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STUDY OF THE THERMAL CONDITIONS OF CONNECTIONS OF WINDOW BLOCKS TO A WALL

Khaitov Maruf Bolikulovich

Teacher, Samarkand State University of Architecture and Construction named after Mirzo Ulugbek, marufkhaitov20@gmail.com

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Abstract

In this article, the temperature regime of the nodes where the external walls and window blocks of buildings are connected is studied. Researches were conducted in natural conditions, and theoretical researches were carried out on them. Proposals have been developed to improve the temperature regime of junctions where external walls and window blocks are connected using extruded polystyrene foam.

Introduction. One of the main directions of the state policy of the Republic of Uzbekistan in the field of rational use of energy are: stabilization of production and consumption of energy necessary for the intensive development of the economy; stimulation of production of energy-efficient and energy-saving equipment and products with minimal energy consumption; stimulating the development of energy-efficient, energy-saving and environmentally friendly technologies and industries [1]. Along with the growing demand for highly comfortable housing, awareness of the world's limited reserves of mineral fuels, water and other resources has brought a new impetus to interest in the concept of an energy efficient home and in innovative holistic solutions suitable for both for cold and hot and humid climates [7]. An approach that uses globally appropriate and applicable technologies, materials and systems for retrofitting, energy efficiency of buildings provides the opportunity not only to create structures with incredible design speed, but also to immediately provide comfort and sustainability in buildings unseen in many places on the planet. Changing the biography and lifestyle of people as a result of an increase in average life expectancy is of great importance in the design of private mansions and residential blocks of flats. In developed countries, the use of living space, energy and water consumption will only increase as a result of rising prosperity. Deepening modernization, striving for comfort and standard of living according to European standards increases the consumption of primary energy per capita, which means on a global scale, at least a doubling of consumption from the current 1.19 tons of mineral fuel (per capita in oil equivalent) already in foreseeable future [7]. But this development takes place against the backdrop of the spread of existing, sometimes outdated technologies. Resistance to the introduction of new technologies leads to the waste of a huge amount of energy. The developed translucent structures and systems for hot and dry climates, in addition to being reliable in operation and providing comfortable conditions and energy efficiency, must be adapted and "accepted" by the local construction industry. Health, well-being and the growing demand for comfort and convenience must be considered as a key factor. Efficiency and well-designed standards, regulations and building codes, as well as

financing schemes, will be key to creating conditions for balanced, sustainable, self-sufficient development. The reduction of natural energy reserves poses an acute problem of energy saving and energy efficiency of buildings. The solution to this problem is closely related to the increased requirements for the quality of building design, since design errors lead to a decrease in the heat-shielding properties of building envelopes and increase energy costs for building operation. The choice of a rational constructive solution at the design stage is associated with the problem of studying the processes of heat and mass transfer, predicting the temperature and humidity regime of building envelopes and improving the accuracy of thermal engineering calculations, since the temperature and humidity regime of enclosures directly affects the microclimate of the premises, heat-shielding properties, reliability and environmental safety of the building.

Research Methodology. To accomplish the tasks set, the following research methods were used:

1) Organization and monitoring of the formation of condensate, mold, shedding of interior finishes as a result of freezing moisture on the internal slopes of window blocks.
2) The study of experimental studies in experimental objects. When deriving analytical dependencies in the proposed calculation methods, the following were used: methods for calculating temperature fields using computer programs; patterns of change in temperature fields; equations of building heat engineering of enclosing parts of buildings; computational methods.

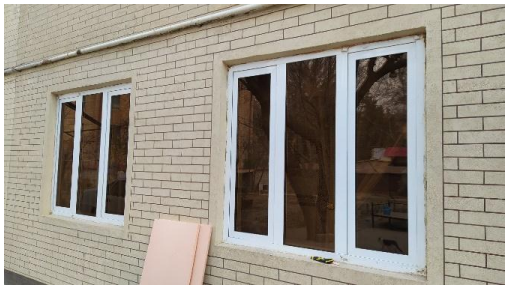
Analysis and results. The results of field studies of the thermal regime of the nodes adjoining window blocks to the walls:

Studies in the form of full-scale experiments were carried out in the city of Samarkand, where the average outdoor temperature of the coldest five-day period with a security of 0.98 is (-15 ° C) [16]. The experiment was carried out on the example of the junctions of two separate window blocks (aluminum profile 50 mm wide with a double-glazed window) to the wall (brickwork on the CPR) with non-insulated and insulated slopes on the outside with extruded polystyrene foam of the living room. Below is a step-by-step process of insulating the slopes of one window block with extruded polystyrene foam Fig. 3.1. For mounting the insulation to the slopes, I used tools: a drill with a drill for concrete, a clerical knife, a hammer, a spatula, a tape measure, a ruler, a mixer.

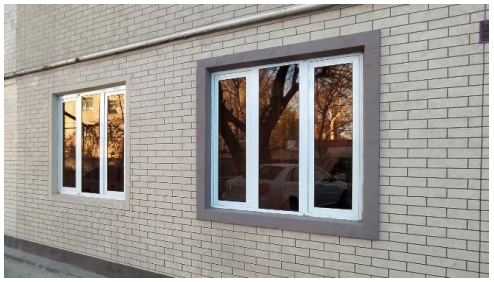
Materials were used such as 2 sheets of extruded polystyrene foam (size 1185x585x20), reinforced waterproof frost-resistant glue Megamix, primer, reinforcing mesh, dowel fungi, metal corners, and sandpaper.

The main physical and mechanical characteristics of extruded polystyrene foam: density - 30-35 kg / m3, flexural strength - 483 kPa, thermal conductivity of the plates in a dry state at a temperature: (25±5)ºC: 0.030 W / (m·ºC), humidity by weight - 0.07%, water absorption in 24 hours: 0.41%.

Before applying each layer, a primer was carefully applied to the previous layer. To form a rough surface, extruded polystyrene foam was treated with coarse sandpaper. This is necessary to improve adhesion with the adhesive.



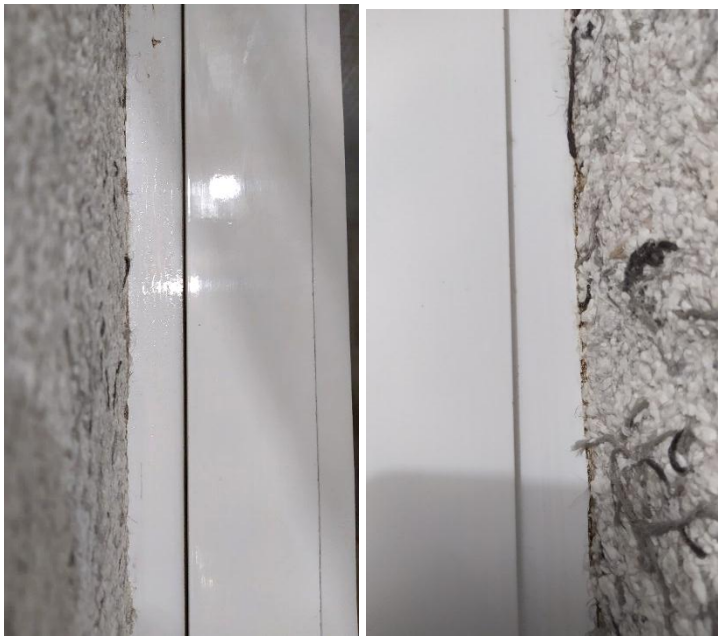
a)



b)

Fig.3.1. Insulation of window block slopes with extruded polystyrene foam: a - view of the facade before insulation; b - view of the facade after the insulation of the slopes.

In winter, surface temperature readings were taken at the junctions of window blocks to walls, both on insulated and non-insulated slopes, and calculations were made. It was visually observed that at a certain temperature and air humidity, condensate appeared on the non-insulated window unit (on the junction and on the frames) (Fig. 3.2.a), while no condensate was observed on the insulated window unit (Fig. 3.2.b).



a) **b)**

Fig.3.2. The condition of the window frame and the junction node under identical temperature and humidity conditions: a) observed condensate; b) no condensation.

Conclusion/Recommendations. As a result of the field experiments and theoretical calculations of the temperature field at the junctions of the window block to the external fences, the following conclusions can be drawn:

1) At the junctions of window blocks to the outer wall without the use of insulation, at a negative outside temperature, condensation is visually observed.
2) The results of the theoretical calculation of the temperature field of the junction of the window block to the outer wall showed a lower temperature of 6.67ºC than the temperature of the condensation point equal to 10.7 ºC with an uninsulated version and an outdoor temperature of -15 ºC.
3) When insulating the outer slopes with extruded polystyrene foam 20 mm thick, no condensation is

observed on the inner surface of the junction of the window block to the wall.

4) The results of a theoretical calculation of the temperature field of the junction of the window block to the outer wall showed a temperature increase of up to 14.6ºC, at a temperature of the condensation point equal to 10.7 ºC with insulated slopes and an outdoor temperature of -15 ºC. In this regard, it is recommended to insulate the external slopes with extruded polystyrene foam. Based on the analysis of methods for calculating the temperature in the thickness of the enclosing structures, as well as as a result of field experiments and theoretical calculations of the temperature field at the junctions of the window block to the external fences, the following conclusions can be drawn:

1) Far from the junction of the window block, i.e. at a distance of 1-1.5 meters from this place to calculate the temperature along the thickness of the wall, you can use the formulas given in KMK 2.01.04-97 * [17].

2) To calculate the temperature at the junction of the window block to the outer wall, the temperature field calculation method based on the finite difference method [13] should be used. In this case, it is recommended to place the grid threads more densely in the area of the field of the junction node, and more rarely in the rest of the field, significantly reducing the number of grid nodes, and, consequently, the number of calculation equations.

3) In the junctions of window blocks to the outer wall without the use of insulation at a negative outdoor temperature, there is a high probability of condensation.

4) The results of the theoretical calculation of the temperature field of the junction of the window block to the outer wall showed a lower temperature of 6.67ºC than the temperature of the condensation formation point equal to 10.7 ºC with an uninsulated version and an outdoor temperature of -15 ºC.

5) When insulating the outer slopes with extruded polystyrene foam 20 mm thick, no condensation is observed on the inner surface of the junction of the window block to the wall.

6) The results of a theoretical calculation of the temperature field of the junction of the window block to the outer wall showed an increase in temperature to 14.6ºC, at a temperature of the condensation point equal to 10.7 ºC with insulated slopes and an outdoor temperature of -15 ºC. In this regard, it is recommended to insulate the external slopes with extruded polystyrene foam.

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