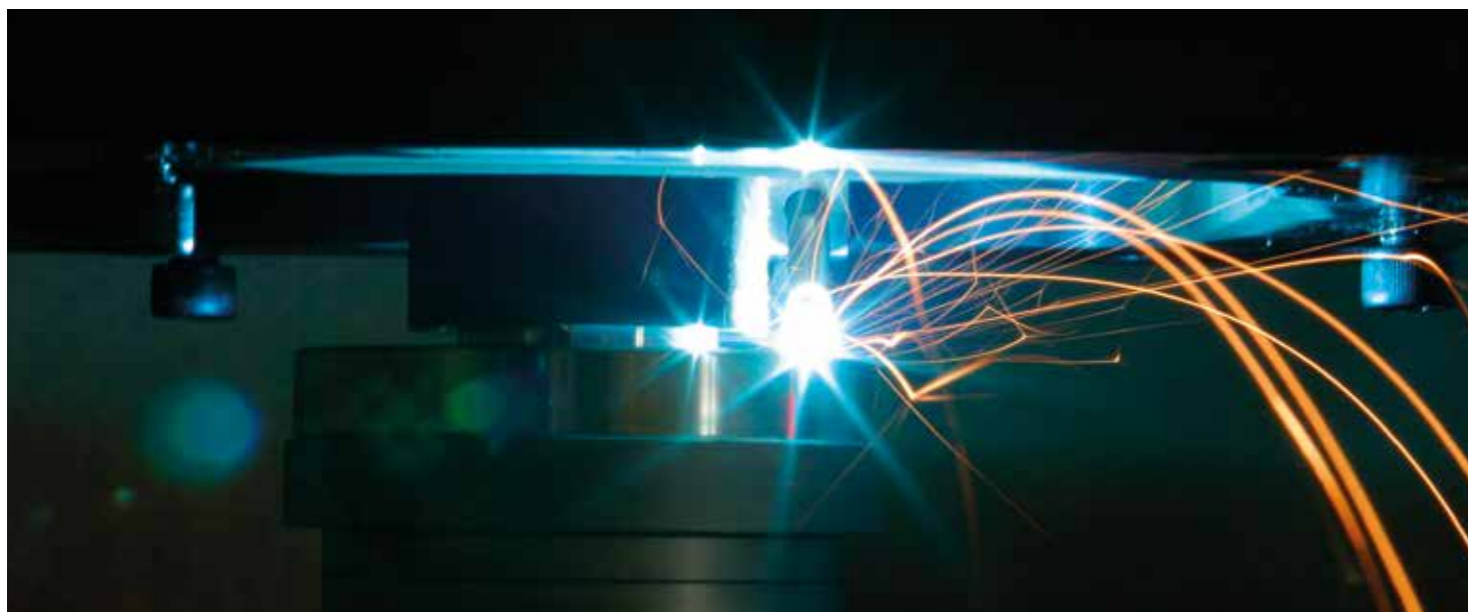


Laser-based systems

Welding and special-purpose applications



Combining the expertise in laser applications with an extensive know how in automation, Fives offers high-productivity systems

Welding - 3-D Cutting - Cladding - Additive manufacturing
Drilling - Hardening - Wire stripping

TYPICAL APPLICATIONS

Automotive

- Gearbox & transmission components
- Driveline components
- Engine parts (shafts, turbochargers,...)
- Axle components
- Tubular chassis components
- Seat recliners

Aerospace & other industries

- Cutting/welding of aluminum alloy parts
- Micro drilling (aero engines)
- Cutting of tubular products
- Laser surfacing of used parts (repair of turbine blades)
- Laser cladding to build up near net shape parts



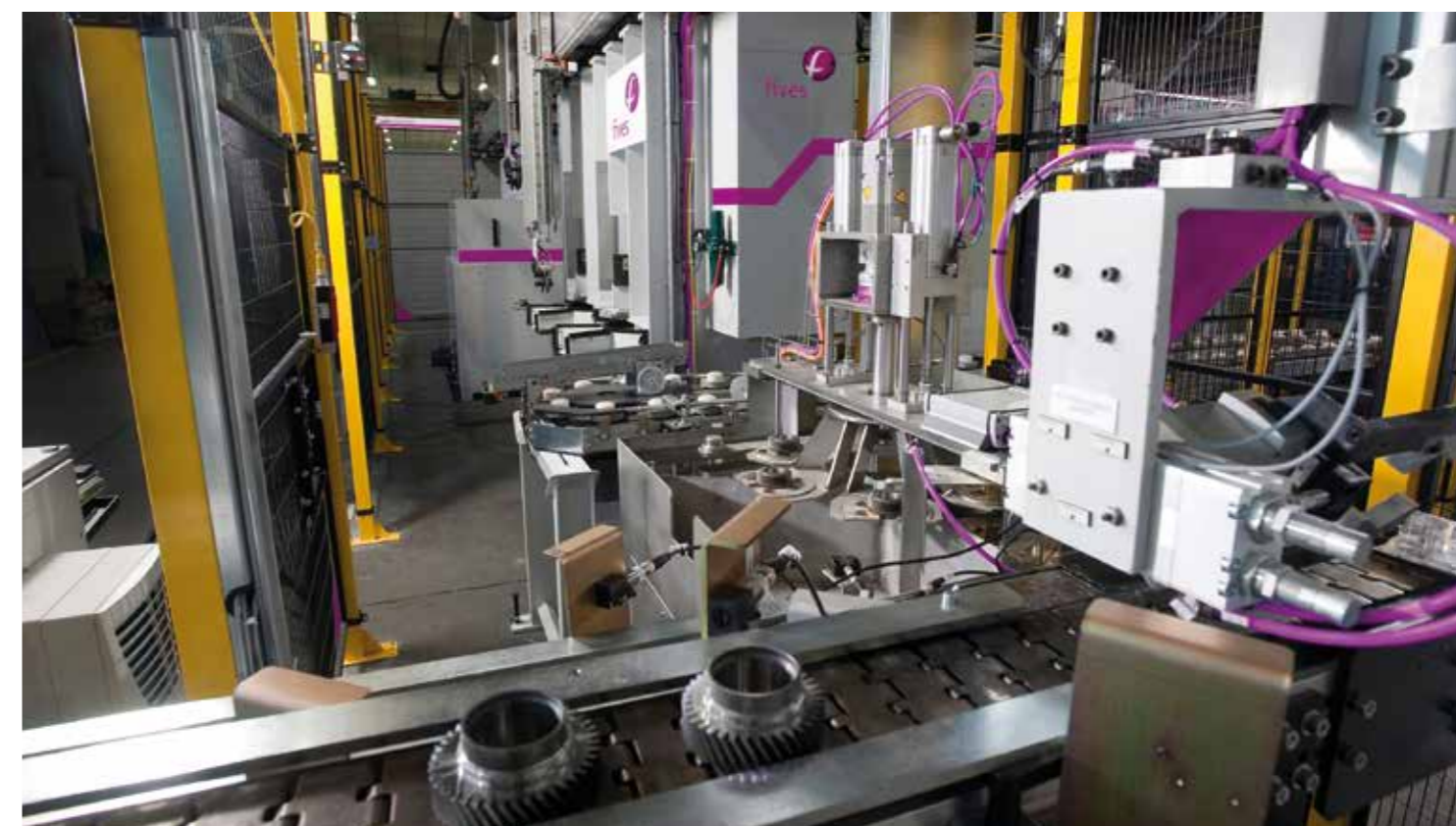
Laser welded components of Manual Transmission gearset, Dual Clutch Transmission



Laser cutting



Laser Metal Deposition



With over 30 years of experience, Fives is a global player in the design and manufacturing of systems using high power laser (≥ 1 kW) for the welding of mechanical parts. This expertise is now extended to other laser-based applications such as 3-D cutting, wire stripping, hardening, cladding and additive manufacturing.

- From Standalone machines to Multi-featured laser-based assembly lines
- High-production systems
- Standard modular design
- Ability to integrate all types of laser sources: CO₂ Lasers, Solid-state Lasers (YAG, fiber, diode Laser)

Fives proposes both standalone machines and multi-featured laser-based assembly lines as well as the related automation systems



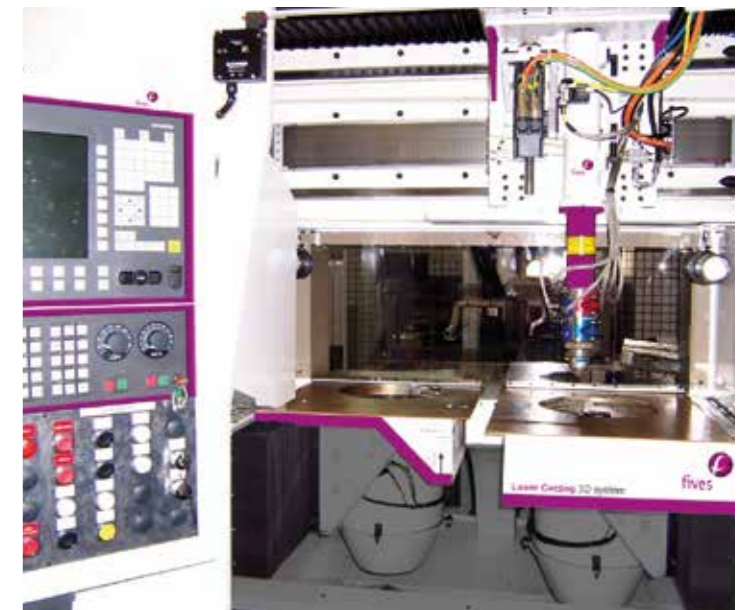
Laser welding cell for transmission shafts

3-D LASER CUTTING SYSTEMS

Ideally suited to demanding cuts

- Systems delivering a high-productivity along with a high accuracy
- Little or no dross/burr on exit side/minimal Heat Affected Zone (HAZ)
- Minimal tooling cost
- Ideally suited to challenging edge cuts of tubular parts (axle beams)
- Steels & non-ferrous metals
- Typical cutting thickness: up to 15 mm (for steel)
- Customized machine feeding: gantry, robot, manipulator, ...
- Range of laser power: 1 to 10 kW

Complementary Fives modules are integrated into the laser cutting cells for achieving the upstream and downstream operations.



Laser cutting of clutch discs

STANDALONE SYSTEMS



Laser welding machine for speed gears

Compact and multi-purpose equipment (welding, cutting, hardening, drilling, ...)

- Based on a standard modular design fitted with customized fixtures (for round parts, shafts,...)
- Manual loading upgradable to a fully automated system
- Standalone machine or integrated into a full-featured assembly cell
- Additional functions can be implemented on purpose (pressing, heating, control...)
- Available in dual station version:
 - 2 rotating tables
 - 2 spindles
 - 2 upper stops
 - 1 shared focusing head
- Integrated automatic loading/unloading (input/output conveyors)

5-AXIS LASER CENTERS/ ADDITIVE MANUFACTURING (AM)



Ideally suited to laser surfacing for the accurate repair of used parts and 3-D manufacturing of complex geometry products

- 5 axis available: 3 axes (X Y Z) + 2 axes (B C)
- Powdered metal feeder and nozzle(s) for Laser Metal Deposition (LMD) & laser assisted additive manufacturing
- Laser surfacing for the accurate repair of used parts (turbine blades) & 3-D manufacturing of complex geometry products (near net shape production for aerospace, mining, energy, medical industries)
- Adaptable working volume up to 1,000 x 700 x 1,000 mm
- Bi-material or multi-material manufacturing

This system can be also used for 5-Axis laser welding, cutting, drilling and hardening operations.

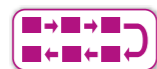
FULLY-AUTOMATED LASER ASSEMBLY LINES

Modular, multi-featured concept & fully automated

The welding operation is supported by a Fives compact welding machine. Other systems commonly integrated into the laser welding lines:



- Washing & drying module
- Pressing module
- Heating module
- In process & final welding seam control modules
- Brushing, deburring module
- Marking module
- Customized automation & interlinking solutions allowing a flexible layout:
 - Buffer magazine
 - Conveying system
 - Gantry
 - Robot
 - Manipulator



Automated laser welding line for automatic transmission gearset

BENEFITS

Laser

- Energy delivered to the workpiece is minimized (minimal heat affected zone)
- High speed processing
- The beam can be guided into hard-to-reach areas
- Operations are performed under normal atmospheric pressure
- Unrivaled repeatability
- Excellent quality finish

Industrialization

- Automation for high-volume production
- Industrial mastery of laser process quality
- Highly reliable systems with low maintenance cost
- Laser safety expertise

Scope of use

Range of laser power	1 to 10 kW
Types of laser	CO ₂ Lasers Solid-state Lasers (YAG, fiber and diode Laser)

CUSTOMER SUPPORT

- Global Support Network
- Preventive maintenance, Remote maintenance
- Process support: training, trials, ...
- Spare parts