REGULATION OF COOLANT TEMPERATURE IN INDIVIDUAL HEATING STATIONS

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Annotation. An individual heating point is a set of devices consisting of elements that ensure the connection of a heating and hot water supply system to a centralized heating network.

The article compares the operating principle of old-style heating units and modern heating units using a controller , a control valve and a circulation pump, where energy saving is achieved by regulating the temperature of the coolant, taking into account changes in the outside air temperature.

Key words: elevator unit, coolant, temperature graph, thermal energy, heating network.

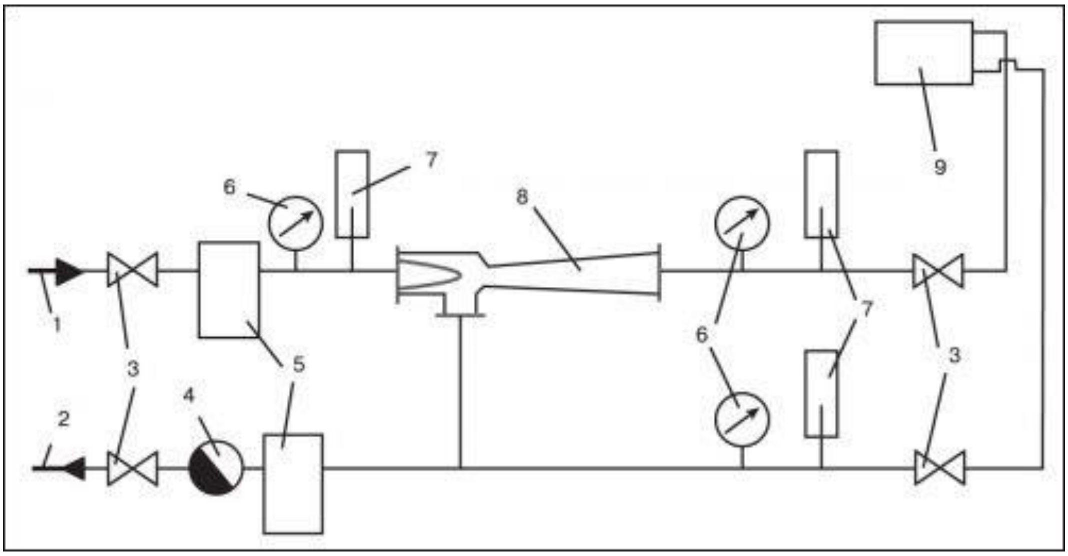
An individual heating point is the most important component of the heat supply of buildings. The regulation of heating and hot water supply, as well as the efficiency of thermal energy use, largely depends on its characteristics. Therefore, much attention is paid to individual heating units during the thermal modernization of buildings, and at the moment large-scale projects for their arrangement in apartment buildings are being implemented in various regions of the country .

The temperature schedule of the heating network operation determines the mode in which the individual heating point will operate in the future and what equipment needs to be installed in it. There are several temperature graphs of network operation:

150/70°C;
130/70°C;
110/70°C;
95 (90)/70°C.

If the coolant temperature does not exceed 95°C, then all that remains is to distribute it throughout the entire heating system. In this case, it is only possible to use a manifold with balancing valves for hydraulic linking of the circulation rings. If the temperature of the coolant exceeds 95°C, it cannot be used directly in the heating system without temperature adjustment. This is precisely the important function of the heating point. In this case, it is necessary that the coolant temperature changes depending on the outside air temperature.

In old-style heating points (Fig. 1), an elevator unit was used as a control device. This made it possible to significantly reduce the cost of equipment, however, with the help of such a heating point it was impossible to accurately regulate the temperature of the coolant, especially during transient operating conditions of the system, i.e. when the outside air temperature ranged from +5 to minus 5°C. The elevator unit provided only “quality” regulation, when the temperature in the heating system changed depending on the temperature of the coolant coming from the centralized heating network. This led to the fact that the "adjustment" of the air temperature in the premises was carried out by consumers using an open window and with huge heat costs that went to nowhere.



Rice. 1. Diagram of a heating point with an elevator unit: 1 – supply pipeline; 2 – return pipeline; 3 – valves; 4 – water meter; 5 – mud collectors; 6 – pressure gauges; 7 – thermometers; 8 – elevator; 9 – heating devices

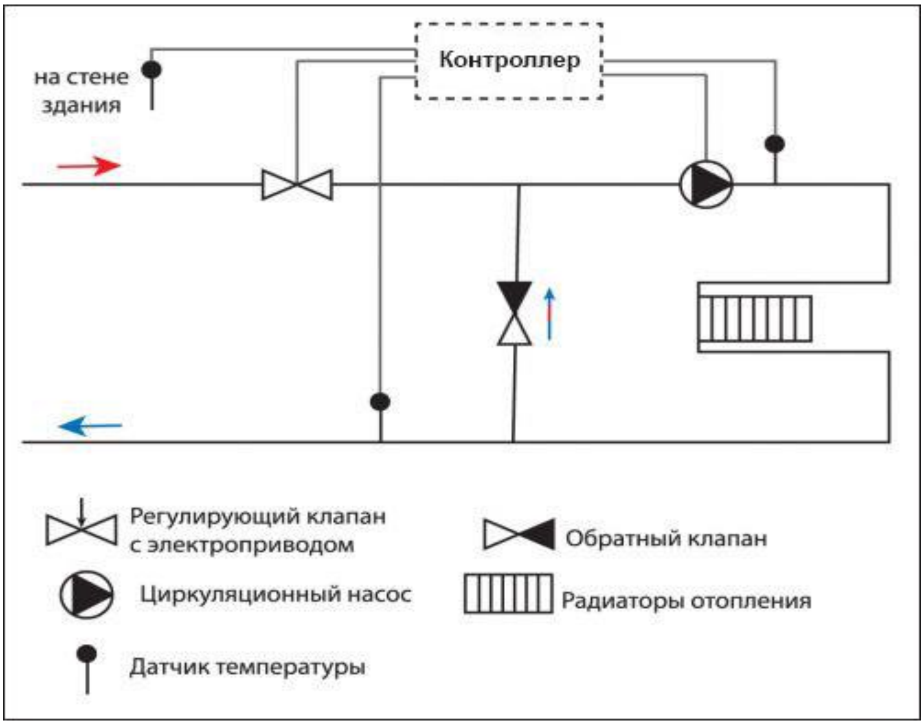
Therefore, the minimal initial investment resulted in financial losses in the long term. Particularly low efficiency of elevator units manifested itself with rising energy prices, as well as with the inability of the centralized heating network to operate according to the temperature or hydraulic schedule for which previously installed elevator units were designed.

The principle of operation of the elevator is to mix the coolant from the centralized network and water from the return pipeline of the heating system to a temperature corresponding to the standard for this system. This occurs due to the ejection principle when using a nozzle of a certain diameter in the elevator design. After the elevator unit, the mixed coolant is supplied to the heating system of the building. The elevator combines two devices simultaneously: a circulation pump and a mixing device. The efficiency of mixing and circulation in the heating system is not affected by fluctuations in thermal conditions in heating networks. All adjustment consists of the correct selection of the nozzle diameter, throttle washer and ensuring the required mixing coefficient (standard coefficient 2.2). There was no need to supply electric current to operate the elevator unit.

However, there are numerous disadvantages that negate the simplicity and unpretentiousness of servicing this device. Operating efficiency is directly affected by fluctuations in the hydraulic regime in heating networks. Thus, for normal mixing, the pressure difference in the supply and return pipelines must be maintained within 0.8 - 2 bar; the temperature at the elevator exit cannot be adjusted and directly depends only on changes in the temperature of the external network. In this case, if the temperature of the coolant coming from the boiler room does not correspond to the temperature schedule, then the temperature at the exit from the elevator will be lower than necessary, which will directly affect the internal air temperature in the building.

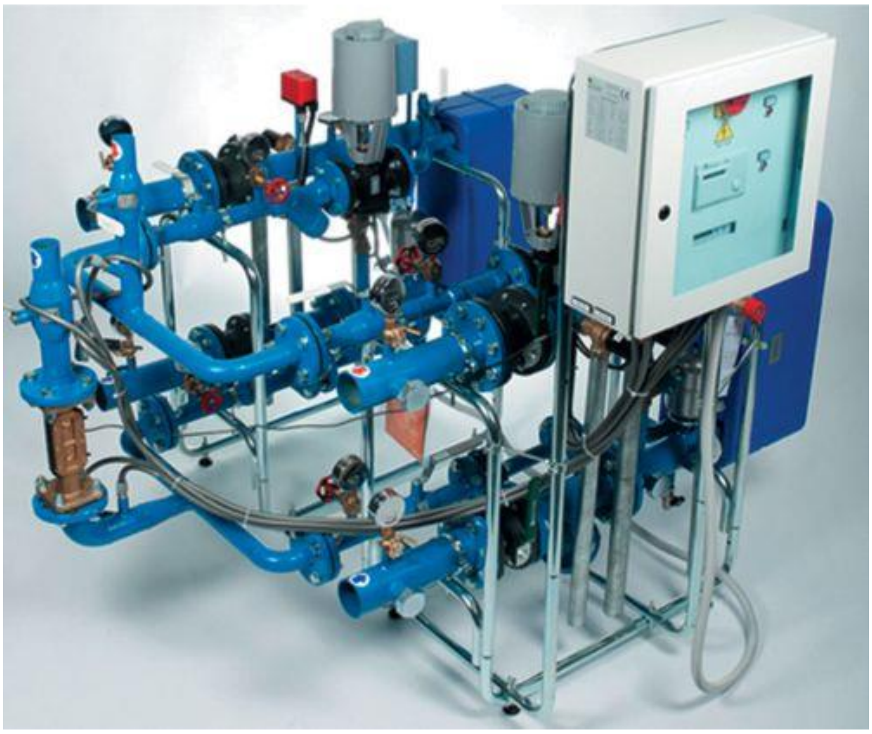
Such devices are widely used in many types of buildings connected to a centralized heating network. However, at present they do not meet energy saving requirements, and therefore must be replaced with modern individual heating units. Their cost is much higher and they require power supply to operate. But, at the same time, these devices are more economical - they can reduce energy consumption by 30 - 50%, which, taking into account rising energy prices, will reduce the payback period to 5 - 7 years, and the service life of an individual heating unit directly depends on the quality of the elements used management, materials and level of training of technical personnel during its maintenance.

In modern individual heating points, energy saving is achieved, in particular, by regulating the temperature of the coolant, taking into account corrections for changes in outside air temperature. For these purposes, in each individual heating point , a set of equipment is used (Fig. 2) to ensure the necessary circulation in the heating system (circulation pumps) and regulate the temperature of the coolant (control valves with electric drives, controllers with temperature sensors).



Rice. 2. Schematic diagram of an individual heating point using a controller , control valve and circulation pump

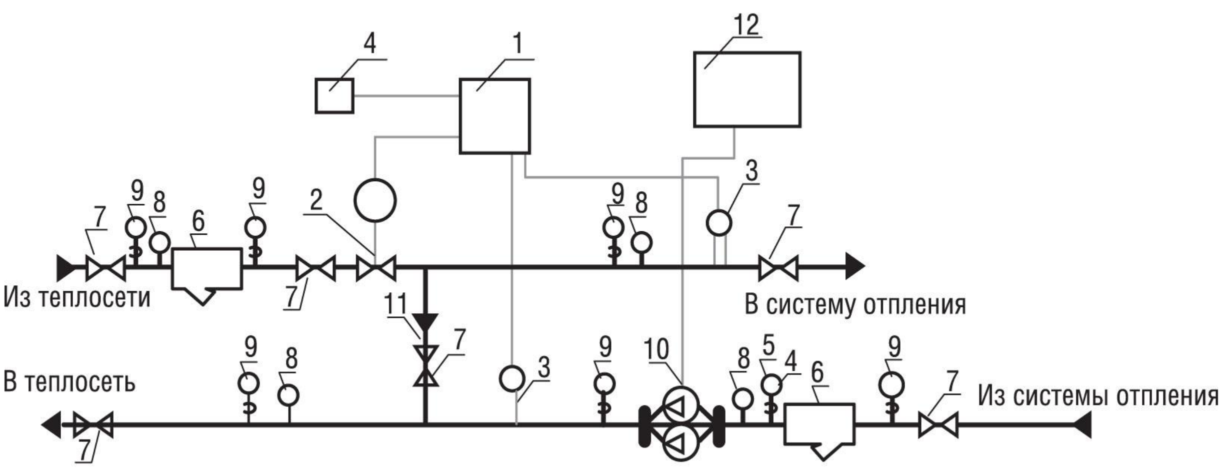
Most individual heating points also include a heat exchanger for connection to an internal hot water supply system with a circulation pump (or without it, depending on the layout of the hot water supply system). The set of equipment depends on the specific tasks and initial data. That is why, due to the various possible design options, as well as their compactness and transportability, modern individual heating units are called modular (Fig. 3).



Rice. 3. Modern modular individual heating unit assembled

Consider the use of an individual heating point in dependent and independent heating connection schemes to a centralized heating network.

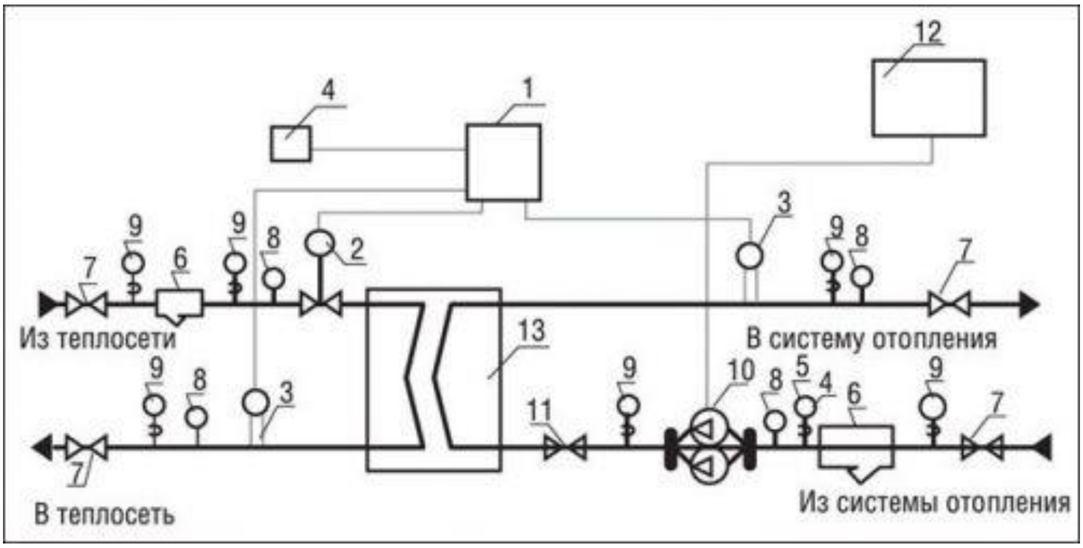
In an individual heating point with a dependent connection of the heating system to external networks, the circulation of the coolant in the heating circuit is supported by a circulation pump. The pump is controlled automatically from the controller or from the corresponding control unit. The controller also automatically maintains the required temperature schedule in the heating circuit. This is done by acting on the control valve located on the supply pipeline on the side of the external heating network ("hot water"). A mixing jumper with a check valve is installed between the supply and return pipelines, due to which the coolant is mixed into the supply pipeline from the return line of the heating system, with lower temperature parameters (Fig. 4).



Rice. 4. Schematic diagram of a modular heating point connected according to a dependent circuit. 1 – controller; 2 – two-way control valve with electric drive; 3 – coolant temperature sensors; 4 – outside air temperature sensor; 5 – pressure switch to protect pumps from dry

running; 6 – filters; 7 – valves; 8 – thermometers; 9 – pressure gauges; 10 – circulation pumps for heating; 11 – check valve; 12 – circulation pump control unit

In this scheme, the operation of the heating system depends on the pressures in the central heating network. Therefore, in many cases it will be necessary to install differential pressure regulators, and, if necessary, pressure regulators "after" or "before" on the supply or return pipelines.



Rice. 5. Schematic diagram of a modular heating unit connected according to an independent circuit: 1 – controller; 2 – two-way control valve with electric drive; 3 – coolant temperature sensors; 4 – outside air temperature sensor; 5 – pressure switch to protect pumps from dry running; 6 – filters; 7 – valves; 8 – thermometers; 9 – pressure gauges; 10 – circulation pumps for heating; 11 – check valve; 12 – circulation pump control unit; 13 – heat exchanger

In an independent system, a heat exchanger is used to connect to an external heat source (Fig. 5). The circulation of the coolant in the heating system is carried out by a circulation pump. The pump is controlled automatically by a controller or a corresponding control unit. Automatic maintenance of the required temperature schedule in the heated circuit is also carried out by an electronic regulator (controller). The controller acts on an adjustable valve located on the supply pipeline on the side of the external heating network ("hot water").

The advantage of this scheme is that the heating circuit is independent of the hydraulic modes of the centralized network. Also, the heating system does not suffer from inconsistencies in the quality of the incoming coolant coming from the external network (presence of corrosion products, dirt, sand, etc.), as well as pressure drops in it. At the same time, the cost of capital investments when using an independent scheme is higher - due to the need for installation and subsequent maintenance of the heat exchanger.

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