Controlling and Calibration of Psychrometric Room

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Abstract - The project reports on the performance of Air Conditioners at difsferent test standards. The future design of air conditioners is being driven by (a) improved energy efficiency standards and (b) the need to eliminate ozone-depleting working fluids. Various agencies of national and international continue to impose more stringent requirements for energy efficiency. In addition, consumer Interest to select unit with lower operating costs further drives the need for improved performance. The main objective of this project is to know the standards which will maintain the standard conditions in psychrometric room (AC test room), which have been constructed to test the air conditioners and to establish different test procedures. The test that should be performed in Air conditioner test room are cooling capacity test. The main objective of the Fabricators & Assemblers are to produce the systems according to requirements of costumers which can give more Output Like cooling effect, low power consumption, high ERR to with stand competition in the market. In every country, the Fabricators follow some standards according to the climatic conditions to test the appliances.

Keywords: Psychrometric room, COP cooling test, power consumption test, effect on climatic conditions, CFM.

I. INTRODUCTION

In our country lies in the hot zone therefore the comfort air conditioning has always been felt to be a necessity for mankind. To achieve Human comfort, heat is extracted from the comfort region and transferred to the environment, which is at a higher temperature. This is done with the help of refrigeration. Though there are many methods to achieve cooling, one process that is mostly applied in refrigeration equipment and its application is vapor compression cycle is in AC units, the more commonly used one is room air conditioners, and then comes the systems which are used for higher tonnages . The invention of Air Conditioning as one of Refrigeration application by WH carrier in developed countries in earlier 19th century, there has been a drastic change in the methods and process used in manufacturing air-conditioning equipment but there is no change in the principle i.e. vapour compression system used in the cycle.

Air conditioners are to be tested by the Psychometric method in the absence of balanced room calorimeter in the country. The test setup consists of two rooms known as cold room (room side) and hot room (outside). The room air conditioner under test is mounted in the opening of the wall common to both cold and hot rooms. The particulars of room sizes, construction, testing equipment, instruments are follows.

The equipment's associated with the air conditioner test room as follows:

- Panel boards
- Split Ac Indoor Unit Installation
- Split Ac outdoor Unit Installation
- Packaged Air Conditioners
- Humidifiers
- Code Tester
- Temperature measuring instrument
- Heaters
- Sampling device

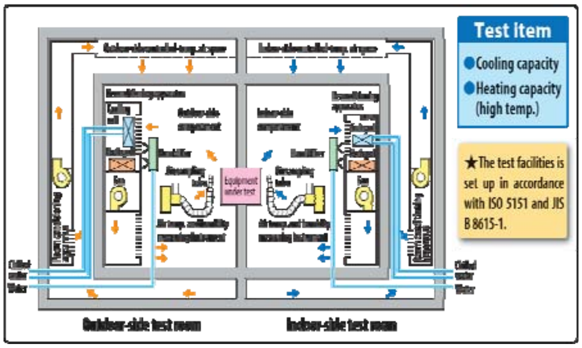


Fig.1: Psychometric laboratory view

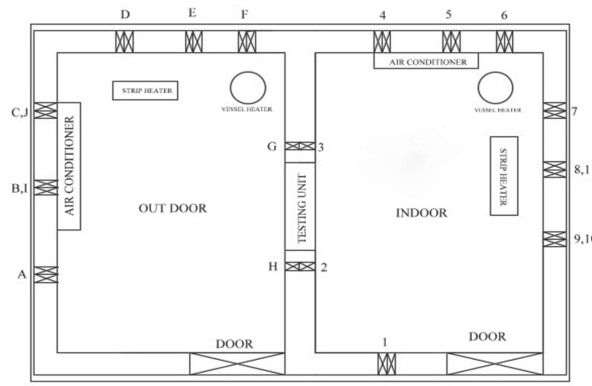


Fig.2: 2-D VIEW OF PSYCHROMETRIC ROOM 1

- DBT- DRY BULB TEMPERATURE
- WBT-WET BULB TEMPERATURE
- DC- DIMMER CENTER
- DR- DIMMER RIGHT
- DL-DIMMER LEFT

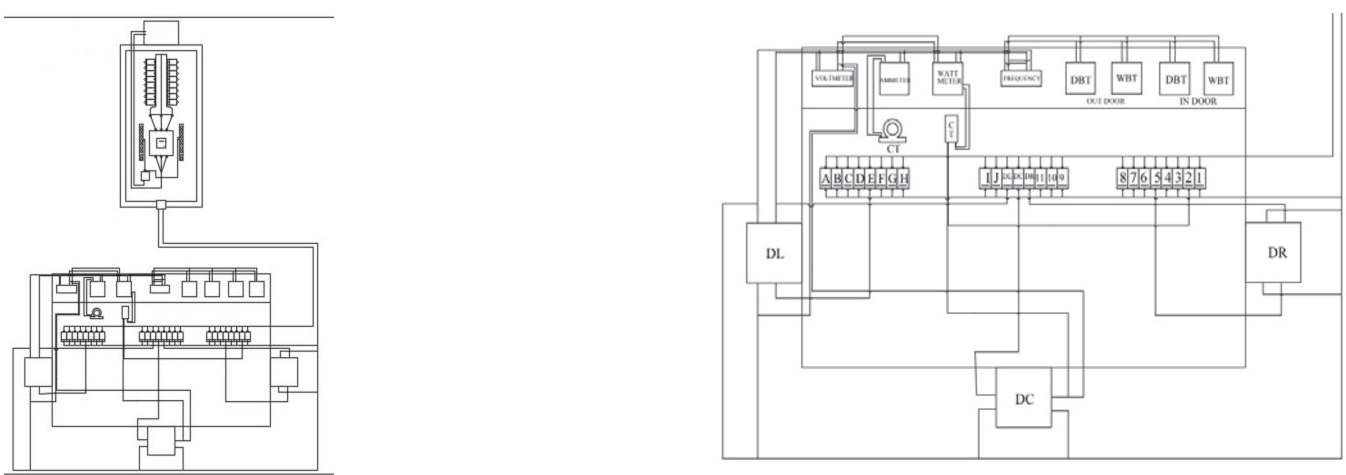


Fig.3:CIRCUIT DIAGRAM 1

Bill of Material for Test Room

S.No	Material used	Qty	Make
1	Plaster Of Paris	-	-
2	Switch Boards	30	PVC
3	Insulating Material	-	Thermocol

II. COMPONENTS OF PSYCHROMETRIC ROOM

2.1 Control Panel:

A control panel is a flat, often vertical, area where control or monitoring instruments are displayed. It is a panel that contains fuses and dimmers (here) for controlling the electrical devices which are inside the room.

They are Interested in factories to monitor and control machines or production lines and in places such as nuclear power generating units , Big Submarines, Aero planes and Super computers. Older control panels are most often well equipped with Automation and analog instruments, whereas nowadays in many cases touch screens are used for monitoring and control purposes

Bill Of Materials of Control Panel:

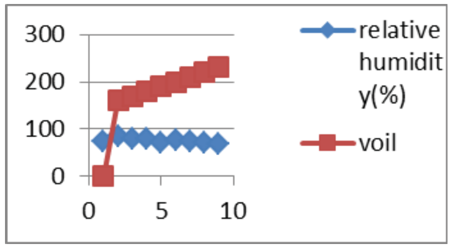
S.No	Material used	Qty	Make
1	M.S Angle Rods		M.S
2	Wooden Plank	2	-
3	Dimmer stat	3	-
4	Voltmeter	1	-
5	Ammeter	1	-
6	Wattmeter	1	-
7	Frequency Indicator	1	-
8	Temperature Indicators	4	-
9	MCB	24	Legrand
10	Wiring		Finolex
11	Bolts & Nuts	40	C.I

Fig.4: Control Panel 1

III. RESULTS

s.no	Time (mins)	Volts	Dry bulb temp	Wet bulb temp	Relative humidity
1	0	0	32.7	27.7	74%
2	5	160	36.2	33.4	84%
3	10	170	39.9	36.1	79%
4	15	180	43.1	38.6	78%
5	20	190	45.9	40.1	72%
6	25	200	48.1	43	77%
7	30	210	50.4	44.4	75%
8	35	220	52.2	45.1	70%
9	40	230	54.1	46.6	68%

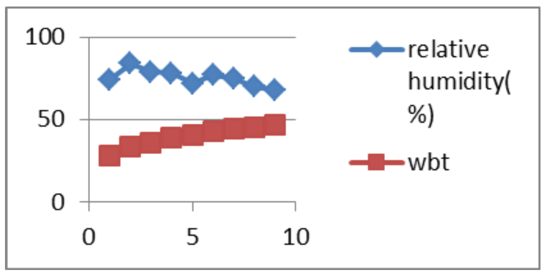
Table 2.1:-Thermocouple Readings



In the present work we have identified there are critical areas where all these conditions place a vital role in the present specified application, from the heating effect of strip heaters. The table 1 shows the thermocouples results the thermocouple are placed at the critical areas are identified as shown in the table.1.

The following results are explained in detail ,with the results obtained by the thermo couples as follows below.

Table 5.2:- Relative Humidity vs Dry Bulb Temperature



In adjacent figure shows graph of a relative humidity and wet bulb temperature. The values are taken at a nine conditions at various timings.At initial stage of a dbt,relative humidity is a value of a 74% and after a value of wbt is 36.2*c then relative humidity is 84%.At a 39.9*c then relative humidity is 79%.At a 38.6*c then relative humidity is 78%.As so values came out.

Relative Humidity vs Volts

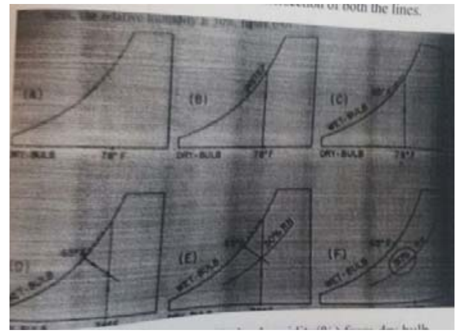
In Fig 5.3 shows graph of a relative humidity and wet bulb temperature.The values are taken at a nine conditions at various timings.At initial stage of a wbt,relative humidity is a value of a 74% and after a value of wbt is 33.4*c then relative humidity is 84%.At a 36.1*c then relative humidity is 79%.At a 38.6*c then relative humidity is 78%.As so values came out.

IV. HUMIDIFIER

A humidifier is a component that increases moisture in a single tested room or an entire building. In Domestic, point-of-use humidifiers are commonly used to increase the moisture in single tested room, while whole-house remained hot The study of HVAC system, provide humidity to the entire house. Medical ventilators often include humidifiers for increased patient comfort. The Large humidifiers are used in commercial, institutional, or industrial contexts, often as part of a larger HVAC system.

OBSERVATION:

S.NO	Time	Voltage	Dry Bulb Temperature	Wet Bulb temperature	Relative Humidity
1	0	0	35.2	29.6	66.1
2	5	160	35.1	29.9	68.2
3	10	170	35.0	29.9	68.7
4	15	180	35.2	30.3	69.9
5	20	190	35.5	30.8	71.2
6	25	200	35.9	31.	71.9
7	30	210	36.2	32.0	74.3
8	35	220	37.0	32.9	75.1
9	40	230	37.7	33.8	76.5
10	45	240	38.5	35.0	79.9



V. TESTING & OPTIMIZATION OF WINDOW AC AT TECUMSEH

Majorly in Domestic purpose we have 2 types of Air Conditioners.

1. WINDOW A C OR UNITARY A C.
2. SPLIT A C.

The main difference in WINDOW and SPLIT A.C is that High pressure and low pressure side are located in one single unit called as WINDOW.AC, and these are located in separate arrangement called as SPLIT.AC. These two types of A.C's are explained below.

CAPACITY CALCULATION OF AIR CONDITIONER:

First we optimize the Test unit according ISO-5151 Test standard @T1 condition i.e,

	DBT	WBT
Indoor Room	27	19
Outdoor Room	35	24

We need to maintain accurate Dry bulb and Wet bulb temperatures at both Indoor and Out door Rooms to get exact cooling capacity. We can take the readings after continuous running of 1hour period at balanced ambient only.
We can calculate the cooling capacity by using psychometric way (by using psychometric chart).

To be find:- Capacity:-? & EER:-?. Formulae: - Q= m (h1-h2).
Q=Cooling capacity. h= Enthalpy m =mass flow rate.

For example:- Consider 1.5 ton SPLIT AC unit running at ISO5151 Standard. i.e
D.B.T = 26.92°c W.B.T =18.7°c Then h1=63kj/kg. (Considered from psychometric chart)
We all know that we take the coincidence point on enthalpy line. Next we had taken the D.B.T & W.B.T at air out (grill) temperature. i.e
D.B.T = 16°c W.B.T =13.5°c h2=32kj/kg.
Mass flow rate = Density X C.F.M. = 0.01223 kg/m3x1231.78 m3/hr (density from Psychometric chart)
Capacity= 0.01223x1231.78x (63-32) =16827 btu/hr.

VI. TESTING OF WINDOW AC AT TECUMSEH TESTING ROOM

For calculation of any values, generally we take a reference to calculate. So here we take the Tecumseh testing room for calibration of our testing specimen, and then calculate the calibration factor and then multiply it with the calculated values of our specimens. Below here are the calculated values at Tecumseh:

FILE: c:\Tecumseh\data\TECUMSEH1112.trf Page 1
Report Generated: 3/26/2015 @ 9:38 AM

TEST_NAME = Cooltst3	Test Standard = ISO-5151
Test Valid = Yes	Operator = G.Sreekanth Reddy
Test Number = __	
Customer = Alessa	Fan Motor Cond = ------
Country = Saudi	Blower = -------
Appliance Type = W.AC	Propeller = -------
Unit Model No = 1	Condensor Coil = ---
Unit Serial No =	Condensor Tube = ----
Capacity = 18000 BTU/HR.	Evaporator Coil = ----
Throw Type = ---	Evaporator Tube = ----
Original Comp = ---	Capillary Tube = Original
Tecumseh Comp = ----	Gas Charge = Original
INDOOR_DB = 27.0	OUTDOOR_DB = 35.0
INDOOR_WB = 19.0	OUTDOOR_WB = 24.0

Test Data for the past 60 minutes:

ID Dry Bulb	80.555 min	80.663 max	80.612 avg	DegF
ID Wet Bulb	66.196 min	66.484 max	66.358 avg	DegF
OD Dry Bulb	94.972 min	95.098 max	95.040 avg	DegF
OD Wet Bulb	75.272 min	75.542 max	75.396 avg	DegF
ID Thermopile	.098948 min	21.273 max	8.4442 avg	Btu/hr
OD Thermopile	-15.019 min	2.2212 max	-4.0388 avg	Btu/hr
BW Thermopile	166.52 min	167.28 max	166.91 avg	Btu/hr
ID Room Power	3841.4 min	5445.3 max	4616.8 avg	W
OD Room Power	6695.1 min	7103.8 max	6889.4 avg	W
OD Water In	51.174 min	51.318 max	51.245 avg	DegF
OD Water Out	58.996 min	59.589 max	59.242 avg	DegF
OD Water Delta T (Inst)	7.7858 min	8.3068 max	7.9962 avg	DegF
OD Water Flow	5718.4 min	5921.9 max	5827.4 avg	Lb/hr
ID H2O In	80.060 min	80.960 max	80.452 avg	DegF
ID Condensate TC	76.460 min	77.540 max	76.910 avg	DegF
OD H2O In	95.360 min	95.900 max	95.623 avg	DegF
OD Condensate TC	97.880 min	98.240 max	98.140 avg	DegF
TU Volts Ph1	230.62 min	230.68 max	230.65 avg	V
TU Amps Ph1	.0 min	.0 max	.0 avg	A
TU Watts Ph1	-.01 min	.02 max	.0014701 avg	W
TU Volts Ph2	230.67 min	230.74 max	230.70 avg	V
TU Amps Ph2	.0 min	.0 max	.0 avg	A
TU Watts Ph2	-.12 min	-.06 max	-.094507 avg	W
TU Volts Ph3	229.93 min	230.12 max	230.02 avg	V
TU Amps Ph3	9.9772 min	10.042 max	10.008 avg	A
TU Watts Ph3	2241.4 min	2257.6 max	2248.6 avg	W
3ph TUP Watts	-2.9845 min	-.97656 max	-2.1083 avg	W
TU Frequency	49.991 min	49.996 max	49.994 avg	Hz
Barometric Pressure	28.084 min	28.097 max	28.090 avg	"Hg
ID To OD Delta P	.0018686 min	.010190 max	.0056243 avg	"H2O
Total ID LNoz Airflow	.0 min	.0 max	.0 avg	SCFM
Total OD LNoz Airflow	.0 min	.0 max	.0 avg	SCFM

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Last 7 samples taken every 10 minutes:

ID Dry Bulb	80.591	80.591	80.627	80.627	80.645	80.591	80.627
ID Wet Bulb	66.376	66.394	66.412	66.412	66.412	66.340	66.358
OD Dry Bulb	95.044	95.080	95.080	95.044	95.026	95.008	94.990
OD Wet Bulb	75.542	75.506	75.416	75.416	75.344	75.308	75.290
ID Thermopile	20.878	16.425	12.269	8.4105	2.5726	1.1873	1.5831
OD Thermopile	-12.163	-10.788	-2.7500	-4.7597	.95194	1.1634	-3.7020
BW Thermopile	166.99	167.22	166.99	166.93	166.58	166.87	166.58
ID Room Power	4577.1	4691.7	4245.3	4369.5	4457.1	4299.9	4526.1
OD Room Power	6821.7	6904.5	6869.1	6819.9	6956.7	6809.7	6865.5
OD Water Flow (Counts)	12870.	13861.	14853.	15844.	16835.	17826.	18817.
TU Watt-Hours Ph1	.0046000	.0049611	.0052500	.0054722	.0057000	.0059389	.0061556
TU Watt-Hours Ph2	-.20756	-.22327	-.23916	-.25502	-.27077	-.28653	-.30206
TU Watt-Hours Ph3	4790.6	5165.6	5540.7	5915.5	6290.3	6664.8	7039.3
3Ph TUP Watt-Hour (1/WH)	.0	.0	.0	.0	.0	.0	.0
ID Watt-Hours (1/WH)	9303.1	10081.	10847.	11619.	12392.	13164.	13945.
OD Watt-Hours (1/WH)	15075.	16231.	17392.	18545.	19713.	20866.	22015.
ID Stm Weight	90.694	89.799	88.874	87.999	87.104	86.238	85.363
OD Stm Weight	89.820	89.820	89.830	89.840	89.840	89.850	89.860

Indoor Total Watthours	= 4642.5 Watthrs
Outdoor Total Watthours	= 6940.2 Watthrs
Test Unit Watthours	= 2248.5 Watthrs
Test unit total cooling effect	= 16142. Btu/hr
EER Energy Efficiency Ratio	= 7.1787 Btu/W
Water consumed by the ID Steam Generators	= 5.3310 lbs/hr
Water Leaving Indoor Room	= 55.000 degF
Test unit sensible cooling effect	= 10491. Btu/hr
Test unit latent cooling effect	= 5650.9 Btu/hr
Sensible Heat Ratio	= 64.992 %
Outdoor Water Loop mass-flow	= 5947.4 lbs/hr
Outdoor Cooling Loop energy removed	= 47556. Btu/hr
Outdoor heating effect no condensate correction	= 16385. Btu/hr
Water consumed by the OD Steam Generators	= -.04 lbs/hr
Outdoor condensate correction	= 230.08 Btu/hr
Outdoor total heating effect	= 16615. Btu/hr
Heat Balance	= 2.8504 %
Barometer Corrected Capacity	= 16378. Btu/hr
Barometer Corrected EER	= 7.2838 Btu/W
Corrected Sensible Heat Ratio	= 64.055 %
% Rated Amps	= Inf. %
% Rated EER	= Inf. % corr
% Rated Btu's	= 90.991 % corr

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Test Data for the past 60 minutes:

Evap Total Inlet(ID1)	48.560 min	49.280 max	48.948 avg	DegF
Evap Inlet #1 (ID2)	48.740 min	49.280 max	49.071 avg	DegF
Evap Inlet #2 (ID3)	49.640 min	50.180 max	49.822 avg	DegF
Evap Inlet #3 (ID4)	44.780 min	45.320 max	45.086 avg	DegF
Evap Middle #1 (ID5)	44.960 min	45.500 max	45.270 avg	DegF
Evap Middle #2 (ID6)	28.940 min	609.62 max	369.80 avg	DegF
Evap Middle #3 (ID7)	172.40 min	18031. max	2080.1 avg	DegF
Evap Outlet #1 (ID8)	-90.760 min	626.54 max	177.27 avg	DegF
Evap Outlet #2 (ID9)	45.680 min	46.400 max	46.070 avg	DegF
Evap Outlet #3 (ID10)	-139.90 min	537.26 max	292.62 avg	DegF
Evap Total Outlet (ID11)	-242.86 min	18031. max	4798.7 avg	DegF
Spare (ID12)	-17967. min	18031. max	-259.38 avg	DegF
Return Gas (OD1)	45.860 min	50.000 max	47.335 avg	DegF
Discharge Gas (OD2)	164.66 min	180.86 max	177.49 avg	DegF
Liquid Exp (OD3)	101.48 min	111.02 max	106.27 avg	DegF
Comp Top Shell (OD4)	72.320 min	73.220 max	72.811 avg	DegF
Comp Mid Shell (OD5)	90.860 min	93.200 max	91.690 avg	DegF
Comp Bottom Shell (OD6)	124.70 min	125.60 max	125.26 avg	DegF
Cond Inlet #1 (OD7)	174.92 min	178.88 max	176.32 avg	DegF
Cond Inlet #2 (OD8)	111.02 min	128.12 max	126.36 avg	DegF
Cond Inlet #3 (OD9)	42.260 min	46.400 max	43.796 avg	DegF
Cond Middle #1 (OD10)	173.12 min	176.90 max	174.88 avg	DegF
Cond Middle #2 (OD11)	176.72 min	185.72 max	180.57 avg	DegF
Cond Middle #3 (OD12)	154.40 min	164.84 max	158.43 avg	DegF
TU Dis Press (1000PSI#1)	-.051370 min	.075554 max	.026175 avg	PSI
TU Suc Press (500PSI#1)	-127.55 min	-127.45 max	-127.48 avg	PSI
High Press (1000PSI#1)	-1.0350 min	-.84542 max	-.92230 avg	PSI
Low Press (500PSI#2)	2.2027 min	2.2980 max	2.2404 avg	PSI
Comp Suction Superheat	.0 min	.0 max	.0 avg	DegF
Liquid Exp Subcool	-154.85 min	-145.13 max	-150.07 avg	DegF
Comp Discharge Superheat	208.50 min	224.70 max	221.28 avg	DegF
Aux Gas Superheat	-287.86 min	815.52 max	177.42 avg	DegF
Aux Liquid Subcool	-815.52 min	287.86 max	-177.42 avg	DegF

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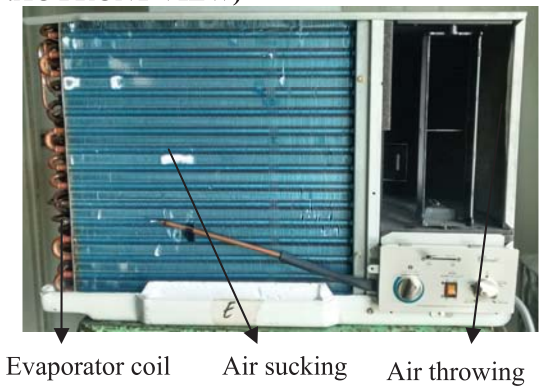
VII. EXPERIMENTAL ANALYSIS OF PSYCHROMETRIC ROOM

The experimental test had been conducted with calorimeter test for air conditioning and vapor compression cycle performance test, the calorimeter has the facility to conduct from small air conditioners unit to large chillers.

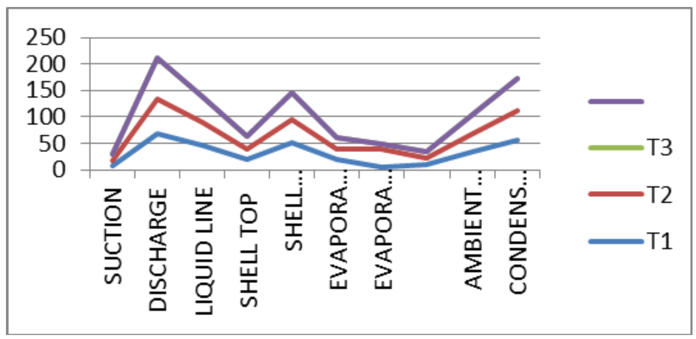
(W.AC FRONT VIEW)



(W.AC SIDE VIEW)

OBSERVATIONS MADE WITH PSYCHROMETRIC ROOM

	T_1	T_2	T_3
Receiver gas	8.3	9.3	12.1
Discharge gas	69.2	65.7	76.0
Liquid line	45.9	44.3	48.1
Shell top	19.0	20.4	24.2
Shell bottom	50.8	43	52.5
Evaporator entry	18.9	19.7	21.4
Evaporator exit	6	34	9.9
Evaporator middle	10	11.1	13.9
Ambient	34.3	34	37.3
Condenser middle	56.4	56.4	60.7



6.1 Cooling Capacity conditions:

Area, Ai =((22/7*4)*SQRT(48.66/1000))+((22/7*4)*SQRT(99.43/1000)) = 0.00962 m2Cubic flow per minute,
Cfm = Ci*Yi*Ai*SQRT ((2*Dp)/D_{le})*3600*0.5885 =0.985*0.998*0.00962*SQRT((2*445)/1.2138)*3600* 0.5885 = 542.56 or 543
Volume flow rate ,Q_{va}= Cfm/2118.88 = 543/2118.88 = 0.2562 m3/sec
Enthalpy difference, D_h = h_{en}-h_{le} = 48.53 - 30.60= 17.93 kj/kg
Mass flow rate, Ma = Volume flow rate (Q_{va})/Specific volume of leaving air (V_{le})= 0.2562/0.8238= 0.3109 kg/sec
Cooling capacity in KW = Mass flow rate (Ma)*Enthalpy difference(D_h)= 0.3109*17.93= 5.5744 kw
Cooling capacity in Btu/hr = cooling capacity in kw*3412.14 = 5.5744 *3412.14= 19020.75 Btu/hr
Cooling capacity in TON of refrigeration = cooling capacity in kw / 3.516 = 5.5744 / 3.516= 1.58544 Ton
Energy efficiency ratio,EER = (cooling capacity in Btu/hr) / (Input power in watts) = 19020/2240= 8.491 Btu/W-hr
Therefore calibration factor for psychrometric room is 19020/21032.43 = 0.904 Which is nothing but **1.096**

6.2 COOLING CAPACITY CALCUALTIONS:-

FORMULAE FOR COOLING CAPACITY CALCULATIONS:

Volume Flow rate of air Qva(m3/sec)= Cfm/2118.88
Enthalpy difference Dh = Enthalpy of moist air entering - Enthalpy of moist air leaving
Mass flow rate of air Ma(kg/s) =Volume flow rate of air/Specific volume of air
Cooling capacity in KW =Mass flow rate of air*Enthalpy difference
Cooling capacity in Btu/hr=Cooling capacity in KW*3412.14
Cooling capacity in Ton of refrigeration=Cooling capacity in KW/3.5167

CALCULATIONS

Calculations at 35OC Ambient: Entering air conditions: DBT-27.11 OC, WBT-19.27 OC

Saturation pr.at DBT, Ps= 610.78*EXP (DBT/(DBT+238.3)*17.2694)/1000
= 610.78*EXP (27.11/(27.11+238.3)*17.2694)/1000 = 3.5642 kpa

Saturation pr. At WBT, Pl =610.78*EXP(WBT/(WBT+238.3)*17.2694)/1000
= 610.78*EXP (19.27/(19.27+238.3)*17.2694)/1000 = 2.2232 kpa

Actual vapour pressure, l lPv = Pv- (((Pt- Pv)*(DBT-WBT)*(1.8))/ (2800-1.3((1.8*DBT) +32))
= 2.2232-(((101.325-2.2232)*(27.11-19.27)*(1.8))/(2800-1.3((1.8*27.11)+32))= 1.7042 kpa

Humidity ratio, W = 0.622*(PV/(Pt-Pv)) = 0.622*(1.7042/(101.325-1.7042)) = 0.01064

Enthalpy of moist air, hen = (1.005*DBT) + (W*(2500+(1.88*DBT)))
= (1.005*27.11) + (0.01064*(2500+(1.88*27.11))) = 54.3878 kj/kg

Specific volume of air, Ven = (287.3*(273+DBT))/((Pt-Pv)*1000)
= (287.3*(273+27.11))/((101.325-1.7042)*1000) = 0.8654 m3/kg

Density of moist air, Den = 1/Ven = 1/0.8653 = 1.1556 kg/m3

Leaving air conditions: DBT-13.78oC,WBT-12.25oC
Saturation pr. At DBT,
Ps = 610.78*EXP (DBT/(DBT+238.3)*17.2694)/1000
= 610.78*EXP (13.78/(13.78+238.3)*17.2694)/1000 = 1.5699 kpa
Saturation pr. At WBT,
P= 610.78*EXP (WBT/(WBT+238.3)*17.2694)/1000
= 610.78*EXP (12.25/(12.25+238.3)*17.2694)/1000 = 1.4209 kpa40
Actual vapour pressure, l
Pv = Pv-(((Pt- Pv)*(DBT-WBT)*(1.8))/(2800-1.3((1.8*DBT)+32))
=1.4209-(((101.325-1.4209)*(13.78-12.25)*(1.8))/(28001.3((1.8*13.78)+32))= 1.3199 kpa
Humidity ratio, W = 0.622*(Pv/(Pt-Pv))= 0.622*(1.3199/(101.325-1.3199)) = 0.0082
Enthalpy of moist air, hle = (1.005*DBT) + (W*(2500+(1.88*DBT)))
= (1.005*13.78) + (0.0082*(2500+(1.88*13.78)))= 34.5613 KJ/KG
Specific volume of air, Vle = (287.3*(273+DBT))/((Pt-Pv)*1000)
= (287.3*(273+13.78))/((101.325-1.3199)*1000)= 0.8238 m3/kg
Density of moist air, Dle = 1/Vle= 1/0.8238=1.2138 kg/m3

6.3: Calculations for cooling capacity:

Area, Ai =$A = \pi r^2$= 0.00962 m2Cubic flow per minute,
Cfm = Ci*Yi*Ai*SQRT ((2*Dp)/D_{le})*3600*0.5885=0.985*0.998*0.00962*SQRT ((2*445)/1.2138)*3600* 0.5885= 203.826 OR 204
Volume flow rate, Qva= Cfm/2118.88 = 543/2118.88= 0.096 m3/sec
Enthalpy difference, D_h = h_{en}-h_{le} = 54.3878 - 34.5613 = 19.8265 kj/kg
Mass flow rate, Ma = Volume flow rate (Q_{va})/Specific volume of leaving air (V_{le}) = 0.096/0.8238 = 0.117 kg/sec
Cooling capacity in KW = Mass flow rate (Ma)*Enthalpy difference(D_h)= 0.3109*19.8265= 2.314 kw
Cooling capacity in Btu/hr = cooling capacity in kw*3412.14 = 2.314*3412.14 = 7897.023 Btu/hr
Cooling capacity in TON of refrigeration = cooling capacity in kw / 3.516 = 2.314/ 3.516 = 0.65 Ton
Energy efficiency ratio, EER = (cooling capacity in Btu/hr) /(Input power in watts)= 7897.023/2240= 3.52 Btu/W-hr

VIII. CONCLUSION

- Every product that is Fabricated is to be tested to know how it works and up to what level it can satisfy the costumers requirement.
- The main objective of this project is testing a c appliance according to different standards by maintaining different combinations of Ambient conditions in Air conditioner test room.

- The testing includes cooling capacity test, power consumption test.
- From capacity test, cooling capacity of system at different temperatures is known. Cooling capacity test is done on AC appliance.
- The specification given by manufacturer for cooling capacity of Air conditioner at 35^{o}C ambient is 21200 Btu/hr, by cooling capacity test in the a c test room it is found that its capacity is lower by 1.4% i.e. 20908 Btu/hr. at 35^{o}C room temp.
- Similarly cooling capacity of AC at 46^{o}C and 54^{o}C ambient is found to be 19332Btu/hr. and 5582Btu/hr.
- Power consumption test is done on air conditioner and found that it consumes when operated for 24hrs, 16.5 Kw/hr units power i.e. 0.687 kw/hr. at 35^{o}C Ambient.
- At 46^{o}C Ambient it is found to at it consumes 24.5 Kw/hr units of power i.e. 1.021kw/hr. in A C test room.
- The various factors observed amidst the testing were, amount of change of refrigerant, pressure drop, suction and discharge pressures, power consumption etc. From these work different procedures for testing AC s are established.
- The test results will give Database to the customers and fabricators. Useful data is for the air conditioning engineers.

IX. FUTURE SCOPE

Because of the variations in the atmosphere due to many things like pollution green house effect, there is a gradually rise in increase of temperature because of which the demand of air conditioners has been increased. So to provide a efficient and less power consumable air conditioners to the people we have to test the air conditioners and know the flaws in it and rectify it we use one of the testing methods as "**PSYCHROMETRIC ROOM**".
By this method we can rectify flaws and increase the efficiency by which we have a lot of future and a vast scope to this. In this way we can conclude that it has a great future and scope.

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