

AP19175311 “Improving energy efficiency and reliability of centralized heat supply based on optimization of thermal insulation parameters” – p.m. Baidyussenov G.N.

Relevance:

Improving the methods of optimization calculation of thermal protection of pipelines, equipment and substantiation of the methodology of selecting thermal insulation materials is important to improve the performance characteristics and efficiency indicators of heating networks with the development of the necessary software.

Heating networks account for a large share of wear and tear and, as a result, financial costs. Reducing the losses of the coolant and its energy potential, increasing the service life of CHS systems through the use of modern pre-insulated pipes and annual monitoring of their condition will allow for the rational use of the country's energy potential and reduce tariffs for thermal energy. Therefore, the analysis of thermal insulation materials that contribute to the efficient and long-term operation of heating networks is an urgent task in the development of heat supply systems.

1) there will be assessed reliability of the existing calculation methods of determining heat losses based on an analysis of actual data on materials, structures, the state of thermal insulation and the magnitude of heat losses in various operating conditions;

2) a methodology will be developed for determining standardized heat losses that allows calculating specific heat losses under different conditions of laying heating networks, taking into account a larger number of operating and design parameters;

3) a methodology will be developed for determining the optimal values of the parameters of thermal insulation made of polyurethane foam and TECHMAT pipelines when designing heating networks that allow for minimal heat loss and ensure energy-efficient technical and economic indicators of the heating network;

4) effective calculation programs and algorithms will be developed for predicting the values of heat loss in underground heating mains at the design stage, ensuring the normal operation of the heating network and preventing the destruction of the insulating and covering layer on the supply and return pipelines, flooding of the channel with network water, moistening of the soil around the heating pipe;

5) the possibilities of reducing heat loss standards to specific values for modern insulating materials (PPU and TECHMAT) will be identified and scientifically substantiated;

6) energy saving methods will be developed for the transmission of thermal energy by reducing heat loss through thermal insulation of pipelines using a thin-film coating on the surface of existing traditional insulation.

The project purpose:

The purpose of the project is to improve methods of optimizing calculation of thermal protection of pipelines, equipment and substantiating the methodology of selecting thermal insulation materials to improve the operational characteristics and efficiency indicators of heating networks with the development of the necessary software.

Expected and achieved results:

1. Reliability of the existing calculation methods of determining heat losses was assessed based on the analysis of actual data of materials, structures, the state of thermal insulation and the values of heat losses in various operating conditions.

2. A method of determining standardized heat losses was proposed that allowed calculating specific heat losses under different conditions of laying heat networks, taking into account a larger number of operating and design parameters.

3. A method of determining the optimal values of the parameters of thermal insulation made of PPU and TECHMAT pipelines was developed when designing heat networks that allowed for minimal heat losses and ensured energy-efficient technical and economic indicators of the heating network..



Figure 1 – Test laboratory bench for studying liquid thermal state that consists of a pipeline with thermal insulation

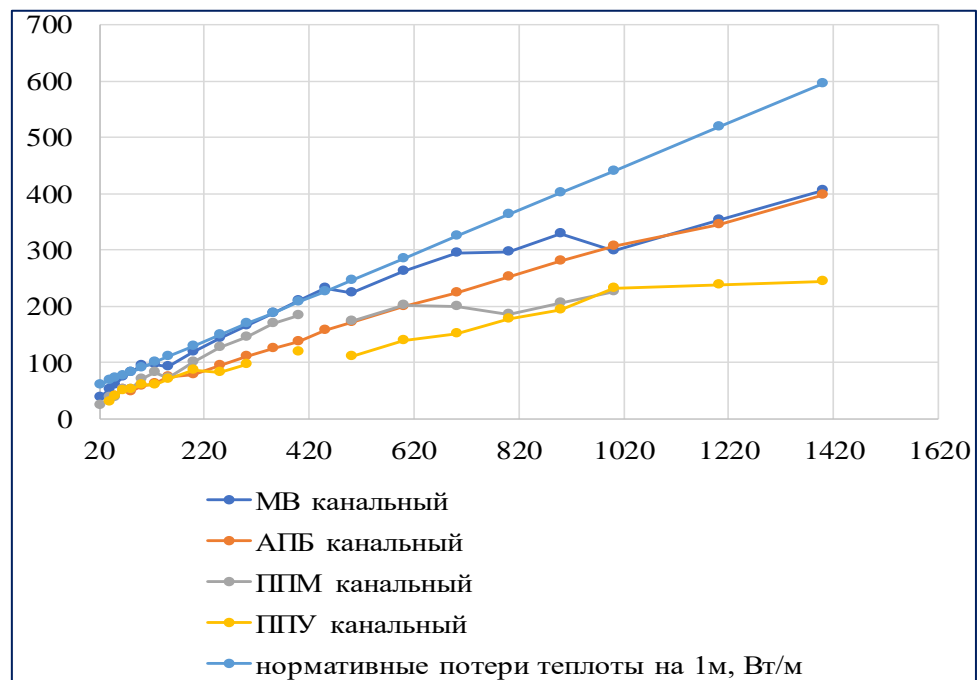


Figure 2 – Specific heat energy losses of a two-pipe channel heating line depending on the nominal diameter of the heating line

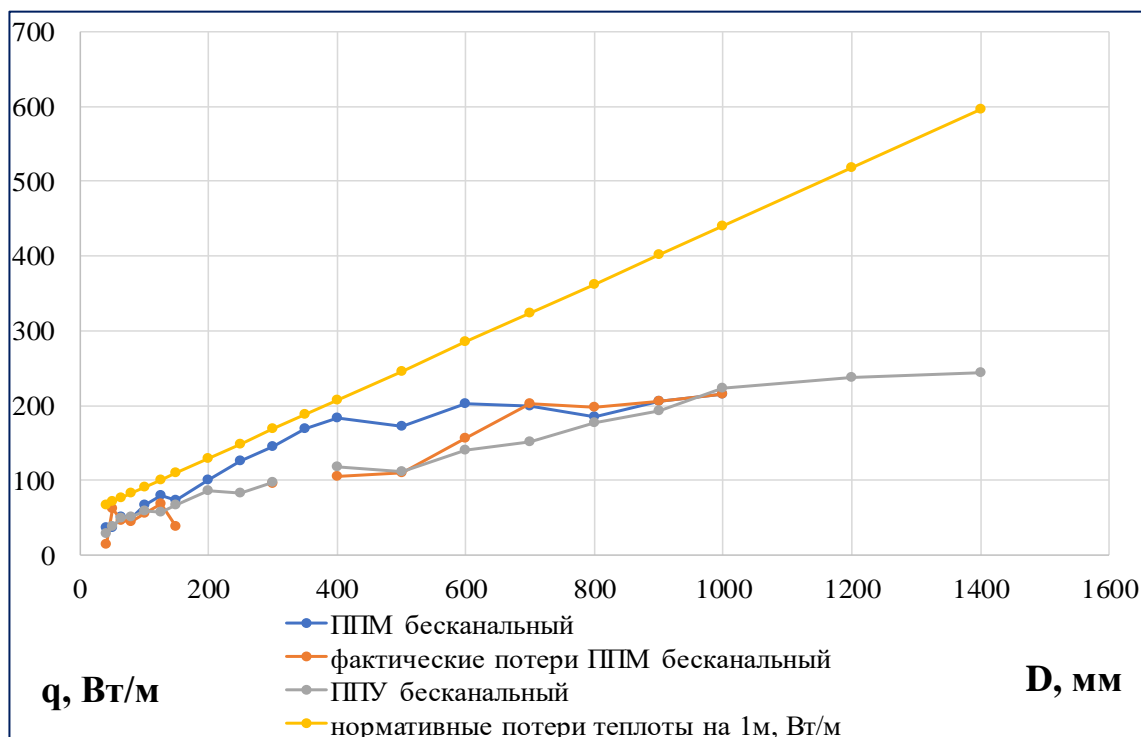


Figure 3 – Specific heat energy losses of a two-pipe ductless heating line depending on the nominal diameter теплопровода

Research team:

1 Baidyussenov Galym Nurzhanovich - scientific supervisor, master, senior lecturer at Abylkas Saginov Karaganda Technical University NJSC.

H-index: 1;

ORCID: 0000-0001-6145-7117;

Scopus Author ID: 57541025100;

ResearcherID: HGD-2613-2022.

2. Abildinova Saule Kianbekovna - scientific consultant, PhD, Associate Professor. G. Daukeyev Almaty University of Power Engineering and Communications NJSC.

H-index 3;

ORCID: 0000-0002-9502-6208;

Scopus Author ID: 57192198775;

ResearcherID: CCO-6276-2022.

List of publications:

1. Obtaining certificates of state registration of rights to copyright objects No. 44234 dated April 3, 2024. Object name: Results of the study to determine transport losses of thermal energy through thermal insulation structures of heating network pipelines. Authors: Baidyussenov Galym Nurzhanovich, Brazhanova Dana Korabayevna, Tleugabylova Makhabbat Kudaibergenovna.

2. Calculation of heat loss from thermal insulation designs of heat networks. Kazakhstan, International scientific and practical conference "XVI Saginov's Readings. Baidyussenov G.N. Integration of science, education and production", June 13-14, 2024, Karaganda

Information for potential consumers:

Improving the methods of optimization calculation of thermal protection of pipelines, equipment and substantiation of the methodology of selecting thermal insulation materials is important to improve the performance characteristics and efficiency indicators of heating networks with the development of the necessary software.

Heating networks account for a large share of wear and tear and, subsequently, financial costs. Reducing the loss of coolant and its energy potential, increasing the service life of CHS systems through the use of modern pre-insulated pipes and annual monitoring of their condition will allow rational use of the country's energy potential, reducing tariffs for thermal energy. Therefore, the analysis of thermal insulation materials that contribute to the efficient and long-term operation of heating networks is an urgent task in the development of heat supply systems.

The study is dealing with improving thermal insulation in the centralized heat supply network. The strengths of the proposal are the high relevance of the topic, that is, the energy efficiency and design of the energy infrastructure. Thus, the proposed topic is of great interest to Kazakhstan. Interesting and sought-after applied research in the field of energy and mechanical engineering objectives of the project and research plan are clear and realistic, there is a good infrastructure

A series of controlled laboratory experiments will be carried out to study the configuration and energy losses.

Scope:

The project is interdisciplinary. This approach is assumed in terms of interaction between narrow scientific fields. The project is relevant both for the civil engineering sector and for the mechanical engineering and energy sectors. Therefore, the proposal is awarded a high rating because it demonstrates interdisciplinary and highly innovative objectives.

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