ECONOMIC MANAGEMENT WINTER THERMAL DESCRIPTION OF RESIDENTIAL ROOMS

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Abstract. In the cold period of the year, the fences protect the living space from outside temperatures and wind, and the heating system allows the maintenance of a certain temperature. The stability of the temperate regime of housing or work space is in correlation with the existence of cold surfaces of outside fences and heating surfaces of the heating system. Cold and hot surfaces bind convective air currents and appear as sources of "positive" and "negative" radiation fluctuations, which are all the more intense - if there are major temperature differences. The outside air temperature is constantly changing. As a consequence, the temperature of the walls of the living or working space changes. The highest temperature differences occur in the peaks of rough winters. If the outside fences and the heating system allow the comfort conditions to be met within the living and working space, especially in the case of raw winters, it is possible to fill the required comfort throughout the winter. Infiltration of cold masses of the air, heat loss by radiation, or vice versa, in proportion to the increase in heat allocation, in people living inside the living or working space, create an unfavorable feeling of cold or increased heat. Such shades not only cause the feeling of a confrontation of life or work, but can also lead to various illnesses.
Keywords: Economic management, Housing and work comfort, Industrial management, Provision of proactive conditions, Heat flow, Heat losses, Projecting parameters, Optimal climate of the living space

INTRODUCTION

The conditions of the winter regime are closely linked to the feeling of confrontation and the fulfillment of hygienic and sanitary conditions throughout the year in the housing and work space. In residential areas, the appropriate groups of housing and work space are usually selected, with approximately the same requirements in terms of securing an industrial confrontation. In addition to hygienic and sanitary conditions, it is necessary to provide appropriate technological requirements. For example, in hospitals, children's cribs, and so on, it is necessary to provide a rigorous technology for requirements related to the requested consortium. This provision of the requested confrontation relates to a year-round period, which also means during periods of rough winters. In some workplaces, where the operating system is generally run periodically over certain time periods, the requirements for the technical optimum of the confrontation may be blurred.

In order to ensure the necessary technological demands of the confrontation, it is necessary to select the thermal protection properties of the enclosures of enclosures, the required heat capacity of the heating system, and fulfill other conditions related to the achievement of the necessary hygienic and sanitary conditions of the place where he lives and works. The choice must be made according to the calculations, which are closely related to the various external budgetary project conditions. This means that the provision of the given internal project conditions is closely related to the budget parameters of the external climate. Indeed, in performing the calculation, by adopting the most extreme budgetary external parameters, for a given region, then the thermal protection of the enclosed space and the thermal protection of the heating system will provide the required sense of confrontation and the safety functioning of the automation and regulation system.

The most extreme cold period of every winter can be called "case". When selecting parameters, based on a certain likelihood of occurrence, it is necessary to treat a number of such "cases". This is taken into account through the so-called coefficient of collecting K_0, whose size shows the share of general characteristic cases, but so that it is in compliance with the budgetary project conditions. The climate parameters for each such case are related to determining the continuity of the required state, and through such security coefficients, the duration of the budgetary project parameters can be indicated. Establishing a deterministic connection of the budgetary conditions with the parameters of the climate, to a large extent ensures the achievement of the required comfort of living space.

The influence of the external climate on the thermal regime of the fence and the living space is very complex. This impact is reflected in the complex correlation of several meteorological parameters. When calculating the heat transfer through the fence of the living space, the influence of the mentioned meteorological parameters must be taken into account in a fairly complex relationship. In the winter thermal regime, such parameters are distinguished as the temperature of the external air t_s, then the influence of the wind speed v_s, and the like. Then, additional

parameters such as the relative humidity of the φ_s, the heat content of the J_s of the outer air, as well as sunlight radiation, wind rose, precipitation, etc., must also be taken into account.

Some of these parameters are interconnected, so changing one of these parameters causes the change of another, and so on. For example, changing the rosette of the wind is closely linked with the change of other budgetary parameters. This means that the provision of budgetary external project conditions, with the condition of the value of the security coefficient, is closely related to the achievement of the required air condition of the living space.

For winter conditions, the budget basically is based on the determination of the determination of dependent budgetary relations in relation to the parameters t_s and v_s, with the participation of the given coefficient for securing the project conditions K_0 .

It should be emphasized that the realization of such an assignment, with the achievement of the required climate of living space, is a very complex task. The calculation can be enlarged if the above procedure is based on the use of probability theory. Namely, the theory of probability is based on the fact that the change of one of the parameters of the living space climate conditions the periodic change of another parameter. This practically means that a relationship can be established:

$$K_0(t_s, v_s) = K_0(t_s) \cdot K_0(v_s / t_s) \qquad (1),$$

where $K_0(t_s)$ is the coefficient of protection for the given outdoor air temperature, while $K_0(v_s/t_s)$ - provides the determination of the wind speed at the specified outside air temperature t_s.

Dependence (1) can be simplified if one takes into account that the second correlation factor $K_0(v_s/t_s)$ equals one with the value, which will say:

$$K_0(t_s, v_s) = K_0(t_s), where \cdot K_0(v_s / t_s) \approx 1 \qquad (2).$$

In addition to the reverse budget task, the following condition can be practically used: The air temperature of the air conditioner can be determined by the given security coefficient $K_0(t_s) = K_0(t_s, v_s)$, while the budgetary values of the external air velocity vs are provided at the adopted ratio $K_0(v_s /t_s) = 1$.

This principled approach can also be used in relation to other important budgetary parameters, such as in relation to the flux of sunken radiation (q):

$$K_0(t_s, q) = K_0(t_s), where \cdot K_0(q / t_s) \approx 1 \qquad (3).$$

Table 1 gives the values of the coefficient of security K_0 for living spaces with different exposition climatic conditions, and for the winter calculated parameters:

CHARACTERISTICS OF LIVING SPACE	Level Requirement	K_o
High required sanitary conditions	Highs (H)	~1
The demands of people or the technological regime	Raised (R)	0.9
Restrictions on the use time of the living or working space	Medium (M)	0.7
Short-term use of workspace	Lovell (L)	0.5

Table 1: Security Coefficient (K_0) for calculating conditions for the winter period of the year.

DETERMINATION OF OPTIMAL RESISTANCE OF THE LIVING SPACE

In addition to the modern technological industrial management, the use of very efficient heat insulating constructive materials is very effective. By using such suitable materials, the required comfort of the living room cubicle can be achieved. With the absorption of such suitable constrained insulating materials, which are suitable for insulation points of view, and which possess the necessary structural strength, with suitable calculation models, the optimum thermal resistance of the fence of the living space can be determined.

As an ecological parameter, with the provision of rational constructive solutions, the size of redundant losses A can be determined:

$$A = K + E \cdot T \qquad (4),$$

wherein:

K- Capital costs of the fence and in connection with this and heating / cooling system, depending on the thermal fence resistance, Euro / m^2;

E-expense costs, which basically refer to the costs of achieving the required heat flux, and the costs of overhauling and maintenance of the fence and heating systems, Euro / m^2;

T-normative deadline for supplementary capital investments, which is adopted in the size of 8.33 years.

The optimum thermal resistance of the enclosure of the living space is determined by the fact that the thermal resistance of the fence is the smallest, that is, the heat shafts are the smallest.

It practically means that the minimum thermal resistance $R_{0,opt}$ is obtained from the requirement that a minimum of the function A is required:

$$\frac{\partial A}{\partial R_0} = 0 \tag{5}$$

First, a simple case will be considered. If we ignore the low losses in relation to the used heath systems, so in determining the costs of K we limit ourselves only to the cost of the fence, then it can be assumed that:

$$K = K_K + \delta_{iz} \cdot C_{iz} \tag{6}$$

where K_K is the cost of the chest structure of the enclosure without an insulating layer (K_K- practically does not depend on the thickness of the insulating layer); δ_{iz} - thickness of the insulation layer, m; C_{iz} of the cost of insulation in the composition of the fence structure, Euro / m^3.

With regard to the calculation of the expense costs E, it can be assumed that the costs mentioned are equal to the product of the exchanged heat flux Q_T, calculated for a period of one year, through 1 m^2 of the fence:

$$E = Q_T \cdot S_T = \frac{(t_L - t_{hp}) \cdot n_{hp}}{R_K + \delta_{iz} / \lambda_{iz}} \cdot S_T \tag{7}$$

wherein:

S_T- the cost of the heat flux of heat generated through the fence, Euro / kJ;

R_K - thermal resistance of the fence without calculating the insulation layer, m^{2}hK / W;

t_{hp} and n_{hp} - temperature and duration of the heating period, ^{0}C and h / year.

If we mark that it is:

$$M = (t_L - t_{hp}) \cdot n_{hp} \tag{8}$$

then the reduced losses A are:

$$A = K_K + \delta_{iz} \cdot S_{iz} + \frac{M \cdot S_T \cdot T}{R_K + \delta_{iz} / \lambda_{iz}} \tag{9}$$

Bearing in mind the relation (5) is obtained accordingly:

$$\partial A / \partial \delta_{iz} = S_{iz} - \frac{M \cdot S_T \cdot T}{\lambda_{iz} \cdot (R_K + \delta_{iz} / \lambda_{iz})^2} = 0 \tag{10}$$

so that optimal (minimum) thermal resistance of the fence can be obtained, and hence the optimum thickness of the insulation layer can be determined:

$$R_{0,opt} = R_K + \frac{\delta_{iz,opt}}{\lambda_{iz}} = \sqrt{\frac{M \cdot S_T \cdot T}{\lambda_{iz} \cdot S_{iz}}} \tag{11}$$

If we take into account the costs in relation to the heating system, as well as the costs of depreciation and regular overhaul, then the ratio is:

$$R_{0,opt} = \sqrt{\frac{(t_L - t_p) \cdot S_Q \cdot (1 + C_Q \cdot T) + (t_L - t_{hp}) \cdot n_{hp} \cdot T \cdot S_T}{\lambda_{iz} \cdot S_{iz} \cdot (1 + C_w \cdot T)}} \tag{12}$$

wherein:

S_Q- is change of losses in the heating system, in Euro, when changing the heat flux by 1 W;

C_O , C_w - costs of depreciation and for current overhaul in relation to capital costs in the fence and heating system, 1/year.

In analogy, the optimum thickness of the insulation layer can be determined when the air conditioning system is used in the given building system. With certain reductions, it is now possible to write:

$$R_{0,opt} = \sqrt{\frac{(t_L - t_p) \cdot S_Q \cdot (1 + C_Q \cdot T) + (t_L - t_{hp}) \cdot n_{hp} \cdot T \cdot S_T + \Re_1 + \Re_2}{\lambda_{iz} \cdot S_{iz} \cdot (1 + C_w \cdot T)}} \qquad (13),$$

$$\Re_1 = (t_{cond.w} - t_{Ls}) \cdot S_{cond.K} \cdot (1 + C_{S.K} \cdot T) ; \Re_2 = (t_{cond.cool} - t_{Ls}) \cdot n_{coll} \cdot T \cdot S_{coll}$$

where the index code K- refers to the codification of the air during the summer period; $t_{cond.w}$- budget outdoor temperature in relation to the summer period; t_{Ls} - temperature in the living space during the summer period; $t_{cond.cool}$ and n_{coll}- mean conditional temperature and prolongation of the cold period; S_{coll} - cost of refrigeration cheese, Euro / J.

Figure 1 shows the appearance of characteristic curves with the determination of the optimal (minimum) thermal resistance value ($R_{0,opt}$, m^2K/W), i.e. the optimum thickness of the insulation layer. It can be noted that one curve is a linear character with a trend in growth, while the other is a curve of a non-linear character with a declining trend. In the resultant curve (A), an optimal (minimum value) of thermal resistance can be determined, whereby the calculations show that the abscise $R_{0,opt}$ in general does not coincide with the abscise of the point of intersection of the characteristic component curves.
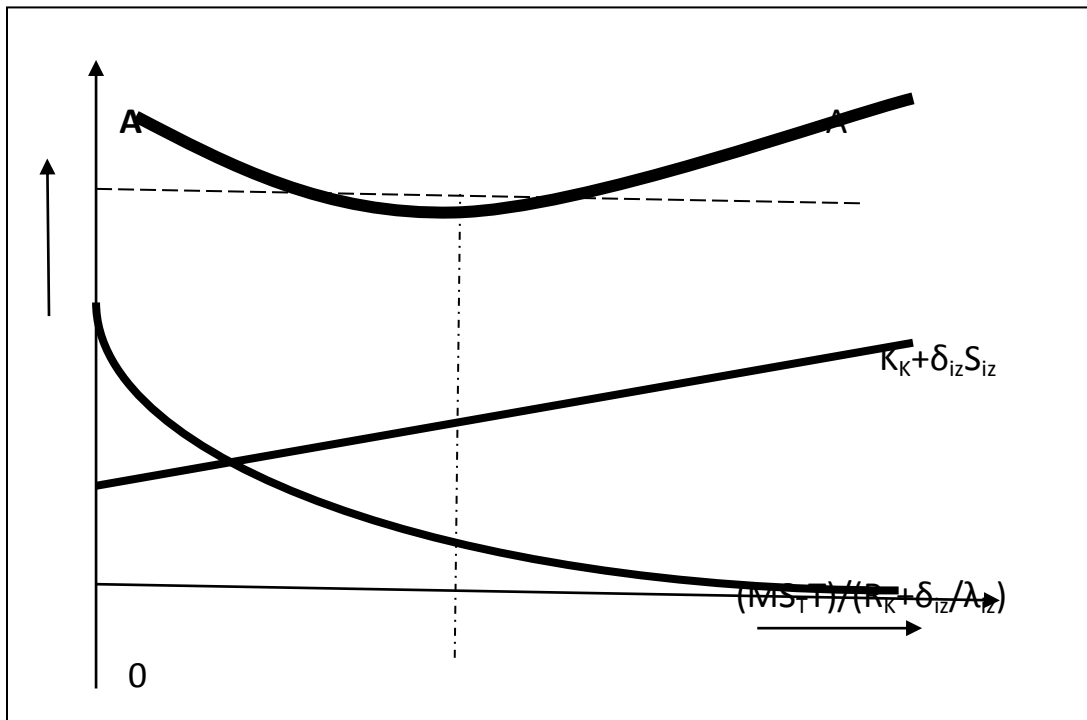

Figure 1: Along with the determination of the optimum thickness of the insulation layer.

In the figure 2 given determination of the optimum (minimum) thermal resistance value for one specific case (for concrete projecting parameters): $t_{hp} = -3.7\ ^0$C, $S_T = 0.48.10^{-9}$ ♀Euro/J, T=212.8,33.24.3600 s, $S_{iz} = 21.5$ Euro/m^3.

According to the diagram in figure 2 it can be noticed:
- With the increase in the value of thermal conductivity (λ_{iz}) of the insulating material, the thermal resistance decreases in its value.

- For the same thermal conductivity, the thermal resistance of the enclosure is higher for a higher temperature value (t_L) of the air.
- It can be concluded that the thermal resistance of the fence is smaller (more optimal) in its value, if insulating materials with a lower thermal conductivity coefficient are used, and if the demanding temperature of the living space is smaller in its magnitude (whereby strict requirements must be taken into account achieving a sense of well-being of life).
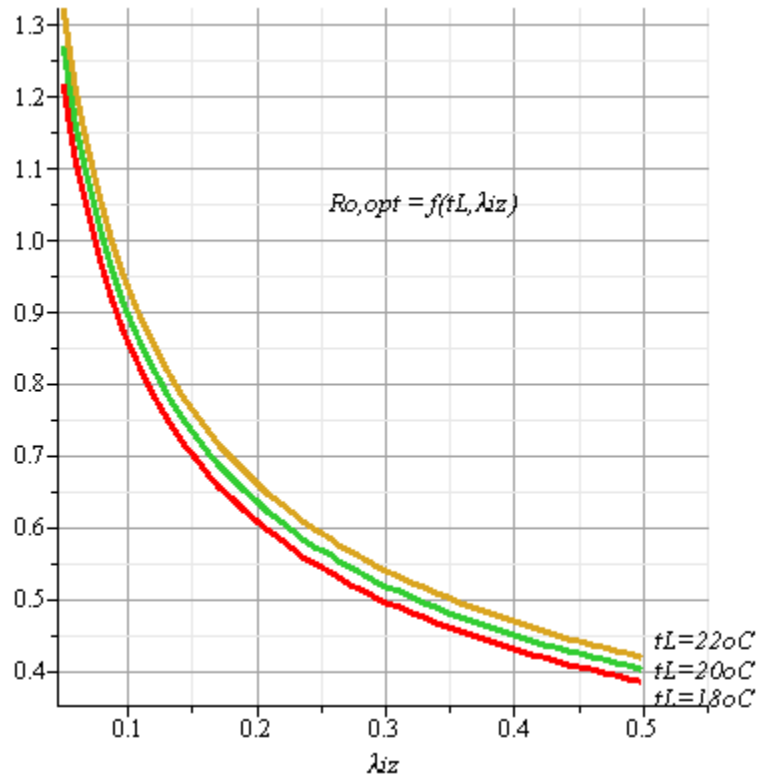

Figure 2: Determination of the optimum (minimum) thermal resistance value for one specific case (for concrete projecting parameters, relation (11)).

In the figure 3 given determination of the optimum (minimum) thermal resistance value for one specific case, for concrete projecting parameters like a figure 2.

According to the diagram in figure 3 it can be noticed:
- With the increase in the value of thermal conductivity (λ_{iz}) of the insulating material, the thermal resistance decreases in its value.
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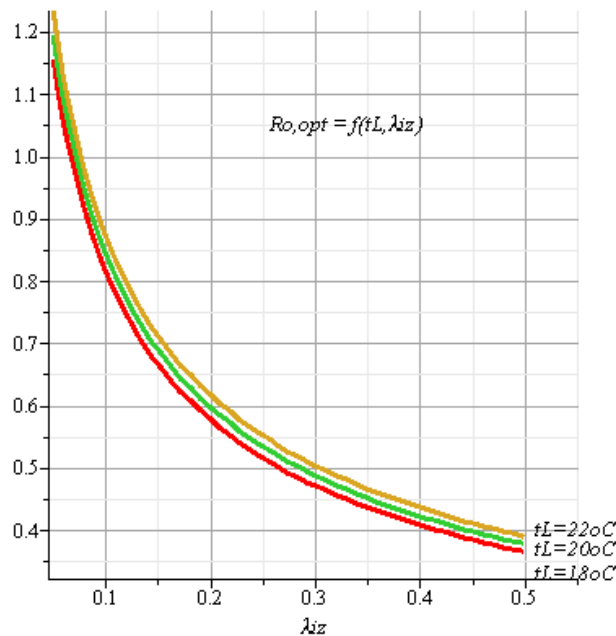
Figure 3: Determination of the optimum (minimum) thermal resistance value for one specific case (for concrete projecting parameters, relation (12)).

CONCLUSION

The paper deals with the problem of determining the optimum thickness of the insulation layer, i.e. the minimum value of thermal resistance. At minimal thermal resistance, the exchanged heat flux is the maximum in its size, and thus it achieves the creation of an optimal climate inside the living space (in residential and office spaces). In doing so, achieving the optimal climate of living space is achieved by using the appropriate selected model, taking into account the given project parameters. It is important to note that technological and economic management interacts here, in terms of achieving the optimal climate of living space.

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