

THE THERMAL COMFORT AND AIR QUALITY IN BUILDINGS

Marian Cristian Raicu¹, Nita Silviu²

¹School of Doctoral Power Engineering

University Polytechnic of Bucharest

²S.C RADOX SRL

Bucharest Romania

¹raicumarian21@gmail.com

²silviu.nita@radox.ro

Abstract— This Article focuses on general issues on these two notions, highlighting how they dictate the performances of a building and the performance of air conditioning equipment, creating a harmony between the mood of those who live in buildings and energy demand arising in the context of creating thermal comfort. In the past 25 years the thermal comfort and air quality have become standards important in choosing construction materials and air conditioning equipment, mode of operation of the buildings, the area where it located, and especially efficient human resource where they work, aimed at increasing productivity in the workplace. In the context of research, this subject does nothing but highlight some solutions to the problems that can occur during operation of the living space can have the direct effect the health of residents implications, the functioning of air conditioning equipment and ventilation later focusing on important technological contributions of equipment and use restrictions in effect reduced power consumption and protection.

Index Terms— thermal comfort, air quality, floor convectors, microclimate parameters, this surface flooring, energy efficiency

I. INTRODUCTION

The purpose of this paper is to highlight the factors that generate or shapes,, thermal comfort "directly involving microclimate parameters (air, light, temperature etc.) and airconditioning and ventilation equipment. On the other hand they must not neglect quality materials in-building as both these may have negative effects on human health or to maintain a long or short period of air quality and optimum temperature in a home. In Romania as in other countries in the world have implemented and amended some laws concerning the characteristics energy consumption and keeping the room air quality and temperature, depending on the area of operation or characteristics of the workplace to avoid certain hazards on human health and the excess energy, electrical or thermal. This type of construction materials and the way new buildings are being built lined EU requirements and legislation, in the context

of reducing energy consumption and preserving health while more individuals and also to protect the environment..

II. COMFORT TEMPERATURE

It is a standard parameter which reflects the thermal comfort of a room. After several analyzes made by researcher Bedford achieved good results and their base Winslow, Herrigton and Gaggia defined this parameter / index as the temperature evenly distributed over an area isolated to us an image (thermal covering) with a platforms coming contact, following an exchange to take place without great loss of heat in outdoor environment such heat transfer will be achieved by convection and radiation in the area considered, taking into account the heat transfer coefficients. [1].

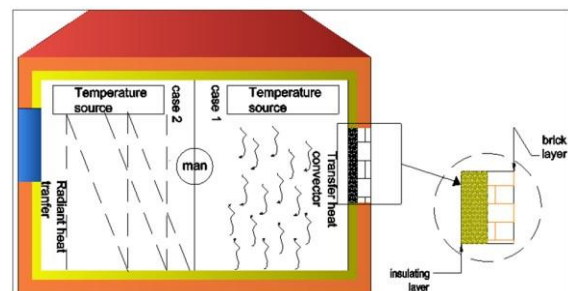


Fig.1 The two cases of heat transfer between the surface of the insulator and a person considered

Fig.1 We see two cases of heat transmission from the source by radiation and convection, and see you around a section of the tire wall. We see that heat is exchanged in two cases between the surface and the man considered without the large heat losses

To To define the value of the comfort temperature is premised on the notion give above and is as simplified form [2]

$$t_0 = \frac{\alpha_r \theta_{mr}}{\alpha_{conv} + \alpha_r} + t_i \quad (1)$$

Where α_r -heat transfer coefficient by radiation ($4.7/m^2 \cdot K$), α_{conv} -coefficient convective heat transfer ($m^2 \cdot K$), θ_{mr} -the mean temperature radiant, t_i -initial temperature, t_0 - temperature comfort calculate.

Instead ASHRAE propose a simplified calculation formula in temperature, with satisfactory results after the winter, if the tenants do not perform vigorous physical activity (passivity) with low metabolic rates between MET = (1.0-1.3) not exposed to direct sunlight and indoor air velocity is estimated at low levels 0.20 m / s [3] and we have:

$$t_0 = \frac{t_{mr} + t_i}{2} \quad (2)$$

ASHRAE (sometimes pronounced ash-ray), stands for the American Society of Heating, Refrigerating, and AirConditioning Engineers. Founded in 1894, it is a global society advancing human well-being through sustainable technology for the built environment. The Society and its more than 50,000 members worldwide focus on building systems, energy efficiency, indoor air quality, refrigeration and sustainability.

MET-métabolique index/metabolic

Values comfortable in a building inhabited in winter can range from 18 [C] (for France) to 24 [C], depending on the degree of protection of clothing, depending on the type of air conditioning equipment and ventilation participate directly to the comfort level, depending on the intensity of the occupants but also the behavior of them in that room.

The work has been funded by the Sectoral Operational Programme Human Resources Development 2007-2013 of the Ministry of European Funds through the Financial Agreement POSDRU/187/1.5/S/155536

III. THERMAL COMFORT

The after reducing energy consumption in buildings is considered one of the main directions of research in their field construction and the climate. Thus part of household energy towards forging the necessary energy to create thermal comfort by optimizing indoor microclimate parameters in inhabited areas. A man carries about 80-90% [4] of activity in a room, in

a confined space and interior microclimate parameters must fulfill an important role in direct and indirect satisfaction of its vital functions . Spaces closed regime must satisfy:

- the need to carry physical and intellectual work in very good conditions
- the need to unfold a program of rest and relaxation or sleep at an optimal level.

Thermal comfort is understood as that feeling of relaxation "the human body feels good in his medium heat. Some studies calculate that and today, between 20 and 125 million [5] Europeans suffer from cold in winter but not in summer must not neglect this problem because result in overheating which produces one discomfort of heat-related causes. For example if we have summer shade or sun, thermal comfort index value of greater than 80 units when we deal with heat discomfort.

IV. SENSATION OF COMFORT

It is important to know that this is a defining element in the decision of creating environment of comfort, as the basis of a decision are the following factors, psychological and time evolution of the psychological balance of the individual, and all of them are directly influenced by: age sex, height, type of clothing worn etc, resulting ultimately assessing the technical comfort. According BPIE thermal comfort,, refers to that state of mind that expresses satisfaction with the thermal environment [6]. Thermal comfort has an important role in human health and welfare: overheats can create a sense of fatigue, has a very low can cause significant problems [7] health and e avoid these troubles impose certain rules and restrictions regarding the level of comfort storing optimally.

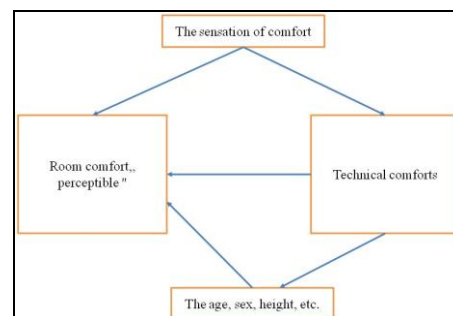


Fig.2 Factors that cause the sensation of comfort

In the figure above we see the factors that cause the feeling of comfort on individuals in a room, depending on the perception of such each and microclimate parameters

The feeling of comfort is strictly dictated by temperature (t) and (φ) indoor air humidity. Thus has the following behavior at higher ambient temperatures less heat loss by radiation and convection, and at lower temperatures the heat losses are higher. To reach a balance between body and environment occurs

evaporation (sweating body), this action is part of the body's ability to adapt to that environment.

When it comes to achieving air conditioning in an enclosure partially or totally mainly aims to achieve either individual convenience or industry's need required in different climatic conditions (winter, summer or in intermediate seasons) [8].

Winter plants must heat that enclosure must regulate moisture content or vent sis purify the air when temperatures extremes are very low, some of the main installations are recommended ventiloconvectors that creates pockets of hot air coils floor in transition seasons (see Figure 3). Summer installations must cool down to the water vapor present in the air, and ventilating air or purify it.

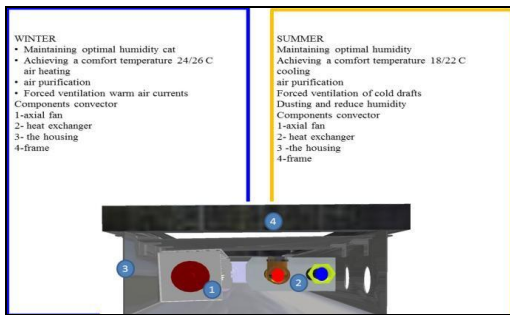


Fig.3 Floor convector summer and winter and its role

In Figure 3 illustrates the two cases studied functioning of equipment, in the summer and winter season. It also presents the operating parameters and components..

V. SENSATION OF COMFORT

In chart 4 we can see made of a line of the e-Comfort (ELC) which pairs well established values of humidity and temperature. According to the studies we can say that the figure made it highlights the state of comfort can be felt both at (t = 26 C with φ = 70%) and the (t = φ = 26.5C with 30%).

t-tempreature [C] φ-
 humidity [%]

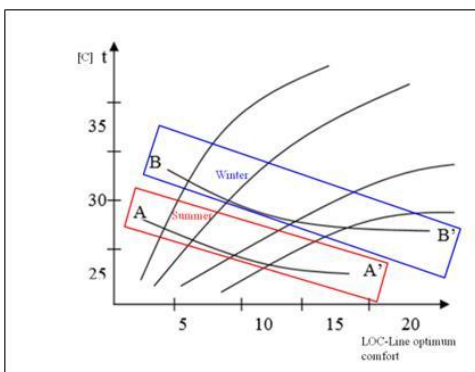


Fig.4 Graph state of thermal comfort[9]

Thus we can deduce that the graph curve AA 'is the maximum comfort during summer, and the curve BB' represents the maximum pet comfort winter imp [10]. The conclusion is that,, state of comfort "may vary from one country to another, from one geographic area to another area, or even in similar areas with values of + 2C + 3C.

VI. AIR QUALITY FROM A BUILDING

It is very important to maintain the microclimate parameters (temperature, humidity etc.) at optimal air quality. Studies show that in a room there is a real flow changes at the molecular level and quality of air because the more space is occupied and active regarding the exchange of gas so it is harmful and adversely affect sensation but the health of comfort while human organism and in direct function of air conditioning equipment. If the room air is mixed with other harmful substances (tobacco smoke, dust, particulate matter, aerosols, etc.) that cause various diseases respirators but substance basic or acidic conditions which may affect over time, directly important functions of air conditioning equipment in that room. Indoor air quality (IAQ) refers to air quality inside buildings is related to the health and comfort and ability to work. To define (IAQ) must take into account the following parameters: ventilation rate and level of exposure to mold or gaseous chemical compounds. Indoor air pollution can be caused by both sources inside and outside, and as an example we can mention the pollution caused by a vacuum cleaner when cleaning is done it releases into the atmosphere from the inside compounds oxy (dust) or compounds gas (flue gas) from the stove when making food. [10] ventilation and air conditioning circulated air in the room must contribute to the permanent preservation of the purity of it, while avoiding the appearance as constituted nuisance, so they must to ensure a level of comfort welfare of residents, according to statistical reports in industrialized countries around 90% of the population operate in confined spaces (home, office, public transport); hence the need to control air quality. To prevent pollution outside the focus is on compliance with acceptable concentrations so were identified around 8,000 chemicals that contaminate the interior spaces. [11] Carbon dioxide CO₂ is the most prevalent main source of producing pollution and among others the human body is the one that produces permanent conditions the exhalation, so each individual produces CO₂ in the atmosphere denied creep metabolism depending on each mathematical process described in relation

3.

$$G=4*10^{-5}*M*S_c=[l/s] \quad (3)$$

Where M- the metabolism specific (W/m^2), S- surface of body (can be considered $1.8 m^2$).

The exhaled air contains about 4.4% CO_2 by volume. It is important to know the level of CO_2 of a room because it can not be cleaned entirely, captured or neutralized knowing the value we can characterize the quality of indoor air.

VII. VENTILATION FOR BUILDINGS

Fanger, to highlight the relationship between indoor air quality and ventilation of rooms, it conducted a survey on a sample of 1,000 people of different ages and sex in a room test at rest. On entering the room for about 168 people have appreciated the quality of the air, and 15% of those who were dissatisfied appreciated. It is important to know what equipment to use for residential ventilation to avoid creating a

discomfort on the human body. Over time and with the development of legislation in this area was found a significant decrease in terms of the number of smokers (the main pollutants) and increasing productivity at work among them. The introduction of tougher regulation and restrictions of „educated "and empowering the population, and young adult smokers. Ventilation in a room can be achieved either mechanically (using ventilation equipment) and natural, like opening a window. A auditorium the more well ventilated and airy with thermal comfort both in summer and winter and is better resmitit human body feels comfortable. Below in table 1 we see some fresh air flow rates set by international standards

Table.1 Fresh air flow rate regulated by international standards [12]

Standards / of the recommendation	The flow of fresh air [l/s*m2]
The theory of Fanger Standart ASHARE 62/1989	5.0 0.7
Standart English BS 5925	1.3
Standart German for largest offices 1946	1.9

VIII. ACKNOWLEDGMENT

The work has been funded by the Sectorial Operational Programme Human Resources Development 2007-2013 of the Ministry of European Funds through the Financial Agreement POSDRU/187/1.5/S/155536

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