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Published in:
Proceedings of Roomvent 2007

Publication date:
2007

Document Version
Publisher's PDF, also known as Version of record

Detailed measurement on a HESCO diffuser

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1 Introduction

Over the last 30 years, the prediction of air flow and temperature distribution in rooms by use of Computational Fluid Dynamics (CFD) has developed from crude calculations of very simple setups to very detailed calculations of complicated setups.

During the same time, CFD has evolved from being a tool used mainly in research to a widespread use of CFD by consulting engineers. This development calls for ways to ensure the quality of the simulations. One way of ensuring this is to use detailed measurements performed in a controlled environment to test both the model and the boundary conditions.

This paper focuses on measuring the inlet velocity from a HESCO diffuser as a function of the volume flow it provides. The diffuser is of the same type as was used in the IEA Annex 20 work and therefore, major knowledge exists on modeling the diffuser and on the airflow in a room caused by the diffuser. The large amount of results is still being used to develop and improve CFD simulations.

The aim of the present work is to establish a relation between the inlet velocity, the effective inlet area and the airflow. This is important because the inlet velocity is a very important boundary condition and if only the volume flow and the geometrical area are used, a relatively large error in the inlet velocity may result.

2 Results

The inlet velocity was measured under isothermal conditions using a Laser Doppler Anemometer (LDA). The inlet velocity was measured for eight different volume flows.

The measurements show a nice relation between the effective inlet area and the inlet velocity. The effective inlet area increases with the inlet velocity and approaches a constant value below the geometrical inlet area.

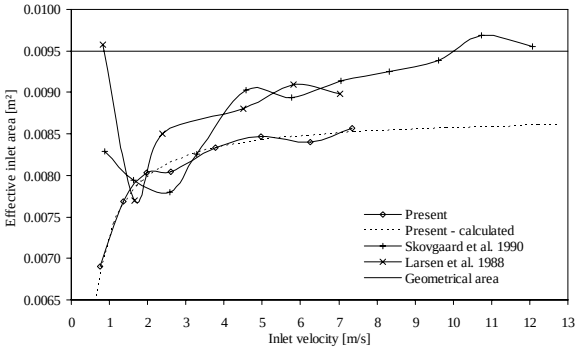

Figure 1. Comparison with previous results.

In figure 1 the results from the present work are compared to the results from the literature. From the figure it is clear that there is a large difference between the previous and the present results. The previous results show large unexplained variations and also effective inlet areas larger than the geometrical area, which is not possible. The large deviation is most likely due to the fact that the previous results where obtained using the HCA and not the LDA.

3 Conclusions

Based on the measurements, an expression for the effective inlet area given as a function of the air change rate is derived. The agreement between the expression and the measurements is excellent and therefore, the expression should bee used when determining boundary conditions for CFD simulations based on the Annex 20 room geometry.