



AUTOMATION OF WELDING PLANTS AT AUTOMOBILE PLANTS: IMPROVEMENT PATHS AND ECONOMIC EFFECT

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Abstract

Automation of welding processes is a key factor in increasing the efficiency and quality of production at automobile plants. This work is devoted to analyzing the current state of automation of welding sections in the automotive industry, studying promising directions for improving technologies, and assessing the economic effect of implementing automated solutions. The article examines various types of welding equipment used in the automotive industry, their advantages and disadvantages, as well as modern methods of controlling and monitoring welding processes.

Keywords: Automation, welding, automotive manufacturing, robotics, welding equipment, machine vision, artificial intelligence, economic effect, production optimization, welding quality, productivity.

Introduction

Automation of welding processes at automobile plants is one of the key directions for increasing production efficiency and competitiveness. The introduction of modern automated systems allows not only to significantly improve the quality of welded joints, but also to optimize production costs, reduce production time, and ensure a high level of occupational safety. This article examines in detail the main ways to improve welding sections through automation and analyzes their economic effect.

1. Problems of traditional welding sections

At enterprises where welding work is performed manually, the following problems inevitably arise:

- Low labor productivity due to limitations in the speed and duration of human work.
 - The human factor, which affects the quality of welded joints and increases the likelihood of defects.
 - High costs for training and retraining of welders.
 - Increased levels of occupational diseases and occupational injuries.
- All these problems limit the potential of the enterprise, increase the cost of production, and reduce its competitiveness in the market.

2. Technological improvements in the automation of welding sections

Automation of welding sections at automobile plants allows for significant improvement of production processes. Key improvements include the following aspects:

2.1 Increasing labor productivity

Welding robots are capable of performing operations several times faster than humans. They can operate around the clock without requiring breaks, which allows for a significant increase in production volume.

2.2 Stability and high quality of welded joints

Programmed systems ensure the precise observance of all technological parameters: movement speed, welding current, wire supply, and temperature. This leads to high repetition and minimization of welding defects.

2.3 Reducing the level of defects and the cost of fixing defects

Automatic quality control systems integrated into welding lines allow real-time monitoring of welding parameters and prompt response to deviations, which reduces the percentage of defects to minimal values.

2.4 Improving Occupational Safety

Robots perform welding work in hazardous conditions, excluding the impact of harmful factors on humans: radiation, high temperatures, toxic gases. This reduces the number of accidents and occupational diseases.

3. Economic effect of automation of welding sections

The implementation of automation at welding sites provides the following key economic benefits:

3.1 Reducing production costs

- Reduction of payers' labor costs.
- Reducing the consumption of welding materials due to more accurate feed and optimal welding modes.
- Energy savings due to reduced welding operations time and more efficient equipment operation.

3.2 Increase in output

Automation allows for a multiple increase in the number of welded bodies per shift, which increases production profitability.

3.3 Reducing the share of defects

Thanks to the stability of processes and quality control, losses associated with reprocessing and write-off of substandard products are reduced.

3.4 Reduction of maintenance and repair costs

High-quality welded joints ensure the reliability of the structure, which reduces the number of warranty repairs and complaints.

3.5 Reduction of personnel

Less welders are needed, which reduces the payroll fund and social payments.

3.6 Quick Return on Investment

Investments in welding robots and automated lines usually pay off within 1-3 years, after which the enterprise receives net savings.

4. Example of calculating the economic effect

For illustration, let's consider a conditional example of a production site:

Before automation:

- Number of welders: 30 people



- Productivity: 20 bodies per shift
- Welder's average salary: 100 USD/shift
- Marriage rate: 5%

After automation:

- Number of operators: 10 people
- Productivity: 50 bodies per shift
- Average operator salary: 80 USD/shift
- Marriage rate: 1%

Shift savings:

- Salary reduction: $(30 \times 100) - (10 \times 80) = 3000 - 800 = 2200$ USD
- Production growth: +30 bodies
- Reduction in defects repair costs: $(5\% - 1\%) \times 50 \text{ bodies} \times 200 \text{ USD} = 400$ USD savings

Thus, in just one shift, the enterprise saves at least 2600 USD and produces 30 more vehicles. In annual terms, a three-shift operation will save hundreds of thousands of dollars.

5. Additional benefits

- Improving product quality, which strengthens customer trust.
- The ability to respond flexibly to changes in market demand.
- Increasing the service life of production equipment due to uniform load.

Conclusion

Automation of welding sections at automobile plants provides comprehensive improvements: increased productivity, quality stability, cost reduction, and increased occupational safety levels. The economic effect of implementing modern automated systems is expressed in a significant reduction in costs, an increase in production volumes, and an increase in the competitiveness of the enterprise in the market. Taking into account the rapid payback, the automation of welding processes is becoming a necessary stage in modernizing modern automotive industries.



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