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Design of Air Condition & Distribution Systems

P.Divakara Rao[3], Krishnam Raju[2], V.Sreenivasulu[3], K.Santosh[1]

Mechanical Engineering, J.B.I.E.T.(Autonomous) Hyderabad.

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ABSTRACT

The objective of an Air conditioning (heating, ventilating, and air-conditioning) system is to control the temperature, humidity, air movement, and air cleanliness, normally with mechanical means, to achieve thermal comfort. Centralized HVAC system
installations utilize a number of separate components that are field assembled to serve the specific needs of an individual building.

Introduction

Distribution components convey a heating or cooling medium from source-located service generators to portions of a building that require conditioning. Delivery components serve as an interface between the distribution system and occupied spaces. In this paper we will focus on the various design options pertaining to cooling and heating air distribution .

All - air systems

As the name implies, in an "all – air" system air is used as the media that transports energy from the conditioned space to the A/C plant. In these systems air is processed in the A/C plant and this processed air is then conveyed to the conditioned space through insulated ducts using blowers and fans. This air extracts (or supplies in case of winter) the required amount of sensible and latent heat from the conditioned space. The return air from the conditioned space is conveyed back to the plant, where it again undergoes the required processing thus completing the cycle. No additional processing of air is required in the conditioned space. [1,6]

The system is categorized by the use of air-handling units (AHU) or roof top packages (RTP) to condition air. The conditioned air is sent through ductwork to the occupied space where it will heat or cool the space as required, and return via return air ducts back to the AHU or RTP. Air Handling Units contain a cooling coil (connected to a chiller or condensing unit), a heating coil (connected to boilers or electric heaters), filters, and one or more circulating fans.[3,4]

Roof Top Packages contain a refrigerant cooling cycle, heating coils (connected to boilers or electric heaters), filters, and one or more circulating fans.A schematic arrangement of an All-Air system with its major components is shown below.

- Corresponding author: V.Sreenivasulu
- E-mail address: vsreenivasulu76@Yahoo.Com
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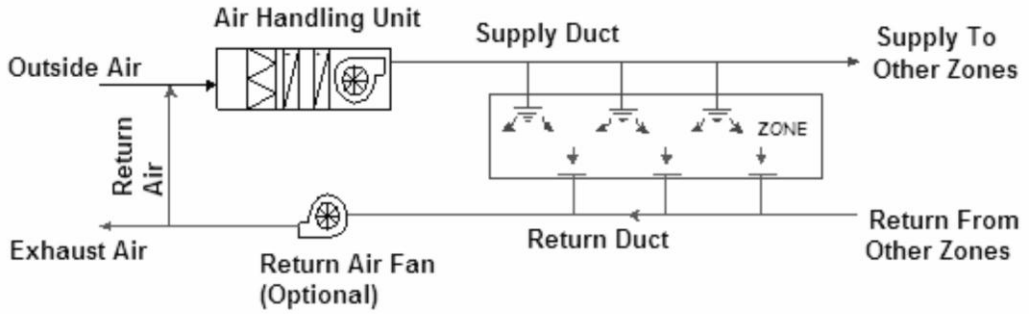


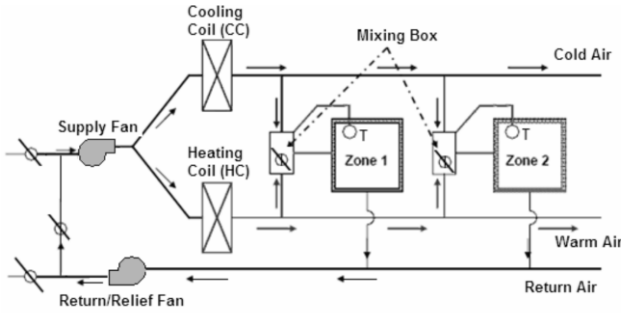
All - Air System

All-air systems require the majority of air supplied to a space beduct system or through plenums formed by various elements of a returned to the air-handling unit for reconditioning, or exhaustedbuilding, such as a suspended ceiling or the building structure from the building. This "return" air may be conveyed in a return air

Dual duct systems

The dual-duct system employs two air ducts; one cold air duct and one warm air duct from the air-handler to the conditioned spaces. Figure below shows the schematic of a dual duct, constant volume system. As shown in the figure, the supply air fan splits the flow into two streams. One stream flow through the cooling coil and gets cooled and dehumidified to about 52°F, while the other stream flows thru the heating coil and is heated to about 95–110°F.

The cold and hot streams flow through separate and parallel ducts. The ducts are not necessarily of equal size, depending upon building heating and cooling loads. Before each conditioned space or zone, the cold and hot air streams are mixed in required proportions using a mixing box arrangement, which is controlled by the zone thermostat. The total volume of air supplied to each zone remains constant; however, the supply air temperature varies depending upon load. The system is well suited for providing temperature control of individual spaces or zones. Return air is accomplished through a single duct system.



Dual Duct, Constant Volume System

Let's check the relationship between the three systems with respect to their ability to control the six main HVAC parameters. These are temperature, relative humidity, pressure, air composition, particulates, and air velocity.

Parameters	All-Air Systems	Air-Water Systems	All-Water Systems
Temperature	Good using modulation of chilled water through coils in air handling units	Good, it uses central air-handling unit and the terminal unit coils for temperature control. The control is achieved through modulation of chilled water through air-handling coil and usually using "on-off" solenoid valve at the terminal units.	Moderate, using modulation or 'on-off' of valve to the terminal units. Air control is also possible using 2 or 3 speed fan motor.
Relative Humidity	Moderate using coils for dehumidification and humidifiers in	Good, it relies primarily on the dehumidification through the chilled	Poor using chilled water atlow temperature atthe terminalunits.

Design of Air handing Unit:

In case where air is one of the fluids, the most economical Heat exchanger is usually the finned tube employing some form of cross flow arrangement

Conclusions

The load calculations and equipment selection calculations have been done keeping in view all the practical aspects of design. The infiltration through swing doors and windows were reduced by providing proper insulations to all doors and windows. The cooling load was reduced by about 30% to 50% by sealing the control room and there by reducing cost of plant. Ventilation was provided by adding 75% of re-circulated air from control room to 25% of fresh outside air. The entire conditioned air is delivered to control room through sheet metal ducts. Unitary type of system was preferred because it has the advantage of moderate initial cost.

Refferance

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