Steps to help optimize cut quality.

Striation marks, angularity and dross tell the story.

Optimizing CO_2 and fiber lasers to achieve maximum cut quality is a very important step in the overall cutting process. The critical points that produce good cuts are the width of the kerf (the material that is lost during the cut), oxidation and roughness of the cut surface, the geometry of the cut parts and the allowable tolerances. Some factors to be considered are the cut speed or 'feed rate', beam focus, gas pressure, standoff and nozzle size/type.

Factory cut chart settings

The following samples show 12 mm, 6 mm and 3.2 mm (1/2", 1/4" and 10 ga.) mild steel, cut with O_2 on a 2 kW fiber laser with one variable changed to show how cut quality is affected. The adjustments will be similar for all CO_2 and fiber laser, cutting mild steel with O_2.

Is the kerf too narrow?

When the kerf is too narrow the cut will have a very smooth edge on the top, a lack of oxidation on the bottom and/or heavy dross.

Probable causes:

- Focus is too low
- Feed rate is too fast
- Gas pressure is too low
- Nozzle size is too small
- Standoff is too low

Is the kerf too wide?

When the kerf is too wide the cut will have a rougher edge, more self burning in the corners of the part, more angularity on the cut edge and occasionally, dross.

Probable causes:

- Focus is too high
- Feed rate is too slow
- Gas pressure is too high
- Nozzle size is too big
- Standoff is too high
- Incorrect nozzle type

Follow these steps to optimize cut quality:

1. Use the closest known settings for the material being cut.
2. Use a test part that has both interior and exterior features.
3. Verify that the lens and/or window is clean and in good condition.
4. Verify that the nozzle is centered properly and is in good condition.
5. Adjust the focus up and down until the cut quality starts to get bad and then set to the middle of that range.
6. Adjust the gas pressure up and down until the cut starts to get bad and then set to the middle of that range.
7. Adjust the federate up by 5% increments. When the cut starts to get bad, set the feed rate 10% slower.

Strike a balance between heat levels and gas flow

Cutting mild steel with a laser is a balance of how much material is heated by the laser beam and how much assist gas flows through the cut.

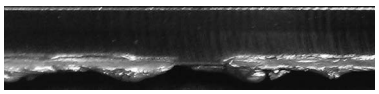
- Heating up too small of an area, or not having enough assist gas flow through the cut will result with the kerf (width of the cut) being too narrow.
- Heating up too large of an area or having too much assist gas flow through the cut will result in the kerf being too wide.

3.2 mm (10 ga.) mild steel cut resulting in too narrow kerf

Factory cut chart settings

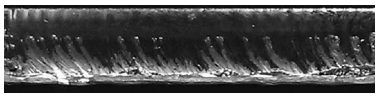
Focus is too low

The kerf is too narrow and doesn't allow enough O_2 into the cut to remove all the molten material.



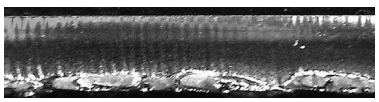
Feed rate is too fast

The cut striations are trailing the direction of cutting and there is not enough time to remove all the molten material.



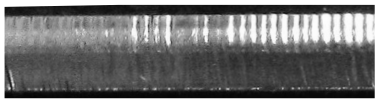
Gas pressure is too low

There is not enough O_2 to remove all the molten material.



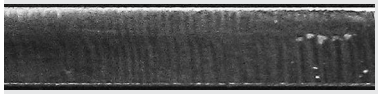
Stand off is too low

The focus spot is in the wrong location, causing the rough edge.

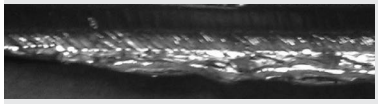


Cut direction

3.2 mm (10 ga.) mild steel cut resulting in too wide kerf

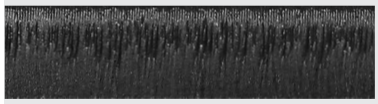


Factory cut chart settings



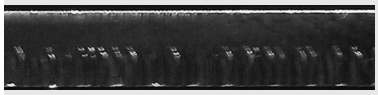
Focus is too high

The laser is melting more material than can be removed from the cut.



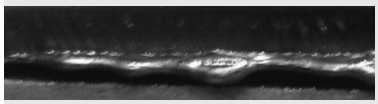
Feed rate is too slow

The cut surface is too rough and productivity is decreased.



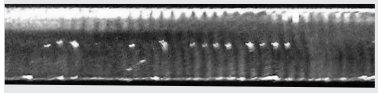
Gas pressure is too high

Too much O_2 results in overheating of the cut and causes intermittent gouges.



Stand off is too high

The laser is melting more material than can be removed from the cut.



Nozzle size is too big

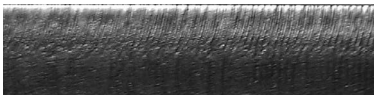
Too much O_2 results in overheating of the cut and causes intermittent gouges.

Cut direction

*Above samples have been cut with O_2 on 2 kW fiber laser. Results will be similar for CO_2 laser cutting mild steel with O_2.

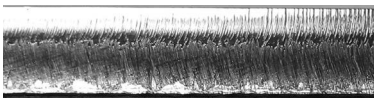
6 mm (1/4") mild steel cut resulting in too narrow kerf

Factory cut chart settings



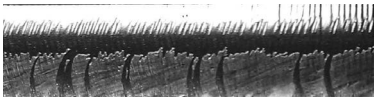
Focus is too low

The kerf is too narrow and doesn't allow enough O_2 into the cut to remove all the molten material.



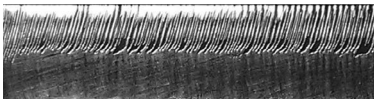
Feed rate is too fast

The cut striations are trailing the direction of cutting and there is not enough time to remove all the molten material.



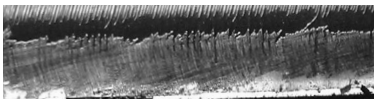
Gas pressure is too low

There is not enough O_2 to remove all the molten material.



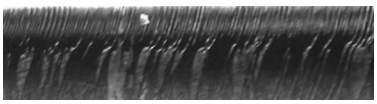
Stand off is too low

The focus spot is in the wrong location, causing the rough edge.



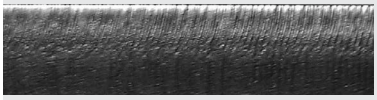
Nozzle size is too small

There is not enough O_2 to cut uniformly.

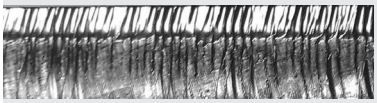


Cut direction

6 mm (1/4") mild steel cut resulting in too wide kerf

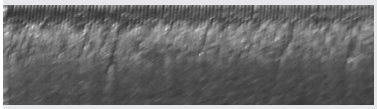


Factory cut chart settings



Focus is too high

The wider focus spot is letting too much O_2 into the cut and burning the material.

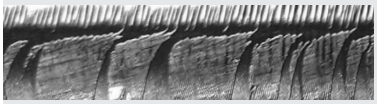


Feed rate is too slow

The cut surface is too rough and productivity is decreased.

Gas pressure is too high

Too much O_2 is entering the cut, causing a rougher edge and inconsistent cutting.

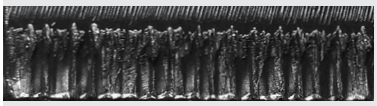


Stand off is too high

Too much O_2 is entering the cut, causing a rougher edge and inconsistent cutting.

Nozzle size is too big

Too much O_2 results in overheating of the cut and causes intermittent gouges.



Nozzle type is incorrect

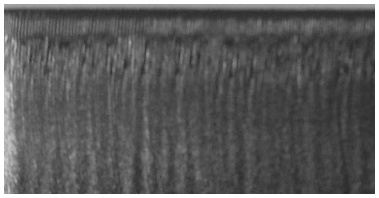
The shape of the gas flow is incorrect, causing a rougher edge.

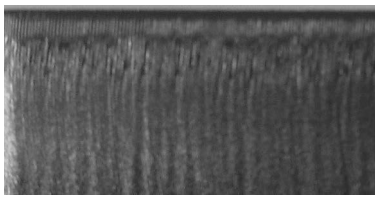
Cut direction

*Above samples have been cut with O_2 on 2 kW fiber laser. Results will be similar for CO_2 laser cutting mild steel with O_2.

12 mm (1/2") mild steel cut resulting in too narrow kerf

Factory cut chart settings

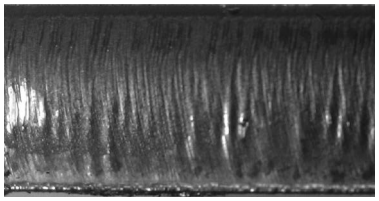


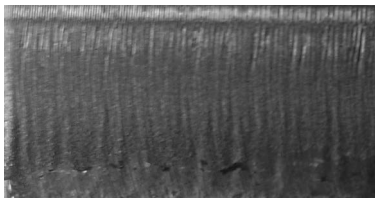


Factory cut chart settings

Focus is too low

The kerf is too narrow and doesn't allow enough O_2 into the cut to remove all the molten material.



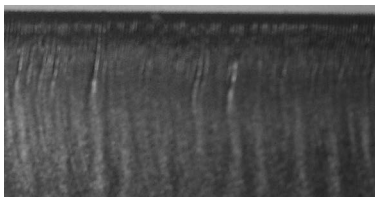


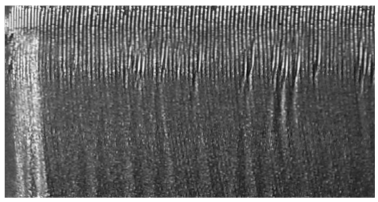
Stand off is too low

The kerf is too narrow to allow enough O_2 into the cut. The oxidation is not covering the entire surface and cutting will be inconsistent.

Feed rate is too fast

The machine is moving too fast to allow enough O_2 into the cut for consistent cutting.



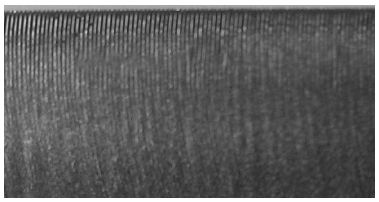


Nozzle size is too small

There is not enough O_2 to cut uniformly.

Gas pressure is too low

The pressure is too low to allow enough O_2 into the cut. The oxidation is not covering the entire surface and cutting will be inconsistent.



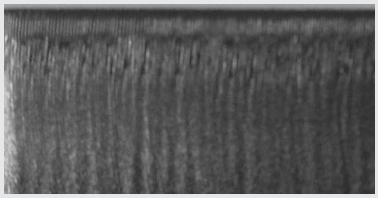
Cut direction

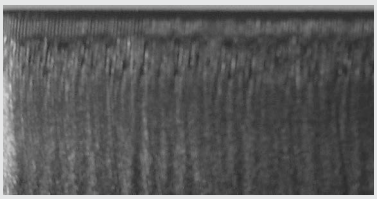
Cut direction

*Above samples have been cut with O_2 on 2 kW fiber laser. Results will be similar for CO_2 laser cutting mild steel with O_2.

12 mm (1/2") mild steel cut resulting in too wide kerf

Factory cut chart settings

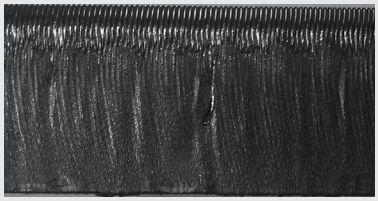


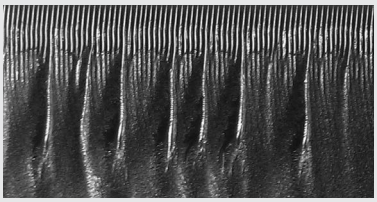


Factory cut chart settings

Focus is too high

Too much O_2 is entering the cut causing intermittent over burning.



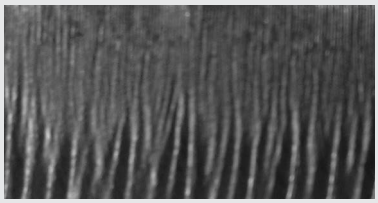


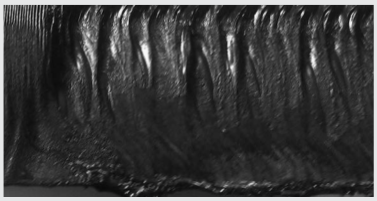
Stand off is too high

Too much O_2 is entering the cut resulting in intermittent over burning.

Feed rate is too slow

The machine is moving too slow resulting in the over burning of the bottom half of the cut. The slower feed rate also reduces productivity.



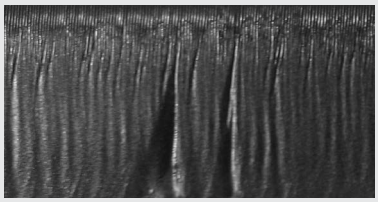


Incorrect nozzle type

The gas flow shape is not correct resulting in inconsistent cutting.

Gas pressure is too high

Too much O_2 is entering the cut resulting in intermittent over burning.



Cut direction

Cut direction

*Above samples have been cut with O_2 on 2 kW fiber laser. Results will be similar for CO_2 laser cutting mild steel with O_2.