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Influence of window installation on heat flow in the external wall

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Abstract

Currently, due to the energy crisis and the need to increase the energy efficiency of buildings, design solutions that reduce heat losses resulting from the occurrence of thermal bridges in building envelopes have become the priority. The structural solutions of walls and windows as well as the materials used to make them are well recognized and their further improvement results in only a slight improvement of technical parameters. While heat losses due to thermal bridges at the window-to-wall interface are still a problem. The article analyses the influence of window position in the wall and the window installation method on the selected thermal and humidity parameters. The traditional installation of windows with the use of polyurethane foam and the so-called "warm installation" in the thermal insulation layer with the use of a specially profiled composite frame were compared. Analytical and numerical calculations have been performed. Numerical simulations were carried out using the TRISCO program for thermal analysis of building components. The computational models were compared with regard to the temperature distribution in the cross-section of the wall and the location of the 0°C isotherm as well as the wall freezing point. The performed analyzes show that the proposed innovative method of window installation system results in eight times lower linear heat transfer coefficient Ψ and a significant reduction in heat losses. In addition, it meets the requirements of The Passive House Institute regarding to the risk of mold and fungus development in the area of thermal bridges and the effectiveness of the window-to-wall interface.

Keywords: composite frame, energy conservation, heat loss, linear heat transfer coefficient, numerical calculations