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Fabrication & Testing Of Duct Air Cooler

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ABSTRACT

The main objective of this project is fabricating the duct system for central Air-conditioning system in a classroom no. ME02. The central air-conditioning system controls the building temperature, humidity, and cleanness, proper air distribution, noise level, & comfort level. Also, this project deals with duct designing for fresh air ventilation, exhaust air duct, return air duct and equipment selection such as Air handling unit, and fan coil unit based on requirement.

1. INTRODUCTION

Air conditioning is mainly based on the principle of thermodynamics, heat transfer and fluid dynamics. Air conditioning process is used to remove heat from indoor air is to create a requirement of a conditioned space by controlling its temperature, humidity, cleanliness and proper air distribution. Calculation of cooling load by taking into account people heat gain, walls, roofs, partition walls, light heat gain, infiltration, and ventilation heat gain. Most of the air conditioning systems require some form of a duct i.e., a passage which carries cooled air from AHU to where the conditioned air is needed. Ducting plays a role of changing the air of a given space by removing the indoor air and supplying conditioned air. Effective design of duct system in air conditioning provides lower power consumption and lower capital cost.

Classroom no. "ME02" has been selected for fabrication and calculation of cooling loads on the basis of floor area, humidity, temperature of heat sources, occupancy, weather conditions, building structure, and geographic location. These results will help in determining the heat load & duct design. The rectangular cross-section of the duct is selected to any space height restrictions and is easy to fabricate.

A. What is Duct Air Cooler?

Ducts are similar to conduits which are channels or passages through which air is either delivered or removed. Duct Air Coolers ensure the supply of fresh cool air which is conditioned through the evaporative cooling technology and also remove the stale air from the room or area. The conduits or the air passage also are effective in ventilation and these Duct Coolers can also serve the twin purpose of providing fresh air/ventilation inside the room or space during the cold weather or the winters.

B. How do Duct Air Coolers work?

A Duct Cooler blows the refreshing and cool air through metal conduits with the required amount of pressure to every part of the room or space targeted to provide cool air. Both the management and the flow of cool air are exemplarily uniform for a Duct Air Cooler, as the air is pushed to a far distance from the fan through ducts and is distributed through single or multiple outlets.

1. PROPOSED METHODOLOGY

A. Define the objectives

Clearly identify the goals of the duct air cooler system. Determine whether the primary aim is to improve indoor air quality, reduce the temperature, or achieve both simultaneously. This will help establish the focus of the methodology.

B. Assess the cooling requirements

Evaluate the cooling needs of the space by considering factors such as room size, occupancy, heat load, and desired temperature range. This assessment will provide a baseline for determining the capacity and specifications of the duct air cooler.

C. Research available options

Conduct thorough research on different types of duct air coolers, such as evaporative coolers, chilled water systems, or refrigerated air systems. Evaluate their pros and cons, energy efficiency, maintenance requirements, and suitability for the specific application.

D. Select the appropriate duct air cooler

Based on the research conducted, choose the most suitable duct air cooler that aligns with the defined objectives and cooling performance.

E. Determine the location of the air cooler unity

Identify the optimal placement of the duct air cooler unit within the building or HVAC system. Ensure adequate space, access for maintenance, and compliance with safety regulations.

F. Determine water supply and drainage

If using an evaporative cooler, ensure a reliable water supply for the cooling process. Assess the feasibility of water sources and plan for appropriate drainage to avoid water accumulation and potential damage.

G. Integrate controls and automation

Implement control systems that enable efficient operation and monitoring of the duct air cooler. Consider temperature sensors, thermostats, timers, and programmable logic controllers to optimize cooling performance and energy consumption.

H. Installation and commissioning

Engage professional HVAC technicians to install the duct air cooler system according to the designed layout and specifications. Ensure proper testing, calibration, and adjustments are carried out during the commissioning process to guarantee optimal performance.

I. Ongoing maintenance and monitoring

Establish a regular maintenance schedule to ensure the smooth operation and longevity of the duct air cooler system. Conduct periodic inspections, cleanings, and filter replacements. Monitor performance indicators such as temperature differentials, airflow rates, and energy consumption to identify any issues or opportunities for improvement.

2. RESULT AND DISCUSSION

All the problems associated with the cooling of the room have been solved. All the losses while delivering the air are calculated and the design is selected by checking all the parameters and CFM has been calculated according to the requirement. Furthermore, the design and development process considered factors such as compactness, ease of installation, and maintenance requirements. The resulting duct cooler was designed to be easily integrated into existing ductwork systems, ensuring minimal disruptions during installation. Additionally, its modular design facilitated easy maintenance and servicing, further enhancing its usability and longevity.

Figure 1: Setup of Duct Air Cooler

Figure 1: Setup of Duct Air Cooler in Classroom

CONCLUSION

The fabrication, installation, and testing of the duct air cooler have been conducted successfully for the classroom. The duct air coolers are known to save energy and electricity bills and have a low cost of maintenance. Therefore, the duct air cooler is not only a green and environment-friendly solution but also ensures substantial savings on budget as the initial purchase cost is low. Since the body of the duct air cooler is made of anti-corrosive and high-resistance metal, it is easy to maintain provided the proper cleaning of the water tank, cooling pads, fan, and pump is done regularly. Also, the metal ducts are made with galvanized steel and are rust-resistant; however, it is always good to check the electrical components, motor, and pump for any wiring issues. The cooling pads need to be cleaned at least once in two months during the season or more frequently on the basis of intensity and hours of usage.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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REFERENCES

[1] Handbook of Air Conditioning System Design /Carrier Air Conditioning Co. by Carrier Air Conditioning Pty. Ltd.

[2] A. Bhatia, HVAC Made Easy: A Guide of Heating and Cooling Load Estimation, PDH online course M196 (4PDH).

[3] A. Bhatia, "HVAC Ducting - Principles and Fundamentals" PDH online course M246 (4 PDH).

[4] M. Hafeez Shaik, Tech supporter "National refrigeration Pvt. Ltd. services" Anantapuram for Heat load calculation and duct design.

[5] Shan K. Wang "HANDBOOK OF AIR CONDITIONING AND REFRIGERATION" Second Edition, McGraw-Hill 2000.

[6] Dennis J. Wessel, Chair "ASHRAE Handbook" Fundamentals Volume 2001.

[7] Dr. Prem C Jain "ISHRAE HVAC Handbook" air conditioning part-1 2007.

[8] M. Ganesh, "Duct Design and 3D Modeling of HVAC System for "Royal Oman Police" Building using Revit MEP" Volume-1, Issue-5, May 2018 www.ijresm.com.