



## ISSUES OF ASSESSING COMFORT MICROCLIMATE PARAMETERS IN ROOMS WHEN HEATING SYSTEMS ARE OPERATING.

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**Abstract.** The main tasks of the heating system are to maintain parameters in the air environment that negatively affect a person, so that a person feels comfortable, that is, does not feel the effects of the environment. In order to ensure that the thermal conditions are comfortable when people stay in apartments for a long time, a lot of research has been carried out, covering the operation of heat supply systems, heat gas supply to buildings, and creating a comfortable climate in apartments.

**Keywords:** water and air heating, heat, microclimate, temperature.

**Абстрактный.** Главные задачи системы отопления — поддерживать в воздушной среде параметры, негативно влияющие на человека, чтобы человек чувствовал себя комфортно, то есть не ощущал воздействия окружающей среды. Для обеспечения комфортного теплового режима при длительном пребывании людей в квартирах проведено множество исследований, охватывающих вопросы эксплуатации систем теплоснабжения, подачи теплоносителя в здания, создания комфортного климата в квартирах.

**Ключевые слова:** водяное и воздушное отопление, тепло, микроклимат, температура.

Today, the increasing demand for non-renewable organic fuels in the global fuel and energy complex requires their extremely economical and productive use. Despite the global economic crisis, our country, having found the right solution to economic problems, has achieved complete energy independence.

New, expandable and rehabilitable gas supply systems have been designed to be built in populated areas and provide natural gas (gas from gas and oil fields) and gas-air mixtures with an excess pressure of up to 1.2 MPa (12 kgf / cm<sup>2</sup>), liquefied hydrocarbon gases (hereinafter referred to as SUG) with an excess pressure of up to 1.6 MPa (16 kgf / cm<sup>2</sup>), including consumers using these gases as fuel. In the operation of combined water and air heating systems, the most important microclimate parameters are the following. Air temperature  $t_{int}$ , radiant temperature  $t_R$ , relative air humidity  $\varphi_{int}$ , air velocity  $v_{int}$ , these parameters are of great importance for human health and work activity, and productivity. In the premises of the building, temperature and relative humidity  $\varphi_{int}$ , = 30-70% are assumed, with low air movement, air temperature  $t_{int}$  and radiant temperature  $t_R$ , are estimated by:

$$t_n = \frac{t_{int} + t_R}{2} \quad (1.1)$$

Fan Ngoc Dang [123] proposed to determine the dependence of thermal conditions in houses on air temperature  $t_{int}$ , relative humidity  $\varphi_{int}$ , air movement  $v_{int}$ , and radiation  $t_R$ , temperature as follows

$$t_n = K_v * t_{int} + (1 - K_v) * t_R \quad (1.2)$$

$$\text{where } K_v = 8.87 v_{int}^{0.5} + 2.32 \varphi_{int} * v_{int}^{0.8} \quad (1.3)$$

If the air in the room is completely still, then  $v_{int} = 0-0.5$  m/s, where  $K_v = 0.5$  and  $1^\circ\text{C}$  is determined by equation (1.2). According to most data, in the rooms of public and residential buildings in winter it is  $18^\circ\text{C}$  and  $24^\circ\text{C}$ .

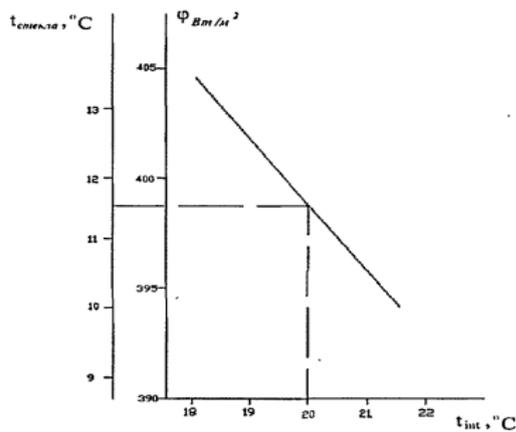
The temperature in the room varies throughout the day, that is, the change does not exceed  $0.5$  and  $1^\circ\text{C}$ ; and  $\pm 1^\circ\text{C}$ . Many sanitary hygienists recommend that the temperature in the rooms during the day should not be allowed. The radiation temperature is of great importance in the perception of heat by humans. The permissible air temperature when people approach or settle on a cold surface is determined by the second condition of comfort conditions.

$$t_{sov}^{lux} \geq 23 - \frac{5}{\varphi}$$

where  $\varphi$  is the radiation K-E

Some studies have shown the permissible limits of heat transfer that can cause a person's face to become cold. That is, the difference between the cooling of the surface of the house window and the temperature of the air in the house (for example, when  $t_{int} = 20^\circ\text{C}$ , the window temperature should not be lower than  $11.6^\circ\text{C}$ ). This relationship is shown in Figure 1.1.

Figure 1.1 shows the minimum permissible radiation to a person's face near a window.



Calculations of radiation conditions in public educational buildings show that, based on the indicator given by the manufacturer, in order to maintain the lowest thermal comfort, the total radiation temperature at the start of work should not be lower than  $15^\circ\text{C}$ .

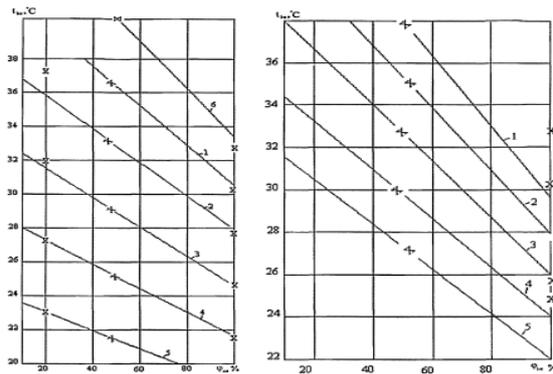
Air humidity has a significant impact on human activity and well-being, and heat exchange with it mainly depends on air temperature and thermal radiation.

The amount of humidity is related to the amount of temperature, which worsens the heat exchange between a person and the environment, which causes the body to overheat. It is desirable that the relative humidity of the air is around  $60\%$ .

In public and residential buildings, the relative humidity of the air is  $30-45\%$ , the permissible humidity is  $25-60\%$ . Studies have shown that when the relative humidity of the air is  $40\%$ , most people feel very dry. When the air humidity is less than  $35\%$ , static electricity particles accumulate on the surface of furniture. Doctors explain that in winter, due to the decrease in relative humidity in heated rooms, people catch more colds. At an air temperature of  $21^\circ\text{C}$  and a relative humidity of  $45-55\%$ , it is best to maintain a moisture content of  $6.5-8.5$  g/kg.

Air temperature and relative humidity do not fully determine the physical state of the environment. In this case, air temperature is of great importance. The movement of air depends on how air exchange is organized, the type of air distribution devices, the speed of air extraction and its consumption. The effect of air velocity on human well-being, along with air temperature and air humidity in the room, is studied. The relationship between air temperature and its relative humidity  $\varphi$ int, the effect on a person in a relaxed state in very light clothing and a person performing moderate work in clothing is presented in Figure 1.2.

Figure 1.2. The relationship between air temperature and relative humidity  $\varphi$ int, the effect on a person at rest in very light clothing (a) and a person performing moderate work (b);



data on the X-ET and NET scales; 1-5-qT values are 6-11.6 w/m<sup>2</sup>. The data of well-known authors who recommended the minimum and maximum air movement in apartments are given in Table 1.1.

An excess of carbon dioxide in the air we breathe has the same negative effect on the human body. If the carbon dioxide content of the air we breathe is 0.5-1.5% [101], it does not significantly affect the physiological functioning of the human body

and its work efficiency.

It is advisable to organize the organization of more external fresh air flows during air exchange in rooms. According to current sanitary standards, a fresh air flow of 20-60 m<sup>3</sup>/cm per person in the room is recommended.

When analyzing the modern assessment of the parameters indicating the comfort conditions in the room, it was shown that the UzR can be allowed to vary within the range of 18-22oC, in the transitional period up to 18-24oC, which will allow people to exercise thermoregulation to the required extent; the minimum heat .. to comply with which the total radiation temperature at the beginning of the working day should not be lower than 15oC; comfortable thermal conditions should be at night temperatures, and the humidity of the air in the room should be in the range of 30-45%; At an air temperature of 23-24oC, the permissible air speed is up to 0.15m/sec; if the oxygen content in the air we breathe is 0.5-1.5%, it does not have much effect on the physiological functioning of the body and the functioning of the human body. The problem of creating comfortable conditions when a person enters the room is solved by a water and air heating system.

The main goal of projects to create an economical internal energy consumption in public and residential buildings is to provide people with comfortable thermal comfort with minimal energy. The energy consumed in buildings is measured by the amount of annual energy consumption, the energy demand for the building is measured by the amount of energy consumed in construction and installation works of internal engineering networks.

When analyzing the norms of the 70s-90s, when the requirements for designing the internal environment of buildings, protecting people's health by creating a comfortable, high-quality environment were accepted as the norm, it was aimed at increasing the volume of construction and installation work, that is, the amount of norms and standards described in the

form of an internal microclimate in buildings, a large amount of energy is spent on the building. In order to save energy consumption and increase its efficiency, it is necessary to control the dependence of heating systems on the environment, create microclimate conditions depending on the seasons. To solve these problems, it is necessary to expand the diagnosis of internal air temperatures. For example, if we use building materials with a high heat capacity, the process of internal heat absorption will be significantly reduced, and due to the radiation of the absorbed heat from the surrounding, the building will not cool down even during non-operated hours.

Temporarily reducing the heating system on non-working days also saves heat. According to experts, heat economy ranges from 5% to 58%. Heat economy directly depends on the mode of operation of heating networks. When the room is constantly heated, the coefficient  $\epsilon$  determined by them shows that the size of the heating system depends on the mode of operation at the highest power during the day and the duration of the room's operation. Heat economy depends on the mode of operation and control of the heating system. To find the right solution to this problem, we need to ensure the mode of operation of the heating system depending on the operating conditions of public and residential buildings.

The most common at present are: water heating system and natural draft ventilation; water heating system and forced draft mechanical ventilation; air heating and forced draft ventilation. The analysis of the heating system of public and residential buildings showed that the air heating system combined with ventilation has a new advantage over the currently used water heating network and natural air convection methods. When a large amount of hot air is supplied to the rooms, the excess pressure there is from 1 Pa to 15 Pa. As a result, the influx of polluted air from below and above and the influx of cold air from the windows are significantly reduced. In creating thermal conditions in public and residential buildings, the air heating system is much better than the water heating system.

The experiments conducted showed that the air temperature in rooms heated by hot air changes in the longitudinal and vertical directions of the air temperature. German experts recommend the use of combined heating networks, in which the main load of the heating system is covered by 50% of the power of electric heating devices, which covers 87% of the heating season and provides 67% of the annual costs. On cold days, electric heating devices are replaced by traditional fuel, which fully covers the calculated heat capacity of the building.

The company "Special" has proposed to use electric heating networks, which can be controlled in the climatic conditions of the city, taking into account economic issues, and electrical appliances with a large heat capacity in the evening. Such a heating network operates at preferential tariffs for 90-95% of the time. French experts believe that the air heating system provides more comfort. They offer combined networks: taking into account the outdoor air temperature, 70% of the heat is supplied by the central heating network, the rest of the heat is supplied by heating and humidifying the air. Many people, especially foreign literature, devoted to the separate, general control of heating systems, have always paid great attention to the use of automatic control for 1-2 heating seasons, which shows that additional savings can be achieved if we organize the heating system not by heating the rooms, but by individual control, then we can save on heat consumption by 20-30%. Until now The supply and exhaust ventilation networks of communal buildings are serviced separately. The ventilation ducts of buildings with a corridor layout often draw air from the corridors according to the norm, and

for the sake of economy, the supply air is also transferred to the corridors, that is, it is not replaced in the rooms where people are constantly working, and the air flow is removed from the service room. In order to organize air exchange in this way, it is necessary to install a large number of supply and exhaust fans. Ventilation equipment occupies a large area of the building, and also consumes a large amount of electricity. For the fans to operate quietly, it is also necessary to install standard sound-absorbing equipment. In addition, the cost-effectiveness of controlling the connection of heating networks in buildings through these ventilation networks is low. From this it can be concluded that the combined water and air heating system is superior in technical and hygienic terms. In this combined water and air heating system, the water heating system is the main. If we assume that it heats the rooms, we assume that it is additional continuous heating with air.

Currently, one of the main problems with the full heat supply of buildings is the short-term failure of 80% of the equipment and devices in the heat supply systems. In this regard, in order to create comfortable conditions in residential buildings, it is recommended to design and implement combined water and air heating systems that are more economically efficient, low-cost, energy-efficient, and have a long service life than the current systems.

#### Conclusion.

Modern public and residential buildings should, first of all, be comfortable for people, environmentally friendly, fit for purpose, and achieve energy efficiency through rational use of energy. When analyzing domestic and foreign literature, it was shown that due to the wear and tear of heating network equipment, buildings are not fully supplied with heat, and air exchange is not well established to create comfortable conditions. To solve these problems, it is advisable to use combined water and air heating networks in public and residential buildings, which will achieve energy efficiency and comfort. When there are no people in the room, temporarily turning off heating systems allows you to save from 5% to 58% of heat. When a large amount of hot air is supplied to the room, excess pressure is created from 1 to 15 Pascal. As a result, the flow of polluted air to the lower and upper rooms is significantly reduced, and cold air entering the room through windows and cracks is reduced.

#### References:

- [1] E. ISO, 14644-1, "Cleanrooms and associated controlled environments—Part 1: Classification of air cleanliness," European Standard, 1999.
- [2] S. Dharan and D. Pittet, "Environmental controls in operating theatres," *Journal of Hospital Infection*, vol. 51, no. 2, pp. 79-84, 2002.
- [3] E. Marcon, S. d. Kharraja, and G. Simonnet, "The operating theatre planning by the follow-up of the risk of no realization," *International Journal of Production Economics*, vol. 85, no. 1, pp. 83-90, 2003.
- [4] A. Macario, T. Vitez, B. Dunn, and T. McDonald, "Where are the costs in perioperative care?: Analysis of hospital costs and charges for inpatient surgical care," *Anesthesiology: The Journal of the American Society of Anesthesiologists*, vol. 83, no. 6, pp. 1138-1144, 1995.
- [5] W. A. C. Zoon, M. G. M. Heijden, M. G. L. C. Loomans, and J. Hensen, "On the applicability of the laminar flow index when selecting surgical lighting," *Building and Environment*, vol. 45, pp. 1976-1983, 09/01 2010.

