

REPORT

on thermal survey findings for the residential apartment block No. 234, building 3, located at prospect Krasnoi Armii, in the city Sergiyev Posad.





Limited Liability Company Teplozashcita

APPROVED

By OOO Teplozashchita Director

(signed) Iu.F. Kolkhir 14 February 2014

Seal: Russia, Volgograd Oblast, Volzhsky * Limited Liability Company * TEPLOZASHCHITA *

REPORT

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1. Object input data

Object – residential apartment block No. 234, building 3, located at prospect Krasnoi Armii, the city Sergiyev Posad, Moscow Oblast.

Number of storeys – 14 storeys, technical basement storey, attic storey.

Number of entrances -3.

Pedestal. Finishing material – ceramic tiles. Pedestal area is 280 m².

External walls. Material: 320 mm thick haydite concrete wall panels. Wall area above grade level is 6,620 m², excluded from the total wall area are glazed recessed balconies with the area of 1,112 m² (80 % of all recessed balconies), glazed projected balconies with the area of 416 m² (80% of all projected balconies), clear window opening area of 1,213 m².

Total interpanel joint length: 3,555 linear meters.

Exterior jamb area: 152 m².



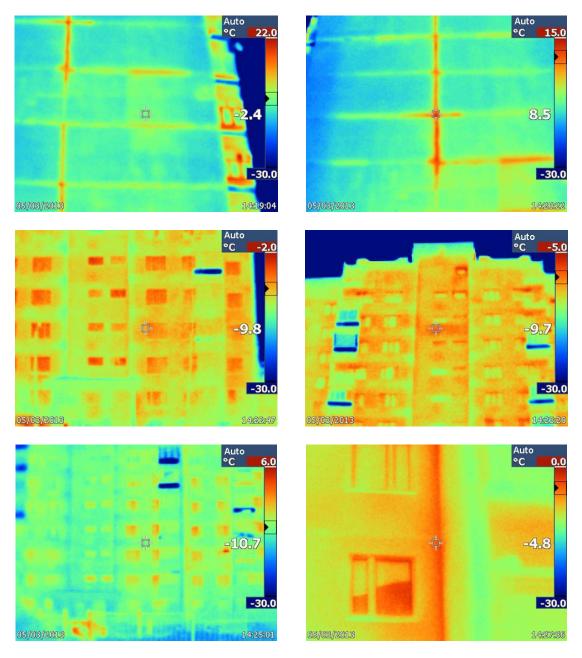
16 January 2013.



2. Object thermal survey findings prior to works execution.

The present survey was initiated by multiple residents' applications and complaints to low air temperatures in the apartments and condensation on indoor exterior wall during the heating season.

Thermal imaging survey data as of 05 March 2013. Outdoor air temperature is minus 20 °C.



Thermal survey findings (Appendix 1) were used to calculate the actual building enclosing structures heat transfer resistance. Averaged wall external surface temperature is applied as the calculation input parameter.



Wall external surface temperature is assumed to be equal to minus 10.7 °C.

Surveyed building enclosing structure design heat transfer resistance is 1.51 m² °C /W.

Surveyed building enclosing structure actual heat transfer resistance is maximum 0.90 m² °C /W.

Based on the sanitary regulations, surveyed building enclosing structure required heat transfer resistance is 1.38 m² °C/W.

Based on the energy efficiency standards, surveyed building enclosing structure required heat transfer resistance for the 1 phase is 1.83 m² °C/W.

Surveyed building does not meet the sanitary regulations, all enclosing structures require winterization.

3. Executed works description/

Thermal insulation was applied on the building exterior enclosing structures during the period from August to September 2013. TEMP-COAT® thermal insulation was used as insulating coating. Manufacturer – the company TEMP-COAT® Brand Products, LLC, USA. Supplier and contractor – the company ZAO Teploenergo.

Insulating coating thickness and insulated surface area are presented in the table No. 1 below.

Table 1.

Object description	Area, m ²	Insulation thickness, mm
Building façade for insulation	6,620	1.0
Jambs	152	1.2
Pedestal	280	0.5

In addition, TEMP-COAT® insulation prevents corrosion, has water-proof and sound-proof properties. Total heat transfer resistance of 1.0 mm coating is equal to 1.0 m² °C/W. Coating application labor input is comparable with painting application labor input, materials are spray, brush or roller applied. Thermal coating service life under standard service conditions is AT LEAST 20 YEARS. Being moisture proof, the coating is easily washable, if dirty. The coating has low resistance to vapor permeability.

TEMP-COAT® is a liquid latex ceramic form of insulation. It is different from other types of insulation, presenting just conductive and convective heat flux barriers. The product consists of billions of ceramic spheres. Low-density gas inside the spheres produces cold and heat barrier. The coating deploys the processes, known as spherical surface emissive and reflective capacities, as well as de-aired spheres low heat conductivity. Coating detailed technical data are presented in the specification TU-5768-001-62595647-2009.



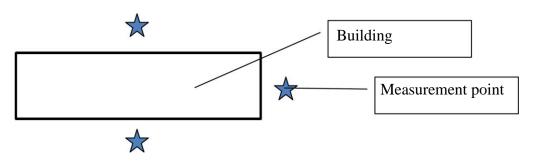


7 October 2013.

4. Object thermal survey findings after works execution.

Temperature measurement points schematic diagram.

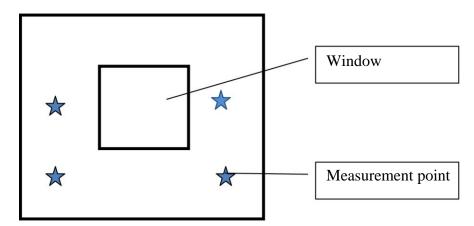
1. Atmospheric air temperature.



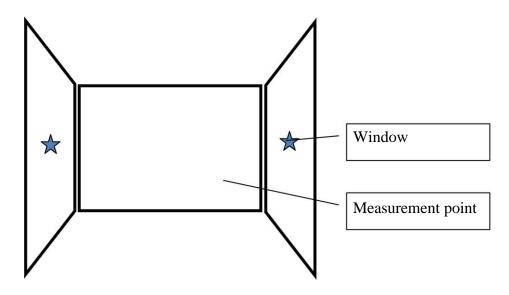
Temperature was measured at 2 m distance from the building wall surface and at 2 m elevation from the ground surface.



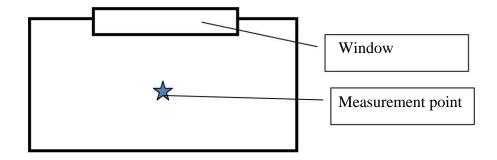
2. External enclosing structure inner surface temperature.



3. Jamb inner surface temperature.



4. Indoor air temperature. Indoor air relative humidity.



Temperature was measured at 2 m distance from the room exterior wall surface and at 2 m elevation from the floor surface.

Temperature and humidity measurements by apartments. 29 January 2014. Outdoor air temperature is minus 23 °C.



Apartment 353, 6th floor.

Kitchen, plastic window

			Point 2.		Point 4.	Point 5.	
		Point 1.	Left	Point 3.	Right	Left	Point 6.
	Room	Left	side,	Right	side,	jamb,	Right
Замер	center	side, top	bottom	side, top	bottom	top.	jamb.
Humidity							
(%)	26	26.1	26	27	27.4	26.9	26.8
Temperature							
(° C)	21	20.8	20.9	20.4	19.9	19	19.2

Bedroom, plastic window

			Point 2.		Point 4.	Point 5.	
		Point 1.	Left	Point 3.	Right	Left	Point 6.
	Room	Left	side,	Right	side,	jamb,	Right
Замер	center	side, top	bottom	side, top	bottom	top.	jamb.
Humidity							
(%)	26.2	25.6	25.5	22.5	26	26	26.3
Temperature							
(° C)	22.7	22.1	21.8	22	19.4	21	21.3

Sitting room, plastic window

			Point 2.		Point 4.	Point 5.	
	_	Point 1.	Left	Point 3.	Right	Left	Point 6.
	Room	Left	side,	Right	side,	jamb,	Right
Замер	center	side, top	bottom	side, top	bottom*	top.	jamb.
Humidity							
(%)	25.7	25.8	27.9	27	25.8	26.3	26
Temperature							
(° C)	22.5	20.9	20.5	22.8	23.7	22.5	22.9

Apartment 301, 7th floor.

Kitchen, wooden window

			Point 2.		Point 4.	Point 5.	
		Point 1.	Left	Point 3.	Right	Left	Point 6.
	Room	Left	side,	Right	side,	jamb,	Right
Замер	center	side, top	bottom	side, top	bottom	top.	jamb.
Humidity**							
(%)	16.1	16.1	16.1	16.1	16.1	16.1	16.1
Temperature							
(° C)	21	19.1	18.6	18.7	18.5	18	18.1



Bedroom, wooden window

			Point 2.		Point 4.	Point 5.	
		Point 1.	Left	Point 3.	Right	Left	Point 6.
	Room	Left	side,	Right	side,	jamb,	Right
Замер	center	side, top	bottom	side, top	bottom	top.	jamb.
Humidity**							
(%)	19.4	19.4	19.4	19.4	19.4	19.4	19.4
Temperature							
(° C)	22.2	20	19	19	18.5	18.2	18.2

Apartment 280, 2nd floor

Kitchen, plastic window

			Point 2.		Point 4.	Point 5.	
		Point 1.	Left	Point 3.	Right	Left	Point 6.
	Room	Left	side,	Right	side,	jamb,	Right
Замер	center	side, top	bottom	side, top	bottom	top.	jamb.
Humidity							
(%)	33.9	33.9	33.9	33.9	33.9	33.9	33.9
Temperature							
(° C)	22	21.2	18.6	20.2	20.5	19.6	19.3

Bedroom, plastic window

			Point 2.	Point 3.	Point 4.	Point 5.	
		Point 1.	Left	Right	Right	Left	Point 6.
	Room	Left	side,	side,	side,	jamb,	Right
Замер	center	side, top	bottom	top*	bottom.	top.	jamb.
Humidity							
(%)	24.2	24.2	24.2	24.2	24.2	24.2	24.2
Temperature							
(° C)	22.7	22.3	21.3	22.9	22.7	22.2	22.8

Sitting room, plastic window

			Point 2.		Point 4.	Point 5.	
		Point 1.	Left	Point 3.	Right	Left	Point 6.
	Room	Left	side,	Right	side,	jamb,	Right
Замер	center	side, top	bottom	side, top	bottom	top.	jamb.
Humidity							
(%)	25.2	25.2	25.2	25.2	25.2	25.2	25.2
Temperature							
(° C)	22.2	21.8	21.8	21.2	20.4	20.9	20.7

Study room, plastic window

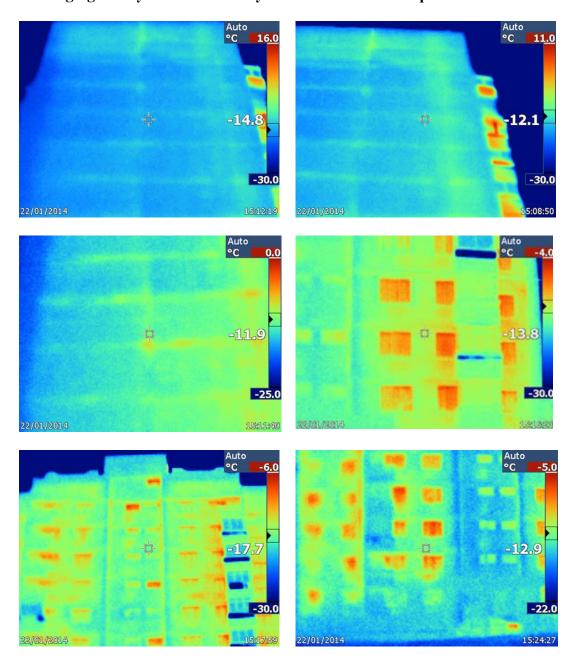
		Point 1.	Point 2.		Point 4.	Point 5.	
		Left	Left	Point 3.	Right	Left	Point 6.
	Room	side,	side,	Right	side,	jamb,	Right
Замер	center	top*	bottom	side, top	bottom	top.	jamb.
Humidity							
(%)	28.9	28.9	28.9	28.9	28.9	28.9	28.9
Temperature							
(° C)	21.9	23.2	21.6	20.8	19	21.8	21.8



Notes.

- *Wall surface temperature exceeds indoor air temperature due to heating radiator, located close to the measurement point. Such values are disregarded in the calculations.
- **Apartment No. 301. Indoor air humidity is lower than average values, as measured in other apartments. This is explained by loose-fitting wooden window frames. Natural ventilation draft is increased due to atmospheric air inflow through window area gaps. This causes room exterior wall excessive cooling.

Thermal imaging survey data. 22 January 2014. Outdoor air temperature is minus 20 °C.





Thermal survey findings (Appendix 2) were used to calculate the actual building enclosing structures heat transfer resistance. Averaged wall external surface temperature is applied as the calculation input parameter.

Wall external surface average temperature is assumed to be equal to minus 17 °C.

Surveyed building enclosing structure design heat transfer resistance is $1.51 + 1.0 = 2.51 \text{ m}^2 \,^{\circ}\text{C}$ /W (rated design solution value is applied).

Surveyed building enclosing structure actual heat transfer resistance is over 2,51 m² °C /W.

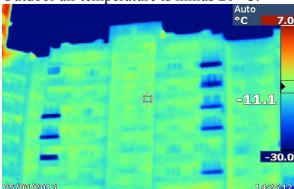
Based on the sanitary regulations, surveyed building enclosing structure required heat transfer resistance is 1.38 m² °C/W.

Based on the energy efficiency standards, surveyed building enclosing structure required heat transfer resistance for the 1st energy saving phase is 1.83 m² °C/W.

5. Comparative thermal survey data

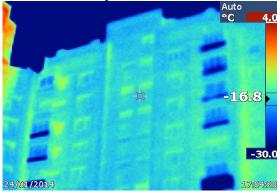
Before thermal insulation application (05.03.2013).

Outdoor air temperature is minus 20 °C.



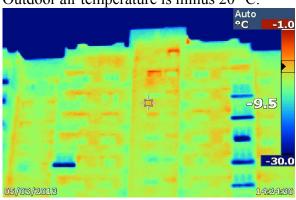
After thermal insulation application (24.01.2014).

Outdoor air temperature is minus 20 °C.



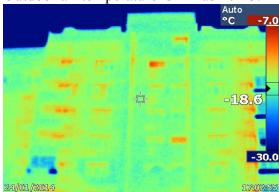


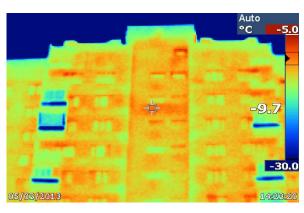
Outdoor air temperature is minus 20 °C.

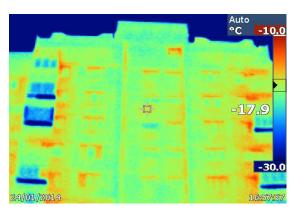


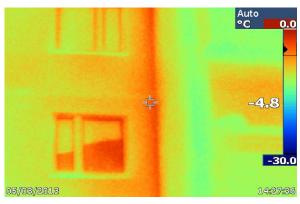
After thermal insulation application (24.01.2014).

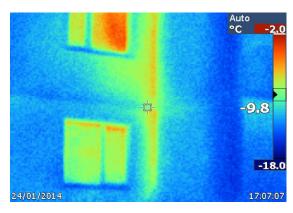
Outdoor air temperature is minus 20 °C.

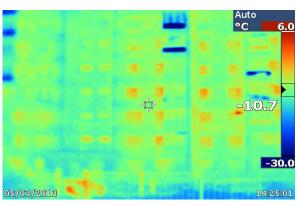


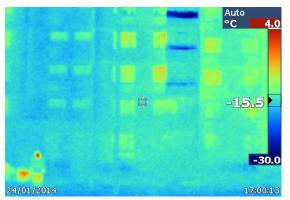








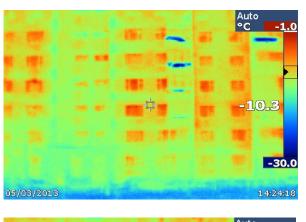


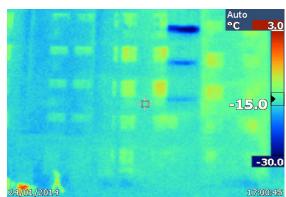


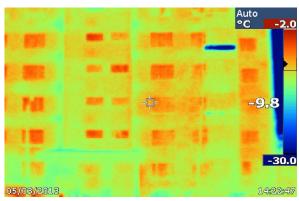


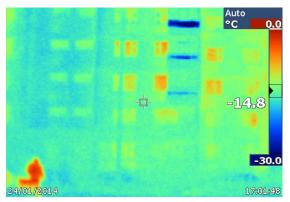
Outdoor air temperature is minus 20 °C.

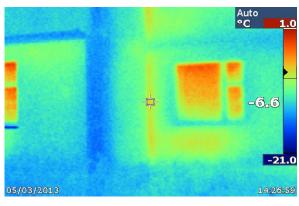
After thermal insulation application (24.01.2014). Outdoor air temperature is minus 20 °C.

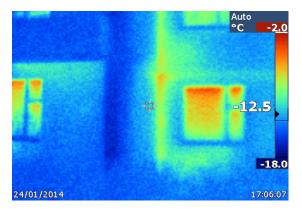


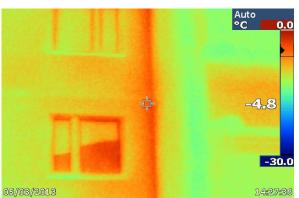


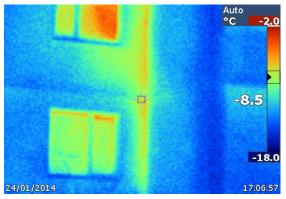










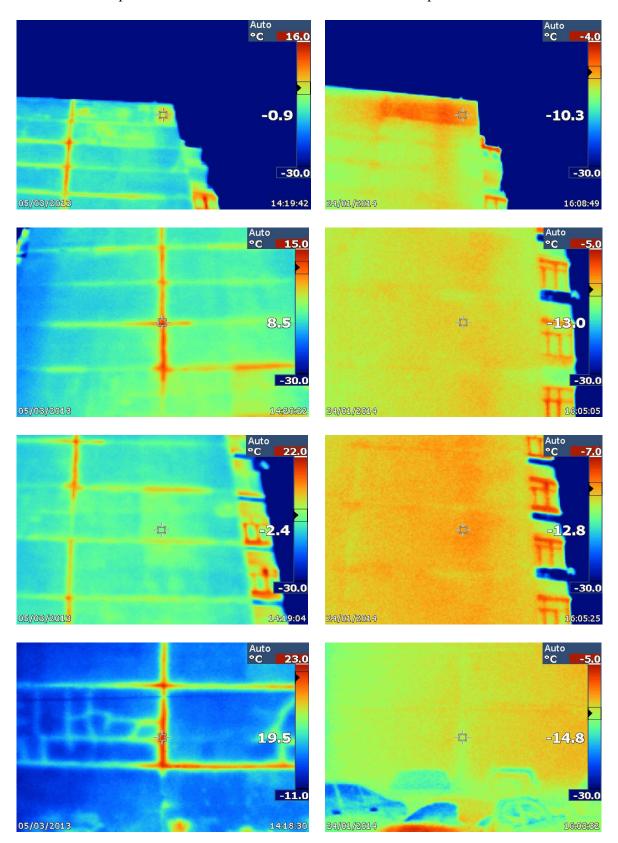




Outdoor air temperature is minus 20 °C.

After thermal insulation application (24.01.2014).

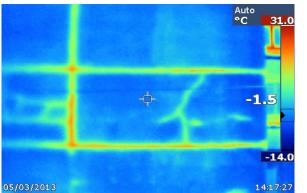
Outdoor air temperature is minus 20 °C.

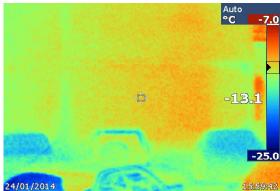




Outdoor air temperature is minus 20 °C.

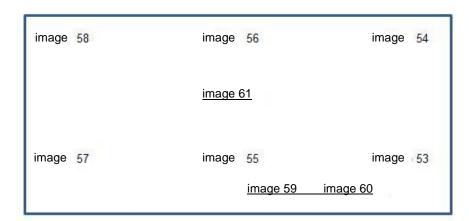
After thermal insulation application (24.01.2014).Outdoor air temperature is minus 20 °C.

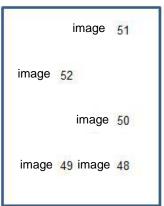




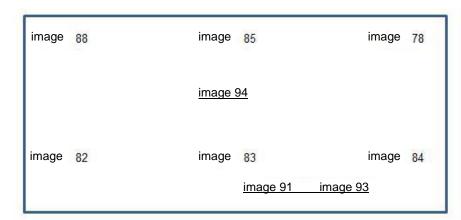
Thermal imaging survey layout.

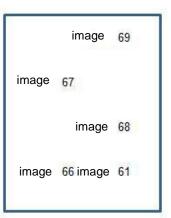
Before thermal insulation application (05.03.2013).





After thermal insulation application (24.01.2014).







6. Summary

Prior to the building thermal insulation application.

Surveyed building enclosing structure design heat transfer resistance is 1.51 m² °C /W.

Surveyed building enclosing structure actual heat transfer resistance is maximum 0.90 m² °C/W.

Based on the sanitary regulations, surveyed building enclosing structure required heat transfer resistance is 1.38 m² °C/W.

Actual indoor air temperature is plus 18 °C.

Enclosing structure inner surface temperature is plus 13 °C.

Multiple residents' applications and complaints to low atmospheric temperatures in the apartments and condensation on indoor exterior walls during the heating season.

After the building thermal insulation application completion.

Based on the energy efficiency standards for the 1st phase of energy saving, surveyed building enclosing structures required heat transfer resistance (for refurbished apartment blocks) is **1.83** $M^2 \, {}^{\circ}C / W$.

As insulation coating thermal insulation TEMP- COAT® is applied. Manufacturer is TEMP-COAT® Brand Products, LLC, USA. Supplier – ZAO Teploenergo. Thermal insulation coating thickness is 1.0 mm. Extra heat transfer resistance is 1.0 m² °C / W.

Design heat transfer resistance of the surveyed building enclosing structure with account for the **actual** heat transfer resistance is equal to $0.90 + 1.0 = 1.90 \text{ m}^2 \text{ °C / W}$.

Actual heat transfer resistance of the surveyed building enclosing structure is over 1.90 m^2 °C / W.

Based on the results of the thermal survey of the residential apartment block No. 234, building 3, located at prospect Krasnoi Armii in the city Sergiyev Posad, Moscow Oblast, the building meets the sanitary and energy efficiency norms, applied to refurbished buildings.



Applications 7.











