

Laser Plastic Welding

Innovative
and flexible



Laser welded plastic components

Leister has the flexibility and expertise to address the diverse and growing demands of the plastics industry. With the versatility of Leister's laser solutions, our customer-centric approach allows us to customize our solutions to fit individual applications and achieve desired results. (concept description p. 8 / 9)



Needle-protection caps (Radial welding)



Oil filter (Quasi-simultaneous welding)



Optical sensor (Simultaneous welding)



Hospital bed convenience remote control (Contour welding)



Cerumen protectors (Mask welding)



Liquid vapor separator LVS (GLOBO welding)



Door handle indicator light (Contour welding)



Multi well plate (Mask welding)



Head-up display (GLOBO-welding)



Cooling unit (Quasi-simultaneous welding)



Technical textile (GLOBO welding)



Piezo valve (Quasi-simultaneous welding)

Flexible system concepts

The engineers at Leister design and configure our laser systems to precisely meet the needs of our customer requirements and applications. The concepts are open for modification and offer sufficient space for customer-specific adaptations.



Infusion pump (Contour welding)



Filter housing (Simultaneous welding)



Soft Touch LED
(Quasi-simultaneous welding)

Laser plastic welding – focused to the point

Laser Plastic Welding –A business unit with many years of experience in the laser welding of plastics; Leister is the only provider of all standard laser welding processes in the industry including two patents for key laser delivery methods (mask welding and Globo welding).

Leister emphasizes consulting

Good consultation is the cornerstone for successful cooperation.

The Laser Plastic Welding business unit has many years of experience in the laser welding of polymers. We take pride in sharing our knowledge to help lock-in optimum process parameters together with our customers. From materials selection and design to integration and optimization, we are dedicated to being a resourceful partner every step of the way.

Leister has been the internationally leading provider of plastic welding machines for over 60 years. Through comprehensive theoretical and practical knowledge in plastics processing, we have established ourselves in the industry as a highly influential component to polymer bonding. Leister was one of the first companies to develop and manufacture laser system for welding plastics. Each of our developments helps to define the state of technological possibility.

With Leister you can expect

Project Support:

- Welding concept consultation
- Materials selection
- Pre-welding layout assessment

Process development:

- Evaluation of a suitable process window and suitable quality monitoring methods
- Component testing, assessment of welding quality
- Implementation of the process in the production environment

Robust Welding Systems:

- Production class turnkey workstations
- Flexible integration solutions
- Intuitive process software

Reliable Service:

- Convenient prototype and limited scale production
- Responsive online diagnostics, maintenance, and on-site assistance
- Preventative maintenance and routine machine inspection contracts available

Laser systems from Leister are used in a wide range of industries.



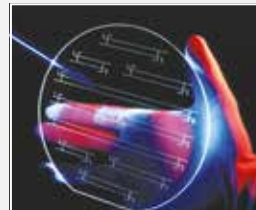
Medical:
Clean and emission-free welding



Automotive:
High reproducibility and process reliability in all dimensions



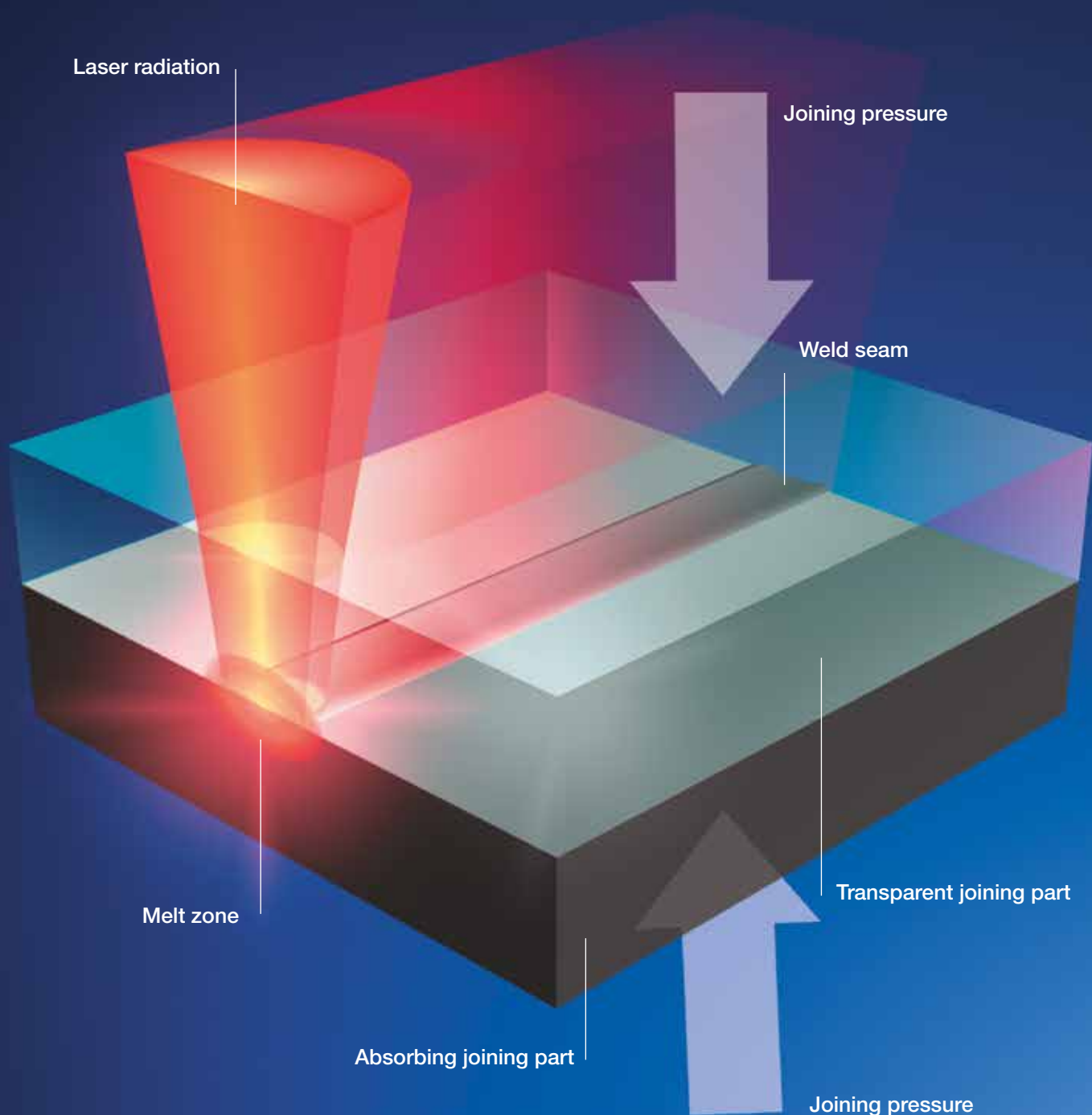
Electronics:
Vibration-free bonding without mechanical stress



Micro technology:
Precise and localized application of energy



Textiles:
Continuous and fast joining of plastic films and fabrics



The laser welding principle

In laser welding of thermoplastics, sometimes referred to as “laser transmission welding” or “through transmission IR welding” (TTIr), transparent and absorbing parts are bonded together.

The laser beam penetrates the transparent plastic and is converted to heat in the absorbing plastic. Since both parts are pressed together during the welding process, heat is conducted from the absorbing to the transparent plastic, allowing both materials to melt and create a bond. In addition to the externally applied clamping force an internal joining pressure is also gene-

rated through the thermal expansion of the laser-heated plastic parts. The internal and external joining pressures ensure strong welding of both parts.

Almost all thermoplastic plastics and thermoplastic elastomers can be welded with the laser beam – including ABS, PA, PC, PP, PMMA, PS, PBT as well as glass fiber reinforced plastic types. The achieved weld seam strength remains within the area of basic material strength.

Laser plastic welding - focused to the point

Laser Plastic Welding - Demanding manufacturing requirements and numerous innovations of recent years have paved the way for the plastics laser welding industry. This demand and rapid innovation together have fostered many new welding concepts and materials centered around the laser welding process.

Laser welding plastics is on the rise

The laser welding procedure has without question established itself in the plastic welding industry. The wide array of applications is explained quite simply by the advantages of the procedure and variety of welding concepts in contrast to the shortcomings of traditional processes and methods.

Leister was involved in the beginnings of this technology and developed new concepts by means of which were not only large three-dimensional components, but also small micro-components. Benefit from our know-how and have us work together with you to bring your application to market-readiness.

Nothing but advantages

- Contactless, flexible joining technique
- Minimum thermal load on the parts to be welded
- Small mechanical load
- Simple geometry for the seam
- No particle release
- Vibration-free processing
- Visually perfectly welded seam
- Highly accurate
- High welding strength
- No wear and tear to tools

Suitable materials

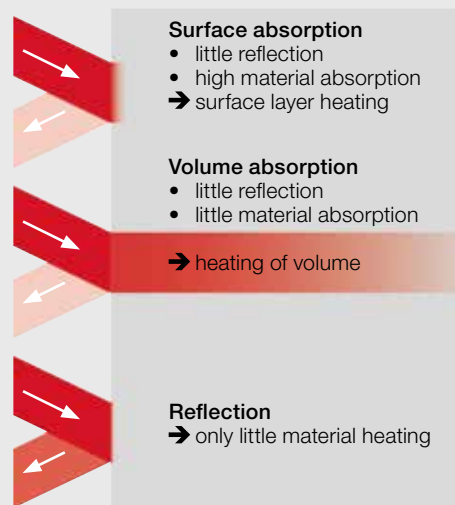
With a laser, practically all thermoplastic polymers and thermoplastic elastomers can be welded. The laser can also be used to weld fiberglass-reinforced or varying materials. A selection of tested material combinations is listed in the table on the following page.

Visual properties

The visual properties of the material combinations are decisive for the welding process. One joint partner must be transparent and one must be absorbent for the laser radiation used. Thermoplasts in their natural state are, as a rule, transparent for this radiation. Absorption is achieved with additives such as carbon black, or soot. Other additives also available on the market, among other things, allow for various color combinations.

Laser transmission

The visual properties as well as transmission characteristics of plastics are influenced by crystallization, filler materials, wall thickness and surface structures. An optimum absorption of the laser radiation lies in layers close to the surface and is achieved with suitable filler materials. In their original state, plastics are transparent for the radiation. The experts at Leister are ready and eager to evaluate your materials suitability for the laser welding process.



The table below shows an excerpt of possible material combinations for laser transmission welding. The material combinations are graded for weldability indicated by color. Many laser weldable combinations listed here cannot be welded by other traditional plastic welding methods.



Materials combinations

		Transparent welding partner																																		
		EVA	PE-LLD	PE-LD	PE-HD	PP	COC	COP	ABS	ASA	SAN	PMMA*	PC	PC/ABS	PS	SB	PET	PBT	PVC	PUR	POM	PA 6	PA 66	PA 11	PA 12	PPS	LCP	PES	PEI	PI	PSU	MABS	TPE	PEEK		
Absorbing welding partner	EVA	●																																		
	PE-LLD		●																																	
	PE-LD			●								●			●		●				●	●	●											●		
	PE-HD				●							●									●	●	●											●		
	PP					●						●									●	●	●											■		
	COC						●																													
	COP							●																												
	ABS								●	■	■	■	■	■	■	●		■	■	■		●						●				●	■	■		
	ASA								■	●	■	■	■	■	■				■	■									●			■				
	SAN								■	■	●	■	■	■	■	●		■	■	■											■				●	
	PMMA*			●	●	●			■	■	■	●	■	■	■	●			■	■		●									■				●	
	PC								■	■	■	■	■	■	■	●		■	■	■			●			●		■				■			●	
	PC/ABS								■	■		■	■	■	■			■	■	■			●			●										
	PS			●					●		●	●	●		●	●			■	●			●	●				●				●				
	SB															●																				
	PET			●					■		●		■					●	■	●																
	PBT								■	■	■	■	■	■		■		■	●	■			●					●				■				
	PVC								■	■	■	■	■	■		●		■	■	●												■			●	
	PUR																			●																
	POM			●	●				●			●									●								●							
	PA 6			●	●	●										●						●	■			●										
	PA 66				●	●							●		●	●						■	●											●		
	PA 11																							●												
	PA 12																		●			●	■		●				●							
	PPS										●		■								●	●	●			●			●							
	LCP																										●									
	PES								●				■						●		●							●		●		■			■	
	PEI																													●						
PI																														●						
PSU								●	●	■	■	●	●		●			●	■								■				●			●		
MABS								■																								●				
TPE					■							●										●											●			
PEEK			●							●	●								●									■				●		●		

- Excellent weldability if laser transmissibility is sufficient
- Good weldability if laser transmissibility is sufficient
- Potentially weldable; welding tests required

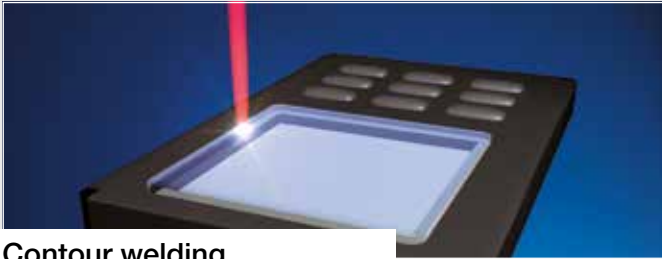
*PMMA: Caution with plate material: cast PMMAs are not weldable.

TPE: Thermoplastic elastomers (TPE) may be joined to other TPEs, of the same type or to form stable thermoplastics, if they are compatible with the base material of the TPE. Thermoplastic elastomers include TPE-O, TPE-U, TPE-V, TPE-C, TPE-S, TPE-A.

Laser Transmission: The degree of transparency of plastics is influenced by crystallisation, fillers, wall thickness, pigments and surface structure. Please check with your Leister contact for compatibility of the transparent joining partner.

Individual solutions for an extensive range of tasks

Laser welding is suitable for diverse areas and applications. To be able to provide the optimum solution for every application, Leister has developed various laser delivery concepts. Optimum solutions provide optimum customer profit returns through maximizing production volume, reduction of production waste, and end-user product satisfaction.

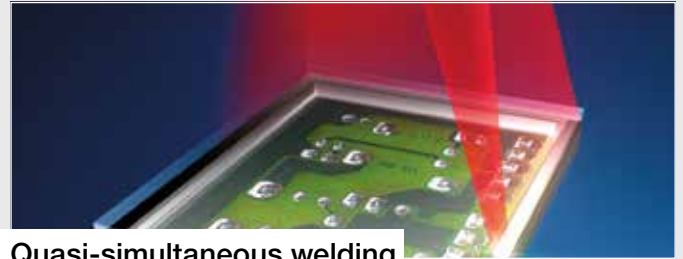


Contour welding

In contour welding, a laser spot is guided sequentially along a predetermined welding pattern, melting it locally. The welding volume remains comparatively small as a result of the geometric conditions, and extrusion of the melt is avoided. Relative motion, is achieved by moving the component, the laser, or a combination of both.

Characteristics and application:

- Laser beam focused to a spot
- Ability to change weld width by varying focal distance
- Arbitrary 2D joining line
- Ideal for frequent changes of component



Quasi-simultaneous welding

Two scanner mirrors deflect the laser spot and guide it along the welding contour at a very high speed. The joining surface is traversed several times per second, whereby the laser beam effectively heats and plasticizes the entire welding contour at the same time. Part tolerances can be melted and collapsed forming a welding bead, as both joining parts are pressed together during the welding process.

Characteristics and application:

- Laser beam focused to a spot
- Great flexibility
- Gap filling possible
- Suitable for small series and mass production

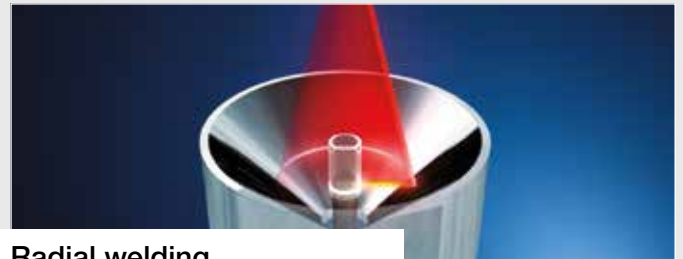


Simultaneous welding

In this technique, one or more lasers heat the entire weld path simultaneously. High power diode lasers are generally used as a result of their compact design. It is very easy to achieve ring and line-shaped welding seams. Almost any beam geometry can be generated by means of special, state-of-the-art beam shaping elements.

Characteristics and application:

- Short processing time
- No relative motion
- Gap filling possible
- Suitable for mass production



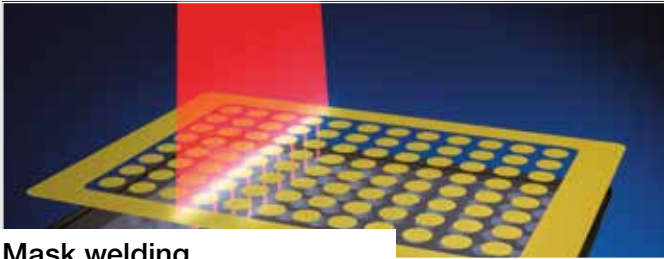
Radial welding

A unique method for bonding cylindrical components whereby a mirror deflects the laser beam such that it impinges radially on the outside symmetrical surface of the component. The tight (inner diameter / outer diameter) fit between the parts to be joined supplies the clamping pressure required for the welding process. The component remains in a fixed position during the circumferential, continuous welding process.

Characteristics and application:

- Suitable for different diameters
- No rotational movement
- High throughput
- No clamping device required

Leister offers systems for Contour, Simultaneous, Quasi-simultaneous and Radial welding. Process capability is further extended through the Leister patented processes of Mask, GLOBO, and Roller welding.



Mask welding

A mask is inserted between the laser source and the parts to be welded. A curtain or collimated laser light is moved across the entire joining area of the parts. The laser is only incident on the components where they are not obscured by the mask. Mask welding achieves a very high resolution, and is suitable for straight and curved weld lines, as well as for two-dimensional structures.

Characteristics and application:

- Line-shaped laser beam
- Any desired joining geometry within a plane
- Fast and flexible
- Suitable for micro and macro applications



GLOBO welding

A laser beam is focused at a point on the joining plane via an air bearing, frictionless, freely rotating glass sphere. The glass sphere not only focuses – it also serves as a mechanical clamping tool. While the sphere rolls on the component, it applies continuous pressure at a point on the joining plane. The glass sphere replaces the mechanical clamping device and expands the scope of laser welding to both continuous and three-dimensional applications.

Characteristics and application:

- Arbitrary joining geometries in two and three dimensions
- Welding without a clamping device
- Simultaneous application of clamping pressure/laser energy
- Suitable for robotic applications



Roller welding

Roller welding is based on the concept of GLOBO welding. A linear laser beam is focused through a glass roller onto the welding plane. The roller is optionally supported on one or two sides and the line widths are available in various lengths. Roller welding enables wider weld seams and hence greater strengths in the weld zone.

Characteristics and application:

- Any two-dimensional welding geometry along a line
- Welding without clamping device
- Different weld seam widths
- Suitable for robotic applications



The patented welding concepts Mask and GLOBO welding developed by Leister were granted the "Swiss Technology Award".

Manual workstations for every application

The NOVOLAS WS-AT is a manual workstation that can be equipped in a wide variety of ways. In addition to the standard version, expansions with rotary indexing table and conveyor belt are also available. These NOVOLAS laser systems are rounded off with comprehensive accessories. This means you can assembly a laser welding system that is tailored to your applications and processes.

NOVOLAS WS-AT

An all-modular, all-purpose system. It contains all components necessary for processing and is ready for connection of all options. You can select any additional components necessary and useful for your process. The NOVOLAS WS-AT laser system can be used in combination with multiple laser and optic modules, thus increasing productivity and efficiency of the production process. Cycle times are optimized by the implementation of a rotary table for automated or partially-automated handling of the components for processing. The control software includes modules for process control and is designed for integration of additional options and accessories. An online process control with good/bad evaluation is implemented into the control system. Immediately after installation of the turnkey system you can start with production.

Technical Data

Laser type		diode laser, fiber laser
Beam shape		spot or line
Laser power	W	spot up to 300, line up to 600
Line length	mm	18 – 95 LineBeam AT
Controller		PC control for laser, axes and process control
Multi laser		multiple lasers per system possible
Data interface		Windows Share
Control interface		customer specific, Ethercat, Profibus, CAN, Profinet, ...
Line voltage	V~	200 / 230 ± 10%, air-cooled also 110
Frequency	Hz	50 / 60
Max. current consumption	A	16 (depending on configuration)
Compressed air connection	bar	6
Cooling		water or air cooled, depending on configuration, exhaust air max. 55 °C
Environment conditions	°C	15 – 40, air cooled up to 35
Dimensions (L x W x H)	mm	standard model 860 x 1240 x 1860, without warning lamp and monitor
Weight	kg	approx. 400 (depending on configuration)
Laser class		1 (with pilot laser 2/2M / 3R)
Operating interface		Leister HMI

CE-conform. Technical data subject to change. Further options on request.

- Turnkey laser system for all laser-welding concepts
- Comprehensive and intuitive human machine interface
- Use of multiple laser and optic modules per system increases throughput and efficiency
- Online process control integrated in system control
- Modular design for customization
- Easy to integrate into existing conveyor systems
- Rotary indexing table with 2-way or 3-way separation

NOVOLAS WS-AT:

Laser welding system, configured as a manual workstation



Table version of a manual workstation

The NOVOLAS TTS (Table Top System) impresses by its functionality on the smallest possible space. This compact manual workstation combines all of the advantages of the laser welding of plastics in an inexpensive and simple programmable system.

NOVOLAS TTS

The compact design of the NOVOLAS TTS contains all of the components necessary for the laser welding of plastics. The laser unit and the processing cell can be set up separately from one another and can thus lend themselves to optimum space utilization in production. Despite the small processing cell, the processing and/or welding surface is 100 x 100 mm.

The NOVOLAS TTS is controlled via a Mini PLC and programmed with an HMI (Human Machine Interface) software developed by Leister. The HMI transfers the process-relevant data into the system where it can then be stored with reference to a particular project.

The welding contour can be programmed individually in the CNC code while other parameters such as laser power and speed can simply be specified.

Once implemented, the system functions autonomously. Input components such as keyboard and monitor can be separated from the system for production purposes. External intervention via a Remote Desktop is also possible if desired.

- Compact and efficient laser welding system
- Investment-optimized production system
- Several applications can be adjusted for production
- Non-process-specific HMI software
- Laser Safety Class 1

Operation cell:

compact and efficient



Technical data

Laser type		Diode laser, air-cooled
Beam shape		Spot, Line, Ring, DOE
Laser power	W	40 (max.)
Pilot laser		LED
Processing area	mm	100 x 100
Max. travel speed	mm/s	200
Max. clamping force	N	1372
Air pressure	bar	6
Control		Embedded PLC for process control of laser and axes
Dimensions (L x W x H)		
Processing cell	mm	500 x 585 x 525
Basic AT compact	mm	550 x 500 x 325
Weight		
Processing cell	kg	~ 65
Basic AT compact	kg	~ 35
Mains voltage	V ~	100 – 240
Max. power consumption	A	10
Frequency	Hz	50 / 60
Cable length between the modules	mm	2000
Environmental conditions	°C	15 - 40
Operating interface		Leister HMI

CE-conform. Technical data subject to change. Further options on request.

NOVOLAS Basic AT Compact:

compact and cost-effective diode laser system



NOVOLAS HMI (Human Machine Interface) software

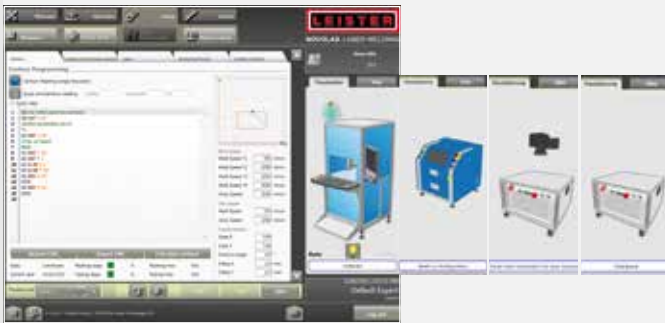
A process-mapping software that is used across the entire product range. It is configured for the modules used and depicts all of the adjustable processes.

Welcome

Both the language and the machine user access level are assigned at the time of user login. Three levels can be selected that are password protected:

- Setup
- Production
- Service

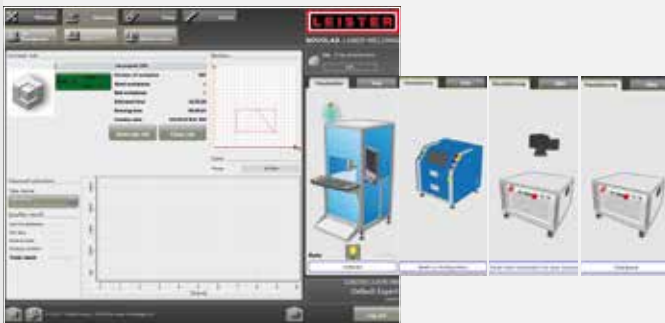
On the right-hand side of the monitor screen, the laser system is depicted, depending on the application.



Setup mode

In Setup mode, process-relevant parameters are set and released for the operator:

1. Movement: Programmable in G-code
2. Laser: Power and process modes
3. Clamping fixture: Function of the clamping system and its modes
4. Quality monitoring: Selection and type of monitoring



Production mode

In Production mode, the operator can:

1. Select a processing program
2. See the number of welded parts that are evaluated as good (green) or bad (red)
3. Select a released quality monitoring that is displayed as a curve in the lower area



SystemOverview

A software that is supplied along with every NOVOLAS Basic AT system. The software visualizes the conditions of the individual modules and supports the integration and the setup of the process. In the event of service cases, the system can be analyzed and updated with this software. Remote-controlled intervention via an Internet access is already pre-installed.

Quality control

Monitoring and qualification of the welding result is adapted to the process on the basis of optional process monitoring methods. Reject procedures that stabilize the overall process can be realized on the basis of these methods.

Process monitoring

Process control in the production process

Pre-process

- Measurement of relevant dimensions
- Flatness measurements
- Measurement of optical characteristics
- Component presence check
- Component positioning check
- Fixture encoding
- Component encoding



Post-process

- Optical inspection
- Pressure decrease test
- Vacuum decrease test
- Destroying test methods
- Burst pressure
- Thin sections
- Tensile test

In-process

- Measurement of Laser power
- Measurement of welding speed
- Pyrometry
- Component position and melting path
- Melting speed
- Clamping force
- Optical monitoring

Monitored welding results

A combination of these three areas often leads to the optimum result. In-process monitoring constitutes online control that can be realized, for example, with a pyrometer for temperature monitoring or a path/force measurement. These options are tailored to the application and the welding method being used.

Pyrometer

- Process control and regulation according to temperature
- Temperature range 100 – 400 °C

Path/force measurement

- Process control and regulation according to joining distance
- Resolution 0.01 mm with 25 mm measuring range
- Resolution 10 N with 2000 N measuring range



The modular, integratable and powerful laser systems

NOVOLAS Basic AT and Basic AT Compact: The combination of these laser systems with the welding principles results in a multitude of options that are a match for any challenge. The systems are designed for integration in production systems and structured for the laser welding of plastics.

NOVOLAS Basic AT and Basic AT Compact

NOVOLAS Basic AT and Basic AT Compact are optimized for the integration into production lines and manufacturing cells. The laser systems can easily be configured for various requirements, due to their consequent modular design. Almost any welding concept can be realized with the different diode lasers and optic modules. The mutually matched components provide high process stability as well as cost-saving production. The use of multiple laser and optic modules in a single system enables an efficient way to increase throughput which also helps reducing costs.

- Flexible and cost-effective; suitable for diverse applications
- Individual control via customer supplied guidance system
- Multiple laser and optic modules in one system possible
- Very high throughput possible with an appropriate upgrade
- Modular design with various optional components
- Rapid - plug-in connections
- Interlock 2-channel in accordance with Performance Level e
- Two Emergency STOP concepts:
 - 1) Internal (E-STOP switched in series)
 - 2) External (externally controlled E-STOP status)

Technical Data

Laser type		diode laser, fiber laser
Beam shape		spot or line
Laser power	W	spot up to 300, line up to 600
Line length	mm	18 – 95, LineBeam AT
Multi laser		Up to 4 laser modules per system possible
Pilot laser / aiming laser	mW	< 3 (Laser class 2/2M / 3R)
Data interface		digital/analog I/O, RS232, RS422/485
Line voltage	V~	200 / 240
Basic AT		for water-cooled lasers
Line voltage	V~	110 – 240
Basic AT and AT Compact		for air-cooled lasers
Frequency	Hz	50 / 60
Max. current consumption	A	10 – 16 (depending on configuration)
Cooling		water or air cooled (depending on configuration)
Environment conditions	°C	15 – 40, air cooled 15 – 35
Dimensions		
Basic AT compact	mm	550 x 500 x 325 (6 HE)
Basic AT		550 x 780 x 878 – 1288 (12 – 24 HE)
Weight	kg	starting at 35 (Basic AT Compact)
Laser class		4

CE-conform. Technical data subject to change. Further options on request.

NOVOLAS Basic AT:

Flexible, modular laser system for integration



NOVOLAS Basic AT Compact:

Compact and cost-efficient laser system featuring an air-cooled diode laser



Integration of the Basic AT systems

The NOVOLAS Basic AT systems have been prepared for integration. Their modularity supports complex integrations, both in manual workstations and in fully automated production operations.

Integration solutions

NOVOLAS Basic AT systems are designed for customer-specific integration. Basic options have been prepared and are applied depending on the integration depth.

The systems are connected to the customer's main system using quick-coupling connections. These couplings are also provided prior to delivery of the system by request. This allows the system to be connected immediately upon delivery.

Each system is equipped with processing optics and suitable software. Monitoring functions and integration aids support installation into the customer-specific systems.



Turnkey system

If customer requirements cannot be met with the NOVOLAS WS-AT, realizing the process with an integrator is an option.

The system shown in the illustration is equipped with a robot, rotary indexing table, and Globo optics. It is operated with a NOVOLAS Basic AT.

Production line

Another integration example is provided in the illustration to the right, with a Basic AT compact that is being used in a fully automated production line. The laser system can be installed independently of the processing location, so that positioning is flexible.



Optics for NOVOLAS laser systems

The Leister concept encompasses two basic optics. They model the various welding concepts by means of exchangeable, beam changing optics modules.

AT / BT optics concept



BT optics

- Optical components only

Spot

Various focal distances and focus diameters



Field

Various edge lengths



DOE

Drawer system, therefore easily exchangeable

Scanner

F-theta lenses for various fields of work:

980 nm	1070 nm
100 x 100 mm	100 x 100 mm
240 x 240 mm	200 x 200 mm
350 x 350 mm	360 x 360 mm

The BT (base technology) optics are small and compact, and only equipped with optical elements. The AT (advanced technology) optics on the other hand offer enhanced process stability through integrated monitoring electronics.



AT optics

- Optical components
- Performance monitoring
- Fiber connection monitoring
- Optional pyrometer

Line

Various line lengths



Ring

Various ring diameters and ring widths

Radial Optic 38

For components with rotational symmetry (≤ 38 mm)
Laser protection can be integrated



Optic for NOVOLAS laser systems

Leister's portfolio of laser systems is rounded off by a multitude of accessory parts co-ordinated with the systems. With these accessory components developed for various applications and requirements, the systems can be optionally equipped according to customer specifications.



Line laser LineBeam AT

- Line lengths 18 – 95 mm
- Laser power up to 600 W
- Homogeneous energy density distribution due to special optics
- Pilot beam for adjustment
- Field lens optional
- Area lens optional



Collimation module for LineBeam AT

- Field lens for collimation
- Line length 38 mm, 48 mm
- Homogenous energy distribution due to special optics
- Pilot beam for adjustment
- Area lens optional



GLOBO optic

- Integrated optical and clamping system
- Glass sphere on air bearing
- Pneumatic clamping device
- Adjustable welding seam width
- Pyrometer optionally available



Globo ball housing laser protected

- coupling nut with enlarged flange
- enhanced laser safety
- easy exchangeable



Roller Optic – double sided bearing

- Localized pneumatic pressure without additional clamping device
- Equalized pressure distribution by pivoting roller
- Line length 3 – 6.7 mm
- Line length 29 – 30 mm (LineBeam)



Roller Optic – single sided bearing

- localized pneumatic pressure without additional clamping device
- equalized pressure distribution by pivoting roller
- line length 3 – 4.9 mm



Radial Optic 68

- For rotationally symmetrical components ($\leq \varnothing 68$ mm)
- Possible to integrate laser safety
- Maximum workpiece height 60 mm, independently of diameter

For Mask welding, apart from the special line lasers, masks are also offered which can be individually manufactured according to customer specifications. Special clamping devices and customer-specific optics belong to Leister's performance spectrum.

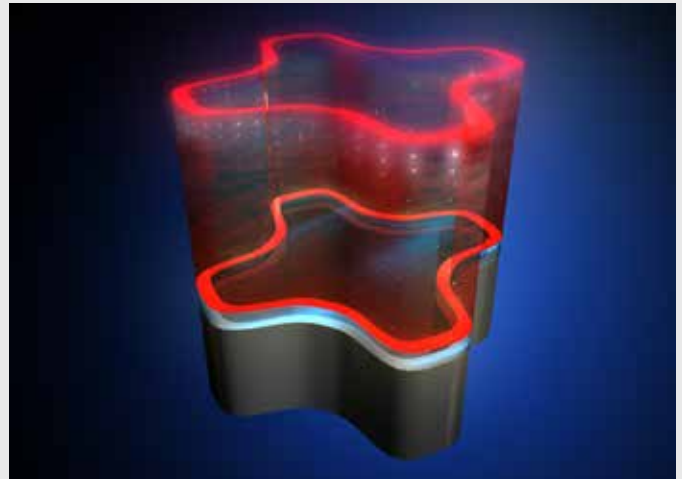
Diffractive optical element (DOE)

A DOE is an optical beam forming element. DOEs are used for the simultaneous welding of point symmetrical contours or for process-optimized beam forming (M-shape) in contour or quasi-simultaneous welding.

Welding with M-shape improves heat distribution in the welding seam and thereby enlarges the process window.

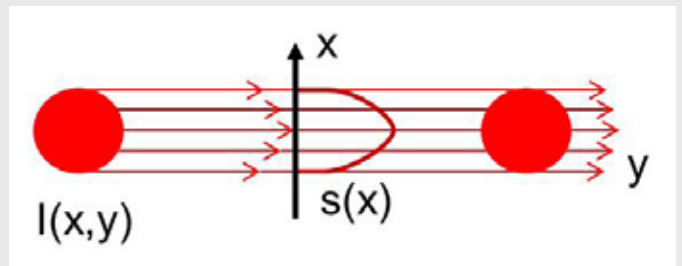
DOEs are also used in the scanner optics in order to configure various welding seam widths with the same working distance.

Please consult your qualified personnel for laser technology to determine which options are best for your application.



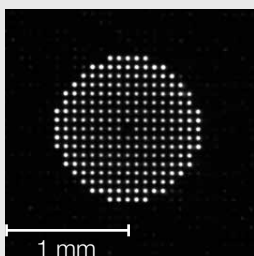
DOE generating an M-shape

DOEs, generating an M-shape, are used to optimize the energy distribution in contour- or quasi-simultaneous welding. During relative movement of the laser beam to the component, the energy distribution $s(x)$ across the weld seam depends on both, the intensity distribution $I(x,y)$ and the speed. A tophat or Gaussian intensity distribution causes an energy distribution with a falling edge during motion (s. figure). Thus, temperature rises more in the middle of the welding seam.

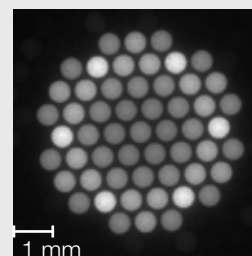
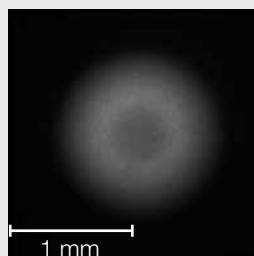


A DOE, generating an M-shape, counteracts with a decreasing power density distribution from outside inwards. To achieve this, the laser beam is multiplied, rearranged and weighted by performance. The complete irradiated area is larger depending on the totality of single beamlets. The good beam quality of fiber lasers support a defined figure of single beams in a plane. (s. figure). The single beams of diode lasers, however, are relatively large with min. 200 μm and overlap if the overall diameter should stay small (s. figure).

DOE (M-shape) with Fiber laser



DOE (M-shape) with Diode laser



Services

The **Laser Plastic Welding** Business Unit understands 'Service' as covering everything from product development through series readiness to after sales service. We know the importance of responsive, reliable service and take every measure to ensure it sets us apart from the rest.



Pre-development

The requirements of a component often determine the joining process. We will be happy to advise you about materials and welding processes for these kinds of individual applications. Afterwards, we support you with your initial welding attempts and their evaluations in one of our optimally equipped applications laboratories.

In addition to state-of-the-art laser welding systems, our applications laboratory also has available extensive opportunities for component testing.

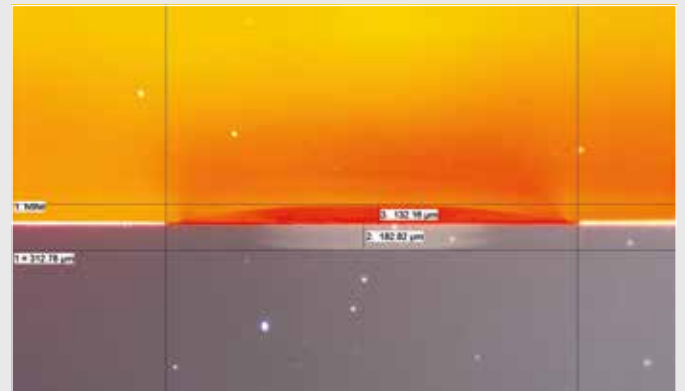
An optimum welding seam layout is just as important for the joining of components as the associated process. Profit from our know-how in plastics processing and in joining techniques in order to be a step ahead even in the pre-development stage.

Process development and optimization

We support you with the selection of the optimum process and by the determination of process data.

For this, all relevant parameters are recorded and a process window is defined which lays the foundation of a machine concept. Use our knowledge as well to optimized processes that are already established.

Section through a laser welding seam of 3 mm width.





Systems integration

Manufacturing a product is made up of individual process steps. Intelligent integrations are the solution in the linkage of these processes.

The NOVOLAS products are specially developed for the welding of plastics with lasers and offer versatile integration options. Use this advantage and plan a professional integration and process adjustment with our specialists.

Machine concepts

Our laser systems are based on standard components that can be expanded in accordance with customer specific needs.

These expansions are also available to you and are comprised of, among other things:

- Coding options for fixtures and components
- Camera-based parts detection or process monitoring
- External laser power measurement
- Good/bad part evaluation with disposal container
- Workpiece boxes
- Customer-specific colors

Simply ask about the possibilities.

After Sales Service

Laser welding systems are investment goods that require regular care and maintenance. Our maintenance contracts are tailored to the systems and follow specified time intervals. We support our customers with an After Sales Service that performs:

- Technical support
- Remote analysis via the Internet or
- On-site repairs in the event of system errors

We are represented worldwide by Leister national companies and distributors and are also therefore in a position to supply spare parts at short notice.



Leister Lasersystems: international success

Laser systems and components made by Leister have successfully been in use throughout the world for many years. Below, you can find a small selection of the numerous customers who put their trust in Leister.



Leister delivers performances

Leister is the worldwide leader in the field of plastic welding and industrial hot-air applications. For over 60 years, Leister has been the worldwide leader in the field of plastic welding and industrial hot-air applications. Leister is proud to develop and produce all products in Switzerland – so you can always rely on the proverbial Swiss made quality.

Over 98 percent of our products are exported. With an established, dense network of 120 sales and service centers all over the globe, you will find a Leister partner guaranteed. We are local worldwide.



Leister Corporate Center in Kaegiswil, Switzerland.

LEISTER
PLASTIC WELDING



For decades now, Leister has been the worldwide market leader. The performance and reliability of our products makes Leister the first choice. Our tools are used in roofing, billboards, tarpaulins, civil engineering, tunneling, landfills, plastic fabrication, flooring and shrinking to name a few.

LEISTER
LASER PLASTIC WELDING



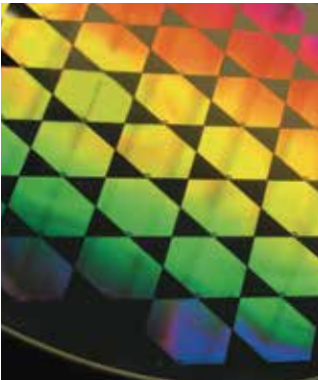
Leister’s innovative laser welding solutions provide alternative production processes in automotive, medical, sensor, electronics and textile manufacturing as well as microsystems technology. The laser-systems can also be used in the field of process heat.

LEISTER
PROCESS HEAT



Hot-air is increasingly deployed in industrial processes. Typical applications include activating, heating, curing, melting, shrinking, welding, sterilizing, drying and warming to name a few. Leister customers profit from our extensive engineering knowledge and benefit from our recommendations during the conceptual design of hot-air applications.

axetris
Company of the Leister Group



Axetris works to ensure our customers remain ahead of their field, now and in the future. We continue to actively develop and produce next-generation sensors and optical components in our cleanroom today.

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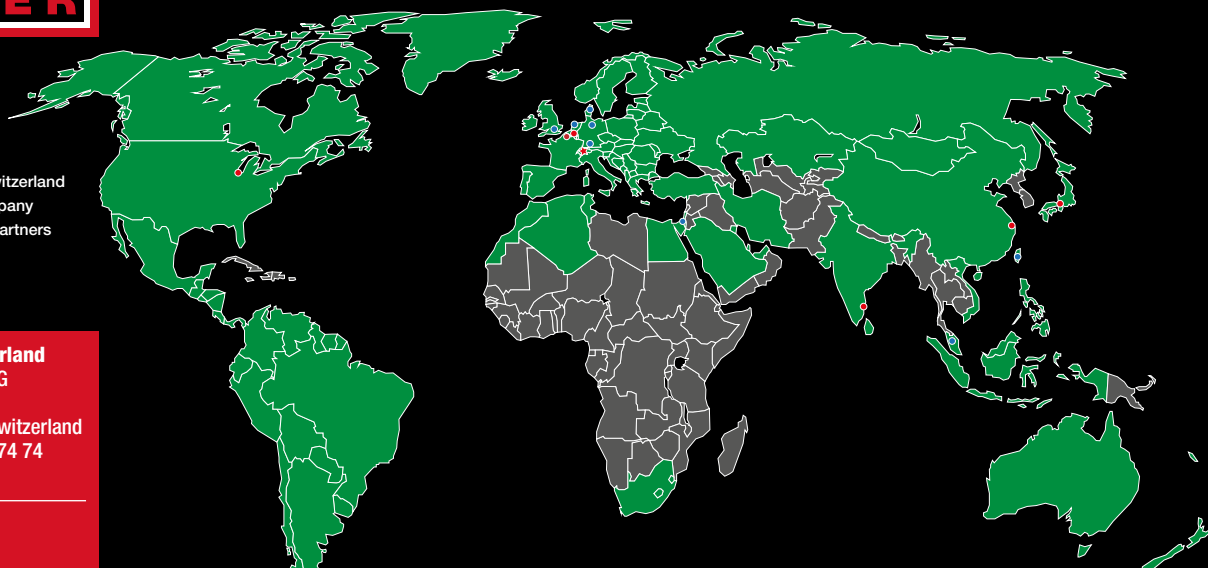
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