
FOUR BASIC ELEMENTS IN ACHIEVING A CUT

FOCUS GAS PRESSURE FEED RATE POWER

Note: Before you change any parameter settings, check the cutting head for a proper nozzle alignment and focus position. Also be sure the nozzle is not loose or damaged.

All of the following parameter changes are listed in order of their importance while cutting with their respective assist gases.

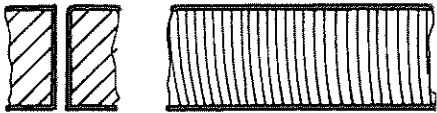
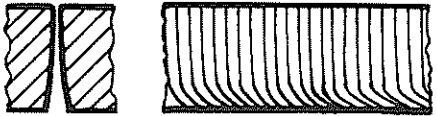
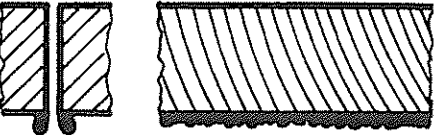
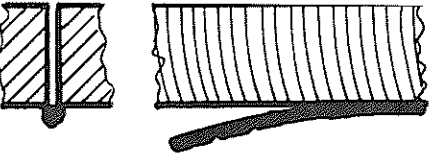
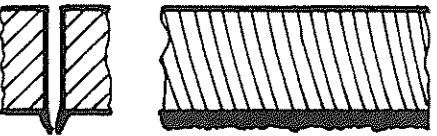
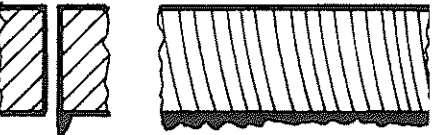
Cutting with Oxygen

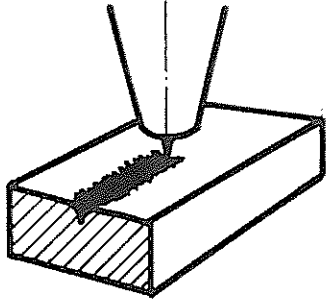
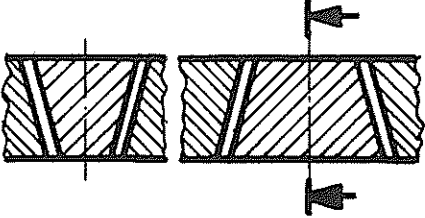
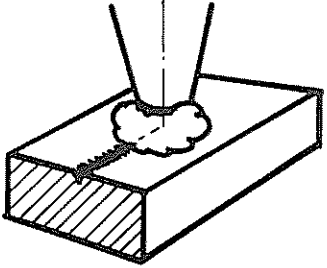

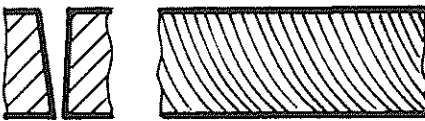
- 1) GAS PRESSURE- An increase in oxygen is an increase in heat. Oxygen is an accelerant used to assist the beam in vaporizing the material. Gas pressure is used to expel molten material. Adjustments are made in $\pm .5$ bar for **high pressure**. Adjustments are made in $\pm .1$ bar for **low pressure**.
- 2) FOCUS-
When **HIGH PRESSURE** cutting, the focus is utilized to melt the material at a depth of .2 to .4mm.
When **LOW PRESSURE** cutting, the focus is used to create a proper channel or (kerf) above the material at a height of .4 to 1.6mm.
- 3) POWER- An increase in power increases the heat generated in the kerf. A change in power is made generally in 5% increments.
- 4) FEED RATE- An increase in the feed rate reduces heat. Adjustments are made +/- 500-100mm/min. for thin material. Adjustments are made 100-5mm/min. for thick material. The feed rate is relative to the heat generated by gas, focus and power.



Cutting with Nitrogen

- 1) FOCUS- Is the most important factor while cutting with nitrogen. Adjustments are made .2 to .4mm +/- depending on the size of the burr. A heavy burr indicates the focus being too high. A fine burr indicates the focus being too low.
- 2) FEED RATE- An increase in the feed rate reduces heat. Adjustments are made +/- 500-100mm/min. in thin material. Adjustments are made 100-10mm/min. for thick material.
- 3) GAS PRESSURE- An increase in gas pressure helps expel the molten material from the kerf as well as reducing heat. Adjustments are made +/- 1 bar.
- 4) POWER- An increase in power increases the heat. A decrease in power decreases the heat. Adjustments are made +/- 5%.

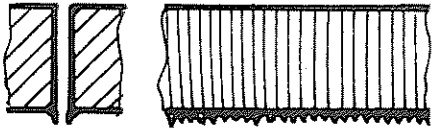

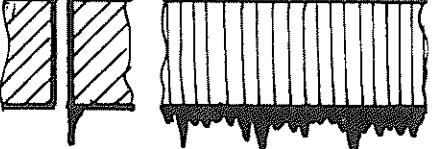
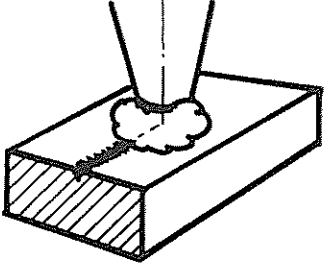
Assessing the Cuts

Structural steel: cutting with O ₂		
Error	Possible causes	Solutions
<p>No burr, uniform drag lines</p> 	<p>right power right feed rate</p>	
<p>Considerable deviation of drag lines on bottom part, cutting hole wider at the bottom</p> 	<p>feed rate too high laser power too low gas pressure too low focal position too high</p>	<p>reduce feed rate increase laser power increase gas pressure lower focus</p>
<p>Burrs on bottom surfaces similar to slag, even drop shaped and easy to remove</p> 	<p>feed rate too high gas pressure too low focal position too high</p>	<p>reduce feed rate increase gas pressure lower focus</p>
<p>Metal burrs joined together can be removed as a single piece</p> 	<p>focal position too high</p>	<p>lower focus</p>
<p>Metal burrs on bottom surfaces, difficult to remove</p> 	<p>feed rate too high gas pressure too low impurities in gas focal position too high</p>	<p>reduce feed rate increase gas pressure use purer gas lower focus</p>
<p>Burrs on one side only</p> 	<p>nozzle incorrectly centered nozzle orifice defective</p>	<p>center nozzle replace nozzle</p>

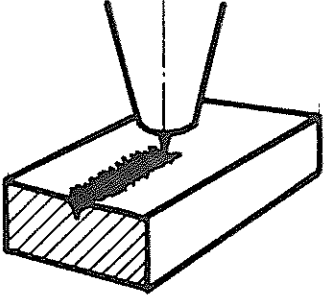
Structural steel: cutting with O ₂		
Errors	Possible causes	Elimination
<p>Material expelled from top side</p> 	<p>power too low feed rate too high</p>	<p>increase power reduce feed rate</p>
<p>Slanting cuts 2 good sides, 2 bad sides</p> 	<p>polarizing mirror not suitable, mounted not correctly or defective polarizing mirror mounted in the place of the deflection mirror</p>	<p>check the polarizing mirror check the deflection mirror</p>
<p>Blue plasma, workpiece not cut off during machining</p> 	<p>wrong gas (N₂) feed rate too high power too low</p>	<p>use oxygen as process gas reduce feed rate increase power</p>
<p>Inaccurate cutting surfaces</p> 	<p>gas pressure too high damaged nozzle nozzle diameter too big poor material</p>	<p>lower the gas pressure replace the nozzle install the right nozzle material with smooth and even surface</p>
<p>No burrs, drag lines slanting a long way back cut narrower at the bottom</p> 	<p>feed rate too high</p>	<p>reduce feed rate</p>

Structural steel: cutting with O ₂		
Errors	Possible causes	Elimination
Formation of craters 	gas pressure too high feed rate too low focus too high rust on surface of plate workpiece under machining has overheated impurities in material	reduce gas pressure increase feed rate lower focus use better quality material
Extremely rough cutting surface 	focal position too high gas pressure too high feed rate too low material too hot	lower focus reduce gas pressure increase feed rate cool material

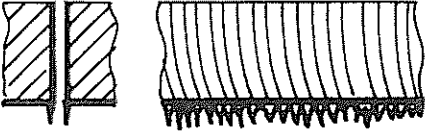
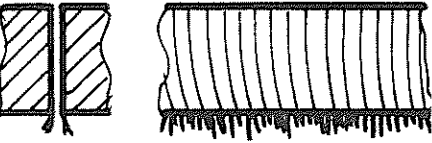
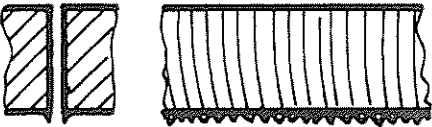
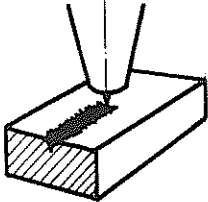
Stainless steel: high-pressure cutting with N₂

Error	Possible causes	Solutions
<p>Formation of fine, regular burrs in the form of drops</p> 	<p>focus too low feed rate too high</p>	<p>raise focus reduce feed rate</p>
<p>Formation of long irregular burrs on both sides in the form of filaments, with tarnishing on large templates</p> 	<p>feed rate too low focal position too high gas pressure too low material too hot</p>	<p>increase feed rate lower focus increase gas pressure cool material</p>
<p>Formation of long irregular burrs on just one side of the cutting edge</p> 	<p>nozzle not centered focal position too high gas pressure too low speed too low</p>	<p>center nozzle lower focus increase gas pressure increase speed</p>
<p>Cutting edge yellowish</p>	<p>nitrogen containing oxygen impurities</p>	<p>use a higher quality of nitrogen</p>
<p>Formation of plasma on straight sections</p> 	<p>feed rate too high power too low focus too low</p>	<p>reduce feed rate increase power raise focus</p>
<p>The beam breaks</p>	<p>feed rate too high power too low focus too low</p>	<p>reduce feed rate increase power raise focus</p>
<p>Formation of plasma at corners</p>	<p>angular tolerance too high modulation too high acceleration too high</p>	<p>reduce angular tolerance reduce modulation or acceleration</p>

Stainless steel: high-pressure cutting with N₂

<p>The beam breaks at the beginning</p>	<p>acceleration too high focus too low The molten material cannot be expelled</p>	<p>reduce acceleration raise focus use circular piercing Use gas ramp</p>
<p>Rough cut</p>	<p>nozzle damaged lens dirty</p>	<p>change nozzle clean lens, replace if necessary</p>
<p>Material expelled from the top</p> 	<p>power too low excessive feed gas pressure too high</p>	<p>increase power reduce feed reduce gas pressure</p>

Aluminum alloys: high-pressure cutting with N₂

Error	Possible causes	Solutions
<p>Formation of long, irregular burrs on both sides in the form of filaments, difficult to remove</p> 	<p>focal position too high gas pressure too low feed rate too low</p>	<p>lower focus increase gas pressure increase feed rate</p>
<p>Formation of long, irregular burrs on both sides, removable by hand</p> 	<p>feed rate too low</p>	<p>increase feed rate</p>
<p>Rough cut</p>	<p>nozzle diameter too large nozzle damaged gas pressure too high</p>	<p>assemble right nozzle replace nozzle reduce gas pressure</p>
<p>Formation of fine, regular burrs, difficult to remove</p> 	<p>focus too low feed rate too high</p>	<p>raise focus reduce feed rate feed rate</p>
<p>Formation of plasma on straight sections</p>	<p>feed rate too high focus too low</p>	<p>reduce feed rate raise focal point</p>
<p>Beam breaks</p>	<p>feed rate too high</p>	<p>reduce feed rate</p>
<p>Formation of plasma on corners</p>	<p>angular tolerance too high modulation too high acceleration too high</p>	<p>reduce angular tolerance reduce modulation or acceleration</p>
<p>The beam breaks at the beginning</p>	<p>approach speed too high focus too low</p>	<p>reduce approach speed raise focus</p>
<p>Rough cut</p>	<p>nozzle damaged</p>	<p>replace nozzle</p>
<p>Material expelled from top</p> 	<p>power too low excessive feed</p>	<p>increase power reduce feed</p>