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# SPECIAL MACHINES AND COMPLEXES USED IN RAILWAY ELECTRIFICATION

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**Abstract:** This article analyzes the types of special machines and technological complexes used in the process of railway electrification, their functions, and their role in the development of modern railway infrastructure. It also highlights the importance of new technical solutions and automated systems in improving the efficiency of electrification works.

**Keywords:** railway, electrification, contact network, installation complex, special machines, technical complexes, automation.

## Introduction

At present, great attention is being paid to the modernization of the transport system and the improvement of energy efficiency through railway electrification. Electrified railways are more environmentally friendly, economically efficient, and capable of higher speeds compared to diesel locomotives.To effectively carry out the electrification process, special technical tools, installation machines, contact network installation complexes, and automated systems are employed. These tools allow for the construction of electrical power supply systems in a short period and with high quality.Railway electrification is a complex, multi-stage process. The following main machines and complexes are used in this process:

**Contact network installation machines (MTK series)** – designed for pulling contact wires, installing poles, and placing insulators.

**Installation platforms (PM series)** – provide safe workplaces for crews operating at heights.

**Machines for installing signal and telecommunication lines** – used in the installation of communication and control systems.

**Wire tensioning devices** – automatically monitor the mechanical tension of wires.

## Complex Electrification Machines

In recent years, to accelerate electrification processes, **complex installation machines** have been introduced. Complex electrification machines are multifunctional technical units designed for the construction, repair, maintenance, and modernization of railway infrastructure—primarily the contact network. They can perform several types of work simultaneously, such as installing poles,

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pulling wires, measuring, welding, lighting, and testing.

The main goal of complex electrification machines is to mechanize and speed up the railway electrification process, thereby increasing labor productivity and reducing manual work.

They allow several technological operations to be performed sequentially:

**EKOM-2000** – simultaneously performs installation of the contact network, pole drilling and installation, and wire pulling. This machine uses electric power to drive crane and drum mechanisms. For example, in the EKOM-2000 machine, the wire is pulled from the drum, its tension is automatically monitored, and precise placement is achieved using synchronized automated systems.

**ESM-1** – equipped with an automated control system that uses GPS and laser measurement instruments to improve precision.

**KMT-1** – a mobile complex used for maintenance and repair work on short sections.

**MTK-500 Machine Diagram**

The schematic shows an electric generator, hydraulic crane, wire-pulling drum, and elevated work platform located on the machine base. The graphic indicates the direction of wire tension, voltage distribution, and installation angles on the poles.

**Working principle:** The generator drives the crane and drum mechanisms → the contact wire is pulled → wire tension is measured using a sensor.

**EKOM-2000 Complex Diagram**

The diagram shows several modules: a pole installation block, an insulator placement mechanism, a wire-pulling drum, and an electric control panel. The graphic illustrates the sequence of operations: pole drilling → wire pulling → insulation → electrical connection.

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**Working principle:** All operations are automatically controlled through electrical and hydraulic systems.

**KMT-1 Mobile Complex Diagram**

The schematic shows the maintenance vehicle equipped with a generator, wire measurement device, thermal imager, and laser-based wire height measuring system.

**Working principle:** While the machine is moving, data on the height and curvature of the contact network are recorded in real-time.

**Modern Technologies and Automation**

Automation and digital monitoring technologies are increasingly being introduced into railway electrification. Examples include:

**Sensor-based measurement systems** – determine the height and curvature of contact wires in real time.

**Robotic installation systems** – reduce the need for human work at heights.

**Drones** – regularly monitor the condition of the contact network, helping plan maintenance schedules.

Machines and complexes used in electrified railways are equipped with energy-saving technologies. They contribute to reducing exhaust emissions, lowering noise levels, and extending operational lifespans, thus supporting environmental sustainability.Complex electrification machines are an integral part of modern railway networks. They enable electrification works to be performed quickly, safely, and accurately. Such machines play a key role in improving infrastructure efficiency, enhancing maintenance quality, and ensuring the stability of the power supply system.

## Conclusion

Special machines and technological complexes used in railway electrification play a crucial role in enhancing the efficiency of railway transport. They enable the rapid installation of electric

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networks, improve safety standards, and reduce maintenance costs. The use of modern automated complexes is of great importance for renewing railway infrastructure, achieving energy efficiency, and ensuring environmental sustainability.

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