Laser Plastic Welding 2015/16

Innovative and flexible.

Version 4.0
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)
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.
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 generated 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 11 | PA 12 | PPS | LCP | PES | PEI | PI | PSU | MABS | TPE | PEEK |
|-----------------------------|-----|-------|------|------|----|-----|-----|-----|-----|-----|------|----|--------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|-----|-----|-----|-----|-----|
| 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

- **Green dot:** Excellent weldability when a laser transmission is present
- **Blue dot:** Good weldability when a laser transmission is present
- **Black dot:** Weldability is possible but should be checked with trial runs
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

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

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

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”. 

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*www.leister.com* | *General Catalog Laser Plastic Welding* | 9
Manual workstations for every application

NOVOLAS WS-AT: The 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 assemble 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser type</td>
<td>diode laser, fiber laser</td>
</tr>
<tr>
<td>Beam shape</td>
<td>spot or line</td>
</tr>
<tr>
<td>Laser power</td>
<td>W</td>
</tr>
<tr>
<td>Spot line up to 300, line up to 600</td>
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</tr>
<tr>
<td>Line length</td>
<td>mm</td>
</tr>
<tr>
<td>18 – 95 LineBeam AT</td>
<td></td>
</tr>
<tr>
<td>Controller</td>
<td>PC control for laser, axes and process control</td>
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<tr>
<td>Multi laser</td>
<td>multiple lasers per system possible</td>
</tr>
<tr>
<td>Pilot laser / aiming laser</td>
<td>mW &lt; 3 (Laser class 2 / 2M)</td>
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<tr>
<td>Data interface</td>
<td>Windows Share</td>
</tr>
<tr>
<td>Control interface</td>
<td>customer specific, Ethercat, Profin, CAN, Profinet, ...</td>
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<tr>
<td>Line voltage</td>
<td>V~</td>
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<tr>
<td>200 / 230 ±10%</td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>Hz</td>
</tr>
<tr>
<td>50 / 60</td>
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<tr>
<td>Max. current consumption</td>
<td>A</td>
</tr>
<tr>
<td>16</td>
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<tr>
<td>Compressed air connection</td>
<td>bar</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Cooling</td>
<td>water or air cooled, depending on configuration, exhaust air max. 55 °C</td>
</tr>
<tr>
<td>Environment conditions</td>
<td>°C</td>
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<tr>
<td>15 – 40, air cooled up to 35</td>
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<tr>
<td>Dimensions (L x W x H)</td>
<td>mm</td>
</tr>
<tr>
<td>standard model 860 x 1240 x 1860, without warning lamp and monitor</td>
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</tr>
<tr>
<td>Weight</td>
<td>kg</td>
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<td>approx. 400 (depending on configuration)</td>
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<td>Laser class</td>
<td>1 (with pilot laser 2 / 2M)</td>
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<td>Operating interface</td>
<td>Leister HMI</td>
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<td>CE-conform. Technical data subject to change. Further options on request.</td>
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</tbody>
</table>

- 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

Technical data

<p>| | |</p>
<table>
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<tr>
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<td>Pilot laser</td>
<td>LED</td>
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<td>Max. travel speed</td>
<td>mm/s 200</td>
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<tr>
<td>Max. clamping force</td>
<td>N 2350</td>
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<td>Air pressure</td>
<td>bar 6</td>
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<td>Control</td>
<td>Embedded PLC for process control of laser and axes</td>
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<td>Dimensions (L x W x H)</td>
<td>mm 500 x 585 x 525</td>
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<td>Processing cell</td>
<td>mm 550 x 500 x 325</td>
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<td>Basic AT compact</td>
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<td>Mains voltage</td>
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<tr>
<td>Frequency</td>
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<td>°C 15 – 40</td>
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<tr>
<td>Operating interface</td>
<td>Leister HMI</td>
</tr>
</tbody>
</table>

Operation cell:

compact and efficient

NOVOLAS Basic AT Compact:

compact and cost-effective diode laser system

www.leister.com
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.
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)

NOVOLAS Basic AT:
Flexible, modular laser system for integration

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<td>18 – 95, LineBeam AT</td>
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<tr>
<td>Multi laser</td>
<td>Up to 4 laser modules per system</td>
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<td>possible</td>
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<td>mW</td>
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<td>RS422 / 485</td>
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<td>Line voltage</td>
<td>V~</td>
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<td>Basic AT</td>
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<td>AT and AT Compact</td>
<td>110 – 240 for air-cooled lasers</td>
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<tr>
<td>Frequency</td>
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<td>50 / 60</td>
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<tr>
<td>Basic AT compact</td>
<td>550 x 500 x 325 (6 HE)</td>
</tr>
<tr>
<td>Basic AT</td>
<td>550 x 780 x 878 – 1288 (12 – 24 HE)</td>
</tr>
<tr>
<td>Laser class</td>
<td>4</td>
</tr>
</tbody>
</table>

NOVOLAS Basic AT Compact:
Compact and cost-efficient laser system featuring an air-cooled diode laser
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. 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.

Spot optic AT
- A range of focal lengths
- Fiber connection control
- Pyrometer (optional)
- Internal laser power measurement

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

Spot optic BT
- A range of focal lengths
- Reduced to optical elements
- Small and compact

Roller optic
- Localized pneumatic pressure without additional clamping device
- Equalized pressure distribution by pivoting roller
- Different body configurations
- Line width range 3 – 30 mm
- Single- or double-sided bearing-mounted

Ring optic
- Nearly any ring diameter 1.8 – 78 mm
- Selectable welding width
- Homogeneous energy distribution

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

Radial optic 38
- For rotationally symmetrical components (≤ Ø 38 mm)
- Possible to integrate laser safety

Radial optic 68
- For rotationally symmetrical components (≤ Ø 68 mm)
- Possible to integrate laser safety
- Max. workpiece height 60 mm, independently of diameter
Quality monitoring

For qualification of welding results, different process related monitoring methods can be applied. A greater degree of production process stabilization is achievable through quantifiable active process controls.

Scanner optic
- F-Theta lense
- Working field 100 x 100 mm
  240 x 240 mm
- Constant focus diameter
- Programmable weld contour
- Pyrometer (optional)

Diffractive Optical Element (DOE)

DOEs are optical elements for beam formation. They are used for the simultaneous welding of point-symmetrical contours or for the process-optimized beam formation (M-shape) with contour or quasi-simultaneous welding. Welds with M-shape improve the heat distribution in the welding seam, thus enlarging the process window.

In addition DOEs are used in scanner optics in order to set various welding seam widths at the same working distance.

Together with the Leister specialists, please check which option is the best for your application.

Process monitoring

Process monitoring during the laser welding of plastics can be divided into three types:

1) Pre-process monitoring
2) In-process monitoring
3) Post-process monitoring

It is often the case that a combination of these three types leads to the optimum result. In-process monitoring is an online monitoring that can be implemented, for example, with a pyrometer for temperature monitoring or by using a distance/force measurement. These options are set depending on the application and welding process used.

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

Path/Force measurement
- Process control and adjustment according to welding length
- Resolution 0.01 mm at 25 mm measuring path
- Resolution 10 N at 2000 N measuring range
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.

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’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.

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 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.
We are local. Worldwide.

Distribution addresses of the Leister Sales and Service Centers

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www.leister.com/laserplasticwelding