

Fiber Laser Cutting Chart — 1 to 12 kW

Mild steel, stainless steel, aluminum, galvanized steel, brass and copper

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These values are starting points. They assume a continuous-wave (CW) fiber laser source with a standard cutting head (125 to 200 mm focusing lens) and gas of suitable purity. The source brand, fiber core diameter, lens and nozzle condition, gas purity and sheet quality all change the final speed; always test on a small sample first.

Data source: reference data published by fiber laser source manufacturers for 1 to 12 kW, compiled and organised for this article.

Laser cutting chart summary: maximum thickness by laser power

Thicknesses are in millimetres, for production-quality cuts. The value in brackets is the maximum thickness that can be cut only with trial parameters, for small batches.

Laser power	Mild steel (O ₂)	Mild steel (N ₂ /air)	Stainless	Aluminum	Brass	Copper
1 kW	8 (up to 10 [†])	1	4 (up to 5 [†])	3	2 (up to 3 [†])	—
1.5 kW	12 (up to 16 [†])	1	5 (up to 6 [†])	3 (up to 4 [†])	2 (up to 3 [†])	—
2 kW	16 (up to 20 [†])	2	6 (up to 8 [†])	4 (up to 6 [†])	4 (up to 5 [†])	—
3 kW	20 (up to 22 [†])	2	8 (up to 10 [†])	6 (up to 8 [†])	5 (up to 6 [†])	—
4 kW	22 (up to 25 [†])	3	10 (up to 12 [†])	8 (up to 10 [†])	6 (up to 8 [†])	—
6 kW	22 (up to 25 [†])	6	16 (up to 20 [†])	12 (up to 16 [†])	10 (up to 12 [†])	—
8 kW	25 (up to 40 [†])	8	25 (up to 30 [†])	25 (up to 30 [†])	—	8 (up to 10 [†])
10 kW	25 (up to 40 [†])	10	25 (up to 40 [†])	25 (up to 40 [†])	12 (up to 16 [†])	8 (up to 10 [†])
12 kW	25 (up to 40 [†])	10	25 (up to 40 [†])	25 (up to 40 [†])	12 (up to 16 [†])	8 (up to 10 [†])

Copper is listed only for 8 kW and above, and **oxygen is recommended** for cutting it; with nitrogen or air, cut quality and stability are poor.

Before you use the laser cutting chart

- **Prerequisites:** a clean, undamaged lens and nozzle, gas of suitable purity (nitrogen at least 99.9%), stable pressure and flow, and working fume extraction.
- **Test order:** always start with a small strip (for example 50×50 mm) before moving on to the final part.
- **Choosing the gas:** oxygen for thick mild steel (faster cutting thanks to the oxidation reaction, oxidised edge); nitrogen for stainless steel, aluminum and brass (bright, oxide-free edge); compressed air for thin mild steel and, at 8 kW and above, for stainless steel at a far lower gas cost. High-consumption workshops usually supply oxygen and nitrogen from a Dewar (liquid gas tank).
- **Safety:** a hood and proper ventilation are mandatory, especially for galvanized steel (zinc fumes).

1. Mild steel (carbon steel) laser cutting chart with oxygen

Cutting speed (m/min)

Thickness (mm)	1 kW	1.5 kW	2 kW	3 kW	4 kW	6 kW	8 kW	10 kW	12 kW
2	4	5	5.2	5.5	—	—	—	—	—
3	3	3.6	4.2	4	4.5	3.6–4.2	—	—	—
4	2.3	2.5	3	3.5	3.5	3.3–3.8	—	—	—
5	1.8	1.8	2.2	3.2	3.2	3–3.6	—	—	—
6	1.5	1.4	1.8	2.7	2.8	2.7–3.2	—	—	—
8	1.1	1.2	1.3	2.2	2.3	2.2–2.5	2.3–2.5	—	—
10	0.8 ⁺	1	1.1	1.5	2	2.0–2.3	2.3	2.3	2.3
12	—	0.8	0.9	1	1.2	1.9–2.1	2	2	2
14	—	0.65 ⁺	0.8	0.9	1	0.8–0.9	1.8	1.8	1.8
16	—	0.5 ⁺	0.7	0.75	0.8	1.2–1.4	1.6	1.6	1.6
18	—	—	0.5 ⁺	0.65	0.7	0.65–0.75	—	—	—
20	—	—	0.4 ⁺	0.6	0.65	0.6–0.7	1.3	1.4	1.4
22	—	—	—	0.55 ⁺	0.6	0.55–0.65	0.65	1.0	1.2
25	—	—	—	—	0.5 ⁺	0.5 ⁺	0.45	0.65	0.95
30	—	—	—	—	—	—	0.25 ⁺	0.35 ⁺	0.8 ⁺
40	—	—	—	—	—	—	0.15 ⁺	0.2 ⁺	0.3 ⁺

Speeds are in **metres per minute (m/min)**. Red values marked ⁺ are trial parameters: production-grade cut quality is not guaranteed and they suit small batches only; for volume production at that thickness, choose a higher power.

Important: in oxygen cutting, speed is set mostly by the reaction between oxygen and steel, not by laser power. That is why, for 2 to 8 mm sheet, even 3 to 6 kW machines are usually run at about **1.2 to 4 kW** and the speed stays almost the same. If you want more speed on thin sheet, use **nitrogen or air** (table in section 2). The benefit of high power in oxygen cutting shows from about 10 mm upwards.

Gas, nozzle and focus settings — 1 to 6 kW

Thickness (mm)	Gas pressure (bar)	Nozzle	Focus (mm)	Nozzle height (mm)
2	1.6 to 2	1.0D, 1.2D	+3	0.8
3 to 10	0.5 to 0.6	1.0D, 1.2D, 1.5D, 2.0D, 2.5D, 1.2E	+2.5 to +4	0.8
12 to 16	0.5 to 0.6	2.5D, 3.0D, 3.5D, 4.0D, 1.2E, 1.4E	+2.5 to +6	0.8 to 1
18 to 25	0.5 to 0.6	4.0D, 4.5D, 5.0D	+2.5 to +4	0.8 to 1

Gas, nozzle and focus settings — 8 to 12 kW

Thickness (mm)	Gas pressure (bar)	Nozzle	Focus (mm)	Nozzle height (mm)
8 to 10	0.6	1.2E	+4 to +6	0.8
12 to 16	0.6	1.2E, 1.4E	+7 to +9	0.8
18 to 22	0.6 to 0.7	1.6E, 1.8E, 1.4SP	+8 to +11	0.5 to 0.8
25 to 30	0.7 to 1.3	1.8E, 1.5SP	+10 to +12	0.5 to 1.2
40	1.5	1.8E	+11.5	1.2

Oxygen oxidises the edge; if a clean edge matters for welding or painting, finish the edge after cutting or use nitrogen for thinner sheet.

2. Mild steel laser cutting chart with nitrogen or air (fast cutting of thin sheet)

Thickness (mm)	1 kW	1.5 kW	2 kW	3 kW	4 kW	6 kW	8 kW	10 kW	12 kW
0.8	18	—	—	—	—	—	—	—	—
1	10	20	25	35	35	45	40–45	50–60	50–80
2	—	—	9	20	15	25	30–35	35–40	45–48
3	—	—	—	—	10	14	20–25	25–30	30–38
4	—	—	—	—	—	8	15–18	18–20	20–26
5	—	—	—	—	—	6.4	10–12	13–15	15–20
6	—	—	—	—	—	5	8–9	10–12	10–13
8	—	—	—	—	—	—	5–5.5	7–8	7–10
10	—	—	—	—	—	—	—	3.5–4.5	5–6.5

Speeds are in metres per minute (m/min). Red values marked + are trial parameters: production-grade cut quality is not guaranteed and they suit small batches only; for volume production at that thickness, choose a higher power.

Thickness (mm)	Gas pressure (bar)	Nozzle	Focus (mm)	Nozzle height (mm)
0.8 to 1	10 to 12	1.5S	0	1
2 to 3	10 to 14	2.0S	-1.5 to 0	0.5
4 to 6	13 to 16	2.0S, 2.5S, 3.0S, 3.5S	-3 to 0	0.5
8 to 10	13	3.0S, 4.0S	-3 to -1	0.5

On thin sheet, cutting mild steel with air or nitrogen is several times faster than with oxygen (for example 2 mm at 6 kW: about 25 m/min with air versus about 5 m/min with oxygen). The edge is oxide-free, though a little fine dross may remain under the part. The higher the power, the thicker the sheet this method pays off for: about 2 mm at 2 to 3 kW, 6 mm at 6 kW and 10 mm at 10 to 12 kW.

3. Stainless steel laser cutting chart with nitrogen

Thickness (mm)	1 kW	1.5 kW	2 kW	3 kW	4 kW	6 kW	8 kW	10 kW	12 kW
0.8	20	—	—	—	—	—	—	—	—
1	13	20	28	45	40	60	60	50–60	63
2	6	7	10	24	20	30	35	35–40	42
3	3	4.5	5	10	12	18	24	25–30	33
4	1	—	3	6.5	7	12	15	18–20	27
5	0.6 ⁺	1.5	2	3.6	4.5	8	10	15	18
6	—	0.8 ⁺	1.5	2.7	3.5	5	8	9	15
8	—	—	0.6 ⁺	1.2	1.8	3.8	5	6	10
10	—	—	—	0.8 ⁺	1.2	2	3.5	4	7.5
12	—	—	—	—	0.8 ⁺	1.2	2.5	3	5.5
14	—	—	—	—	—	1	2	2.4	3.5
16	—	—	—	—	—	0.6	1	2	2.3
18	—	—	—	—	—	0.5 ⁺	1.5	1.5	1.5
20	—	—	—	—	—	0.3 ⁺	0.8	1.2	1.45
25	—	—	—	—	—	—	0.4	0.6	0.9
30	—	—	—	—	—	—	0.2 ⁺	0.25 ⁺	0.26 ⁺
40	—	—	—	—	—	—	—	0.15 ⁺	0.15 ⁺

Speeds are in metres per minute (m/min). Red values marked ⁺ are trial parameters: production-grade cut quality is not guaranteed and they suit small batches only; for volume production at that thickness, choose a higher power.

Thickness (mm)	Gas pressure (bar)	Nozzle	Focus (mm)	Nozzle height (mm)
0.8 to 2	10 to 12	1.5S, 2.0S	-1 to 0	0.5 to 1
3 to 6	8 to 16	3.5B, 2.0S, 2.5S, 3.0S, 3.5S	-3 to 0	0.5
8 to 12	5 to 16	5.0B, 6.0B, 3.0S, 3.5S, 4.0S	-7.5 to 0	0.5
14 to 20	6 to 20	5.0B, 7.0B, 4.0S, 5.0S	-12 to -6	0.3 to 0.5
25 to 40	6 to 15	7.0B	-13 to +9	0.3

Cutting stainless steel with compressed air (8 kW and above)

At high power, stainless steel can also be cut with compressed air at almost the same speed as nitrogen, with a much lower gas cost. The edge is slightly darker than with nitrogen.

Thickness (mm)	8 kW	10 kW	12 kW
1	60	50–60	60
2	35	30–35	38
3	25	25	28
4	16	20	25
5	10	17	18
6	8	10	15
8	5.5	7	10
10	3.5	6	6.5
12	2.5	4.5	4.5
14	2	3	2.6
16	1	2	2.3
18	0.8	1.5	1.9
20	0.7	1.2	1.4
25	0.5	0.6	1
30	0.25 ⁺	0.25 ⁺	0.28 ⁺

For a bright, oxide-free stainless edge, nitrogen purity matters (at least 99.9%). A yellow or black edge usually means low gas purity.

4. Aluminum laser cutting chart with nitrogen

Thickness (mm)	1 kW	1.5 kW	2 kW	3 kW	4 kW	6 kW	8 kW	10 kW	12 kW
0.8	18	—	—	—	—	—	—	—	—
1	10	18	20	30	30	50	45	55	45
2	5	6	10	18	20	25	30	30	35
3	1.5	2.5	4	8	13	16	25	25	25
4	—	0.8 ⁺	1.5	6	7	10	15	20	20
5	—	—	0.9 ⁺	3.2	5	6	10	16	16
6	—	—	0.6 ⁺	2	3	4	7	9	11
8	—	—	—	0.9 ⁺	1.3	2	4	6	7
10	—	—	—	—	0.8 ⁺	1.2	2.5	4.5	5
12	—	—	—	—	—	0.7	2	2	2.6
14	—	—	—	—	—	0.5 ⁺	1.2	1.5	1.7
16	—	—	—	—	—	0.4 ⁺	1	1.2	1.6
18	—	—	—	—	—	—	0.8	1	1.3
20	—	—	—	—	—	—	0.6	0.8	1
25	—	—	—	—	—	—	0.5	0.6	0.6
30	—	—	—	—	—	—	0.2 ⁺	0.25 ⁺	0.45 ⁺
40	—	—	—	—	—	—	—	0.15 ⁺	0.3 ⁺

Speeds are in **metres per minute (m/min)**. Red values marked ⁺ are trial parameters: production-grade cut quality is not guaranteed and they suit small batches only; for volume production at that thickness, choose a higher power.

Thickness (mm)	Gas pressure (bar)	Nozzle	Focus (mm)	Nozzle height (mm)
0.8 to 2	12 to 14	1.5S, 2.0S	-1 to 0	0.5 to 1
3 to 6	12 to 16	2.0S, 2.5S, 3.0S	-3.5 to -1	0.5
8 to 12	14 to 18	5.0B, 2.5S, 3.0S, 3.5S, 4.0S	-5 to -4	0.5
14 to 20	16 to 20	5.0B, 7.0B, 4.0S, 5.0S	-9 to -5	0.3 to 0.5
25 to 40	16 to 18	7.0B	-10 to +8	0.3

Aluminum is highly reflective. Keep the sheet surface clean, and if piercing is difficult, use pulsing and the staged piercing method (below).

5. Galvanized steel laser cutting settings

Galvanized sheet is carbon steel with a zinc coating, so its settings are close to those for mild steel:

- **Thin and medium sheet:** start from the **section 2 table (mild steel with nitrogen or air)**. Nitrogen or air prevents the zinc coating from burning back along the edge and gives a cleaner cut.
- **Thicker sheet:** use the **section 1 table (oxygen)** and fine-tune the speed with a test sample.
- The zinc coating changes cutting behaviour slightly; the mild steel values are only a starting point, so always confirm the final speed on a sample.

Safety warning: zinc produces toxic fumes when it vaporises. Strong fume extraction, suitable filtration and personal protective equipment for the operator are mandatory.

6. Brass and copper laser cutting chart

Brass with nitrogen (m/min)

Thickness (mm)	1 kW	1.5 kW	2 kW	3 kW	4 kW	6 kW	10 kW	12 kW
1	9	15	18	28	28	40	40	40
2	2	5	8	15	15	20	27	35
3	0.8 ⁺	1.8 ⁺	3	6	8	14	20	22
4	—	—	1.3	3	5	9	15	18
5	—	—	0.8 ⁺	2.2	3	5.5	11	15
6	—	—	—	1.3 ⁺	2.5	3.8	7	10
8	—	—	—	—	1 ⁺	1.8	5	7
10	—	—	—	—	—	1	4	5
12	—	—	—	—	—	0.7 ⁺	2	2.4
14	—	—	—	—	—	—	1 ⁺	1.4 ⁺
16	—	—	—	—	—	—	0.7 ⁺	1 ⁺

Copper with oxygen (m/min) — 8 kW and above

Thickness (mm)	8 kW	10 kW	12 kW
1	30	30	35
2	20	20	25
3	14	15	18
4	8	10	12
5	5	6	8
6	3	4	5
8	1.5	2	2.5
10	0.7 [†]	0.7 [†]	1.2 [†]

Speeds are in metres per minute (m/min). Red values marked [†] are trial parameters: production-grade cut quality is not guaranteed and they suit small batches only; for volume production at that thickness, choose a higher power.

Brass and copper are highly reflective. **Oxygen is recommended** for copper; with nitrogen or air, cut quality and stability are poor. Before cutting copper or brass, make sure the laser source has back-reflection protection.

Nozzle codes and focus sign

Nozzle code	Type	Main use
S	Single layer, high gas flow	High-pressure gas cutting: stainless steel, aluminum, brass, and mild steel with nitrogen or air
D	Double layer	Mild steel cutting with oxygen
E	High-speed double layer	Fast bright-surface cutting of thick mild steel with oxygen at high power (6 kW and above)
B	Stepped single layer (Boost)	Thick stainless steel and aluminum with nitrogen or air at high power and lower pressure

The number next to the code is the nozzle bore in millimetres (for example 1.5S is a 1.5 mm single-layer nozzle). In the focus column, **positive (+)** means the focal point is above the sheet surface, **negative (–)** means inside the sheet and **zero** means on the surface. Rule of thumb: **positive focus with oxygen, zero or negative focus with nitrogen or air**, becoming more negative as the sheet gets thicker.

Piercing thick sheet: the three-stage method

On thick sheet, the start hole is pierced in three consecutive stages. At each stage the nozzle moves closer to the sheet and the focus becomes more negative. The values below are the typical pattern for 1 to 6 kW (at 6 kW the nozzle height for mild steel is about 4 mm higher):

Stage	Nozzle height (mm)	Focus (mm)	Mild steel with oxygen	Stainless with nitrogen
1 (start)	12	0	Pulse duty 50–100%, 100–300 Hz, 1 bar, 0.1–0.2 s	Pulse duty 100%, 600–1000 Hz, 10 bar, 0.1–0.2 s
2 (middle)	8	–4 to –5	Pulse duty about 45%, 0.6–0.8 bar, 0.2–2.5 s	Pulse duty 35–60%, 10 bar, about 0.5 s
3 (final)	4	–5 to –8	Pulse duty 40–55%, 0.6–0.7 bar, 1–3 s	Pulse duty 35–45%, 10 bar, 1–1.5 s

The thickest sheet each power typically pierces: **1 kW** mild steel 10 / stainless 5 mm, **2 kW** mild steel 20 / stainless 8, **3 kW** mild steel 22 / stainless 10, **4 kW** mild steel 25 / stainless 12, **6 kW** mild steel 25 / stainless 20, and **8 to 12 kW** mild steel up to 30 and stainless with nitrogen up to 20 mm.

Tuning speed, gas pressure and focus: testing and optimisation

- **Start from the chart:** where a range is given, start in the middle of it.
- **Step-by-step testing:** cut a 50 to 100 mm sample for each combination, inspect the edge, and change only one parameter at a time by 10 to 20 percent.
- **Focus and nozzle height first:** most edge-quality problems come from focus and nozzle-to-sheet distance, not speed.
- **Lens and nozzle:** a dirty lens or damaged nozzle severely reduces quality; inspect them regularly.

Fixing dross and common laser cutting problems (quick troubleshooting)

Problem	Likely cause	Solution
Fine, regular dross under the part	Focus too low or speed too high	Raise the focus, reduce the speed
Irregular stringy dross and surface discoloration	Focus too high, speed too low or gas pressure too low	Lower the focus, increase speed and pressure
Dross on one side of the cut only	Nozzle not centred or nozzle bore damaged	Re-centre the nozzle or replace it
Hard, sticky dross under the part	Speed too high, pressure too low, impure gas or focus too high	Reduce speed, increase pressure, use purer gas, lower the focus
Incomplete cut / drag lines deflected and wide at the bottom	Speed too high, power too low, pressure too low or focus too high	Reduce speed, increase power and pressure, lower the focus
Molten metal spraying upward or plasma along the cut	Speed too high, power too low or focus too low	Stop immediately so spatter does not reach the lens; reduce speed and increase power
Rough cut surface	Focus too high, pressure too high, speed too low or overheated sheet	Lower focus and pressure, increase speed, let the sheet cool
Black or yellow edge on stainless steel	Low nitrogen purity	Use nitrogen of at least 99.9% purity
Heavy fumes with galvanized steel	Insufficient ventilation	Improve fume extraction and use personal protective equipment

Daily laser cutting machine maintenance checklist

- Clean the protective lens with alcohol and a lens tissue
- Inspect the nozzle and replace it if the bore is worn or deformed
- Check nozzle centring and height calibration
- Log gas pressure and daily consumption
- Cut a test sample at the start of each shift, because temperature, humidity and gas quality vary day to day
- Check the extraction system and filters (especially for galvanized steel)

Speeds are in metres per minute. Red values marked † are trial parameters, suitable for small batches only. This chart is a starting point; finalise the settings with a test sample on your own machine. For settings advice and machine selection: asimelectronic.com · 021-44000095