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JAPANESE WELDING FABRICATION DURING 2009 ECONOMIC CRISIS

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The paper presents statistical data characterizing the condition of the Japanese market of welding equipment at the final stage of the world financial-economic crisis of 2009.

Keywords: *welding fabrication, market of equipment and materials, action plan, priority areas*

Market of the main structural materials. In 2009 the world financial crisis resulted in a considerable reduction of production of the main structural materials in Japan. Compared to 2008, production of raw steel was reduced to 26.3 % and was equal to 87.5 mln t. This is the lowest level of productions since 1969. Output of all kinds of finished steel products was also greatly reduced. Table 1 gives the data on hot-rolled stock production for the period of 2007–2009 [1].

Metal working industries reduced their orders by 30 % (to 37.5 mln t). Steel consumption in construction decreased by 26.1 % (to 9.6 mln t), in mechanical engineering by 29.8 % (to 18.2 mln t), and in shipbuilding by 2.8 % (to 5.5 mln t). Automotive companies reduced their orders for steel products to the greatest degree (by 35.5 %, to 7.3 mln t). As predicted by JFF Holdings, in 2010 an increase of the volume of orders in automotive and mechanical engineering industries is anticipated.

Production of primary aluminium in 2009 decreased by 23.2 % (to 5.1 thou t), secondary aluminium — by 36.9 % (to 666.0 thou t), aluminium rolled stock — by 21.4 % (to 1.062.8 thou t), and that of extruded sections — by 24.2 % (to 673.1 thou t). Domestic consumption of aluminium in 2009 was equal to 3250.1 thou t (by 23.4 % less than in 2008). Table 2 gives the pattern of consumption of aluminium rolled stock and extruded sections in Japan by individual industries and in construction [2].

Welding consumables market. Welding consumables market in Japan is closely related to structural metal market, particularly, that of steel [3]. Reduced consumption of finished steel products by the main metal working industries led to a considerable reduction of welding consumables market. For instance, consumption of welding consumables in shipbuilding

Table 1. Hot rolled stock production, thou t

Hot rolled stock	2007	2008	2009	2009/2008, %
Conventional steel	86,704.4	84,299.5	63,487.9	75.3
Special	21,498.2	21,782.1	13,247.1	60.8

was reduced by 10.9 %, as well as consumption of welding consumables in automotive and bridge construction, industrial mechanical engineering, and in a number of other industries, that resulted in decrease of total production volume in 2009 by almost 30 %, compared to 2008, and it reaching the minimum level for the last 20 years. This led to reduction of welding consumable manufacture by individual product types (from 9 to 44 %).

Volume and pattern of domestic consumption of the main groups of welding consumables in 2009 are shown in Table 3 [4].

Reduction of the total volume of welding consumable consumption affected the pattern of consumption of individual types of welding consumables. Flux-cored wire consumption decreased to the smallest degree (by 9 %), and its share in the pattern of consumption rose to 38.7 %, becoming commensurate with the fraction of solid wire application, the volume of application of which dropped to the greatest degree (44.2 %). Volumes of foreign trade in welding consumables were also reduced. Import of welding consumables decreased by 40.0 % (33.62 thou t); solid wire import — by 56.6 % (to 11.5 thou t), that of coated electrodes — by 20.4 % (to 1.58 thou t). On the other hand, flux-cored wire import rose by 4 %, and in 2009 amounted to 14.4 thou t, while export of welding consumables decreased by 31.5 % (39.9 thou t).

Table 2. Industrial pattern of consumption of aluminium rolled stock and extruded sections, thou t

Industry	Rolled stock		Extruded sections	
	2009	2009/2008, %	2009	2009/2008, %
Food	428.6	−1.1	0.9	−18.9
Dishware manufacture	2.7	−6.5	1.2	−35.5
Foil	113.1	−21.8	–	–
Metal products	76.7	−20.4	18.9	−25.7
Electric power	76.9	−29.0	31.1	−5.7
Transportation	118.8	−37.7	104.3	−36.6
Industrial mechanical engineering	19.1	−47.4	40.4	−44.8
Construction	40.6	−12.2	426.2	−17.1
Other	40.4	−47.3	38.4	−32.4
Total	916.9	−19.3	661.3	−24.0

By estimates of Japanese experts, in 2010 no significant growth of production is anticipated in metalworking industry and in construction, so that welding consumables demand will remain practically on 2009 level. In 2010 the volume of welding consumable manufacture is predicted to increase by 2.1 % (257.6 thou t). Welding consumable export in 2010 will increase by 2.0 % (up to 36.7 thou t), and import — by 2.3 % (up to 34.38 thou t).

Welding consumable market. 2009 marked a considerable decline of welding equipment manufacture: quantity of manufactured welding equipment was reduced by 60 % (by almost 50 % in terms of cost). Table 4 gives the data on the volume of welding equipment manufacture in Japan in 2009/2008, as well as 2010 prediction [5].

Volume of arc welding equipment is equal to about 95 % of all welding equipment produced in Japan. In 2009 production of standard automatic and semi-automatic equipment for arc welding decreased by 66.7 % (22,100 pcs). Almost 90 % of equipment of the above type are MAG welding machines. Industry's demand for this type of equipment is very high, but in connection with production decline in automotive, shipbuilding and some other industries, investments into this sphere of welding fabrication have been practically frozen. Shipbuilding was an exception, having had a sufficient backlog of orders. However, it does not seem possible to stabilize the situation by the efforts of just this industry.

Despite a considerable setback in production of automatic and semi-automatic equipment, output of new generation welding equipment with digital control systems is rising continuously in this segment. At present in construction and in a number of other industries producing welded structures, traditional welding equipment is being replaced by digital equipment: of every 10 units of equipment four are replaced by equipment fitted with power sources with digital control systems. About 10 % of digital power source output is exported to the countries of North America, Europe and Asia.

According to 2010 forecast, a growth of manufacturing of standard automatic and semi-automatic equipment by 12 % in terms of quantity is anticipated that will amount to 24,700 pcs, and in terms of cost, an increase of sales is anticipated on the level of 15 % against 2009 level.

Manufacturing of resistance welding machines in 2009 decreased by 65.4 % in terms of quantity, and by 55.3 % in terms of cost. In 2010 a 13.8 % (3300 pcs) growth of manufacturing of these machines is anticipated, that is associated with the predicted increase of export in automotive sector in 2010.

Japan is the world leader in the field of manufacture of industrial robots and production automation based on welding process robotization. Welding robots make up about 20 % of all the robots produced in the

Table 3. Volume and pattern of domestic consumption of welding consumables

Type of welding consumable	2008		2009		2009/2008, %	2010 (prediction)	
	thou t	%	thou t	%		thou t	%
Coated electrodes	40.6	11.4	30.6	12.1	75.4	29.4	11.5
Wires:							
for submerged-arc welding + flux	40.2	11.3	28.9	11.4	71.9	31.3	12.3
thin solid	167.5	46.7	93.4	37.0	55.8	95.5	38.2
for TIG welding, gas welding, cutting, etc.	2.1	0.6	1.9	0.8	90.5	1.9	0.8
Flux-cored wire	107.5	30.0	97.4	38.7	90.9	99.5	37.2
Total	358.4	100.0	252.2	100.0	70.4	257.6	100.0

country, of which the absolute majority are robots used for traditional technologies of arc and resistance welding, and more than 70 % of them are used in automotive industry.

Proceeding from statistical data, during the first half of 2009 reduction of production volume of welding robots in terms of cost, compared to a similar period of 2008, amounted to more than 57 %. Domestic consumption of robots during this period was reduced by almost 55 %, and export — by 60 %. Table 5 gives the data on cost fraction of welding robot manufacture in 2008, as well as in the first half of 2009. Decline in welding robot manufacture affected the resistance welding sector to a greater degree [6].

The above-said leads to the conclusion that the world financial-economic crisis had a strong influence on Japanese economy, including metalworking industries and welding fabrication. The volume of welding equipment manufacture decreased from 30 to 60 % by individual product types.

In response to the crisis, the welding industry, research organizations and professional associations of Japan developed specific action plans both on the level of individual firms and organizations, and the national long-term (up to 20 years) programs of welding fabrication development. Japanese manufacturers believe that the main priority for the near-term is maintaining reasonable market prices and return on investment. To increase the turnout in welding equipment market, Japanese specialists proposed action programs «New cost» and «Three in one», under which it is intended to perform optimization of welding fabrication, eliminating considerable overheads, optimisation of technological processes of welding, as well as development of new high-quality products. The efforts of manufacturers, dealers and users of welding equipment should be coordinated, domestic sales should be increased by studying the needs of welding structure fabricators, particularly of small and medium companies.

Japan is trying to become world leader, «have its own face» also in the field of welding and joining technologies. With this purpose the Japanese welding society proposed a new philosophy of research performance in the sector of welding and manufacturing of welding equipment — self-made concept. On the government level as part of activities of the Japan Welding Society, programs of research in the field of specific welding and joining technologies for the next 20 years have been developed, as well as strategic goals of welding technology development in individ-

Table 4. Indices of welding equipment fabrication in Japan

Equipment	2008, pcs (bln JPY)	2009, pcs (bln JPY)	2009/2008, % (bln JPY)	2010 prediction, pcs (bln JPY)
All arc welding equipment	128,100 (39,797)	50,900 (20,790)	39.7 (52.2)	56,800 (21,550)
Including:				
rotary converters	22,200 (6324)	7900 (2590)	35.6 (41.0)	9500 (3100)
automatic and semi-automatic machines	66,400 (21,847)	22,100 (8200)	33.3 (37.5)	24,700 (9430)
power sources, etc.	39,500 (11,626)	20,900 (10,000)	52.9 (86.0)	22,600 (9020)
Resistance welding machines, total	8400 (9841)	2900 (4400)	34.6 (44.7)	3300 (4900)
Total	136,500 (49,638)	53,800 (25,190)	39.4 (50.7)	60,100 (26,450)

Table 5. Cost fraction (mln JPY) of manufacture, domestic supplies and export of industrial robots and manipulators for welding in the first half of 2008 and 2009

Applications	January–June 2008			January–June 2009			January–June 2009/ January–June 2008, %		
	Domestic consumption	Export	Total	Domestic consumption	Export	Total	Domestic consumption	Export	Total
All industrial robots	103,896	200,723	304,598	51,200	58,586	109,786	49.3	29.2	36.0
For the following welding processes, in particular:	26,552	30,203	56,755	12,101	12,102	24,203	45.6	40.1	42.6
arc	14,791	13,385	28,176	7363	6234	13,957	49.8	46.6	49.5
resistance	11,702	16,803	28,506	4701	5864	10,565	40.2	34.9	37.1
laser	15	10	25	11	–	11	73.3	–	44.0
other	44	5	49	27	4	31	61.4	80.0	63.3

ual industries. Main directions of research and industrial production sectors were outlined, which will be the main consumers of the developed welding and joining technologies. Priority directions of research include welded structures, welding processes, welding metallurgy, fatigue strength of welded structures, welding arc physics, beam treatment, lightweight structure development, microwelding, joining over the interface. Fields of shipbuilding and bridge construction, nuclear engineering, chemical industry, high pressure vessel manufacture were named as priority areas for the Japanese welding fabrication. Under the program it is planned to develop and introduce a systems approach in performance of research and development, and creation of new product samples. It is intended to produce welded structures and products with a new level of properties based on the compiled intelligent databanks that will enable designing welding consumables and welded structure characteristics, as well as welding technology and optimizing it. The proposed systems approach will enable standardization of the process of welding and joining on a qualitatively new level.

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