DEVELOPMENT OF THE THEORY OF MATHEMATICAL MODELING AND ITS APPLICATION IN EDUCATION AND INDUSTRY

PROGRAM OF FLOW DIAGRAM FOR BOILER INSTALLATION

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Training of specialists at the present stage requires skills in handling computer technologies. The problem of calculation of flow diagram for boiler installation, which is one of the practically-oriented tasks of mathematical training of students of speciaity ”Information systems and technologies” has been considered. At a certain selection of parameters the developed calculation program makes it possible to increase efficiency of flow diagram, reduce power consumption and firing rate for heating, which is a topical problem in energy policy of the Republic of Belarus.

The aim of the paper is application of fundamental knowledge to the development of practical skills in the area of object-oriented analysis, programming and elements of design in solving practical tasks.

Material and methods. The basic thermal scheme of the boiler installation characterizes the essence of the main technological process of energy conversion and use of heat of the working medium in the installation. In developing basic flow diagram for reliable and cost-effective operation the type of the installation (steamer, water-heating and other boiler installations, heat and power plant), type and parameters of heat-carrying agent are determined on the basis of loads and in some cases on technical-economic calculations. Heat efficiency calculation of the designed flow diagram for boiler installation can be done taking into account efficiency factor [1].

Results and their discussion. Firing rate for auxiliaries of the boiler installation $\sum Q_{\text{св}}$ is sometimes 7–17% of the heat supplied to the consumers and depends on the parameters and type of heat-carrying agent; type of heat supply system (open or closed); method of heat-carrying agent heating (steam or hot-water generating units), deaeration system of feed water, amount of condensate returned from consumers as well as on the complexity of the basic flow diagram.

To work out and calculate a flow diagram it is necessary to have the following initial data:
- function of the boiler installation;
- heat-carrying agent;
- type of fuel;
- characteristics of heat supply system;

- amount of heat demands and parameters of the heat-carrying agent;
- amount and portion of the condensate returned;
- temperature of the raw water entering into the boiler installation as well as temperature of the water going to the chemical water treatment (the latter is connected with the quality of the incoming water and the scheme required for its treatment).

On the basis of the above mentioned data the calculation of the basic flow diagram is carried out. It consists of the following stages:

- selection and approximate determination of the parameters of the working medium in the various sections of the flow diagram;
- equating of the material balances for heat-carrying agent and working medium flows;
- developing and solving of the heat balance taking into account losses, starting with external parts of the flow diagram – raw water heaters, feed water, blow expander , etc.;
- calculation of water, steam and other heat-carrying agent consumption required for certain elements of flow diagram – heaters, chemical treatment of water, deaerators, etc. and specification of total heat flow from the boiler installation;
- determination of installation heat efficiency.

Conclusions. In this paper calculation of flow diagram program is carried out according to pre-determined values: boiler unit capacity, installation losses on the chemical water treatment, pressure loss in diagram elements.

Furthermore, while making exact calculations it is necessary to take into account pressure drop in steam lines and accessories up to heat exchanger of the boiler installation as well as to the consumers of the process steam which is determined at the minimum load of aggregates.

The results of the work are reported and discussed at the 44th Scientific and Technical Students' Conference at Mogilev State University of Food Technologies held on the 18-19th of May, 2017. There were given recommendations for further development and working out of the program.

Reference list:
1. Delyagin G.N., Lebedev V.I., Permyakov B.A. Heat-generation installations: Textbook for HEI /. – M.: Stroyizdat, 1986. – 559 p. [in Russian].