HVAC DESIGN FOR COLLEGE AUDITORIUM

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• Introduction

HVAC- Heating ventilation air conditioning is a branch of mechanical engineering, which is concerned in accomplishing both inside as well as vehicular human comfort by providing adequate and satisfactory heat and fresh air. Apart from residential, HVAC system is also very significant and essential in many Industries, Laboratories, in cold storage and preservation purpose, pre-cooling and pasteurization of milk, in various manufacturing process in rubber industries, textile industries, etc. It includes in the process of exchanging or replacing air in any place to offer high indoor air quality which involves temperature control, oxygen replenishment, and removal of moisture, odours, smoke, heat, dust etc. from air This poster provides essential details to design Auditorium of 1000 seats.

• Location Detail

Location is Changa, Anand region and we considered summer as a design condition.

Condition	Outside (°C)	Inside (°C)
DBT	43.33	23.83
WBT	26.4	17.77
%RH	37	55
Daily Range	19 º C	

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• Load calculation

Heat gain through the walls and roof.

Heat gain through wall and roof is given by…

$$Q = U * A * (CLTD)$$

U = overall heat transfer coefficient
A = area of the wall through which heat is passing CLTD= cooling load temperature difference
So, according to our design,

$$Q_{STRUCTURE} = 56995.26\ W$$

2. *Heat gain through windows and doors*

$$Q_W = A*(SC*SCHF + U*CLTD)$$

Q_W = Heat transfer through glass window (door)
SC = Shading Coefficient
SHGF = Solar Heat Gain Factor
U = Overall heat transfer coefficient
CLTD = Cooling load temperature difference

$$Q_W = 12295.65\ W$$

3. *Heat gain due to lighting*

$$Q_{LIGHTING} = W*F_U*F_S$$

W = Total Wattage of light = 22186 W
F_U = Usage factor (used wattage / installed wattage) = 1
F_S = Special allowance (Ballast factor) = 1.25

$$Q_{LIGHTING} = 27587.68\ W$$

4. *Heat gain due to appliances*

$$Q_{APPLIANCES} = W * \text{Usage Factor}$$

$$Q_{APPLIANCES} = 1650\ W$$

5. *Heat gain due to people*

Here, we consider 1000 people are seating so for seating at rest 120 W/person load and 20 people are dancing so 250 W/person.

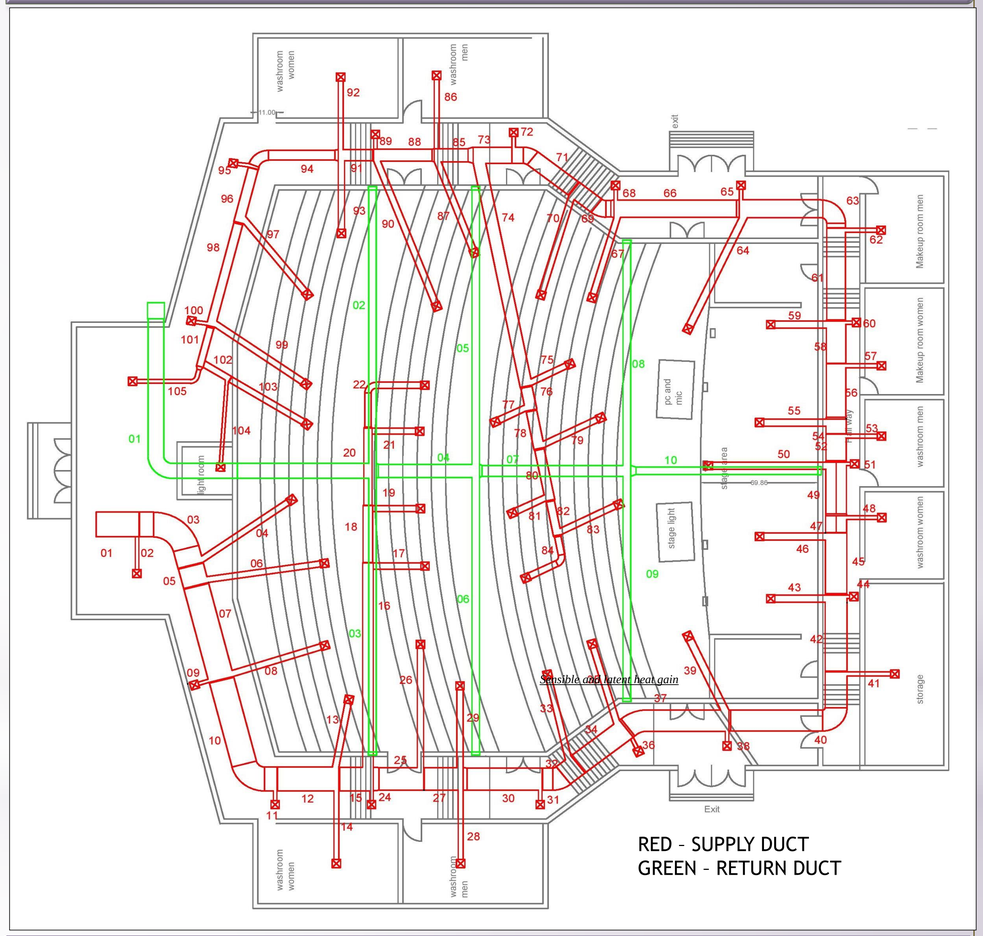
$$Q_{PEOPLE} = 125000\ W$$

• Total Heat Load

$$Q_{SENSIBLE} = Q_{STRUCTURE} + Q_W + Q_{People} + Q_{LIGHTING} + Q_{APPLIANCES} + 10\%$$

$$Q = 245881.45\ W = 70\ T.R.$$

Fig. DUCT DESIGN



• Duct Design

There are many theories which defines the sizing of the ducts like…

- equal friction
- static regains
- total pressure
- velocity reduction
- constant velocity

We use equal friction method…

$$D^{3.704} = 1.5656*(Q/V)^{1.852}$$

D = 1.545 m (Main Duct)

Corresponding to that we find out all 105 ducts diameter.

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