

Laser Material Processing

2.0

High precision

LaserJob's proprietary laser systems provide superior precision for cutting, welding, drilling and labelling customer-designed finite parts and forms. In order to guarantee the highest quality laser material processing with increasingly difficult and finite requirements, the manufacturing process takes place in controlled air conditioned production rooms with all results validated by modern optical measurement technology and comprehensive quality assurance procedures. LaserJob specializes in the treatment of very thin stainless steel foils, starting from 0.010 mm with minimum tolerances of ± 0.005 mm.

To guarantee a precisely-cut opening of 20 μ m we reduce heat transference in both the fiber lasers and pulsed Nd-YAG-lasers by utilizing constant compressed-air surface cooling. With a working surface of 550 mm x 560 mm or 600 mm x 800 mm we can cut single components up to large volumes.

In addition to cutting, welding, drilling or labelling, moulded components can be mechanically modified and enhanced with the use of the laser. Examples include: bending, creating cavities, and milling.

Some of the industries we supply include: the automotive industry, medical technology, fine mechanics, the electronics industry, environmental products, measurement, engineering and jewellery design.

Advantages mechanically

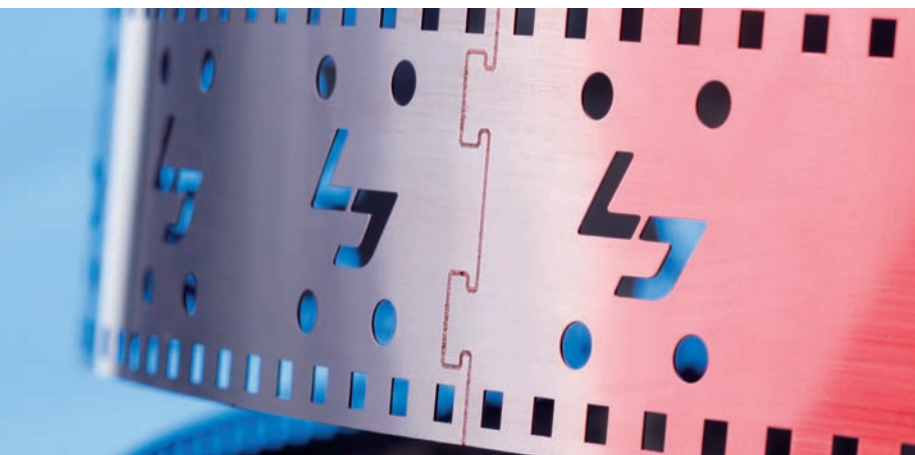
- no material distortion
- contour accuracy of $\pm 5 \mu$ m
- contact-free material processing
- treatment of hardened surfaces
- prototyping up to full-scale production

CAD construction in-house

From hand sketches to CAD drawings we can generate cutting instructions for the laser. Some of the file formats we can accommodate include: DXF/DWG/HPGL/Gerber/DPF/ODB++/GDSII/IGES. We are also able to convert image files such as JPEG/TIFF or Photoshop files.



Example for laser cutting parts



LaserJob GmbH
Liebigstraße 14
82256 Fürstenfeldbruck, Germany
phone +49 (0) 8141 52778-0
fax +49 (0) 8141 52778-69
info@laserjob.de
www.laserjob.de

LaserJob Inc.
55 Fleming Drive, Unit 24
Cambridge, ON N1T 2A9, Canada
phone +1 (0) 519 620-1221
info@laserjob.ca
www.laserjob.com

Laser Material Processing

Laser cutting

We cut in micro dimensions

With a working surface 600 mm x 800 mm our high performance Nd-YAG-laser can cut precise parameters. Our micro exact and high focused laser material process allows minimal material distortion, minimum change in material properties, and optimum contour definition.

Material selection of our laser systems

All materials, alloys and metal composites (listed in table 1) can be processed in the specified dimensions. For inquiries regarding other metals, please contact our specialists. In order to laser cut very thin metal foils in metal thicknesses of 0.010 mm–0.020 mm we recommend the use of custom fixtures, which can be designed and built at our factory.

In order to provide fast delivery, LaserJob has an extensive stock of high-precision metals available. Material test certificates are available upon request. Specialty stainless steel with specific properties (e.g. higher tensile strength or higher fine grain properties) can be custom ordered upon request.

Laser cut with micro-tabs

For very thin materials and delicate parts we recommend the application of micro-tabs. Micro-tabs allow stable post-processing steps such as deburring, polishing or coating. We also recommend micro-tabs to avoid bending, and to insure stable handling. For production in multiple panels or with minimum material thickness, LaserJob can deliver the parts separate from the base material in single pieces. In the base material a precision bore hole can be integrated for the production of small parts in series. This leads to a fast and non-destructive release of the parts from the base material through stamping tools or pressing tools.

The position of the micro-tabs is discussed in detail in advance with the customer.

LaserJob offers two variation of micro-tabs (see picture 1 and 2). Variation A is recommended when it is possible to exceed the outline contour of the laser cutting parts. Variation B is recommended if it is prohibited to exceed the outlines because of construction reasons and therefore internal micro-tabs are necessary. In general the micro-tabs have the size of 0.2 mm–0.05 mm in width.

Rework steps

LaserJob has the ability to deliver the manufactured parts burr free or with a minimum burr due to unique properties of the cutting quality. If special requirements are required, we offer rework treatments in form of

– Brushing

With a CNC controlled brushing system the cutting burrs on the laser exit side are removed. The brush head moves in all four directions, covering the entire area.

– Polishing or manual grinding

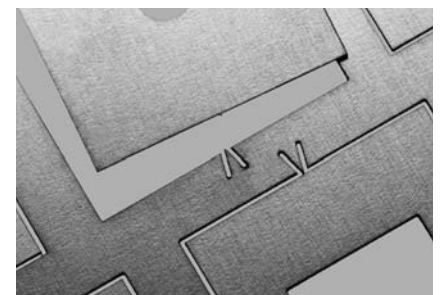
If the parts are delicate and below a material thickness of 0.2 mm, we recommend manual grinding of the parts.

– Grinding (Trovalizing)

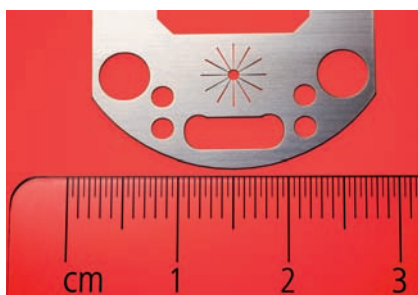
With a capacity of 5 ltr or 10 ltr/container all parts can be treated with a material thickness of 0.5 mm and a maximum size of 50 x 50 mm.

Material	Min. Thickness (mm)	Max. Thickness (mm)
Stainless steel ST37 Stahl	0.010	3.00
Tin Plates	0.010	2.0
Aluminium AlMg3	0.010	1.5
Anodised Alu	0.010	1.5
Copper Cu	0.010	1.0
Copper/ Beryllium CuBe	0.010	1.0
Copper/Tin CuSn	0.010	1.0
E-Copper	0.010	1.0
Brass CuZn	0.010	1.0
Nickel	0.1	1.0
Silver	0.1	1.0
Nickel/Silver	0.1	1.0
Titanium	0.1	2.0
Tantal	0.1	1.0
Gold Au	0.2	1.0
Invar	0.050	2.0

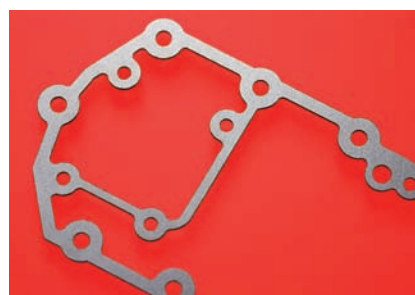
Table 1: Material selection



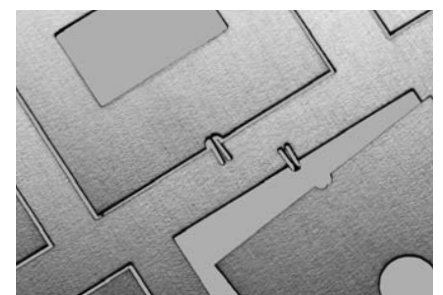
Picture 1: Micro-tab with excess outlines



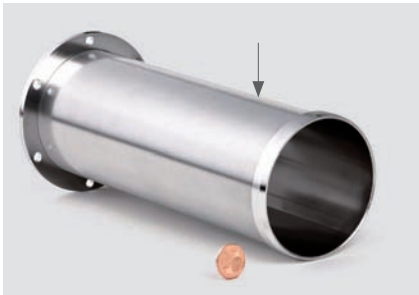
Example for a laser cutting part: Drive plate



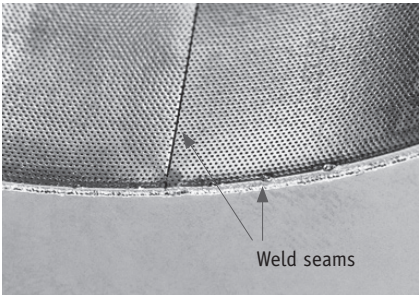
Example for a laser cutting part: Motor seal



Picture 2: Internal micro-tab



Picture 5: Filter with weld seam and welded flange gasket



Detailed view

Laser welding

Perfect laser welding down to the smallest micro detail

The pulsed Nd-YAG-Laser allows for solid and safe welding of parts and areas on micro levels. The weld seams are laser-welded without the addition of material and are reliably interconnected without splices. With the focused/pulsed energy input of the laser beam you have the advantage of low thermal stress and very low material distortion. With our laser systems we manufacture a maximum laser welding depth of 8 mm. With the 4 axes (3 linear and 1 rotary) NC-control system we achieve optimal all-round welds. We produce from single piece orders up to high volume production. If a clamping device is required we are able to construct and manufacture it.

Typical laser welding applications are utilized in the following industries: automotive industry, machine production and equipment industry, medical products, and electronics industry (see picture 3, 4 and 5).

Material selection, which can be processed with our laser welding systems

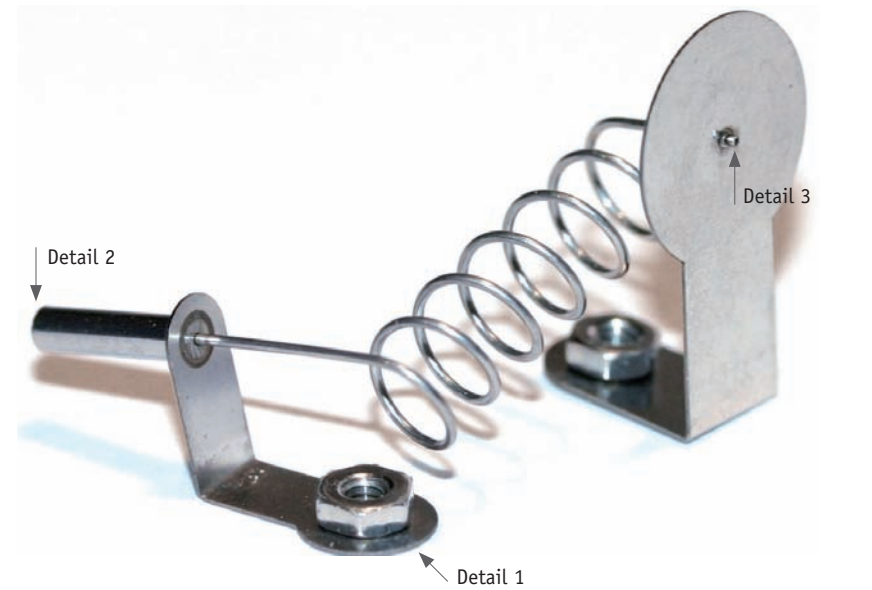
The results of the welding process are heavily dependent on the selection of suitable materials. Materials for optimal welding results include:

- Stainless steel (1.4301 und 1.4310)
- Nickel
- Invar
- Gold
- pure Aluminium 99%
- pure Copper 99%

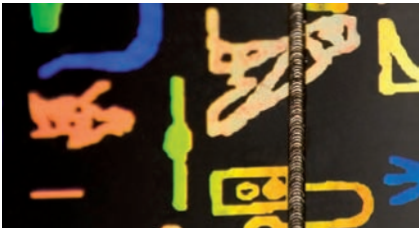
Metal alloys with additives such as sulphur, lead, magnesium, silicon, zinc and carbon are worse for the laser welding process. Welding trials are required on a case-by-case basis when these alloys are specified.

Advantages

- high stability of welding seam
- welding without additional material
- minimum heat-affected zones and narrow weld seams (< 0.25 mm)
- lowest material distortion
- gas-tight and water resistant welding
- optically smooth laser seam



Picture 3: Vaporizer



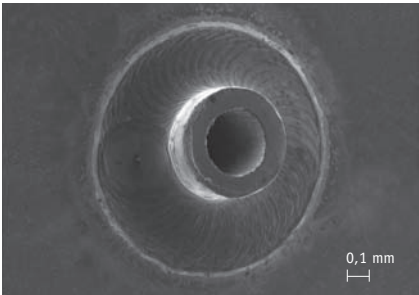
Picture 4: Example for laser welding of nickel foil with hologram



Detail 1



Detail 2



Detail 3

Laser drilling

Smaller than small

LaserJob is able, depending on the material thickness, to laser drill the smallest boreholes. We laser drill stainless steel material with a thickness of $t = 75\text{ }\mu\text{m}$ (0.0029 inch) boreholes with a diameter of $30\text{ }\mu\text{m} - 40\text{ }\mu\text{m}$ (0.0011-0.0015 inch) and with an accuracy of $\pm 2\text{ }\mu\text{m}$. With this guaranteed high precision, our laser technology finds application for defined gas flow rates or liquid flow rates. During the laser drilling process, the laser beam generates contact-free bore holes (from very fine up to larger boreholes) by quickly placing energy in the material with a short laser pulse in a high power density. Therefore the material melts and evaporates. The higher the pulsed energy, the more the material melts and evaporates. During the evaporation process, the volume increases in the borehole and, suddenly, the high pressure forces the melted material out.

Benefits:

- high accuracy
- low tolerances
- lowest material distortion

Application examples:

- measuring disc with boreholes for defined gas volumes (see picture 6 and 7)
- drain valve
- throttle plate
- pinhole
- singling disc

Laser labelling

We label with microscopically small features

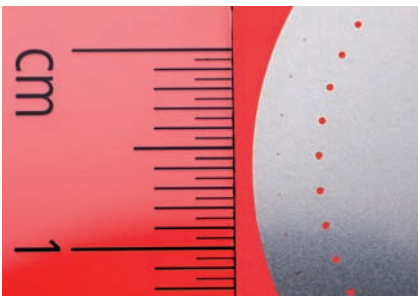
High quality laser labelling is used in many industrial applications. LaserJob offers laser labelling via job-shop service for a variety of industrial labelling tasks as well as for new development and prototyping. On flat or curved surfaces or on parts with complicated geometry, laser labelling is the most flexible and resistant method. The laser labelling process generates very flexible texts, graphics, numerical sequences and codes direct from the software. Excel-, graphics or CAD files (DXF, HPGL, XLS, CDR, PDF) may also be processed. Labelling with Data Matrix Code is also a very important application in the industry and production. The long shelf-life and the precision of the laser labelling guarantee, even after many years, assure good readability (see picture 8). The identification of batches for traceability is an essential production method for labelling different parts and materials. We laser label many metals such as: stainless steel or steels; hardened surfaces; anodized aluminium; polymers (ABS), and self-adhesive foils.

Advantages:

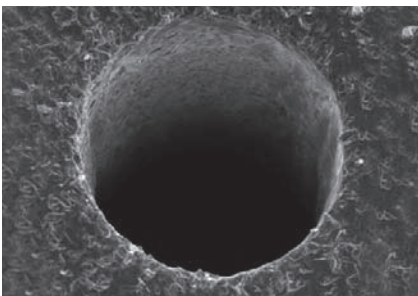
- sustainability of the laser labelling
- flexible laser labelling (numerical sequences, flexible texts etc.)
- no additional material necessary
- fast and highly reliable labelling (see picture 9)



Picture 9: Example of labelling



Picture 6: Measuring disc with 40 µm borehole



Picture 7: Borehole



Picture 8: Data Matrix Code

Laser ablation with Ultra-Short Pulse Laser

Since 2011, LaserJob has utilized a new and innovative laser beam source which offers new fields for laser ablation applications.

With the development of an ultra-short pulsed laser (USP laser), the field of laser ablation applications expand. Pulses with a short duration of less than 15 ps (15 x 10⁻¹² s) and energies of several mJ (millijoule) can show completely different absorption behaviours of the materials in the laser ablation process. Since heat conduction is no longer possible in such a short time, the molecule chains are broken off directly with the grid structure of the material bond. The material sublimates (direct transmission from solid to gaseous state). Even materials which do not react with a wave length of 530 nm (green) (e.g. glasses, sapphires, etc.) are now possible to process with USP lasers. LaserJob's USP laser even allows laser ablation, borehole drilling and structure surfacing of metal alloys. The USP lasers are an additional high precision and universal tool, available for the laser ablation process.

Advantages

- laser ablation of glasses, polymers, sapphires, diamonds
- laser ablation of ceramic substrates without micro cracks
- no material distortion
- laser ablation of very fine layers



Example of laser ablation
Cold material processing

Quality assurance and quality control

Quality assurance is extremely important at LaserJob. Effective quality control starts with incoming inspection of stainless steel sheets. A thickness measurement instrument measures every stainless steel sheet with an accuracy of $\pm 0.5 \mu\text{m}$ (see picture 10). Directly after the laser cutting process, aperture size and aperture geometry are controlled. The OKM measurement system detects on an area of 400 mm x 200 mm with a precision of $0.5 \mu\text{m} + L/400$ the position of the apertures (see picture 11). The contour of apertures is controlled with an accuracy of $0.5 \mu\text{m}$ using a CCD camera with transmitted light (see picture 12). Pad size and pad geometry are measured immediately after the laser cutting process and a report is generated in a document form or certificate of analysis.



Picture 10: Thickness measurement



Picture 11: OKM-measurement system



Picture 12: Microscope

In regularly intervals, control and maintenance of the lasers takes place with the support of a laser interferometer. The laser systems are reviewed in terms of position accuracy and machine capability with an accuracy of $\pm 0.1 \mu\text{m}$.

In addition, micro-sections can be carried-out as a quality control. The micro-section preparation is helpful to determine the micro-structure of the material and provides information about type, amount, size and form of the local distribution of the orientation relationship and about the real structure of the micro-constituents.

www.laserjob.de

Service

LaserJob supports you with a highly qualified and motivated team. Precise coordination with your requirements and project flexibility are trademarks of our service. We can deliver our products from single pieces up to series production within 3 days after order entry.

We offer additional

- CAD construction
- custom fixture construction
- prototyping to full-scale production
- rework process
- data storage
- customer material storage
- short delivery time
- inspection sheet or initial sample test report
- complete execution
- material test certificate
- bending, including sinking (subsidiences) and coatings
- multi-shift operation
- standard materials available from stock
- passivations
- qualified employees

Shipping conditions

Shipping time

Standard shipment time ex works is
3 work days
Order entry before 2 p.m.
Ready for shipment the next work day

24 hour express shipment ex works is
after notification
Order entry before 2 p.m.
Ready for shipment the next work day

6 hour express shipment ex works is
after notification
Order entry until 1 p.m.
Ready for shipment the same work day

Common carrier: UPS, DHL, GO, FedEx (any shipping service) as well as direct delivery with courier and delivery with partner companies.

Packaging

All LaserJob stencils are shipped in reusable packaging. To avoid damage of the parts, proven packaging materials are used and we carefully pack even on customer request.

Order process

For a complete and fast order processing we need the drawing of the parts with tolerances. We can read drawings in DXF-format or Gerber files.

To guarantee fast handling of your order, send the purchase order via

- e-Mail: mail@laserjob.de
- fax: +49 (0)8141 52778-60
- post

Please send the datas via
e-mail to mail@laserjob.de

We are ISO 9001:2008 certified



LaserJob data sheets

- 1.0 SMD stencil
- 1.1 NanoWork®-stencil
- 1.2 PatchWork®-stencil
- 1.3 Tensioning system LJ 745
- 1.4 Frames and tensioning system
- 1.5 Repair and Re-balling stencil
- 1.6 Wafer bumping-stencil
- 1.7 LTCC Via fill-stencil
- 2.0 Laser Material Processing

Auch in Deutsch erhältlich.

