

THE INFLUENCE OF THE AIR VELOCITY AND HUMIDITY ON THE THERMAL HUMAN COMFORT OF PASSENGER COMPARTMENT¹

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KEYWORDS – *automotive HVAC, human thermal comfort, mean radiant temperature, PMV - PPD indices*

The increasing market demand for highly effective and efficient HVAC systems for automotive applications has determined a great impulse in the research and development of innovative methods and instruments to predict passengers' thermal sensation.

The optimization of the passenger's compartment conditions consists in some means with subjective effect, having the purpose of achieving the comfort state needed to the driver but also to the passengers. Achieving the comfort state is conditioned by the way the ambient microclimate ensures the sensation of thermal comfort to the persons inside the automotive.

It is well known that one of the requirements to be fulfilled is that a person to be in thermal neutrality according to the comfort equation. This is described and evaluated by the PMV – PPD (Predicted Mean Vote – Predicted Percentage of Dissatisfied) indices (ISO 7730), which take into account the following six parameters: activity, clothing, air temperature, mean radiant temperature, air velocity and humidity.

The interaction of convective, radiation and conduction heat exchange in a passenger's compartment is very complex. The solar variable radiation, the influence of heterogeneous air temperature and air velocity from the vehicle's ventilation or air conditioning system create a climate that may vary considerably in space and time.

Consequently, this paper shows the influence of air velocity and humidity on the thermal human comfort of passengers' compartment starting from the body's energy balance and the block representation of the model for thermal comfort regulation in the passenger compartment. The three parameters taken into account for the calculation of the thermal comfort indices, which accomplish a combination between the air temperature, t_a , the mean radiant temperature, \bar{t}_r , air velocity, v_a and humidity, RH are: operative temperature (t_o), equivalent temperature (t_{eq}) and effective temperature (t_{ef} or ET*). The calculus of the mean radiant temperature takes into account the interior surfaces of passenger compartment (the windows surface, the inside roof lining surface, the inside doors car surface, the inside floor car surface) and corresponding temperatures of each surface. In the end, the calculation performed in this paper helps to find out the indices of the comfort, PMV and PPD, in every moment and depending on any parameter, which influences the comfort of the passenger compartment.

Thus, the paper reports on some of the typical but delicate aspects and problems in the assessment of thermal climate in vehicles depending on these different parameters.

¹ This paper is addressed to the following topic: *Body design for passenger cars, trucks and buses/ Comfort and convenience*