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INCREASING THE ENERGY EFFICIENCY OF WALLS WITH WINDOW STRUCTURES

Mykola Savytskyi, Dr. Sc. (Tech.), **Viktor Kolokhov,** Cand. Sc. (Tech.),
Artem Sopilnyak, Cand. Sc. (Tech.), **Kostiantyn Shlyakhov,** Cand. Sc. (Tech.),
Andrii Tytiuk, Cand. Sc. (Tech.)
State Higher Education Institution
"Prydniprovska State Academy of Civil Engineering and Architecture"

Problem statement. Not so long ago, wooden windows with double frames or twin frames were installed in our houses. And such windows had many cracks which created a draft and allowed dust to pass through. Since heating costs were relatively low at the time, no one paid much attention to this.

But over the time, realizing the timing of the depletion of energy sources and the rapid rise in prices for them, people began to spend money wisely on utility costs and count heat losses.

Thanks to modern technologies, today it is possible to manufacture sealed metal-plastic windows with a single-chamber or two-chamber glass unit. At the moment, the main advantages of metal-plastic structures are determined by glass, fittings and a profile that is used for the manufacturing of sashes and frames, as well as energy-saving glass coatings.

So, during the construction of new housing or its reconstruction, the windows must have the minimum permissible values of heat transfer resistance: − for the first temperature zone of Ukraine − 0.75 ($m^2 \cdot K$)/W, and the walls − 3.3 ($m^2 \cdot K$)/W [12].

This indicator can be easily ensured for walls, but it is not so simple and very expensive for windows.

Also, to increase comfort, it is necessary to take into account the fact that condensation can form on the surface of the glass units, and moisture can accumulate on the slopes of the window openings, leading to the destruction of the trim and the appearance of mold.

Modern conditions of comfort and periodic increases in energy efficiency requirements for enclosing structures make us constantly improve the construction of window filling. And one of these types of window construction is a double-frame window construction with modern metal-plastic windows spaced at a distance (by calculation) to ensure thermal conductivity and increase noise insulation.

Purpose of the study. Increasing the heat transfer resistance of translucent structures for filling window openings.

Main results. For some covering constructions with windows, thermal conductivity calculations were performed using the "Elcut 5" software package.

When determining the reduced resistance of heat transfer of the structure, the following materials were taken: material of the bearing wall − heavy concrete λ = 2.04 W/(m·K) for operating conditions B [1]; window 3-chamber PVC profile − 0.63 W/(m·K) [3]; air gap − 0.15 W/(m·K) according to table 12 (with a closed layer width of 5…30 cm) [4] taking into account the phenomena of convection and radiation; standard window glass − λ = 1.0 W/(m·K) [5].

As an initial constructive solution, the enclosing structure (according to Fig. 1) was adopted, the walls of which were made of large reinforced concrete wall blocks, wooden windows with double frames, and a reinforced concrete decorative U element.

As a result of the calculation in the "Elcut 5" software package, data on the temperature distribution isofields before (on the left) and after insulation (on the right), as well as the change in the heat flux, were obtained.

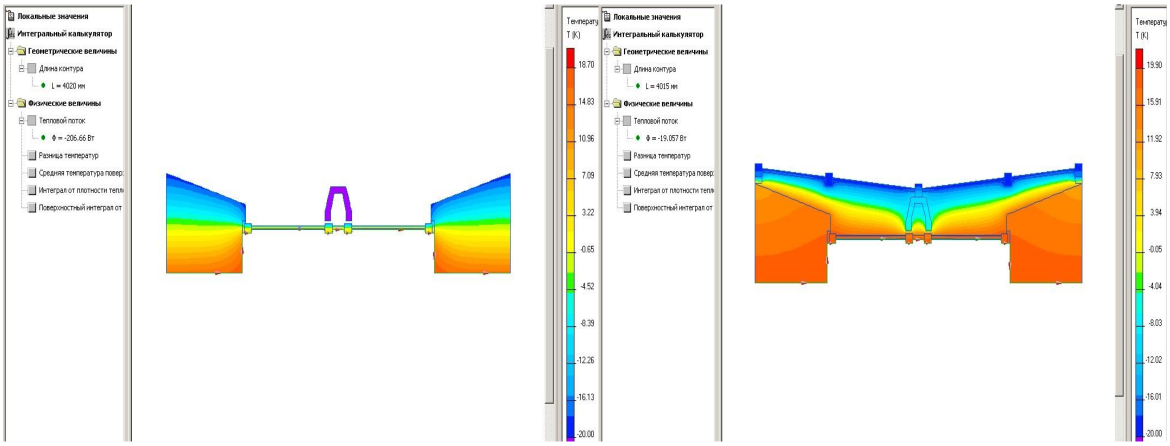

Fig. 1. Variant of a fragment of the enclosing structure before (left) and after (right) insulation with temperature distribution isofields

As seen in Figure 1, the heat flux decreased from 206 to 19 W, and, accordingly, the thermal conductivity coefficient of such a structure will decrease from 1.29 to 0.12 W/(m·K). At the same time, the reduced resistance to heat transfer increases from 0.31 to 3.36 (m^2 K)/W.

Conclusion. For enclosing translucent structures, the installation of an additional window frame increases the resistance to heat transfer, thereby reducing heat losses, the slopes become warmer, which prevents the formation of condensation on the window and the formation of fungus on the surface of the slopes.

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