

Extended Pilot Arc for XPR®

White paper

Introduction

What is Extended Pilot Arc (EPA)?

For most plasma cutting applications, the plasma arc starts directly over a workpiece to pierce and cut. In some cases, it is necessary or convenient to start cutting at the edge of the workpiece (edge starting). These cuts require precise knowledge of the location of the edge for the plasma cutting arc to successfully transfer to the workpiece. EPA technology removes the need to know the exact location of the workpiece edge by letting the plasma torch move in the direction of the workpiece during the pilot arc state. This functionality is available for all XPR plasma power supplies with a 141545 main control PCB. There are multiple processes available with EPA. These processes combine to enable cutting of carbon steel from 3 mm to 50 mm (12 GA to 2 in.), aluminum from 6 mm to 32 mm (1/4 in. to 1-1/4 in.), and stainless steel from 12 mm to 32 mm (7/16 in. to 1-1/4 in.).

Benefits:

- Improves transfer reliability for applications when the edge of the workpiece is not precisely known or repeatable.
- Reduces cycle time because edge-finding is eliminated.
- Makes it easier to cut plate remnants that are irregular or that moved during cutting.

What does Extended Pilot Arc NOT do?

- Does not support starting exceptionally far from the workpiece (*See Figure 3*).
- Does not eliminate the need to set a cutting height.
- Does not provide a continuous pilot arc.

How does Extended Pilot Arc work?

Extended Pilot Arc (EPA) works by sending the motion signal from the XPR when the pilot arc comes on, and by extending the maximum duration of the pilot arc state. After the pilot arc and motion signal are initiated, the pilot arc must transfer to the workpiece or be canceled within the timeout limits (1,000 ms for the XPR170® and XPR300®, 5,000 ms for the XPR460®).

EPA technology gives the integrator and end user minimal-effort integration, using existing signals and standard XPR cut chart formatting as much as possible. EPA processes have unique Process IDs, which have been added to the XPR. These process IDs differ from the standard cutting process IDs to give good edge severance and transfer reliability when approaching the edge of a workpiece with a pilot arc.

What are the available processes, and what materials and thicknesses can I cut with Extended Pilot Arc?

Metric - Extended Pilot Arc Material & Thickness Coverage																																																					
Process ID	Process Description	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	40	44	45	48	50											
3101	80A O2/Air	80A - MST																																																			
3121	130A O2/Air	130A - MST																																																			
3120	170A O2/Air		170A - MST																																																		
3160	300A O2/Air									300A - MST																																											
3180	460A O2/Air											460A - MST																																									
3130	170A Air/Air					170A - Aluminum																																															
3170	300A N2/N2									300A - Aluminum																																											
3170	300A N2/N2											300A - Stainless Steel																																									

English - Extended Pilot Arc Material & Thickness Coverage																										
Process ID	Process Description	12 GA	1/8"	10 GA	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	3/4"	7/8"	1"	1.125"	1.25"	1-3/8"	1.5"	1-5/8"	1.75"	1-7/8"	2"			
Decimal Units:		0.105	0.125	0.135	0.188	0.25	0.313	0.375	0.438	0.5	0.563	0.625	0.75	0.875	1	1.125	1.25	1.375	1.5	1.625	1.75	1.875	2			
3101	80A O2/Air	80A - MST																								
3121	130A O2/Air					130A - MST																				
3120	170A O2/Air				170A - MST																					
3160	300A O2/Air							300A - MST																		
3180	460A O2/Air									460A - MST																
3130	170A Air/Air					170A - Aluminum																				
3170	300A N2/N2							300A - Aluminum																		
3170	300A N2/N2					300A - Stainless Steel																				

Note: The 170 A Air / Air EPA process uses the same consumable parts as the 300 A O₂ / Air standard-cutting process.

System requirements

- XPR plasma power supply with a 141545 main control board and any gas connect console (Core™, CorePlus™, VWI™, or OptiMix™)
 - Includes all XPR460 plasma power supplies.
 - Includes any XPR170 or XPR300 plasma power supplies with a serial number equal to or after XPR170-010000/XPR300-010000. Older XPR170 and XPR300 plasma power supplies will require a 141545 main control PCB retrofit. Please reference the *XPR Control PCB Replacement Field Service Bulletin* (10088336) for more information.
- Most recent XPR firmware (version 1.3 or higher)
- XPR consumables for your process of choice
 - ***Note: The 170 A Air / Air EPA process uses the same consumable parts as the 300 A O₂ / Air standard-cutting process.***
- A method of selecting a Process ID in your XPR
 - EtherCAT®, Serial RS-422, Wireless, or Ethernet LAN

How it works (detailed)

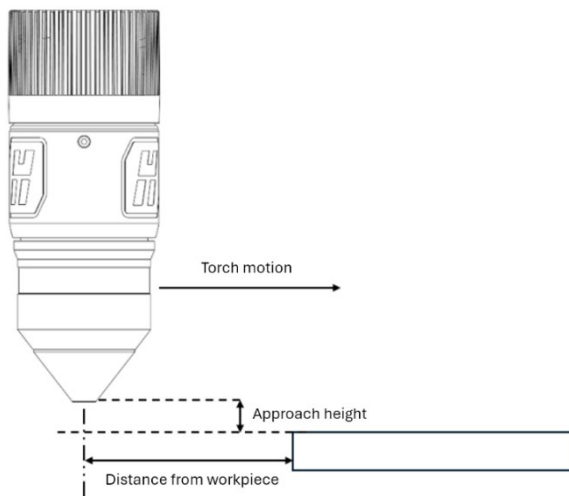
The EPA functionality is enabled on the XPR plasma power supply by selecting an EPA Process ID. As an example, the 300 A O₂/Air EPA Process ID is 3160. Note that this is different than the standard 300 A O₂/Air cutting Process IDs of 1201 through 1206. These are some important differences between the standard cutting Process IDs and the EPA Process IDs:

- For the XPR170 and XPR300 plasma power supplies: Pilot arc timeout increases to 1,000 ms (standard cutting remains 500 ms).
- For the XPR460 plasma power supply: Pilot arc timeout increases to 5,000 ms (standard cutting remains 500 ms).
- The plasma power supply **motion signal turns on when the plasma power supply enters the pilot arc state** instead of when the pilot arc transfers to the workpiece.
- There is a newly added Transfer signal in place of the previously unused Auto Pierce Detect signal. This signal turns on when the cutting arc is established onto the workpiece. This signal is also enabled for standard cutting processes with XPR firmware version 1.3 or higher.
- Plasma preflow pressures are lower than standard processes.
 - ***Note: During preflow when using EPA processes, there may be a slight oscillation in the sound produced by the preflow gas. This is expected and is not a cause for concern.***
- The current and gas ramp-up times are faster than standard processes to help with severance at the start of the cut.

In addition to the changes in the plasma power supply associated with the EPA Process IDs, there are also recommended changes to the motion of the torch during the starting process.

- Pierce delay should be set to 0. This will minimize the time the pilot arc is on.
- The approach height (See *Figure 2*) for EPA cutting can be different than the standard cut height or transfer height. Approach heights in the EPA cut charts are intended to provide reliable arc transfer and full edge severance. The starting distance (See *Figure 2*) from the workpiece should be chosen to provide repeatable clearance from the edge and minimize the necessary pilot arc time. The EPA cut charts in this white paper can help determine maximum starting distance based on plasma power supply type and approach speed.
- Approach speed values in the EPA cut charts are typically reduced from the equivalent standard-cutting process speeds. This speed reduction helps to fully sever the edge at the start of the cut but is also fast enough to provide dross-free cutting on most Category 1 thicknesses. Thinner (Category 3) materials can require slower speeds for reliable edge severance. Thicker materials usually work best at, or near, standard cutting speeds. The EPA cut charts in this white paper give a starting point to achieve good edge severance and cutting speed balance.
- Approach speeds below approximately 510 mm per minute (20 inches per minute) will have a bad effect on transfer reliability. When cutting thicker materials that require less than 510 mm per minute (20 inches per minute) of cutting speed, it is suggested to approach faster than 510 mm per minute (20 inches per minute) and slow to an appropriate speed after the arc is transferred to the workpiece. The Transfer signal can be used to determine when to change the speed if desired.
- The EPA cut charts in this white paper show cutting thickness ranges that are less than the standard cutting processes. This is to show how to approach, transfer, and cut at a constant speed. For end users who use the Transfer signal, or another technique to change speeds at the edge, it is possible to sever thicker materials in most situations.

Figure 2: Approach distance and approach height



The XPR plasma power supplies take advantage of an advanced duty cycle limiter that prevents certain electrical components in the system from overheating with excessive pilot arc utilization. Several attempts can be made to start a pilot arc before the limit is enforced initially. If there are continued long-duration pilot arcs with very short cuts, eventually the limit will be enforced. The system will show a 527 alert and preflow for approximately the duration shown in the alert's smart data before allowing the next start. The system will continue flowing preflow gases and fire when the circuitry is sufficiently cooled. The theoretical maximum cooling time is approximately 25 seconds for all XPR systems.

Class	ID	On Time	Description	Details
Info	527	13d 5h 8min 54s	Pilot arc cooldown	wait time:13.0s

Details of the system settings for the available EPA processes are in the EPA cut charts in this white paper. Consumable parts in general correspond to the standard-cutting process equivalent (e.g., for 170 A O₂/Air EPA, use 170 A O₂/Air consumable parts). In the case of 170 A Air/Air EPA, however, it is necessary to use 300 A O₂/Air consumable parts.

Gas flow rates during preflow and piloting are reduced compared with standard cutting processes. This helps arc transfer reliability and has an added side-benefit of reduced gas usage compared with what could otherwise be expected with longer pilot arc on times.

Recommended values for approach height and approach speed are in the EPA cut charts in this white paper. The recommended speed depends on the thickness of the workpiece, while all approach and cutting heights were tested at 0.25 inch (7 mm). These values are intended to give reliable transfer, full initial severance, and good cut quality. The cut speed and cut height can stay the same as the approach speed and height for all EPA cutting. In this case, the recommended arc voltage and kerf compensation are in the EPA cut charts in this white paper. If the cutting speed and cutting height are changed from the values in the EPA cut charts, the voltage and kerf compensation will also need to be adjusted to agree with those parameters.

The approach distances and speeds tables (See Figure 3) show approximately how quickly the torch can reach the workpiece at a given speed and distance from the edge. Times below 1 second are appropriate for all XPR plasma power supplies. Times between 1 second and 5 seconds require an XPR460. Times above 5 seconds will take too long to reach the workpiece and should be avoided.

Figure 3: Approach distances and speeds

Within 1s travel time
Within 5s travel time
Longer than 5s travel time

Metric		Speed (mm/minute)									
		500	1000	1500	2000	2500	3000	3500	4000	4500	5000
Distance from part (mm)	10	1.2	0.6	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.1
	20	2.4	1.2	0.8	0.6	0.5	0.4	0.3	0.3	0.3	0.2
	30	3.6	1.8	1.2	0.9	0.7	0.6	0.5	0.5	0.4	0.4
	40	4.8	2.4	1.6	1.2	1.0	0.8	0.7	0.6	0.5	0.5
	50	6.0	3.0	2.0	1.5	1.2	1.0	0.9	0.8	0.7	0.6
	60	7.2	3.6	2.4	1.8	1.4	1.2	1.0	0.9	0.8	0.7
	70	8.4	4.2	2.8	2.1	1.7	1.4	1.2	1.1	0.9	0.8
	80	9.6	4.8	3.2	2.4	1.9	1.6	1.4	1.2	1.1	1.0
	90	10.8	5.4	3.6	2.7	2.2	1.8	1.5	1.4	1.2	1.1
	100	12.0	6.0	4.0	3.0	2.4	2.0	1.7	1.5	1.3	1.2

English		Speed (inch/minute)									
		20	40	60	80	100	120	140	160	180	200
Distance from part (inch)	0.5	1.5	0.8	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2
	1	3.0	1.5	1.0	0.8	0.6	0.5	0.4	0.4	0.3	0.3
	1.5	4.5	2.3	1.5	1.1	0.9	0.8	0.6	0.6	0.5	0.5
	2	6.0	3.0	2.0	1.5	1.2	1.0	0.9	0.8	0.7	0.6
	2.5	7.5	3.8	2.5	1.9	1.5	1.3	1.1	0.9	0.8	0.8
	3	9.0	4.5	3.0	2.3	1.8	1.5	1.3	1.1	1.0	0.9
	3.5	10.5	5.3	3.5	2.6	2.1	1.8	1.5	1.3	1.2	1.1
	4	12.0	6.0	4.0	3.0	2.4	2.0	1.7	1.5	1.3	1.2

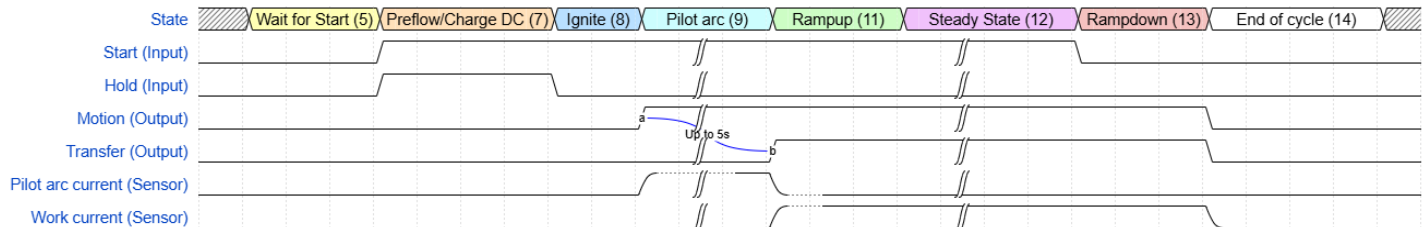
Communication & Integration

The Extended Pilot Arc timing diagram (See Figure 4) describes the state of the XPR signals when using an EPA process.

Major signal changes from standard cutting processes:

- **Motion** turns ON when Pilot Arc is established.
- **Transfer*** turns ON when the arc transfers to the workpiece. This signal is not needed to use the EPA feature. It can be used to expand the capabilities of the integrated cutting system if beneficial.

Figure 4: Extended Pilot Arc timing diagram



* **Transfer** is a new signal that utilizes the previously unused auto pierce detect output. Refer to the Connect for Communication chapter in the XPR Instruction Manual that came with your cutting system for additional information.

Signal name	Discrete I/O	EtherCAT I/O
Start	J14 pins 3 and 4	Object 0x7000:01 bit 0
Motion	J14 pins 5 and 6	Object 0x6000:01 bit 0
Transfer* (Previously Auto Pierce Detect)	J19 pins 5 and 6	Object 0x6000:01 bit 1

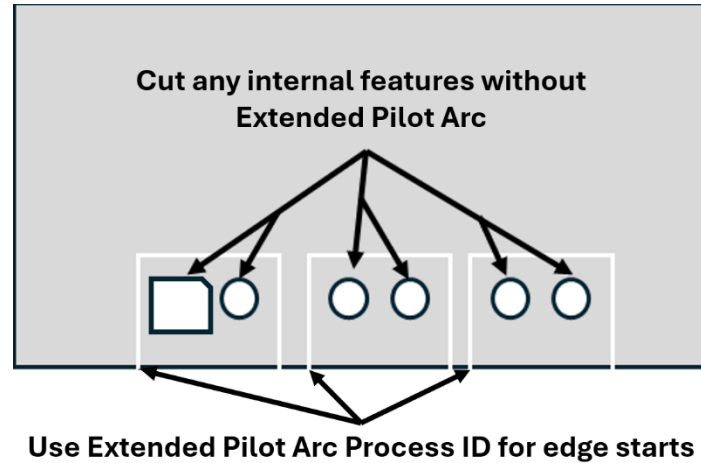
New fault codes can occur during system operation when using EPA. Existing fault codes can still occur.

ID	enum	Priority	Description	Details	Smart Data 1	Smart Data 2	Action	Code cancels with
526	248	Alert	Extended pilot arc t/o	This occurs after 5 seconds (XPR460) or 1 second (XPR300/XPR170) of extended pilot arc if the work lead current sensor does not measure current greater than the transfer reference value.	Time without current (milliseconds)	Work lead current (amperes: A)	End of cycle	Start or set process or remote on-off
527	249	Info	Pilot arc cooldown	This occurs if pilot arc ignition is prevented due to time remaining on cooldown	Time remaining	None	None	Start or set process or remote on-off

Best practices and guidelines

- At first use, or when EPA is being used more frequently than usual, there can be an odor from the pilot arc circuit's resistor as it heats up during use. **This is not a cause for concern.** The system has limitations in place that will prevent the circuitry from being damaged.
- Pilot arc on time has an effect on cut quality. Every effort has been made to minimize nozzle wear during piloting. This is the tradeoff for more pilot arc time when not starting over the workpiece. If cut quality is of high importance, pilot arc time should be minimized. It can be necessary to change the nozzle more frequently than during standard cutting, especially if there is high uncertainty in the edge location and higher pilot arc on times are needed. There is no formal guide for life expectations versus pilot time. Hypertherm suggests monitoring cut quality and changing consumable parts as necessary for your cut quality requirements.
- Cut height has an effect on transfer reliability. In general, lower heights will transfer better. Hypertherm has not found significant differences in the 6 mm to 9 mm (0.25 inch to 0.35 inch) range. This will be a good starting point for someone wanting to try this feature.
- Speed has an effect on transfer reliability and edge severance. Approaching the workpiece more quickly will increase transfer reliability but can reduce the ability to effectively sever the edge of the workpiece. Speeds listed in the EPA cut charts in this white paper are tested to be a good balance between transfer reliability and edge severance reliability. Some adjustments can be necessary based on desired outcomes.
- It is recommended to use no pierce delay in order to minimize pilot arc on time during motion towards the edge of the workpiece. A pierce delay will force the system to hold its position until the pierce delay timer has elapsed.
- Voltage-based height control must be disabled until the arc is transferred to the workpiece. It is possible to use the Transfer signal, or timing, to determine when voltage-based height control can be enabled.
- The pilot arc may attempt to transfer to slats or fixtures if the torch passes over these items during the pilot arc state. To prevent this, either start sufficiently far away or, if possible, electrically insulate the workpiece from fixtures so that transfer does not occur. Lab testing has shown that the pilot arc can reach material up to 0.75 inch (19 mm) below the face of the shield.
- A new Transfer signal has been added so that the controller can know when the system has transferred to the workpiece. This functionality can be used to enable various techniques, including but not limited to:
 - **Speed change** – Either approach the workpiece slower or faster than usual to aid in transfer reliability, edge severance, cut quality, or any combination of these conditions and more.
 - **Height change** – Approaching at a higher height gives additional clearance and cutting at a lower height can give improved cut quality.
 - **Blind edge cutting** – The Transfer signal can be used to determine the location of the torch relative to the starting edge after the cut has begun. This can allow for more precise positioning of features relative to the starting edge while not needing to initially find the starting edge.
- Hypertherm has found that EPA starts can sever the edge of a workpiece with improved quality compared to conventional edge starting because of the continuous motion without delays at the edge.

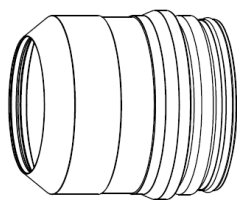
- When making cuts that do not require EPA for starting, the standard-cutting process is suggested. For example, when cutting parts from the edge of a 3/4-inch-thick mild steel workpiece using 300 A, the interior cuts would ideally be made with the 1201 Process ID (or the True Hole® ID), and the EPA Process ID would only be used for the edge starts.
 - *Note: While this is considered the best practice, Hypertherm has found that the EPA Process IDs typically work acceptably well for standard piercing and edge starting if the correct parameters are in place. If you do choose to use EPA processes for standard cutting, be aware that relevant cutting parameters will need to be adjusted and that there can be a decrease in the life of consumable parts.*



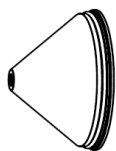
Extended Pilot Arc cut charts

Process and system settings

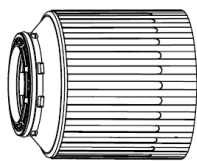
SYSTEM SETTINGS								
Cut type	Process description	XPR Process ID	Pilot arc timeout XPR170 & 300 (s)	Pilot arc timeout XPR460 (s)	Pilot flow		Cut flow	
					Plasma gas	Shield gas	Plasma gas	Shield gas
Extended Pilot Arc	80A O2-Air EPA	3101	1	5	5	5	82	52
Extended Pilot Arc	130A O2-Air EPA	3121	1	5	5	5	92	82
Extended Pilot Arc	170A O2-Air EPA	3120	1	5	5	5	78	79
Extended Pilot Arc	300A O2-Air EPA	3160	1	5	10	10	90	26
Extended Pilot Arc	460A O2-Air EPA	3180	1	5	5	5	73	44
Extended Pilot Arc	170A Air-Air EPA	3130	1	5	10	10	90	79
Extended Pilot Arc	300A N2-N2 EPA	3170	1	5	10	10	90	54

Mild steel – 80 A O₂ Plasma / Air Shield – Extended Pilot Arc, above water (Core, CorePlus, VWI, OptiMix)

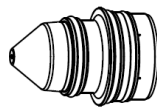
Shield retaining cap
420200



Shield
420246



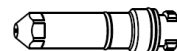
Nozzle retaining cap
420365



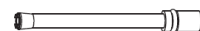
Nozzle
420243



Swirl ring
420242



Electrode
420240



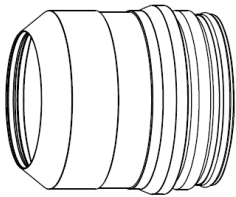
Water tube
420368

Flow rate (lpm/scfh)			
	N2	O2	Air
Pre flow	16 / 34	-	-
Pierce flow	-	-	-
Cut flow	-	24 / 51	37 / 79

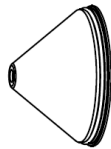
Metric											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
mm							mm/min	mm	volts	seconds	mm
3	3	3101	5	5	82	52	3000	7.0	137	0.0	2.3
4	3	3101	5	5	82	52	2600	7.0	138	0.0	2.4
5	3	3101	5	5	82	52	2200	7.0	138	0.0	2.4
6	1	3101	5	5	82	52	1900	7.0	140	0.0	2.4
7	1	3101	5	5	82	52	1600	7.0	141	0.0	2.4
8	1	3101	5	5	82	52	1400	7.0	142	0.0	2.5
9	1	3101	5	5	82	52	1200	7.0	143	0.0	2.5
10	1	3101	5	5	82	52	1100	7.0	144	0.0	2.5
11	2	3101	5	5	82	52	1050	7.0	144	0.0	2.5
12	2	3101	5	5	82	52	1000	7.0	144	0.0	2.5

English											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
in							in/min	in	volts	seconds	in
0.105	3	3101	5	5	82	52	125	0.250	136	0.0	0.090
0.125	3	3101	5	5	82	52	115	0.250	137	0.0	0.090
0.135	3	3101	5	5	82	52	110	0.250	137	0.0	0.090
0.188	3	3101	5	5	82	52	90	0.250	138	0.0	0.095
0.25	1	3101	5	5	82	52	70	0.250	140	0.0	0.095
0.313	1	3101	5	5	82	52	55	0.250	142	0.0	0.096
0.375	1	3101	5	5	82	52	45	0.250	143	0.0	0.096
0.438	2	3101	5	5	82	52	42	0.250	144	0.0	0.096
0.5	2	3101	5	5	82	52	40	0.250	144	0.0	0.096

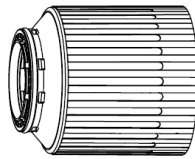
Mild steel – 130 A O₂ Plasma / Air Shield – Extended Pilot Arc, above water (Core, CorePlus, VWI, OptiMix)



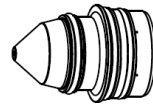
Shield retaining cap
420200



Shield
420255



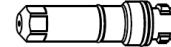
Nozzle retaining cap
420365



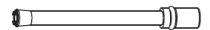
Nozzle
420252



Swirl ring
420242



Electrode
420249



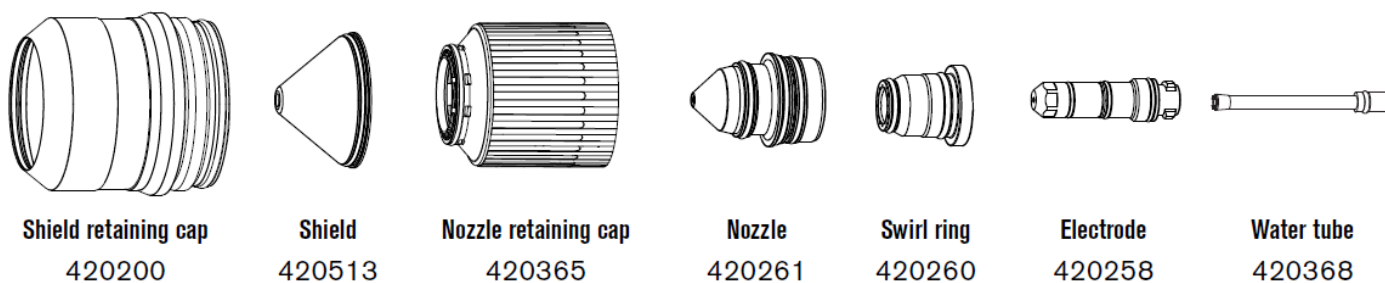
Water tube
420368

Flow rate (lpm/scfh)			
	N ₂	O ₂	Air
Pre flow	29 / 62	-	-
Pierce flow	-	-	-
Cut flow	-	31 / 65	54 / 115

Metric											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
mm							mm/min	mm	volts	seconds	mm
3	3	3121	5	5	92	82	4700	7.0	148	0.0	2.6
3.5	3	3121	5	5	92	82	4500	7.0	148	0.0	2.6
4	3	3121	5	5	92	82	4200	7.0	148	0.0	2.6
5	3	3121	5	5	92	82	3800	7.0	148	0.0	2.6
7	1	3121	5	5	92	82	3200	7.0	149	0.0	2.6
10	1	3121	5	5	92	82	2400	7.0	149	0.0	2.7
12	1	3121	5	5	92	82	2000	7.0	150	0.0	2.7
15	2	3121	5	5	92	82	1600	7.0	152	0.0	2.7
18	2	3121	5	5	92	82	1300	7.0	155	0.0	2.9
20	2	3121	5	5	92	82	1000	7.0	157	0.0	3.1
23	2	3121	5	5	92	82	700	7.0	161	0.0	3.4
25	2	3121	5	5	92	82	500	7.0	165	0.0	3.8

English											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
in							in/min	in	volts	seconds	in
0.135	3	3121	5	5	92	82	180	0.250	148	0.0	0.103
0.188	3	3121	5	5	92	82	155	0.250	148	0.0	0.102
0.25	1	3121	5	5	92	82	135	0.250	149	0.0	0.101
0.313	1	3121	5	5	92	82	115	0.250	149	0.0	0.103
0.375	1	3121	5	5	92	82	100	0.250	149	0.0	0.104
0.438	1	3121	5	5	92	82	85	0.250	149	0.0	0.104
0.5	1	3121	5	5	92	82	75	0.250	150	0.0	0.104
0.563	2	3121	5	5	92	82	67	0.250	151	0.0	0.110
0.625	2	3121	5	5	92	82	60	0.250	153	0.0	0.113
0.75	2	3121	5	5	92	82	45	0.250	156	0.0	0.119
0.875	2	3121	5	5	92	82	32	0.250	160	0.0	0.131
1	2	3121	5	5	92	82	20	0.250	165	0.0	0.158

Mild steel – 170 A O₂ Plasma / Air Shield – Extended Pilot Arc, above water (Core, CorePlus, VWI, OptiMix)



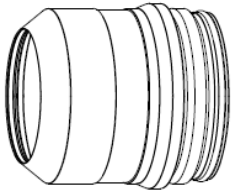
Example images. The appearance of your consumable parts could be different.

Flow rate (lpm/scfh)			
	N2	O2	Air
Pre flow	8 / 17	-	22 / 46
Pierce flow	-	-	-
Cut flow	-	33 / 70	53 / 113

Metric											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
mm							mm/min	mm	volts	seconds	mm
5	3	3120	5	5	78	79	5000	7.0	137	0.0	2.8
10	1	3120	5	5	78	79	3100	7.0	138	0.0	2.9
15	1	3120	5	5	78	79	1950	7.0	143	0.0	3.1
20	2	3120	5	5	78	79	1400	7.0	144	0.0	3.4
25	2	3120	5	5	78	79	1050	7.0	148	0.0	3.7
30	2	3120	5	5	78	79	825	7.0	149	0.0	4.0

English											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
in							in/min	in	volts	seconds	in
0.188	3	3120	5	5	78	79	200	0.250	137	0.0	0.111
0.25	3	3120	5	5	78	79	180	0.250	138	0.0	0.111
0.375	1	3120	5	5	78	79	130	0.250	138	0.0	0.115
0.5	1	3120	5	5	78	79	95	0.250	140	0.0	0.115
0.625	1	3120	5	5	78	79	70	0.250	143	0.0	0.127
0.75	2	3120	5	5	78	79	60	0.250	144	0.0	0.133
1	2	3120	5	5	78	79	40	0.250	148	0.0	0.147
1.25	2	3120	5	5	78	79	30	0.250	149	0.0	0.160

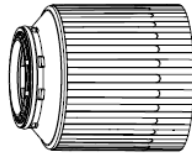
Mild steel – 300 A O₂ Plasma / Air Shield – Extended Pilot Arc, above water (Core, CorePlus, VWI, OptiMix)



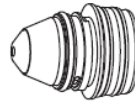
Shield retaining cap
420200



Shield
420491



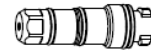
Nozzle retaining cap
420365



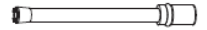
Nozzle
420279



Swirl ring
420406



Electrode
420276



Water tube
420368

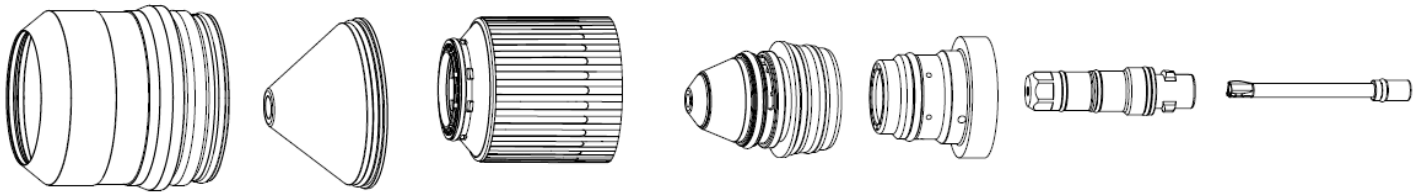
Example images. The appearance of your consumable parts could be different.

Flow rate (lpm/scfh)			
	N2	O2	Air
Pre flow	13 / 27	-	35 / 74
Pierce flow	-	-	-
Cut flow	-	47 / 99	65 / 137

Metric											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
mm							mm/min	mm	volts	seconds	mm
10	3	3160	10	10	90	26	3750	7.0	159	0.0	3.8
15	1	3160	10	10	90	26	3050	7.0	160	0.0	3.9
20	1	3160	10	10	90	26	2300	7.0	160	0.0	4.1
25	1	3160	10	10	90	26	1800	7.0	163	0.0	4.3
30	2	3160	10	10	90	26	1400	7.0	166	0.0	4.6
35	2	3160	10	10	90	26	1150	7.0	169	0.0	5.0
40	2	3160	10	10	90	26	950	7.0	172	0.0	5.2

English											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
in							in/min	in	volts	seconds	in
0.375	3	3160	10	10	90	26	150	0.250	159	0.0	0.150
0.563	3	3160	10	10	90	26	125	0.250	159	0.0	0.153
0.75	1	3160	10	10	90	26	95	0.250	160	0.0	0.160
0.875	1	3160	10	10	90	26	80	0.250	161	0.0	0.164
1.125	2	3160	10	10	90	26	60	0.250	165	0.0	0.180
1.25	2	3160	10	10	90	26	50	0.250	167	0.0	0.190
1.375	2	3160	10	10	90	26	45	0.250	169	0.0	0.197
1.5	2	3160	10	10	90	26	40	0.250	171	0.0	0.205

Mild steel – 460 A O₂ Plasma / Air Shield – Extended Pilot Arc, above water (Core, CorePlus, VWI, OptiMix)



Shield retaining cap	Shield	Nozzle retaining cap	Nozzle	Swirl ring	Electrode	Water tube
420200	520002	420365	520001	420819	420834	420368

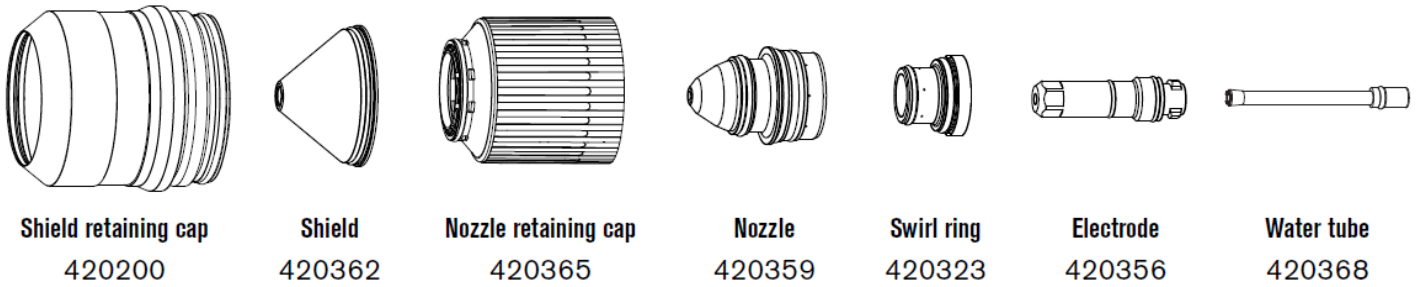
Example images. The appearance of your consumable parts could be different.

Flow rate (lpm/scfh)			
	N2	O2	Air
Pre flow	14 / 29	-	23 / 48
Pierce flow	-	-	-
Cut flow	-	58 / 123	98 / 207

Metric											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
mm							mm/min	mm	volts	seconds	mm
12	3	3180	5	5	73	44	3900	7.0	157	0.0	4.6
15	3	3180	5	5	73	44	3450	7.0	160	0.0	4.7
20	3	3180	5	5	73	44	2825	7.0	161	0.0	4.8
25	1	3180	5	5	73	44	2200	7.0	163	0.0	5.0
30	1	3180	5	5	73	44	1750	7.0	164	0.0	5.3
35	1	3180	5	5	73	44	1400	7.0	166	0.0	5.6
40	1	3180	5	5	73	44	1200	7.0	169	0.0	5.8
45	2	3180	5	5	73	44	1000	7.0	170	0.0	6.1
50	2	3180	5	5	73	44	800	7.0	173	0.0	6.4

English											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
in							in/min	in	volts	seconds	in
0.5	3	3180	5	5	73	44	150	0.250	158	0.0	0.183
0.625	3	3180	5	5	73	44	130	0.250	160	0.0	0.186
0.75	3	3180	5	5	73	44	115	0.250	161	0.0	0.188
1	1	3180	5	5	73	44	85	0.250	163	0.0	0.199
1.25	1	3180	5	5	73	44	65	0.250	164	0.0	0.211
1.5	1	3180	5	5	73	44	50	0.250	169	0.0	0.225
1.75	2	3180	5	5	73	44	40	0.250	169	0.0	0.237
2	2	3180	5	5	73	44	30	0.250	173	0.0	0.255

Stainless steel – 300 A N₂ Plasma / N₂ Shield – Extended Pilot Arc, above water (Core, CorePlus, VWI, OptiMix)



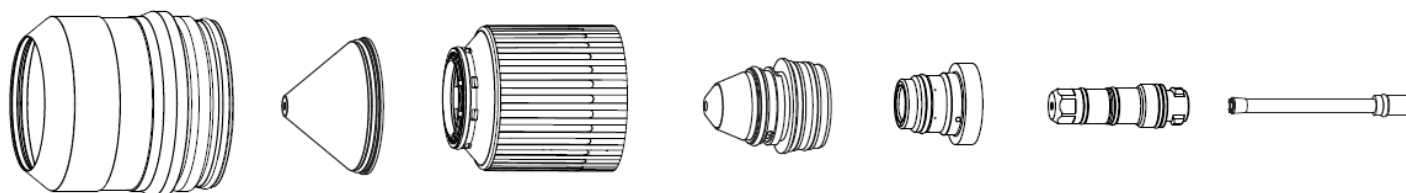
Example images. The appearance of your consumable parts could be different.

Flow rate (lpm/scfh)	
	N ₂
Pre flow	47 / 99
Pierce flow	-
Cut flow	172 / 365

Metric											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
mm							mm/min	mm	volts	seconds	mm
12	3	3170	10	10	90	54	3050	7.0	172	0.0	3.4
15	3	3170	10	10	90	54	2400	7.0	174	0.0	3.6
20	1	3170	10	10	90	54	1750	7.0	176	0.0	3.7
25	1	3170	10	10	90	54	1300	7.0	180	0.0	3.7
30	2	3170	10	10	90	54	975	7.0	182	0.0	3.8
32	2	3170	10	10	90	54	875	7.0	182	0.0	3.9

English											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
in							in/min	in	volts	seconds	in
0.438	3	3170	10	10	90	54	130	0.250	171	0.0	0.133
0.5	3	3170	10	10	90	54	115	0.250	172	0.0	0.138
0.75	1	3170	10	10	90	54	75	0.250	176	0.0	0.143
1	1	3170	10	10	90	54	50	0.250	181	0.0	0.147
1.25	2	3170	10	10	90	54	35	0.250	182	0.0	0.153

Aluminum – 170 A Air Plasma / Air Shield – Extended Pilot Arc, above water (Core, CorePlus, VWI, OptiMix)



Shield retaining cap	Shield	Nozzle retaining cap	Nozzle	Swirl ring	Electrode	Water tube
420200	420491	420365	420279	420406	420276	420368

Example images. The appearance of your consumable parts could be different.

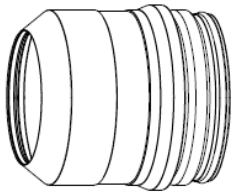
Note: The 170 A Air / Air EPA process uses the same consumable parts as the 300 A O₂ / Air standard-cutting process.

Flow rate (lpm/scfh)		
	N2	Air
Pre flow	13 / 27	35 / 74
Pierce flow	-	-
Cut flow	-	113 / 240

Metric											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
mm							mm/min	mm	volts	seconds	mm
6	3	3130	10	10	90	79	4450	7.0	174	0.0	2.9
10	3	3130	10	10	90	79	2750	7.0	177	0.0	3.1
15	1	3130	10	10	90	79	1600	7.0	182	0.0	3.4
20	2	3130	10	10	90	79	950	7.0	186	0.0	3.6
25	2	3130	10	10	90	79	700	7.0	192	0.0	3.8

English											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
in							in/min	in	volts	seconds	in
0.25	3	3130	10	10	90	79	170	0.250	174	0.0	0.118
0.375	3	3130	10	10	90	79	115	0.250	176	0.0	0.122
0.5	1	3130	10	10	90	79	85	0.250	179	0.0	0.128
0.625	1	3130	10	10	90	79	55	0.250	183	0.0	0.135
0.75	2	3130	10	10	90	79	40	0.250	186	0.0	0.143
1	2	3130	10	10	90	79	27	0.250	193	0.0	0.154

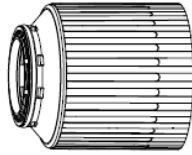
Aluminum – 300 A N₂ Plasma / N₂ Shield – Extended Pilot Arc, above water (Core, CorePlus, VWI, OptiMix)



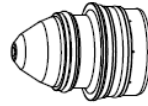
Shield retaining cap
420200



Shield
420362



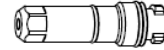
Nozzle retaining cap
420365



Nozzle
420359



Swirl ring
420323



Electrode
420356



Water tube
420368

Example images. The appearance of your consumable parts could be different.

Flow rate (lpm/scfh)	
	N2
Pre flow	47 / 99
Pierce flow	-
Cut flow	172 / 365

Metric											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
mm							mm/min	mm	volts	seconds	mm
12	3	3170	10	10	90	54	3050	7.0	172	0.0	3.4
15	3	3170	10	10	90	54	2400	7.0	174	0.0	3.6
20	1	3170	10	10	90	54	1750	7.0	176	0.0	3.7
25	1	3170	10	10	90	54	1300	7.0	180	0.0	3.7
30	2	3170	10	10	90	54	975	7.0	182	0.0	3.8
32	2	3170	10	10	90	54	875	7.0	182	0.0	3.9

English											
Workpiece thickness	SYSTEM SETTINGS						CNC SETTINGS				
	Cut Category	XPR Process ID	Pilot arc gas flow		Cutflow		Approach speed	Approach height	Arc voltage	Pierce delay	Kerf compensation
			Plasma gas	Shield gas	Plasma gas	Shield gas					
in							in/min	in	volts	seconds	in
0.375	3	3170	10	10	90	54	190	0.250	171	0.0	0.145
0.5	3	3170	10	10	90	54	150	0.250	174	0.0	0.148
0.75	1	3170	10	10	90	54	85	0.250	180	0.0	0.157
1	1	3170	10	10	90	54	55	0.250	186	0.0	0.163
1.25	4	3170	10	10	90	54	35	0.250	194	0.0	0.173

See Extended Pilot Arc in action at www.hypertherm.com

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