A PROJECT REPORT

ON

"DESIGN AND DRAFTING OF HVAC SYSTEM"

Submitted by

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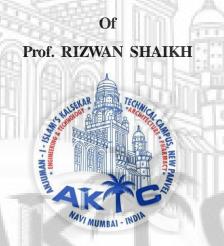
KHAN MOHAMMED FAIZ ALAM 16ME31

In partial fulfillment for the award of the Degree

Of

BACHELOR OF ENGINEERING IN

MECHANICAL ENGINEERING UNDER THE GUIDANCE



DEPARTMENT OF MECHANICAL ENGINEERING ANJUMAN-I-ISLAM

KALSEKAR TECHNICAL CAMPUS NEW PANVEL,

 $NAVI\ MUMBAI - 410206$

UNIVERSITY OF MUMBAI

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ANJUMAN-I-ISLAM KALSEKAR TECHNICAL CAMPUS NEW PANVEL (Approved by AICTE, recg. By Maharashtra Govt. DTE, Affiliated to Mumbai University)

PLOT #2&3, SECTOR 16, NEAR THANA NAKA, KHANDAGAON, NEW PANVEL, NA VI MUMBAI-410206. Tel: +91 22 27481247/48 * Website: www.aiktc.org



This is to certify that the project entitled

DESIGN AND DRAFTING OF HVAC SYSTEM'

Submitted by

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To the Kalsekar Technical Campus, New Panvel is a record of bonafide work carried out by him under our supervision and guidance, for partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in Mechanical Engineering as prescribed by University Of Mumbai, is approved.

Internal Examinar

(Prof. RIZWAN SHAIKH)

Head of Department

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(Prof. ZAKIR ANSARI)



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APPROVAL OF DISSERTATION

This is to certify that the thesis entitled

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(Internal Examiner)

(External Examiner)

Date: _____

ACKNOWLEDGEMENT

DESIGN AND DRAFTING OF HVAC SYSTEM

After the completion of this work, we would like to give our sincere thanks to all those who helped us to reach our goal. It's a great pleasure and moment of immense satisfaction for us to express my profound gratitude to our guide **Prof. RIZWAN SHAIKH** whose constant encouragement enabled us to work enthusiastically. His perpetual motivation, patience and excellent expertise in discussion during progress of the project work have benefited us to an extent, which is beyond expression.

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Chapter: 01 INTRODUCTION

SPLIT SYSTEM

A split system is an air-conditioning or heat pump system that uses refrigerant as the heat exchange fluid and has an evaporator, compressor and condenser as separate components. In most modern commercial application, the compressor and condenser are combined into a single piece of equipment called a condensing unit. Refrigerant piping, custom-designed to meet the physical requirement of each individual application, connects the system component.

A typical residential central air-conditioning system is a split system. The compressor and condenser are combined as a single condensing unit mounted outdoors. The evaporator, a finned coil is mounted in a section of ductwork downstream of a furnace blower. Two flexible refrigerant lines, one for gas and one for liquid, connect the components.

This white paper is intended as a primer on light commercial and industrial split systems. It reviews basic design and installation requirements, equipment, application differentiators, and typical application for split systems.

DUCT SYSTEM

Ducts are conduits or passages used in heating, ventilation, and air conditioning (HVAC) to deliver and remove air. The needed airflows include, for example, supply air, return air, and exhaust air. Ducts commonly also deliver ventilation air as part of the supply air. As such, air ducts are one method of ensuring acceptable indoor air quality as well as thermal comfort.

A duct system is also called ductwork. Planning (laying out), sizing, optimizing, detailing, and finding the pressure losses through a duct system is called duct design.

What is a Duct Air Conditioning system?

Ducted air conditioning is the most efficient cooling system for homes and businesses on the market today. Ducted Air Conditioners can cool every room in your home or office using just one system. Through one system, you can keep you temperature of your bedroom cool and inviting for cosy sleep; living room little balmy for perfect party; your kids room comfortable for their daily activities and much more. In general Ducted AC is the ideal cooling system for Queensland climate and big houses with more than 3 bedrooms. It allows for complete control of the temperature inside the premise. This system can also be combined with a dehumidifier to lower the amount of moisture for maximum comfort.

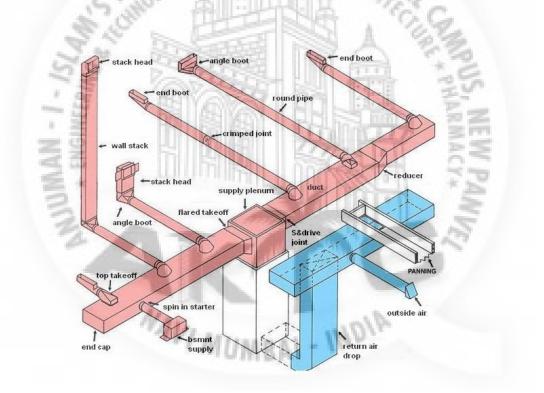


Fig. 1.1 Air Duct Design

How Does Ducted AC Work?

Ducted air conditioning works by funnelling cool air from a central unit (usually installed in your roof) through a series of ducts to every room in your home. The circulation of air is usually zoned, that allows you to control airflow, temperature and turning off any zones. This reduces the running cost and allows to have temperature of house comfortable for Queensland's climate with hot summers and cold winters.

Unless your home has a ductless system or relies solely on window units for cooling, it has ducts. You probably have a good idea how ducts carry air from the central inside unit of your AC or your heater, but those ducts represent only part of the system. To understand how air moves throughout your home, it's helpful to know about air sources and what your HVAC system does to keep you comfortable.



What is a Split Air Conditioning system?

A split air conditioner consists of an outdoor unit and an indoor unit. The outdoor unit is installed on or near the exterior wall of the room that you wish to cool. This unit houses the compressor, condenser coil and the expansion coil or capillary tubing. The sleeklooking indoor unit contains the cooling coil, a long blower and an air filter.

Why use Split AC?

In a split system (unlike a window unit), the compressor and fan for the condenser are located outside the room being cooled and therefore the major sources of noise are removed. This makes it easy to cool multiple rooms or maintain the temperature throughout a large room via the use of two indoor cooling units.

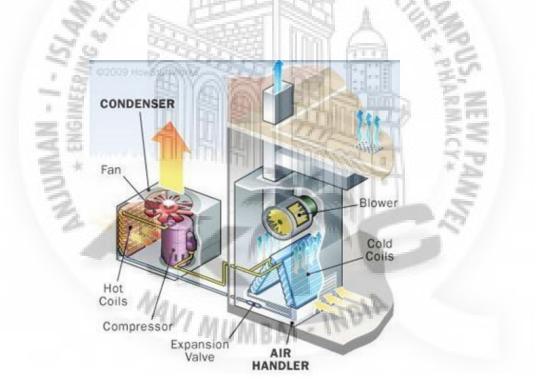


Fig.1.2 Window And Split-System AC Units

1.1 PROBLEM DEFINATION

A right sized HVAC system will provide the desired comfort and will run efficiently. Right-sizing of an HVAC system is the selection of equipment and the design of the air distribution system to meet the accurate predicted heating and cooling loads of the house. Right-sizing the HVAC system begins with an accurate understanding of the heating and cooling loads on a space.

The main purposes of a Heating, Ventilation and Air-Conditioning (HVAC) system are to help maintain good indoor air quality through adequate ventilation with filtration and provide thermal comfort. HVAC systems are among the largest energy consumers in office. The choice and design of the HVAC system can also affect many other high performance goals, including water consumption (water cooled air conditioning equipment) and acoustics.

One of the most common air conditioning problems is improper operation. If your air conditioner is on, be sure to close your home's windows and outside doors. For room air conditioners, isolate the room or a group of connected rooms as much as possible from the rest of your home.

Other common problems with existing air conditioners result from faulty installation, poor service procedures, and inadequate maintenance. Improper installation of a central air conditioner can result in leaky ducts and low airflow.

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1. : AIM/OBJECTIVE

- The aim is to keep it more comfortable inside the house than it is outside. The split air conditioners are used for single rooms or small office spaces.
- The aim is to design and control Split AC system such that to minimize the life cycle costs, including capital, operational costs, maintenance and commissioning costs etc.
- Air conditioning is the process of removing heat and moisture from the interior of an occupied space to improve the comfort of occupants
- The end goal of split air system is to reduce humidity by at least 55%, cool the internal living space and ultimately expel the warm air into the atmosphere.
- Promote the project through dedicated dissemination channels and networking in order to rise market awareness and pave the way for subsequent commercial exploitation and wide replication at the European level.
- Rise society and consumers awareness about newer and low carbon residential air conditioning technologies, thus trying to encourage changes in consumers' attitudes, inspire more environmentally responsible behaviors and stimulate European investments in innovative eco-friendly technologies.

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Chapter: 02

LITERATURE SURVEY

SR.	TITLE	AUTHER	ABSTRACT
NO.			
NO. 1	Design And Drafting of Hvac, Central Air Conditioning System For An Office Building,	K. Ratna Kumari , A. Raji Reddy , M. Vidya Sagar	The heating, ventilation, and air-conditioning (HVAC) system is arguably the most complex system installed in a building and is responsible for a substantial component of the total building energy use. A right sized HVAC system will provide the desired comfort and will run efficiently. Right-sizing of an HVAC system is the selection of equipment and the design of the air distribution system to meet the accurate predicted heating and cooling loads of the house. Right-sizing the HVAC system begins with an accurate understanding of the heating and cooling loads on a space; however, a full HVAC design involves more than just the load estimate calculation; the load calculation is the first step of the iterative HVAC design procedure. This strategy guideline discusses the information needed to design the air distribution system to deliver the proper amount of conditioned air to a space. Heating and cooling loads are dependent upon the building location, sighting, and the construction of the house, whereas the equipment selection and the air distribution design are dependent upon the loads and each other.

2	Designand	Akusu O.M.,	This project study is applicable to the field of
	Construction	Salisu, S., and	heating, ventilation and air conditioning. The
	of Split Unit Air	Akinfaloye, O.A.	design and construction of a split unit air
	Conditioner	0	conditioner was carried out to achieve a suitable
			comfort in an office environment. After a study
			of existing air-conditioners and survey for
			availability of materials, the design concept of
			the split unit air-conditioner was achieved. And
			the following standard part were estimated as;
			compressor power rating 2.5hp, condenser
			power 8KW, evaporator power 5.85KW and
		SERAN	power rating of blower as 120watts. And with a
		1. 100. 1	ATTAL AND THE ATTAL
	15	the way	working fluid of refrigerant R410A which is
	34	0° ~ 1	weak compared to refrigerant R22 but less
	2.2		hazardous to the environment. The split unit air
	20%	7.55	conditioner was tested for conformance to
	- 3	BYA	specification and it was satisfactory.
	· 22	HA ISA	
	NGN		IN IZZZUTAT SE

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Chapter: 03 METHODOLOGY

- 1. Site visit / site survey.
- 2. Measurement of area.
- 3. Design of plant layout.
- 4. Heat load calculation.
- 5. Equipment selection.
- 6. Location of equipment and clearance of ducting and piping routes.
- 7. Duct sizing and duct designing.
- 8. Diffuser selection.
- 9. Location of supply and return diffuser for architectural asthetic.
- A) Heat load calculation:-
- A) Room sensible heat load:-
 - 1) Solar heat gain through glasses.
 - 2) Solar and transmission gain trough wall and roof.
 - 3) Transmission gain except walls and roof.
 - 4) In filteration and outside air.
 - 5) Internal heat.
 - 6) By adding all the above factor we will get room sensible heat total.

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- B) Room latent heat load:-
 - 1) Outside air.
 - 2) Air
- 3) By adding all the above the roof factor we will get room latent heat total.

Chapter: 04

Analyzing work

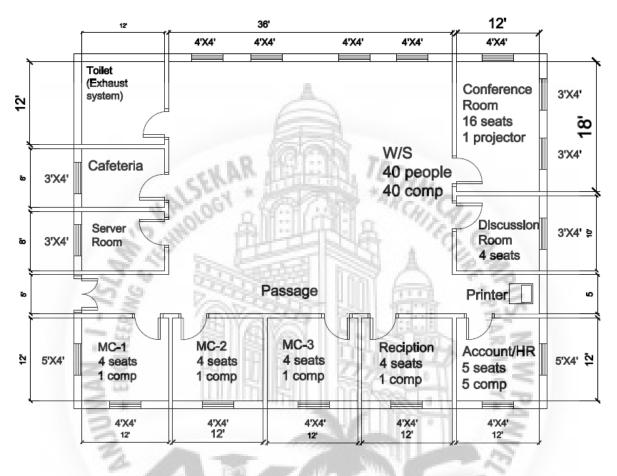


Fig.2.1 OFFICE LAYOUT

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DETAIL OF OFFICE LAYOUT

- 1. The above figure shows the layout of the office.
- 2. In this figure various room are to be air conditioned.
- 3. This figure is in direction of N-S-E-W.
- 4. MC-1 Consist of 4 seats and 1 computer. The exposed walls are in west and south direction. The glass window is attached to both the exposed walls.
- 5. MC-2 Consist of 4 seats and 1 computer. The exposed wall in south direction. The glass window is attached to the exposed wall 6. MC-3 is same as MC-2.
- 7. ACCOUNT/HR consist of 5 seats and 5 computer. The exposed wall is in south Direction. The glass window is attached to the exposed wall.
- 8.Discussion room consist of 4 seats. The exposed wall in east direction. The glass window is attached to the exposed wall.
- 9.Conference room consist of 16 seats and 1 projector. The exposed wall is in east and North direction. 2 glass window attached to exposed wall in east and 1 glass window attached to exposed wall in north.
- 10. The toilet area is not required air conditioning.
- 11. Cafeteria consist of exposed wall in west with glass window attached to it.
- 12. Server room required air conditioning 24//7 with exposed wall in west. The glass window attached wall.

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HEAT LOAD ESTIMATION

DESIGN DATA:-

1. AREA (Manager Cabin)

Area=12'*12'=144 sq.ft.

Height=10.5 feet

Lighting Load=1.25 w/sq.ft.

Computer=200 w

People=4

Weight of the wall=80 lb/sq.ft.

From design data book and psychometric chart.

SPECIFICATION	D.B (F °)	W.B (F °)	R.H(%)	GR/LB
Outside	95	83	60	153
Inside	75	62.5	50	65
Difference	20	20.5	10	88

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A)Room sensible heat load:-

- A) Room total heat load= Room sensible heat total + Room latent heat total.
- B) Load on cooling coil.
- C) Tonnage
- D) Sensible heat factor = (ERSH / ERSH+ERLH)
- E) Select ADP
- A)Dehumidified rise = (1-B.F)*(I.T-ADP)
- B) Total Dehumidified CFM= (RSHT/ 1.08*D.R)

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2.AREA (Account/HR)

Area=12'*12'=144 sq.ft.

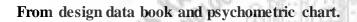
Height=10.5 feet

Lighting Load=1.25 w/sq.ft.

Computer=200 w

People=5

Weight of the wall=80 lb/sq.ft.



-1 18	REAN 7	Ern.	
ok and psychome	etric chart.	ARCHITEL	
D.B(F°)	W.B(F°)	R.H(%)	GR/LB
95	83	60	153
75	62.5	50	65
20	20.5	10	88
	ok and psychome D.B(F°) 95 75	D.B(F°)W.B(F°)95837562.5	D.B(F°) W.B(F°) R.H(%) 95 83 60 75 62.5 50

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A)Room sensible heat load:-

3.AREA (Discussion room)

Area=12'*10'=120 sq.ft.

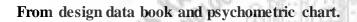
Height=10.5 feet

Lighting Load=1.25 w/sq.ft.

Computer=200 w

People=4

Weight of the wall=80 lb/sq.ft.



-1 18	REAN 7	Ern.	
ok and psychome	etric chart.	ARCHITEL	
D.B(F°)	W.B(F°)	R.H(%)	GR/LB
95	83	60	153
75	62.5	50	65
20	20.5	10	88
	ok and psychome D.B(F°) 95 75	D.B(F°)W.B(F°)95837562.5	D.B(F°) W.B(F°) R.H(%) 95 83 60 75 62.5 50

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A)Room sensible heat load:-

4.AREA (Conference room)

Area=18'*12'=216 sq.ft.

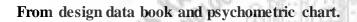
Height=10.5 feet

Lighting Load=1.25 w/sq.ft.

Computer=200 w

People=16

Weight of the wall=80 lb/sq.ft.



weight of the wan-ov		REN. D	Ecu.	
From design data boo	A SCALE	atria abart	ARCHICA,	
SPECIFICATION	D.B(F°)	W.B(F°)	R.H(%)	GR/LB
Outside	95	83	60	153
Inside	75	62.5	50	65
Difference	20	20.5	10	88

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A)Room sensible heat load:-

5.AREA (Cafeteria)

Area=12'*8'=96 sq.ft.

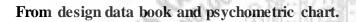
Height=10.5 feet

Lighting Load=1.25 w/sq.ft.

Computer=200 w

People=6

Weight of the wall=80 lb/sq.ft.



weight of the wall=8	SEKAR		ECHN,	
From design data boo	ok and psychome	etric chart.	RCHIEL C	
SPECIFICATION	D.B (F °)	W.B(F°)	R.H(%)	GR/LB
Outside	95	83	60	153
Inside	75	62.5	50	65
Difference	20	20.5	-10	88

NAVI MUMBAI - INDIA

A)Room sensible heat load:-

6.AREA (Server room)

Area=12'*8'=96 sq.ft.

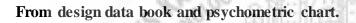
Height=10.5 feet

Lighting Load=1.25 w/sq.ft.

Computer=200 w

People=1

Weight of the wall=80 lb/sq.ft.



weight of the wall=8	u io/sq.it.	REAL R	Ecu.	
From design data has	LALSON *		ARCHICA.	
From design data boo	CHART II	11118	D H(0/)	СРДР
SPECIFICATION	D.B (F °)	W.B(F°)	R.H(%)	GR/LB
Outside	95	83	60	153
Inside	75	62.5	50	65
Difference	20	20.5	-10	88
22. *		and the second s	* <u>11-1228</u>	2

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A)Room sensible heat load:-

7.AREA (Passage)

Area=1452 sq.ft.

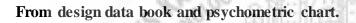
Height=10.5 feet

Lighting Load=1.25 w/sq.ft.

Computer=200 w

People=40

Weight of the wall=80 lb/sq.ft.



o io/sq.it.	REAL R	Ecu.	
ok and psychome	etric chart.	ARCHICAL	
D.B(F°)	W.B(F°)	R.H(%)	GR/LB
95	83	60	153
75	62.5	50	65
20	20.5	10	88
	ok and psychome D.B(F°) 95 75	D.B(F°)W.B(F°)95837562.5	D.B(F°) W.B(F°) R.H(%) 95 83 60 75 62.5 50

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A)Room sensible heat load:-

*HEAT BALANCE SHEET (MC-1)

Length	Width	Height (F.C)	Area	Volume					
0	0	10.5	144.00	1512.00					
Item	Area/Qty	Sun Gain/	Factor	BTU/HOUR	Conditions	DBT	WBT	% RH	GR/LB
		Temp Diff.	1000000				1.000	1.1.1.1.1.1.1.1.1	
		Rtu/hr/saft							2.
A) .ROOM SENSIBLE					Outside	95	83	60	153
	Solar gain-G		0.54	-	Room	75	62.5	50	65
<u>N</u>	0	23	0.56	0	Difference	20	20.5	10	88
<u> </u>	16	14	0.56	125	Low March		(-
SW	20	145	0.56	1624	B.F.	0.12			
NE	0	145	0.56	0	L D.F.	0.12			
SE	0	12	0.56	0	Sensible Heat Fa	dor		0.91	
SW	0	10.0	0.56	0	perior rearra			0.21	2
NW	0	138	0.56	0	199	A. Car	1		
	lar &Trans. Gain		(J)		Selected ADP	1124	-	53.8	
N	0	0	0	0		6	Call	500058-88	
E	0	0	0	0	Dehumidified rise	e	1. Val	18.656	
S	110	29	0.33	1053		A	2.20		
W	106	23.5	0.33	822	TOTAL D.CFM	Cumin	5.20	543.63	
NE	0	0	0	0		21111	1.6		12
SE	0	0	0	0	TONNAGE	1		1.3	
SW	0	0		0			-		
NW	0	0	0	0	SQFT / TR	the second second		114.7	_
Roof Exp.	0.00	37	-0.12	0	COLLINGTON	and the second second		26.0	_
	ns.Gain except V		1.1.1.1.1.1	02.4	SQFT/PERSON	Barriel .		36.0	-
All Glass	36	20	1-13	814	OFMUCOFT			3.8	-
Partition	252.00	15	0.33	1247 691	CFM/SQFT		-	3.8	-
Ceiling Floor	144.00	15	0.32	1231	CFM/TR			432.9	-
HUUI	Infiltration & Ou			1201	CENT IN		-	402.9	-
Infiltration.	anna daon a Ou	N ONCE AN			F.A CHANGES			1.1	-
Outside air	28.64	20	0.1296	74	- HI OF HITCEO		241		
	Internal H	and the second se		-	R.A CHANGES			21.6	
People	4	1	245	980			100		
Light (W)	144.00	1.25	3.41	614					
Computers (W)	1	200	3.41	682					
Equipments (KW)	0	1	3400	0	Comments:				
			de	9958	1.Outside Condit				
Fan Motor Output		Safety	5%	996	2.Weight of Wall				
ROOM SENSIBLE HE	AT TOTAL	1		10953		are considered o	f Ordinary Typ	be with 45 Deg Ve	netian Blind
(B). ROOM LATENT H	JEAT			100 C 100 C 100 C	of LIGHT Color.	Ils are considered	ac avpaced		
Out Side Air	28.64	88	0.0816	206		onsidered is 1.25			
People	4	1	205	820		ording to 3pm for 1		May	
Room Latent Head S				1026		lemperature cons			RH level
Safety	5%			51		consideration ha			
ROOM LATENT HEA	TOTAL			1077	to sun.				
ROOM TOTAL HEAT			30	12030		of the drawing pro	vided is consi	dered as NORTH.	
OUT SIDE AIR SEN /									
Sensible	28.64	20	0.9504	544	Values given		17 NO 8 C N		
Latent	28.64	88	0.5984	1 508	Values taken from	n ASHRAE handb	ook		
Return Duct	5%			548				Long Land	
Heat Gain	20-25-25	-			Calculated value:	s from given and a	ASHRAE hand	book	
24-24 C 14 M 12 C									
TONS OTHER HEAT GAINS	GRAND TOTA	L HEAT (BTU/	HR)	14,631 439					

*HEAT BALANCE SHEET (MC-2)

Langel	14C-lat	Lucker (Sol)		hele	Area:	MC-2			
Length	Width	Height (F.C.)	Area	Volume					
0	0	10.5	144.00	1512.00					
Item	Area/Qty	Sun Gain/	Factor	BTU/HOUR	Conditions	DBT	WBT	%RH	GR/LB
		Temp Diff.							
(A) .ROOM SENSIBL	FLOADS	Rtu/br/caft			Outside	95	83	60	153
(A) .ROUM SENSIBL	Solar gain-G	2241			Room	75	62.5	50	65
N	0	23	0.56	0	Difference	20	20.5	10	88
E	0	12	0.56	0	Difference	20	1.0	100 0000000000000000000000000000000000	
S	16	14	0.56	125		6			
w	0	145	0.56	0	B.F.	0.12	1		
NE	0	12	0.56	0			-		
SE	0	12	0.56	0	Sensible Heat F	actor		0.89	
SW	0	100	0.56	0	locitonoic ricari	up tor			
NW	0	138	0.56	0	- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	S.W.			
	ar & Trans. Gain	-Wall & roofs	1 mill 1	0.019	Selected ADP	110.1Ca		53	
N	0	0	0	0		11591	/		
E	0	0	0	0	Dehumidified ri	se	~	19.36	
S	110	29	0.33	1053	Contraction of the	. 10.	100		
w	0	23.5	Q.33	0	TOTAL D.CFM	1 6	a later	428.95	
NE	0	0	0	0		A	a the	L	
SE	0	0	0	0	TONNAGE		r. 90	1.1	
SW	0	0	0	0	L_TOTHINGL	1111			
NW	0	0	0	0	SQFT / TR	A CONTRACTOR	1000	133.7	
Roof Exp.	0.00	37	0.12	0	OQT 17 TR		200		-
	s.Gain except V	Valls & Roofs	ESS I	ALTIVIER V	SQFT/PERSON	A COLORADO	1	36.0	
All Glass	16	20	1.13	362	OQT INT ERCON		100 miles		-
Partition	473.00	15	0.33	2341	CFM/SQFT	THE LEP		3.0	
Ceiling	144.00	15	0.32	691	CFIM/SQF1		200	0.0	
Floor	144.00	15	0.57	1231	CFM/TR			398.3	
	Infiltration & Ou					Contraction of the	100	070.0	-
Infiltration.		It side All	1	1	F.A CHANGES			1.1	-
Outside air	28.64	20	0.1296	74	F.A CHANGES				
Outside all	Internal H	1	0.1270		R.A CHANGES		and the second se	17.0	-
People	4	1	245	980	IN.A CHANGES		100	17.0	5.8
Light (W)	144.00	1.25	3.41	614			P 29		
Computers (W)	1	200	3.41	682	11		-		
Equipments (KW)	0	1	3400	0	Comments:				
				8154	1.Outside Conc				
Fan Motor Output	5.00%	Safety	5%	815	2.Weight of Wa				
ROOM SENSIBLE HI		Joarety		8969		ss are considered	of Ordinary T	vne with 45 Dea	Venetian Blir
NO ON OLNOIDEL			Mar.		of LIGHT Color.		of of analy i	ype with 40 beg	venetian bii
(B). ROOM LATENT	HEAT		1010			valls are consider	red as exposed	4	
Out Side Air	28.64	88	0.0816	206		considered is 1.2			
People	4	1	205	820	The second s	cording to 3pm fo		of May	
Room Latent Head	Sub Total			1026		Temperature co			% RH level
Safety	5%			51		to consideration			
ROOM LATENT HEA	TTOTAL			1077	to sun.				
ROOM TOTAL HEAT				10046		of the drawing p	rovided is con	sidered as NORT	н.
OUT SIDE AIR SEN /	LAT HEAT (LO	AD ON COOLIN	G COIL)						
Sensible	28.64	20	0.9504	544	Values given				
Latent	28.64	88	0.5984	1508		om ASHRAE han	dbook		
Return Duct			-						
Heat Gain	5%			448	Calculated value	es from given an	d ASHRAF ha	ndbook	
TONS	GRAND TOT	L HEAT (BTU/		12,547				9.00 / 7 870/7907	
		L HEAT (BTU/		376					
OTHER HEAT GAINS		LIEAT (DTU		12,923					
TONS	GRAND 1014	L HEAT (BTU/	HR)	12,923					

*HEAT BALANCE SHEET (MC-3)

longth	Width	Height (F.C.)	Aron	Volume					
Length				Volume					
1997 (A. 1997) 1997 - 1997 (A. 1997)	0	10.5	144.00	1512.00	12 NO.21	1000000	1012521021	10002100	
Item	Area/Qty	Sun Gain/ Temp Diff.	Factor	BTU/HOUR	Conditions	DBT	WBT	% RH	GR/LB
(A) .ROOM SENSIBL	FLOADS	Rtu/br/eatt	3	-	Outside	95	83	60	153
	Solar gain-G	GLASS	0		Room	75	62.5	50	65
N	0	23	0.56	0	Difference	20	20.5	10	88
E	0	12	0.56	0	13				
S	16	14	0.56	125		0.10	7		
W	0	145	0.56	0	B.F.	0.12			
NE	0	12	0.56	0	- In the second second	-	1	0.89	-
SE	0	12	0.56	0	Sensible Heat Fa	actor		0.89	
SW	0	138	0.56	0	C	MAL.			
NW	r &Trans. Gain		No. Co. Co.		Selected ADP	DINE.		53	
N	0	0	0	0	Selected ADP	Chi M		00	
E	0	0	0	0	Dehumidified ris	e 7	-	19.36	
S	110	29	0.33	1053	pendimented ne	0	Ca		
W	0	23.5	0.33	0	TOTAL D.CFM	1 6	No.	428.95	
NE	0	0	0	0		A			
SE	0	0	0	0	TONNAGE	<u></u>	6.20	1.1	
SW	0	60	0	0		1111	3.14		
NW	0	0	0	0	SQFT / TR	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Sec. Co.	133.7	
Roof Exp.	0.00	37	0.12	0			100	04.0	_
	Gain except		BOIL	A WARN	SQFT/PERSON	The second second	100	36.0	-
All Glass	16	20	1.13	362	The last		77 454		
Partition	473.00	15	0.33	2341 691	CFM/SQFT	Buladad	100	3.0	
Ceiling	144.00	15	0.32	1231	0514/70		- 2 -2	398.3	2
Floor	nfiltration & O	37.35	0.37	1231	CFM/TR	-	The Party States	390.3	-
Infiltration.	nititration & O	ut side Air			F.A CHANGES		100	1.1	-
Outside air	28.64	20	0.1296	74	F.A CHANGES		-		8
outoide un	Internal H	leat			R.A CHANGES		100	17.0	
People	4 🚅	1	245	980	100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100	1.	10000		- 2
Light (W)	144.00	1.25	3.41	614			P 29		
Computers (W)	1	200	3.41	682	1.0				
Equipments (KW)	0	1	3400	0	Comments:				
				8154	1.Outside Condi				
Fan Motor Output		⁶ Safety	5%	815 8969	2.Weight of Wal				
ROOM SENSIBLE HE	AT TOTAL			8909	3. Exposed glas	s are considered	d of Ordinary Ty	pe with 45 Deq	Venetian Bl
(B). ROOM LATENT I			NA		of LIGHT Color. 4. All External w	alle are epocido	rod as ovposed		
Out Side Air	28.64	88	0.0816	206	5.Lighting load	Contraction of the second second second second			
People	4	1	205	820	6.All data is acc			May	
Room Latent Head S	Sub Total			1026	7. Indoor Room				% RH level.
Safety	5%			51	8. The space inte				
ROOM LATENT HEAT	T TOTAL	80		1077	to sun.				
ROOM TOTAL HEAT	(A + B)		202	10046	9. The Top side of	of the drawing p	provided is cons	idered as NORT	Ή.
OUT SIDE AIR SEN /			G COIL) 0.9504	544					
Sensible	28.64	20	0.9504	1508	Values given		alle e e la		
Latent Deturn Duct	20.04	00	0.3964	1306	Values taken fro	m ASHRAE har	Idbook		
Return Duct	5%			448	Calculated value	e from given or		dbook	
Heat Gain	00410707		(10)	10.545	Calculated value	p from given ar	IU ASHKAE NAN	UDOOK	
TONS	GRAND TOT	AL HEAT (BTU/	HR)	12,547 376					
OTHER HEAT GAINS									

*HEAT BALANCE SHEET (ACCOUNT/HR)

	Ĩ	Î.	Terrore and the second	1	Area:	ACCOUNT/HR			
Length	Width	Height (F.C)	Area	Volume					
0	0	10.5	144.00	1512.00	12	45		505	25
Item	Area/Qty	Sun Gain/ Temp Diff.	Factor	BTU/HOUR	Conditions	DBT	WBT	% RH	GR/LB
(A) .ROOM SENSIBL	ELOADS	BIIIZALIZZA	50 - C	(2) 	Outside	95	83	60	153
	Solar gain-G	LASS			Room	75	62.5	50	65
Ν	0	23	0.56	0	Difference	20	20.5	10	88
E	20	13	0.56	146					
S	16	14	0.56	125					
W	0	145	0.56	0	B.F.	0.12	(s) (s)		
NE	0	12	0.56	0					
SE	0	12	0.56	0	Sensible Heat F	actor		0.91	
SW	0	100	0.56	0		HAL.			
NW	0	138	0.56	0	F */	S Wim			
	ar & Trans. Gain		100	6.02508	Selected ADP	"CE"CA		53.8	
N	0	0	0	0	(Friday and	11.24	/	40.050	_
E	106	25.5	0.33	892	Dehumidified ris	se	Ph	18.656	
S	110	29	0.33	1053	I see a second		and the	606.65	-1
W	0	23.5	0.33	0	TOTAL D.CFM	- A - 6	a tala	686.65	
NE	0	0	0	0	Tourse		10 Tan	1.6	
SE	0	0	0	0	TONNAGE	long the	1	1.0	
SW	0	0	0	0	for an interest		100	91.8	-
NW	144.00	37	0.12	639	SQFT / TR		and the second s	91.0	_
Roof Exp.			0.14	039		the second second	and the second	28.8	_
NY AVARANY AND AND AND A	s.Gain except V 36	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		014	SQFT/PERSON	Contraction of the local division of the loc	20 22	20.0	-
All Glass		20	1.13	814	1. 17-1.34	and the second second	-	1.0	_
Partition	473.00	15	0.33	2341	CFM/SQFT	Balandad	100	4.8	-
Ceiling	144.00	15	0.52	0 1231	00000			437.9	_
Floor	C and a second sec	2470V	0.57	the second second second	CFM/TR	The second secon	The Party of	437.9	_
	nfiltration & Ou	ut side Air		_	EA OUANOEO	Contraction of the	1 1	1.3	-
Infiltration. Outside air	33.64	20	0.1296	87	F.A CHANGES		100	1.5	-
Outside all	Internal		0.1200	07	R.A CHANGES		-	27.2	-
People	5	1	245	1225	R.A CHANGES		1000	27.2	
Light (W)	144.00	1.25	3.41	614			A 12		
Computers (W)	5	200	3.41	3410			~		
Equipments (KW)	0	1	3400	0	Comments:	1 10			
			1 0.00	12577	1.Outside Cond	ition MUMBAL			
Fan Motor Output	5.00%	Safety	5%	1258	2.Weight of Wa				
ROOM SENSIBLE HE	EAT TOTAL			13835		s are considered	d of Ordinary Ty	pe with 45 Dea	Venetian Blin
			de.		of LIGHT Color.		a or or an ary ri	ipe initi to beq	renetien Din
(B). ROOM LATENT	HEAT		TAX.		4. All External w	alls are conside	red as exposed		
Out Side Air	33.64	88	0.0816	242	5. Lighting load	considerd is 1.2	5W/Sqft		
People	5	1	205	1025	6.Alll data is acc	cording to 3pm f	or the month o	f May	
Room Latent Head S				1267	7. Indoor Room	Temperature co	onsidered : 25 D	Deg C and 50-60	% RH level.
Safety	5%			63	8. The space int	o consideration	has been cons	idered as roof e	xposed direct
ROOM LATENT HEA				1330	to sun.				
ROOM TOTAL HEAT	(A + B)	18	12	15165	9. The Top side	of the drawing p	provided is cons	sidered as NORT	H.
OUT SIDE AIR SEN /				600					
Sensible	33.64	20	0.9504	639	Values given				
Latent	33.64	88	0.5984	1771	Values taken fro	om ASHRAE har	ldbook		
Return Duct	5%			692					
Heat Gain	10,000	C 311			Calculated valu	<mark>e</mark> s from given ar	nd ASHRAE har	ldbook	
TONS	GRAND TOT	AL HEAT (BTU/	HR)	18,267					
OTHER HEAT GAINS	S @ 3%			548					
TONS	GRAND TOT	AL HEAT (BTU/	(HR)	18,816					
TONS	GRAND TOT	AL HEAT (BTU/	(HR)	18,816					

*HEAT BALANCE SHEET (DISCUSSION ROOM)

HEAT LOAD CALCULATIONS

ength	Width	Height (F.C)	Area	Volume
0	0	10.5	120.00	1260.00
Item	Area/Qty	Sun Gain/ Temp Diff.	Factor	BTU/HOUR
	1	Btu/br/saft		
) .ROOM SENSIBLE L		1 400		
N	Solar gain-G	LASS 23	0.56	0
E	12	13	0.56	87
S	0	14	0.56	0
w	0	145	0.56	0
NE	0	12	0.56	0
SE	0	12	0,56	0
SW	0	100	0.56	0
NW	0	138	0.56	0
Sola	ar & Trans. Gain-	Wall & roofs	Sec. Co. V.	17 10 20
Ν	0	0	0	0
E	93	25.5	0.33	783
S	0	29	0.33	0
W	0	23.5	0.33	0
NE	0	0	0	0
SE	0	0	0	0
SW	0	0	0	0
NW	0	0	0	0
of Exp.	120.00	37	0.12	533
	s.Gain except V		- Contraction	A COLORADO
Glass	12	20	1.13	271
rtition	473.00	15	0.33	2341
ling	0.00	15	0.32	0
or	120.00	15	0.57	1026
	Infiltration & Ou	it side Air		
iltration.	07.0	00	0.1007	74
utside air	27.2	20	0.1296	71
	Internal H		0.45	000
ople	4	1	245	980 512
ght (W)	120.00		3.41	0
mputers (W)	0	200	3.41 3400	0
uipments (KW)	0		5400	6603
n Motor Output	5.00%	6 Safety	5%	660
DOM SENSIBLE HEAT		Joarety	0.0	7264
JOIN GENOIDLE HEA	TOTAL		14.	
). ROOM LATENT HE	AT		WAL.	-
ut Side Air	27.2	88	0.0816	195
eople	4	1	205	820
om Latent Head Sub			A.	1015
afety	5%			51
OM LATENT HEAT T	OTAL			1066
OM TOTAL HEAT (A	+ B)			8330
				- 2
JT SIDE AIR SEN / LA				F47
nsible	27.2	20	0.9504	517
tent	27.2	88	0.5984	1432
turn Duct	5%			363
eat Gain	(Fact		-	000
NS		HEAT (BTU/H	IR)	10,642
HER HEAT GAINS (a		*** ***		319
NS	ICDAND TOTA	HEAT (BTU/H	R)	10,962

27-02-2020 DISCUSSION ROOM

Conditions	DBT	WBT	% RH	GR/LB
Outside	95	83	60	153
Room	75	62.5	50	65
Difference	20	20.5	10	88
				1
B.F.	0.12			
Sensible Heat Facto	pr		0.87	
Selected ADP	W/C		53	
Dehumidified rise	14	-	19.36	
TOTAL D.CFM	14	2 La	347.40	
TONNAGE	5	1. 20	0.9	
SQFT / TR		125	131.4	
SQFT/PERSON		2	30.0	
CFM/SQFT	111	20	2.9	
CFM/TR	0	24	380.3	
F.A CHANGES	10	THE PL	1.3	_
R.A CHANGES		1	16.5	

omments:

Outside Conditiolion MUMBAI

Weight of Wall = 80lb/sqft

Exposed glass are considered of Ordinary Type with 45 Deg Venetian Blinds

LIGHT Color.

All External walls are considered as exposed.

Lighting load considerd is 1.25W/Sqft

All data is according to 3pm for the month of May

Indoor Room Temperature considered : 25 Deg C and 50-60% RH level.

The space into consideration has been considered as roof exposed directly sun.

The Top side of the drawing provided is considered as NORTH.

lues given

es taken from ASHRAE handbook

culated values from given and ASHRAE handbook

*HEAT BALANCE SHEET (CONFERENCE ROOM)

HEAT LOAD CALCULATIONS

Date: Area:

Length	Width	Height (F.C)	Area	Volume
0	0	10.5	216.00	2268.00
Item	Area/Qty	Sun Gain/	Factor	BTU/HOUR
		Temp Diff.		
		Btu/br/caft		
A) .ROOM SENSIBL				-9-
	Solar gain-G		0.52	110
N	16 24	13	0.56	116
E		13	0.56	
<u>S</u>	0	14	0.56	0
W	0	145	0.56	0
NE	0	12	0.56	0
SE	0	100	0.56	0
SW	0	138	0.56	0
NW			0.30	0
and and	r & Trans. Gain- 110	14.5	0.33	526
E N	165	25.5	0.33	1388
S	0	29	0.33	0
S	0	23.5	0.33	0
NE	0	0	0	0
Sector States	0	0	ŏ	0
SE	0	0	0	0
SW	0	0	0	0
NW	144.00	37	0.12	639
Roof Exp.	Gain except V	120	14.14	009
	24	and the second se	1.13	E42
All Glass	336.00	20	0.33	542 1663
Partition	0.00	15	0.33	0-
Ceiling	216.00	15	0.52	1847
Floor			0.91	1047
	nfiltration & Ou	t side Air		
Infiltration.	92.96	20	0.1296	241
Outside air	and the second se		0.1290	241
Decembra	Internal H	1	245	3920
People	216.00	1.25	3.41	921
Light (W)	0	200	3.41	0
Computers (W)	1	1	3400	3400
Equipments (KW)	1		5400	15379
Con Motor Output	5.00%	Safety	5%	1538
Fan Motor Output ROOM SENSIBLE HE		Salety	0.0	16917
CON SENSIBLE HE			1.	
(B), ROOM LATENT	HEAT		TAL.	12
Out Side Air	92.96	88	0.0816	668
People	16	1	205	3280
Room Latent Head S	Sub Total			3948
Safety	5%			197
ROOM LATENT HEA	TTOTAL			4145
ROOM TOTAL HEAT	1198.m			21062
	998 (m. 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 174 - 1			
OUT SIDE AIR SEN /				
Sensible	92.96	20	0.9504	1767
Latent	92.96	88	0.5984	4895
Return Duct	50			0.44
Heat Gain	5%			846
TONS	GRAND TOTA	L HEAT (BTU/	HR)	28,570
OTHER HEAT GAINS	310 M/2 62/10/2		1	857

27-02-2020

CONFERENCE ROOM

Conditions	DBT	WBT	% RH	GR/LB
Outside	95	83	60	153
Room	75	62.5	50	65
Difference	20	20.5	10	88
B.F.	0.12]		
Sensible Heat Fact	or		0.80	-0
Selected ADP	Mica.		51	
Dehumidified rise	1100	0	21.12	
TOTAL D.CFM	<u>``</u>	La_	741.68	
TONNAGE	2 1	1.70	2.5	
SQFT / TR		25	88.1	
SQFT/PERSON		2.	13.5	
CFM/SQFT	auto	30 111	3.4	_
CFM/TR	0	23	302.4	
F.A CHANGES	10	12	2.5	
R.A CHANGES		-	19.6	-

Comments:

1. Outside Condition MUMBAI

2.Weight of Wall =80lb/sqft

3. Exposed glass are considered of Ordinary Type with 45 Deg Venetian Blinc of LIGHT Color.

100

4. All External walls are considered as exposed.

5. Lighting load considerd is 1.25W/Sqft

6.AllI data is according to 3pm for the month of May

7. Indoor Room Temperature considered : 25 Deg C and 50-60% RH level.

8. The space into consideration has been considered as roof exposed directly to sun.

9. The Top side of the drawing provided is considered as NORTH.

Values given

Values taken fro<mark>m</mark> ASHRAE handbook

Calculated values from given and ASHRAE handbook

*HEAT BALANCE SHEET (CAFETERIA)

Length	Width	Height (F.C.)	Area	Volumo	Area:	CAFETERIA			
0	0	10.5	96.00	Volume 1008.00					
			1		O table	DDT	WDT	0% D11	00/10
Item	Area/Qty	Sun Gain/ Temp Diff.	Factor	BTU/HOUR	Conditions	DBT	WBT	% RH	GR/LB
		Rtu/br/caft		0					1.50
(A) .ROOM SENSIBL		a warna			Outside	95	83	60	153
72.25	Solar gain-G		0.54	0	Room	75	62.5	50	65
<u>N</u>	0	23	0.56	0	Difference	20	20.5	10	88
<u> </u>	0	13	0.56	0		<u>, </u>	2	- <u></u>	57- 57-
S	12	145	0.56	974	D D C	0.12	ř –		
W NE	0	143	0.56	0	B.F.	0.12	1		
SE	0	12	0.56	0	Sensible Heat Fa	lotor		0.84	
SW	0	100	0.56	Ő	Sensible near Fa	actor		0.04	3
NW	0	138	0.56	0		MAL.			
	r &Trans. Gain	and the second se	Sec. Call		Selected ADP	D. Com.		51.8	
N	0	0	0	0	OCICCICCI ADI	W. A.			
E	0	25.5	0.33	0	Dehumidified ris	e		20.416	
S	0	29	0.33	0	Dendrindined Ho		C		
Ŵ	72	23.5	0.33	558	TOTAL D.CFM	1 2	St.	377.62	
NE	0	0	0	0		1 7	0.126	1	
SE	0	Ø	0	0	TONNAGE		6 60	1.1	
SW	0	0	0	0		1000	1. 10		
NW	0	0	0	0	SOFT / TR	and the second	10 000	86.9	
Roof Exp.	0.00	37	0.12	0	100111111	1.1.1.1	100		
	s.Gain except \	Walls & Roofs.	- E-C 1	A DUST AND	SQFT/PERSON	1.0 C 1 C 1	100	16.0	
All Glass	12	20	1.13	271		5.0	70 25		
Partition	473.00	15	0.33	2341	CFM/SQFT	TELT?	100 110	3.9	
Ceiling	96.00	15	0.32	461		the second second	100 100		_
Floor	96.00	15	0.57	821	CFM/TR	20101	~~~	341.9	
A DESTRUCTION AND A D	nfiltration & O	ut side Air			OT NY III		ing ingo		
Infiltration.	intration a of				F.A CHANGES	CC all	1. 1.	2.1	
Outside air	35.76	20	0.1296	93	TH CONTRACTORS		-		
	Internal F	leat			R.A CHANGES		100	22.5	
People	6	1	245	1470	1	All and and			S2
Light (W)	96.00	1.25	3.41	409			B 259		
Computers (W)	1	50	3.41	171			~		
Equipments (KW)	0	1	3400	0	Comments:				
				7569	1.Outside Condi	tion MUMBAI			
Fan Motor Output	5.00%	Safety	5%	757	2.Weight of Wall	=80lb/sqft			
ROOM SENSIBLE HE	EAT TOTAL			8326	3. Exposed glass	s are considered	of Ordinary Ty	pe with 45 Deq	Venetian B
			100	9	of LIGHT Color.				
(B). ROOM LATENT			NAL.		4. All External wa	alls are consider	ed as exposed	I.	
Out Side Air	35.76	88	0.0816	257	5. Lighting load				
People	6	1	205	1230	6.Alll data is acc	ording to 3pm fo	or the month o	of May	
Room Latent Head S				1487	7. Indoor Room			2. ^ . 선생님께서 알려야 한 신상 소리는 것 것 같아요.	
Safety	5%			74	8. The space into	o consideration l	has been cons	idered as roof e	xposed dire
ROOM LATENT HEA				1561	to sun.				
ROOM TOTAL HEAT	(A + B)	1	1	9887	9. The Top side o	of the drawing p	rovided is cons	sidered as NORT	Ή.
	1			0 0					
OUT SIDE AIR SEN /				600					
Sensible	35.76	20	0.9504	680	Values given	101151-51			
Latent	35.76	88	0.5984	1883	Values taken fro	m ASHRAE han	dbook		
Return Duct	5%			416					
Heat Gain	1.1.200.02			-0	Calculated value	s from given an	d ASHRAE har	ndbook	
TONS	GRAND TOT	AL HEAT (BTU/	HR)	12,866					
OTHER HEAT GAINS	S@ 3%	10		386					
TONS		AL HEAT (BTU/	HD)	13,252					

*HEAT BALANCE SHEET (SERVER ROOM)

Length	Width	Height (F.C)	Area	Volume	Area:	SERVER ROOM	VI		
0	0	10.5	96.00	1008.00					
Item	Area/Qty	Sun Gain/	Factor	BTU/HOUR	Conditions	DBT	WBT	% RH	GR/LB
item	Alea/Qty	Temp Diff.	Factor	BIO/HOOK	Conditions	DBT	WDI	20 KU	GR/LD
A) .ROOM SENSIBL	FLOADS	Rtu/hr/caft	201		Outside	95	83	60	153
A) INCOMOLINOIDE	Solar gain-G	LASS			Room	75	62.5	50	65
N	0	23	0.56	0	Difference	20	20.5	10	88
E	0	13	0.56	0					
S	0	14	0.56	0	100	0.10	-		
W	12	145	0.56	974 0	B.F.	0.12			
NE	0	12	0.56	0	Sensible Heat Fa	and an	1	0.98	
SE SW	0	100	0.56	0	Sensible Heat Fa	ajctor	11	0.90	
NW	0	138	0.56	0	10 A	TNI_			
	ar &Trans. Gain	-Wall & roofs	- mail	6000	Selected ADP	6.4C+		54.6	
N	0	0	0	0		11591		01036805	
E	0	25.5	0.33	0	Dehumidified ris	e	0	17.952	1
S	0	29	0.33	0	All and a second	Va	10	774.00	
W	72	23.5	0.33	558	TOTAL D.CFM	4 4	a la far	771.09	
NE	0	-	0	0	TONNAGE	\sim	1 50	1.4	
SE SW	0	1 0	0	0	LIUNNAGE	1111	1. 10	1.4	<u> </u>
NW	0	0	0	0	SQFT / TR	1.11.12	100.00	66.7	
Roof Exp.	0.00	37	0.12	0	SQLTZIN		20.0		_
	s.Gain except V	Valls & Roofs.	ESS II.	ALW KARN	SQFT/PERSON		The second	96.0	
II Glass	12	20	1.13	271	THE REAL PROPERTY		100 100		
Partition	473.00	15	0.33	- 2341	CFM/SQFT	Section 11	1000	8.0	
Ceiling	96.00	15	0.32	461	61724	- B	And and the second		
loor	96.00	15	0.57	821	CFM/TR		-	535.9	_
1253 Co. 1 (13)	Infiltration & Ou	ut side Air		_			-	0.6	_
nfiltration.	10.76	20	0.1296	28	F.A CHANGES		100	0.0	_
Outside air	Internal H		0.1250	20	R.A CHANGES		-	45.9	-
People	1	1	245	245	IN.A CHANGES		100	10.5	
_ight (W)	96.00	1.25	3.41	409		And and the owner of	P 234		
Computers (W)	1	200	3.41	682	In the second		100		
quipments (KW)	1	2	3400	6800	Comments:				
a Alabert Ander the				13591	1.Outside Condi				
an Motor Output		Safety	5%	1359 14950	2.Weight of Wal				
ROOM SENSIBLE HI	EAT TOTAL		He .	14950	 Exposed glas of LIGHT Color. 	s are considered	d of Ordinary T	vpe with 45 Deq	Venetian E
B). ROOM LATENT	HEAT	80	10110		4. All External w	alls are conside	red as exposed	i.	
Dut Side Air	10.76	88	0.0816	77	5. Lighting load	considerd is 1.2	25W/Saft		
People	1	1	205	205	6.All data is acc				
Room Latent Head				282				Deg C and 50-60	
Safety	5%			14 296	8. The space int	o consideration	has been cons	sidered as roof e	xposed dir
ROOM LATENT HEA				15246	to sun.	af the drawing r		aidered as NODT	-11
CONVITOTAL HEAT		1	2	10240	9. The top side (or the drawing L	orovided is con	sidered as NORT	п.
OUT SIDE AIR SEN /	LAT HEAT (LO	AD ON COOLI	G COIL)	2					
Sensible	10.76	20	0.9504	205	Values given				
atent	10.76	88	0.5984	567	Values taken fro	m ASHRAE har	ndbook		
Return Duct	5%			748					
leat Gain				740	Calculated value	s from given ar	nd ASHRAE hai	ndbook	
ONS	A CONTRACTOR OF THE OWNER OF THE OWNER	AL HEAT (BTU/	(HR)	16,765					
OTHER HEAT GAINS				503					
ONS	GRAND TOT	L HEAT (BTU/	(HR)	17,268					

*HEAT BALANCE SHEET (PASSAGE)

HEAT LOAD CALCULATIONS

Length	Width	Height (F.C)	Area	Volume
0	0	10.5	1452.00	15246.00
Item	Area/Qty	Sun Gain/ Temp Diff.	Factor	BTU/HOUR
(A) .ROOM SENSIBLE	ELOADS	Rtu/hr/caft	201	
	Solar gain-G	LASS		
N	64	13	0.56	466
E	0	13	0.56	0
S	24	14	0.56	188
W	0	145	0.56	0
NE	0	12	0.56	0
SE	0	12	0.56	0
SW	0	100	0.56	0
NW	0	138	0.56	0
	&Trans. Gain-			1.000
<u>N</u>	314	14.5	0.33	1502
<u> </u>	102	25.5	0.33	976
S	0	23.5	0.33	976
W	0	45.5	0.55	0
NE	0	0	0	0
SE	0	0	0	0
SW	0	0	0	0
NW NW	1452.00	37	0.12	6447
Roof Exp.	.Gain except W		1 194.14	0447
All Glass	88		1.13	1989
	1400.00	20	0.33	6930
Partition	0.00	15	0.33	0-
Ceiling	1452.00	15	0.57	12415
Floor	California and California		0.57	12415
N 0259928 - 1985	nfiltration & Ou	it side Air		
Infiltration.	287.12	20	0.1296	744
Outside air	and the second se		0.1290	744
Decele	Internal H	1	245	9800
People	1452.00	1.25	3.41	6189
Light (W) Computers (W)	40	200	3.41	27280
Equipments (KW)	1	1	3400	3400
Equipments (KW)		-		78326
Fan Motor Output	5.00%	Safety	5%	7833
ROOM SENSIBLE HE	ΑΤ ΤΟΤΑΙ	Joanety		86159
NOON SENSIBLE THE			11.	
(B). ROOM LATENT H		1	A day	
Out Side Air	287.12	88	0.0816	2062
People	40	1	205	8200
Room Latent Head S		-		10262
Safety	5%			513
ROOM LATENT HEAT				10775
ROOM TOTAL HEAT ((A + B)	1	2	96934
OUT SIDE AIR SEN / I	AT HEAT (LO	AD ON COOLII	G COIL)	
Sensible	287.12	20	0.9504	5458
Latent	287.12	88	0.5984	15120
	504			4000
Return Duct		1	1	4308
	5%			
Heat Gain		L HEAT (BTU)	(HR)	121 819
Return Duct Heat Gain TONS OTHER HEAT GAINS	GRAND TOTA	L HEAT (BTU/	HR)	121,819

27-02-2020 PASSAGE

Date: Area:

DBT WBT GR/LB Conditions %RH 95 83 60 153 Outside 75 62.5 65 50 Room 20 20.5 10 88 Difference 0.12 B.F 0.89 Sensible Heat Factor 51.2 Selected ADP 20.944 Dehumidified rise 3,809.05 TOTAL D.CFM 10.5 TONNAGE 138.9 SQFT / TR 36.3 SQFT/PERSON 2.6 CFM/SQFT 364.3 CFM/TR 1.1 F.A CHANGES R.A CHANGES 15.0

Comments:

1. Outside Condition MUMBAI

2.Weight of Wall =80lb/sqft

3. Exposed glass are considered of Ordinary Type with 45 Deg Venetian Blinc of LIGHT Color.

4. All External walls are considered as exposed.

5. Lighting load considerd is 1.25W/Sqft

6.All data is according to 3pm for the month of May

7. Indoor Room Temperature considered : 25 Deg C and 50-60% RH level.

8. The space into consideration has been considered as roof exposed directly to sun.

9. The Top side of the drawing provided is considered as NORTH.

Values given

alues taken from ASHRAE handbook

Calculated values from given and ASHRAE handbook

CALCULATIONS

Manager cabin.

A] Room sensible heat load:-

1) Solar heat gain through glass:-

*Solar heat gain through exposed glass in south.

 $Q=U \times A \times \Delta T$

Q=0.56×20×14

Q=125 Btu/hr

*Solar heat gain through exposed glass in west.

 $Q=U \times A \times \Delta T$

Q=0.56×20×145

Q=1624 Btu/hr

1) Solar heat gain through walls and roof:-

*Solar heat gain by exposed wall in south.

 $Q=U \times A \times \Delta T$

Q=0.33×110×29

Q=1053 Btu/hr

*Solar heat gain through exposed wall in west.

NAVI

INDIA

 $Q=U \times A \times \Delta T$

Q=0.33×106×23.5

Q=822 Btu/hr

1) Transmission gain except walls and roof:-

*Transmission gain through all glasses.

 $Q=U \times A \times \Delta T$ ir.aiktclibrary.org Q=1.13×36×20

Q=813 Btu/hr

*Transmission gain through partition.

 $Q=U \times A \times \Delta T$

Q=0.33×252×15

Q=1247 Btu/hr

*Transmission gain through ceiling.

 $Q=U \times A \times \Delta T$

Q=0.32×144×15

Q=691 Btu/hr

*Transmission gain through floor.

 $Q=U \times A \times \Delta T$

Q=0.57×144×15

Q=1231 Btu/hr

=>Infilteration and outside air:-

*Infilteration there is no filteration. NAVI MUMI

*Outside air.

 $Q=U \times A \times \Delta T$

Q=0.1296×28.64×20

Q=74 Btu/hr

=>Internal heat:-

*Heat gain by people.

Q=Btu/hr 1 person × number of people occupied

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Q=245×4

Q=980 Btu/hr

*Heat gain by lighting.

Q=Dissipation in watt × total area × 3.41

Q=1.25×144×3.41

Q=613 Btu/hr

*Heat gain by computer.

Q=Dissipation in watt × 3.41

Q=200×3.41

Q=628 Btu/hr

=>Sub total of RSHL= 9985

AC Fan motor + safety of factor =10%= 998.5

Room sensible heat total = 10953

B] Room latent heat load:-

* Outside air.

 $Q=U \times A \times \Delta T$

Q=0.0816×28.64×88

Q=206 Btu/hr

*Heat gain by people.

Q=Btu/hr 1 person × number of people

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Q=205×4

Q=820 Btu/hr

=>Sub total of RLHL= 1026

Duct leak loss = 5% = 51

Room latent heat total = 1077 Btu/ hr

Room latent heat load [A+B] = 12030 Btu/hr

*Outside air sensible/latent heat (load on cooling coil)

Sensible heat load.

 $Q=U \times A \times \Delta T$

Q=0.9504×28.64×20

Q=544 Btu/hr

Latent heat load.

 $Q=U \times A \times \Delta T$

Q=0.5984×28.64×88

Q=1508 Btu/hr

Return duct= 5% = 518

Tons [grand total heat (Btu/hr)] = 14631

Other heat gain @=3%=439

Tons [grand total heat Btu/hr)] = 15069

Tonnage = (15069/12000) = 1.3 T.R

Selected ADP = 53.8

Dehumidified rise = (1-0.12)×(75-53.8) = 18.65

Sensible heat factor =ERSH/(ERSH+ERLH) = 0.91

- INDIA

Total Dehumidified CFM = RSHT/(1.08×18.65) = 544

Chapter: 05 OUTCOME

Split and multi type split air conditioning system offer superior performance, energy efficiency, and comfort in stylish solution conforming to all interior spaces and lifestyles. An extensive product line up utilizes split technology for lower costs and environmental impact.



Chapter: 06 RESULT

- 1. Total tonnage required for Manager Cabin-1 is 1.3 tons of refrigeration. Total dehumidified Cubic Air Flow per minute is 544.
- 2. Total tonnage required for Manager Cabin-2 is 1.1 tons of refrigeration. Dehumidified Cubic Air Flow per minute is 429.
- 3. Total tonnage required for ACCOUNT/HR is 1.6 tons of refrigeration. Total dehumidified Cubic Air Flow per minute is 686.
- 4. Total tonnage required for Discussion Room is 0.91 tons of refrigeration. Total dehumidified Cubic Air Flow per minute is 347.
- 5. Total tonnage required for Conference Room is 2.5 tons of refrigeration. Total dehumidified Cubic Air Flow per minute is 742.
- 6. Total tonnage required for Cafeteria is 1.1 tons of refrigeration. Total dehumidified Cubic Air Flow per minute is 377.
- 7. Total tonnage required for Server Room is 0.97 tons of refrigeration. Total dehumidified Cubic Air Flow per minute is 771.

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8. Total tonnage required for Passage is 10.5 tons of refrigeration.

Total dehumidified Cubic Air Flow per minute is 3809.05.

Chapter: 07 CONCLUSION

- The rate of change in our industry will be exponential. Some changes will be caused by improvements in technology whereas others will be the result of influences outside our immediate control. As engineers, we have an obligation to be proactive in encouraging changes that are of benefit to the society we serve. This in turn will have direct benefit to our industry and to each of us individually. You can be part of that positive change by sharing your knowledge with other engineers through publications, serving with standard writing organizations and participating in technical societies. We are a "peopleoriented" profession. Our designs have a direct impact on the people who occupy our buildings. We will continue to discover ways to assure their comfort and health, while reducing our impact on the environment and natural resources. Changes will occur and for the better. Our vision for our industry can be fulfilled as we take action through our contributions to the technology of HVAC.
- Air condition system makes our life very comfortable.
- We can protect Hot and Cold weather by Air Conditioning System.
- Refrigeration and Air Conditioning has become a necessity in every sphere of human utility and industrial set-up.
- There is a great difference in the theoretical knowledge and actual execution of any work. The theoretical knowledge is not sufficient for a worker. The execution of this knowledge provides self confidence and opportunity for success in future. In this way our project to say that without this type of activity in a technical institution a student may be graduated by not educated. A technical may launch an in industry in future if he not unemployed.

Chapter: 08 FUTURE SCOPE

The split systems that are out today will undoubtedly be improved as the popularity of this system continues to increase and competition exists between manufacturers to produce the best product. In the meantime, it is best to study the operating principles of what's already out there so that the performance of these installed systems can be optimized through proper design, installation and commissioning.

The scope of HVAC industry is promising and has a lot for the future as the office construction industry is increasingly showing a shift towards intelligent office infrastructure. The rapid emergence of such infrastructure suggests that in the near future smart buildings will outnumber other kinds of buildings.

Being in the Heating, Ventilation and Air Conditioning (HVAC) industry these days is a good place to be. With growth predicted as high as 5.7% by 2018, it's a potential \$120 billion industry. The global economy is on the up too, which makes for the first major growth factor. New markets are opening themselves up to air conditioning or heating systems. The HVAC industry is growing fast owing to the current technological developments in controlling climate along with government's stringent rules and regulations to make HVAC products and equipment more environmental friendly and energy efficient.

The HVAC scope of work document ensures that all of your project requirements are defined well before would-be contractors submit their proposal. For example, with stringent scope of work documents, you will only get contractors capable of the work — and that too within your stated budget and timeline — contacting you. However, for contractors, aligning with stringent HVAC requirements isn't a trivial task.

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