OUR WORK

ATM CASE STUDY 1

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PDL ENGINEERS CARRIED OUT ANALYSIS TO ASSESS THE FLOW AND TEMPERATURE DISTRIBUTION IN A FAN AND DISPLAY SYSTEM INCORPORATED WITHIN AN ATM TO PREDICT AND MITIGATE SCREEN MISTING.

PDL is a global provider of exemplary engineering design and analysis consultancy services. Our engineering capabilities mitigate risk, shorten development timescales and reduce development costs.

PDL engineers supported a world leader in consumer transaction technologies and specifically in the supply of automated teller machines (ATM).

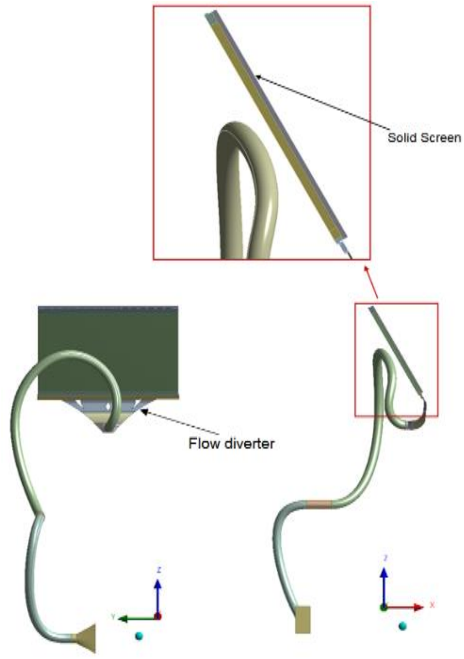

Figure 1: Fan & display screen geometry

THE INITIAL MODEL SHOWED GOOD COMPARISON WITH TEST DATA IN TERMS OF THE LOCATION AND AMOUNT OF MISTING PREDICTED.

PDL engineers carried out a computational fluid dynamics (CFD) analysis using ANSYS CFX to assess the flow and temperature distribution in a fan and display system incorporated within an ATM to predict and mitigate screen misting.

The main objectives of the CFD project were:

1) Perform a thermal simulation for the flow of air through the fan and display system.
2) Calculate the Dew Point (the temperature below which misting will occur) based on the fan inlet temperature, pressure and relative humidity.
3) Assess the flow and temperature distribution in the system.
4) Assess the fluid temperatures next to the screen against the Dew Point to predict misting.
5) Perform design iterations on system components to mitigate misting.

THE BEST RESULT WAS OBTAINED BY REMOVING INTERNAL OBSTRUCTIONS WITHIN THE FLOW DIVERTER AND THE GAPS IN A FLOW STRAIGHTENER

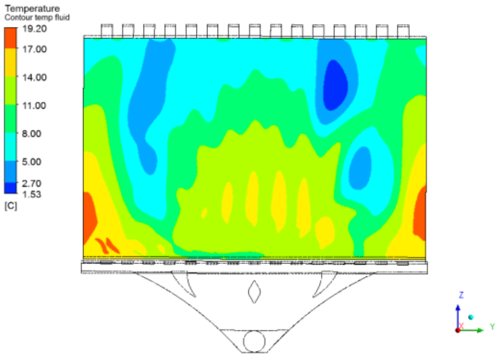

Figure 2: Screen fluid temperature

Features of the analysis setup included:

- The solid screen was included in the model to facilitate application of external convection boundary conditions.
- Empirically derived correlation formulae were employed to model the convection coefficient based on natural convection which varied with the screen temperature.
- A fan curve was used to iteratively calculate flow rate based on the back pressure in the fluid domain.
- Test data was used to refine the initial model: a thermal boundary condition was introduced to the fluid boundary opposite the screen to more accurately model heat losses.

The initial model showed good comparison with test data in terms of the location and amount of misting predicted. The low temperatures exhibited a close correlation with areas of recirculation in the flow, caused by ribs in the flow diverter component. Various ideas were tested to reduce the amount of flow recirculation. The best result was obtained by removing internal obstructions within the flow diverter and the gaps in a flow straightener. In this case a very laminar flow was obtained and the minimum temperature was increased significantly above the dew point.

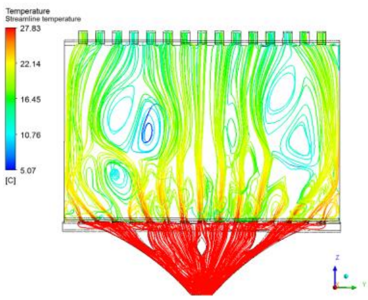

Figure 3: Streamlines coloured by temperature

For further information regarding PDL's engineering capabilities please email: solutions@pdl-group.com or telephone our head office.