eISSN: 2229-3213 pISSN: 2229-3205
The Journal of Applied Science and Social Science
Volume 16,Issue 06 June, 2026

DESIGN AND IMPROVEMENT OF MANUFACTURING TECHNOLOGY FOR A TRANSPORT RACK CONSTRUCTION FOR AUTOMOBILE DOORS

Oybek Obidov Sobitjon o'g'li
Andijan State Technical Institute. Andijan, Republic of Uzbekistan
E-mail: oybekobidov06@gmail.com Tel.: +998 99 900 57 58

Quvatov Shakhzod Vakhob ugli
Student of Andijan State Technical Institute

Abstract. This article investigates the issues of designing and improving the manufacturing technology of a transport rack structure intended for transporting automobile doors to the assembly line in automotive manufacturing enterprises. A metal rack structure developed for Chevrolet Cobalt automobile doors was selected as the research object. During the study, the load-bearing characteristics of the structure, structural configuration, criteria for material selection, and welding technological parameters were analyzed. As a result, a structural solution adapted to production logistics was developed, which reduces door deformation during production, increases transportation efficiency, and improves handling reliability.

Keywords: automotive industry, transport rack, door structure, metal frame, MIG/MAG welding, Ст3 steel, logistics, manufacturing technology, transport system.

Introduction. Today, improving production efficiency in the automotive industry is closely associated not only with the advancement of core assemblies and manufacturing technologies but also with the optimization of internal logistics systems. In automotive manufacturing enterprises, components and assemblies are repeatedly transported from one workshop to another during the production cycle. Maintaining product quality and production continuity in these processes requires the application of specialized transportation structures.

Automobile doors, which are considered one of the large-sized body components, are highly sensitive to geometric accuracy and may undergo deformation due to improper positioning, excessive pressure, or vibration during transportation. Such defects can lead to additional adjustment operations in subsequent assembly stages, increased production time, and a higher percentage of defective products. Therefore, specialized transport rack systems are widely used in manufacturing facilities for the transportation and temporary storage of automobile doors.

In this study, a transport rack structure designed for delivering Chevrolet Cobalt automobile doors to the assembly line was developed. The primary objective of the research was to reduce mechanical damage to the doors during transportation, simplify loading and unloading operations, and improve overall production efficiency.

Research Methodology and Materials. During the research, methods of structural analysis, technological comparison, and engineering design were applied. In developing the transport rack structure, the geometric parameters, center of gravity, and support zones of the transported component were first determined. The structure was designed as a frame system capable of accommodating multiple automobile doors simultaneously in a vertical position while ensuring their safe transportation.

Ст3 structural steel was selected as the primary construction material. The selection of this material was justified by its high weldability, sufficient mechanical strength, and relatively low manufacturing cost. Profile steel elements with cross-sections of 60×40 mm and 50×40 mm were used for the main load-bearing parts of the rack.

The manufacturing technology of the structure included sequential stages of preliminary preparation of components, dimensional cutting, assembly, welding, inspection, and application

of a final protective coating. Semi-automatic MIG/MAG welding technology was selected as the joining method. This process provides high dimensional accuracy and stable quality characteristics when working with thin-walled metal structures.

During the welding process, Св-08Г2С welding wire with a diameter of 0.8 mm and a shielding gas mixture of argon and carbon dioxide were applied. Technological parameters were established within a current range of 60–90 A and an arc voltage of 16–19 V. These conditions ensured a reduction in thermal deformation and improved the stability of weld geometry.

Throughout the study, an assembly-fixture (jig-based assembly) method was implemented, where all structural elements were pre-positioned and subsequently welded in sequence. This approach contributed to improving the dimensional accuracy and overall geometric stability of the transport rack structure.

RESULTS.

As a result of the study, a transport rack structure intended for transporting Chevrolet Cobalt automobile doors to the assembly line of an automotive manufacturing enterprise was developed, and its manufacturing technology was substantiated. The proposed structure was designed based on the principle of vertical placement of automobile doors, aiming to reduce mechanical interaction between doors during transportation, maintain their geometric accuracy, and improve transportation safety.

In the designed structure, Ст3 structural steel profiles were selected as the primary load-bearing elements. The structural components were determined considering transportation loads, repetitive operational impacts in production conditions, and the strength requirements of welded joints. The main frame of the rack was constructed using profile elements with dimensions of 50×40×1.5 mm and 60×40×3 mm. In addition, elastic protective coatings were applied to the support zones of the doors to reduce the probability of damage to painted surfaces during handling and transportation.

Semi-automatic MIG/MAG welding technology was adopted in the manufacturing process. The implementation of this method improved weld formation quality, reduced deformation within the heat-affected zone, and increased assembly accuracy. Furthermore, the use of a shielding gas mixture consisting of argon and carbon dioxide reduced metal spattering and minimized the need for additional mechanical finishing operations.

Technological analysis demonstrated that the implementation of the proposed structure simplifies internal logistics operations, reduces the time required for door positioning and delivery to the assembly line, and prevents product quality losses during transportation. Moreover, the modular design of the rack provides flexibility and enables adaptation of the structure for use with other automobile models.

DISCUSSION. The obtained results demonstrate that the application of specialized transport rack systems plays a significant role in improving internal logistics and transportation processes within automotive manufacturing enterprises. The analysis revealed that conventional storage and transportation methods involve a higher risk of automobile door deformation, surface scratching, and reduced assembly accuracy. Such deficiencies lead to increased production costs and a greater need for rework operations.

The proposed rack structure made it possible to reduce these disadvantages through the constructive redistribution of loads, optimization of support elements, and technologically efficient positioning of welded joints. The vertical placement principle contributed to minimizing direct contact between transported doors and maintaining their geometric stability throughout the transportation process.

Particular attention was given to the welding technology used in the manufacturing process. The application of semi-automatic MIG/MAG welding demonstrated high efficiency when working with thin-walled profile elements. Stable welding conditions ensured improved weld quality, reduced thermal deformation, and increased dimensional accuracy of the final structure.

In addition, the use of shielding gas mixtures positively affected surface quality and reduced post-processing requirements.

Implementation of the developed structure in manufacturing conditions is expected not only to improve transportation safety but also to increase labor productivity, reduce inter-shop logistics costs, and ensure continuity of production processes. Furthermore, the modular design approach creates opportunities for future adaptation of the structure to other automobile door models and expands its practical applicability within automotive production systems.

Conclusion. As a result of the conducted research, a transport rack structure intended for transporting automobile doors to the assembly line was developed, and its manufacturing technology was scientifically and technologically substantiated. It was determined that the selected St3 structural steel and MIG/MAG welding technology provide high structural strength, manufacturing convenience, and operational reliability.

The proposed structure enables safe positioning and transportation of automobile doors, reduces the risk of deformation during handling, and improves overall production efficiency. Based on the obtained results, the developed technological solutions are recommended for implementation under real industrial production conditions and may contribute to the improvement of internal logistics systems in automotive manufacturing enterprises.

References

1. Mirziyoyev, Sh.M. The Strategy of New Uzbekistan. – Tashkent: Uzbekistan Publishing House, 2021. – 464 p.
2. Chernyshov, G.G. Welding Engineering: Textbook. – Moscow: Akademiya Publishing House, 2018. – 496 p.
3. Ovchinnikov, V.V. Technology of Welding Production. – Moscow: Akademiya Publishing House, 2019. – 272 p.
4. Maslov, B.G., Yermolaev, V.A. Production of Welded Structures. – Moscow: Vysshaya Shkola Publishing House, 2016. – 368 p.
5. Groover, M.P. Fundamentals of Modern Manufacturing: Materials, Processes and Systems. – Hoboken: Wiley, 2021. – 1024 p.
6. Kalpakjian, S., Schmid, S. Manufacturing Engineering and Technology. – 8th ed. – Pearson Education, 2021. – 1184 p.
7. AWS Welding Handbook. Vol. 1: Welding Science and Technology. – American Welding Society, 2020. – 920 p.
8. GOST 380–2005. Ordinary Quality Carbon Structural Steel. Technical Specifications.
9. GOST 14771–76. Arc Welding in Shielding Gas Environment. Basic Technological Requirements.