



# Use F5 to Cut Stainless Steel

Powermax65/85/105®

Application Note

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**Hypertherm Inc.**

Etna Road, P.O. Box 5010  
Hanover, NH 03755 USA  
603-643-3441 Tel (Main Office)  
603-643-5352 Fax (All Departments)  
info@hypertherm.com (Main Office Email)  
**800-643-9878 Tel (Technical Service)**  
technical.service@hypertherm.com (Technical Service Email)  
**800-737-2978 Tel (Customer Service)**  
customer.service@hypertherm.com (Customer Service Email)  
**866-643-7711 Tel (Return Materials Authorization)**  
**877-371-2876 Fax (Return Materials Authorization)**  
return.materials@hypertherm.com (RMA email)

**Hypertherm Plasmatechnik GmbH**

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

**Hypertherm (S) Pte Ltd.**

82 Genting Lane  
Media Centre  
Annexe Block #A01-01  
Singapore 349567, Republic of Singapore  
65 6841 2489 Tel  
65 6841 2490 Fax  
**65 6841 2489 (Technical Service)**

**Hypertherm (Shanghai) Trading Co., Ltd.**

Unit 301, South Building  
495 ShangZhong Road  
Shanghai, 200231  
PR China  
86-21-60740003 Tel  
86-21-60740393 Fax

**Hypertherm Europe B.V.**

Vaartveld 9  
4704 SE  
Roosendaal, Nederland  
31 165 596907 Tel  
31 165 596901 Fax  
31 165 596908 Tel (Marketing)  
**31 165 596900 Tel (Technical Service)**  
**00 800 4973 7843 Tel (Technical Service)**

**Hypertherm Japan Ltd.**

Level 9, Edobori Center Building  
2-1-1 Edobori, Nishi-ku  
Osaka 550-0002 Japan  
81 6 6225 1183 Tel  
81 6 6225 1184 Fax

**Hypertherm Brasil Ltda.**

Rua Bras Cubas, 231 – Jardim Maia  
Guarulhos, SP - Brasil  
CEP 07115-030  
55 11 2409 2636 Tel  
55 11 2408 0462 Fax

**Hypertherm México, S.A. de C.V.**

Avenida Toluca No. 444, Anexo 1,  
Colonia Olivar de los Padres  
Delegación Álvaro Obregón  
México, D.F. C.P. 01780  
52 55 5681 8109 Tel  
52 55 5683 2127 Fax

**Hypertherm Korea Branch**

#3904 Centum Leaders Mark B/D,  
1514 Woo-dong, Haeundae-gu, Busan  
Korea, 612-889  
82 51 747 0358 Tel  
82 51 701 0358 Fax

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One of Hypertherm's long-standing core values is a focus on minimizing our impact on the environment. Doing so is critical to our, and our customers', success. We are always striving to become better environmental stewards; it is a process we care deeply about.

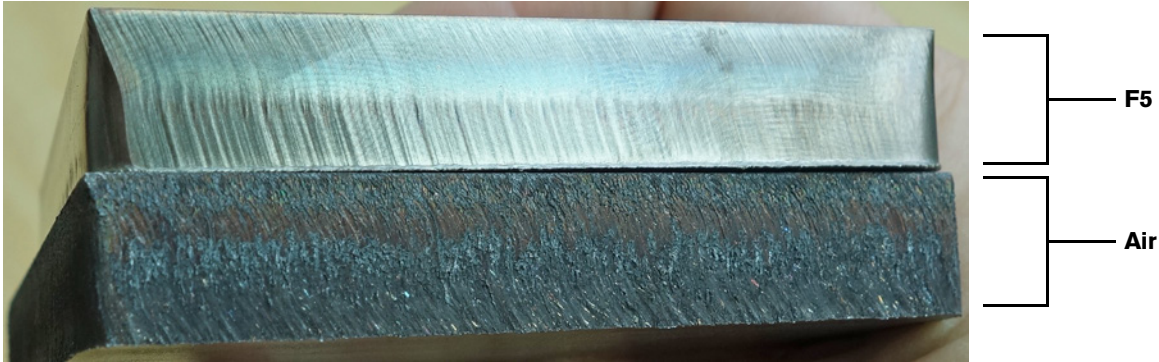
			<p><b>WARNING!</b>  <b>GAS CYLINDERS CAN EXPLODE IF DAMAGED</b></p>
		<p>Gas cylinders contain gas under high pressure. If damaged, a cylinder can explode.</p> <p>For high pressure regulators, adhere to the manufacturer’s guidelines for safe installation, operation, and maintenance.</p> <p>Before plasma cutting with F5 gas, read the safety instructions in the <i>Safety and Compliance Manual</i> (80669C). Failure to follow safety instructions can result in personal injury or in damage to equipment.</p>	


	<p><b>WARNING!</b>  <b>EXPLOSION HAZARD – UNDERWATER CUTTING WITH FUEL GASES</b></p>	
	<p>Do not cut under water with fuel gases containing hydrogen.</p> <p>Doing so can result in an explosive condition that can detonate during plasma cutting operations.</p> <p>F5 comprises 95% nitrogen (N<sub>2</sub>) and 5% hydrogen (H).</p>	

**Plasma cutting comparison: F5 versus air**

You can use F5 gas to cut stainless steel with Duramax™ torches on the Powermax65, Powermax85, and Powermax105. **When used with a Powermax system, F5 should be used only to cut stainless steel.**

Plasma cutting with F5 produces smooth, shiny cuts with silver edges that are close to the base color of the metal. F5 avoids the dark heat affected zone that typically results with air plasma cutting.



 These samples were cut from 1/2 inch (approximately 13 mm) stainless steel 304B at 105 A using a Powermax105.

## Use F5 to Cut Stainless Steel

F5: Advantages	F5: Disadvantages	F5: Similarities to air
<ul style="list-style-type: none"> <li>▪ Smooth, shiny cut edge</li> <li>▪ Silver cut edge, similar to the base color of the metal – no dark heat affected zone</li> <li>▪ No oxidation of the cut surface – the cut steel maintains its corrosion resistance</li> <li>▪ Ability to use the same Duramax consumables as for standard cutting and gouging with air (includes CopperPlus™ electrodes)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Stainless steel only</li> <li>▪ Slower cut speeds</li> <li>▪ F5 gas is more expensive than compressed air</li> <li>▪ Not recommended for thicknesses less than 3 mm or 10 gauge (GA) or for use with FineCut® consumables</li> <li>▪ Slightly degraded cut quality on bevel cuts</li> </ul>	<ul style="list-style-type: none"> <li>▪ Approximately the same amount of dross. With F5 and with air, stainless steel dross is dark in color and can be challenging to remove.</li> <li>▪ Approximately the same gas pressure requirements</li> </ul>

## F5 cut charts

The following cut charts provide guidelines for cutting stainless steel with F5 at 45 A, 65 A, 85 A, and 105 A. For each F5 process, there are metric and English charts. Hypertherm collected the cut chart data under laboratory test conditions using new consumables. Each cut chart contains the following information:

- **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 plate being cut).
- **Torch-to-work distance** – Distance between the shield and the workpiece during cutting. This may also be known as cut height.
- **Initial pierce height** – Distance between the shield and the workpiece when the torch is triggered, prior to descending to the cut height.
- **Pierce delay time** – Length of time the triggered torch remains stationary at the pierce height before the torch starts the cutting motion.
- **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** (cut speed and voltage) – 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.
- **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 in the tables.




The arc voltage increases as the consumables wear, so the voltage setting may need to be increased to maintain the correct torch-to-work distance. Some CNCs monitor the arc voltage and adjust the torch lifter automatically.

- Each cut chart lists hot and cold gas flow rates:
  - **Hot flow rate** – Plasma is on, the system is operating at running current, and the system is in a steady state at the default system pressure (automatic mode).
  - **Cold flow rate** – Plasma is off and the system is in a steady state with gas flowing through the torch at the default system pressure (postflow).

## 45 A shielded cutting

Stainless steel / F5

 Do not use this process with the Powermax45 and T45m machine torch or with the Duramax Hyamp torches and consumables. It is designed for Duramax machine torches and consumables.

Flow rate – slpm/scfh	
Hot	217 / 460
Cold	241 / 510

**Metric**

Material Thickness	Torch-to-Work Distance	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*	1.5	3.8	250	0.4	1545	139	2250	135	1.1
4					1430		1920	137	
5				0.5	1320	140	1595	139	1.0
6				0.6	1210	141	1270	140	
7					1095		945	142	

**English**

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
inches	inches	inches	%	seconds	in/min	volts	in/min	volts	inches
10 GA*	0.06	0.15	250	0.4	59	139	83	136	0.043
3/16				0.5	53	140	66	138	0.038
1/4				0.6	46	141	46	141	0.033

\* F5 is not recommended for thicknesses less than 3 mm or 10 gauge (GA).

## Use F5 to Cut Stainless Steel

### 65 A shielded cutting

Stainless steel / F5



This process is designed for Duramax machine torches and consumables. It is not intended for use with Duramax Hyamp torches or consumables.

Flow rate – slpm/scfh	
Hot	168 / 355
Cold	205 / 435

#### Metric

Material Thickness	Torch-to-Work Distance	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*	1.5	3.8	250	0.1	3275	131	4600	131	0.9
4				0.2	2670	134	3755		
5				0.5	2060	136	2910	132	1.0
7					1165	141	1655	134	
9		4.5	300	0.7	925	144	1310	136	1.2
11					685	147	965	138	
13					1.2	445	149	620	140


#### English

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
inches	inches	inches	%	seconds	in/min	volts	in/min	volts	inches
10 GA*	0.06	0.15	250	0.1	119	132	167	131	0.036
3/16				0.2	87	136	122	132	0.040
1/4				0.5	49	140	70	133	0.044
3/8				0.7	34	145	48	137	0.047
1/2		0.18	300	1.2	19	149	26	140	0.050

\* F5 is not recommended for thicknesses less than 3 mm or 10 gauge (GA).

## 85 A shielded cutting

Stainless steel / F5

 This process is designed for Duramax machine torches and consumables. It is not intended for use with Duramax Hyamp torches or consumables.

Flow rate – slpm/scfh	
Hot	191 / 405
Cold	224 / 475

**Metric**

Material Thickness	Torch-to-Work Distance	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*	1.5	3.8	250	0.1	5705	126	7230	127	1.0
5				0.2	3430	130	4415	129	
7				0.5	1770	133	2350	131	1.1
9					1445	136	1895	134	
11		4.5	300	0.7	1115	139	1440	137	1.2
13					820	142	1030	140	
15				1.0	690	145	855	142	1.4
17					560	147	685	144	
19		Edge Start			435	149	510	146	1.5
20		Edge Start			370	150	425	147	

**English**

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
inches	inches	inches	%	seconds	in/min	volts	in/min	volts	inches
10 GA*	0.06	0.15	400	0.2	206	127	262	127	0.041
3/16					146	129	187	128	
1/4				0.5	74	132	98	130	0.044
3/8					54	137	70	135	
1/2		0.18	300	1.0	33	142	42	140	0.053
5/8					25	146	31	143	
3/4				Edge Start			17	149	20

\* F5 is not recommended for thicknesses less than 3 mm or 10 gauge (GA).

## 105 A shielded cutting

Stainless steel / F5



This process is designed for Duramax machine torches and consumables. It is not intended for use with Duramax Hyamp torches or consumables.

Flow rate – slpm/scfh	
Hot	222 / 470
Cold	269 / 570

**Metric**

Material Thickness	Torch-to-Work Distance	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
6	3.2	6.4	200	0.5	2505	149	3965	149	1.1
8					1985	153	3145	151	1.3
10				1465	156	2325	154	1.4	
12				945	160	1505	156	1.6	
16		0.75	720	163	955	160	1.7		
20		8	250	1.2	640	166	670	164	1.9
25		Edge Start			400	171	465	167	2.4
26					350	172	420		2.5

**English**

Material Thickness	Torch-to-Work Distance	Initial Pierce Height		Pierce Delay Time	Best Quality Settings		Production Settings		Kerf Width
					Cut Speed	Voltage	Cut Speed	Voltage	
inches	inches	inches	%	seconds	in/min	volts	in/min	volts	inches
1/4	0.125	0.25	200	0.5	95	150	150	149	0.046
3/8					63	156	99	153	0.055
1/2				30	161	48	157	0.063	
5/8				29	163	38	160	0.068	
3/4		0.31	250	1.2	27	165	28	163	0.072
7/8		Edge Start			21	168	23	165	0.084
1					15	171	18	167	0.095