffler Air Control Cable - PS to Water Muffler Air Control Box*

See water muffler instruction manual IM173 for remaining connections to water muffler and detailed information on the water muffler system.

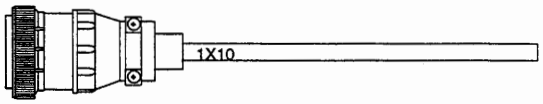


From 1X11	Color	To WM Air Cntrl 10X1	Signal
11	Wht	1	Water Muffler Hot
12	Black	2	AC Neutral
13	Red	3	Contactor Coil
14	Brown	4	Water Muffler Coil
6	Green	5	Ground

(9)

Part No.	Length
023905	25 ft (7.5 m)
023906	50 ft (15 m)
023907	75 ft (23 m)
023908	100 ft (30.5 m)
123149	120 ft (36.6 m)
023909	150 ft (46 m)
123043	180 ft (54.9 m)
023910	200 ft (61 m)

(10) *Water Muffler Pump Cable - Power Supply to Water Muffler Pump*



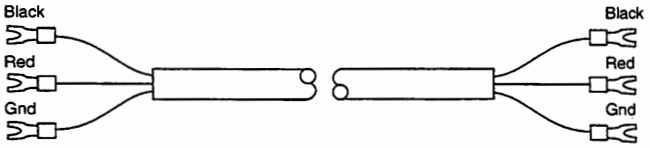
From 1X10	Color	Signal
2	Black	Water Muffler Coil
4	White	AC Neutral
3	Green	Ground

(10)

Part No.	Length
023866	50 ft (15 m)
023867	75 ft (23 m)
023868	100 ft (30.5)

(11) *Hold cable - PS to Second HT4001 Power Supply*

When using a multi-torch system, the hold cable interfaces the two HT4001 power supplies. Make connections at TB3 on both supplies. TB3 is located on the inside rear wall of the HT4001 power supply.



PS1 TB3 End	Color	PS2 TB3 End	Signal
86	Black	86	Hold signal
87	Red	87	Hold common
GND	Shield	GND	Hold shield

(11)

Part No.	Length
023340	15 ft (4.5 m)
023341	25 ft (7.5 m)
023342	50 ft (15 m)
023343	100 ft (30.5 m)
023344	150 ft (46 m)

GAS PANEL CONNECTIONS

See page 3-3 for gas panel connection to power supply.
Hoses from supply gases to the gas panel are provided by the customer.

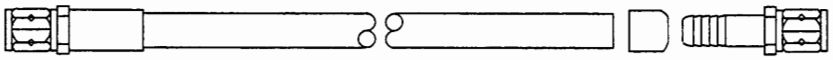
Note: The following 20-ft length (6.1 m) hoses and cable between the gas panel and the RHF&MV console can be ordered as a package with one number - 128224.

(12) *Injection Water Hose - Gas Panel to RHF&MV Console*

(12)

Part No.	Length
024018	20 ft (6.1 m)

Note: Turn counterclockwise to tighten

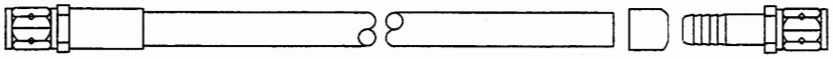


(13) *Plasma Preflow Gas Hose - Gas Panel to RHF&MV Console*

(13)

Part No.	Length
024308	20 ft (6.1 m)

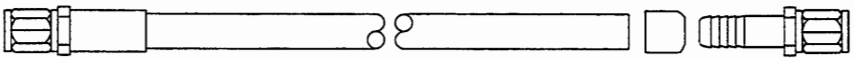
Note: Turn counterclockwise to tighten



(14) *Plasma Cut Flow Gas Hose - Gas Panel to RHF&MV Console*

(14)

Part No.	Length
024017	20 ft (6.1 m)



(15) *Gas Panel/RHF&MV Console Cable - Gas Panel to RHF&MV Console*

(15)

Part No.	Length
023647	20 ft (6.1 m)

From 3X2	To 4X1	Signal
16	16	SV4A Preflow/Cutflow
17	17	SV4A Preflow/Cutflow
10	10	Ground
23	23	SV4B Preflow/Cutflow
24	24	SV4B Preflow/Cutflow
25	25	Ground
29	29	SV5 Plasma Off
30	30	SV5 Plasma Off
34	34	Ground
11	11	MV1 Decrease
12	12	120VAC Neut.
18	18	Ground
14	14	MV1 Increase
21	21	Ground

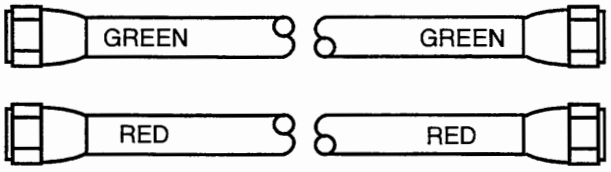
RHF&MV CONSOLE CONNECTIONS

See pages 3-2 and 3-3 for RHF&MV console connections to the power supply and gas panel.

(16) ***Cooling Hose Set- RHF Console to Water Cooling System***
There are two 3/8" hoses with #6 swivel connectors in this hose set. For two-torch systems, double the hose order.

Caution:	**Connect WATER OUT on the RHF&MV console to RETURN on the water chiller, and connect WATER IN on the RHF&MV console to DISCHARGE on the water chiller.**

See the water chiller instruction manual 802410 for details.



(16)

Part No.	Length	Part No.	Length
028652	10 ft (3 m)	028444	100 ft (30.5 m)
028440	15 ft (4.5 m)	028902	110 ft (33.6 m)
028653	20 ft (6 m)	028896	115 ft (35.1 m)
028441	25 ft (7.5 m)	128129	120 ft (36,6 m)
128173	35 ft (10.5 m)	028747	125 ft (38.1 m)
028442	50 ft (15 m)	028445	150 ft (46 m)
128052	60 ft (18 m)	128064	170 ft (51.9 m)
028443	75 ft (23 m)	028637	200 ft (61 m)
128078	85 ft (25.9 m)		

TORCH CONNECTIONS

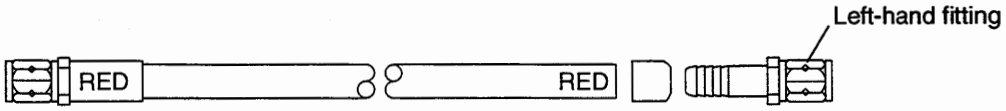
See page 3-1 for torque specifications

Routing the Torch Leads

Prior to connecting the torch leads to the RHF&MV console, gas panel and torch, the torch leads must be routed between the cutting machine, RHF&MV console and the torch. You will generally need to route the leads through a festoon or a power track.

Caution:	**Before routing the leads, make sure the torch is removed from the torch leads. Damage to the torch could result from dropping, banging, or scraping. Once the torch leads have been routed, proceed with torch connections.**

(17) ***Injection Water Hose - Gas Console to Torch***



(17)

Part No.	Length	Part No.	Length
024033	15 ft (4.5 m)	024208	45 ft (13.7 m)
024018	20 ft (6 m)	024258	50 ft (15 m)
024034	25 ft (7.5 m)	024179	53 ft (16 m)
024035	30 ft (9 m)	024128	60 ft (18 m)
024036	35 ft (10.5 m)	024345	75 ft (23 m)
024037	40 ft (12.2 m)	024346	100 ft (30.5 m)

1. Slide the injection water hose through the torch insulating sleeve.

2. Using a 7/16" open-end wrench on the left-handed torch fitting and a 7/16" open-end wrench on the left-handed injection water hose fitting, turn the water-hose fitting in a counterclockwise direction to tighten.

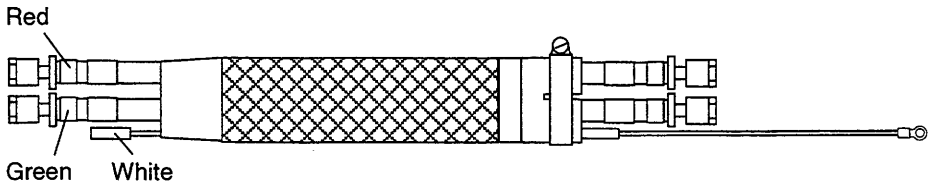
3. Make injection water hose connection at gas panel.

The following shielded torch leads, plasma gas hose, off-valve cable, off-valve hose, and off valve with torch can be ordered as a 25-foot (7.5 m) package under one number: 128256 for the standard torch or
128257 for the beveling torch

(18) *Shielded Torch Leads - RHF&MV Console to Torch*

(18)

Part No.	Length
028511	25 ft (7.5 m)



1. Slide the shielded torch leads through the insulating sleeve.

2. Using a 9/16" open-end wrench on the two largest torch fittings and a 1/2" open-end wrench on the two largest lead fittings, connect the leads to the torch. Note color code on torch and torch leads.

3. Attach and **hand tighten** the white pilot arc lead from the torch leads to the corresponding connector on the torch body.

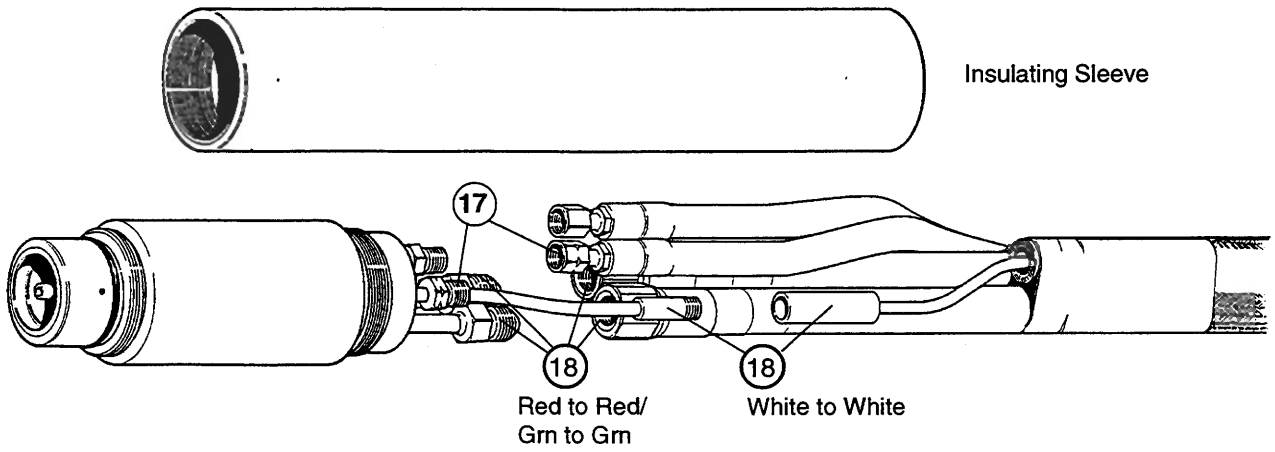
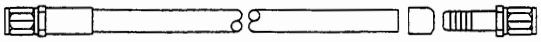


Figure 3-2 Torch Connections - 1 of 2

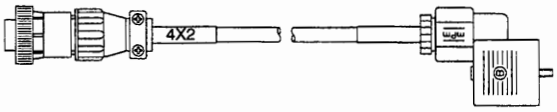
(19) *Plasma Gas Hose - RHF&MV Console to Off-Valve*



(19)

Part No.	Length
024214	25 ft (7.5 m)

(20) *Off-Valve Cable - RHF&MV Console to Torch Off-Valve*



(20)

Part No.	Length
123315	25 ft (7.5 m)

From 4X2	Color	To Off-Valve Connector	Signal
1	Black	1	Plasma Off & Vent
2	Red	2	
3	N/A	Cut	Drain
4	Clear	⏚	Ground

(21) *Off-Valve Hose - Off-Valve to Torch*

(21)

Part No.	Length
024317	5 ft (1.5 m)

1. Connect one end of the off-valve hose to the remaining lead fitting of the torch. Use 7/16" open-end wrenches to tighten this connection. (Fig. 3-3, 2 of 2)
2. Slide the insulating sleeve over the torch body and screw together.
3. Connect the other end of the off-valve hose to the off valve. (Fig. 3-3, 2 of 2)
4. Connect the other end of the plasma gas hose to the off valve. (Fig. 3-3, 2 of 2)
5. Connect the off-valve cable to the off valve. (Fig. 3-3, 2 of 2)
6. Attach the torch to the torch mounting bracket. See *Mounting the Machine Torch* on page 3-13.

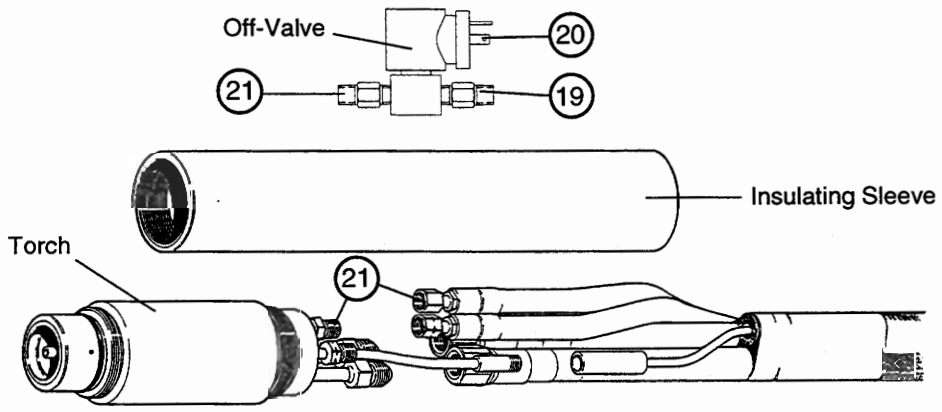


Figure 3-3 Torch Connections -2 of 2

MOUNTING THE MACHINE TORCH

1. Loosen the securing screws and install the machine torch (with torch leads attached) in the torch mounting bracket. See Figure 3-4.

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 and not touching the stainless steel torch body. Position the torch approximately 0.25 " (6 mm) from the work surface.

3. Tighten the securing screws.

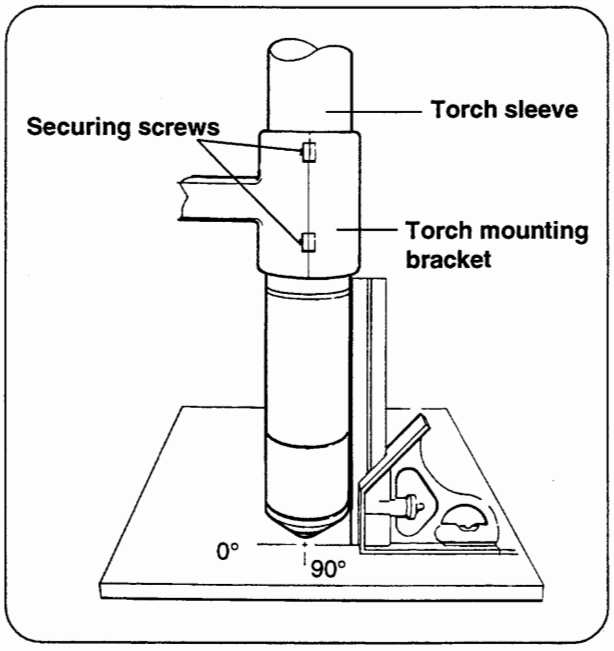


Figure 3-4 Torch Alignment

Torch Alignment

Prior to cutting with the 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 0° and 90°. See Figure 3-4.

Hypertherm

Section 4

OPERATION

Refer to HT4001 Instruction manual 802000 for explanation of power supply and timer/counter front panel controls and indicators.

FRONT PANEL CONTROLS AND INDICATORS

HT4001 Titan Gas Panel (Fig. 4-1)

FM1
Indicates the flow rate % of N_2 plasma gas. Percentages are specified in the *Cut Charts.*

FM2
Indicates the flow rate % of O_2 plasma gas flow. Oxygen flow rate percentage is specified in the *Cut Charts.*

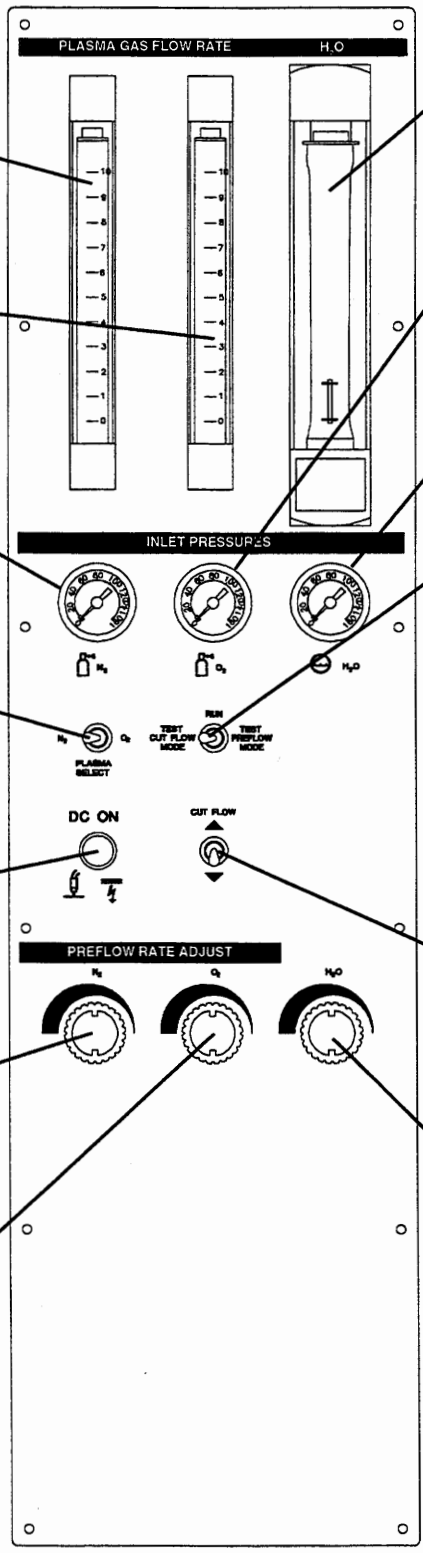
PG1
Indicates the N_2 plasma inlet pressure. Gas inlet pressures are specified in the *Cut Charts*

S1
Selects the use of either N_2 or O_2 as the plasma cutting gas.

LT1
Illuminates when main contactor closes, indicating that DC power is being supplied to the torch

MV2
Adjusts N_2 plasma gas flow rate % while in TEST PREFLOW mode. Preflow plasma gas flow rate percentages are specified in the *Cut Charts.*

MV3
Adjusts O_2 plasma gas flow rate % while in TEST PREFLOW mode. Preflow plasma gas flow rate percentages are specified in the *Cut Charts.*



FM3
Indicates the flow rate % of injection water flow to the torch. Percentages are specified in the *Cut Charts.*

PG2
Indicates the O_2 plasma inlet pressure. Gas inlet pressures are specified in the *Cut Charts.*

PG3
Indicates injection water inlet pressure.

S2
TEST PREFLOW - Sets the plasma preflow flow rate on the flowmeter. In this position the contactor is disabled.
TEST CUT FLOW - Allows the selected plasma gas flow rate to be adjusted on the flowmeter for cutting conditions. In this position the contactor is disabled.
RUN - Enables the contactor and the subsequent firing of the arc after the Water flow % rate and gas % rates have been set in the Test Preflow and Test Cut Flow positions.

S3
Adjusts N_2 or O_2 plasma gas flow rate % while in TEST CUT FLOW mode. Plasma gas flow rate percentages are specified in the *Cut Charts.*

MV4
Adjusts injection water flow to the torch.

Designations
FM1-FM3 — Flowmeter
LT1 — Indicator Lamp
MV2-MV4 — Motor Valve
PG1-PG3 — Pressure Gauge
S1-S3 — Toggle Switch

N_2 — Nitrogen
O_2 — Oxygen

Figure 4-1 HT4001 Titan Gas Panel Controls and Indicators

DAILY START-UP

Prior to start-up, ensure that your cutting environment and your clothing meet the safety requirements outlined in the *Safety* section of this manual. If problems occur during start-up, refer to **Section 3** for installation requirements.

WARNING

Before operating this system, you must read the *Safety* section thoroughly! Turn main disconnect switch to the HT4001 power supply OFF before proceeding with the following steps

Check Torch

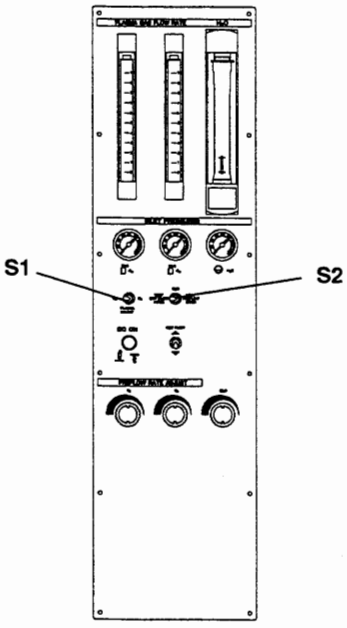
1. Remove the consumables from the torch and check for worn or damaged parts. **Always place the consumables on a clean, dry, oil free surface after removing. Dirty consumables can cause the torch to malfunction.**

   - Check the pit depth of the electrode using the electrode gauge assembly. The electrode should be replaced when the depth exceeds .050 inch (1.3 mm).
   - Wipe the current ring in the torch with a clean paper towel or Q-tip.
   - Refer to the *Cut Charts* later in this section to choose the correct consumables for your cutting needs.

2. Replace consumable parts. Refer to *Changing Consumable Parts* later in this section for detailed information on replacing consumables.

3. Ensure that the torch is squared to the material. Refer to **Section 3**: *Installation* for the torch alignment procedure.

Turn Gases and Water On



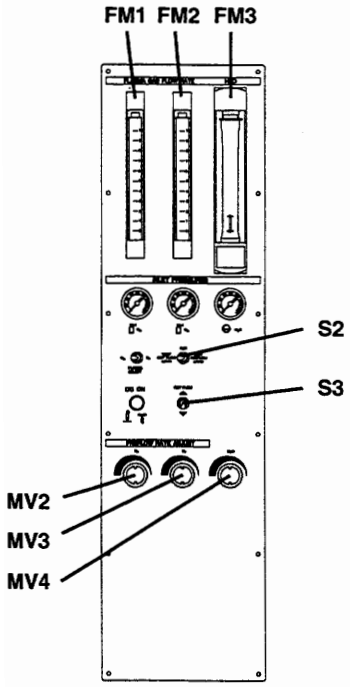
4. Set S2 toggle switch on the gas panel to RUN.
5. Set the main disconnect switches for the power supply and the water chiller to ON.
6. Set S1 on the gas panel to N_2 or O_2.
7. Turn the required supply gases On.
   - When using nitrogen as the plasma gas, adjust supply regulator to read 150 psi +/- 10 psi (10.3 bar +/- 0.7 bar) at the N_2 pressure gauge on the gas panel.
   - When using oxygen as the plasma gas, adjust supply regulator to read 120 psi +/- 10 psi (8.3 bar +/- 0.7 bar) at the O_2 pressure gauge on the gas panel.
8. Turn the water supply to the water chiller ON.
9. Turn on the water chiller by depressing the START switch.

Turn Power Supply On and Adjust Voltage/Current

10. Turn on the power supply by moving the POWER circuit breaker on the rear of the power supply to the UP position. Ensure that the POWER AC indicator on the power supply illuminates. If the POWER ON light fails to illuminate, see **Section 3**: *Installation* for proper setup.

11. Set the voltage and current. Select the arc current and arc voltage from the *Cut Charts* for the type and thickness of metal to be cut.

    Note: If using the H-401 power supply as a slave and you need to reduce the existing arc current level, lower the current to below 360A before resetting to the desired value. Note also that the current control adjust knob on the front of the H-401 supply will have no effect on setting current for the slave.



Adjust Preflow Gases

12. Set S2 on the gas panel to TEST PREFLOW. Set the preflow flow rates on the N_2 (FM1) and/or O_2 (FM2) flow meters using the MV2 and/or MV3 metering valves. Select the test preflow rates from the *Cut Charts*.

    Note: If you have changed consumable parts or if the power supply has been off for more than 1 hour, purge gas lines by leaving the system in TEST PREFLOW for 1 minute.

Adjust Cut Flow Gases and Water Injection Flow Rate

13. Set S2 on the gas panel to TEST CUT FLOW.

14. Set the cut flow rate on the N_2 or O_2 flow meters using the S3 cut flow momentary switch. Select the cut flow rates from the *Cut Charts*.

Note: If you have changed consumable parts or if the power supply has been off for more than 1 hour, purge gas lines by leaving system in TEST CUT FLOW for 1 minute.

15. Check the water flow rate at the water flow meter (FM3) and adjust with the MV4 metering valve. See the *Cut Charts* for water flow rates.

16. Verify that there is a uniform conical water pattern at the front of the torch. If the pattern is irregular, shut the power supply down at the main disconnect switch and check the nozzle and swirl ring. Replace with new parts, if they are worn or damaged.

17. Set S2 to RUN after the test preflow and test operate flow rates have been set.

The system is now ready for operation.

CUTTING TECHNIQUES

The *Cut Charts* in this section display parameters to provide the best cut angle, least dross and best cut surface finish. The following suggestions serve to explain certain cut conditions and how they can be improved upon or avoided.

How to Get Better Cut Quality

In order to get the best cut quality, verify that the HT4001 Titan system is set up properly. The 3 major components of cut quality are: cut angle, dross conditions, and shape of cut surface.

Cut Angle

Cut angle is defined as either positive or negative. A positive cut angle is when there is more material removed from the top of the kerf than from the bottom of the kerf (V-shaped cut). A negative cut angle is when there is more material removed from the bottom of the cut than from the top of the kerf (under cut). The 2 most common cut angle faults are: cuts not acceptably square, and non-uniform cut angles (one side positive and one side negative). Causes and possible solutions are listed below.

1. **Cuts not acceptably square** (greater than 5° angle on all sides):

    - Improper torch standoff distance. A positive cut angle indicates a stand-off that is too high. A negative cut angle indicates a standoff that is too low. Vary the arc voltage to correct the cut angle.

    - Damaged consumable parts. If the nozzle orifice is worn uniformly, the cut angle will show positive. Check and replace consumables, if necessary. Refer to *Changing Consumable Parts* later in this section.

    - Machine travel is in the wrong direction. The square cut angle is on the right side relative to the forward motion of the torch.

2. **Non-uniform cut angles**:

    - Damaged or worn nozzle and/or shield. Check and replace consumables, if necessary. Refer to *Changing Consumable Parts* later in this section.

    - The torch out of vertical alignment dwith the workpiece. Verify that the torch is at right angles to the workpiece in order to get a clean, vertical cut. See *Torch Alignment* in the **Installation** section.

Dross Conditions

1. **Low Speed Dross**

    - When the travel speed is too slow, the arc shoots ahead and dross forms as a heavy bubbly deposit at the bottom of the kerf that can be easily removed. Increasing the speed will reduce this type of dross.

2. **High Speed Dross**

   - When the travel speed is too fast, the arc lags behind and dross forms as a thin, linear bead of solid metal attached very close to the kerf. The dross appears to be a fused continuation of the kerf wall, is welded to the bottom of the cut, and is very difficult to remove. Reduce high speed dross by decreasing the travel speed. If this does not remove the dross, lower the torch standoff distance by decreasing arc voltage.

3. **Intermittent Dross**

   - Can be caused by worn consumable parts
   - May be material dependent
   - May be dependent on metal temperature. Warm and hot metal is much more prone to dross accumulation than cool metal. For example, the first cut in a series of cuts will likely have the least amount of dross. As the workpiece heats up, dross levels are likely to increase on subsequent cuts.

Shape of the Cut Surface

The ideal shape of the cut face is straight. Sometimes the cut face becomes either concave or convex. Maintain the correct torch height and cut speed to keep the cut face straight.

1. **Concave cut face** (bevel on inside)

   - Caused by the standoff distance being too low. Increasing the arc voltage will increase the standoff distance and straighten the cut face.

2. **Convex cut face** (top of cut rounded)

   - Caused by the standoff distance being too high or the cutting current being too high. Try reducing the arc voltage and then reducing the cutting current.

How to Get Longer Consumable Life

In order to optimize consumable life, follow these guidelines:

1. **Pierce Height**

   The pierce height should be twice as high as the cutting height to prevent pierce splatter from building up on the front of the nozzle and/or shield.

2. **Pierce Delay**

   Pierce delay is determined and programmed on the machine interface. Allow enough time for the pierce to be complete before starting the machine motion.

3. **Ramp Down**

   In order to properly ramp down gas and current to extend consumable life, the torch must end its cut while over the workpiece.

4. **Extending Electrode Life**

   - Program the lead out when the drop part is the one wanted, but do not program the lead out into the drop part.
   - Use a chain cut, if possible.
   - Purge the gas lines before cutting.

5. **Extending Nozzle Life**

   - Do not lead out to the drop part, which will cause the arc to stretch.
   - Purge the gas lines to clean the plasma chamber before cutting.
   - Make sure that the torch does not dive into the plate during cutting.

6. **Extending Shield Life**

   - Make sure that the shield does not touch the plate during cutting. The pierce height should be twice as high as the cutting height.
   - Keep the shield front clean to prevent double arcing.

7. **Material**

   Attempting to cut highly magnetic metal plate will shorten consumable life. Long consumable life is difficult to achieve when cutting plate that is high in nickel content.

How to Get Better Pierces

1. Set the initial pierce height to twice the cutting height.
2. **Increase the pierce delay time.** The pierce delay must be on long enough to let the arc pierce through the material before the machine moves.

How to Increase Cutting Speed

1. **Use a higher current level.** The consumables must be changed when increasing the current.
2. **Reduce the torch standoff distance.** However, the shield must not touch the plate. The cutting surface will bevel inside if the standoff distance is too low.

COMMON CUTTING FAULTS

- Torch pilot arc will initiate, but will not transfer. Causes can be:

  1. Work cable connection on cutting table not making good contact.

  2. Malfunction in HT4001 Titan system.

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

  1. Current is set too low (check *Cut Chart* information).

  2. Cut speed is too high (check *Cut Chart* information).

  3. Torch parts are worn (see *Changing Consumable Parts*).

  4. Metal being cut is too thick.

- Dross forms on the bottom of the cut - See *Dross Conditions* earlier in this section.

- Cut angle not square - See *How to Get Better Cut Quality* earlier in this section.

- Short consumable life - See *How to Get Longer Consumable Life* earlier in this section.

TECHNICAL QUESTIONS

Claims for defective merchandise -- If your system does not function correctly:

1. Re-check all pre-installation and installation requirements and connections.

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

3. If you need additional assistance, call Customer Service at 1-800-737-2978 or Technical Service at 1-800-643-9878.

CUT CHARTS

The Cut Charts on the following pages are optimized to provide the best cut angle, least dross and best cut surface finish. Keep in mind that the charts provide a good starting point and that optimum cutting must be tuned to the application and materials on site. Increasing cut speed, lowering the torch standoff, for example, all present certain trade- offs. Depending on the cutting application, it is up to the operator to determine if the trade-offs are acceptable.

Caution:	**Before cutting, check all settings and adjustments and check for damaged torch parts and worn consumable parts.**

HT4001 without Slave - CUT CHART AND CONSUMABLE PARTS INDEX

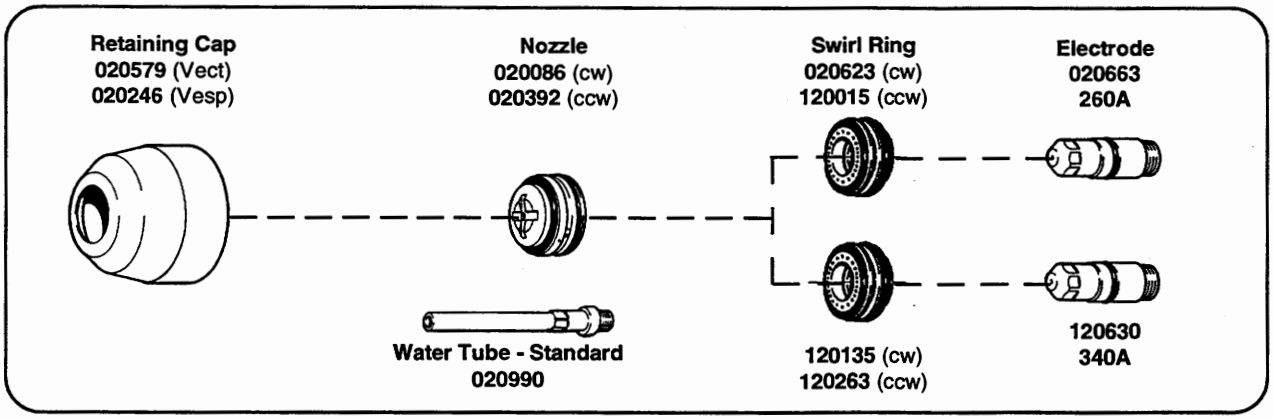
Consum. Type	Metal	Amps	Plasma Gas	Retaining Cap	Nozzle	Swirl Ring	Electrode	Page
* STANDARD	Mild Steel	260	Oxygen	020579	020086	020623	020663	4-10
		340	Oxygen	020579	020086	120135	120630	4-10
		260	Nitrogen	020579	020089	020039	020082	4-11
		400	Nitrogen	020579	020084	020039	020082	4-11
	Stainless	260	Nitrogen	020579	020089	020039	020082	4-12
		400	Nitrogen	020579	020084	020039	020082	4-12
	Aluminum	260	Nitrogen	020579	020089	020039	020082	4-13
		400	Nitrogen	020579	020084	020039	020082	4-13
** BEVEL	Mild Steel	260	Oxygen	120390	120384	020623	020975	4-14
		340	Oxygen	120390	120384	120460	120836	4-15
	Mild / Stainless	260	Nitrogen	120390	120386	020039	020968	4-16
		400	Nitrogen	120390	120387	020039	020968	4-16
	Aluminum	260	Nitrogen	120390	120386	020039	020968	4-17
		400	Nitrogen	120390	120387	020039	020968	4-17

HT4001 with Slave - CUT CHART AND CONSUMABLE PARTS INDEX

Consum. Type	Metal	Amps	Plasma Gas	Retaining Cap	Nozzle	Swirl Ring	Electrode	Page
* STANDARD	Mild / Stainless	260	Nitrogen	020580	020281	020039	020285	4-18
		400	Nitrogen	020580	020282	020039	020285	4-18
		600	Nitrogen	020580	020283	020039	020285	4-18
		760	Nitrogen	020580	020284	020040	020285	4-18
	Aluminum	260	Nitrogen	020580	020281	020039	020285	4-19
		400	Nitrogen	020580	020282	020039	020285	4-19
		600	Nitrogen	020580	020283	020039	020285	4-19
		760	Nitrogen	020580	020284	020040	020285	4-19
** BEVEL	Mild / Stainless	260	Nitrogen	120390	120386	020039	020968	4-20
		400	Nitrogen	120390	120387	020039	020968	4-20
		600	Nitrogen	120390	120388	020039	020968	4-20
		760	Nitrogen	120390	120389	020040	020968	4-20
	Aluminum	260	Nitrogen	120390	120386	020039	020968	4-21
		400	Nitrogen	120390	120387	020039	020968	4-21
		600	Nitrogen	120390	120388	020039	020968	4-21
		760	Nitrogen	120390	120389	020040	020968	4-21

* Use standard consumables with the PAC620 if the torch will only be making cuts 90° to the work surface.
** Use bevel consumables with the PAC620 if the torch will be making cuts between 45° and 90° to the work surface.

HT4001 without Slave
PAC620 Torch - Standard Consumables
Mild Steel - Oxygen Plasma



ENGLISH

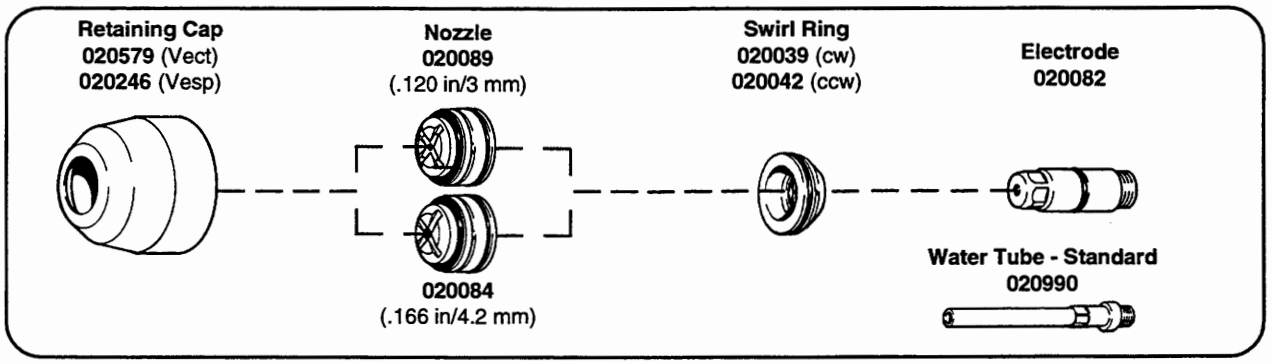
Electrode	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Preflow Rate (O_2) (%)	Test Cut Flow Rate (O_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
260A	1/4	6.35	16	11	80	60	120	260	1/8	3	170	4320
	1/2	12.7	16	11	80	60	130	260	3/16	5	100	2540
	3/4	19.1	16	11	80	60	135	260	3/16	5	70	1780
	1	25.4	16	11	80	60	140	260	3/16	5	50	1270
340A	1/2	12.7	16	11	80	60	130	340	1/8	3	110	2800
	3/4	19.1	16	11	80	60	140	340	3/16	5	85	2160
	7/8	22.2	16	11	80	60	145	340	3/16	5	75	1900
	1	25.4	16	11	80	60	145	340	3/16	5	65	1650
	1-1/4	31.8	16	11	80	60	145	340	3/16	5	45	1140

METRIC

Electrode	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Preflow Rate (O_2) (%)	Test Cut Flow Rate (O_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
260A	8	16	11	80	60	125	260	3-4	3850
	10	16	11	80	60	130	260	4	3300
	12	16	11	80	60	130	260	4-5	2730
	15	16	11	80	60	135	260	5	2260
	20	16	11	80	60	135	260	5	1700
	25	16	11	80	60	140	260	5	1300
340A	15	16	11	80	60	135	340	5	2570
	20	16	11	80	60	140	340	5	2080
	25	16	11	80	60	145	340	5	1680
	30	16	11	80	60	145	340	5	1280

Notes:
- Minimum O_2 inlet pressures remain at one setting of 120 psi (8.2 bar) for all material thickness.
- Minimum N_2 inlet pressures remain at one setting of 150 psi (10.3 bar) for all material thickness.
- O_2 flow rate at full scale is 127 scfh (60 l/min) @ 120 psi (8.2 bar) inlet pressure.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.

HT4001 without Slave
PAC620 Torch - Standard Consumables
Mild Steel - Nitrogen Plasma



ENGLISH

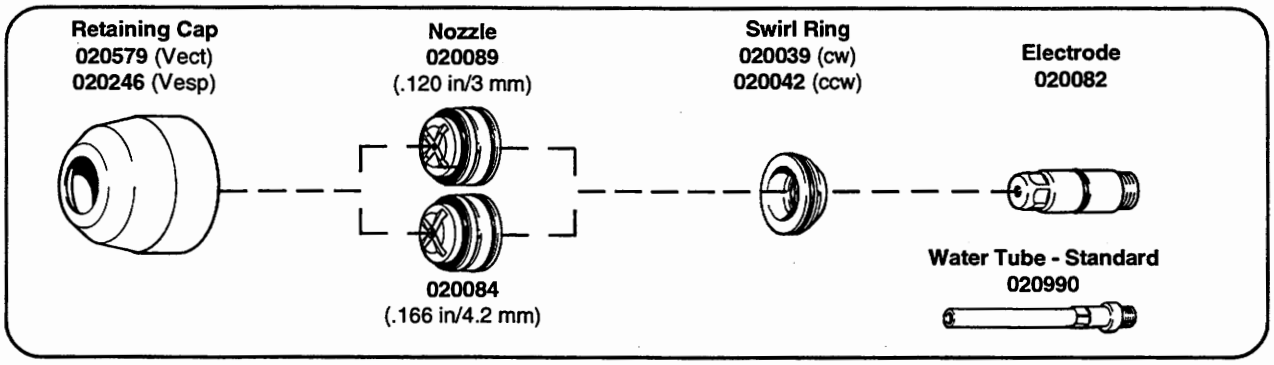
Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	125	260	1/8	3	450	11430
	.075	1.91	30	30	45	130	260	1/8	3	300	7620
	1/8	3.18	30	30	45	135	260	1/4	6	200	5080
	1/4	6.35	30	30	45	145	260	5/16	8	145	3690
.166" 400A max.	1/8	3.18	45	45	62	140	300	1/4	6	175	4450
	1/4	6.35	45	45	62	140	360	1/4	6	145	3690
	3/8	9.53	45	45	62	145	360	1/4	6	125	3180
	1/2	12.7	45	45	62	150	400	1/4	6	95	2420
	3/4	19.1	45	45	62	150	400	5/16	8	50	1270
	1	25.4	45	45	62	155	400	3/8	10	30	760

METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	45	145	260	8	3840
4.2 mm 400A max.	6	45	45	62	140	360	6	4660
	8	45	45	62	145	360	6	3420
	10	45	45	62	145	360	6	3060
	12	45	45	62	150	400	6	2580
	15	45	45	62	150	400	6-7	2000
	20	45	45	62	150	400	8	1190
	25	45	45	62	155	400	10	790

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.
  Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current), gradually lower the initial height of the torch until transfer occurs.

HT4001 without Slave
PAC620 Torch - Standard Consumables
Stainless Steel - Nitrogen Plasma



ENGLISH

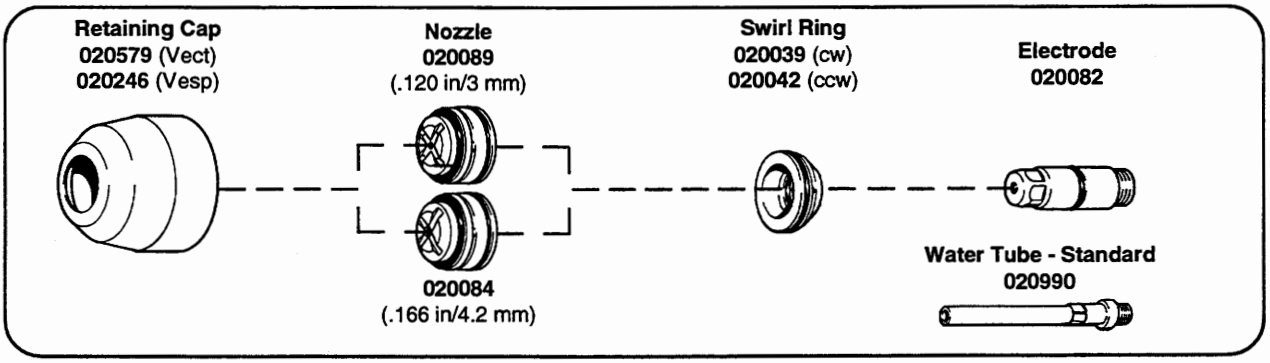
Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	125	260	1/8	3	450	11430
	.075	1.91	30	30	45	130	260	1/8	3	300	7620
	1/8	3.18	30	30	45	135	260	1/8	3	200	5080
	1/4	6.35	30	30	45	145	260	1/8	3	150	3810
.166" 400A max.	3/8	9.53	45	45	62	150	380	3/16	5	125	3170
	1/2	12.7	45	45	62	155	400	3/16	5	100	2540
	3/4	19.1	45	45	62	160	400	3/16	5	50	1270
	1	25.4	45	45	62	165	400	1/4	6	30	760
	1-1/2	38.1	45	45	62	185	400	1/4	6	20	510
	2	50.8	45	45	62	200	400	1/4	6	12	300

METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	45	145	260	3	3950
4.2 mm 400A max.	10	45	45	62	150	380	5	3070
	12	45	45	62	155	400	5	2680
	15	45	45	62	160	400	5	2080
	20	45	45	62	160	400	5-6	1200
	25	45	45	62	165	400	6	790
	35	45	45	62	180	400	6	570
	50	45	45	62	200	400	6	310

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.
  Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current), gradually lower the initial height of the torch until transfer occurs.

HT4001 without Slave
PAC620 Torch - Standard Consumables
Aluminum - Nitrogen Plasma



ENGLISH

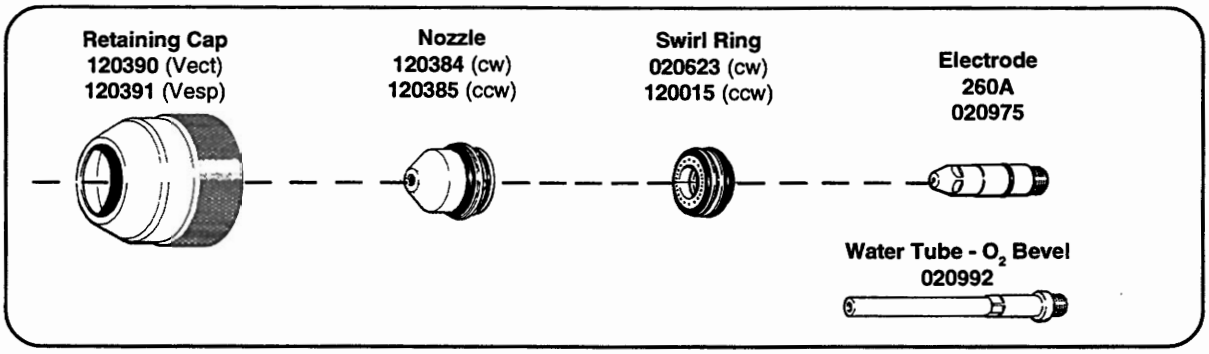
Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	125	260	1/8	3	540	13700
	.075	1.91	30	30	45	130	260	1/8	3	360	9140
	1/8	3.18	30	30	45	135	260	1/8	3	240	6100
	1/4	6.35	30	30	45	145	260	1/8	3	180	4570
.166" 400A max.	3/8	9.53	45	45	62	150	360	3/16	5	150	3800
	1/2	12.7	45	45	62	155	380	3/16	5	120	3050
	3/4	19.1	45	45	62	160	400	3/16	5	60	1520
	1	25.4	45	45	62	165	400	1/4	6	35	900
	1-1/2	38.1	45	45	62	190	400	1/4	6	30	760
	2	50.8	45	45	62	200	400	1/4	6	15	380

METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	85	145	260	3	4730
4.2 mm 400A max.	10	45	45	62	150	360	5	3700
	12	45	45	62	155	380	5	3200
	15	45	45	62	160	400	5	2500
	20	45	45	62	160	400	5-6	1420
	25	45	45	62	165	400	6	940
	35	45	45	62	190	400	6	790
	50	45	45	62	200	400	6	400

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.
  Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current), gradually lower the initial height of the torch until transfer occurs.

HT4001 without Slave
PAC620 Torch - Beveling Consumables
Mild Steel - Oxygen Plasma



ENGLISH

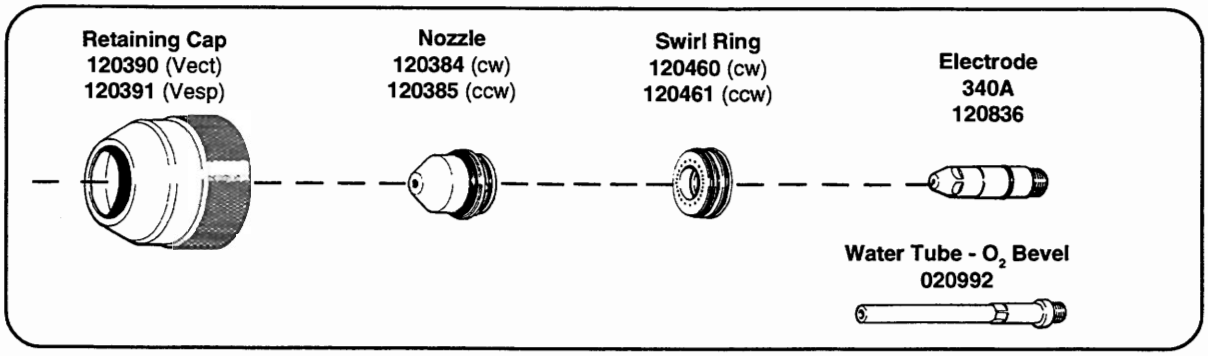
Electrode	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Preflow Rate (O_2) (%)	Test Cut Flow Rate (O_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
260A	1/4	6.35	16	11	85-90	73	120	260	1/8	3	165	4190
	1/2	12.7	16	11	85-90	73	125	260	1/8	3	100	2540
	3/4	19.1	16	11	85-90	73	135	260	3/16	5	65	1650
	1	25.4	16	11	85-90	73	140	260	1/4	6	45	1140

METRIC

Electrode	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Preflow Rate (O_2) (%)	Test Cut Flow Rate (O_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
260A	6	16	11	85-90	73	122	260	3	4200
	8	16	11	85-90	73	124	260	3-4	3600
	10	16	11	85-90	73	127	260	4	3000
	12	16	11	85-90	73	130	260	4-5	2500
	15	16	11	85-90	73	132	260	5	2100
	20	16	11	85-90	73	136	260	5-6	1500
	25	16	11	85-90	73	141	260	6	1100

Notes:
- Minimum O_2 inlet pressure remains at one setting of 120 psi (8.2 bar) for all material thickness.
- Minimum N_2 inlet pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- O_2 flow rate at full scale is 127 scfh (60 l/min) @ 120 psi (8.2 bar) inlet pressure.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.

HT4001 without Slave
PAC620 Torch - Beveling Consumables
Mild Steel - Oxygen Plasma



ENGLISH

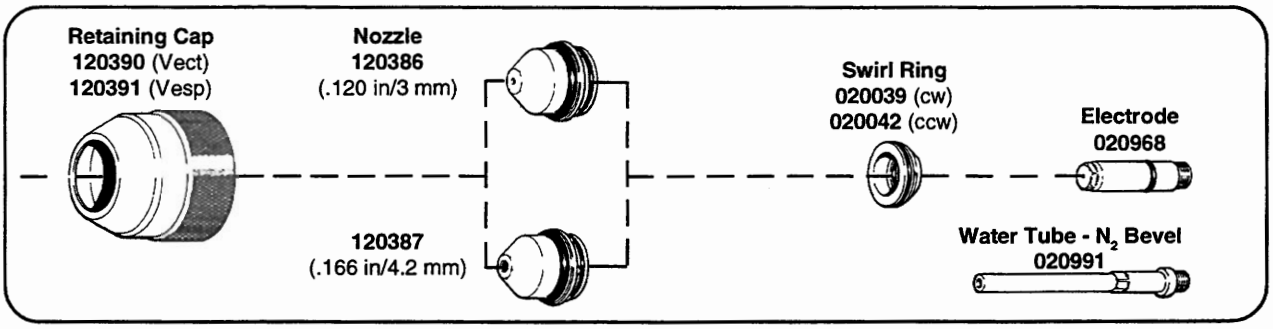
Electrode	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Preflow Rate (O_2) (%)	Test Cut Flow Rate (O_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
340A	1/2	12.7	16	11	85	73	135	340	3/16	5	110	2800
	3/4	19.1	16	11	85	73	140	340	3/16	5	85	2160
	1	25.4	16	11	85	73	145	340	3/16	5	65	1650
	1-1/4	31.8	16	11	85	73	145	340	3/16	5	45	1140

METRIC

Electrode	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Preflow Rate (O_2) (%)	Test Cut Flow Rate (O_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
340A	15	16	11	85	73	135	340	5	2570
	20	16	11	85	73	140	340	5	2080
	25	16	11	85	73	145	340	5	1680
	30	16	11	85	73	145	340	5	1280

Notes:
- Minimum O_2 inlet pressure remains at one setting of 120 psi (8.2 bar) for all material thickness.
- Minimum N_2 inlet pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- O_2 flow rate at full scale is 127 scfh (60 l/min) @ 120 psi (8.2 bar) inlet pressure.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.

HT4001 without Slave
PAC620 Torch - Beveling Consumables
Mild Steel or Stainless Steel - Nitrogen Plasma



ENGLISH

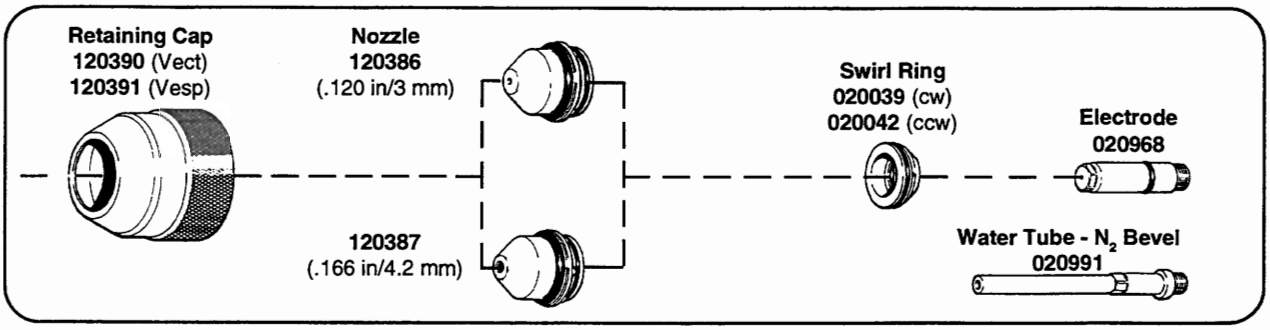
Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	125	240	1/8	3	425	10800
	.075	1.91	30	30	45	130	240	1/8	3	285	7240
	1/8	3.18	30	30	45	145	240	3/16	5	190	4830
	1/4	6.35	30	30	45	155	240	3/16	5	145	3680
.166" 400A max.	1/8	3.18	45	45	62	125	300	1/4	6	170	4320
	1/4	6.35	45	45	62	135	340	1/4	6	140	3560
	3/8	9.53	45	45	62	145	360	1/4	6	120	3050
	1/2	12.7	45	45	62	145	380	5/16	8	90	2290
	3/4	19.1	45	45	62	150	400	5/16	8	50	1270
	1	25.4	45	45	62	155	400	3/8	10	30	760

METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	45	155	240	5	3800
4.2 mm 400A max.	6	45	45	62	135	340	6	3640
	8	45	45	62	140	360	6	3300
	10	45	45	62	145	360	6	2930
	12	45	45	62	145	380	6-7	2450
	15	45	45	62	150	400	8	1900
	20	45	45	62	150	400	8	1200
	25	45	45	62	155	400	10	790

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.
  Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current), gradually lower the initial height of the torch until transfer occurs.

HT4001 without Slave
PAC620 Torch - Beveling Consumables
Aluminum - Nitrogen Plasma



ENGLISH

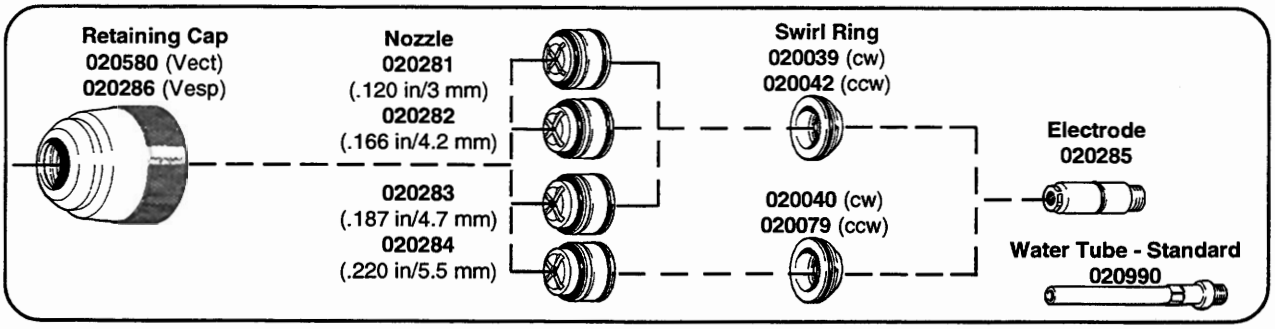
Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	120	240	1/8	3	520	13200
	.075	1.91	30	30	45	125	240	1/8	3	345	8760
	1/8	3.18	30	30	45	130	260	3/16	5	230	5840
	1/4	6.35	30	30	45	140	260	1/4	6	170	4320
.166" 400A max.	1/8	3.18	55	55	62	140	280	1/4	6	220	5590
	1/4	6.35	55	55	62	150	320	1/4	6	165	4190
	3/8	9.53	55	55	62	150	340	1/4	6	130	3300
	1/2	12.7	55	55	62	150	360	1/4	6	110	2800
	3/4	19.1	55	55	62	150	380	5/16	8	60	1520
	1	25.4	55	55	62	165	380	3/8	10	35	890

METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	45	140	260	6	4500
4.2 mm 400A max.	6	55	55	62	150	320	6	4340
	8	55	55	62	150	340	6	3720
	10	55	55	62	150	340	6	3220
	12	55	55	62	150	360	6	2900
	15	55	55	62	150	360	6-7	2330
	20	55	55	62	155	380	8	1430
	25	55	55	62	165	380	10	930

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.
  Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current), gradually lower the initial height of the torch until transfer occurs.

HT4001 w/Slave
PAC620 Torch - Standard Consumables
Mild Steel or Stainless Steel - Nitrogen Plasma



ENGLISH

Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	125	260	1/8	3	450	11430
	.075	1.91	30	30	45	130	260	1/8	3	300	7620
	1/8	3.18	30	30	45	135	260	1/4	6	200	5080
	1/4	6.35	30	30	45	145	260	5/16	8	145	3680
.166" 400A max.	1/8	3.18	45	45	62	140	300	1/4	6	175	4450
	1/4	6.35	45	45	62	140	360	1/4	6	145	3690
	3/8	9.53	45	45	62	145	360	1/4	6	125	3180
	1/2	12.7	45	45	62	150	400	1/4	6	95	2420
	3/4	19.1	45	45	62	150	400	5/16	8	50	1270
	1	25.4	45	45	62	155	400	3/8	10	30	760
.187" 600A max.	1/2	12.7	45	45	65	145	480	5/16	8	110	2800
	3/4	19.1	45	45	65	155	500	3/8	10	70	1780
	1	25.4	45	45	65	160	560	3/8	10	60	1530
	1-1/2	38.1	45	45	65	170	600	3/8	10	30	760
	2	50.8	45	45	65	180	600	3/8	10	20	510
.220" 760A max.	2	50.8	70	70	73	180	700	1/2	13	25	630
	3	76.2	70	70	73	200	760	5/8	16	12	300

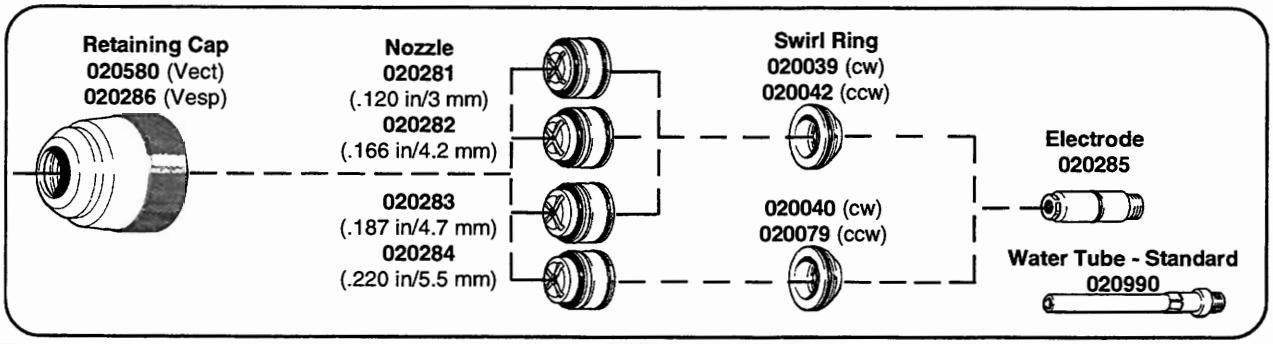
METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	45	145	260	8	3800
4.2 mm 400A max.	6	45	45	62	140	360	6	3770
	8	45	45	62	145	360	6	3430
	10	45	45	62	145	360	6	3050
	12	45	45	62	150	380	6	2600
	15	45	45	62	150	400	6-7	2000
	20	45	45	62	150	400	9	1200
	25	45	45	62	155	400	10	790
4.7 mm 600A max.	15	45	45	65	150	500	9	2400
	20	45	45	65	155	500	10	1750
	25	45	45	65	160	560	10	1540
	35	45	45	65	165	580	10	950
	50	45	45	65	180	600	10	520
5.5 mm 760A max.	60	70	70	73	190	740	15	510
	75	70	70	73	200	760	16	320

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.

Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current). gradually lower the initial height of the torch until transfer occurs.

HT4001 w/Slave
PAC620 Torch - Standard Consumables
Aluminum - Nitrogen Plasma



ENGLISH

Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	125	260	1/8	3	540	13710
	.075	1.91	30	30	45	130	260	1/8	3	360	9150
	1/8	3.18	30	30	45	135	260	3/16	5	240	6100
	1/4	6.35	30	30	45	145	260	1/4	6	180	4570
.166" 400A max.	1/8	3.18	45	45	62	140	300	1/4	6	230	5840
	1/4	6.35	45	45	62	145	320	1/4	6	180	4570
	3/8	9.53	45	45	62	150	360	1/4	6	150	3810
	1/2	12.7	45	45	62	150	380	1/4	6	120	3050
	3/4	19.1	45	45	62	160	400	5/16	8	60	1530
	1	25.4	45	45	62	170	400	3/8	10	35	890
.187" 600A max.	1	25.4	45	45	65	155	500	3/8	10	80	2030
	1-1/2	38.1	45	45	65	170	560	3/8	10	45	1150
	2	50.8	45	45	65	180	600	3/8	10	30	760
.220" 760A max.	2	50.8	70	70	73	180	700	1/2	13	30	760
	3	76.2	70	70	73	200	760	5/8	16	15	380

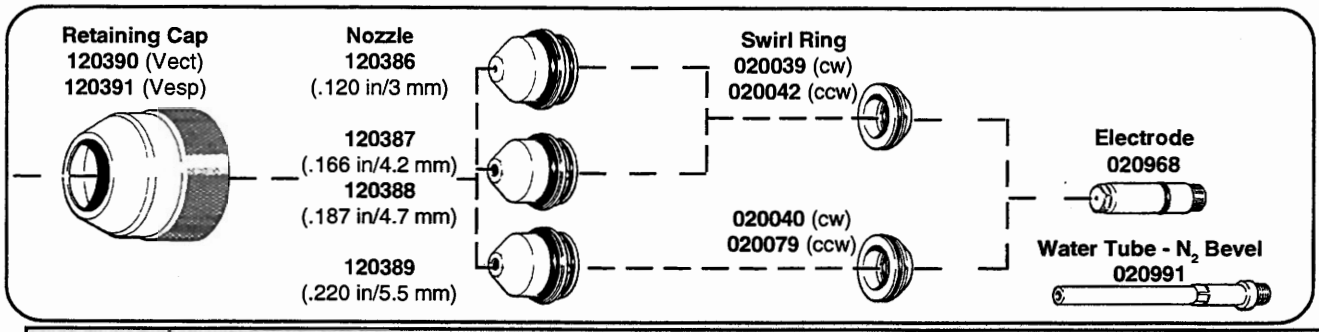
METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	45	145	260	6	4740
4.2 mm 400A max.	6	45	45	62	145	320	6	4700
	8	45	45	62	150	340	6	4170
	10	45	45	62	150	360	6	3700
	12	45	45	62	150	380	6	3200
	15	45	45	62	155	400	7	2500
	20	45	45	62	160	400	8-9	1420
	25	45	45	62	170	400	10	930
4.7 mm 600A max.	30	45	45	65	165	540	10	1710
	40	45	45	65	175	600	10	1090
	50	45	45	65	180	600	10	780
5.5 mm 760A max.	60	70	70	73	190	740	14	620
	75	70	70	73	200	760	16	380

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.

Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current), gradually lower the initial height of the torch until transfer occurs.

HT4001 w/Slave
PAC620 Torch - Beveling Consumables
Mild Steel or Stainless Steel - Nitrogen Plasma



ENGLISH

Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	125	240	1/8	3	425	10800
	.075	1.91	30	30	45	130	240	1/8	3	285	7240
	1/8	3.18	30	30	45	145	240	3/16	5	190	4820
	1/4	6.35	30	30	45	155	240	3/16	5	145	3680
.166" 400A max.	1/8	3.18	45	45	62	125	300	1/4	6	170	4320
	1/4	6.35	45	45	62	135	340	1/4	6	140	3550
	3/8	9.53	45	45	62	145	360	1/4	6	120	3050
	1/2	12.7	45	45	62	145	380	5/16	8	90	2280
	3/4	19.1	45	45	62	150	400	5/16	8	50	1270
	1	25.4	45	45	62	155	400	3/8	10	30	760
.187" 600A max.	1/2	12.7	55	55	65	140	480	3/8	10	100	2540
	3/4	19.1	55	55	65	145	500	3/8	10	70	1780
	1	25.4	55	55	65	150	560	3/8	10	60	1520
	1-1/2	38.1	55	55	65	165	580	3/8	10	30	760
	2	50.8	55	55	65	175	600	7/16	11	20	510
.220" 760A max.	1-1/4	31.8	60	60	73	170	700	1/2	13	40	1020
	2	50.8	60	60	73	175	720	1/2	13	25	630
	3	76.2	60	60	73	185	760	5/8	16	12	300

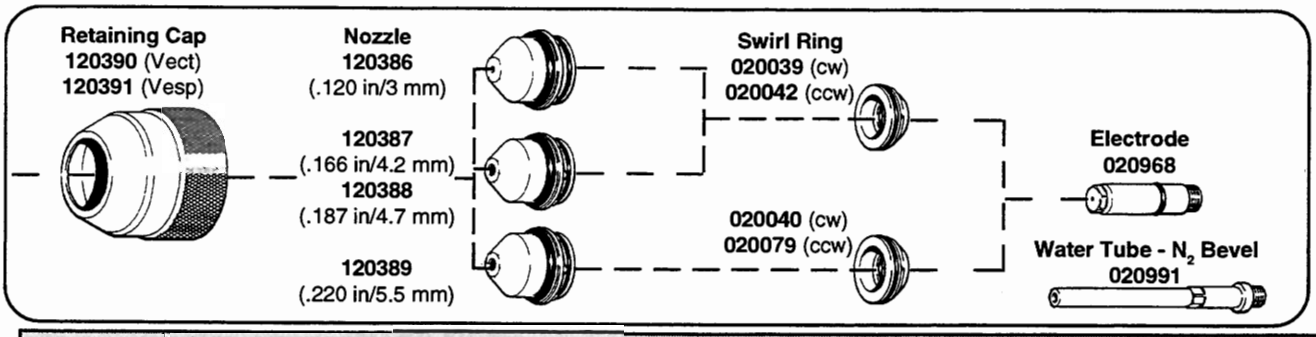
METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	45	155	240	5	3800
4.2 mm 400A max.	6	45	45	62	135	340	6	3640
	8	45	45	62	140	360	6	3300
	10	45	45	62	145	360	6	2930
	12	45	45	62	145	380	6-7	2450
	15	45	45	62	150	400	8	1910
	20	45	45	62	150	400	8	1190
	25	45	45	62	155	400	10	790
4.7 mm 600A max.	15	55	55	65	140	500	10	2260
	20	55	55	65	145	500	10	1740
	25	55	55	65	150	560	10	1540
	35	55	55	65	160	580	10	950
	50	55	55	65	175	600	11	530
5.5 mm 760A max.	35	60	60	73	170	700	13	950
	50	60	60	73	175	720	13	650
	60	60	60	73	180	740	15	510
	75	60	60	73	185	760	16	320

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.

Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current), gradually lower the initial height of the torch until transfer occurs.

HT4001 w/Slave
PAC620 Torch - Beveling Consumables
Aluminum - Nitrogen Plasma



ENGLISH

Nozzle	Material Thickness (in)	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (in)	Torch Standoff (mm)	Travel Speed (ipm)	Travel Speed (mm/min)
.120" 260A max.	.035	.889	30	30	45	120	240	1/8	3	520	13200
	.075	1.91	30	30	45	125	240	1/8	3	345	8760
	1/8	3.18	30	30	45	130	260	3/16	5	230	5840
	1/4	6.35	30	30	45	140	260	1/4	6	170	4320
.166" 400A max.	1/8	3.18	55	55	62	140	280	1/4	6	220	5590
	1/4	6.35	55	55	62	150	320	1/4	6	165	4190
	3/8	9.53	55	55	62	150	340	1/4	6	130	3300
	1/2	12.7	55	55	62	150	360	1/4	6	110	2790
	3/4	19.1	55	55	62	150	380	5/16	8	60	1520
	1	25.4	55	55	62	165	380	3/8	10	35	890
.187" 600A max.	1	25.4	55	55	65	165	500	3/8	10	70	1780
	1-1/2	38.1	55	55	65	170	600	3/8	10	35	890
	2	50.8	55	55	65	170	600	3/8	10	25	630
.220" 760A max.	2	50.8	60	60	73	175	700	1/2	13	30	760
	3	76.2	60	60	73	200	760	5/8	16	20	510

METRIC

Nozzle	Material Thickness (mm)	Test Preflow Rate (N_2) (%)	Test Cut Flow Rate (N_2) (%)	Water Flow Setting (%)	Arc Volts (V)	Arc Current (A)	Torch Standoff (mm)	Travel Speed (mm/min)
3 mm 260A max.	6	30	30	45	140	260	6	4500
4.2 mm 400A max.	6	55	55	62	150	320	6	4350
	8	55	55	62	150	340	6	3700
	10	55	55	62	150	340	6	3200
	12	55	55	62	150	360	6	2900
	15	55	55	62	150	360	7	2350
	20	55	55	62	150	380	8	1400
	25	55	55	62	165	380	10	930
4.7 mm 600A max.	30	55	55	65	170	560	10	1460
	35	55	55	65	170	600	10	1100
	50	55	55	65	170	600	10	650
5.5 mm 760A max.	60	60	60	73	190	740	14	680
	75	60	60	73	200	760	16	520

Notes:
- Minimum N_2 inlet supply pressure remains at one setting of 150 psi (10.3 bar) for all material thickness.
- Water inlet pressure is 150 psi (10.3 bar) minimum to RHF, gas console & MV console.
- N_2 flow rate at full scale is 374 scfh (176 l/min) @ 150 psi (10.3 bar) inlet pressure.
- Set initial torch height (before piercing) to approximately twice the Torch Standoff distance for the material you are cutting.

Note: If arc does not transfer when set at twice the torch standoff (in the case of thick metal being cut at high current), gradually lower the initial height of the torch until transfer occurs.

CHANGING CONSUMABLE PARTS

WARNING

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

Inspect the consumable parts before cutting for wear, and replace when needed. **Always place the consumables on a clean, dry, oil free surface after removing. Dirty consumables can cause the torch to malfunction.** Refer to Figure 4-2.

Removal and Inspection

1. Unscrew the retaining cap.

2. Remove the nozzle from the torch. Check the ceramic portion of the nozzle for signs of wear and arcing.

3. Unscrew the electrode from the torch head using a 7/16" (11 mm) hex wrench (wrench supplied in all of the spare parts kits). Replace the electrode if the crater in the center of the insert is in excess of .050 inch (1.3 mm) deep.

4. Remove the swirl ring from the electrode and inspect it for plugged holes or other damage.

5. If the tip of the water tube is damaged at all, see *Changing the Water Tube* later in this section.

Replacement

Before replacing the consumable parts, clean the current ring in the torch - see Figure 4-2. Use a clean paper towel or cotton swab to remove any dirt, grease, etc., from the current ring.

1. Replace the electrode by screwing it back into the torch head. Use the 7/16" (11 mm) socket wrench to tighten down the electrode. **Do not overtighten.**

2. Apply a light coating of silicone grease to both O-rings of the swirl ring before installing. As a guideline, you should be able to feel the grease on your fingers, but not see it. **Do not use an excessive amount of grease.** Too much grease will plug the swirl ring ports, causing improper gas flow during operation.

   When installing the swirl ring, make sure to place the smaller diameter end up toward the rear of the torch.

3. Before installing the nozzle, apply a small amount of silicone grease to the nozzle's O-rings. As a guideline, you should be able to feel the grease on your fingers, but not see it. **Do not use an excessive amount of grease.** Insert the nozzle into the torch and push it into place.

4. Replace the retaining cap by **tightening it snugly by hand to insure good electrical contact** between the nozzle and the torch.

   If the cap does not go on easily, clean the threads on the torch body and the retaining cap and apply a small amount of silicone grease to the O-ring located just below the threads of the torch body.

   Note: Failure to tighten the retaining cap snugly (or to keep the threads and current ring clean) will result in pitting of the stainless steel current ring causing gas and water leaks around the upper nozzle O-ring, impairing cut quality. The **retaining cap should be tightened by hand only.**

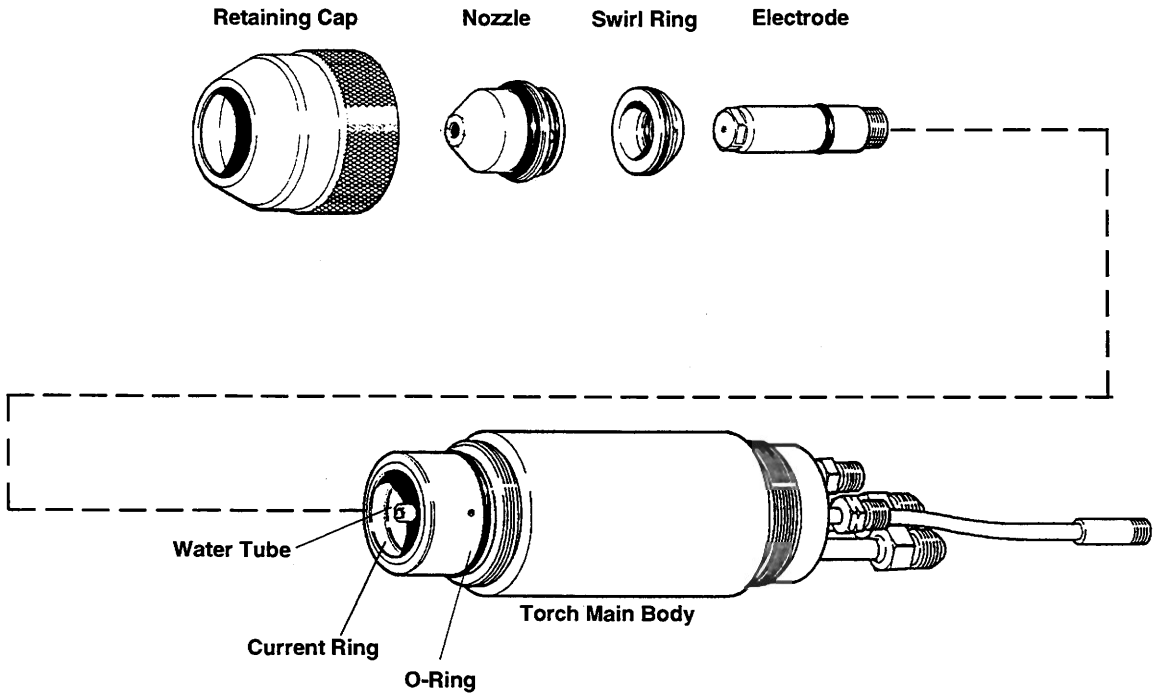


Figure 4-2 Changing Consumable Parts

Changing the Water Tube

Problems and causes you may find with a defective or improperly installed water tube:

- Short electrode life: Water tube not screwed in tightly; wrong water tube for consumables
- Flow switch interlock shutting down the system: Water flow restricted due to loose water tube
- Humming or rattling sound coming from the torch: Water tube bent or loose

If you suspect a problem with the water tube, you may need to replace it.

1. Disconnect power supply from power source.
2. Remove all consumables from torch (see *Changing Consumable Parts* earlier in this section).
3. Verify that the correct water tube is installed - The standard water tube (020990) is recessed about 5/64 of an inch (2 mm) from the end of the torch head. The nitrogen beveling water tube (020991) extends about 19/64 of and inch (7.5 mm) from the end of the torch head. The oxygen beveling water tube (020992) extends about 23/64 of an inch (9.1 mm) from the end of the torch head.
   Note: part numbers are laser engraved on the water tubes.
4. Look for any damage or bends in the water tube.
5. Remove and replace the water tube by using the water tube wrench (027347) supplied with the consumable parts kits - Fig. 4-3. **When installing water tube, do not overtighten!** Snug down by hand only.

WARNING

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

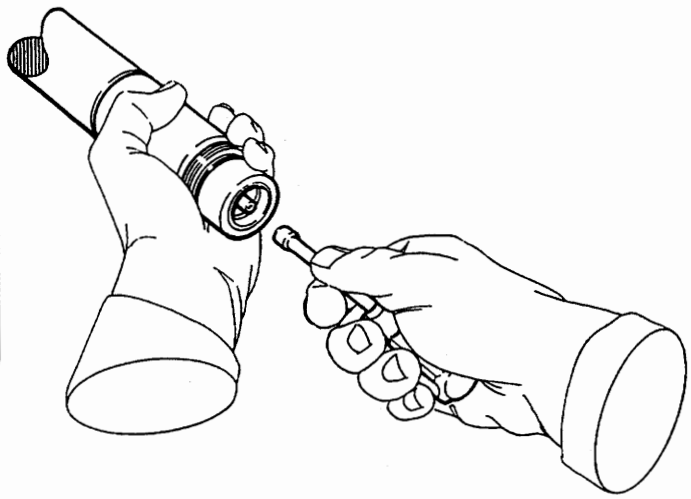


Figure 4-3 Changing the Water Tube

Hypertherm

Section 5

PARTS LIST

This section provides part numbers for the components in the HT4001 Titan Gas Panel, Remote High Frequency&Motor Valve Console (also called "High Frequency Console") and PAC620 torch for the Titan Integrated Plasma System.

- See *Installation* in this manual for cable and hose part numbers.
- See HT4001 Instruction Manual 802000 for consumable parts kits, power supply breakdown, and parts for other HT4001 options.

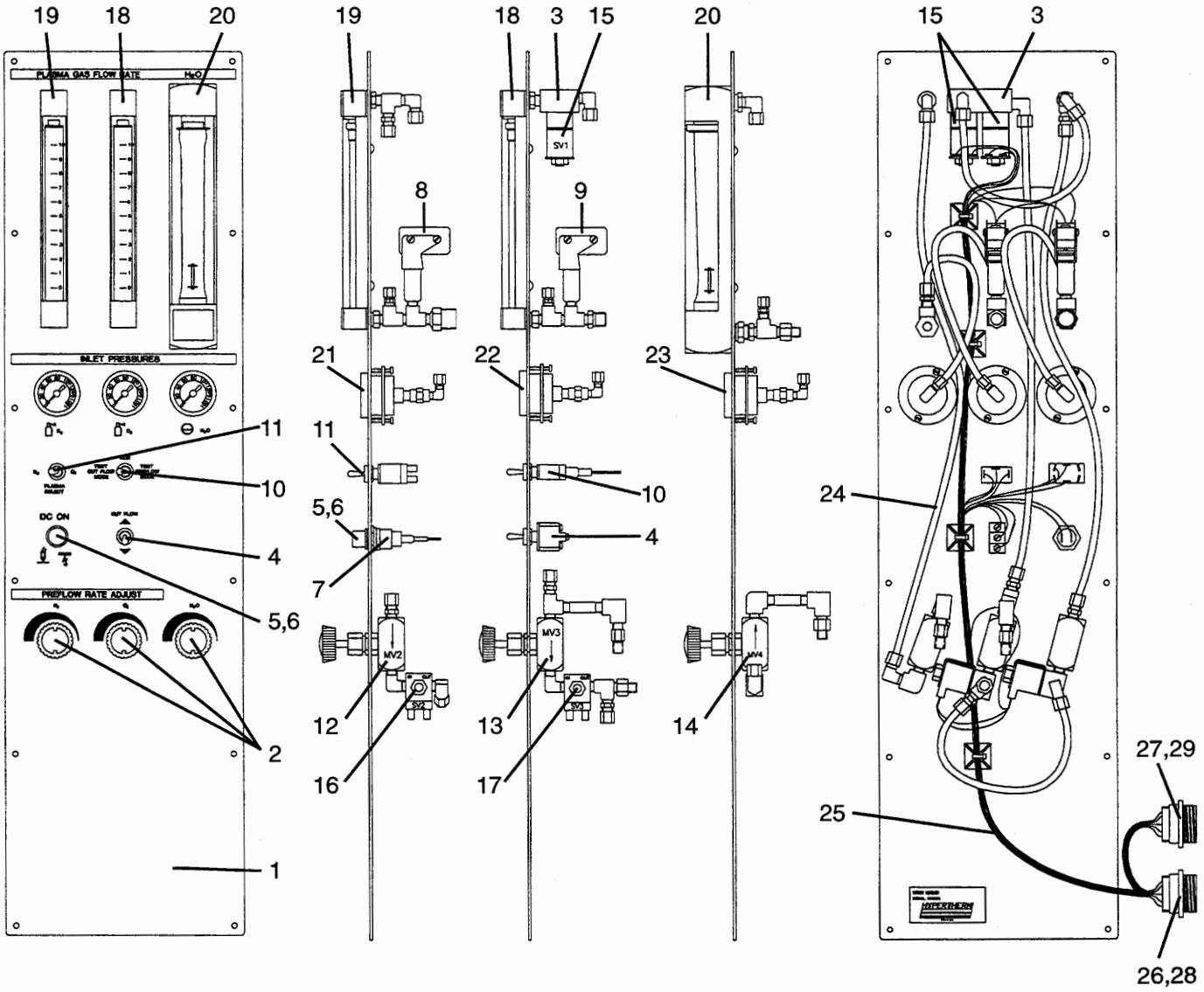


Figure 5-1 HT4001 Titan Gas Panel

GAS PANEL - 077024

Item	Part Number	Description	Designator	Qty.
1	001628	Panel:HT4001 Titan Gas Console		1
2	004117	Cap:Needle Valve		3
3	004718	Manifold:Motor Valve		1
4	005042	Toggle Switch:Momentary ON/OFF/ON	**S3**	1
5	005089	Lens:White		1
6	005149	Bulb:120VAC	**LT1**	1
7	005151	Lamp Holder		1
8	005243	Pressure Switch:80 psi 1/8 NPT	**PS1**	1
9	005243	Pressure Switch:80 psi 1/8 NPT	**PS2**	1
10	005180	Toggle Switch:SP3T ON/OFF/ON	**S2**	1
11	005181	Toggle Switch:DPDT ON/NONE/ON	**S1**	1
12	006064	Motor Valve:1/8 FPT .125 Orifice	**MV2**	1
13	006064	Motor Valve:1/8 FPT .125 Orifice	**MV3**	1
14	006064	Motor Valve:1/8 FPT .125 Orifice	**MV4**	1
15	006109	Solenoid Valve:1/8FPT120V2W NC MANF	**SV1A,SV1B**	2
16	006106	Solenoid Valve:1/8FPT 120V TFE Plunger	**SV2**	1
17	006106	Solenoid Valve:1/8FPT 120V TFE Plunger	**SV3**	1
18	011053	Flowmeter:0-10 SC/BP-8 Float Cal 2%	**FM2**	1
	011058	Flowtube/BP-8 Float:0-10 SC Cal. 2%		1
	011081	Float Stop		1
	011008	Shield, Plastic, 63S0503M0010		1
19	011056	Flowmeter:0-10 SC/BT-8 Float Cal 2%	**FM1**	1
	011057	Flowtube/BT-8 Float:0-10 SC Cal. 2%		1
	011081	Float Stop		1
	011008	Shield, Plastic, 63S0503M0010		1
20	011069	Flowmeter:1.9 SCFM/3F9 Float (NO-V)	**FM3**	1
21	022027	Pressure Gauge:160# 1.5" 1/8CBM Panel	**PG1**	1
22	022027	Pressure Gauge:160# 1.5" 1/8CBM Panel	**PG2**	1
23	022027	Pressure Gauge:160# 1.5" 1/8CBM Panel	**PG4**	1
24	046077	Tubing:1/4"OD .04W Blue Nylon		11 ft
25	**129213**	**Harness:HT4001 Titan Gas Assy**		1
26	008176	Pin:24-20 AWG TYPE III+CRP		27
27	008186	Socket:24-20 AWG TYPE III+CRP		14
28	008208	Receptacle Shell:CPC 23-37 Reverse Sex	**3X1**	1
29	008447	Receptacle Shell:CPC 23-37 Standard Sex	**3X2**	1

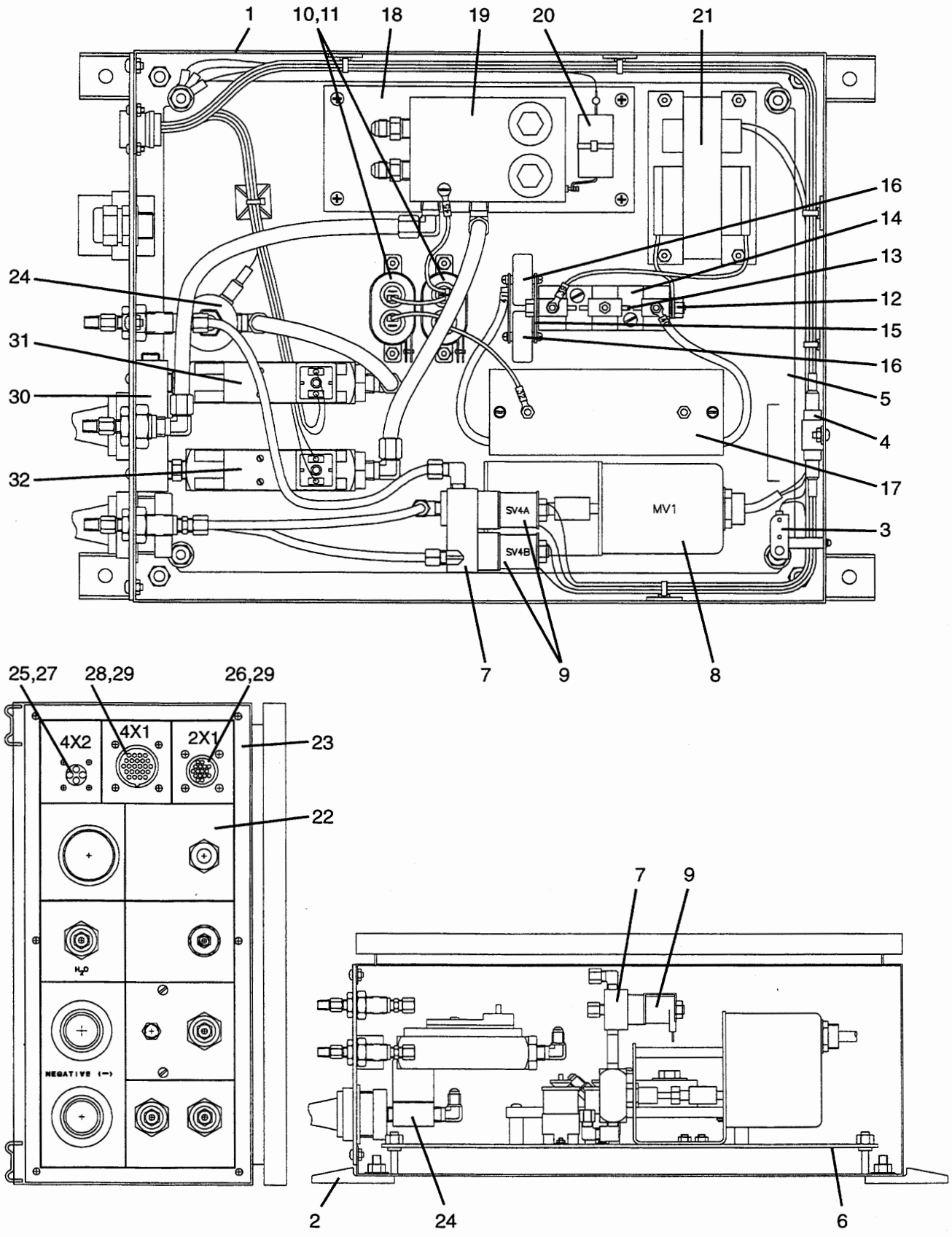


Figure 5-2 HT4001 Titan RHF&MV Console

RHF&MV CONSOLE - 077028

Item	Part Number	Description	Designator	Qty.
1	002279	Enclosure:2000/4001/3070 Titan RHF		1
2	002285	Foot:Titan RHF Console		4
3	005100	Limit Switch:Door Interlock	**S1**	1
4	009045	Filter:1A 1B1 AC Electric	**FL1**	1
5	**077025**	**HT4001 Titan RHF PNL**		1
6	001629	Box:HT4001 Titan RHF		1
7	004718	Manifold:Motor Valve		1
8	006063	Motor Valve:Electric 1/8FPT .125 Orifice	**MV1**	1
9	006109	Solenoid Valve:1/8FPT120V2W NC MANF	**SV4A,SV4B**	2
10	009246	Capacitor:.5µF 2500WV	**C4A, C4B**	2
11	009247	Bracket:009246 Cap Mounting		2
12	**009350**	**Spark Gap Assembly:40-200/2000/HD**	**SG1**	1
13	004061	Electrode:Spark Gap 1/8 X 1.6		3
14	004140	Base:40/0/100/200/HD Spark Gap		1
15	004144	Bar:009350 Spark Gap Cap Mounting		1
16	009280	Capacitor:.002µF 15KV	**C5A,C5B**	2
17	109075	Inductor:HT4001-Titan HF Coil	**T2**	1
18	**129209**	**Negative Bus SA:HT4001 Titan**		1
19	004074	Block:200/400/500 Cath Neg Bus		1
20	009224	Capacitor:.22µF 1000WV 10%	**C7**	1
21	**129306**	**High Voltage Xfmr SA:HT4001 Titan RHF**	**T1**	1
22	**129210**	**Panel SA:HT4001 Titan**		**1**
23	001632	Panel:HT4001 Titan Side		1
24	006031	Solenoid Valve:350# 1/4 FPT 120V NC	**SV6**	1
	129214	**Harness:HT4001 Titan HF & Motor-Valve**		1
25	008186	Socket:24-20 AWG Type III+CRP		4
26	008193	Receptacle Shell:CPC 17-16 Std Sex	**2X1**	1
27	008210	Receptacle Shell:CPC 11-4 Rvs Sex	**4X2**	1
28	008447	Receptacle Shell:CPC 23-37 Std Sex	**4X1**	1
29	008985	Pin:18-16AWG TypeIII		10
	129224	**Manifold SA:HT4001 Kobold Flowswitch**		1
30	004457	Manifold:500/4X00 Kobold Flowswitch		1
31	005139	Flowswitch:0.25 GPM SPST 1/4 NPT	**FS2**	1
32	005140	Flowswitch:1.20 GPM SPST 1/4 NPT	**FS1**	1

PARTS LIST

HT4001 TITAN STANDARD TORCH ASSEMBLY WITH 25' LEADS - 128256

Item	Part Number	Description	Qty.
	128256	HT4001 Titan Standard Torch Assy w/25' Leads	
1	028507*	PAC620 Standard Torch Assy	1
2	028944	Leads:Torch Power with Sleeve 25'	1
3	024214	Hose Assy:3/16Blue RH'A' 25'	1
4	123315	Cable:4001 Titan MotorValve/Tch Off Vlv 25'	1
5	024317	Hose Assy:1/4Blue RH'A' 5'	1
6	129159	Off-Valve SAIII:PAC620 Tch	1

* See page 5-8 for detail of PAC620 Standard Torch Assy

HT4001 TITAN BEVEL TORCH ASSEMBLY WITH 25' LEADS - 128257

Item	Part Number	Description	Qty.
	128257	HT4001 Titan Bevel Torch Assy w/25' Leads	
1	028741**	PAC620 Bevel Torch Assy	1
2	028944	Leads:Torch Power with Sleeve 25'	1
3	024214	Hose Assy:3/16Blue RH'A' 25'	1
4	123315	Cable:4001 Titan MotorValve/Tch Off Vlv 25'	1
5	024317	Hose Assy:1/4Blue RH'A' 5'	1
6	129159	Off-Valve SAIII:PAC620 Tch	1

** See page 5-7 for detail of PAC620 Bevel Torch Assy

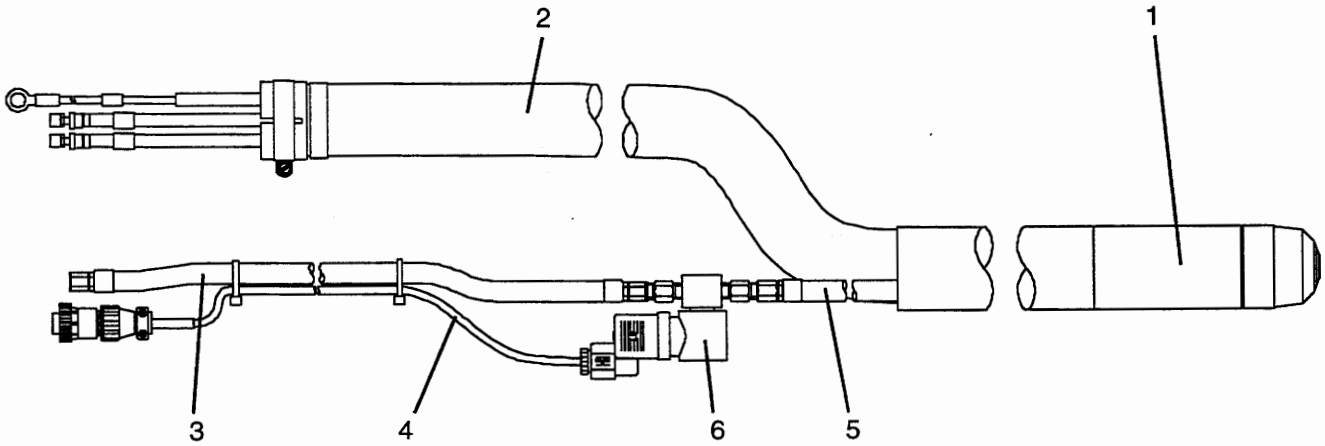


Figure 5-3 128256 or 128257 Torch Assembly

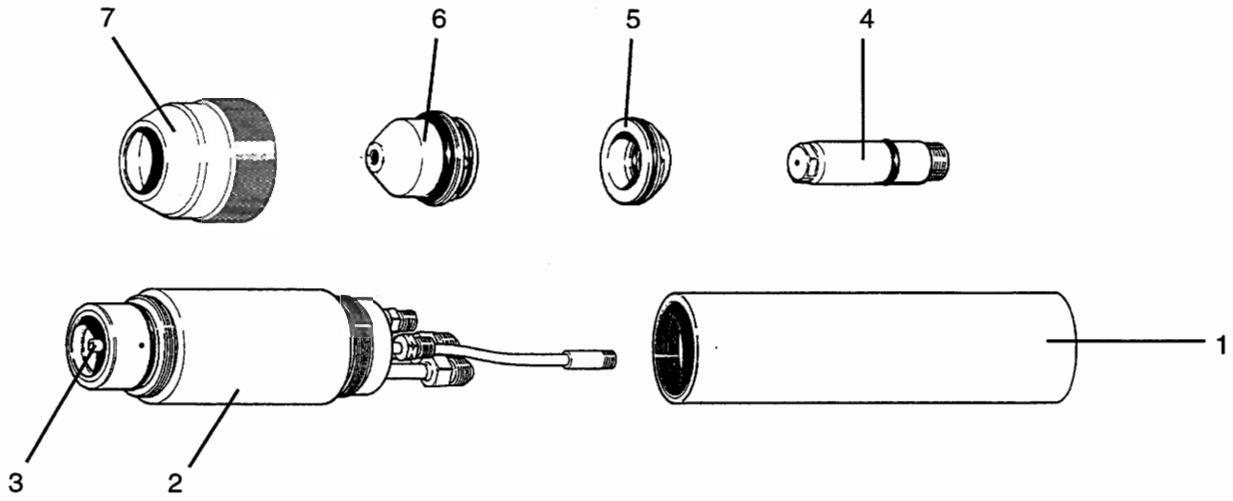


Figure 5-4 PAC620 Beveling Torch Assembly

PAC620 BEVEL TORCH ASSEMBLY - 028741

Item	Part Number	Description	Qty.
	028741	**PAC620 Bvlng Torch Assy**	
1	020749	Torch mounting Sleeve:PAC610/620	1
2	**020970**	**PAC620 Bev Torch Main Body**	1
3	020991	Water Tube:620 Bev N2 Electdcool	1
4	020968	Electrode:PAC620 Bev N2	1
5	020039	Swirl Ring: .120/.166/.187 N2	1
6	120387	Nozzle:PAC620 Bev. .166 N2	1
7	120392	Ret Cap:PAC620 Bev N2 Noz Vectra	1

TORCH MOUNTING BRACKET - 020046

Part Number	Description	Designation	Qty.
020046	**Torch Mounting Bracket w/Clevis:2"**		**1**
020032	Bracket: 2" Torch Mounting		1
020044	Clevis: Torch Mounting Bracket		1

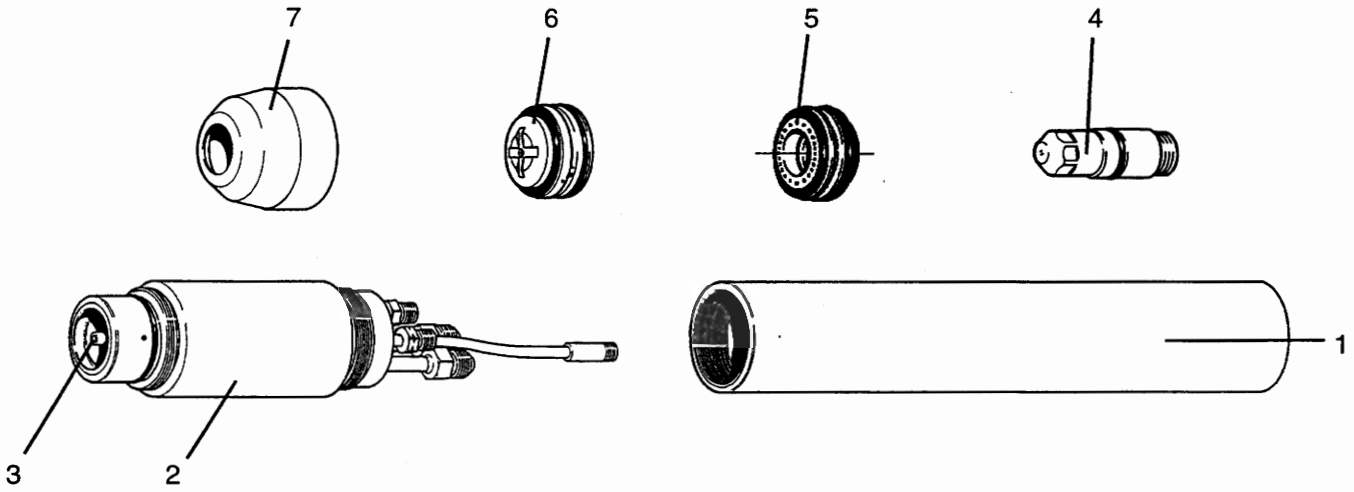


Figure 5-5 PAC620 Standard Torch Assembly

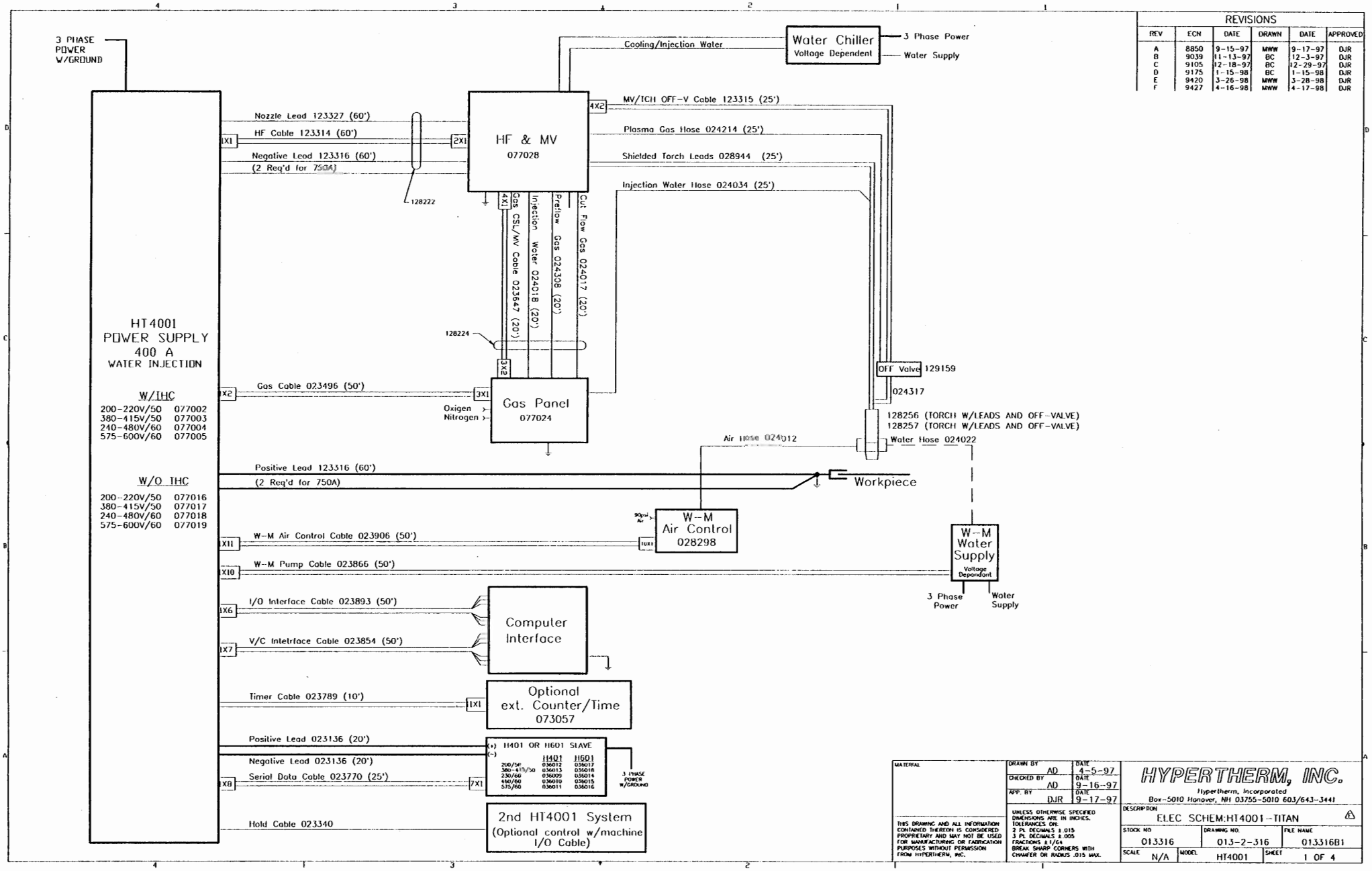
PAC620 STANDARD TORCH ASSEMBLY - 028507

Part Item	Number	Description	Qty.
	028507	**PAC620 Standard Torch Assy**	
1	020041	Torch mounting Sleeve:2" Generic	1
2	**020328**	**PAC620 Standard Torch Main Body**	1
3	020990	Water Tube:400/600/170 Electdcool	1
4	020663	Electrode:O2	1
5	020623	Swirl Ring:O2	1
6	020086	Nozzle: .099 O2	1
7	020579	Ret Cap:PAC620 Standard (Vectra)	1

TORCH MOUNTING BRACKET - 020046

Part Number	Description	Designation	Qty.
020046	**Torch Mounting Bracket w/Clevis:2"**		**1**
020032	Bracket: 2" Torch Mounting		1
020044	Clevis: Torch Mounting Bracket		1

See HT4001 Instruction Manual 802000 for consumable parts kits, power supply breakdown, and parts for other HT4001 options.



REVISIONS					
REV	ECN	DATE	DRAWN	DATE	APPROVED
A	8850	9-15-97	MWW	9-17-97	DJR
B	9039	11-13-97	BC	12-3-97	DJR
C	9105	12-18-97	BC	12-29-97	DJR
D	9175	1-15-98	BC	1-15-98	DJR
E	9420	3-26-98	MWW	3-28-98	DJR
F	9427	4-16-98	MWW	4-17-98	DJR

MATERIAL

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DRAWN BY	AD	DATE 4-5-97
CHECKED BY	AD	DATE 9-16-97
APP. BY	DJR	DATE 9-17-97

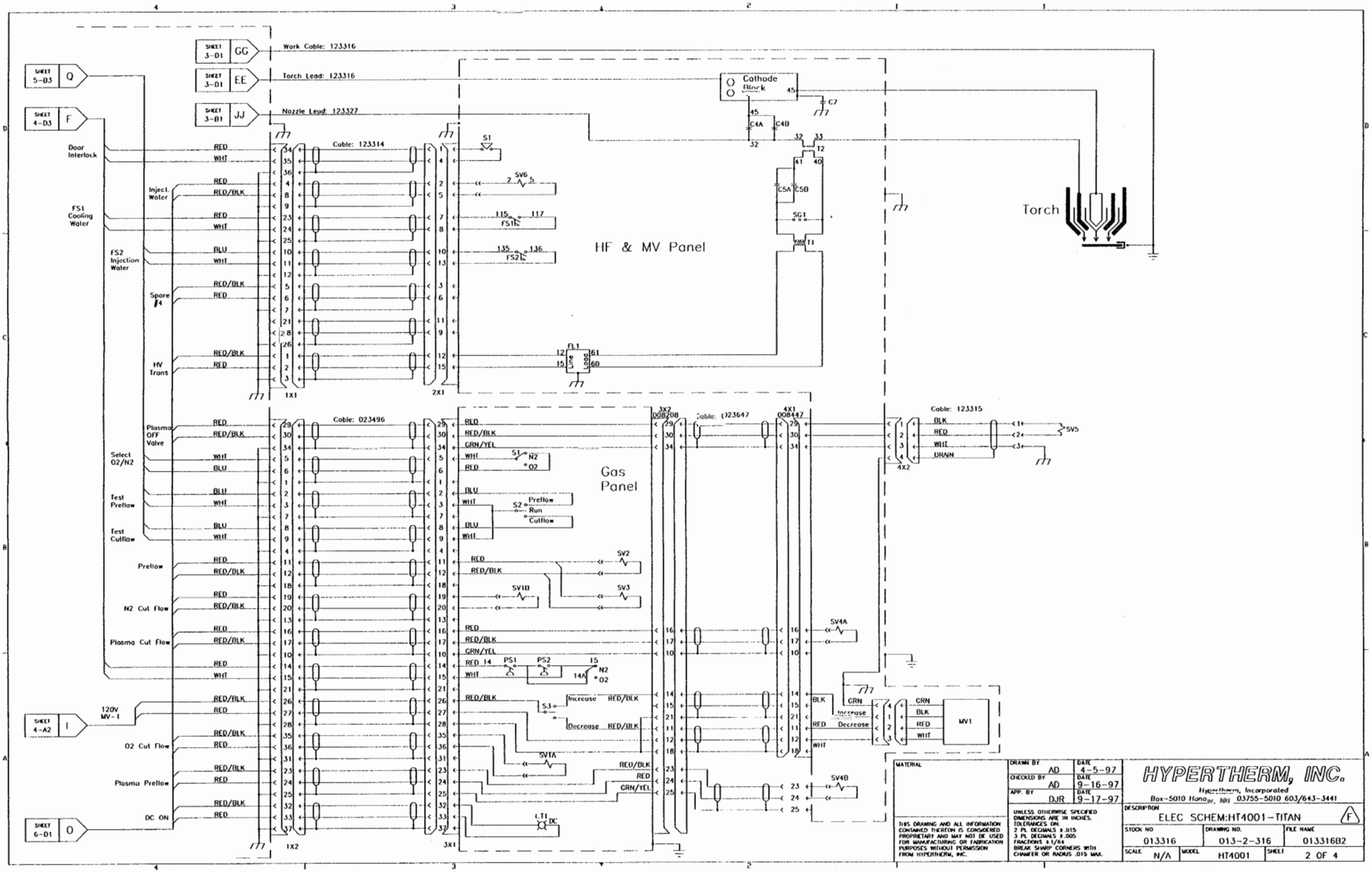
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON:
2 PL DECIMALS ± .015
3 PL DECIMALS ± .005
FRACTIONS ± 1/64
BREAK SHARP CORNERS WITH CHAMFER OR RADIUS .015 MAX.

HYPERTHERM, INC.
Hypertherm, Incorporated
Box-5010 Hanover, NH 03755-5010 603/643-3441

DESCRIPTION: ELEC SCHEM:HT4001-TITAN

STOCK NO	DRAWING NO.	FILE NAME
013316	013-2-316	013316B1

SCALE	MODEL	SHEET
N/A	HT4001	1 OF 4



MATERIAL	DRAWN BY AD	DATE 4-5-97	HYPERTHERM, INC.
	CHECKED BY AD	DATE 9-16-97	Hypertherm, Incorporated Box-5010 Hanover, NH 03755-5010 603/643-3441
	APP. BY DJR	DATE 9-17-97	DESCRIPTION ELEC SCHEM:HT4001-TITAN (F)
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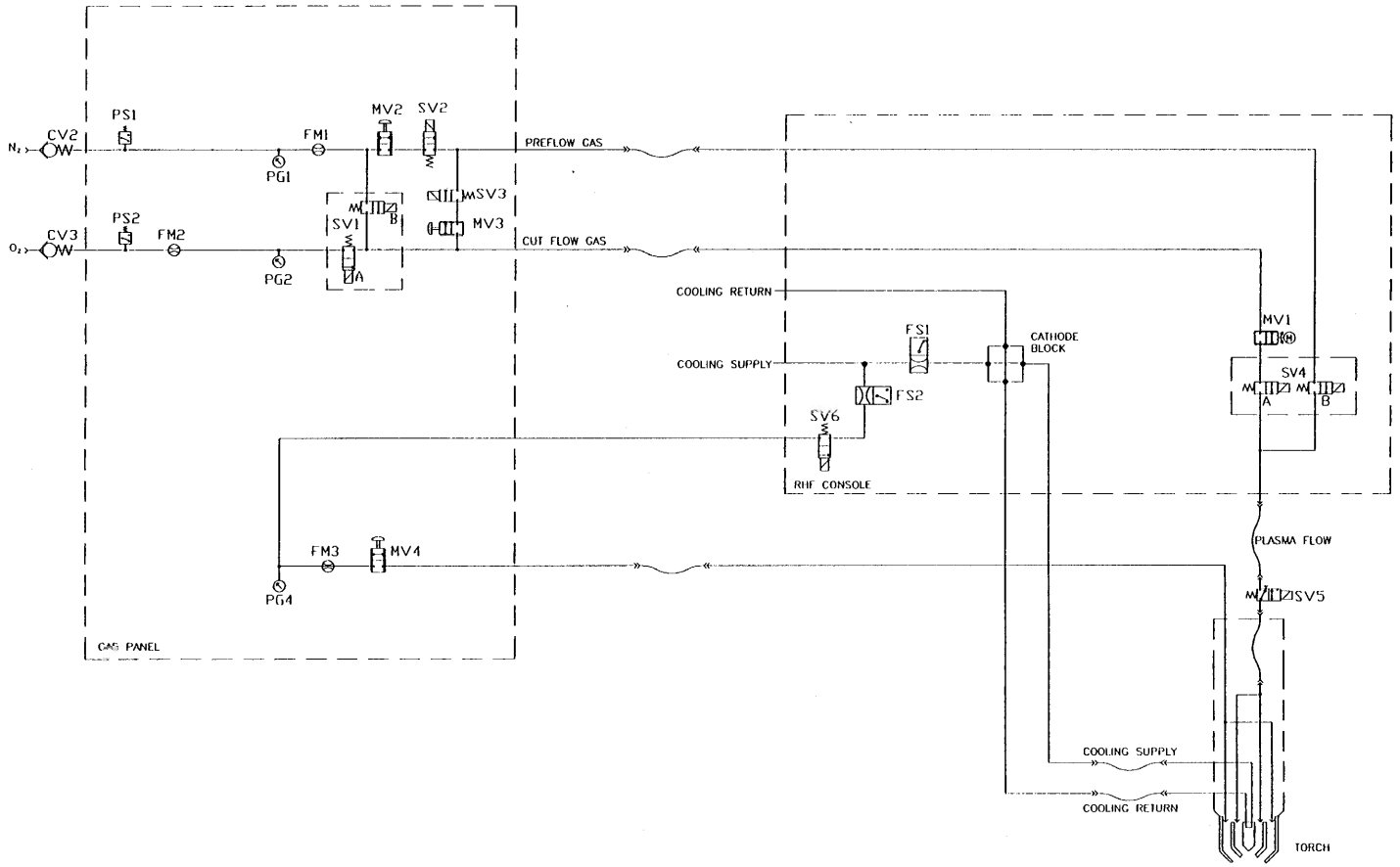

FM1	FLOW METER, NITROGEN
FM2	FLOW METER, OXYGEN
FM3	FLOW METER, INJECTION WATER
PG1	PRESSURE GAUGE, NITROGEN INLET
PG2	PRESSURE GAUGE, OXYGEN INLET
PG4	PRESSURE GAUGE, INJECTION
PS1	PRESSURE SWITCH, NITROGEN INLET
PS2	PRESSURE SWITCH OXYGEN INLET
MV1	METERING VALVE, PLASMA MOTOR
MV2	METERING VALVE, N_2 PREFLOW
MV3	METERING VALVE, O_2 PREFLOW
MV4	METERING VALVE, INJECTION WATER
SV1A	SOLENOID VALVE, O_2 CUTFLOW
SV1B	SOLENOID VALVE, N_2 CUTFLOW
SV2	SOLENOID VALVE, N_2 PREFLOW
SV3	SOLENOID VALVE, O_2 PREFLOW
SV4A	SOLENOID VALVE, CUTFLOW
SV4B	SOLENOID VALVE, PREFLOW
SV5	SOLENOID VALVE, PLASMA OFF
SV6	SOLENOID VALVE, INJECTION WATER
FS1	FLOW SWITCH, COOLING WATER
FS2	FLOW SWITCH, INJECTION WATER

NOTES:
1. FOR ELECTRICAL DIAGRAM SEE DWG. NO.

MATERIAL

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CHECKED BY	AD	DATE 9-16-97
APP. BY	DJR	DATE 9-17-97

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HYPERTHERM, INC.
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Box-5010 Hanover, NH 03755-5010 603/643-3441

DESCRIPTION: ELEC SCHEM:HT4001-TITAN (F)

STOCK NO.	DRAWING NO.	FILE NAME
013316	013-2-316	013316B3

SCALE	MODEL	SHEET
N/A	HT4001	3 OF 4

ELECTRICAL SCHEMATIC RHF & GAS PANEL SEE 013316 SHEET 2

POWER UNIT ELECTRICAL DIAGRAM SEE 013254

TIMING DIAGRAM SEE 013254 SHEET 14

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	CHECKED BY AD	DATE 9-16-97	Hypertherm, Incorporated
	APP. BY DJR	DATE 9-17-97	Box-5010 [illegible], NH 03755-5010 603/643-3441
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			STOCK NO. 013316 / DRAWING NO. 013-2-316 / FILE NAME 01331684
			SCALE N/A / MODEL HT4001 / SHEET 4 OF 4