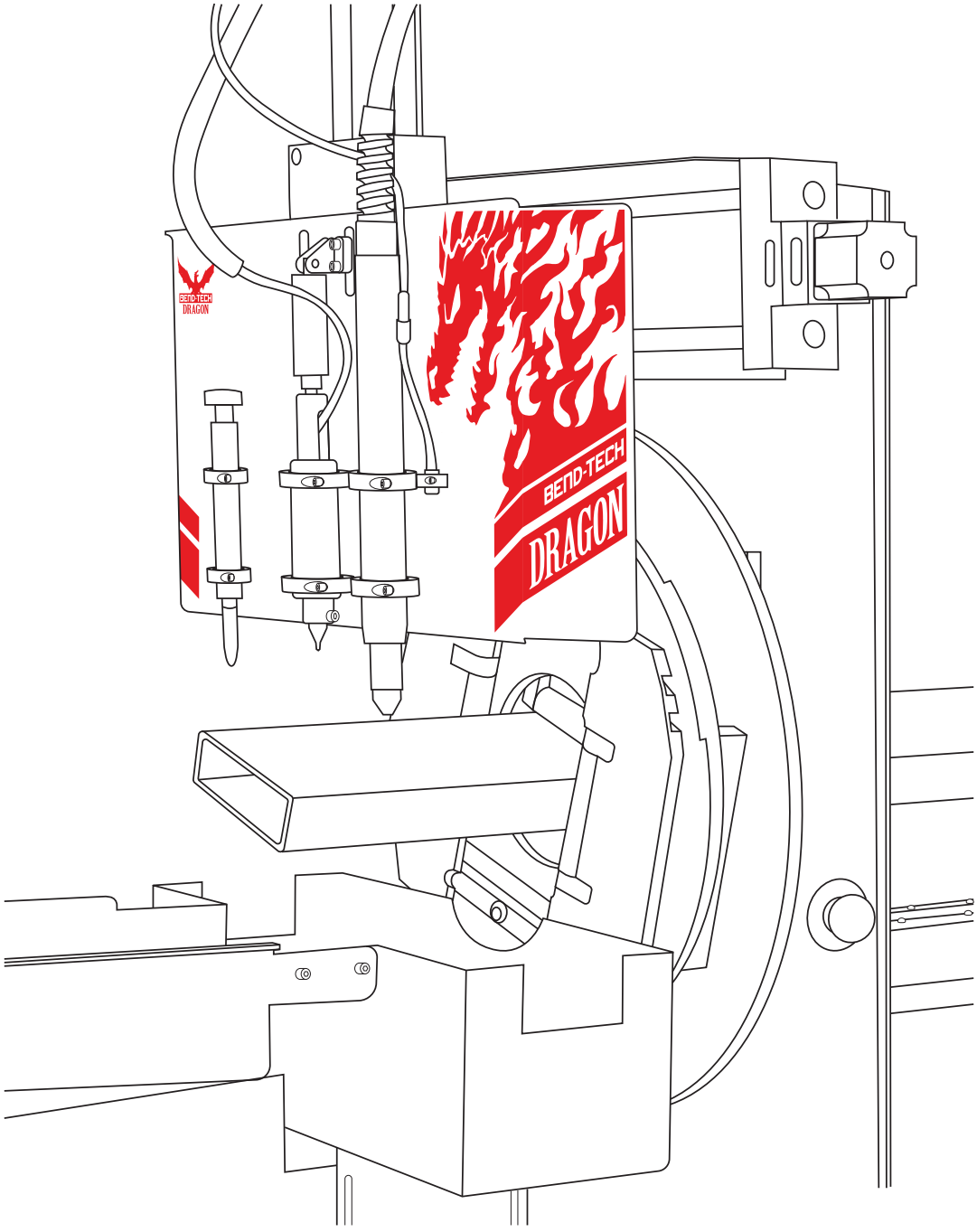
Part 1 of 1

BEND-TECH

DRAGON MACHINES

Plasma Cutting Charts



Dragon Machines

Cutting Charts
Revision 03

English
Original Instructions

October 2022

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Contents

Plasma Cutting Overview

1.1 Bend-Tech Supported Plasma Units

Bend-Tech offers a selected of plasma units to suit your shop's needs.

Hypertherm

- Powermax 45XP
- Powermax 65 SYNC
- Powermax 85 SYNC

Everlast

- PowerPlasma 62i
- PowerPlasma 82i

Thermal Dynamics

- Cutmaster A60i
- Cutmaster A80

1.2 Definitions

Amperage setting

The amperage setting at the top of the page applies to all the settings given on that page.

Material Thickness

Thickness of the workpiece (metal material being cut).

Torch-to-Work Distance (cutting height)

The distance between the shield and the workpiece during cutting.

Initial Pierce Height (pierce height)

Distance between the shield and the workpiece when the torch is fired, prior to descending to the cut height. Pierce height is normally 2.5 times the cutting height.

Pierce Delay Time (dwell time)

Length of time the triggered torch remains stationary at the pierce height before the torch starts the cutting motion.

Kerf Width

Width of material removed by the cutting process. The kerf widths were obtained with the “Best Quality” settings and are for reference only. Differences between installations and material composition may cause actual results to vary from those shown.

Best Quality Settings (cut speed and voltage)

Settings that provide the starting point for finding the best cut quality (best angle, least dross, best cut-surface finish). Adjust the speed for your application and table to obtain the desired result.

Production Settings (cutting feed rate)

70% to 80% of the maximum speed ratings. These speeds result in the greatest number of cut parts, but not necessarily the best possible cut quality.

Lead In/Out

Allow a lead-in distance approximately equal to the thickness of the material being pierced. A material with a 1/8 “ wall thickness requires a 1/8 “ lead-in. Lead

1.3 Consumable Life

How often you need to change the consumables on your plasma unit will depends on a number of factors:

- The thickness of material being cut.
- The average length of the cut.
- The air quality (presence of oil, moisture, or other contaminants)
- Proper torch-to-work distance
- Proper pierce height

Under normal conditions, the electrode will wear out first during machine cutting. A general rule of thumb is that a set of consumables lasts approximately 3-5 hours of actual “arc on” time.

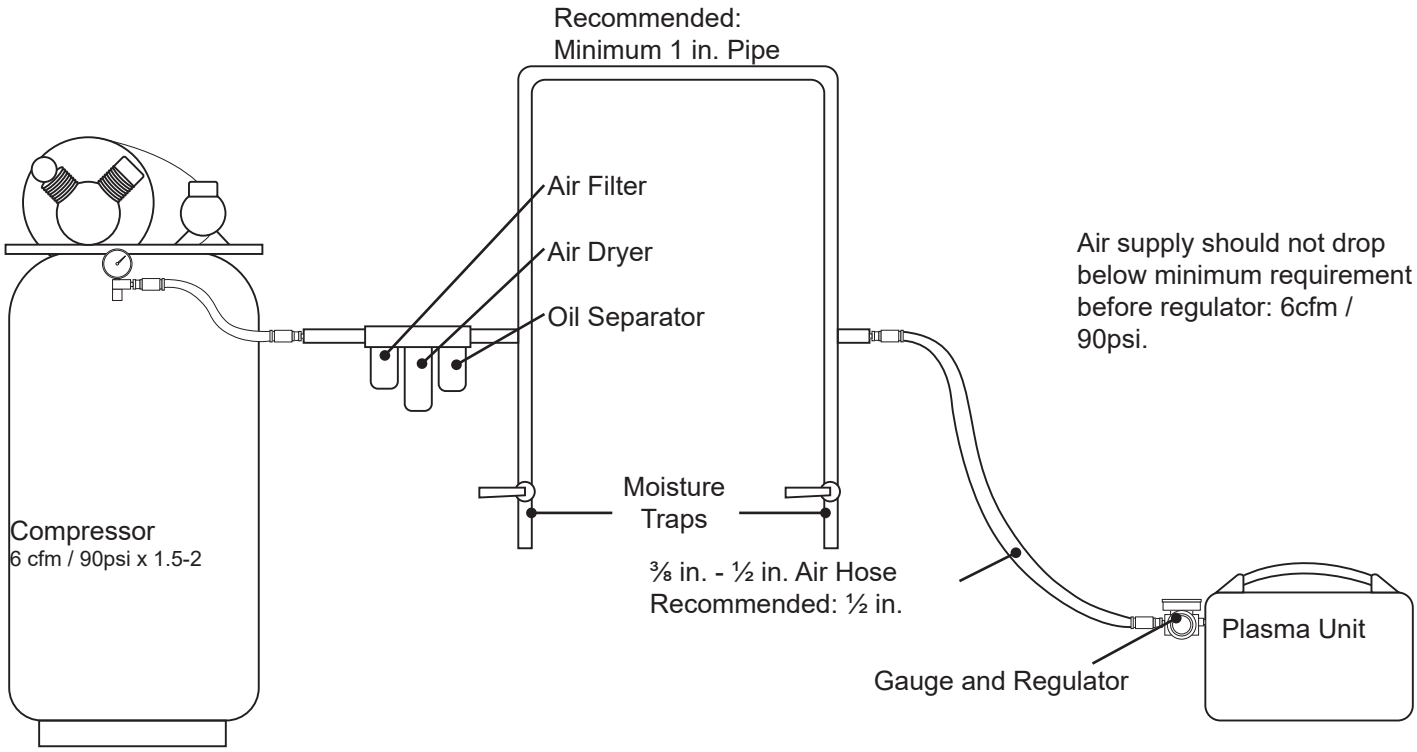
1.4 Gas Supply

The gas supply can be shop-compressed or cylinder-compressed. A high-pressure regulator must be used on either type of supply and be capable of delivering gas to the air inlet on the power supply.

If the supply quality is poor:

- Cut speeds decrease
- Cut quality deteriorates
- Cutting thickness capability decreases
- Life on the consumables shortens.

1.4.1 Additional gas filtration



When site conditions introduce moisture, oil, or other contaminants into the gas line, use a 3-stage filtering system.

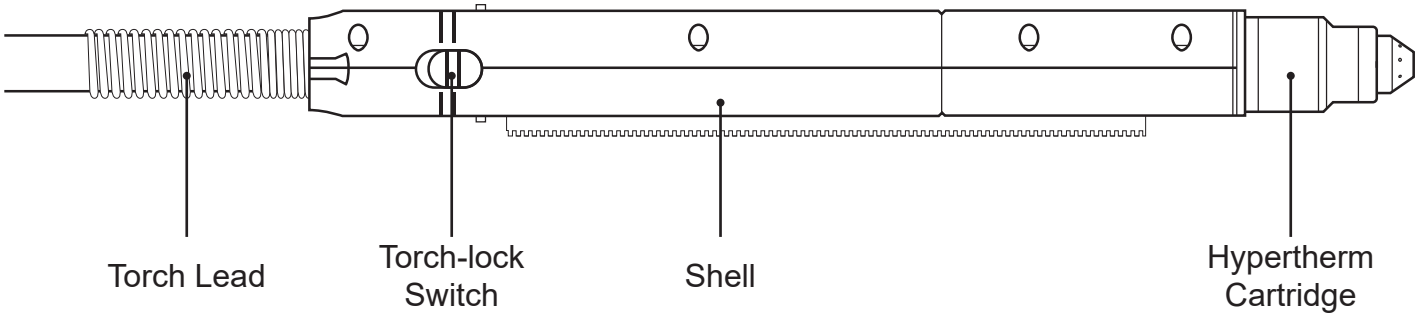
The filtering system should be installed between the gas supply and the power supply. Additional gas filtration may increase the required minimum inlet pressure.

02 Hypertherm

2.1 Hypertherm Information

This document does not replace the Operator's Manual for Hypertherm. Ensure you review the Hypertherm Manuals, for more in depth information relating to the plasma unit and plasma cutting.

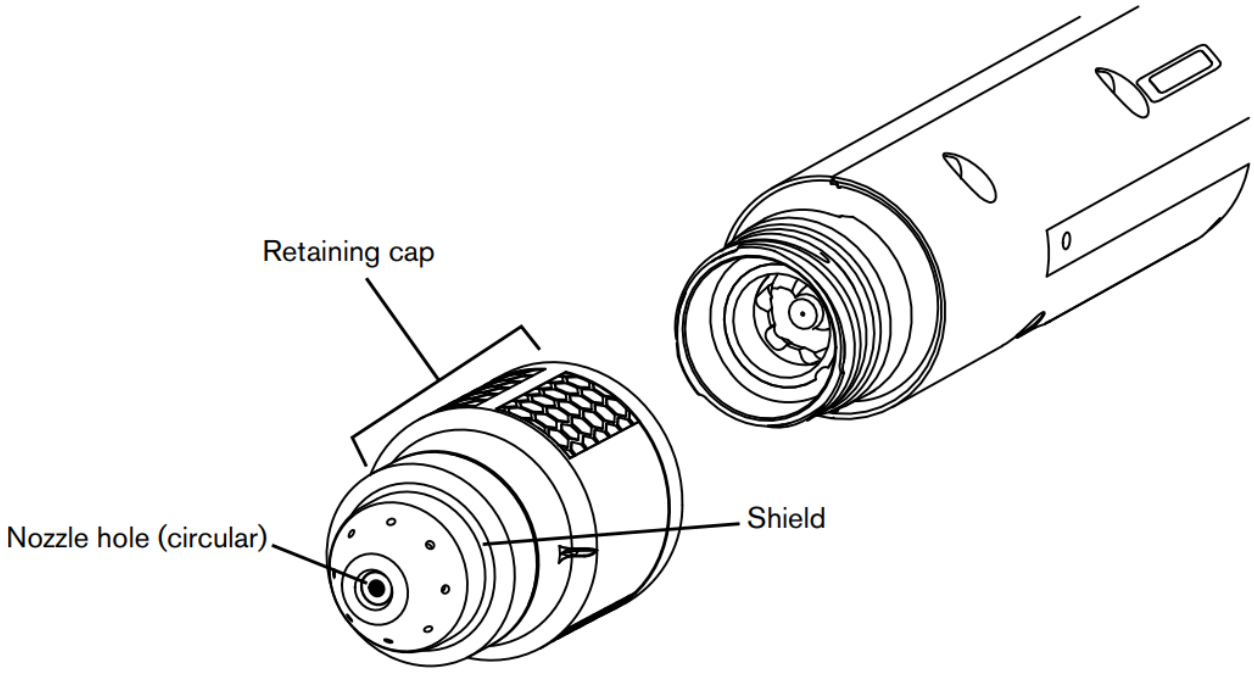
Hyperthem Document Library: https://www.hypertherm.com/en-US/support/documents-library/



2.2 Consumables

The Hyperthem Powermax SYNC systems use a cartridge style torch type, instead of the multipart consumables used by the previous Powermax systems. The Bend-Tech Dragon supports two types of SYNC cartridges, the Mechanized Cutting cartridge and the FineCut Mechanized Cutting cartridge.

Cartidge Type		Purpose
	Mechanize Cutting (gray)	Use these standard cartidges for the widest range of cutting applications.
	FineCut Mechanize Cutting (gray)	Use these cartridges to get a narrower kerf on thin mild steel and stainless steel up to 10 guage (3 mm).



Check the following items for indications that a cartridge is near or at end-of-life.

- **Examine the nozzle hole.** A nozzle hole in good condition is circular. If the nozzle hole is not circular, replace the cartrige.
- **Higher rate of 0-30-0 faults.** As a cartridge wears, unwanted material can collect inside the cartridge and cause 0-30-0 faults to occur. In some conditions, you can remove this material by carefuly shaking the cartridge.
- **Examine the crown.** The crown in the square copper piece inside the cartridge. Push down on the crown and then release the spring tension. A crown in good condition goes back to its start position. If the crown stays in the down position, carefully shake the cartridge. If the crown continues to stay in the down position, replace the cartridge.
- **0-32-0 or 0-32-1 fault codes.** If the system shows an 0-32-0 or 0-32-1 fault code, install a new cartridge.

Important

Do not try to disassembly the cartridge.

2.3 SYNC Cutting Charts

Important

Reduce the Cut Speed listed by 20% when cutting with the Dragon Machines.

2.3.1 85A Mild Steel

English

Material Thickness	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
	in.	*in.*	*%*	*Seconds*	*ipm*	*Volts*	*ipm*	*Volts*	*in.*
10 GA	0.125	0.150	120	0.2	250	134	334	132	0.063
3/16 in.					185	134	226	133	0.070
1/4 in.				0.5	130	135	153	134	0.077
3/8 in.					70	136	86	136	0.088
1/2 in.		0.188	150		46	139	55	139	0.096
5/8 in.				1.0	34	142	39	142	0.103
3/4 in.		0.250	200	1.5	25	146	28	144	0.108
7/8 in.		Edge Start			19	150	22	147	0.114
1 in					13	153	17	150	0.120
1-1/8 in.					9	157	13	153	0.128
1-1/4 in.					6	161	10	157	0.139

Metric

Material Thickness	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
mm	*mm*	*mm*	*%*	*Seconds*	*mm/min*	*Volts*	*mm/min*	*Volts*	*mm*
3	3.2	3.8	120	0	6930	134	9580	131	1.5
4				0.2	5560	134	7140	132	1.7
6					3560	135	4220	134	1.9
8				0.5	2360	136	2820	135	2.1
10		4.8	150		1630	137	2030	137	2.3
12					1240	138	1520	138	2.4
16				1.0	840	142	970	142	2.6
20		6.4	200	1.5	580	147	660	145	2.8
25		Edge Start			360	153	430	150	3.0
30					200	159	300	155	3.4

2.3.2 65A Mild Steel

English

Material Thickness	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
	in.	*in.*	*%*	*Seconds*	*ipm*	*Volts*	*ipm*	*Volts*	*in.*
10 GA	0.125	0.150	120	0.1	191	133	225	132	0.053
3/16 in.				0.2	138	133	166	131	0.057
1/4 in.				0.5	93	133	117	132	0.062
3/8 in.				0.7	44	136	64	134	0.072
1/2 in.				1.2	30	140	40	138	0.081
5/8 in.		0.250	200	2.0	22	145	27	143	0.089
3/4 in.		Edge Start			16	150	19	147	0.097
7/8 in.					11	153	14	151	0.104
1 in					8	155	10	153	0.110

Metric

Material Thickness	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
mm	*mm*	*mm*	*%*	*Seconds*	*mm/min*	*Volts*	*mm/min*	*Volts*	*mm*
3	3.2	3.8	120	0.1	5330	133	6250	132	1.3
4					4220	133	500	131	1.4
6				0.2	2570	133	3200	132	1.5
8				0.5	1550	135	2130	133	1.7
10				0.7	1040	137	1500	135	1.9
12				1.2	840	139	1120	137	2.0
16		6.4	200	2.0	560	145	660	143	2.3
20		Edge Start			380	151	430	148	2.5
25					200	155	280	153	2.8

2.3.3 45A Mild Steel

English

Material Thickness	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
	in.	*in.*	*%*	*Seconds*	*ipm*	*Volts*	*ipm*	*Volts*	*in.*
26 GA	0.125	0.150	120	0.0	350	137	501	135	0.044
22 GA					350	137	445	137	0.049
18 GA				0.1	350	138	408	138	0.057
16 GA					350	138	398	139	0.061
14 GA				0.2	278	139	318	140	0.065
12 GA				0.4	173	140	219	140	0.071
10GA					115	141	162	139	0.073
3/16 in.				0.5	68	142	107	138	0.074
1/4 in.				0.6	46	141	74	141	0.075

Metric

Material Thickness	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
mm	*mm*	*mm*	*%*	*Seconds*	*mm/min*	*Volts*	*mm/min*	*Volts*	*mm*
0.5	3.2	3.8	120	0.0	8890	137	12500	135	1.1
1				0.1	8890	138	10670	138	1.4
1.5					8890	138	10190	139	1.5
2				0.2	6600	139	7620	140	1.7
3				0.4	3630	141	4830	139	1.8
4					2260	142	3400	138	1.9
6				0.6	1240	141	2010	140	1.9

2.3.4 FineCut Mild Steel

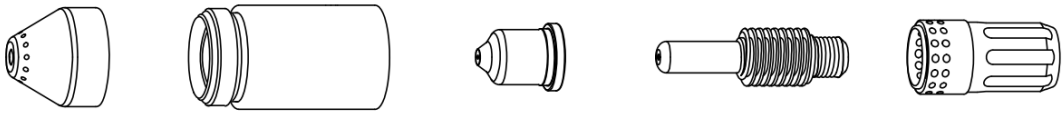
English

Material Thickness	Amps	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Kerf Width
						Cut Speed	Voltage	
GA	*A*	*in.*	*in.*	*%*	*Seconds*	*ipm*	*Volts*	*in.*
26 GA	40	0.14	0.14	100	0.0	350	90	0.033
24 GA						350	90	0.032
22 GA						350	90	0.026
20 GA						350	90	0.024
18 GA	45				0.1	350	89	0.020
16 GA					0.2	250	88	0.021
14 GA					0.3	220	88	0.021
12 GA					0.4	115	91	0.032
10 GA					0.5	100	89	0.031

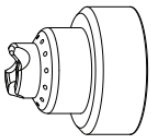
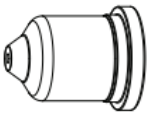
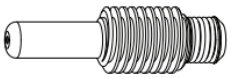
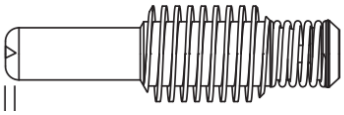
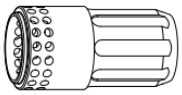
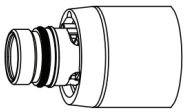
Metric

Material Thickness	Amps	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Kerf Width
						Cut Speed	Voltage	
mm	*A*	*mm*	*mm*	*%*	*Seconds*	*mm/min*	*Volts*	*mm*
0.5	40	3.5	3.5	100	0.0	8900	90	0.8
0.6						8900	90	0.8
0.8						8900	90	0.6
1						8890	90	0.6
1.5	45				0.2	6550	88	0.5
2					0.3	5260	88	0.5
3					0.4	2750	90	0.8
4					0.6	2250	88	0.8

2.4 Hypertherm 45 XP Consumables & Cutting Charts



220817 | 220854 (220953 for ohmic sensing) | 220941 | 220842 | 220857

Part		Inspect	Action
	Shield or Deflector	The center hole for roundness. The gap between the shield and the nozzle for accumulated debris.	Replace the shield if the hole is no longer round. Remove the shield and clean away any material.
	Nozzle	The center hole for roundness. 	Replace nozzle if the center hole is not round.
	Electrode	The pit depth. 	Replace electrode if the surface is worn or the pit depth is greater than 1.6mm (1⁄16”) deep
	Swirl Ring	The surface inside the swirl ring for damage or wear and the gas holes for blockages.	Replace swirl ring if the surface is damaged or worn or any of the gas holes are blocked
	Torch O-Ring	The surface for damage, wear, or a lack of lubrication.	If the O-Ring is dry, lubricate it and the threads with a thin layer of silicone lubricant. If the O-Ring is worn or damaged, replace it.

Important

Reduce the Cut Speed listed by 20% when cutting with the Dragon Machines.

2.4.1 45A Mild Steel

English

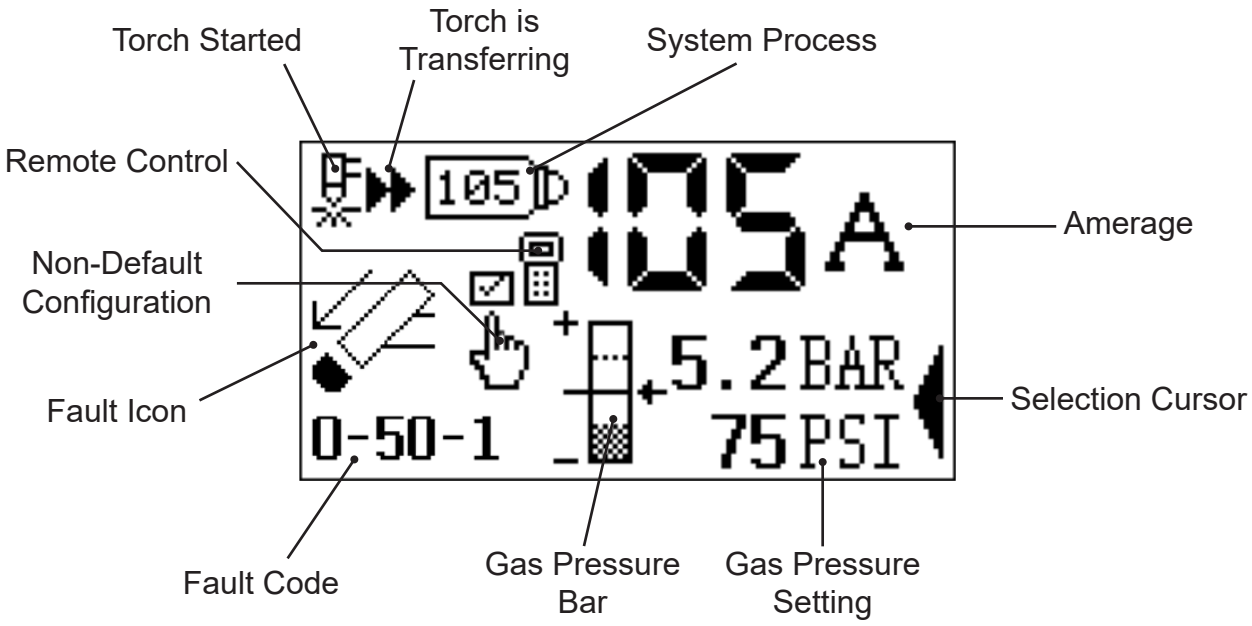
Material Thickness	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
GA or in.	*in.*	*in.*	*%*	*Seconds*	*ipm*	*Volts*	*ipm*	*Volts*	*in.*
16 GA	0.06	0.15	250	0.1	249	128	320	125	0.053
14 GA				0.2	225	128	320	125	0.054
10 GA				0.4	129	128	181	128	0.057
3/16				0.5	85	129	122	129	0.059
1/4				0.6	48	130	72	129	0.061
3/8				0.8	33	136	38	133	0.069
1/2				1	18	141	24	139	0.077
5/8	Edge Start				13	146	16	141	0.082
3/4					7	151	10	145	0.086
7/8					6	154	7	151	0.0103
1					4	157	6	154	0.119

Metric

Material Thickness	Cut Height	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
mm	*mm*	*mm*	*%*	*Seconds*	*mm/min*	*Volts*	*mm/min*	*Volts*	*mm*
2	1.5	3.8	250	0.2	5560	128	7910	125	1.4
3					3960	128	5590	128	
4				0.4	2800	128	3960	128	1.5
6				0.6	1430	130	2110	127	
8					1020	133	1385	130	1.7
10				0.8	780	136	920	134	1.8
12				1	540	140	690	138	1.9
16	Edge Start				310	146	400	141	2.1
20					170	152	240	147	2.2
25					110	157	145	154	3

2.5 Hypertherm Fault Codes

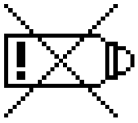
Fault codes, along with icons and signals, are like check engine lights on a car and mean “stop cutting”. The Hypertherm plasma system has powerful instruments that act intuitively. They will automatically shift the power supply into safety mode to protect both the operator and the machine. Fault codes need to be cleared before it is safe again to operate the system. The Hypertherm status screen shows the fault code in the lower left corner of the screen.



2.4.1 Fault Codes and Solutions

Fault Code	Description	Fault LED	Fault Icon	Solutions
0-12-n	Low input gas pressure or unstable gas pressure: Warning (the system continues to operate).	On		Adjust the gas inlet pressure as needed.
0-13-n	AC input unstable: Warning (the system continues to operate).	Yellow		Correct the power source.

0-14-n	Problem with the cardrige installation.	Yellow	 or 	Do one of the following: • Set the torch-lock switch to the yellow lock position and then back to the green “ready to fire”position. • Do a quick restart. • Install the cartridge again. If the cartridge is not recognized, do one of the following: • When this fault occurs, you can continue to cut or gouge, but you must set the output current (A) and the operating mode manually. Also, the system cannot collect data about the Hypertherm cartridge. • Lightly blow air into the cartridge to remove all dust or other contamination. Install the cartridge again. • Ensure that the green ring inside the cartridge is not broken.
0-19-9	The input power stopped. Or, power PCB hardware protection occurred for components in the plasma power supply.	Yellow		This fault code stops the system from operating. Do the following. • This fault can be the result of electrical noise. Wait for the fault to go away, and continue to cut. • If this fault continues to occur, it can identify a possible hardware fault with an internal component., and you can see a A hardware fault shows as a 1-nn-n, 2-nn-n, or 3-nn-n fault code. A qualified service technician must repair the system. Speak to your distributor or authorized repair facility.
0-20-0	Low gas pressure.	Yellow		Check the input gas supply. Adjust the gas pressure to the acceptable range using Manual Mode.
0-21-0	Gas flow lost while cutting.	Yellow		Restore the gas inlet pressure and restart the power supply. Check the torch lead for leaks or kinking.

0-22-0	No gas input.	Yellow		Connect the gas source and restart the power supply.
0-30-n	This indicates either a “torch stuck open” or a “torch stuck closed” situation.	Yellow		If the consumables become loose or were removed while the power supply is ON, turn OFF the power supply, correct the problem and then turn ON the power supply to clear this fault. Change consumables. If the consumables appear to be installed correctly, the torch may be damaged. Contact your Hypertherm distributor or authorized repair facility.
0-32-n	The system sensed that the cartridge in use is at end-of-life.	Yellow		This fault code stops the system from operating. Install a new cartridge to remove the fault condition.
0-40-n	Over/Under temperature.	Yellow		Leave the power supply on to allow the fan to cool the power supply. If the internal temperature of the power supply approaches -30° C (-22° F), move the power supply to a warmer location.
0-50-n	Retaining cap off	On		Turn OFF the power supply. Verify that the consumables are installed and restart the power supply. If the consumables appear to be installed correctly, the torch may be damaged. Contact your Hypertherm distributor or authorized repair facility.

0-51-0	Start/Trigger signal on at power up. This situation indicates that the power supply is receiving a start signal. It is sometimes referred to as a “Stuck Start”.	Yellow		If the power supply is turned on while the torch trigger is pressed, the system is disabled. Release the trigger and recycle the power switch.
0-52-0	Torch not connected	Yellow		Plug a torch lead into the FastConnect receptacle on the front of the power supply and recycle the power switch.
0-60-n	AC input voltage error	Yellow		Phase loss: Check all input phases and fuses. Over voltage: Check the line, decrease the voltage. Under voltage: Check the line, increase the voltage.
0-61-0	AC input unstable: Shutdown	Yellow		The incoming line current is unstable. Power down and correct the line problem before continuing.
0-98-n	Internal communication failure	Yellow		Power down, wait 20 seconds, power up. A qualified service technician must open the power supply case and check the ribbon cable between the control board and the DSP board.
1-nn-n 2-nn-n 3-nn-n	System hardware fault - service required Indicates a major fault with the system	Yellow		A qualified service technician must service the system. Contact your distributor or authorized repair facility.

2.4.1 Common Machine-Cutting Faults

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

- The work cable is not making good contact with the cutting table or the cutting table is not making good contact with the workpiece.
- The torch-to-work distance is too large.

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

- The consumables are worn and need to be replaced. For optimized performance in a mechanized application, replace the nozzle and the electrode together.
- The work cable is not making good contact with the cutting table or the cutting table is not making good contact with the workpiece.
- The current (amperage) is set too low. See Section 3, Torch Setup for more information.
- The cut speed is too high. See the cut charts in Section 3, Torch Setup, for more information.
- The metal being cut exceeds the maximum capacity for the selected amperage. See Section 1, Specifications.

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

- The consumables are worn and need to be replaced. For optimized performance in a mechanized application, replace the nozzle and the electrode together.
- The cutting speed is not correct. Refer to the cut charts in Section 3, Torch Setup, for more information.
- The current (amperage) is set too low. Refer to the cut charts in Section 3, Torch Setup, for more information.

The cut angle is not square. Causes can be:

- The consumables are worn and need to be replaced. For optimized performance in a mechanized application, replace the nozzle and the electrode together.
- The direction of the torch travel is incorrect. The high-quality cut is always on the right with respect to the forward motion of the torch.
- The distance between the torch and the workpiece is not correct.
- The cutting speed is not correct. Refer to the cut charts in Section 3, Torch Setup, for more information.

The consumables' life is shortened. Causes can be:

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

03 Everlast

3.1 Everlast Information

Review the PowerPlasma 62, 82, 102 i series plasma cutter Product Manual or the PowerPlasma i Series New Generation Product Manual.

Everlast Manuals: https://www.everlastgenerators.com/product-manuals

Everlast has no specific cutting charts for their plasma unit. Please refer to the cutting charts listed under the Hypertherm section above.

3.1.1 Everlast Plasma Requirements

The Everlast unit will come with everything you need as far as a basic starter kit for consumables, torch, and regulator. However, customers will need to supply the following.

1. A suitable air-compressor and at least 3/8” supply line hose. 1/2” supply may be required for long distances. The input side on the regulator is the standard 1/4” quick connect fitting. Suitable units should follow recommendations found in the product specifications. Oilless and pancake compressors are not suitable.

2. The air compressor will need to be regulated. Do not use a pressure switch on the air compressor to control the air pressure. A gate or ball valve installed on the air compressor is not enough either. Control the air pressure at the tank with an adjustable regular. Install the regulator so that the actual cutting pressure can be regulated. The supply pressure needs to be 90PSI at the air compressor. More then 100PSI supplied to the cutter’s regulator may damage the regulator.

Important

A separate inline air dryer must be provided by the customer to prevent torch damage, and excessive consumable wear. The unit includes a regulator/water trap, but is not designed to remove all water or moisture.

3. A separate air dryer is needed. Moisture destroys the consumable life and eventually the torches as well. The regulator/filter included with the unit is not sufficient to remove moisture from the system. It is designed to trap particulates and slugs of water created by the coupling and decoupling process. A refrigerated system is not necessary. Cartridge type systems with replaceable elements are recommended.

4. Additional consumables with different sizes to match the cut amperage are needed. The stock consumables are designed for use at the maximum amperage of the machine. The orifice in the plasma tip is specifically designed for a range of Amps. To see that range, check the plasma torch pages; each tip diameter corresponds to a specified amps range. Lowering air pressure to compensate for lower Amps results in poor quality cuts and inconsistent arc behavior. Always match the consumable size to the Amperage being used.

3.2 Consumables

A Consumable Key, which is provided with the unit, is required to replace the Everlast Consumables.

Nozzles and tips are measures in millimeters. Different size nozzles will vary in kerf width, and the Dragon CAM software may not match. Please check part length, hole size, and update the material library if needed.

Nozzle/Tip	1.0mm	1.1mm	1.2mm	1.3mm	1.4mm
Kerf Width	~0.0394	~0.0433	~0.0472	~0.0511	~0.0551

To purchase Everlast consumables visit https://www.everlastgenerators.com/catalog/plasma-consumables. Bend-Tech currently offers the 62i and the 82i for purchase. Ensure the consumables purchased work for the plasma unit that came with the machine.

3.3 Everlast Error Codes

Error Code	Diagnosis
E01	OVER OR UNDER VOLTAGE. Check power input cable for length/size, check input voltage. Running on poor quality power supply or dirty power from generator.
E02	OVER TEMPERATURE/DUTY CYCLE EXCEEDED. Allow unit to rest for 15 minutes. Check for obstacles. Then clean unit internals paying close attention to boards and heat sinks. Make sure unit is unplugged for 10 minutes before opening and cleaning.
E03	AIR PRESSURE TOO LOW OR NOT CONNECTED. Increase air pressure to normal operating air pressure of 65 to 72 PSI. Air pressure safety cut out will engage around 45 PSI.
E04	OVER CURRENT. Check to make sure input power cable is correct length and size. Internal unit fault or low input voltage. Possible issue running on generator with dirty power. Identify cause, plug directly into the receptacle. Cycle the switch one time. If the code does not clear, call Everlast Tech Support.
E05	TORCH SWITCH IS STUCK CLOSED. This simply means that the arc has been trying to start for too long. if this does not clear after releasing the switch, turn off the unit immediately and check torch switch for stuck contact. If the pilot arc is engaged without attempting to cut for more then 3 seconds this will activate.
Other	Contact Everlast Tech Support.

3.3.1 Common Everlast Cutting Issues

If the torch won't ignite, loosen the torch clamps. The torch clamps secure the torch on the toolhead, and if the clamps are over-tightened, it will restrict the torch mechanism for firing.

Everlast consumables are expected to have a shortened lifespan compared to Hypertherm products.

No.	Trouble	Cause/Solution
1.	Air flows but arc does not start within 2-3 seconds.	Check consumables for wear and tightness. Check fuse. Check air pressure. Sticky or slow spring/piston on torch blow back mechanism. Release trigger and try again.
2.	Air flows but pilot arc does not start or spark but arc starts when nozzle is rubbed on the metal.	Fuse blown. Replace with 30 A automotive type, slow blow. PCB issue.
3.	Will not start arc.	Air pressure too low or too high. Torch electrode/blow back mechanism stuck in rear position. (Clean and re-lubricate or replace head). Missing swirl ring (usually happens after consumable change).
4.	Pilot arc will not light. Arc will start when torch is drug on the metal.	Possible missing swirl ring. Pilot arc wire is disconnected.

5.	Pilot arc will not transfer and amps read approx. 25-27 amps while switch is held. (Arc barely cuts or only “scratches” the surface of the metal or cut is extremely slow on thin materials	Check work clamp connection. Make sure rust is removed from work clamp contact area. Faulty clamp. Arc continuity is not being sensed. If these steps do not correct the issue, contact Everlast.
6.	Arc sputters.	Inadequate air flow or air pressure. Improperly sized nozzle. Change to nozzle/tip with smaller diameter orifice as amps are lowered. Readjust air pressure. Loose consumables. Check tightness. Worn Consumables.
7.	Consumables are dirty, smutty looking upon inspection. Premature wear on consumables. Shortened consumable life. Tips are melted looking.	Moisture, oil contamination of consumable. Wrong Consumables. Poor quality aftermarket consumables. Drag cutting with wrong consumables. Wrong cutting technique.
8.	Premature wear on consumables. Short consumable life. Uneven wear of consumables, melting of cup.	Moisture, oil contamination of consumable. Excessive pilot arc time. Improper cutting technique. Wrong piercing technique.
9.	Arc will not start with pilot arc or by drag/scratch starting nozzle directly on metal. Machine runs.	Torch cup is loose, safety contact pins dirty or not making contact with cup face. Torch switch wire is loose. Problem with central connector. Torch is not properly connected. IGBT or PCB bad, contact Everlast.
10.	Over current/duty cycle error code. Machine runs, but no output.	Duty cycle exceeded or over current. Allow machine to cool. Reset main power switch after full cool down period. Make sure fan is not blocked. Check wiring and remove excess/ undersized extension cords. Operated on “dirty power” generator and unit has failed.
11.	Unstable arc at lower amps.	Nozzle orifice size is too large. Use nozzle with smaller orifice. Air pressure too high or too low. Poor work clamp connection.
12.	Arc tries to start but irregular, dancing arc and/or arc melts through side of nozzle.	Missing swirl ring, or worn electrode or both. Check and replace. Make sure swirl ring is not cracked.
13.	Arc will try to start if touched to the metal, but no air flow while switch is pressed.	Stuck or dirty solenoid valve. Loose solenoid wire connection. Bad PCB. Contact Everlast.
14.	Air flows continuously. Erratic or unpredictable shutting off of air after post flow time has expired.	Place switch into “normal” or “cut” mode. Reduce post flow time. Solenoid is stuck. Contact Everlast.
15.	Excessively beveled cut.	Worn consumables, too high of stand-off height.
16.	Cup and/or nozzle is melting or cracking.	Improper cutting technique/excessive piercing.
17.	Power input circuit breaker trips repeatedly.	Improperly sized circuit. Internal issue. Contact Everlast.
18.	Arc “blows out” when ready to cut.	Too high of air pressure. Wrong size consumable for amperage being used.

04 Thermal Dynamics

4.1 Thermal Dynamics Information

Review the Thermal Dynamics Cutmaster A60i or A80 series plasma cutter Product Manuals

Thermal Dynamics Manuals: https://www.thermal-dynamics.com/tdus/en/td-support/documentation/index.cfm

4.2 Gas Supply

The input gas supply is for Air only. Not for used with Oxygen (O2). Max gas pressure should not exceed 125 psi (8.6 bar). Operating pressure is ~75 psi (5.2 bar).

4.2.1 Single-Stage Air Filter

An optional filter kit is recommended for improved filtering with compressed air, to keep moisture and debris out of the torch. Refer to the appropriate manual for your specific Thermal Dynamic plasma unit for installation instructions. Installation differs slightly between the A60i and A80 models.

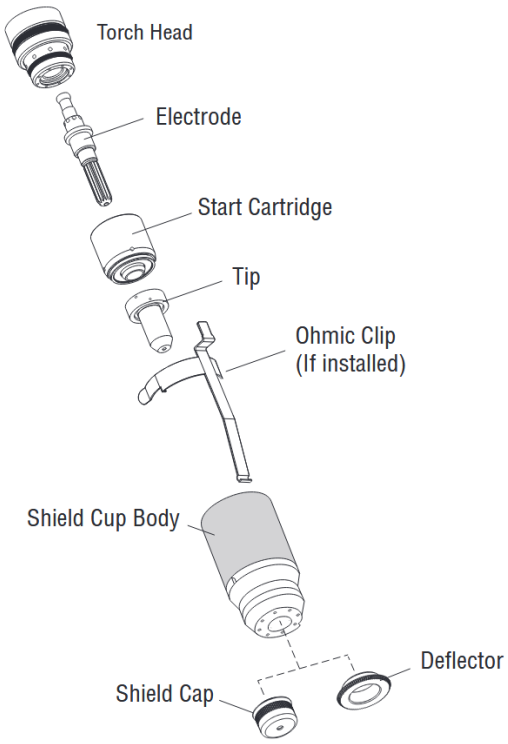
4.2.2 Two-Stage Air Filter

This optional two-stage air filter is also for use on compressed air shot systems. Filter removes moisture and contaminants to at least 5 microns. Refer to the appropriate manual for your specific Thermal Dynamic plasma unit for installation instructions. Refer to the appropriate manual for your specific Thermal Dynamic plasma unit for installation instructions. Installation differs slightly between the A60i and A80 models.

4.3 Torch Operation

To pierce, the arc should be started with the torch positioned as high as possible above the plate while allowing the arc to transfer and pierce. This standoff helps avoid having molten metal blow back onto the front end of the torch.

A pierce or dwell time is required for machine cutting. The torch travel should not be enabled until the arc penetrates the bottom of the plate. As motion begins, torch standoff should be reduced to the recommended cutting height for optimum speed and cut quality. Clean spatter and scale from the shield cup and the tip as soon as possible.



4.4 Consumables

We DO NOT use the Drag Tip consumables for this machine torch. Use Standoff Consumables.

Check the electrode for excessive wear. Replace electrode if worn back more than 0.062” (1.5mm) or if excessive off center wearing.

Different consumables are required for different Amperages. Use the table below to identify which tips to purchase.

Tip	9-8205	9-8206	9-8208	9-8209	9-8210	9-8231	9-8211	9-8212	9-8233
Amperage	20	30	40	50	60	70	80	100	120

4.5 Cutting Charts

4.5.1 40A Mild Steel

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
20		0.036	70 (25’ lead) 75 (50’ lead)	101	0.14	160	0.18	0.0	0.05
16		0.060		103		140			
14		0.075		105		120		0.1	0.06
12		0.105		108		80		0.2	
10		0.135		110		60		0.3	
	3/16	0.188		111		55		0.4	
	1/4	0.250		117		40		0.5	0.07
	3/8	0.375		119		25		1.2	
	1/2	0.500		120		15	0.2	2.0	

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1	4.8 (7.6m lead) 5.2 (15.2m lead)	101	3.6	3990	4.6	0.0	1.1
2		105		2920		0.1	1.4
3		109		1810		0.3	1.5
4		110		1470			1.6
5		112		1345		0.4	
6		116		1100		0.5	1.7
8		118		815		1.0	
10		119		595		1.5	1.8
12		120		435	5.1	2.0	

4.5.2 40A Stainless Steel

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
18		0.050	75 (25’ lead) 80 (50’ lead)	110	0.19	60	0.20	0.00	0.07
16		0.063		100		50			
14		0.078		105		45		0.10	
12		0.109		110		40		0.20	
10		0.141		108		35		0.30	
	3/16	0.188		110		30		0.40	
	1/4	0.250		120		18		0.50	0.08
	3/8	0.375		126		10		2.00	
	1/2	0.500		118		8	Edge Start		0.09

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1	5.2 (7.6m lead) 5.5 (15.2m lead)	112	4.8	1670	4.8	0.0	1.7
2		105		1140	5.1	0.1	1.8
3		109		980		0.2	
4				845		0.3	
5		111		715		0.4	
6		118		525		0.5	2.0
8		123		350		1.5	
10		125		245		2.0	
12		120		215	Edge Start		2.2

4.5.3 40A Aluminum

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
20		0.040	70 (25’ lead) 75 (50’ lead)	95	0.16	300	0.16	0.0	0.06
16		0.063		97		170			
12		0.097		113		100		0.2	0.07
11		0.125		115		90	0.18	0.3	
9		0.160		113	0.18	85		0.4	
	3/16	0.188		116		75		0.5	
	1/4	0.250		128		30		1.0	0.08
	3/8	0.375		150		10	Edge Start		0.09

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1.0	4.8 (7.6m lead) 5.2 (15.2m lead)	95	4.1	7620	4.1	0.0	1.5
2.0		104		3500		0.2	1.6
3.0		115		2350	4.6	0.3	1.7
4.0		113	4.6	2170		0.4	
5.0		118		1740		0.5	1.8
6.0		125		1015		0.8	1.9
8.0		139		500	Edge Start		2.0
10.0		153		180	Edge Start		2.2

4.5.4 60A Mild Steel

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
16		0.060	85 (25’ lead) 90 (50’ lead)	118	0.19	290	0.19	0.00	0.08
14		0.075		120		285		0.10	
11		0.120		118		180			
10		0.135		119		176			0.07
	3/16	0.188		121		100		0.20	0.08
	1/4	0.250		122		80		0.30	
	3/8	0.375		124		50		0.50	0.09
	1/2	0.500		132		26		0.75	0.10
	5/8	0.625		135		19	Edge Start		
	3/4	0.750		136		14			0.08
	1	1.000		150		6			0.11

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1	5.9 (7.6m lead) 6.2 (15.2m lead)	115	4.8	7540	4.8	0	2.1
2		120		4015		0.10	1.9
3		118		4570			1.9
4		120		3650		0.20	1.9
5		121		2465			2.1
6		122		2145		0.30	2.0
8		123		1635		0.40	2.2
10		125		1180		0.60	2.4
12		130		795		0.75	
15		134		530	Edge Start		
20		139		325			2.2
25		149		165			2.7

4.5.5 60A Stainless Steel

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
16		0.063	85 (25’ lead) 90 (50’ lead)	119	0.19	350	0.20	0.00	0.05
14		0.078		116		300		0.10	0.07
11		0.125		1123		150			
10		0.141		118		125			0.08
	3/16	0.188		122		90		0.20	
	1/4	0.250		123		65		0.30	0.09
	3/8	0.375		130		30		0.50	
	1/2	0.500		132		21		0.90	0.08
	5/8	0.625				14	Edge Start		0.11
	3/4	0.750		135		10	Edge Start		0.10

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1	5.9 (7.6m lead) 6.2 (15.2m lead)	124	4.8	10890	5.1	0.00	0.8
2		116		7560		0.10	1.7
3		122		4365			
4		119		2865		0.20	2.1
5		122		2195			
6		123		1790		0.30	2.2
8		127		1190		0.40	
10		130		725		0.50	
12		132		580		0.90	2.1
15				405	Edge Start		2.6
20		136		230	Edge Start		2.5

4.5.6 60A Aluminum

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
16		0.064	85 (25’ lead) 90 (50’ lead)	123	0.25	440	0.25	0.00	0.08
14		0.079		126		300		0.10	0.09
11		0.120		128		250			
	3/16	0.188		132		170		0.20	
	1/4	0.250				85		0.30	
	3/8	0.375		141		45		0.50	0.10
	1/2	0.500		148		30		0.80	0.09
	5/8	0.625		145	0.19	18	Edge Start		0.08
	3/4	0.750		147		12	Edge Start		0.10

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1	5.9 (7.6m lead) 6.2 (15.2m lead)	118	6.4	17010	6.4	0.00	1.8
2		126		7680		0.10	2.3
3		128		6410			
4		130		5230		0.20	
5		132		4010			2.4
6				2640		0.30	
8		137		1630		0.40	
10		142		1085		0.60	
12		146		845		0.70	2.3
15			4.8	540	Edge Start		2.1
20		148		260	Edge Start		2.5

4.5.7 80A Mild Steel

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
16		0.060	85 (25’ lead) 90 (50’ lead)	110	0.19	320	.20	0.00	0.06
11		0.120		113		230		0.10	0.07
10		0.135		110		180		0.20	
	3/16	0.188				136		0.30	
	1/4	0.250		115		100		0.40	0.09
	3/8	0.375		125		42		0.50	
	1/2	0.500		23		40		0.60	
	5/8	0.625		133		18		0.75	0.10
	3/4	0.750		140	0.25		Edge Start		0.11
	7/8	0.875		150		10			
	1	1.000		152		8			0.13

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1	5.9 (7.6m lead) 6.2 (15.2m lead)	109	4.8	8915	5.1	0.00	1.5
2		111		7415		0.10	1.7
3		113		5915			1.8
4		110		4095		0.30	1.7
5		111		3325			1.8
6		114		2745		0.40	2.2
8		120		1775		0.50	2.3
10		125		1060			
12		123		1025		0.60	
15		130		610		0.75	2.5
20		143	6.4	395	Edge Start		2.7
25		152		210	Edge Start		3.2

4.5.8 80A Stainless Steel

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
16		0.063	85 (25’ lead) 90 (50’ lead)	110	0.19	340	0.25	0.00	0.06
11		0.125		115		300		0.10	
10		0.141				280			
	3/16	0.188				140		0.20	0.07
	1/4	0.250		118		100		0.30	0.08
	3/8	0.375		119		45		0.40	
	1/2	0.500		124		26		0.80	0.10
	5/8	0.625		133		16	Edge Start		
	3/4	0.750		136		10	Edge Start		0.11

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1	5.9 (7.6m lead) 6.2 (15.2m lead)	108	4.8	9020	6.4	0.00	1.5
2		111		8380			
3		114		7730		0.10	
4		115		5865		0.20	1.6
5				3410			1.8
6		117		2765		0.30	1.9
8		119		1815		0.40	2.0
10		120		1070		0.60	2.1
12		123		765		0.80	2.3
15		131		475	Edge Start		2.5
20		137		205	Edge Start		3.0

4.5.9 80A Aluminum

English

Material Thickness			Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
GA	*fraction*	*decimal*	*PSI*	*Volts*	*in*	*ipm*	*in*	*sec*	*in*
16		0.064	85 (25’ lead) 90 (50’ lead)	116	0.25	350	0.25	0.00	0.10
11		0.120		120		280		0.10	
	3/16	0.188		124		180		0.20	
	1/4	0.250		130		110		0.30	0.09
	3/8	0.375		136		55		0.40	0.11
	1/2	0.500		139		38		0.60	
	5/8	0.625		136	0.19	26		0.75	0.10
	3/4	0.750		150		14	Edge Start		0.12
	7/8	0.875		153		10	Edge Start		0.11

Metric

Material Thickness	Gas Pressure (Air)	Ar Voltage	Torch Working Height	Travel Speed	Initial Piercing Height	Pierce Delay	Kerf Width
mm	*Bar*	*Volts*	*mm*	*mm/min*	*mm*	*sec*	*mm*
1	5.9 (7.6m lead) 6.2 (15.2m lead)	114	6.4	8890	6.4	0.00	2.4
2		117		8420			2.5
3		120		7170		0.10	
4		122		5710		0.20	
5		125		4315			
6		129		3190		0.30	2.4
8		133		2070		0.40	2.5
10		136		1330		0.50	2.7
12		138		1060			2.9
15		137	4.8	745		0.75	2.5
20		151		325	Edge Start		3.0

4.6 Common Errors

Error Code	Description
MAX	Over Pressure
90	Internal Error
85	Check Consumables
80	Consumables Missing
75	Start Error
70	Parts in Place
65	Input Pressure
MIN	Under Pressure

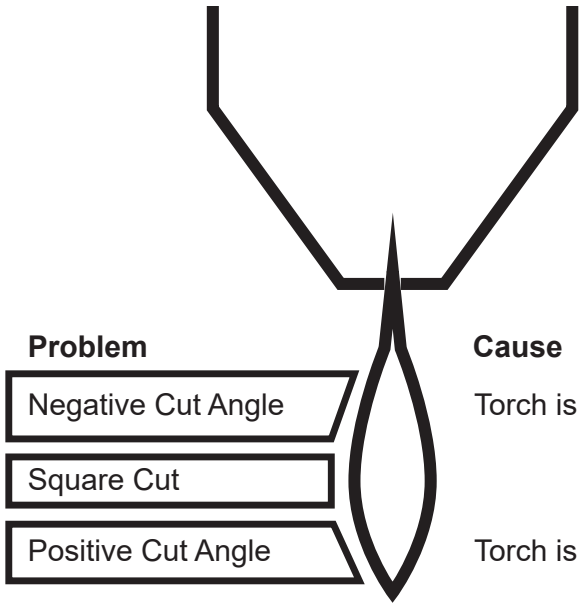
05 Cut Quality

5.1 Cut Quality

There are several factors relating to cut quality to consider. Here a some general guidelines for improving cut quality for all plasma unit types.

5.1.1 Cut or Bevel Angle

A positive cut angle, or bevel results when more material is removed from the top of the cut than from the bottom. A negative cut angle results when more material is removed from the bottom of the cut. The squarest cut angle will be on the right side with respect to the forward motion of the torch. The left side will always have some degree of bevel.



Problem	Cause	Solution
Negative Cut Angle	Torch is too low.	Raise the torch; or if you are using a torch height control, increase the arc voltage.
Square Cut		
Positive Cut Angle	Torch is too high.	Lower the torch; or if you are using a torch height control, decrease the arc voltage.

If a cut-angle problem persists, check the torch-to-work distance. Also consider the material being cut: if the metal is magnetized or hardened, cut angle problems are more likely.

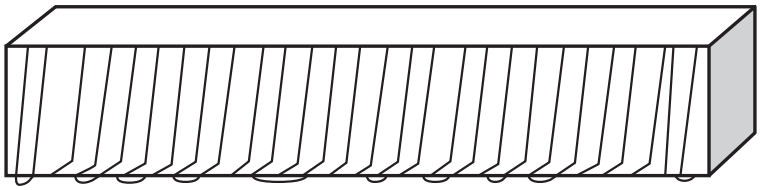
5.1.2 Dross

Dross is the left-over oxidized metal created by the Plasma cutting arc. Some amount of dross will always be present when cutting with air plasma. However, amount and type of dross can be minimized by adjusting the plasma system correctly for your application. The amount of and type of dross created is addicted by torch cut height, cut speed, air pressure, consumable size and even torch angle.

- Excess dross appears on the top edges when the torch is too low. Adjust the cutting height until dross is reduced.
- Low-speed dross forms when the torch's cutting speed is too slow and the arc angles ahead. It forms as a heavy, bubbly deposit at the bottom of the cut and can be removed easily. To reduce low-speed dross increase the cutting feed rate.
- High speed dross forms when the cutting speed is too fast and the arc angles behind. It forms as a thin, linear bead of solid metal attached very close to the cut. It is more firmly attached to the bottom of the cut than at low speed and is difficult to remove. To reduce high-speed dross decrease the cutting feed rate, and/or decrease the torch-to-work distance (cutting height).

Results of a Cut at Correct Speed, Air Pressure, and Torch Angle

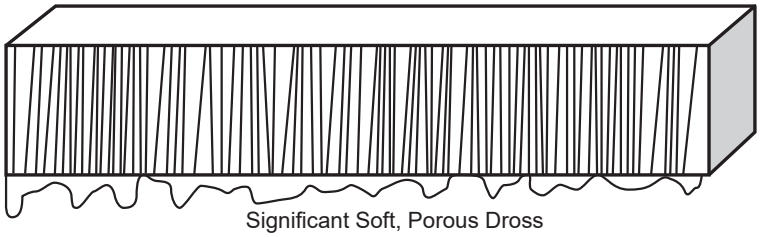
Smooth, Even Cut Lines with a Rearward Sweep



Minimal Easy to Clean Dross

Results of a Cut Slow Speed

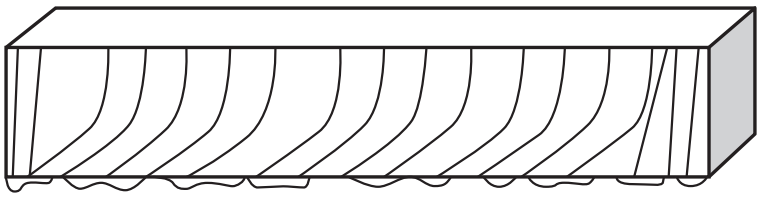
Vertical Cut Lines



Significant Soft, Porous Dross

Results of a Cut at Fast Speed

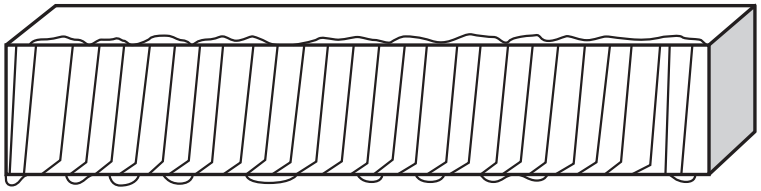
Rough, Distinct Cut Lines Spaced Far Apart



Noticeable Small, Hard Dross

Results of too much Standoff or Worn Consumables

Top Dross, Slight Beveling at Top

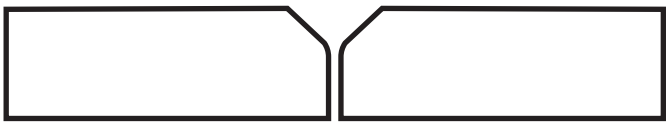


5.1.3 Problems that can occur

Frequently, more than one problem may exist. Closely evaluating all issues can help narrow down cutting problems. Examine the cut for these additional issues to help you track down cut problems.

Results of too much current or too much stand off height.
(End View)

Melted Top Edge



Results of worn consumables or low air pressure or out of square torch.
(End View)

Severly Angled Cut at Top

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