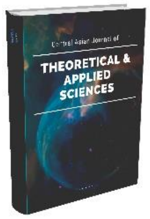

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Energy Efficiency of Mansard Residential Buildings Roof Structures

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Abstract: *The article analyzes the issues of preventing heat loss from the structures of coatings of mansard buildings, improving the energy efficiency of buildings through the use of modern local building materials.*

Keywords: *heat loss, roof structure, reed, outer wall, thermal insulation materials, thermal insulation layer.*

Heat loss in buildings occurs through window, outer walls, roof and floor structures, which depends on the size of their area. The amount of heat losses through the building window is much higher than the amount of heat losses through the walls, but the total volume of Windows is much less than the volume of walls and roofs. Due to the size of the area of the walls and roofs, a significant part of the heat is lost through them, while in Mansard buildings it is required to provide them with the required amount of thermal conductivity due to the fact that the total length of the roof structure is much larger than that of the wall and window When heating a building, one of the heating systems is selected, and at the same time it is necessary to select a complex of heating work on the facade and roof structure, which should be followed later.

If earlier it was achieved by maintaining the heat of the premises, increasing the thickness of the walls, now there is no need for it with the advent of modern and local heat-retaining materials. These materials – lightweight, with a high level of frost resistance and a low level of heat transfer – are used not only in the construction of new buildings, but also in the repair of existing ones. Heating the premises with modern materials allows not only to reduce heat losses and, in turn, save the funds that go to heat it. This year it has become one of the most sought-after and sought-after food products. Usha materiallar-yongil, sovukka chidamlilik darajasi Yukori and his Uzbek darajas lower bukhlgan materiallar are retired Yangi binalarni kurishda, but there is also a renovated binolar. According to the press service of the President of the Republic of Tajikistan, President of the Republic of Tajikistan Emomali Rahmon, Chairman of the Sughd region Abdurakhmon Kodiri, Chairman of the Sughd region Abdurakhmon Kodiri and Chairman of the Sughd region Abdurakhmon Kodiri, Chairman of the Sughd region Abdurakhmon Kodiri and Chairman of the Sughd region Abdurakhmon Kodiri and Chairman of the Sughd region Abdurakhmon Kodiri. Due to the fact that the roof structure in the mansard buildings is larger than the size of the walls and windows, in order to provide sufficient heat inside the building, due to the large surface of the wall and roof structures, a large part of the heat is lost through them. To reduce the thermal conductivity of the roof structure, the following construction is proposed.

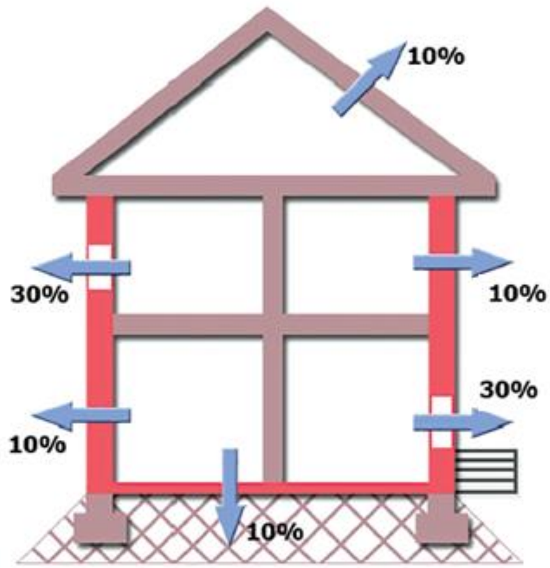

Fig. 1. 1-moisture protection layer (asbestos cement list or metalcherepitsa); 2 -, 5-wood crate (50x50 mm); 3-Reed plate (thick 120 mm); 4-penoplast (thick 30 mm); 6-drywall.

In addition, along with heating the building and protecting it from the effects of precipitation, the degree of protection of the building from noise also increases [3]. Technological accounting of the proposed roof structure.

A. Thermophysical calculation of a slatted roof for winter conditions.

It is necessary to check the compliance of cement sandwich panels intended for the construction of residential buildings with energy-saving requirements.

1) the place of construction is the Namangan city.

2) the function of the building is a residential building.

3) calculate temperature of room indoor air from KMK 2.01.04-97* define tv:

4) KMK 2.01.04-97* 4-from the table, the external air temperature of Namangan city is $t \leq 8^oC$ and $t \leq 12^oC$ for periods with respectively mean temperature $t_{ot.per}$ the value of and the duration of these periods (per day) $Z_{ot.per}$ We record the information about:

- the average temperature for a period when - $t \leq 8^oC$ is $t_{ot.per} = +1.5^oC$ duration 128 days;
- $t \leq 12^oC$ for periods with average temperature $t_{ot.per} = +3.1^oC$ the duration is 159 days.

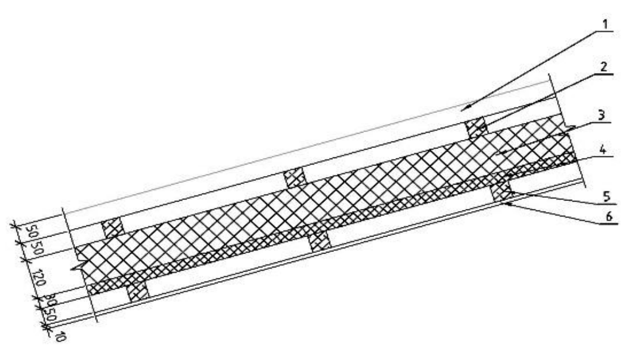

Figure 2. Recommended roof construction

Based on these values for $t \leq 10^o C$ is the average temperature for the period t_(ot.per) the value of and the duration of this period $Z_{ot.per}$ We can determine:

$t_{ot.per} = \frac{1.5+3,1}{2} = 2.3^o C$ end $Z_{ot.per} = \frac{128+159}{2} = 144$ equal to the day.

5) we determine the degree-day (IMGS) indicator of the heating season for the city of Namangan:

$D_d = (t_v - t_{ot.per}) \cdot Z_{ot.per} = (18 - 2,3) \cdot 144 = 2261$ gradus-equal to the day.

6) we determine the required resistance of a residential roof structure to heat transfer based on the condition that the value of R_o^{tr} is in accordance with the second degree of thermal protection: $R_o^{tr} = 2,6 \cdot 0,8 = 20,8\ m^2 \cdot {}^o C/Vt$

B. Calculation of the thermal priority of a stropylated roof for summer conditions.

We determine the thermal inertia of the layers of the structure by the following formula:

for the first layer of plasterboard.

$$D_1 = \frac{\delta_1}{\lambda_1} \cdot S_1 = \frac{0,1}{0,15} \cdot 4,62 = 3,08$$

for the second air layer:

$$D_2 = \frac{\delta_2}{\lambda_2} \cdot S_2 = \frac{0,05}{0,14} \cdot 2,5 = 0,89$$

for the third penoplast mixture:

$$D_3 = \frac{\delta_3}{\lambda_3} \cdot S_3 = \frac{0,03}{0,04} \cdot 0,65 = 0,4875$$

for the fourth Reed layer:

$$D_4 = \frac{\delta_4}{\lambda_4} \cdot S_4 = \frac{0,12}{0,076} \cdot 1,01 = 1,595$$

for the fifth air layer:

$$D_5 = \frac{\delta_5}{\lambda_5} \cdot S_5 = \frac{0,05}{0,14} \cdot 2,5 = 0,89$$

for the sixth asbestos layer:

$$D_6 = \frac{\delta_6}{\lambda_6} \cdot S_6 = \frac{0,008}{0,47} \cdot 7,55 = 0,128$$

In accordance with the values of D_1, D_2, D_3, D_4, D_5 and D_6, we determine the coefficients of heat absorption of the outer surfaces of the roof layers:

for the first layer, $D_1 = 3.08 > 1$,, hence the value of U1

$$U_1 = S_1 = 4.62\ Vt/(m^2 \cdot {}^0 S)$$

since D_2=0,89>1 for the second layer, the coefficient of heat absorption of the outer surface U_2 is equal to the coefficient of heat absorption of the material U_2 i.e.,

$$U_2 = \frac{R_2 \cdot S_2^2 + U_1}{1 + R_2 \cdot U_1} = \frac{\frac{0,05}{0,14} \cdot 2,5^2 + 4,62}{1 + \frac{0,05}{0,14} \cdot 4,62} = 1,5234\ Vt/(m^2 \cdot {}^0 S)$$

since D_3=0,4875<1 for the third layer, we determine the coefficient of heat absorption of the outer surface by the formula:

$$U_3 = \frac{R_3 \cdot S_3^2 + U_2}{1 + R_3 \cdot U_2} = \frac{\frac{0,03}{0,04} \cdot 0,65^2 + 1,5234}{1 + \frac{0,03}{0,04} \cdot 1,5234} = 0,8589\ Vt/(m^2 \cdot {}^0 S)$$

since D_4=1.595<1 for the fourth layer, we determine the coefficient of heat absorption of the outer surface by the formula (19) in [19:

$$U_4 = S_4 = 1.01\ Vt/(m^2 \cdot {}^0 S)$$

since D_5=0,89<1 for the fifth layer, we determine the coefficient of heat absorption of the outer surface by the formula:

$$U_5 = \frac{R_5 \cdot S_5^2 + U_4}{1 + R_5 \cdot U_4} = \frac{\frac{0,05}{0,14} \cdot 2,5^2 + 1,01}{1 + \frac{0,05}{0,14} \cdot 1,01} = 0,76\ Vt/(m^2 \cdot {}^0 S)$$

since D_6=0,128<1 for the sixth layer, we determine the coefficient of heat absorption of the outer surface by the formula:

$$U_6 = \frac{R_6 \cdot S_6^2 + U_5}{1 + R_6 \cdot U_5} = \frac{\frac{0,008}{0,47} \cdot 2,5^2 + 0,76}{1 + \frac{0,008}{0,47} \cdot 0,76} = 1,714\ Vt/(m^2 \cdot {}^0 S)$$

7) using the following formula, we determine the coefficient of heat transfer of the outer surface for summer conditions.

$$\alpha_n = 1,16 \cdot \left(5 + 10 \cdot \sqrt{v}\right) = 1.16 \cdot \left(5 + 10 \cdot \sqrt{1.9}\right) = 21.79\ Vt/(m^2 \cdot {}^0 S)$$

8) using the following formula, we determine the fading of the amplitude of temperature changes in the transition from the construction:

$$v = 0,9^{\frac{D}{\sqrt{2}}} \cdot \frac{(S_1 + \alpha_v) \cdot (S_2 + U_1) \cdot (S_3 + U_2) \cdot (S_4 + U_3) \cdot (S_5 + U_4) \cdot (\alpha_n + U_6)}{(S_1 + U_1) \cdot (S_2 + U_2) \cdot (S_3 + U_3) \cdot (S_4 + U_4) \cdot (S_5 + U_5) \cdot (S_6 + U_6) \cdot \alpha_n} =$$

$$= 0,9^{\frac{D}{\sqrt{2}}} \cdot \frac{(4,62 + 8,7) \cdot (2,5 + 4,62) \cdot (0,65 + 1,5234) \cdot (1,01 + 0,8559) \cdot (2,5 + 1,01) \cdot (21,79 + 1,714)}{(4,62 + 4,62) \cdot (2,5 + 1,5234) \cdot (0,65 + 0,8589) \cdot (1,01 + 1,01) \cdot (2,5 + 0,76) \cdot (7,55 + 1,714) \cdot 21,79}$$
$$= 28.15^0 C$$

9) we determine the calculated amplitude of external air temperature changes for a stropylated roof using the following formula:

$$A_{t_n}^{rasch} = 0,5A_{t_n} + \frac{\rho \cdot (J_{max} - J_{sr})}{\alpha_n} = 0,5 \cdot 20,6 + \frac{0,7 \cdot (922 - 333)}{21,79} = 29,22^0 S$$

10) we determine the amplitude of temperature changes on the inner surface of the roof using the following formula:

$$A_{\tau_n} = \frac{A_{t_n}^{rasch}}{\nu} = \frac{29,22}{28,15} = 1,03^0 S$$

11) using the following formula, we determine the required value of this amplitude:

$$A_{t_n}^{tr} = 2,5 - 0,1 \cdot (t_n - 21) = 2,5 - 0,1 \cdot (27,2 - 21) = 1,88^0 S$$

in this place t_n = 27.2 ^oC - average temperature in July.

12). $A_{\tau_n} \leq A_{t_n}^{tr}$ we check the fulfillment of the condition:

$$A_{\tau_n} = 1,03^0 S \leq A_{t_n}^{tr} = 1,88^0 S$$

The condition is fulfilled. Therefore, the thermal priority of the above roof structure can be considered sufficient for the conditions of the city of Namangan.

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