WELDING EQUIPMENT

JOINT STOCK CORPORATION
SHIPBUILDING & SHIPREPAIR
TECHNOLOGY CENTER

JSC “Shipbuilding & Shiprepair Technology Center” (JSC SSTC) develops and implements advanced and effective technologies on welding and allied processes. Since 1939 dozens of welding machines of different types were developed and implemented at shipbuilding enterprises.

Features of SSTC engineering activity are the following:

- Independent development of welding technical processes together with equipment design and manufacture;
- System analysis of welding engineering, carried out by company for more than 70 years;
- Development of effective capital investment projects;
- Involvement of domestic and foreign companies (operating in areas of welding equipment, designing, monitoring and control systems) in joint activities.

SSTC performs:

- Development of principal technology for manufacturing of Customer’s construction together with selection of welding materials, welding equipment, optimal technology of weld seals forming and system of quality control organization as part of ISO 3834;
- Development of proposals for modernization manufacturing facilities, together with selection of welding equipment, designing and manufacturing of special-purpose tooling;
- Design and manufacture of special-purposed welding equipment;
- Development of action plan for prevention of welding deformations;
- Post-welding deformations correction.

Substantial part of regulations on welding and allied technologies in shipbuilding is controlled by SSTC as the State Scientific Center of the Russian Federation.

Currently, SSTC develops software-controlled welding equipment fitted out with process detectors and adopts laser processing technologies.

Technologies and equipment developed and designed by SSTC were presented at specialized exhibitions in Russia and abroad and awarded with diplomas.

SET OF AUTOMATED WELDING EQUIPMENT FOR FABRICATION OF FOUNDATIONS AND HULL STRUCTURES

This complex is intended for robotized welding of angle joints, T-joints and overlap joints of foundations and hull structures.

The complex includes the following assemblies:

- Two welding robots with groove and seam tracking system upon welding;
- Two welding arc power sources for semiautomatic welding (MIG/MAG) in shielding gas environment. Comes together with welding torches and feeding mechanisms;
- Two linear motion sensors with automatic lubrication system;
- Control cabinet with touch-control operator panel;
- Two automatic stations for torch cleaning and calibration;
- Two filter-ventilation units;
- Welding station;
- Guard fence.

Performance of the above system matches foreign analogues.

Welding robot

Set of automated welding equipment for fabrications of foundations and hull structures

Number of robot's degrees of freedom in linear motion module	380
Operation	Semiautomatic welding in shielding gas environment (MIG/MAG)
Welding position	Lower, horizontal, vertical
Welding joints	Angle joints, T-joints, overlap joints
Welding speed, m/min	max. 0.5
Positioning accuracy, mm	±0.08
Max. dimensions of processed items, mm	1000 x 1200 x 3000
Weld items thickness, mm	4—20
Weld material	Low-alloyed, corrosion-resistant steels

ASSEMBLY AND WELDING STAND FOR INVAR TUBES IN TANK MEMBRANES OF GAS CARRIER

The stand has a modular design and provides mechanized assembly, tack welding and automatic contact seam welding of membrane tube, a part of membrane tanks of a gas carrier, consisting of wooden box with insulation, covered with invar.

Main components (modules) of the stand:

- Bed for mechanized assembly and welding of invar tubes;
- Auxiliary welding gun with built-in transformer and cooler for tack welding;
- Self-propelled welding head;
- Portal for handling welding equipment, mounting parts and handling of ready articles;
- Independent liquid cooling system;
- Control cabinet;
- Remote control panels.

Rated voltage of 3-phase supply net 50Hz, V	380
Max. welding current, kA	7.2
Max. power, kVA	50
Adjustment of welding current	phase shift
Welding current adjustment range, %	10–50
Welding speed adjustment range, m/min	0.1–1.2

PLASMA WELDING AUTOMAT FOR THICK ALUMINUM PLATES

Thickess of welded metal, mm	16–20
Rated welding current at 100% duty rating, A	700
Welding wire diameter, mm	1.6 / 2.0
Welding speed, m/hour	8–30
Plasma-generating and shielding gas	Argon
Plasma-generating gas consumption, l/min	up to 5
Shielding gas consumption, l/min	up to 40
Additional shielding gas consumption, l/min	up to 60

TESTING RESULTS

Bending test

Tensile test

The automat is intended for plasma welding of aluminum plates up to 20 mm thick with non-consumable electrode.

Advantages of the equipment:

- Single-run butt welding with non-consumable electrode of aluminum plates up to 20 mm thick with simultaneous shaping of weld back;
- Absence of non-metallic impurities in the welding joint due to cathode cleaning of main and filler material;
- Reduction of welding deformations due to concentrated heat input;
- Strength of welded joints is similar to parent metal with the same plastic properties;
- No metal spatters during welding;
- High productivity.

PLASMA TECHNOLOGIES

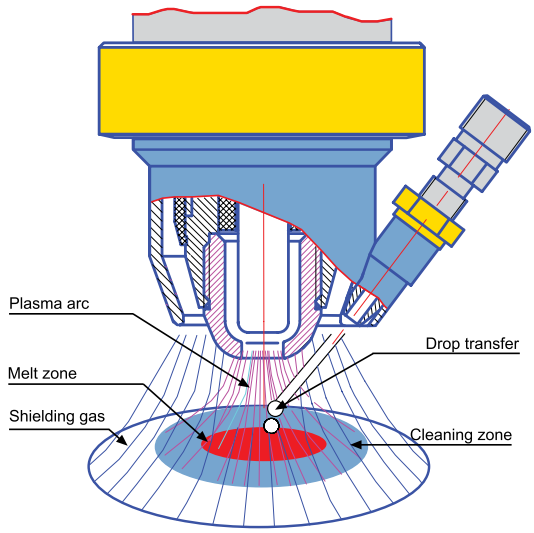
SEMI-AUTOMATED MACHINE PPN200

Semi-automated machine “PPN-200” (ППН-200) is purposed for plasma welding and weld deposition for articles made from aluminum, nonferrous alloys and corrosion-resistant steels by nonconsumable electrode.

Application:

shipbuilding, machine building (including food-manufacturing industry), aircraft industry and other branches where welding of essential parts is required.

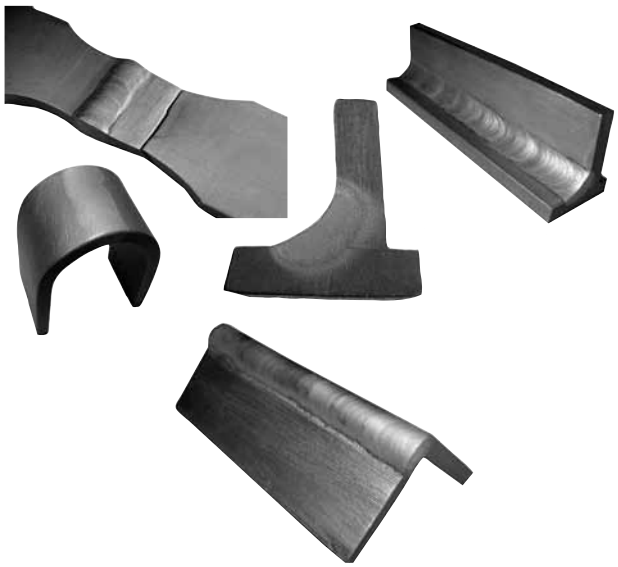
Rated welding current at 60% duty rating, A	200
Source outer characteristic	steep-grade
Current adjustment range, A	20–200
Filler wire diameter, mm	0.8–1.2
Adjustment limit of filler wire feeding speed, m/h	40–400
Gas consumption (Ar), l/min: - Orifice gas - Shield gas	 0.1–1 5–20



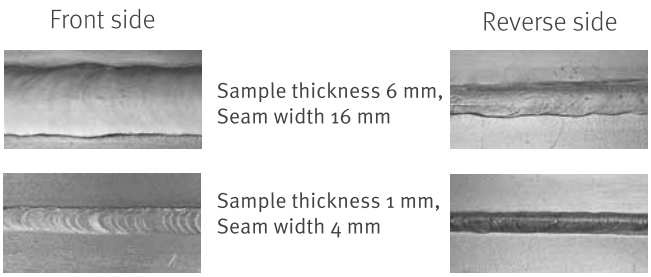
Plasma welding advantages:

- High-quality welding of abutting joints, T-joints and angle joints in any space attitude;
- High quality of weld and purity are provided by means of catodic cleaning effect;
- Welding deformations decrease due to reduction of product heating by welding;
- Fine formation of weld seam with graded junction from weld metal to parent metal, thus increasing endurance strength of junction;
- Capability of pure aluminum welding;
- Absence of metal splashes during welding.

SAMPLES FROM AL-MG 5 ALLOY WITH THICKNESS OF 5 MM



JOINT WELDS FROM AL-MG 61 ALLOY



SOFTWARE-CONTROLLED WELDING TECHNOLOGIES

MACHINES FOR VERTICAL WELDING AND WELD DEPOSITION ON SEAMS OF HEAVY-WALL CONSTRUCTIONS

OPENING PREPARATION WELDING MACHINE “VERTICAL-S”

The machine is purposed for single-pass welding in shield gas environment in vertical position of ships and off-shore rigs heavy-wall structures with thickness up to 100 mm and weld seam with length up to 3.2 m.

BUILDING-UP MACHINE FOR WELDS REINFORCEMENT “VERTICAL-N”

The machine is purposed for welding deposition to reinforce weld seams with length up to 3.2 m in shield gas environment in vertical position of ships and off-shore rigs heavy-wall structures.

Application: assembly and welding facilities at shipbuilding, chemical and oil-and-gas enterprises.

Use of machines allows:

- To decrease welding performance time in 1.3–1.5 times;
- To decrease production cost of construction manufacturing for 15–20%;
- To increase accuracy and quality of constructions manufacturing;
- To avoid auxiliary manufacturing operations.

	«VERTICAL – S»	«VERTICAL – N»
Materials	Low-alloy, high-strength and cold-resistant steel	
Welding thickness, mm	up to 100	up to 100
Voltage of AC supply mains, V	380	380
Rated welding current, A	500	315
Welding speed, m/h	0.8—8.0	1.0—6.0
Filler wire feed speed, m/h	100–500	150–750
Filler wire diameter, mm: Solid section Powdery	 2.0 2.4	 1.2 –
Shield gas consumption, l/min	20–130	10–20
Cooling water consumption, l/min	9–14	3–8
Longitudinal travel speed of nozzle, m/h	20–100	–
Longitudinal motion of nozzle, m/h	20–120	–
Welding machine range of operation in relation to control cabinet, m, max	30	30
Weight, kg, max	1250	900

SPECIAL EQUIPMENT

Machines “Toriy-3” and “SPR 1350×150-2” (СПР 1350×150-2) are components of system, designed for repairing of steam generators of nuclear steam generating plants on «Rossiya» type icebreakers. This equipment is functioning under conditions of constrict space and controllable effect of ionizing radiation.

SPR 1350×150-2

The machine SPR 1350×150-2 is purposed for cutting of welding seam of captive lid joint with steam generator on nuclear-powered icebreakers in order to replace pipe system of steam generator when repairing power plant.

The machine control system is based on controller, installed in moveable control console, fitted out with touch display and TV-monitor in order to observe cutting process using TV-camera, fixed on machine circuit plate.

The design of machine provides two ways of signal transmission, which control axial drives: with use of RF modem or through collector rings.

Processing maximum diameter, mm	1300
Welding seam size (legs), mm	65×140
Circuit plate rotation frequency, rpm	4
Horizontal feed (stepless), mm/min	0.1–33
Vertical feed (stepless), mm/min	0.1–125
Total capacity, KW	6
Weight, kg	3800

THE MACHINE «TORIY-3»

The machine “Toriy-3” is purposed for welding of side weld of captive lid and steam generator joint on nuclear-powered icebreakers in order to replace pipe system of steam generator when repairing power plant.

Welding is performed by means of nonconsumable tungsten electrode together with filler wire feed in mixture of shield gases, such as argon and helium.

The machine is fitted out with industrial computer and 2 TV-cameras for welding remote control.

Supply current type	380 V, 50 Hz
Welding current type	Direct
Polarity	Direct
Welding current adjustment limits, A	30–500
Welding speed, m/h	6–30
Filler wire feed speed, m/h	30–140
Total capacity, kW	26
Weight, kg	1800

Introduced system is implemented and applied at FSUE “Atomflot”, Murmansk.

JSC SSTC

- Performs design of welding equipment and development of full set of work papers and operational documentation by dedicated design engineering bureaux
- Possesses welding processes technical experts
- Develops offers for manufacture modernization together with selection of welding equipment
- Provides training of Customer's specialists

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