Piergiacomo Cancelliere, J Appl Mech Eng 2017, 6:5(Suppl)
DOI: 10.4172/2168-9873-C1-011

CFD analysis and experimental tests of a fire safety pressurized smokeproof enclosure

Piergiacomo Cancelliere
Italian National Fire Rescue and Service – CNVVF – Rome, Italy

Pressure differential systems have the purpose of maintaining tenable conditions in protected spaces for different types of building safe places like, escape routes, firefighting access routes, lobbies, stairwells and refuge areas. The aim of pressure differential systems is to establish airflow paths from protected spaces at high pressure to spaces at lower or ambient pressure, preventing the spread of toxic gas released during a fire. This strategy ought to be supported by a detailed design of the necessary air supply, considering also the cycle of opening and closing doors during the egress phase. The study deals with the design and experimental test of a simple pressure differential system intended to be used in a building as a pressurized smoke proof enclosure. Experimental tests are conducted in a simple 3 meter side cubic enclosure with two doors and no vent openings (Figure 1 and Figure 2). While a centrifugal fan blows constant airflow inside the structure, pressure trend in time is recorded during steady state and transient conditions; additionally, the velocity of the airflow across the doors has been measured by means of an anemometer. Numerical simulations are carried out to reproduce the same smoke proof enclosure configuration (both geometry and boundary conditions) using Fire Dynamics Simulator (FDS). Furthermore, specific attention is paid to the modelling of the leakage across the doors, directly inserted in the model through a localized HVAC (Heating and Venting Air Conditioning) advanced leakage function. Comparison between experimental tests and numerical simulations are provided. Once the model was correctly calibrated, other geometrical and mechanical configurations have been analyzed and studied, looking for more convenient and efficient positions of the fan to fulfil the requirements of pressure differential, airflow velocity and door handle force. This study highlights some fundamental aspects on the pressurization and depressurization during steady state and transient phases, trying to identify if there are airflow profiles typical of some geometrical configurations.

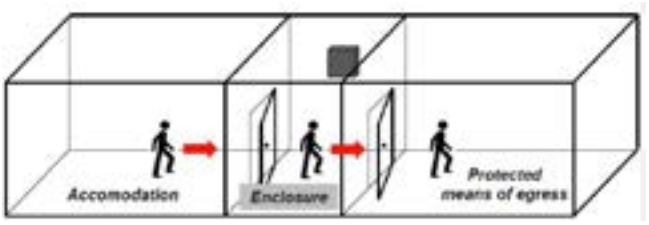

Figure1: *Pressurized fire safety smoke proof enclosure*

Figure2: *Experimental fire safety smoke proof enclosure*

Biography

Piergiacomo Cancelliere got his Master's Degree in Electrical Engineering in April 1998 at the University of Cassino, Italy. He took his PhD in Conversion of Electrical Engineering from the Second University of Naples in 2007. He started his career as an Electrical Engineer working for some relevant electrical enterprises, such as ABB. From June 2001 to April 2006, he was with the Electrical Machines and Drives Research Group of the University of Cassino. In May 2006, he joined the Italian National Fire Rescue and Service. He is currently a Senior Fire Officer. His technical and scientific topics cover both active and passive fire protection measures, fire assessment of electrical installations, components and ATEX related aspects. He is also a member of several TCs of the Italian Electrotechnical Committee and of the Italian technical standardization organization. He has authored more than 50 papers on international, national journals and conference proceedings.

piergiacomo.cancelliere@vigilfuoco.it