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REVIEW PAPER ON DESIGN OF DUCT AND COOLER FOR ME-02 CLASSROOM

Nayan somkuwar [1] Harsh Yadav [2] Shreyas Chavhan[3] Shivam nampalliwar [4] Aryan borkar[5]

M. Nematullah Nasim[6]

[1,2,3,4,5)] Students, Department of mechanical engineering, ACET

[6)] Professor, Department of mechanical engineering, ACET

Abstract

The creation and execution of an effective duct and cooler system for educational settings are the main goals of this project. By enhancing indoor air quality and temperature control, the goal is to provide a pleasant and beneficial learning environment.

The project starts with a detailed examination of the existing classroom circumstances, taking into account elements like space needs, occupancy, ventilation, and temperature. Appropriate design parameters are created based on this research to produce the best cooling and air dispersion. Determining the required air capacity and fan capacity is essential for achieving the desired cooling effect. Proper airflow distribution throughout the workplace is crucial to ensure that every area receives adequate cooling. Selecting fans with the appropriate capacity and efficiency will help maintain the desired comfort level while minimizing energy consumption.

Introduction

The need for efficient air-cooling solutions has become critical in the current situation. A suitable duct system and fan must be chosen in order to effectively cool a room. In countries where the outside temperature exceeds comfortable conditions, there is a high demand for designers who can develop solutions for cooling factories and various industries. It is essential to carefully evaluate the external and internal conditions of the workplace to create an ideal environment for productive work. Our project focuses on analyzing and examining the factors and conditions related to duct design and installation in order to achieve optimal cooling performance Understanding the specific requirements of the classroom is crucial for designing an efficient cooling system. By considering factors such as the size of the space, heat-generating equipment, insulation, and local climate conditions, you can determine the optimal duct design and fan selection to achieve the desired cooling effect.

OBJECTIVE

1) To provide Air cooling with reduced power consumption
2) Create a Reliable system
3) Reduce frictional losses
4) Optimum utilization of space
5) Proper air distribution through-out classroom
6) To Reduce noise

LITERATURE SURVEY

1. D.L. Lansing and W.E. Zorumski's "Effects of wall admittance changes on duct transmission and radiation of sound"

This study focuses on how changes in the acoustic characteristics of duct walls affect sound transmission via ducts. The study explores the impact of a single modification in duct wall acoustic admittance in a rectangular infinite-length duct with airflow. The acoustic behaviour and sound transmission properties of these ducts are examined by the authors.

2. J. E. O'Brien and E. M. Sparrow's "Corrugated-Duct Heat Transfer, Pressure Drop, and Flow Visualisation"

This study reports on tests done to measure the pressure drop, flow visualisation, and forced convection heat-transfer coefficients in a corrugated duct. The performance of heat transmission and pressure drop characteristics of flow in a duct with corrugated walls are investigated by the authors. They also offer visualisations of the duct's flow patterns.

3. L. W. Carlson and T. F. Irvine's "Fully Developed Pressure Drop in Triangular Shaped Ducts"

In this study, the authors concentrate on determining the pressure drop in a triangular-shaped duct's hydrodynamic section. The purpose of the study is to comprehend the behaviour of pressure drop under fully developed flow circumstances. The authors offer insights into the flow characteristics and energy losses in triangular-shaped ducts by analysing the pressure drop.

Heat emitting sources in the classroom

1) Peoples sitting in classroom
2) Numbers of Lights, fans other electrical appliances in the classroom
3) Windows exposed to sun
4) Walls in direct contact with sun
5) Walls not in direct contact with sun
6) Roof
7) Floor

Specifications of the classroom

1) sitting capacity =60 people
2) No of fans =5
3) No of light =4
4) Projector =1
5) No of windows =4
6) No of doors = 2
7) Area of roof = Area of floor=75.80 sq.m.

Duct :- A duct is a hollow conduit or passage used to transport air, gases, or fluids from one location to another. In the context of cooling systems, a duct is an enclosed pathway that distributes cooled air from a central air conditioning unit or air cooler to various areas within a building or space.

Types of duct :-

1) Circular duct
2) Rectangular duct
3) Square duct

Different methods of duct design

1) Velocity reduction method
2) Equal friction method
3) static Regain Method

DUCT DESIGN BY EQUAL FRICTION METHOD

(Design Tools Duct Sizer Version 6.4 McQuay)

$$M^\circ = Q/(CP \times \Delta T)$$

where,

M° = mass flow rate kg/s

Q = (kW) heat load

Cp = Specific heat capacity (kJ/kgK)

ΔT = temperature difference

Cp = 1.026 (kJ/kgK) (standard value from ISHRAE)

ΔT = should be less than 10 °C

= 14.07 kW Total Heat Transfer

M° = 2.07 kg/s

M° = kW/(kJ/kgK.8K)

Density of Air = 1.2 kg/m3

Specific volume = Density-1

= 1.2-1 = 0.833 m3/kg

Formula :-

v° = m° X v

v° = volume flow rate (m3/s)

m° = mass flow rate (kg/s)

V = specific volume (m3/kg)

V = 2.07 X 0.833

V = 1.73 m3/s (1cubic metre/second = 2118.8 cfm)

So,

v = 1.73*2118

= 3665 cfm

Required Specifications of duct and cooler

1) Cooler:-

Metal body cooler

6 Honey comb pads

1440 rpm motor

1100 watts exhaust motor

24'' fan made of fiber

2 water pumps

2) Duct :-

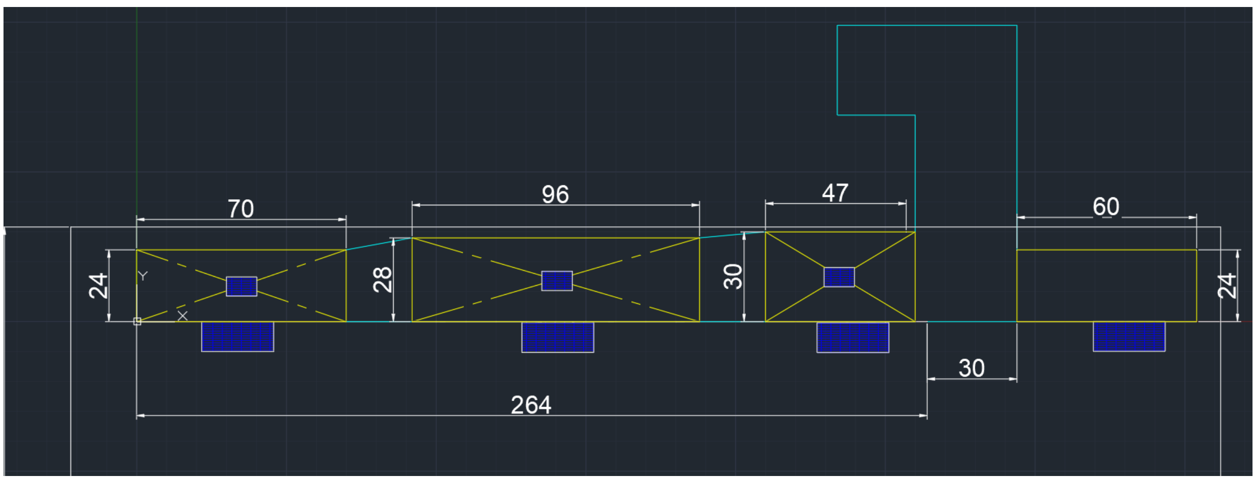
GI sheet material

Gauge:- 24

Powder coated double deflection aluminium grills

(12”*12” 3 no , 24”*10” 4 no)

Proposed design:-



Conclusion :-

In order to design an air cooler that provides effective cooling and create comfortable conditions for students, it is crucial to consider various factors, including the classroom conditions, when calculating the heat load. Taking these factors into account will ensure that the cooling system is appropriately sized and capable of meeting the cooling demands of the space.

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