6.0 Reference List

1. "Statistical Digest 2013 CEB". Internet: www.ceb.lk/sub/publications/statistical.aspx, [2014.08.17]

2. "Generation and reservoir statistics on 25th August 2014". Internet: www.pucsl.gov.lk/english/, [2014.08.25]

3. Total Annual Energy Dispatch 2012, 2013 and 2014, System Control Center, CEB

4. "Thermodynamic for engineer". Internet: www.thermodynamics-engineer.com/ diesel %20-cycle/, [2014.09.02]

5. K. Mollenhauer, K.G.E. Johnson, H. Tschöke, *Hand book of Diesel Engine*, Page 293

6. "How a Cooling System Works". Internet: www.asc-ind.com/cooling-system-information/how-a-cooling-system-works/, [2014.08.015]

7. *Cooling Water Treatment Essential Expertise for Water*, Energy and Air.SM, Nalco Company Operations

8. "DieselNet Technology Guide". Internet: www.DieselNet.com, [2014.08.21]

9. G. Amarasekera, *Overview of Lubricant Technology*, Laugfs Lubricants Limited

10. "Overheated lubricating oil". Internet: www.tpub.com/engine3/en32-53.htm, [2014.010.02]

11. "Water in oil contamination". Internet: www.machinerylubrication.com/Read/192/water-contaminant-oil, [2014.10.05]

12. P.C. Sharma, *Advantage of total energy systems, Power Plant Engineering*, Page 379

13. H.A. Saber1a, R.R.I.A. Barwari, Z.J. Talabany, *Effect Of Ambient Air Temperature On Specific Fuel Consumption Of Naturally Aspirated Diesel Engine*, (2013), Science and Engineering, Vol. 1(1), 1-7

14. Parsons Brinckerhoff, *Thermal Power Station Advice, Reciprocating Engines Study*, 2009

15. Heat recovery". Internet: www.kalfrisa.com/Archivos/Descargas/Recuperators.pdf, [2014.08.22]

16. "Waste heat recovery heat exchanger classification and principle". Internet: www.sehenstar.cn/Showsolutions/?84-1.html, [2014.11.02]

17. "Spiral wound finned tubes". Internet: www.finnedtubesindia.com/spiralwoundfinned tube s.html, [2014.11.10]

18. "Heat exchanger". Internet: www.willworldengineering.com/product%209.html, [2014.11.10]

19. "What is an absorption chiller". Internet: www.absorptionchiller4u.blogspot.com/2013 /01 /what-is-absorption-chiller-system.html, [2014.10.30]

20. D. Mahone, *Advanced Design Guideline Series*, Southern California Gas Company, New Buildings Institute, 1998

21. V.H. Johnson, *Heat-Generated Cooling Opportunities in Vehicles*, National Renewable Energy Laboratory, United States

22. A. Bhatia, *Overview of Vapour Absorption Chilling Systems,* B.E. PDH online Course M130 (4 PDH),2012

23. F. Kreith and R.E. West, *CRC hand book of energy efficiency*, Page526

24. *Advantages and Disadvantages of using absorption chillers to lower utility bills*, naval facilities engineering service center, Port Hueneme, California 93043-4370

25. P.N. Ananthanarayanan, *Basic Refrigeration and Air Conditioning*, TataMcGraw-Hill Publishing Company Limited

26. *A.09. Operating Instructions*, C30 HP00, Absorption Cooling Division, Thermax Limited

27. M. Talbi and B. Agnew, *Energy Recovery from Diesel Engine Exhaust Gases for performance Enhancement and Air Conditioning*, Academic of Maritime Studies, Tripoli- Libiya

28. R. J. Yadav and R. S. Verma, *Effect of Utilization of Waste Heat From Diesel Generator to Run Air Conditioning Plant*, Department of Mechanical Engineering, Pimpri Chichwad College of Engg., Nigdi, Pune- 411 044

29. *ISO 3046-1:2002 standard*

30. A.K.L. McCrone, *Diesel Plant Operators Hand Book*, Blackstone & Co Ltd, Page 184

31. "Ministry of Power and Energy", Internet: www.powermin.gov.lk/english/?p=3121, [2014.11.20]

32. "Density of air". Internet: www.sengpielaudio.com/index.html, [2014.11.30]

33. "Humidity ratio of Air". Internet: www.engineeringtoolbox.com/humidity-ratio-air-d_686.html, [2014.11.30]

34. Broad Central Air Conditioning (Absorption LiBr+H2O), Broad X Non-Electric Chiller, Model Selection & Design Manual

35. "Central Bank of Sri Lanka". Internet: www.cbsl.gov.lk/htm/english/_cei/er/e1.asp

Appendix A: Graphical interpretation of Table 4.2 in Mathlab software

Table 4.2: Percentage of deration Vs percentage of humidity at constant atmospheric temperatures [30]

Atmospheric Temperature	Percentage Humidity									
	10	20	30	40	50	60	70	80	90	100
	Percentage Derating									
85						0.5	1.0	1.5	2.0	2.4
90					0.4	1.0	1.6	2.2	2.7	3.3
95				0.2	0.9	1.6	2.2	2.9	3.6	4.2
100				0.7	1.5	2.2	3.0	3.8	4.6	5.3
105			0.3	1.2	2.1	3.0	3.9	4.8	5.7	6.6
110			0.7	1.8	2.8	3.8	4.9	5.9	6.9	8.0
115			1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6
120		0.4	1.7	3.1	4.5	5.9	7.3	8.6	10.0	11.4
125		0.8	2.3	3.9	5.5	7.1	8.7	10.2	11.8	13.4

X =

```
  80   80   80   80   80   80   80   80   80   80
  85   85   85   85   85   85   85   85   85   85
  90   90   90   90   90   90   90   90   90   90
  95   95   95   95   95   95   95   95   95   95
 100  100  100  100  100  100  100  100  100  100
 105  105  105  105  105  105  105  105  105  105
 110  110  110  110  110  110  110  110  110  110
 115  115  115  115  115  115  115  115  115  115
 120  120  120  120  120  120  120  120  120  120
 125  125  125  125  125  125  125  125  125  125
```

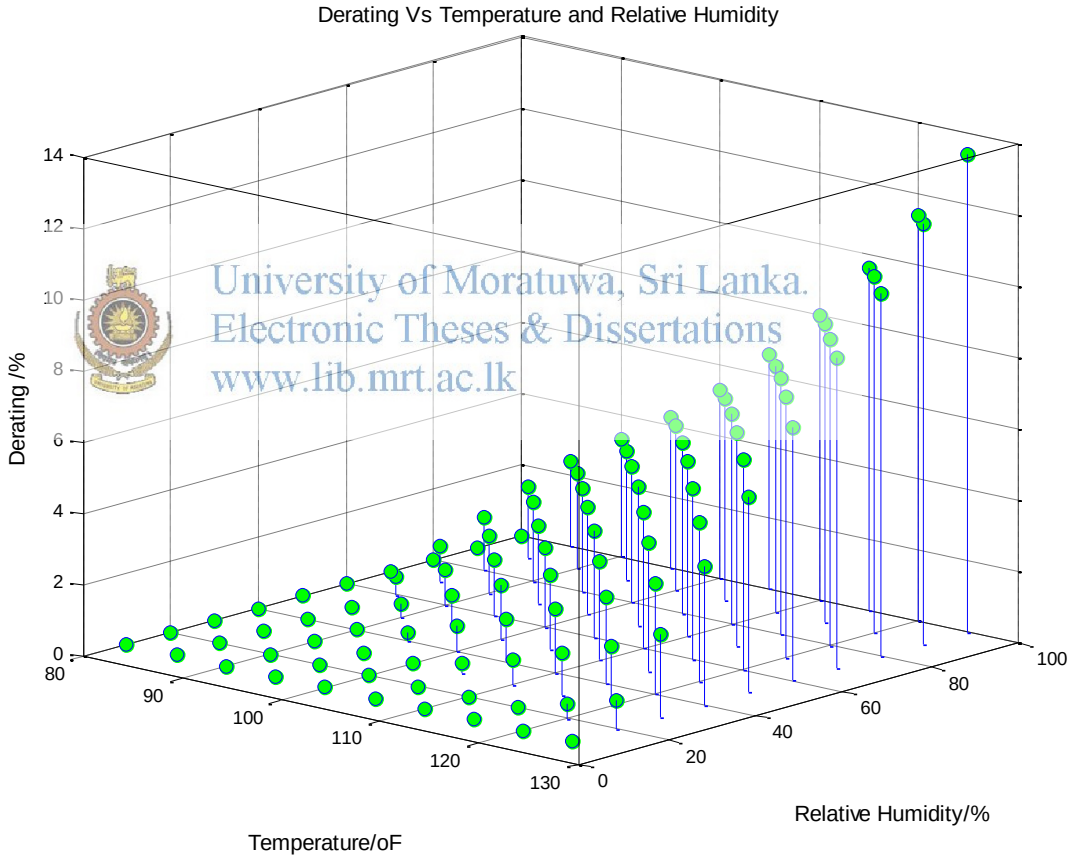
y =

```
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
  10   20   30   40   50   60   70   80   90  100
```

z =

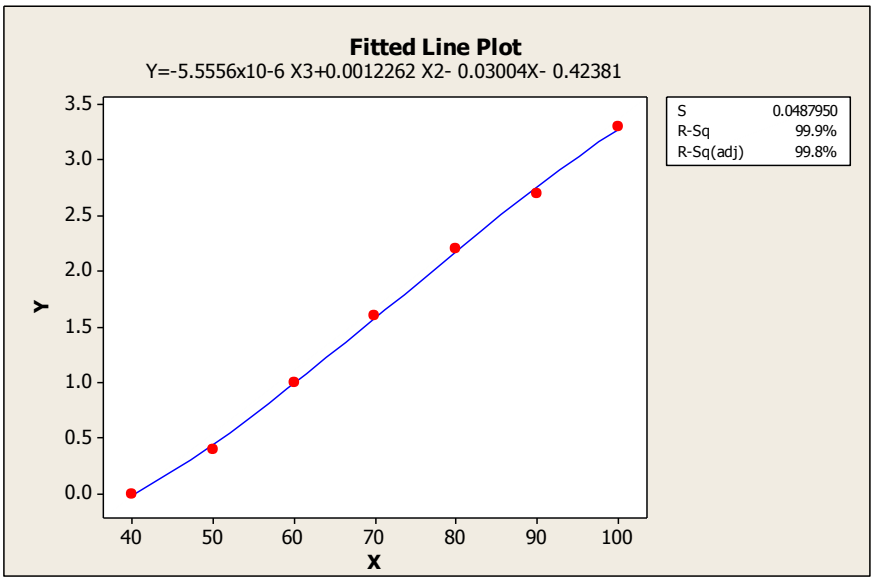
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0.5000	1.0000	1.5000	2.0000	2.4000
0	0	0	0	0.4000	1.0000	1.6000	2.2000	2.7000	3.3000
0	0	0	0.2000	0.9000	1.6000	2.2000	2.9000	3.6000	4.2000
0	0	0	0.7000	1.5000	2.2000	3.0000	3.8000	4.6000	5.3000
0	0	0.3000	1.2000	2.1000	3.0000	3.9000	4.8000	5.7000	6.6000
0	0	0.7000	1.8000	2.8000	3.8000	4.9000	5.9000	6.9000	8.0000
0	0	1.2000	2.4000	3.6000	4.8000	6.0000	7.2000	8.4000	9.6000
0	0.4000	1.7000	3.1000	4.5000	5.9000	7.3000	8.6000	10.0000	11.4000
0	0.8000	2.3000	3.9000	5.5000	7.1000	8.7000	10.2000	11.8000	13.4000

```
>> stem3(x,y,z,'MarkerFaceColor','g')
>> grid on
```



Appendix B: Calculations of the model

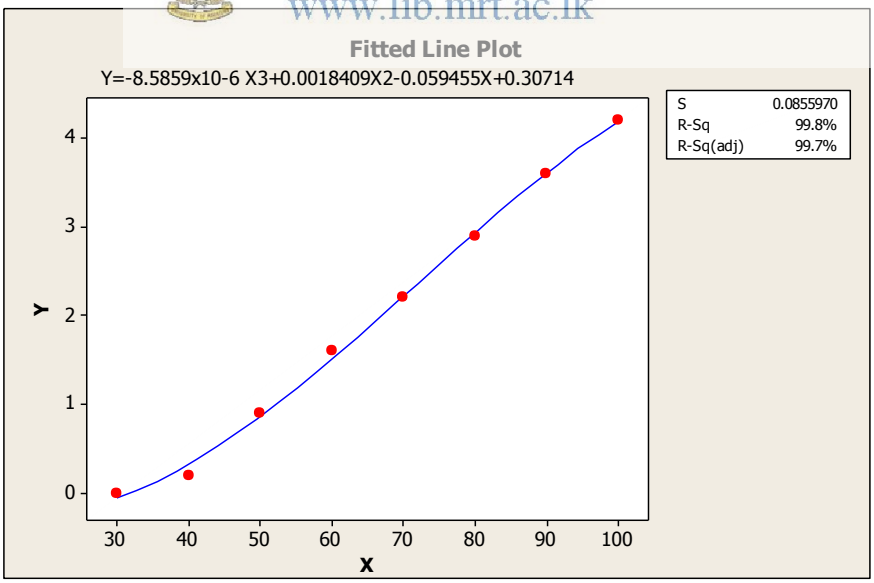
When the temperature is maintaining at 90°F,



$Y=-5.5556x10\text{-}6\ X^3+0.0012262\ X^2-\ 0.03004X-\ 0.42381$----------> T90

Regression Analysis is S = 0.0487950 R^2= 99.9% R^2 (adj) = 99.8% P= 0.000

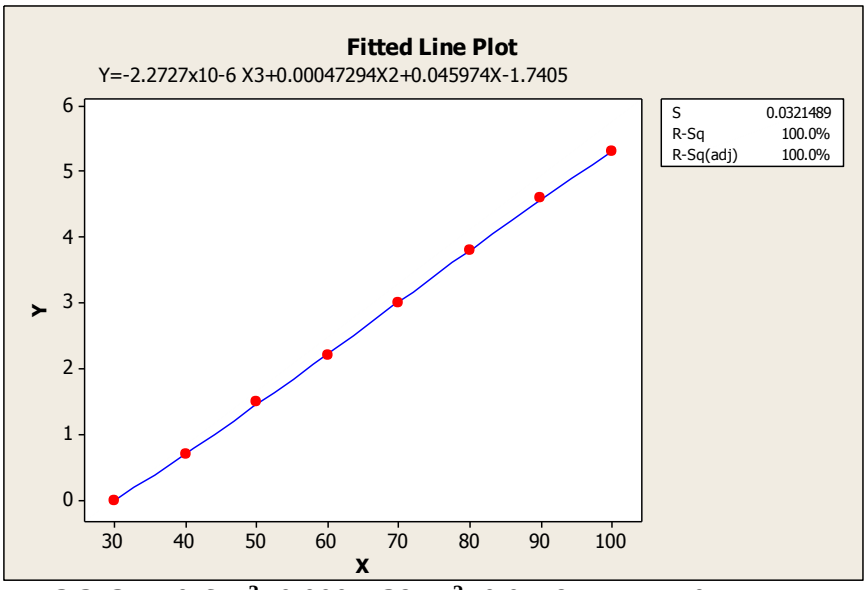
When the temperature is maintaining at 95°F,



$Y=-8.5859x10\text{-}6\ X^3+0.0018409X^2-0.059455X+0.30714$----------> T95

Regression Analysis is S = 0.0855970 R^2= 99.8% R^2 (adj) = 99.7% P= 0.000

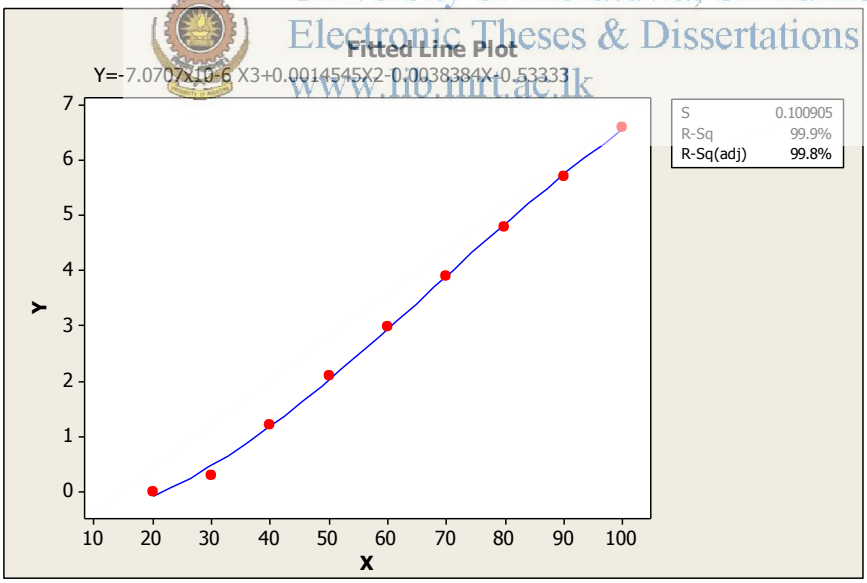
When the temperature is maintaining at 100°F,



Y=-2.2727x10-6 X^3+0.00047294X^2+0.045974X-1.7405----------> T100

Regression Analysis is S = 0.0321489 R^2 = 100.0% R^2 (adj) = 100.0% P= 0.000

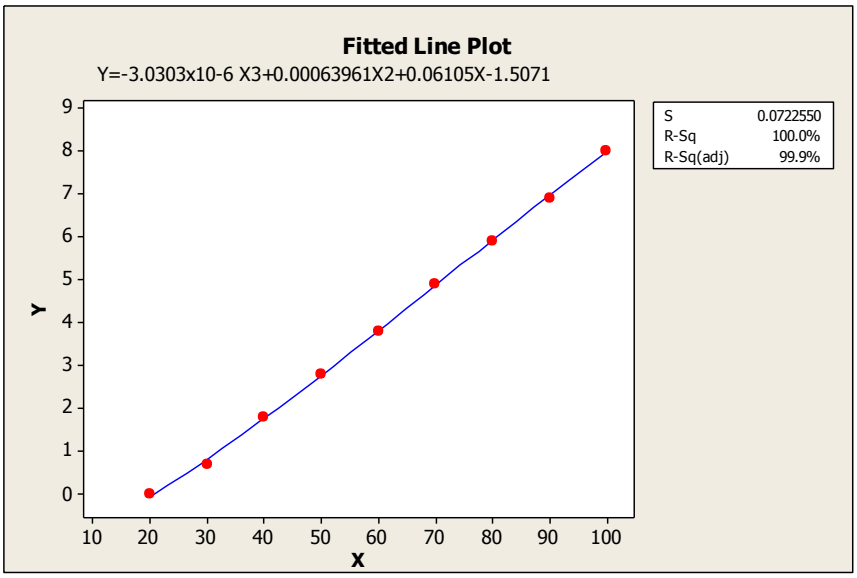
When the temperature is maintaining at 105°F,



Y=-7.0707x10-6 X^3+0.0014545X^2-0.0038384X-0.53333---------> T105

Regression Analysis is S = 0.100905 R^2= 99.9% R^2 (adj) = 99.8% P= 0.000

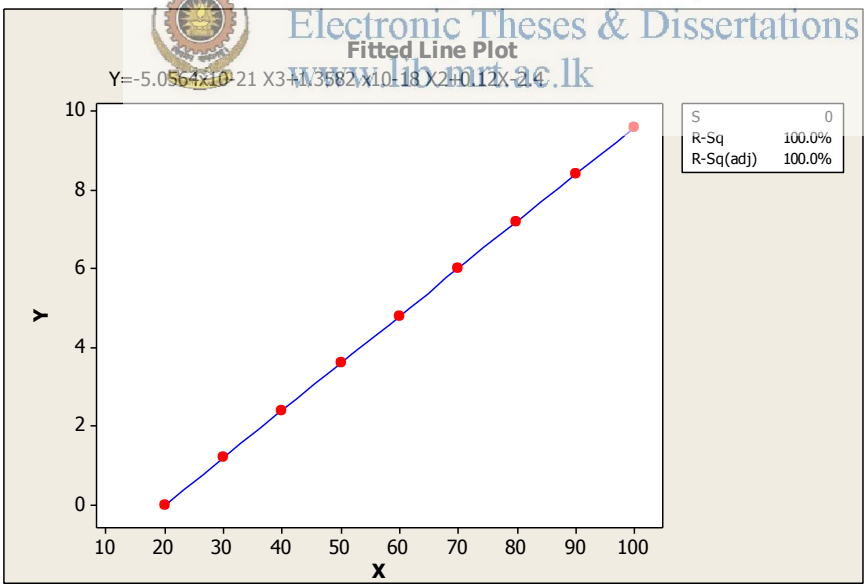
When the temperature is maintaining at 110°F,



Y=-3.0303x10-6 X^3+0.00063961X^2+0.06105X-1.5071----------> T110

Regression Analysis is S = 0.0722550 R^2= 100.0% R^2 (adj) = 99.9% P= 0.000

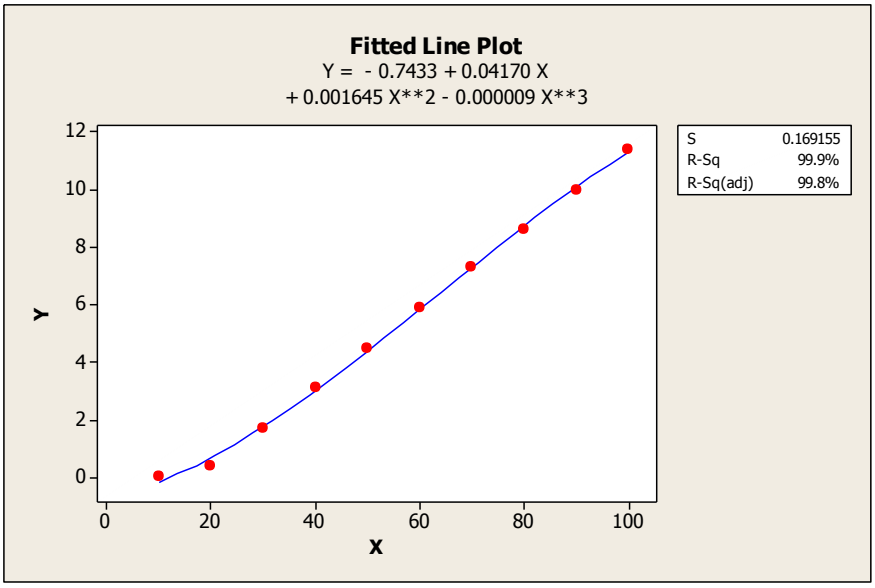
When the temperature is maintaining at 115°F,



Y=-5.0564x10-21 X^3+1.3582 x10-18 X^2+0.12X-2.4----------> T115

Regression Analysis is S = 0 R^2= 100.0% R^2 (adj) = 100.0% P= 0.000

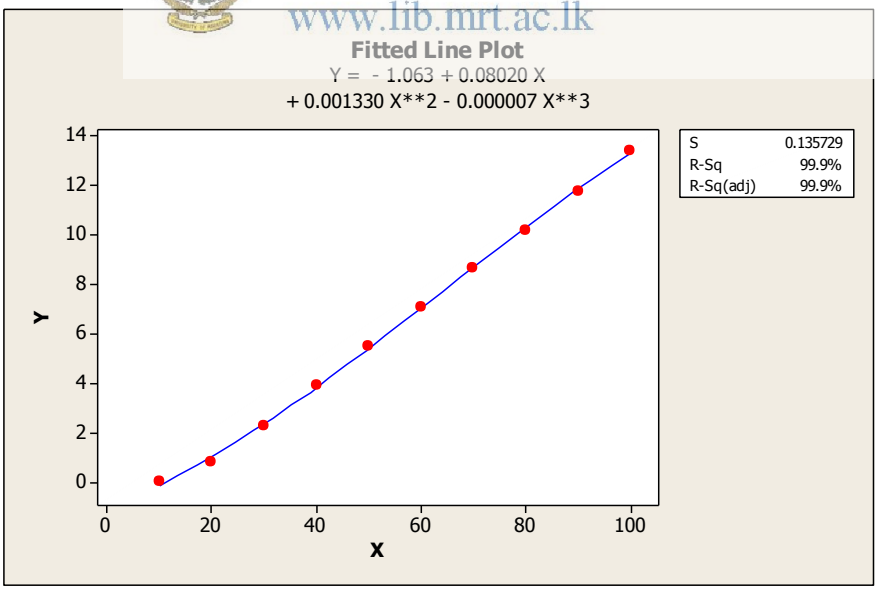
When the temperature is maintaining at 120°F,



Y=-8.5664x10-6 X^3+0.0016445X^2+0.041696X-0.74333----------> T120

Regression Analysis is S = 0.169155 R^2 = 99.9% R^2 (adj) = 99.8% P= 0.000

When the temperature is maintaining at 125°F,



Y=-6.9347x10-6 X^3+0.0013298X^2+0.080204X-1.0633----------> T125

Regression Analysis is S = 0.135729 R^2 = 99.9% R^2 (adj) = 99.9% P= 0.000

Appendix C: Scatter plot of measured temperature and RH points using Matlab software

x =

Columns 1 through 15

82.0400 81.6800 81.5000 81.1400 81.1400 80.9600 81.3200 84.3800 86.3600

89.7800 93.5600 93.5600 93.9200 96.6200 94.8200

Columns 16 through 30

93.2000 90.6800 87.4400 85.1000 84.3800 83.6600 82.9400 82.5800 82.0400

81.8600 81.3200 81.3200 81.1400 80.9600 81.1400

Columns 31 through 45

81.3200 84.2000 89.2400 89.2400 89.7800 90.3200 90.8600 90.8600 93.7400

93.7400 90.5000 88.1600 85.2800 83.8400 83.3000

Columns 46 through 48

82.7600 82.4000 82.2200

y =

Columns 1 through 15

70.4000 78.8000 80.1000 81.1000 79.1000 81.1000 80.2000 73.6000 69.4000

61.6000 54.6000 54.6000 53.5000 44.5000 46.8000

Columns 16 through 30

50.7000 59.8000 65.4000 72.3000 69.9000 72.7000 74.4000 75.7000 77.5000

80.0000 80.6000 80.6000 81.1000 80.2000 81.9000

Columns 31 through 45

82.2000 75.2000 64.3000 64.2000 59.7000 58.4000 51.6000 50.0000 44.5000

47.1000 59.3000 66.2000 69.4000 72.3000 75.5000

Columns 46 through 48

77.2000 77.8000 78.6000

>> scatter (x,y,'+','r')

p =

Columns 1 through 15

82.4000 82.0400 81.8600 81.5000 81.5000 81.3200 81.6800 84.7400 86.7200

90.1400 93.9200 93.9200 94.2800 96.9800 95.1800

Columns 16 through 30

93.5600 91.0400 87.8000 85.4600 84.7400 84.0200 83.3000 82.9400 82.4000

82.2200 81.6800 81.6800 81.5000 81.5000 81.5000

Columns 31 through 45

81.6800 84.5600 89.4200 89.6000 90.1400 90.6800 91.2200 91.2200 94.1000

94.1000 90.8600 88.5200 85.6400 84.2000 83.6600

Columns 46 through 48

83.1200 82.7600 82.5800

q =

Columns 1 through 15

72.5000 80.9000 82.2000 83.2000 81.2000 83.2000 82.3000 75.6000 71.4000

63.6000 56.6000 56.6000 55.5000 46.5000 48.8000

Columns 16 through 30

52.7000 61.8000 67.4000 74.3000 71.9000 74.7000 76.4000 77.7000 79.5000

82.0000 82.6000 82.6000 83.1000 82.2000 83.9000

Columns 31 through 45

84.2000 77.2000 66.3000 66.2000 61.7000 60.4000 53.6000 52.0000 46.5000

49.1000 61.3000 68.2000 71.4000 74.3000 77.5000

Columns 46 through 48

79.2000 79.8000 80.6000

>> scatter (p,q,'+','g')

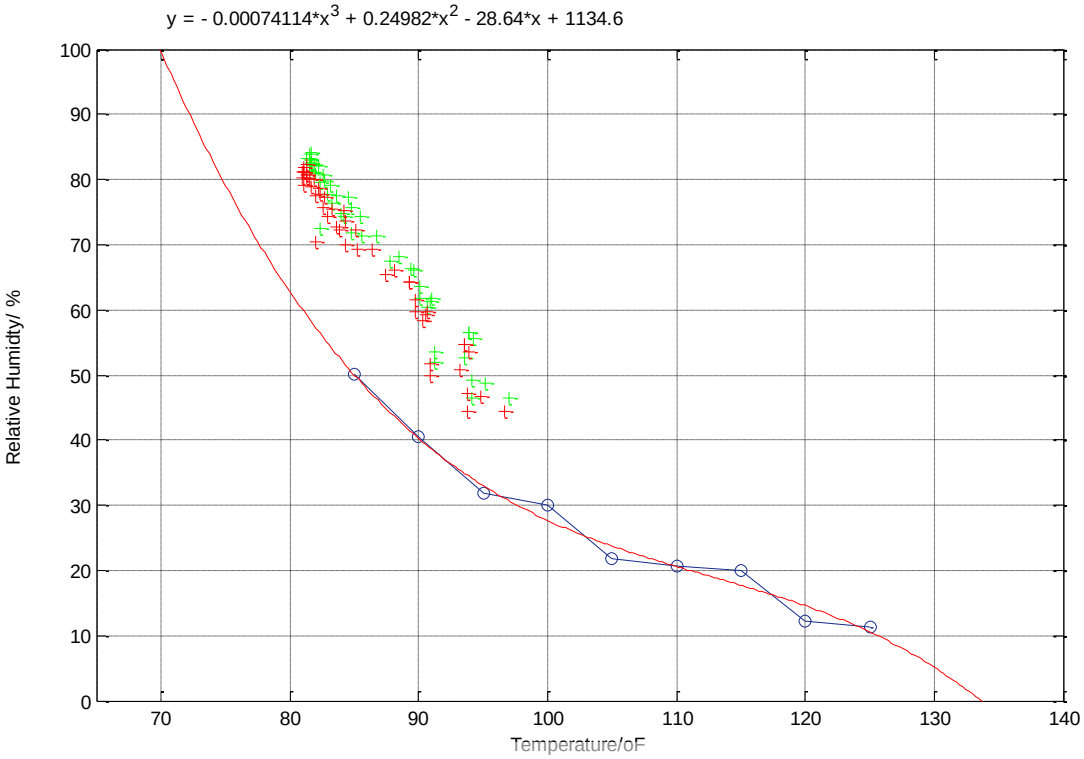


Figure 1: Scatter plot of measured temperature and RH points with permissible value of the instrument using Matlab software

Appendix D: Psychrometric chart enthalpy calculations

(For 28^{o}C and 72.5 % RH**)**

Appendix E: Psychrometric chart cooling load calculations

(For 25^{o}C and 30 % RH and 34.4^{o}C and 56.6 % RH**)**

Appendix F: Hot water chiller performance data

NOTE: Extracted from Model Selection and Design manual of Broad Central Air Conditioning (Absorption LiBr+H2O), Broad X Non- Electric Chiller

Packaged Single-stage Steam/Hot W./Exhaust Chiller Performance Data BDSY/BDHY/BDEY: steam/hot water/exhaust

(pumpset, enclosure data are the same as steam chiller)

Code	Model	Cooling capacity	Chilled W		Cooling W		Steam consump.	Hot water consu-mp.	Exhaust consu-mp.	Exhaust consu-mp.	Solution wt.	Unit ship. wt.	Main shell ship. wt.	Chiller operation weight
			Flowrate	Pressure drop	Flowrate	Pressure drop								
		kW	m^3/h	kPa	m^3/h	kPa	kg/h	m^3/h	kg/h	kW	t	t	t	t
Single-stage steam chiller BDS steam 0.1MPa	20	233	28.6	30	64.7	50	456	/	/	2.5	0.7	3.5	/	4
	30	349	42.9	30	97.1	50	688	/	/	2.5	0.8	4.5	/	5.1
	50	582	71.4	30	162	50	1146	/	/	2.5	1.7	6.5	/	7
	75	872	107	30	243	60	1714	/	/	5.3	2.2	8.5	/	9.5
	100	1163	143	30	324	60	2288	/	/	5.7	2.4	10.5	/	11.5
	125	1454	179	30	405	60	2863	/	/	5.7	3.2	12.5	/	14
	150	1745	214	40	486	60	3438	/	/	5.7	3.5	14	/	16
	200	2326	286	40	647	60	4581	/	/	8.6	5.5	20	/	22
	250	2908	357	50	809	70	5728	/	/	10.1	6.0	23.5	/	26
	300	3489	429	50	971	70	6876	/	/	10.1	8.2	28	/	31
	400	4652	571	50	1295	70	8167	/	/	13.9	8.9	32	/	37
	500	5815	714	60	1618	90	11465	/	/	13.8	11.7	/	27	44
	600	6978	857	60	1942	90	12567	/	/	17.5	14.5	/	29	49
Single-stage hot water chiller BDH hot water 98°C	20	205	25.2	25	59.5	50	/	24.4	/	2.5	0.7	3.5	/	4
	30	307	37.6	25	87.3	50	/	36	/	2.5	0.8	4.5	/	5.1
	50	512	62.9	25	146	50	/	60	/	2.5	1.7	6.5	/	7
	75	767	94.2	25	218	60	/	90	/	5.3	2.2	8.5	/	9.5
	100	1023	125	25	291	60	/	120	/	5.7	2.4	10.5	/	11.5
	125	1279	157	25	364	60	/	150	/	5.7	3.2	12.5	/	14
	150	1535	188	30	437	60	/	180	/	5.7	3.5	14	/	16
	200	2046	251	30	582	70	/	240	/	8.6	5.5	20	/	22
	250	2558	313	40	728	70	/	300	/	10.1	6.0	23.5	/	26
	300	3069	376	40	873	70	/	361	/	10.1	8.2	28	/	31
	400	4092	503	40	1164	70	/	481	/	13.9	8.9	33	/	37
	500	5115	628	50	1455	90	/	601	/	13.8	11.7	/	28	44
	600	6138	754	50	1746	90	/	722	/	17.5	14.5	/	30	50
Single-stage exhaust chiller BDE exhaust 300°C	20	233	28.6	30	64.7	50	/	/	5621	2.5	0.8	4	/	4.4
	30	349	42.9	30	97.1	50	/	/	8474	2.5	1.2	5	/	5.5
	50	582	71.4	30	162	50	/	/	14128	2.5	2.1	7	/	7.6
	75	872	107	30	243	60	/	/	21138	5.3	2.5	9	/	10
	100	1163	143	30	324	60	/	/	28218	5.7	2.8	11	/	12.5

Appendix G: Steam chiller performance data

NOTE: Extracted from Model Selection and Design manual of Broad Central Air Conditioning (Absorption LiBr+H2O), Broad X Non- Electric Chiller

Steam Chiller Performance Data

BSY: Steam from power generation or industrial waste streams

Mode	BS	20	30	50	75	100	125	150	200	250	300	400	500	600	800	1000
Cooling capacity	kW	233	349	582	872	1163	1454	1745	2326	2908	3489	4652	5815	6978	9304	11630
	10^4kcal/h	20	30	50	75	100	125	150	200	250	300	400	500	600	800	1000
Chilled W																
Flowrate	m^3/h	28.6	42.9	71.4	107	143	179	214	286	357	429	571	714	857	1143	1429
Pressure drop	kPa	30	30	30	30	30	30	40	40	50	50	50	60	60	60	60
cooling W																
Flowrate	m^3/h	48.8	72.3	122	183	244	305	366	488	610	733	977	1221	1465	1953	2442
Pressure drop	kPa	50	50	50	50	50	50	50	50	60	60	60	70	70	70	70
Steam consumption	kg/h	248	372	619	931	1240	1553	1866	2486	3112	3734	4983	6227	7473	9967	12455
Power demand	kW	1.7	3.2	4.3	4.6	6.8	6.8	6.8	10.2	10.2	11.7	13.2	17.7	20.7	25.9	34.9
Solution weight	t	0.8	1.1	1.9	2.6	3.0	4.1	4.6	6.7	7.5	9.9	11.2	14.6	17.5	22.7	28.2
Unit ship. wt	t	4	5.9	7.5	9	11.5	14	16	21	26	/	/	/	/	/	/
Main shell ship. wt	t	2.5	3.4	4.5	5	6.5	7.5	8.5	11	13	15	20	24	28	29	30
Operation weight	t	4.5	6.6	8.5	10	13	16	18	24	30	35	43	54	63	75	85

Packaged Steam Chiller Performance Data

Mode		BSY	20	30	50	75	100	125	150	200	250	300	400	500	600	800	1000
Cooling capacity		kW	233	349	582	872	1163	1454	1745	2326	2908	3489	4652	5815	6978	9304	11630
Pumpset	chilled/heating W.pump																
	external head	mH_2O	22	22	22	24	24	27	27	27	28	28	28	32	32	32	32
	power demand	kW	4	7.5	7.5	15	15	22	30	37	44	60	60	110	110	150	180
	cooling W.pump																
	external head	mH_2O	10	10	10	15	15	15	15	15	16	16	16	17	17	17	17
	power demand	kW	3	7.5	7.5	15	15	22	22	37	44	44	60	90	110	150	180
	total power demand	kW	7	15	15	30	30	44	52	74	88	104	120	200	220	300	360
	operation weight	t	0.5	0.7	0.8	3.3	3.3	3.6	3.7	6.3	6.6	7.2	8.8	5.9/8.6	6.1/8.8	6.1/9.8	9.6/9.8
Cooling tower	power demand	kW	5.5	11	11	11	15	15	15	22	37	37	37	55.5	74	74	92.5
	operation weight	t	2.5	4.5	5.1	5.9	7.6	14.3	14.3	19	23.4	23.4	28.7	35.1	46.7	57.4	71.8
Enclosure	ventilation power demand	kW	0.3	0.3	0.3	1.0	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	3.0	3.0	3.0
	weight	t	0.5	0.7	0.8	3.4	3.4	3.9	3.9	5.2	5.6	6.3	6.8	11.0	11.5	14.5	15.5
Electricity and water consumption	total power demand	kW	14.5	30.6	30.6	46.6	53.3	67.3	75.3	107.7	137.2	154.7	172.2	275.2	317.7	402.9	490.4
	water demand for cooling	t/h	0.6	0.9	1.5	2.0	3.0	3.8	4.5	6.0	7.5	9	12	15	18	24	30

Appendix H: Chiller performance data and prices

NOTE: Extracted from Model Selection & Design Manual of Broad X Absorption Chiller.

HTG Enlarged Models Performance Data & Price

Fuels: natural gas, biogas, diesel or gas/oil

Model		BYZ	20	50	75	100	125	150	200	250	300	400	500	600	800	1000
chiller	cooling capacity	kW	233	582	872	1163	1454	1745	2326	2908	3489	4652	5815	6978	9304	11630
		10^4kcal/h	20	50	75	100	125	150	200	250	300	400	500	600	800	1000
	heating capacity	kW	179	449	672	897	1121	1349	1791	2245	2687	3582	4489	5385	7176	8967
	hot water capacity	kW	80	200	300	400	500	600	800	1000	1200	1600	/	/	/	/
	chilled water															
	flow rate	m^3/h	28.5	71.3	107	142	178	214	285	356	427	570	712	854	1139	1429
	pressure drop	kPa	30	30	30	30	30	40	40	50	50	50	60	60	60	60
	cooling water															
	flow rate	m^3/h	48	120	180	240	300	360	480	600	720	960	1200	1440	1920	2400
	pressure drop	kPa	50	50	50	50	50	50	50	60	60	60	70	70	70	70
	chilled/heating water															
	flow rate	m^3/h	15.3	38.5	57.9	77.1	96.4	116	154	193	231	309	386	463	617	771
	pressure drop	kPa	20	20	20	20	20	20	30	30	40	40	50	50	60	60
	hot water															
	flow rate	m^3/h	3.4	8.6	12.9	17.2	21.5	25.8	34.4	43.0	51.6	68.8	/	/	/	/
	pressure drop	kPa	20	20	20	20	20	20	30	30	40	40	/	/	/	/
	nature gas consumption															
	cooling	m^3/h	17.1	42.7	64.1	85.5	107	128	171	214	257	342	427	513	684	855
	heating	m^3/h	19.4	48.5	72.6	97	121	146	194	243	290	387	485	582	776	970
	hot water	m^3/h	8.8	22	33	44	55	66	88	110	132	176	/	/	/	/
	power demand	kW	2.5	5.8	6.6	9.8	9.8	11.6	16.7	16.7	21.7	25.2	31.9	40.7	49.9	63.3
	solution weight	t	1.1	2.6	3.25	3.9	4.9	5.6	8	9	11.7	13.5	17	21.6	28.7	34.7
	unit ship. wt.	t	4	7.1	9	11.2	13.8	16.4	19.2	23.6	/	/	/	/	/	/
	main shell ship. wt.	t	/	/	5.4	7	8.3	9.2	12	14.5	16.3	21.3	25.9	29.9	38.3	37.5
	operation weight	t	5.2	9.8	12.8	17.1	19.4	22.0	29.9	35.5	42.4	52.9	63.4	76.5	97.1	113.2
pump set	chilled water pump															
	external head	mH_2O	19	19	20	20	22	22	22	22	22	22	26	26	26	26
	power demand	kW	4	11	15	15	22	30	37	44	60	60	110	110	150	180
	cooling water pump															
	external head	mH_2O	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	power demand	kW	3	7.5	15	15	22	22	37	44	44	60	90	110	150	180
	hot water pump															
	external head	mH_2O	10	10	12	12	12	12	12	12	12	12	/	/	/	/
	power demand	kW	0.39	0.58	2.2	3	3	4.4	4.4	4.4	6	6	/	/	/	/
	operation weight	t	9	14.3	3.8	3.8	4.2	4.3	7.1	7.4	8.1	9.7	5.9/8.6	6.1/8.6	6.1/9.8	9.6/9.8
	pump set power demand	kW	7.39	19.08	32.2	33	47	56.4	78.4	92.4	110	126	200	220	300	360
cooling tower	cooling tower power demand	kW	5.5	11	11	15	15	15	22	37	37	44	55.5	74	88	110
	operation weight	t	/	5.1	5.7	7.3	12.3	12.3	14.6	20.2	20.2	24.2	30.3	40.4	48.4	60.4
machine room	lighting, ventilation power demand	kW	0.3	0.3	1.0	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	3.0	3.0	3.0
	weight	t	/	/	5.6	5.6	6.5	6.5	8.6	9.4	10.5	11.4	18.4	19.2	24.2	25.8
electricity consumption of water distribution system	total power demand	kW	15.7	36.2	50.3	59.3	73.3	84.5	118.6	148.1	170.7	197.2	289.4	337.7	440.9	536.3
	electricity consumption for cooling	kW	15.3	35.6	49.6	56.3	72.1	81.8	118.8	148.3	167.8	195.6	291.6	343.9	449	540
	electricity consumption for heating	kW	5	12.8	19	19.5	28.3	38	48.5	56	74	76.2	126	137	182	212
	electricity consumption for hot water	kW	1.4	2.4	6.2	7.5	9.3	12.4	15.9	16.4	20	22.2	/	/	/	/
	waterconsumption(cooling)	t/h	0.6	1.5	2	3	3.8	4.5	6	7.5	9	12	15	18	24	30
price	chiller	Euro1,000	76	153	189	221	258	286	356	410	469	576	670	758	964	1164
	pump set	Euro1,000	19	26	44	60	71	81	108	128	144	170	203	238	295	345
	cooling tower	Euro1,000	9	15	/	/	/	/	/	/	/	/	/	/	/	/
	machine room	Euro1,000	3	4	11	11	15	15	18	23	23	23	35	35	45	51
	total	Euro1,000	107	198	244	292	344	382	482	561	636	769	908	1031	1304	1560