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WELDING EQUIPMENT MODERNIZATION

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Abstract: This article deals with the automation problems of welding production, the RTC composition. It was selected specific robotic systems, parameters which are versatile and suitable for most products.

Keywords: robotic complex, automation, industrial robot, gas-shielded arc welding, contact-spot welding, welding tongs.

INTRODUCTION

The aim of modernization and automation of welding equipment is obtaining high and stable quality indicators of welded joints, subjective factors exclusion (welders qualification, his physical state and moral well-being), as well as improving technical and economic indicators. Automation and modernization of welding processes is aimed primarily at obtaining products, meeting world standards not only in the automotive industry, but also in all developing mechanical engineering, including the industrial equipment production.

The robotization problem of welding production includes a selection of generic or specialized robotics tools and complex solution of technical and economic issues, associated with the robotics implementation in a specific welding production.[1]

Basic prerequisites for effective implementation of robots [2]:

1) Improving the workpieces accuracy for welding by robots. With very low build quality, the robot will not be able to provide high quality welding, even with adaptive control systems (tracking or vision systems).

2) Development and optimization of technologies for robotic welding. When developing a welding technology using a robot, it is necessary to take into account the sequence of seams. Due to the maintaining possibility the welding process parameters with high accuracy when using a robot, it is possible to more accurately set the arc energy characteristics to obtain welds of a given quality.

3) Separation of welding, product installation and removal, which reduces the robot downtime and increases its efficiency.

MAIN PART

The robotic complex for welding (Fig. 1) consists of a manipulation system, welding equipment, a control device and measuring devices of a geometric and technological adaptation system. The manipulation system, in its turn, consists of a manipulator for the welding tool (welding torch) and a manipulator for the workpiece to be welded. [3] An integral part of the robotic complex is also equipment for positioning and moving the product (one or two-axis rotators, tilters or other robots), as well as equipment for cleaning the burner, ventilation system and protective barriers.

As an example, let's consider the two most common types of welding used in modern mechanical engineering: gas-shielded arc welding method and contact spot welding. The universal welding robot Kawasaki RS015X is used as a RTC for gas-shielded arc welding; industrial robot Kawasaki BX200X for resistance spot welding.

Kawasaki R-series industrial robots specially designed for electric arc welding. Kawasaki RS015X has a long lifespan, features an ergonomic design, and the highest rates of accuracy in performing the required tasks. Extended range expands the possibilities of using robots in various industries. The main criterion when choosing this robot is a great reach, which is a very important factor when welding metal structures of various types and sizes, figure 2.

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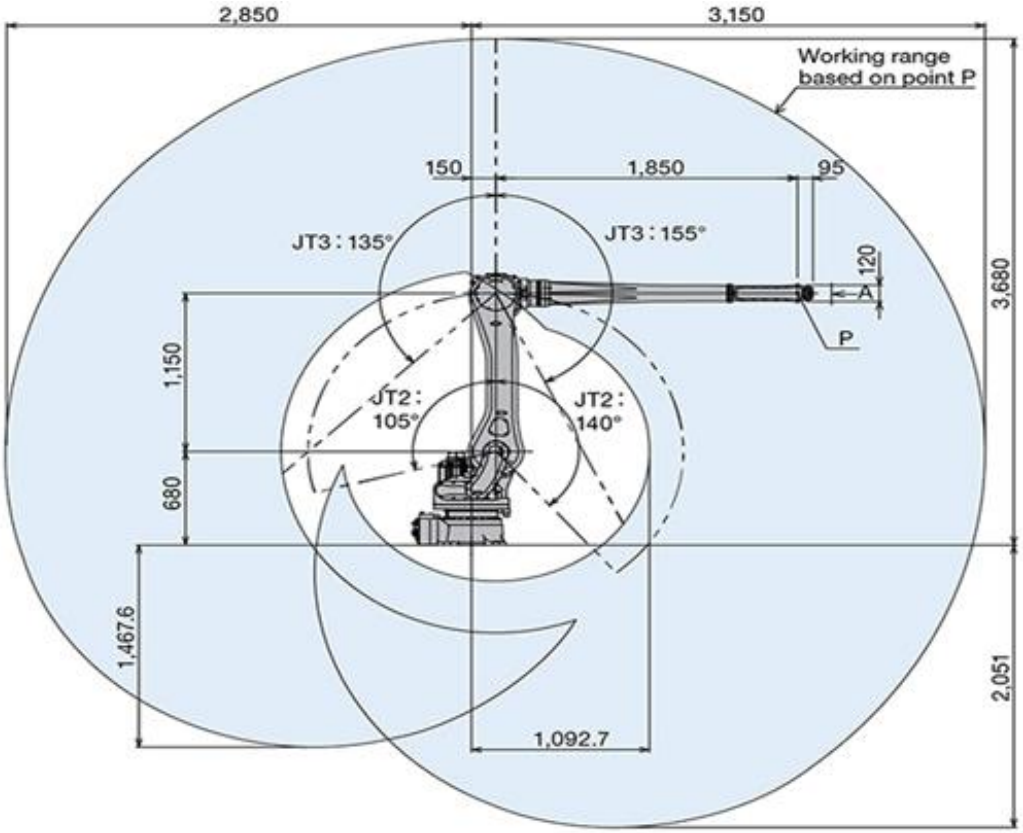

Fig. 2. The sizes and ranges of Kawasaki RS015X.

Below are the main characteristics of the Kawasaki RS015X RTC, table 1.

Table 1.

Specialization:	universal, welding, arc welding
Number of robot axes:	6
Reach:	3150 mm
Carrying capacity:	15 kg
Accuracy:	150 microns
Manipulator weight:	545 kg
Producing country:	Japan

Contact spot welding will be carried out by a Kawasaki BX200X industrial robot. The robot is equipped with high-performance, high-speed motors and the latest anti-vibration control technology. This significantly reduces the welding time. Spot welding pliers must have a large sticking out of the electrodes and a sufficient compression force, which result their mass will be large. This robot has sufficient lifting capacity, which solves the above problem. One of the main criteria when choosing this robot is its great reach, Figure 3.

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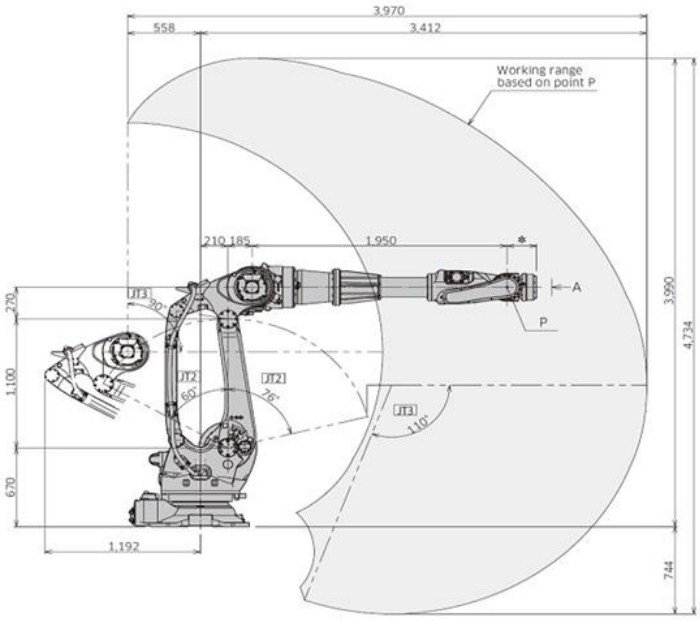

Fig. 3. The sizes and ranges of Kawasaki BX200X.

This industrial robot has a separate (outside the actuator and manipulator) welding power source. Such a scheme has obvious advantages: the welding tongs of such a robot do not contain a transformer, as a result of which their mass is reduced, which leads to a decrease in axle loads, an increase in positioning accuracy and the speed of linear movements. Disadvantage: an increase in the dimensions of the welding circuit and the installed power of the power equipment. Below are the main characteristics of the Kawasaki BX200X RTC, table 2.

Table 2.

Number of robot axes:	6
Reach:	3412 mm
Carrying capacity:	200 kg
Accuracy:	70 micron
Manipulator weight:	1450 kg
Producing country:	Japan

DeltaSpot X-jaw will be used as welding gun, Fig. 4. The DeltaSpot welding gun uses a movable contact strip. Contact tape provides surface protection of welding electrodes and process repeatability.[4] The main technical characteristics of the DeltaSpot X800 clamp are shown in table 3.

Table 3.

Stick out of electrodes:	800 mm
Maximum electrode pressure:	3 кН
Mass:	125 kg

Fig. 3. Robotic spot welding pliers DeltaSpot X800.

On the basis of the above-mentioned RTCs (Kawasaki RS015X, Kawasaki BX200X), it is possible to create a similar robotic manipulator, but superior in its technical and economic indicators. By combining two robots capabilities of different purpose, you can get the RTC versatility. A revolving mechanism creation for changing working welding equipment, i.e. replacing the gas-shielded arc welding torch with contact-spot welding with robotic tongs, or in the reverse order, will allow one RTC to be used to perform two different welding processes.

To create this RTC, it is necessary: to change the robotic pliers design, in order to reduce the mass (for example, the use of light aluminum alloys); increase the robot reach for working with large-sized items; modernize the welding inverter in order to

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reduce energy consumption; creation of control programs that allow changing the working welding equipment without forced stops.

Reducing energy consumption can be achieved by installing solar panels as protective enclosures for the welding area. This method will partially compensate for the required energy consumption of the RTC and the welding equipment itself. It is known that strong radiation emanates from the arc, about 70% of the radiation energy is released in the ultraviolet radiation form, 15% as infrared radiation, and these are all rays not visible to the human eye and only 15% in the visible light form. Today, scientists are developing panels that allow the electric current generation using ultraviolet radiation. This will make it possible to use more than 70% of the radiation energy released during the welding process. The disadvantage of this method is the need for constant cleaning of the panels.

RTC for welding is capable of increasing production efficiency several times. The use of welding robots is a key element in ensuring high quality of welded joints, reducing the rejects percentage, making it possible to achieve significant savings in welding consumables and electricity, and reducing warpage (welding deformations). Opportunities open up to conduct production on a smaller area. The shortening of production time and ensuring the identity of the finished product, achieved in the robotic production, are also very important.

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