



Technology and equipment for electro-magnetic control of welding process for the purpose of providing high-quality joints of wide variety of steels and alloys

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National Technical University of Ukraine “Kyiv Polytechnic Institute” (NTUU “KPI”) was founded in 1898. It is the leading technical university of research type in Ukraine. The following world-known scientists were studying and teaching in the university:

Yevgeniy and Boris Paton – founders of almost all known welding processes and welding science itself,

Sergey Koroliov – rocket designer,

Igor Sikorskiy – helicopter designer,

Stepan Timoshenko – famous mechanician,

Sergey Lebedev – mathematician and others.

Detailed information may be found on <http://kpi.ua/>

Welding Faculty was founded in 1948 by Yevgeniy Paton. The Faculty is a part of Training Centre of NTUU “KPI” and E. O. Paton Electric Welding Institute. The Department coordinates activities of 17 subdepartments in different universities of Ukraine in the field of training of welding specialists and scientific research in welding and surface engineering.

For further information do not hesitate to visit <http://interweld.kpi.ua>.

Brief project specification

At present world leading machine engineering enterprises widely use new materials (steels, alloys, composite materials) to increase term of use of their products and to ensure their reliability for certain conditions of exploitation. Such materials often have a low weldability, though possessing some unique physical and mechanical properties. Traditional solution of the mentioned problem is to develop new specialized welding consumables for every single material. This leads to considerable waste of finances, materials and time. Technologies developed by Welding Department make it possible to join any materials without marked properties alterations and with minimum defect quantity.



Technologies of welding with electro-magnetic effect are based on controlling of welding pool hydrodynamic, fillet metal transfer and welding arc as a heat source using outer magnetic fields in the area of welding.

Welding pool hydrodynamic control helps to obtain welds in any attitude with defined and stable geometrical characteristics. Also it influences weld crystallization processes. The control results in:

decreasing of porosity	12X18H10T	7 times
	AMr6	12 times
	BT1-0	17 times
increasing of hot cracks resistance	12X18H10T	1,5 – 2 times
	ЭИ-943	1,4 times
	ЭП718	4 times
corrosion speed reducing	13X25H18	1,3 times
	BT1-0	1,25 times
increasing of resistance to transcrystallite corrosion	X17H13M3T	1,7 times
	03X18H11	2 times
shortening of weld sections with defects	12X18H10T and Ст3	7,5 times
	AMr6	4,3 times



a



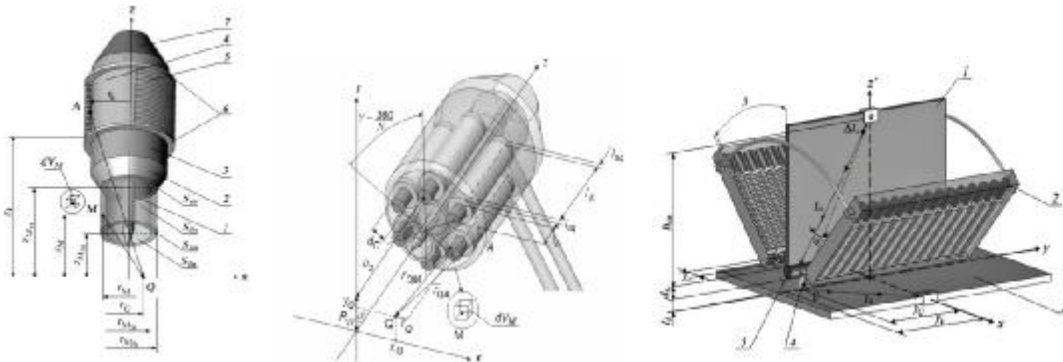
b

Appearance of welds provided by underwater welding:
a – using traditional technology; *b* – using electro-magnetic effects (joints left
to right welded on the depth of 1 m, 10 m, 30 m and 50 m)



Practical application results

The developed technology of electro-magnetic control resulted in specialized equipment. Research data are copyright (5 patents of Ukraine).



Control magnetic field sources

Developed technologies and equipment are now used on Kyiv aircraft plant, Yuzhnyi machine engineering plant (Dnepropetrovsk), Saratov aircraft plant, Baltic plant (Peterburg), Frunze Sumy machine engineering scientific-productional plant, Perm motorbuilding plant, Malyshev Kharkov plant.

Developed equipment may be demonstrated on Welding Department of NTUU "KPI" or on client's territory.

Fields of activities of organizations which may be interested in using of the developed equipment

Developed technologies and equipment help to solve the following problems:

- welding of complex-alloyed steels, alloys and composite materials for the needs of chemical enterprises;
- - welding of aluminum and titanium alloys for the needs of aircraft plants;
- underwater welding during mounting and repairing of main pipelines located in offshore areas;
- welding of complex-alloyed steels, aluminum and titanium alloys and composite materials in machine engineering.