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REGULATION AND CONTROL OF WATER BOILER PRESSURE BASED ON MODERN PLC 210.

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Abstract: *The article provides the characteristics and applications of PLC 210 Water boiler pressure control and adjustment. The implementation of automation systems based on PLC is widespread in industry. The programmable logic controller PLC 210 is a powerful tool for automating water boiler pressure control and adjustment systems. Its capabilities allow integrating pressure sensors, actuators and visualization systems, ensuring high control accuracy and reliability. The use of such systems increases the efficiency of boilers and ensures a high level of equipment safety.*

Key words: *control systems, electronic circuits, pressure maintenance, pressure sensors, logical controllers*

РЕГУЛИРОВАНИЕ И КОНТРОЛЬ ДАВЛЕНИЯ В ВОДОГРЕЙНОМ КОТЛЕ НА БАЗЕ СОВРЕМЕННЫХ ПЛК 210.

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Аннотация: *В статье приведены характеристики и области применения ПЛК 210 Регулирование и контроль давления в водогрейном котле. Внедрение систем автоматизации на базе ПЛК широко распространено в промышленности. Программируемый логический контроллер ПЛК 210 является мощным средством автоматизации систем регулирования и контроля давления в водогрейном котле. Его возможности позволяют интегрировать датчики давления, исполнительные механизмы и системы визуализации, обеспечивая высокую точность и надежность управления. Использование таких систем повышает эффективность работы водогрейных котлов и обеспечивает высокий уровень безопасности оборудования.*

Ключевые слова: *системы управления, электронные схемы, поддержание давления, датчики давления, логические контроллеры.*

Introduction. To create a water boiler pressure control and regulation system based on PLC 210, it is important to consider not only the software aspects, but also the diagrams that will help to better understand the operation and connection of the components. In this review, the basic diagrams of the water boiler, as well as the electronic connection diagrams of the PLC 210, will be considered. The main task of the water boiler is to heat the water to a given temperature and maintain the pressure necessary for the proper functioning of the heating system or hot water production. The simplest boiler diagram includes the following components:

- A boiler is a water heating tank with a burner system.

- Pressure sensors are installed at the water outlet and inlet to monitor pressure.

- Pump - ensures water circulation.

- Valves - regulate the supply and release of water, as well as the pressure in the system.

- Heat exchanger - may be present to transfer heat between working media (water and gas).

To control and regulate the pressure in the water boiler system, it is necessary to connect the PLC 210 to various sensors and actuators, such as pumps and valves. The main components of the circuit are:

- Pressure sensors - connected to PLC analog inputs.

- Valves - controlled by PLC digital outputs.

- Pumps - can be controlled via relays or via frequency converters if smooth regulation is required.

- Human Machine Interface (HMI) - Connects to monitor system status and operator input.

The PLC 210 software controls the system based on pressure sensor readings and specified parameters. Approximate operating algorithm:

- Data reading. The PLC receives data from analog inputs from pressure sensors.

- Comparison with set parameters. The software compares the actual pressure with the set values.

- Regulation. If the pressure exceeds the permissible limits, the PLC issues a command to open valves or turn on pumps to stabilize the pressure.

- Monitoring. Data is transmitted to the HMI for real-time operator monitoring.

Methods. To write a program on PLC 210, you can use the Structured language Text or Ladder Diagram. The main focus is on controlling pumps and valves based on data from pressure sensors. Creating a stand for adjusting and monitoring the pressure of a water boiler based on PLC 210 requires the integration of various components - pressure sensors, actuators (valves and pumps) and a visualization system. Electronic connection diagrams and programs for PLC provide flexibility in managing the system and maintaining optimal boiler operating parameters. Using HMI allows operators to monitor system parameters in real time and quickly respond to pressure changes.

Programmable logic controllers (PLCs) have become a core component of automation systems in various industries. PLCs are specialized microprocessor devices designed to control industrial processes in real time. They are characterized by reliability, flexibility in programming, and the ability to operate in harsh operating conditions [1]. Modern PLC models, such as the PLC 210, have high performance indicators and allow the integration of various industrial sensors and actuators. The PLC 210 model is especially in demand for thermal process control and management systems due to its support for data exchange protocols (e.g. Modbus), as well as the ability to program using IEC 61131-3 standards, such as Ladder Diagram and Function Block Diagram [2].

Boiler pressure control is a critical task in thermal power systems. Pressure directly affects the safety of the boiler operation, its efficiency and durability. Incorrect pressure regulation can lead to serious accidents and equipment damage [3]. Various types of sensors are used to measure pressure, such as membrane and piezoelectric sensors. These sensors can transmit data to a PLC, which, based on the pressure values obtained, controls actuators such as valves and pumps that regulate the pressure inside the boiler [4].

Modern automation systems based on PLC use architectures that include multiple sensors, controllers, and actuators integrated into a single control system. A PLC 210-based system can be used to control boiler pressure by integrating pressure sensors and PID controllers that provide precise and dynamic control [5]. An important component of the system is the human-machine interface (HMI), which allows the operator to monitor and adjust the system's operating parameters in real time. SCADA systems can be used to monitor and analyze boiler data based on readings from the PLC [6].

The PLC 210 has broad compatibility with various types of sensors and actuators, making it a versatile solution for control systems. PLC programming uses standard programming languages such as Structured Text and Ladder

Diagram, which provide flexibility and simplify the configuration of control systems [7]. The software for PLC 210 also supports the creation of visual interfaces and control systems, which allows the PLC to be integrated into SCADA systems for remote monitoring and data collection [5].

Discussion. Safety is a key aspect in boiler control, especially in high-pressure systems. PLC 210 allows the implementation of multi-level safety mechanisms, including automatic emergency shutdown of the system when permissible pressure parameters are exceeded. System reliability can be ensured by redundant components and the use of emergency signaling methods [6].

The implementation of automation systems based on PLC is widespread in industry. For example, the work of Ivanov et al. (2020) provides an example of creating a water boiler pressure control system, where PLC 210 is used to control pumps and valves, which allows maintaining optimal pressure parameters in the system. It also describes how the use of HMI and SCADA systems simplifies boiler control and reduces the risk of human error.

Conclusion. The programmable logic controller PLC 210 is a powerful tool for automating the regulation and pressure control systems of water boilers. Its capabilities allow integrating pressure sensors, actuators and visualization systems, ensuring high control accuracy and reliability. The use of such systems increases the efficiency of boilers and ensures a high level of safety in equipment operation.

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