

Interior Heat Comfort Improvement

By Means of Doors and Windows of Higher Insulation Capabilities and Inner- Wall-and-Ceiling Decorative Coatings of Low Heat Permeability

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In recent times, both the specialized editions and such addressing the general public are paying attention to the formation of an optimal temperature and humidity field as a necessary condition for a good life comfort. Subjects of publication are a number of contemporary materials and structures such as front wall protection systems, low heat conductivity materials, materials of high hydro-insulating properties, and others. Their application is also encouraged by the Regulations for the Designing of the Heat Insulation of Buildings in Bulgaria (Regulation 1, State Gazette number 7/26.01.1999).

Parallel to that, the Regulations allow for the applications of materials and items leading, on the one hand, to increased heat losses, and to worsening of the inhabited spaces quality, on the other. Typical heat comfort deterioration during the winter season is

the formation of cold zones within the rooms.

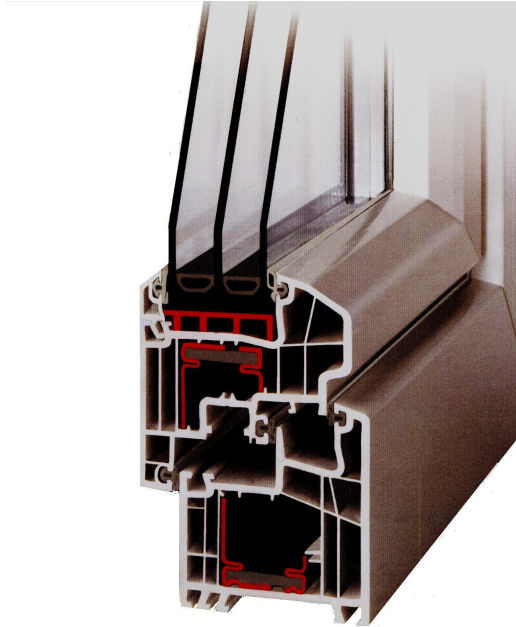
Such zones are characterized by abrupt temperature drops, they are conducive to condensation, and impart the unpleasant subjective feeling of chill.

In present times, the main reason for the formation of such zones is

**the low insulating capabilities
of the commonly utilized windows and balcony doors.**

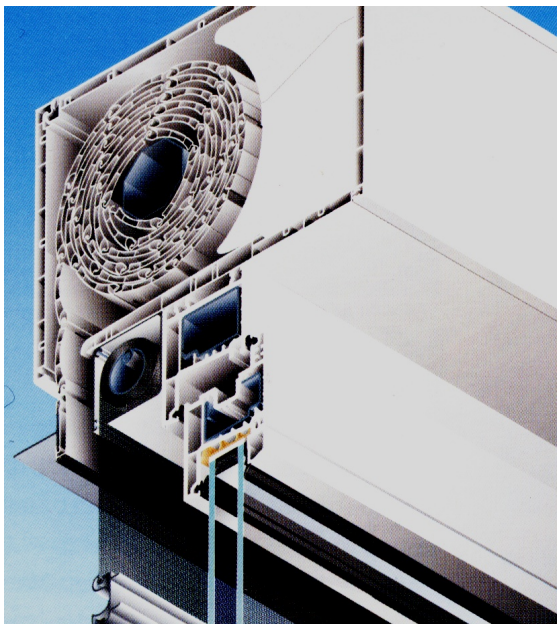
Regulation 1 is sufficiently rigid as to the compact parts of the surrounding wall structure (heat transfer coefficient k lower than $0,5 \text{ W/m}^2\text{K}$). At the same time, the Regulation is rather generous to window frames and allows in this case a maximum heat transfer coefficient $k = 2,65 \text{ W/m}^2\text{K}$. The predominant part of locally employed doors and windows have $k = 1,8$ to $2 \text{ W/m}^2\text{K}$, that is, everything is all right from the normative point of view, however, such practice leads to 4 (four) times higher heat losses through the windows, in comparison to the compact parts.

This leads to high temperature losses and deteriorated living comfort. In order to solve the problem, it is necessary to implement doors and windows of **k** lower than 1,2 W/m²K.



This window has triple glass, Low-e coating over inside surface of the outside glass and many section frame. It has heat insulation possibility ($\kappa = 0,8$ W/m²C) very near to the possibility of the wall construction.

A substantial reduction in heat losses and restrained window condensation will be achieved through the installation of external roller-blinds, made of profiles, either hollow or filled with foamy polyurethane.

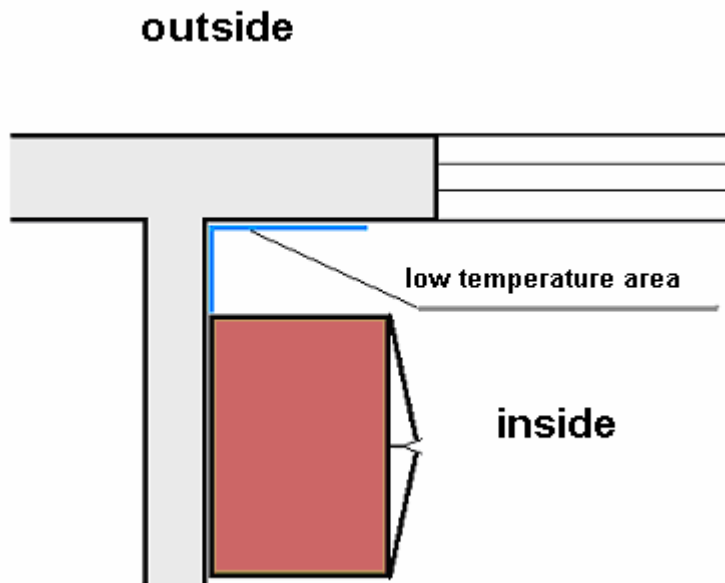


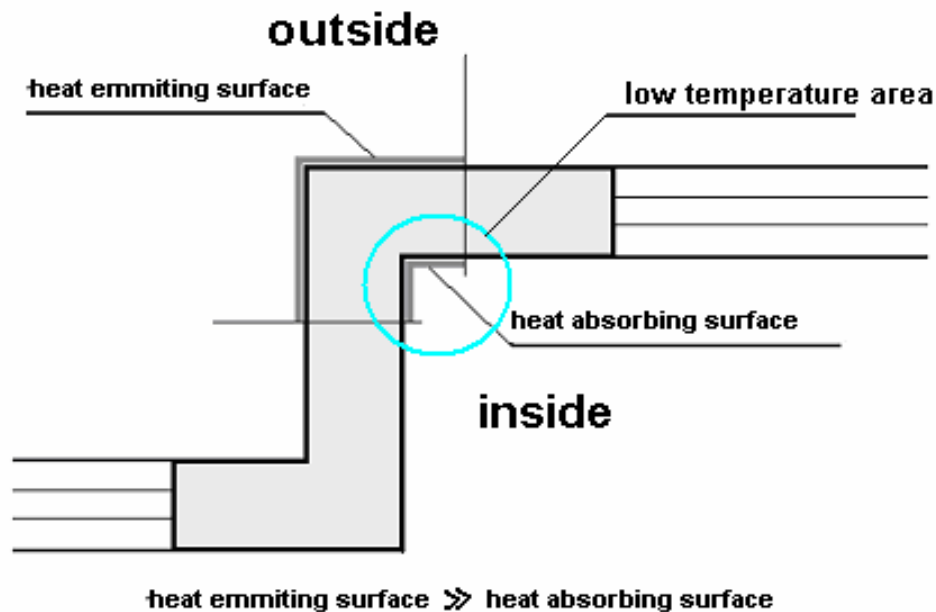
The external roller-blinds are a good sun protective means in the summer, and during cold winter nights they reduce about 10% of the heat losses and restrict the risks of condensation.

As it was pointed out above, the application of Regulation 1 warrants the achievement of high insulation properties of the compact parts of weather-exposed structures. On the other hand, through the external laying of the main insulation, the wall structures are well protected against outdoor temperature fluctuations. Which is then the reason, practically leading to the formation of

**zones of lowered temperature along
weather-exposed external wall structures?**

This process is particularly characteristic for such indoor spaces, which are used only a few hours a day, and, because of economical considerations, the heating in them is switched on immediately before use – bedrooms, studies, etc. In such cases, the wall surface temperature lags significantly behind the rapidly increasing inner air temperature and cold zones form along the external boundaries of the spaces, giving the inhabitants the feeling, that the walls are “drawing” and “generating cold”. Particularly consistent they are behind curtains, in back of massive pieces of furniture, and others. (see the following examples)





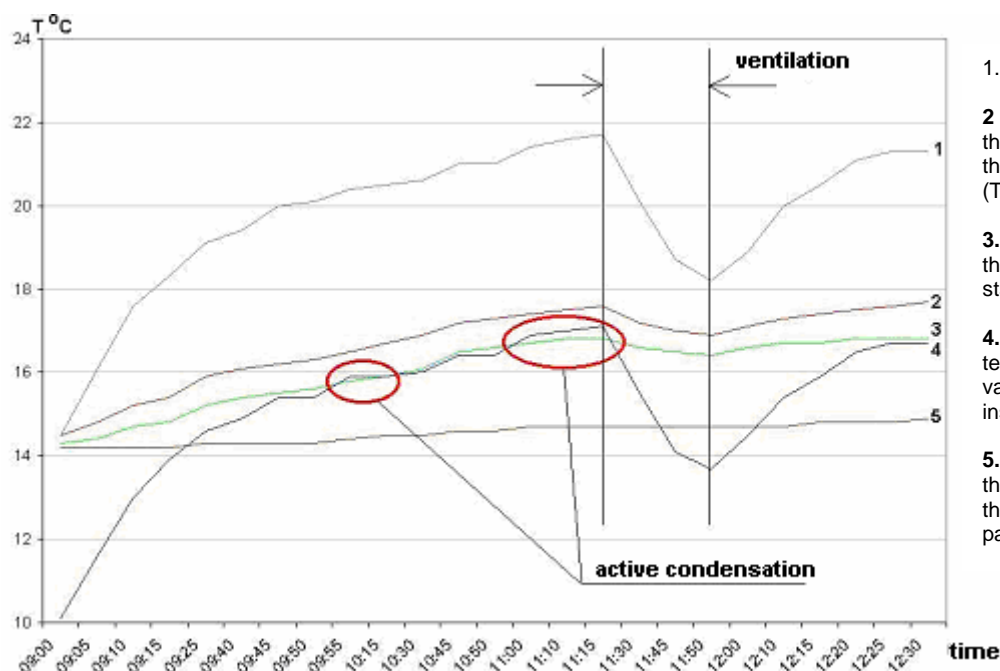
In such zones, the wall surface temperatures remain for a long time lower than the condensing temperature, as a result of which intensive condensation takes place. In spite of being properly calculated, the external insulation remain in this case ineffective – the temperature waves do not practically attain it, because of their fading away in the inert main wall structure.

The solution of this problem, concerning an increasing number of dwellings, is the replacement of the traditional wall surfacing – latex, wall-papers – by

**decorative coatings
of low heat permeability.**

Typical coatings, belonging to this group, are thermo-ceramic coatings (ThermoShield), pearly-wall-papers, foamy-polyurethane-wall-papers, cork coatings, etc.

Under the conditions of the above described heat-exchange process of strongly pronounced non-stationary nature, the low heat permeability of the coating ensures high contact temperature between indoor air and boundary wall surface. The formation of a cold zone, which would worsen the comfort of inhabitation, is avoided. Also eliminated are the conditions for the emerging of condensation and mould.



1. Variation of the room temperature in

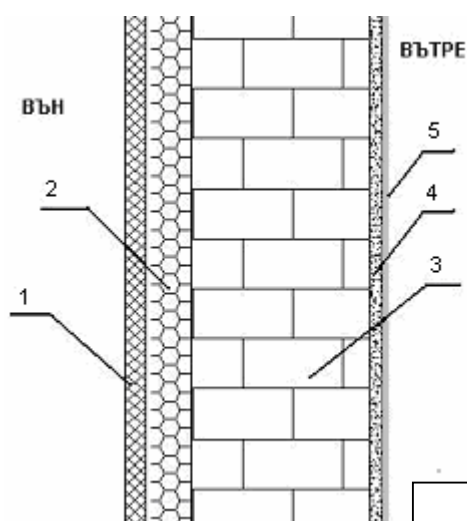
2 Variation of the temperature of the part of wall surface, coated by thermo-ceramic coating (ThermoShield)

3. Variation of the temperature of the part of wall surface, coated by standard latex paint

4. Variation of the condensation temperature in accordance with the variation of the temperature off inside air, containing 75% humidity.

5. Variation of the temperature of the wall construction - 5 cm under the surface (equal for the both parts)

Comparative analyses of two wall surfaces, one of them painted by standard latex, and the other – by popular thermo-ceramic coating. The part of the wall, coated by the ceramic coating keeps stabile temperature (2), higher than the temperature of condensation (4), but in the latex painted part (3) the risk of condensation is greater – there is condensation in the red signed areas.



1. Outside multi-layer coating with decorative, protective and hydro-insulating properties;
2. Heat insulation /polystyrene foam, polyurethane foam, mineral wool/
3. Basic wall construction /bricks, concrete/
4. Inside plaster $\lambda < 0,16 \text{ W/m}^0\text{C}$ /with or without filling/
5. Decorative coating of low heat permeability $\beta < 1,7 \text{ W.h}^{1/2}/\text{m}^2.^0\text{C}$ /ThermoShield, Pearl-wall papers, Cork/

Optimal wall construction, suitable for non-stationary heat exchange, providing good climate and healthy conditions in the living environment

The elimination of disturbances in the optimal temperature and humidity field, considered in the Report, makes it possible to minimize a number of problems, disagreeable to the inhabitants, and contributes to the achievement of a higher overall standard of inhabitation.