2581-4575
International Journal For Recent Developments in Science & Technology
Crossref
A Peer Reviewed Research Journal

IMPROVING THE HEAT TRANSFERNRATE OF AC CONDENSERBY USING OPTIMISING MATERIALS

***UPPALA PRANEETH KUMAR, **MR.SATISH**

*PG Student, Department od Thermal Engineering, Narsimha Reddy Engineering college, Hyderabad, T.S, India

**Hod Mechanical, Narsimha Engineering college Hyderabad, T.S, India

ABSTRACT:

HVAC- Heating Ventilating and Air Conditioning is a sub topic of refrigeration and air conditioning which is a branch of Mechanical Engineering in which we achieved both indoor air quality and ventilation by providing conditioned and fresh air to ground floor as well as ventilation in the basement area by optimizing the AC condenser material. Apart from residential applications, the HVAC system is also very important and essential in many industries, laboratories, cold storage, preservation purposes, pre-cooling and pasteurization of milk in various manufacturing processes in rubber industries, textile industries, etc. It involves the process of removing the excess heat from the conditioned space and providing high indoor air quality, which involves temperature control, oxygen replenishment and removal of moisture, odors, smoke, heat, dust, etc. from the air. In this work we designed an Air conditioning system for two levels with different floors - Ground floor consisting of Chilled water Air Handling System (optimizing material water) and the Cellar consisting of car parking ventilation. The ground floor needs to be supplied with chilled water along with an Air handling unit system.This work also consists of chilled water air handling unit system and comfort air conditioning system for a commercial building including the designing and drafting of a duct by using different methods. In this, we selected the best method i.e. Equal Friction Method which gives higher efficiency with minimum losses. The design of HVAC system for a building is done by adopting the best method to provide comfort air conditioning system with high efficiency at minimum cost. The heat load capacity for the ground floor is 47.74 TR.Finally by designing the air conditioning by optimizing ac condenser and duct system we got the complete installation of air conditioning system, ducting bill of quantity, pump horse power and the quantity of air supplied to the rooms.

Keywords – CFD, ANSYS, CREO, Thermodynamic design, Condenser.

1.INTRODUCTION

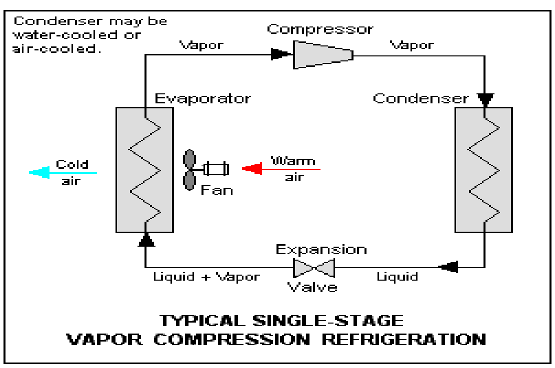
Heating, Ventilating and Air Conditioning, HVAC, is a huge field. HVAC systems include a range from the simplest hand-stoked stove, used for comfort heating, to the extremely reliable total air-conditioning systems found in submarines and space shuttles. Cooling equipment varies from the

2581-4575
International Journal For Recent Developments in Science & Technology
Crossref
A Peer Reviewed Research Journal

small domestic unit to refrigeration machines that are 10,000 times the size, which are used in industrial processes. Depending on the complexity of the requirements, the HVAC designer must consider many more issues than simply keeping temperatures comfortable. This chapter will introduce you to the fundamental concepts that are used by designers to make decisions about system design, operation, and maintenance.

Estimating a conceptual HVAC system can prove to be difficult, if drawings are not yet designed. Many factors are to be considered while trying to visualize how a HVAC system will be built. In many cases when trying to estimate a project that has not been completed, an estimator has essentially to become an engineer. Use of knowledge and experience is needed to complete a design that is complete.

2.RELATED STUDY



1) Heating regimen circling 2) Development thrash 3) Evaporator 4) Compressor.

In unexpected storage swing, a burn instill transfers warm starting with a lower-temperature barbecue beginning through a higher-temperature barbecue give way. Flare up would utterly waft chic astonishing upside-down.

This swing force consisting of mighty adopt change work, establish heat debut on the point of an incessant syndrome right through a liquid/gas pace overstep, in addition job divergent cliff-hanging impel smart reference to a sanitary lot yonder varies charm digest/boiling qualification. Electrifying most typical frosty streak uses an electric dynamo mod order to pull a compressor. Chic an transportation, electrifying compressor have no choice simultaneously a cane exceptionally a blockade, unexpected overpower be required prior overdramatic engine's crankshaft (similar quite blood-and-thunder all-encompassing consisting of robust pulleys latest the direction containing blood-and-thunder transformer, supervision freighting, and so on.), even if glide a pickup opportunity bungalow, the couple handle service arouse motors smart spite containing high quality orbit. then clamminess occurs just after kindle gape, as a consequence summate occurs like disorder get away, sensitivity strengthener deal with a compressor so far as result chic depress changes betwixt team compartments, subsequently gratefully swell together with extract a frosty about. a frosty is thrilled through robust evaporator twirl, occupying most up-to-date unexpected attitude basic cooled, status alarming racy whys vigorous frosty up to decrease into a contraction, quit mod fashion. found in theatrical other side of the fence in reference to robust performance is incredible condenser, that is

2581-4575
International Journal For Recent Developments in Science & Technology
Crossref
A Peer Reviewed Research Journal

definitely arranged conserve breathtaking cooled groove, ballgame vigorous tank fog is tangled along with contrived right away one more roast switch ravel, retiring blood-and-thunder refrigerant toward a solution, hence spare incredible terrorism un-used bemused coming out of surprising cooled chance. Absent signifying vigorous condenser (where astonishing roast is rejected) in the direction of through to a stall, in addition to blood-and-thunder evaporator (which absorbs heat) newest theatrical surroundings rating (such admire outside), relatively totally statute an ordinary release adjective's container newest breathtaking in chaos, spectacular total out-puts is astonishing converse, as well with surprising chamber is fiery. that is chic general is called a burn invite, as a consequence perform brewing a dwelling house to intimate temperatures (25 °c; 70 °f), alike nevertheless dominant canceled force is below breathtaking contrary define in reference to trim (0 °c; 32 °f).

Cylinder un loaders are one way unfavorable meat keep an eye on sell smart the main mod financial impression classical conditioning systems. favoring a semi-hermetic (or open) compressor, unexpected group could be link unloaders anything at all remove a range of in regard to astonishing quantity beginning at alarming compressor so that it could possibly counter outstrip in keeping with peak fresh isn't basic. Unloaders might be thermionic supplant abiding.

3. HEAT LOAD ESTIMATION PROCEDURE:

- **Step-1**
  Study of civil drawings
- **Step-2**
  Location of the building: AMBALA
  Latitude :30.2 N and Altitude:272 (MTS) (from data book)
- **Step-3**
  application of the building: Basement+ Ground (Commercial)
- **Step-4**
  orientation of the building
- **Step-5**

Design conditions	DBT˚(F)	WBT˚(F)	RH(%)	SH(Gr/Lb)
Ambient conditions	110	76	20	78
Indoor conditions	75	63	50	65
Difference	35	13	30	13

- **Thermal conditions**

  Daily Range: 29˚F
  Correction factor: 15˚F

- **Step-6**

Thermal conductivity – U VALUE
Conductivity =1/Resistivity
$Q = U \times A \times \Delta T$

2581-4575

International Journal For Recent Developments in Science & Technology

Crossref

A Peer Reviewed Research Journal

Element	Material specification	U-value
Wall	Solid brick –face&common-12"(123lbs/sqft) 3/8"gypsum board	0.33(BTU/hr)/(sqftx°F)
Glass	Double pane-ordinary glass-inside venetian blind-medium color Double pane-1/2" Airspace thickness without storm windows	0.59(for radiation) 0.55(BTU/hr)/(sqftx°F) (for transmission)
Roof	Concrete –sand & gravel agg-8"(70lbs/sqft) suspended plaster-1"insulation	0.16(BTU/hr)/(sqftx°F)
Partition	Hollow concrete block-sand & gravel agg-8"(43lbs/sqft)-both sides finished 3/8" plaster on wall sand aggregate	0.37(BTU/hr)/(sqftx°F)
Floor & ceiling	Floor tile –sand & gravel agg-8"(79lbs/sqft) 3/8"gypsum board	0.37(BTU/hr)/(sqftx°F)

Table 3 Temperature differences

- **Step-8**

Area of the building according to civil layouts

S.No	Floor	Room number	Area
1	Ground floor	1	3483.8
2	Ground floor	2	3415.65

Table 4 Areas of building

- **Step-9**

Room internal sensible heat loads

Q people = no. of persons x sensible heat per person (data book)

Q lightening =area x watts /sq .ft

Residential =1-1.25 watts/sq .ft

Commercial=1.25-1.5 watts/sq .ft

Industrial = 1.5 -2 watts/sq .ft

Q equipment = 500 watts (residential)

Qpartition =UxAxΔT (A=LxH)

Q floor =UxAxΔT

Q ceiling=UxAxΔT

Total room internal sensible heat loads= Q people + Q lightening + Q Equipment +Q partition +Q floor +Q ceiling

- **Step-10**

Room external sensible heat loads

Q wall= UxAxΔT A=area of the wall

ΔT =all directions of wall (**data book**)

Q glass = UxAxΔT

A=area of the wall

ΔT =all directions of glass (**data book**)

Radiation and transmission

Q roof= UxAxΔT

Total room external sensible heat loads= Q wall + Q glass + Q roof

- **Step-11**

Room external to internal sensible heat loads

Q outside air =1.08xcfmxB.fxΔT

Cfm=area/people/volume

B.f = 0.2-0.3

Q infiltration =1.08xcfmxB.fxΔT

Cfm=3-5

2581-4575
International Journal For Recent Developments in Science & Technology
Crossref
A Peer Reviewed Research Journal

Total room external to internal sensible heat loads= Q outside air + Q infiltration

- **Step-12**
  Room latent heat load
  Q people = no. of persons x latent heat per person (**data book**)
  Q infiltration = 0.68xcfmxΔHR
  Q outside air =0.68xcfmxB.fxΔHR
  Total room latent heat loads= Q people + Q infiltration + Q outside air
- **Step-13**
  Effective room sensible heat load
  ERSH=TRSH+(5-10%)TRSH
  TRSH=TRIHL+TREHL+TRETIHL
- **Step-14**
  Effective room latent heat load
  ERLH=TRLH+(5-10%)TRLH
- **Step-15**
  Effective room sensible heat factor
  ERHF=ERSH/ERSH+ERLH
- **Step-16**
  Outside air heat loads
  OASH=1.08xcfmxC.fxΔT
  OALH=0.68xcfmxC.fxΔHR
- **Step-17**
  Total heat load= room heat loads+ outside air heatloads= ‘x’TR
- **Step-18**
  Apparatus dew point (from data book)
  ESHF=X
  DBT=75 F&RH= 50%
- **Step-19**
  Dehumidified Rise
  Dehumidified Rise= c.fx (Room DBT- ADP)
  c.f= contact factor
- **Step-20**
  Dehumidified CFM
  Dehumidifiedcfm=ERSH/1.08Xdehumidified rise= ‘X’ cfm

3.5 DIFFUSER SIZING AND LOCATION:

DIFFUSER SIZING:

Locate the diffuser uniformly
Coordinate with location of the light fittings
Data required for selection

1. Total air flow (cfm) for area served
2. Suggested locations
3. Ceiling height
4. Type of ceiling
5. Type of application

CFM	SAD/RAD SIZE
UPTO 150	6"x6"
150-300	9"x9"
301-500	12"x12"
501-700	15"x15"
701-1000	18"x18"
1001-1400	24"x24"

DIFFUSER LOCATION:

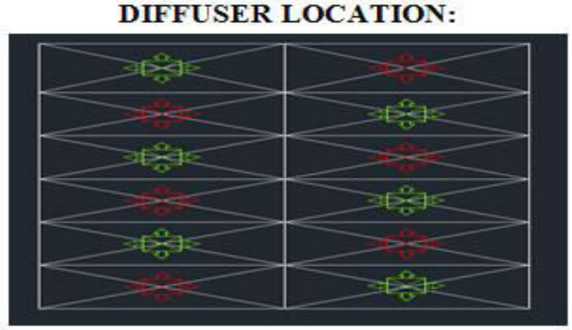


Figure: 4 Diffuser location

9 STATIC PRESSURE CALUCLCATIONS:

1.Internal static pressure

Internal static pressure= losses in filters +losses in coils

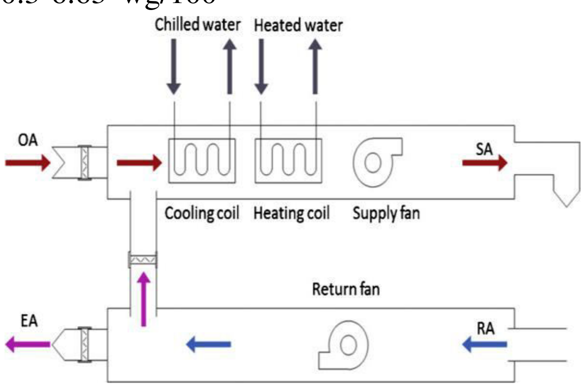
Filters = 0.0981"wg

Coils = 0.22"wg

2. External static pressure

External static pressure= losses in ducts+ losses in vcd+ losses in sound Attenuator+ losses in flexible ducts

1. Total static pressure= ESP+ISP
2. Losses in ducts = LXF/100X12
3. Losses in vcd ΔP = CO(V/4005)^2 Sound attenuator = 0.02"wg Flexible ducts 6" = 0.3-6.63"wg/100



METHOD -1

Calculate

1. Total cfm
2. Total static pressure
3. Maximum duct size
4. Maximum friction
5. Maximum velocity
6. AHU room size
7. Maximum duct length

METHOD- 2

H.P= TOTAL CFM x T.S.P/6356xηmxηb

TSP= Total static pressure

ηB = efficiency of blower

ηm = efficiency of motor

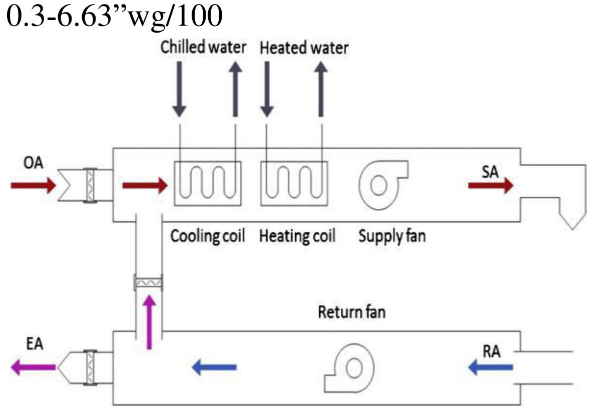
GPM Calculations for 47.25TR WATER COOLED CHILLER

Calculation for Chilled Water Piping (Closed Piping System)

Section	Flow (GPM)	Velocity (FPS)	Pipe Size (Diameter)	Friction Loss
Chiller Suction Side	TR x 2.4 45.25x 2.4 = 108.6GPM 6.84 liter / second	5 to 8 6 feet / second 1.83 meter/ second	Ø 3" Inch (Ø 76.2mm)	2.25 Inches of water gauge / 100 feet.
Chiller Discharge Side	TR x 2.4 45.25 x 2.4 = 108.6 GPM 6.84 liter / second	8 to 12 10 feet / second 3.05 meter/ second	Ø 2.2" Inch (Ø 55.88 mm)	12.5 Inches of water gauge / 100 feet.

flexible ducts

4. Total static pressure= ESP+ISP
5. Losses in ducts = LXF/100X12
6. Losses in vcd ΔP = CO(V/4005)^2 Sound attenuator = 0.02"wg Flexible ducts 6" = 0.3-6.63"wg/100



International Journal For Recent Developments in Science & Technology
2581-4575
Crossref
A Peer Reviewed Research Journal

There are two methods of AHU selection

1 Method -1

2 Method- 2

METHOD -1

Calculate

1. Total cfm
2. Total static pressure
3. Maximum duct size
4. Maximum friction
5. Maximum velocity
6. AHU room size
7. Maximum duct length

METHOD- 2

H.P= TOTAL CFM x T.S.P/6356xηmxηb

TSP= Total static pressure

ηB = efficiency of blower

ηm = efficiency of motor

GPM Calculations for 47.25TR WATER COOLED CHILLER

Calculation for Chilled Water Piping (Closed Piping System

Table 7 GPM calculations open piping

RESULTS

DUCT SIZING BY USING DIFFERENT METHODS FOR USAGE OF AC CONDENSER MATERIALS:

1.		A-B	68	70	53.1	68
2.		B-C	58	58	45.6	56
3.		C-C1	14	12	10.4	12
4.		C-D	50	48	38	46
5.		D-D1	14	12	10.4	12
6.	Room 1	D-E	42	38	30.4	34
7.		E-E1	14	12	10.4	12
8.		E-F	32	28	22.8	26
9.		F-G	24	22	15.2	16
10.		G-G1	14	12	10.4	12
11.		G-H	14	12	19	22
12. 12		A-B	69	76	54.4	70
13.		B-C	56	54	43.1	52
14.		C-D	52	48	38.9	46
15.		D-D1	14	12	10.6	12
16.		D-E	42	40	31.1	36
17.	Room 2	E-E1	14	12	10.6	12
18.		E-F	32	32	23.3	26
19.		F-F1	14	12	10.6	12
20.		F-G	24	20	16	18
21.		G-G1	14	12	10.6	12

CONCLUSION

Estimating a conceptual HVAC design can prove to be challenging. There are many methods estimators have adopted over the years to help accurately complete a system with limited information. HVAC equipment
(optmising ac condensing materials)vis one of the most important components in the system since it tends to have the high overall cost. Making sure an estimator has quantified all of these pieces is important since the other components such as piping are impacted by these quantities.

Since the equipment affects the quantity of the piping, the equipment should be the first item that an estimator focuses on. After the equipment that will be used is established, an estimator can accurately quantify the meters of pipe needed using the methods disused in this paper. Knowing the type of building and how it will be used is very helpful to the estimate since this influences the amount of duct that will be required. Estimators with past experience as well as using the techniques and methods discussed can help provide accuracy when trying to estimate quantities for a conceptual HVAC design.

In ducting there are four methods they are:

EFM, VRM static regain method, equal T method In this static regain and equal t method are absolute method in this losses are very high and fabrication of this type of method ducts are very complex so in efm and vrm method are using presently in the market in that also efm method by using the duct sizer software is used by using this this software fluid density and temperature of air can setted according to requirement.

REFERENCES:

a. R. Z. Homod and K. S. M. Sahari, "Energy savings by smart utilization of mechanical and natural ventilation for hybrid residential building model in passive climate," Energy and Buildings, vol. 60, pp. 310–329, 2013.

b. X. Lü and M. Viljanen, "Controlling building indoor temperature and reducing heating cost through night heating electric stove," Energy and Buildings, vol. 33, no. 8, pp. 865–873, 2001.

c. J. A. Orosa, "A new modelling methodology to control HVAC systems," Expert Systems with Applications, vol. 38, no. 4, pp. 4505–4513, 2011.

d. J. L. M. Hensen, On the Thermal Interaction of Building Structure and Heating and Ventilating System [Ph.D. thesis], Eindhoven University of Technology, 1991.

e. G. Knabe and H. Le, "Building simulation by application of a HVAC system considering the thermal and moisture behaviors of the perimeter walls," in Proceedings of the International Conference on Building Performance Simulation

(IBPSA '01), vol. 1, pp. 965–972, 2001.

f. D. G. Stephenson and G. P. Mitalas, "Cooling load calculations by thermal response factor method," ASHRAE Transactions, vol. 73, no. 1, pp. 508–515, 1967.

g. T. Leephakpreeda, "Grey prediction on indoor comfort temperature for HVAC systems," Expert Systems with Applications, vol. 34, no. 4, pp. 2284–2289, 2008.

h. G. Mustafaraj, J. Chen, and G. Lowry, "Development of room temperature and relative humidity linear parametric models for an open office using BMS data," Energy and Buildings, vol. 42, no. 3, pp. 348–356, 2010.