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HYDRAULIC MODE IN HEAT SUPPLY SYSTEMS

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Annotation: The article discusses an improved technology for adjusting heat supply systems using throttle devices, which pays special attention to the method of monitoring and interpreting the results of adjusting based on measurement data of two coolant temperatures - before and after the building heating system.

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Solving the issues of setting up and adjusting heat supply systems, especially if heat consumers do not have units, for automatic control and accounting of energy resources, is a significant difficulty. At the same time, it is known that it is in this - the transport and distribution link of the centralized heat supply system - that the main reserves of saving heat and electricity are contained.Only in the presence of a well-established system, all heat consumers receive a coolant of the required parameters to meet their needs, a heat supply organization - a stable heat-hydraulic regime at the heat source and in heat networks, and with it - the opportunity to engage in their development, increase the reliability and efficiency of production processes and energy transportation [1,2]. As experience shows, using the traditional method - with the installation of throttle washers in the input nodes of heat consumers - it is very difficult to achieve high-quality adjustment of even small heat supply systems, including 50 -100 buildings. To understand this, it is enough to see what the internal heating systems, basements, and thermal units of some residential buildings built in the last century in our city are like. It is also useful to get acquainted with the personnel and methods of work of individual management companies, which often know only one way to eliminate residents' complaints about insufficient heating - to drill out or remove the throttling washer at the entrance to the house [4].

Improved technology for adjusting heat supply systems using throttle devices is proposed in the works, which pays special attention to the method of monitoring and interpreting the results of adjusting based on measurement data of two coolant temperatures - before and after the building heating system. This technique has been quite successfully used for many years and, in our opinion, is a brilliant example of the resourcefulness of the mind of domestic engineers, since it allows you to set up systems in the absence of a direct measurement of the coolant flow. The main disadvantage of this method is the impossibility in practice to achieve an accurate measurement of the temperature of the coolant (or, at least, for all consumers with the same error), especially with the help of portable devices (pyrometers, contact thermometers).

The traditional way of adjustment with the installation of throttle washers allows for achieving an acceptable result only at the cost of great joint efforts of heat supply (heat network) organizations serving the housing stock [1,2]. With this method, adjustment is carried out in several stages: installation of calculated throttle devices for all consumers (in summer); creation and maintenance of a stable hydraulic regime at the heat source and consumers (at the beginning of the heating season); one-time survey of all consumers with temperature measurements of the direct and return pipelines (at stable negative outdoor temperatures); analysis of the results by the accepted methodology; preparation and issuance of instructions to individual consumers for the installation of adjusted throttle devices, their installation; re-examination, etc.

We list the main disadvantages of this method:

- the difficulty of access for adjustment personnel to the places of installation of throttle devices at consumers;

- the impossibility of promptly adjusting the diameters of the openings of the constricting devices for consumers (they need to be made; it is not always possible to drain a section of the pipeline, because the shut-off valves “do not hold”, all the locksmiths are in an accident, etc.);

- adjustment takes a long period - from two weeks to a month;

- adjustment measures must be carried out at the beginning of the heating season - immediately after the start-up and "nurturing" of the heating systems of buildings at all boiler houses at the same time, for which, as a rule, there is not enough time and personnel;

- the temperature of the outside air and the coolant during this period is usually unstable, which reduces the reliability of measurements and distorts the final result;

As a result, while the adjustment is in progress, some consumers manage to dismantle (ream) the throttle washers, which further delays the process [5].

The adjustment result is considered satisfactory if the coolant flow rate at the source is 10% higher than the calculated value immediately after the adjustment is completed. If the adjustment is not performed with sufficient quality, then we observe a sluggish process of increasing the circulation of the coolant in the system (while maintaining a given pressure drop at the source), which indicates the removal of narrowing devices by individual consumers. With an increase in network water consumption of more than 20%, measures are taken to identify such consumers, prescriptions are written that are far from being always followed [4].. In some cases, the process of removing or reaming narrowing devices can be avalanche-like, as a result of which there is a need for re-adjustment. In practice, with this adjustment technology, by the middle of the heating season, the consumption of network water at our facilities reached a certain equilibrium point with an excess of the calculated value of 10-30%. This leads to excessive consumption of electricity and the need to maintain inflated pumping capacities.

Ultimately, realizing the disadvantages of this adjustment method, one can conclude that it is necessary to make additional costs to improve the efficiency and controllability of the heat supply systems in operation.

Balancing valves offer significant advantages over throttling disks:

- allows you to change the flow area and flow rate of the coolant by fixing the specified position;

- are at the same time a locking device (ball valve).

- allow measuring of the actual flow rate of the coolant by attaching a portable flow meter (special differential pressure gauge) to the measuring ports of the valve.

With the help of balancing valves, we finally managed to "bridle" the hydraulics of some heat supply systems that could not be adjusted in any way, and put the hydraulic regime of internal consumer systems under control, while increasing the quality of their heating.
The technology for performing adjustment work using static balancing valves is as follows:

1. A hydraulic calculation of the heating network is carried out according to the usual method with the determination of the calculated available and extinguished pressures at the entrance to the buildings.

2. As a rule, due to design features, the maximum allowable quenchable pressure on the balancing valve should not exceed 10 m. Art. Based on our experience, we can recommend the optimal value of the damped pressure of 4-7 m. Art. The valve size is selected for the calculated value of the damped pressure, taking into account the passage of the calculated coolant flow rate at approximately 50% of the stem opening [1,2].

3. If the pressure to be extinguished exceeds 10 m. Art., in series with the valve, it is necessary to install a throttle washer. The valve size in this case is selected by 50% of the calculated damped pressure (50% is throttled on the washer). The throttle washer can be installed in a regular place - in the thermal unit of the building. In this case, the heat supply organization, even in the absence of access to the building, retains the ability to limit or, conversely, add consumption per individual consumer within ± 30%.

4. It is allowed to install balancing valves in any place - in thermal chambers, areas of above-ground laying, and buildings, taking into account the restrictions specified in the technical documentation of the equipment manufacturer. About the existing stop valves on the consumer, the balancing valve can be installed: in series, in parallel (i.e., on the bypass of the stop valves, which must

be reliably closed by installing a plug), or instead of it, on the supply or return pipeline. When using brass-threaded valves, it is necessary to take measures to prevent the transmission of forces from the pipelines to the fragile valve body [1,2].

5. When developing a project for the installation of balancing valves, it is desirable to apply special anti-vandal measures that prevent unauthorized access to them by unauthorized persons.

6. In order to save money, or in the absence of technical feasibility, one common balancing valve can be installed per group of buildings, and the distribution of flows after the valve is carried out by installing throttle washers in buildings.

7. Upon completion of installation, before the start of the heating season, all valves are set to the design position according to the pre-setting table obtained as a result of hydraulic calculation and selection of valves [3].

8. After the completion of the start-up of the coolant to all houses and the establishment of a stable hydraulic regime at the boiler house, it is possible, without waiting for the onset of cool weather and without looking back at the compliance of the boiler room with the temperature schedule, to carry out the actual network adjustment measures. That is, sequentially (in any sequence) bypass all installed balancing valves, measure the actual consumption of network water for each consumer, and immediately correct it to the calculated value.

9. Adjustment can be considered completed under the following conditions: 1) flow rate deviation for individual consumers ± 10% of the calculated one; 2) coincidence of the value of the total flow of network water, measured at the valves, with the readings of the flow meter at the boiler house with an error of no more than ± 5%; 3) not exceeding the estimated consumption of network water at the source by more than 10%.

Conclusion: based on the results of the work, a technical report is drawn up, and the heating network area's operating personnel are given a table containing the calculated and actual values of the coolant flow and the final setting positions (degree of opening) of the balancing valves.

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