

Laser Welding/Soldering under High Vacuum

Joining of all Current, Reactive and Refractory Metals with Highest Quality Standards

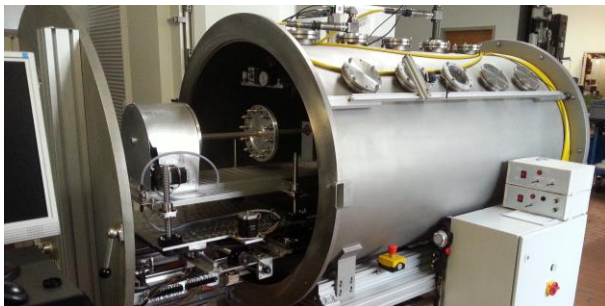
Convincing Laser Welding Technology:

- Suitable for all common metals, esp. reactive and refractory metals as well as mixed material compounds
- Laser (wave length) selectable based on material characteristics (absorption rate)
- Maximum purity and freedom from pores in weld seam through high vacuum of up to 10^{-5} mbar
- Weld strength close to material properties
- High energy density enables high feed speeds and short process times
- Lowest heat-affected zone (pulsed laser), therefore hardly any tendency to tension, crack or splash
- Significantly greater welding depths or lower laser power compared to welding in atmosphere
- Welding depths of 20mm (CW) and 1.5mm (pulse laser), depending on the material and Feed
- No damage / mech. loading of the workpieces, especially suitable for electronic components and sensors
- Insensitive to magnetic and electromagnetic fields
- High degree of automation, highest precision and repeatability, finest weld seam geometries



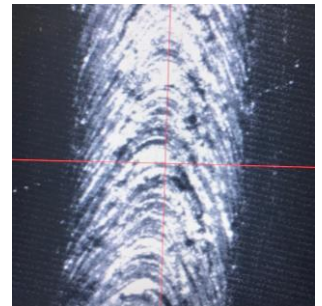
Advantages and Benefits:

- Selectable, controlled welding atmosphere
- Highest strength and purity
- No cracks, pores, splashes
- High precision and reproducibility
- Flexible, modular system design
- Highest energy efficiency
- Low investment and operating costs



Our Offerings:

- Welding systems for labs + manufacturing
- Process validation
- Test welds
- Process ramp-up
- Job shop (small + medium size series)



Suitable for the following materials:

- All common metals, including
- Alloy steel, stainless steels, aluminum
 - Reactive metals (Zirconium, Titanium, Beryllium)
 - Refractory metals (Tungsten, Molybdenum, Tantalum, Niobium)
 - Mixed material compounds

Target Applications / Industries:

- Aerospace
- Energy technology, renewable energies
- Automotive industry
- Engine and turbine construction
- Medical technology
- Electronics, Sensors and Measuring Devices
- Defense technology

Convincing System Technology:

- Welding and soldering applications under controlled atmosphere (e.g. vacuum, inert gas)
- High vacuum up to 10^{-5} mbar, short evacuation time due to scalable pump station
- Flexible system design according to the requirements of process, workpiece and production
- Efficient use through multiple welding operations (parallel, sequential) per evacuation cycle
- Uncomplicated single or multiple workpiece fixtures (e.g. magnetic fixtures)
- Optical inline quality control or monitoring of the welding temperature possible
- Insensitive to disruptive influences (e.g. magnetic, electromagnetic fields)
- No generation of X-rays, no lead shielding required
- No loss of performance due to alternating steam protection inside the vacuum chamber
- Long service life, maintenance-friendly design
- Highest (total ~) energy efficiency in vacuum welding
- Low investment and operating costs compared to alternative welding technologies (e.g. EB welding)
- Flexible system design (one laser for different sized chambers, easy change of laser head)
- Modular structure enables spatial separation of the laser, vacuum chamber and supply modules

Technical Specifications:

Vacuum Modul

a) Vacuum chamber:

- Stainless steel, Aluminum (depending on req's)
- Chamber diameter (from 300 to 1,500 mm)
- Chamber length (from 500 to 2,000 mm)
- Equipment (fixed holder, slide-in unit, removable workpiece carrier)
- Workpiece manipulators (up to 6 CNC axes, XYZ-table, rotary table, single or multiple turret)
- Number of laser irradiation openings can be defined
- Fixed or movable vapor protection

b) Pump station:

- Pump capacity can be variably designed, according to chamber size and cycle times
- Mounted on the vacuum chamber
- Pre-stage (one rotary vane pump) and main stage (one / multiple turbo-molecular pumps)
- Vacuum adjustable up to 10^{-5} mbar
- Vacuum supply unit, entry lock optional

Laser-Modul

- Disk / fiber laser
- Pulsed, continuous wave (CW) or switchable
- One or more laser heads per laser possible
- Wave length selectable via laser selection
- All common brands/makes can be used
- Beam guidance to the chamber via fiber optic cable
- Beam preparation through lens optics
- Simple change of location of the laser head
- Integration of inline camera systems for Quality control possible

Welding Kinematics

- Maximum work piece dimensions depend. on chamber size and weld seam geometry
- One or more stationary welding points
- Sequential or parallel welding operations
- Single or multiple product fixtures
- Feed via workpiece manipulators on up to 6 axes
- Targeted focusing / de-focusing via workpiece manipulators

High-quality products require high-performance, requirement-specific manufacturing technology. We are happy to advise and support you in designing your high-vacuum laser welding system!

**Are you interested in one of our systems or do you have any questions?
Contact us today!**