ROBOTIZED LASER COMPLEXES

JOINT STOCK CORPORATION
SHIPBUILDING & SHIPREPAIR
TECHNOLOGY CENTER

ROBOTIZED COMPLEX FOR PRECISE LASER CUTTING AND WELDING

The system is intended for automatic laser cutting and laser arc welding of complex-shaped 3D structures made of steel or various aluminium alloys for manufacturing marine engineering articles and ship hull structures.

Main functional units of the complex:

- Ytterbium fiber-optic laser;
- Optical switch, allowing beam transfer through optical fiber in turns to each of laser modules;
- Robot manipulator;
- Control console;
- Laser-arc module with optical head for welding and special welding torch with collision sensor;
- System for pointing to welding butt;
- Video monitoring of welding process;
- Module for 3D laser cutting with automatic system for maintaining height above the processed surface.

Main advantages of the complex:

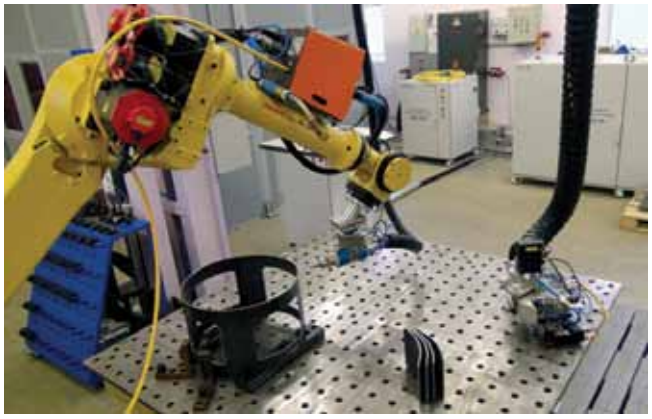
- Performing welding and cutting at one position without shifting the article;
- Processing of complex-shaped 3D structures in any position;
- High productivity;
- Wide range of processed materials thickness;

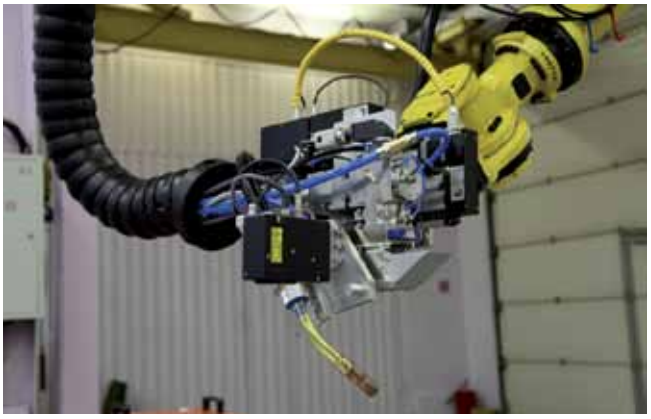
  High reliability and low operational costs.

COMPLEX SPECIFICATION:

Laser type	Fiber
Laser power, kW	up to 25
Welding current, max, A	500
Thickness of materials for cutting, mm Steel Aluminium	 1-20 1-12
Thickness of materials welded in one run, mm Steel Aluminium	 1-24 1-14
Processing zone, mm	8000×3500×1500
Positioning accuracy, mm	0.1
Processing speed, max, m/min	6
Position for welding and cutting	any

The robotized complex can be employed in automobile and rail car construction, chemical engineering, oil and gas industry, construction sector.





ROBOTIZED COMPLEX FOR WELDING OF MARINE ENGINEERING ARTICLES

The complex is intended for welding of thin-walled parts to massive structures, including those in hard-to-reach places, e.g. heat exchangers tube plates, pump drive units, etc.

Main functional units of the complex:

- Ytterbium optic fiber laser;
- Robot manipulator;
- Control console;
- Head for welding of tube sheets («scanator»);
- Head for welding in hard-to-reach places.

For welding of tube sheets and other items, requiring complex-shaped weld located in one plane, there is a so called «scanator» head, which allows laser beam to move along the pre-set path due to a system of controlled reflecting mirrors.

Optical head for welding in hard-to-reach places is normally used for welding of inner circular welds. It focuses laser beam perpendicular to inner surface of a cylindrical item. The beam moves against the item due to motion of rotary mirror module around the central axis of the weld (rotation of one of the head units) or by means of rotary device.

Apart from marine engineering, such complex may be employed in chemical, oil and gas industry and other sectors, where manufacturing of complex-shaped thin-walled components or welding-in cylindrical component with wall thickness up to 3 mm into a solid structure of outer casing may be required.

COMPLEX SPECIFICATION:

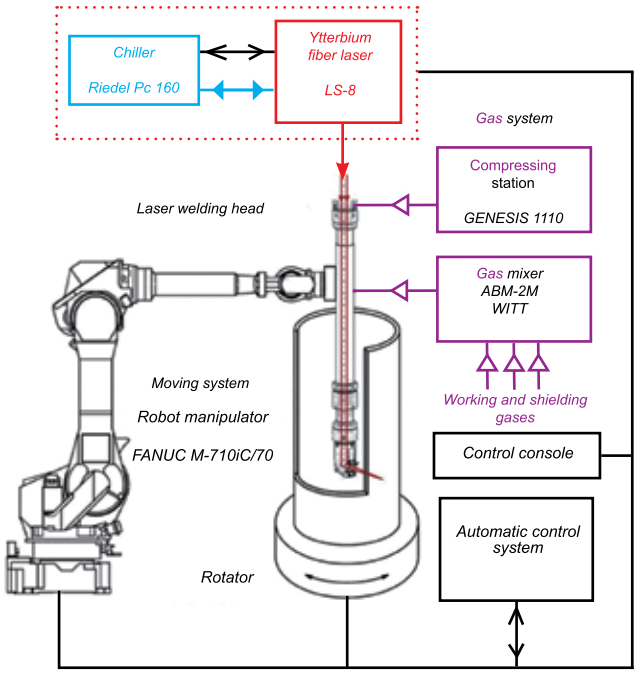
Type of laser	Fiber
Laser power, kW	8
Welding position	любое
Positioning accuracy, mm	0.05
Processing speed, max, m/min	30
Thickness of materials welded in one run with scanator head, mm:	
High-alloyed steel Copper alloys	0.5–8.0 0.5–5.0
Distance between holes in tube plate, mm	2
Thickness of materials welded in one run with head for welding in hard-to-reach places:	
High-alloyed steel	0.1–3.0

Implemented technologies:

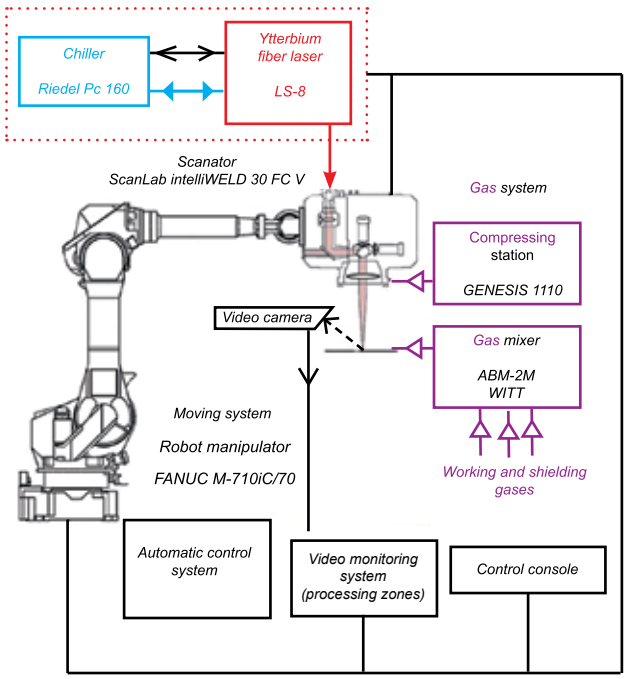
- Manufacturing of tube plates;
- Welding in hard-to-reach places.

Main advantages of the complex:

- Welding-in tubes of any cross-section into tube plate;
- High speed and productivity of welding;
- Welding of high-alloyed steel and copper alloys;
- High positioning accuracy;
- High reliability and low operational costs.



Functional diagram of the complex with head for welding in hard-to-reach places



Functional diagram of the complex with “scanator” head

ROBOTIZED LASER CLADDING COMPLEX

This Complex is purposed for production and repair of marine equipment and engineering articles with use of gas powder laser cladding.

Main functional units of the complex:

- Travel module: robot manipulator, double-axis positioning device;
- Laser irradiation generation module: ytterbium fiber laser, laser source and laser head cooling system;
- Gas powder mixture preparation and distribution module: powder feeder, gas mixer;
- Optical module: optical laser head, laser cladding nozzle;
- Control module: control rack, control console;
- Video monitoring module: industrial video cameras, video processing system.

Main advantages:

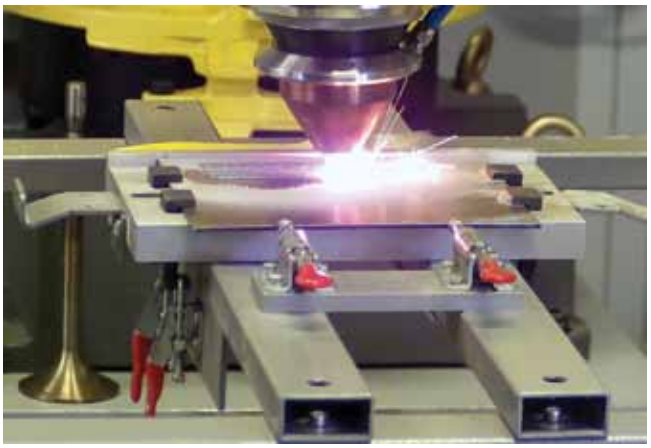
- Mixing coefficient of deposit and base material is minimal;
- Adhesion level between weld deposit and base material is high;
- Heat input in processed article is minimal;
- Surface layers with thickness of few hundreds microns can be deposed;
- High wearing resistance of surface layers, applied by laser cladding – in comparison with surface layers, deposed with traditional procedures;
- Low material consumption rate;
- High automation level.

COMPLEX SPECIFICATION:

Laser type	Fiber
Laser output power, kW	4
Processed articles dimensions, mm	up to 1000×1000×500
Positioning accuracy, mm	0.05
Operating tool travel velocity, m/min	0.1-8.0
Deposition rate, kg/hour	1.5–2.0
Processed materials	Construction materials, being used in corroding mediums with high mechanical loads

Complex implements laser gas powder deposition, enabling to avoid residual stresses and structure deformation by applying program control of travel of laser beam with deposed powder over processed surface with minimal thermal impact on the same. This is a high-efficient procedure with impressive coefficient of efficiency and level of automation.

Complex can be used in shipbuilding, chemical, oil and gas, automotive and aircraft industries.



Project “Program-controlled complex of equipment for laser welding of marine engineering articles” was awarded 1st grade diploma with gold medal at the International Fair “High-Tech. Innovations and Investments”.

At the exhibition “Russian Maritime Industry” in 2014, as per decision of competition comittee, Robotized complex for production and repair of ship engineering items was awarded with a golden medal in category New technologies in shipbuilding and ship machinery repair.

At the exhibition “Photonics” in 2015 folowing the results of competition forbest domestic project in the area of laser equipment and laser-optic technologies, the project “Optic head LSC-PI for laser welding in hard-to-reach areas” was awarded with title “Laureate of competition LAS-2015.

7, Promyshlennaya Street, St. Petersburg, 198095, RUSSIA
Phone: +7 (812) 786-2610, Fax: +7 (812) 786-0459
e-mail: inbox@sstc.spb.ru **www.sstc.spb.ru**