Use of Ansys Fluent to design Pressure Differential Systems (PDS) Autor: Izabela Tekielak Skałka, i.tekielak@smay.eu, SMAY

ABSTRACT:

How to properly design a pressure differential system (PDS) on a staircase? This task is relatively simple in simple buildings. However, it is difficult in complex buildings, e.g. high-rise buildings or power plants. In such buildings the protection of the staircase requires a special approach. The design problem may be the effect of wind, stack effect or heat gains in an adjacent part of the building. The solution to this problem can be using Ansys Fluent during the design of the PDS in a complex building. The program allows us to examine many different solutions of the PDS and choosing the best.

Ansys Fluent uses a tetrahedral mesh, which gives the possibility to combine large and small element sizes in one geometry (fig.1). The advantage of the program is the possibility of taking into account the stack effect or the effect of additional pressure on the openings, which can be caused by wind for example.

The presented analysis was created for a 60 m high building. The prepared models allow both the tests of pressure distribution when all doors to the staircase are closed as well as the tests of air flow through the open door. The results of PDS when all doors are closed are show on fig.2.

Three solution of PDS have been examined.

Fig. 1. Mesh in the model with concentration of elements near gap in the door.



[Pa]

Fig. 2. Distribution of overpressure in the staircase when all the doors are closed.



SCOPE OF PROBLEM

Comparison of system operation in winter (inlet temperature -20° C) and summer (inlet temperature +32° C).

— System 1, summer — System 2, summer — System 3, summer

---- System 1, winter ---- System 2, winter ---- System 3, winter

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