CFD INVESTIGATION OF HVAC SYSTEMS IN COMMERCIAL BANK APPLICATIONS

By

Eng.Elsayed Mohammed Mohammed Fouda

A Thesis Submitted to the Faculty of
Engineering at Cairo University in Partial
Fulfilment of the Requirements for the Degree of
MASTER OF SCIENCE
In
MECHANICAL POWER ENGINEERING

FACULTY OF ENGINEERING, CAIROUNIVERSITY
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Title of Thesis: CFD INVESTIGATION OF HVAC SYSTEMS IN COMMERCIAL BANK APPLICATIONS

Key Words: CFD, indoor air quality, thermal comfort, ventilation systems, commercial bank.

Summary:
The air conditioning applications in commercial banks are considered as one of the important HVAC applications, with wide variety of heat, water vapor, and carbon dioxide sources due to high occupancy load of customers. So, the present thesis is devoted to numerically investigate the influence for four different cases to change in location of supply and exhaust air, velocity of inlet air and change area of inlet diffuser and outlet grille to improve indoor air quality for a bank hall. The work focuses on air flow patterns, thermal behavior and carbon dioxide dispersion in a bank hall.

The study is carried out using computational fluid dynamics (CFD) simulation techniques as embedded in the commercially available CFD code (Ansys FLUENT 15).

The CFD software run on after meshing the modeling for more than 11000,000 mesh element size for all cases .It's modeling techniques solved the equations of energy, momentum, continuity and species transport as well as RNG k-epsilon model equations for turbulence closure.

The results showed that the best design when air supply from ceiling and air extraction ports distributed on all side walls and increasing number of air extraction ports on all side walls will lead to minimize the recirculation air zones. Also the results showed the thermal comfort depends on inlet air velocity when increasing the supply air velocity; indoor air quality is good andsuitable.

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

FIGURE DESCRIPTION PAGE