Appendix A:

Original Rooftop Unit Complete Schedule:

General Description					Fan Section				Heating Section		Cooling Section		
Unit	Area Served	Fuel	Energy Used (MBh)	Weight (lb)	Total Air (cfm)	Outside Air (cfm)	Static Pressure (" H20)	Motor H.P.	Output (MBh)	Efficiency (%)	Sensible (MBh)	Total (MBh)	Temperature Leaving Unit (F)
RTU-1	Reception	N. Gas	250	2200	5000	500	1.0	3.0	203	81	119.5	162.0	58.6
RTU-2	Kid's Club	N. Gas	250	2200	5000	700	1.0	3.0	203	81	102.0	145.8	58.6
RTU-3	Pool	N. Gas	500	5100	10500	3500	1.2	7.5	400	80	223.3	302.4	58.0
RTU-4	Lockers	N. Gas	350	2400	8300	3350	1.0	7.5	284	81	136.0	168.1	60.5
RTU-5	Basketball	N. Gas	250	2500	7500	750	1.0	5.0	203	81	159.8	226.5	58.3
RTU-6	Free Weights	N. Gas	250	2400	6000	750	1.0	3.0	203	81	133.8	199.2	55.2
RTU-7	Aerobics	N. Gas	500	4000	10000	1000	1.0	7.5	400	80	220.3	319.5	56.5
RTU-8	Racquetball	N. Gas	150	1700	4000	500	1.0	3.0	122	81	79.0	118.6	57.6
RTU-9	Cardio	N. Gas	400	2600	6600	1675	1.0	5.0	324	81	161.5	250.1	56.9
RTU-10	Cardio	N. Gas	400	2600	6600	1675	1.0	5.0	324	81	161.5	250.1	56.9
RTU-11	Lower Stairs	N. Gas	250	2300	5500	750	1.0	3.0	203	81	120.0	172.0	57.1
RTU-12	Spinning	N. Gas	150	1700	3500	500	1.0	3.0	122	81	80.8	117.8	57.7
RTU-13	Mezzanine	N. Gas	250	2400	5900	750	1.0	3.0	203	81	133.8	199.2	55.2

Packaged Cooling & Gas/Electric Rooftops

Voyager™
12½ – 25 Tons — 60 Hz

Packaged Cooling (TC)*

Packaged Gas/Electric (YC)*

August 2005

RT-PRC024-EN

Performance Data (12½, 15 Ton) Standard Efficiency

Table PD-1 — Gross Cooling Capacities (MBH) 12½ Ton Three Phase T/YC*150D3, D4, DW, DK

		Ambient Temperature																					
		85						95						105						115			
	Enter Dry	Entering Wet Bulb																					
CFM	Bulb	61		67		73		61		67		73		61		67		73		61		67		73	
Airflow	(F)	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC
4500	75	135.0	108.0	153.0	86.0	162.0	59.3	126.0	103.0	146.0	82.0	158.0	56.7	116.0	98.2	138.0	77.7	152.0	53.8	106.0	93.1	127.0	80.0	145.0	50.5
	80	136.0	128.0	154.0	105.0	163.0	79.5	127.0	123.0	147.0	101.0	159.0	76.5	117.0	117.0	138.0	97.0	153.0	73.2	110.0	110.0	128.0	92.2	145.0	69.6
	85	142.0	142.0	154.0	123.0	164.0	95.9	135.0	135.0	147.0	120.0	159.0	94.2	127.0	127.0	138.0	116.0	153.0	91.7	120.0	120.0	128.0	111.0	146.0	88.5
	90	150.0	150.0	155.0	142.0	166.0	112.0	144.0	144.0	148.0	139.0	161.0	111.0	137.0	137.0	139.0	136.0	154.0	109.0	130.0	130.0	130.0	130.0	146.0	107.0
5000	75	139.0	114.0	155.0	89.8	163.0	60.4	129.0	109.0	149.0	85.4	159.0	57.9	120.0	104.0	141.0	89.5	154.0	55.0	109.0	98.9	131.0	85.1	147.0	51.6
	80	140.0	136.0	156.0	109.0	164.0	81.3	130.0	130.0	149.0	106.0	160.0	79.1	123.0	123.0	141.0	102.0	155.0	75.8	115.0	115.0	131.0	97.5	147.0	72.2
	85	147.0	147.0	157.0	129.0	166.0	98.2	141.0	141.0	150.0	126.0	161.0	96.8	133.0	133.0	141.0	123.0	155.0	94.8	125.0	125.0	131.0	118.0	148.0	91.9
	90	155.0	155.0	158.0	148.0	167.0	115.0	149.0	149.0	151.0	147.0	163.0	115.0	143.0	143.0	143.0	143.0	157.0	114.0	135.0	135.0	135.0	135.0	149.0	111.0
5500	75	142.0	120.0	157.0	91.3	164.0	61.5	132.0	115.0	151.0	88.8	160.0	59.0	122.0	110.0	143.0	84.2	155.0	56.1	112.0	104.0	133.0	89.9	148.0	52.9
	80	143.0	143.0	158.0	112.0	165.0	82.0	135.0	135.0	152.0	110.0	161.0	80.4	127.0	127.0	143.0	107.0	156.0	78.3	119.0	119.0	134.0	102.0	149.0	74.7
	85	152.0	152.0	159.0	133.0	167.0	99.9	145.0	145.0	152.0	132.0	163.0	99.1	138.0	138.0	144.0	129.0	157.0	97.4	130.0	130.0	134.0	125.0	150.0	95.0
	90	159.0	159.0	160.0	154.0	169.0	118.0	153.0	153.0	153.0	153.0	164.0	118.0	147.0	147.0	147.0	147.0	158.0	117.0	140.0	140.0	140.0	140.0	151.0	116.0
6000	75	145.0	125.0	158.0	93.3	165.0	62.5	135.0	120.0	153.0	91.2	161.0	60.1	125.0	115.0	145.0	87.3	156.0	57.2	115.0	110.0	136.0	82.8	149.0	54.0
	80	147.0	147.0	159.0	115.0	166.0	82.9	140.0	140.0	153.0	114.0	162.0	81.7	132.0	132.0	145.0	111.0	157.0	79.3	123.0	123.0	136.0	107.0	150.0	76.5
	85	155.0	155.0	161.0	137.0	168.0	101.1	149.0	149.0	154.0	137.0	164.0	101.0	142.0	142.0	146.0	135.0	158.0	99.8	134.0	134.0	137.0	131.0	151.0	97.8
	90	161.0	161.0	162.0	159.0	170.0	120.0	156.0	156.0	156.0	156.0	166.0	121.0	150.0	150.0	150.0	150.0	160.0	121.0	143.0	143.0	143.0	143.0	152.0	119.0

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain **NET** cooling capacity subtract indoor fan heat. For indoor fan heat formula, refer to appropriate airflow table notes.
2. MBH = Total Gross Cooling Capacity
3. SHC = Sensible Heat Capacity

Table PD-2 — Gross Cooling Capacities (MBH) 15 Ton Three Phase T/YC*180B3, B4, BW, BK

		Ambient Temperature																					
		85						95						105						115			
	Enter. Dry	Entering Wet Bulb																					
CFM	Bulb	61		67		73		61		67		73		61		67		73		61		67		73	
Airflow	(F)	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC	MBH	SHC
5400	75	168.0	133.0	188.0	106.0	198.0	73.0	157.0	128.0	181.0	101.0	194.0	70.4	147.0	122.0	172.0	97.0	187.0	67.3	137.0	117.0	162.0	92.1	179.0	63.2
	80	168.0	156.0	188.0	128.0	199.0	97.3	155.0	155.0	181.0	125.0	195.0	94.3	149.0	143.0	172.0	120.0	188.0	90.8	140.0	137.0	162.0	115.0	179.0	86.7
	85	174.0	174.0	189.0	150.0	200.0	117.0	166.0	166.0	182.0	147.0	196.0	115.0	158.0	158.0	172.0	143.0	189.0	113.0	150.0	150.0	162.0	138.0	180.0	110.0
	90	184.0	184.0	190.0	172.0	202.0	136.0	177.0	177.0	183.0	170.0	197.0	135.0	170.0	170.0	170.0	170.0	190.0	133.0	162.0	162.0	165.0	157.0	181.0	131.0
6000	75	172.0	140.0	190.0	110.0	199.0	74.3	161.0	134.0	184.0	106.0	195.0	71.7	151.0	129.0	175.0	101.0	189.0	68.7	140.0	124.0	165.0	96.1	181.0	64.9
	80	169.0	169.0	191.0	133.0	200.0	99.4	164.0	157.0	184.0	130.0	196.0	97.2	155.0	151.0	176.0	126.0	190.0	93.8	145.0	145.0	165.0	121.0	182.0	89.9
	85	181.0	181.0	192.0	156.0	202.0	119.0	173.0	173.0	185.0	154.0	198.0	118.0	165.0	165.0	176.0	151.0	191.0	116.0	157.0	157.0	166.0	146.0	183.0	113.0
	90	189.0	189.0	193.0	179.0	204.0	140.0	183.0	183.0	183.0	183.0	199.0	139.0	176.0	176.0	178.0	171.0	193.0	138.0	168.0	168.0	170.0	166.0	184.0	136.0
6600	75	176.0	147.0	192.0	112.0	200.0	75.5	165.0	141.0	186.0	110.0	196.0	73.0	154.0	136.0	178.0	105.0	190.0	69.8	144.0	130.0	168.0	99.8	182.0	66.1
	80	178.0	171.0	193.0	136.0	201.0	101.0	169.0	165.0	187.0	135.0	197.0	98.8	160.0	159.0	178.0	131.0	191.0	96.1	150.0	150.0	168.0	127.0	183.0	92.6
	85	185.0	185.0	194.0	161.0	203.0	122.0	179.0	179.0	188.0	160.0	199.0	121.0	171.0	171.0	179.0	158.0	193.0	119.0	163.0	163.0	169.0	153.0	185.0	116.0
	90	193.0	193.0	193.0	193.0	205.0	143.0	188.0	188.0	188.0	188.0	201.0	143.0	181.0	181.0	182.0	178.0	195.0	142.0	173.0	173.0	174.0	174.0	186.0	140.0
7200	75	179.0	152.0	194.0	114.0	201.0	76.7	168.0	147.0	188.0	112.0	197.0	74.2	158.0	142.0	180.0	109.0	191.0	71.0	142.0	142.0	170.0	103.0	183.0	67.2
	80	182.0	177.0	195.0	140.0	202.0	103.0	173.0	172.0	189.0	139.0	198.0	100.0	164.0	164.0	181.0	136.0	192.0	97.6	155.0	155.0	171.0	132.0	184.0	94.4
	85	189.0	189.0	196.0	166.0	204.0	125.0	183.0	183.0	190.0	166.0	200.0	123.0	176.0	176.0	182.0	164.0	194.0	121.0	167.0	167.0	167.0	167.0	186.0	119.0
	90	197.0	197.0	197.0	197.0	206.0	146.0	192.0	192.0	193.0	187.0	202.0	146.0	185.0	185.0	186.0	184.0	196.0	146.0	177.0	177.0	177.0	177.0	188.0	144.0

Notes:
1. All capacities shown are gross and have not considered indoor fan heat. To obtain **NET** cooling capacity subtract indoor fan heat. For indoor fan heat formula, refer to appropriate airflow table notes.
2. MBH = Total Gross Capacity
3. SHC = Sensible Heat Capacity

*Indicates both downflow and horizontal units.

Dimensional Data (12½ Ton) High Efficiency (12½, 15, 17½ Ton) Standard Efficiency

Figure DD-1 — Cooling with Optional Electric Heat & Gas/Electric — 12½-17½ Tons Standard Efficiency, 12½ Ton High Efficiency

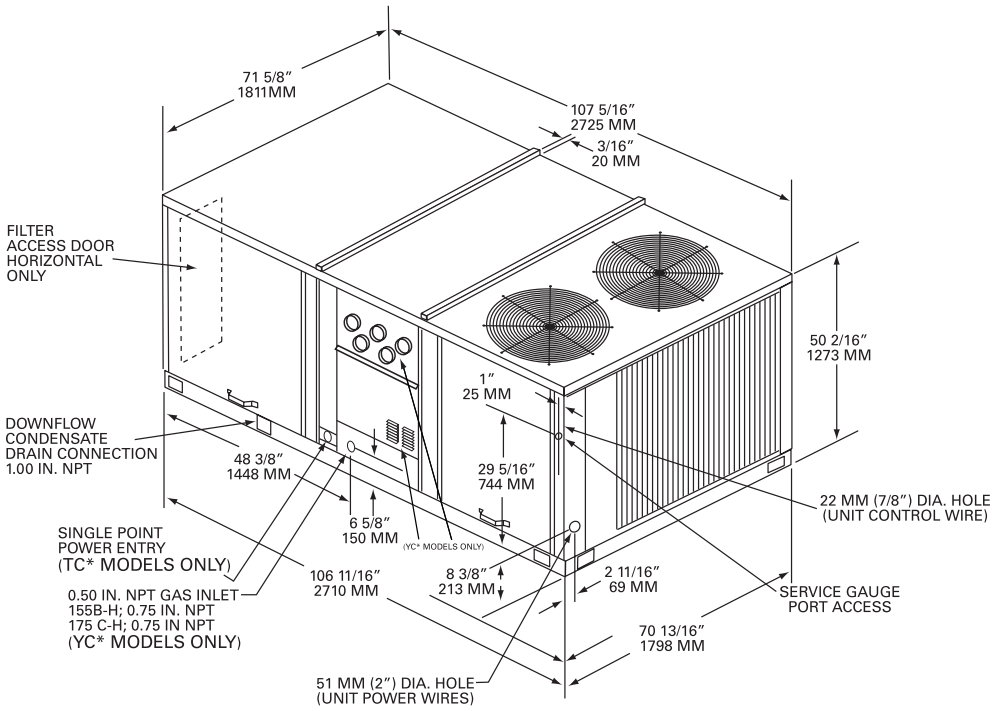
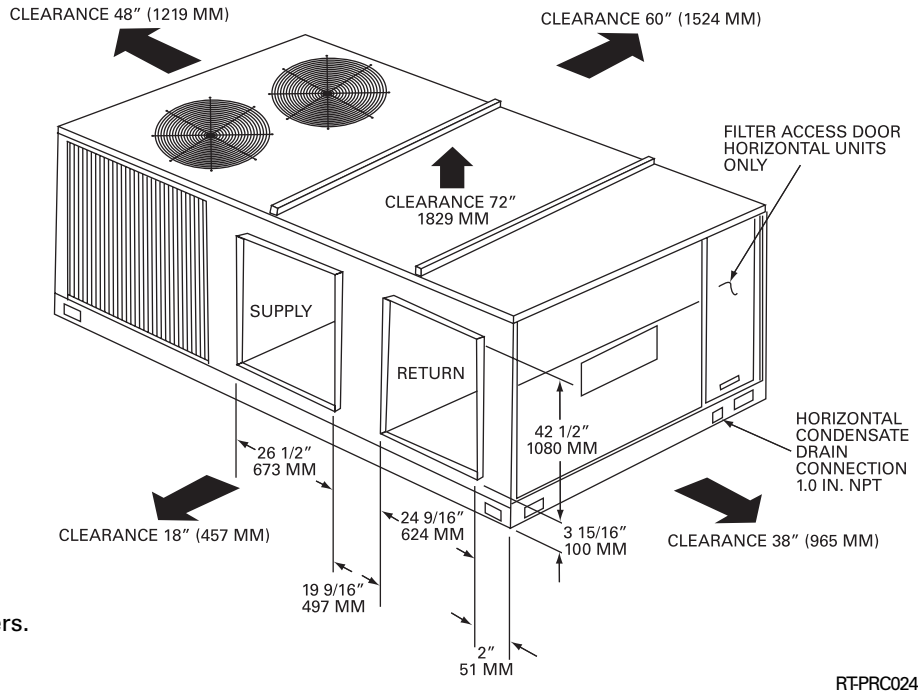


Figure DD-2 — Cooling with Optional Electric Heat & Gas/Electric — 12½-17½ Tons Standard Efficiency 12½ Ton High Efficiency — Downflow Unit Clearance



All dimensions are in inches/millimeters.

Figure DD-3 — Cooling with Optional Electric Heat & Gas/Electric — 12½-17½ Tons Standard Efficiency, 12½ Ton High Efficiency Roof Curb

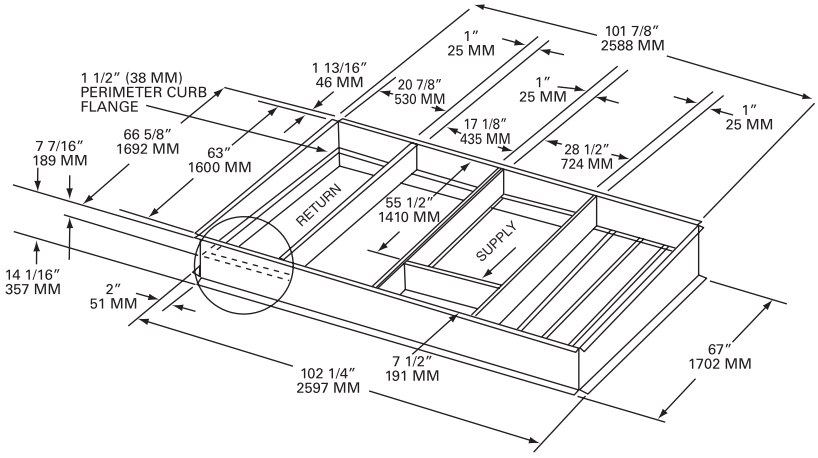


Figure DD-4 — Cooling with Optional Electric Heat & Gas/Electric — 12½-17½ Tons Standard Efficiency, 12½ Ton High Efficiency Downflow Duct Connections — Field Fabricated

Note: Duct flanges mount 7-7/16" down inside the curb on the 1-1/2" curb flanges. Roofcurb is intended for downflow use only.

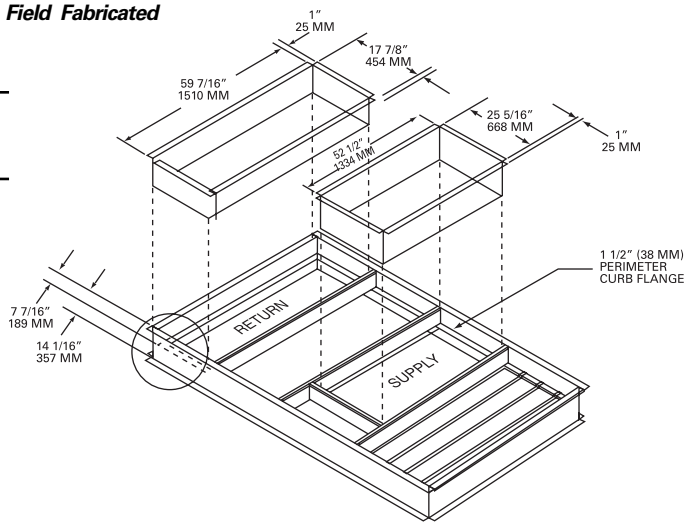
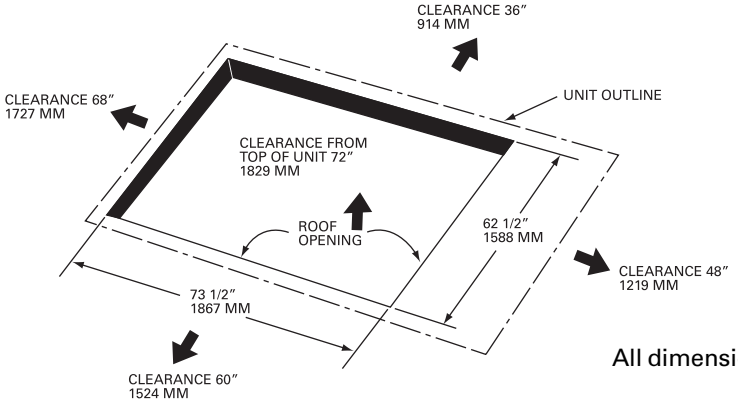


Figure DD-5 — Cooling with Optional Electric Heat & Gas/Electric — 12½-17½ Tons Standard Efficiency, 12½ Ton High Efficiency Horizontal Unit Supply/Return and Unit Clearance



All dimensions are in inches/millimeters.

Appendix B:

Pool Evaporation Equations Used for Section 3.3.1

2003 ASHRAE Handbook of HVAC Application Complete Evaporatoin Equation

$$w_p = \frac{A}{Y} \cdot (p_w - p_a) \cdot (95 + 0.425 \cdot V)$$

w_p = evaporation of water, lb/h

A = area of pool surface, ft^2

V = air velocity over water surface, fpm

Y = latent heat required to change water to vapor at surface water temperature, Btu/lb

p_a = saturatoin pressure at room air dew point, in. Hg

p_w = saturation vapor pressure taken at surface water temperature, in. Hg

2003 ASHRAE Handbook of HVAC Application Shortened Equation

Assuming Y = 1000 Btu/lb and V ranging from 10-30 fpm

$$w_p = 0.1 \cdot A \cdot (p_w - p_a) \cdot F_a$$

F_a = 1.0 for public use

Values used in equation:

p_w = 1.1025 in. Hg
p_a = 0.645 in. Hg
A = 2250 ft^2

TRANE®

Series R™ Helical Rotary Liquid Chillers

Model RTHD
175-450 Tons (60 Hz)
125-450 Tons (50 Hz)

Built for Industrial and Commercial Applications

August 2004

RLC-PRC020-EN

General Data

Nominal Data

Nominal Compressor	B1	B2	C1	C2	D1	D2	D3	E3
Tonnage (60 Hz)	175-200	200-225	225-275	275-325	325-400	375-450	N/A	N/A
Tonnage (50 Hz)	125-150	150-175	175-225	225-275	275-325	300-350	325-375	375-450

Notes:
1. Chiller selections can be optimized through the use of the ARI-Certified Series R selection program and by contacting your local Trane sales office.

General Data

Compressor Code	Evaporator Code	Condenser Code	Evaporator Water Storage Gallons	Evaporator Water Storage Liters	Condenser Water Storage Gallons	Condenser Water Storage Liters	Refrigerant Type	Refrigerant Charge lb	Refrigerant Charge kg
B1	B1	B1	41	155	28	106	HFC-134a	410	186
B1	C1	D1	55	208	31	117	HFC-134a	490	222
B2	B2	B2	45	170	29	110	HFC-134a	410	186
B2	C2	D2	58	220	34	129	HFC-134a	490	222
C1	D6	E5	45	170	29	110	HFC-134a	490	222
C1	D5	E4	52	197	32	121	HFC-134a	490	222
C1	E1	F1	82	310	60	226	HFC-134a	525	238
C2	D4	E4	52	197	32	121	HFC-134a	490	222
C2	D3	E3	78	295	47	178	HFC-134a	490	222
C2	F2	F3	107	405	61	231	HFC-134a	625	284
D1	D1	E1	69	261	44	166	HFC-134a	475	216
D1	F1	F2	102	386	57	216	HFC-134a	625	284
D1	G2	G2	144	545	91	344	HFC-134a	700	318
D2/D3	D2	E2	74	280	47	178	HFC-134a	475	216
D2/D3	F2	F3	107	405	61	231	HFC-134a	625	284
D2/D3	G3	G3	159	602	97	367	HFC-134a	700	318
E3	D2	E2	74	280	47	178	HFC-134a	475	216
E3	F2	F3	107	405	61	231	HFC-134a	625	284
E3	G3	G3	159	602	97	367	HFC-134a	700	318

General Data Water Flow Rates

Minimum/Maximum Evaporator Flow Rates (Gallons/Minute)

Evaporator Code	Two Pass			Three Pass			Four Pass		
	Min	Max	Nominal Conn Size (In.)	Min	Max	Nominal Conn Size (In.)	Min	Max	Nominal Conn Size (In.)
B1	253	1104	8	168	736	6	—	—	—
B2	288	1266	8	192	844	6	—	—	—
C1	320	1412	8	213	941	6	—	—	—
C2	347	1531	8	232	1022	6	—	—	—
D1	415	1812	8	275	1206	8	—	—	—
D2	450	1980	8	300	1320	8	—	—	—
D3	486	2131	8	324	1417	8	—	—	—
D4	351	1542	8	234	1028	8	—	—	—
D5	351	1542	8	234	1028	8	—	—	—
D6	293	1287	8	196	860	8	—	—	—
E1	450	1980	8	300	1320	8	—	—	—
F1	563	2478	10	376	1655	8	—	—	—
F2	604	2667	10	404	1780	8	—	—	—
G1	—	—	—	505	2218	10	379	1666	8
G2	—	—	—	550	2413	10	411	1807	8
G3	—	—	—	622	2732	10	466	2050	8

Notes:
1. Minimum flow rates are based on **water only**.
2. All water connections are grooved pipe.

Minimum/Maximum Evaporator Flow Rates (Liters/Second)

Evaporator Code	Two Pass			Three Pass			Four Pass		
	Min	Max	Nominal Conn Size (mm)	Min	Max	Nominal Conn Size (mm)	Min	Max	Nominal Conn Size (mm)
B1	16	70	200	11	46	150	—	—	—
B2	18	80	200	12	53	150	—	—	—
C1	20	89	200	13	59	150	—	—	—
C2	22	97	200	15	65	150	—	—	—
D1	26	114	200	17	76	200	—	—	—
D2	28	125	200	19	83	200	—	—	—
D3	31	134	200	20	89	200	—	—	—
D4	22	97	200	15	65	200	—	—	—
D5	22	97	200	15	65	200	—	—	—
D6	18	81	200	12	54	200	—	—	—
E1	28	125	200	19	83	200	—	—	—
F1	36	156	250	24	104	200	—	—	—
F2	38	168	250	25	112	200	—	—	—
G1	—	—	—	32	140	250	24	105	200
G2	—	—	—	35	152	250	26	114	200
G3	—	—	—	39	172	250	29	129	200

Notes:
1. Minimum flow rates are based on **water only**.
2. All water connections are grooved pipe.

Minimum/Maximum Condenser Flow Rates (Gallons/Minute)

Condenser Code	Two Pass		
	Min	Max	Nominal Conn Size (In.)
B1	193	850	6
B2	212	935	6
D1	193	850	6
D2	212	935	6
E1	291	1280	8
E2	316	1390	8
E3	325	1420	8
E4	245	1080	8
E5	206	910	8
F1	375	1650	8
F2	355	1560	8
F3	385	1700	8
G1	444	1960	8
G2	535	2360	8
G3	589	2600	8

Notes:
1. Minimum flow rates are based on **water only**.
2. All water connections are grooved pipe.

Minimum/Maximum Condenser Flow Rates (Liters/Second)

Condenser Code	Two Pass		
	Min	Max	Nominal Conn Size (mm)
B1	12	54	150
B2	13	59	150
D1	12	54	150
D2	13	59	150
E1	18	81	200
E2	20	88	200
E3	21	90	200
E4	15	68	200
E5	13	57	200
F1	24	104	200
F2	22	98	200
F3	24	107	200
G1	28	124	200
G2	34	149	200
G3	37	164	200

Notes:
1. Minimum flow rates are based on **water only**.
2. All water connections are grooved pipe.

Marley UPDATE™ Version 4.7.0
Product Data: 3/22/2006

3/31/2006 8:09:20 AM

Job Information

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Fax 717-796-9717

Cooling Tower Definition

Manufacturer	Marley	Fan Motor Speed	1200 rpm
Product	NC Class	Fan Motor Capacity per cell	20.00 BHp
Model	NC8305FL1	Fan Motor Output per cell	20.00 BHp
Cells	1	Fan Motor Output total	20.00 BHp
CTI Certified	No	Air Flow per cell	114400 cfm
Fan	8.000 ft, 8 Blades	Air Flow total	114400 cfm
Fan Speed	313 rpm, 7866.5 fpm	ASHRAE 90.1 Performance	72.6 gpm/Hp
Fans per cell	1		

Sound Pressure Level 75 dBA/Cell, 5.000 ft from Air Inlet Face. See sound report for details.

Conditions

Tower Water Flow	935.0 gpm	Air Density In	0.07056 lb/ft³
Hot Water Temperature	95.00 °F	Air Density Out	0.07109 lb/ft³
Range	10.00 °F	Humidity Ratio In	0.01855
Cold Water Temperature	85.00 °F	Humidity Ratio Out	0.02979
Approach	4.90 °F	Wet-Bulb Temp. Out	88.61 °F
Wet-Bulb Temperature	80.10 °F	Estimated Evaporation	10.7 gpm
Relative Humidity	50 %	Total Heat Rejection	4658600 Btu/h

- This selection meets your design conditions.
- The performance for this selection is not guaranteed because the approach is less than 5 °F.
- This selection is not CTI Certified because: the approach is less than 5 °F.

Weights & Dimensions

	Per Cell	Total
Shipping Weight	8870 lb	8870 lb
Max Operating Weight	19170 lb	19170 lb
Width	18.750 ft	18.750 ft
Length	10.896 ft	10.896 ft
Height	12.979 ft	
Static Lift	12.234 ft	

Minimum Enclosure Clearance

Clearance required on air inlet sides of tower without altering performance. Assumes no air from below tower.

Solid Wall	6.051 ft
50 % Open Wall	4.300 ft

Weights and dimensions do not include options; refer to sales drawings. For CAD layouts refer to file NC8305.dxf

Cold Weather Operation

Heater Sizing (to prevent freezing in the collection basin during periods of shutdown)

Heater kW/Cell	18.0	15.0	12.0	9.0	7.5	6.0	4.5
Ambient Temperature °F	-16.14	-6.05	4.04	14.13	19.17	24.22	29.26

TRANE®

Air-Cooled Series R™ Rotary Liquid Chiller

Model RTAC
140 to 500 Tons (60 Hz)
140 to 400 Tons (50 Hz)
Built For the Industrial and Commercial Markets

May 2005

RLC-PRC006-EN

Table P-1. 60 Hz standard efficiency machines in English units

Evaporator Leaving Water Temperature (F)	Unit Size Model RTAC	Condenser Entering Air Temperature (F) 85 Tons	85 kW input	85 EER	95 Tons	95 kW input	95 EER	105 Ton	105 kW input	105 EER	115 Tons	115 kW input	115 EER
40	140 STD	138.0	139.9	10.9	128.4	152.4	9.4	118.5	166.4	8.0	108.4	182.1	6.7
	155 STD	151.4	152.3	10.9	141.1	165.9	9.4	130.4	181.2	8.0	119.5	198.3	6.8
	170 STD	165.6	165.0	11.0	154.5	179.8	9.5	143.1	196.5	8.1	131.5	215.0	6.9
	185 STD	180.5	183.4	10.8	168.6	199.4	9.4	156.2	217.5	8.0	143.5	237.8	6.8
	200 STD	196.6	202.7	10.7	183.6	219.8	9.3	170.1	239.3	7.9	156.2	261.2	6.7
	225 STD	215.5	221.8	10.7	201.6	240.7	9.3	187.1	262.1	8.0	172.0	286.2	6.8
	250 STD	236.1	242.2	10.8	220.9	262.7	9.4	205.1	285.9	8.0	188.8	312.0	6.8
	275 STD	267.1	268.2	11.0	249.4	291.5	9.5	231.2	317.8	8.1	212.5	347.2	6.9
	300 STD	298.4	307.1	10.7	278.8	332.7	9.3	258.5	361.8	8.0	237.5	394.5	6.8
	350 STD	338.2	348.1	10.7	316.4	376.8	9.3	293.7	409.5	8.0	270.2	446.3	6.8
	400 STD	400.8	412.7	10.7	374.7	447.0	9.3	347.6	485.9	8.0	319.5	529.6	6.8
	450 STD	440.2	453.6	10.7	412.0	491.1	9.3	382.6	533.7	8.0	352.2	581.6	6.8
	500 STD	481.1	495.5	10.7	450.4	536.1	9.4	418.5	582.3	8.1	385.4	634.2	6.9
42	140 STD	143.2	142.9	11.1	133.3	155.5	9.5	123.1	169.6	8.1	112.6	185.4	6.9
	155 STD	157.1	155.5	11.1	146.4	169.2	9.6	135.4	184.7	8.2	124.2	201.8	6.9
	170 STD	171.7	168.5	11.2	160.3	183.4	9.7	148.6	200.2	8.3	136.6	218.8	7.0
	185 STD	187.2	187.4	11.0	174.8	203.5	9.5	162.1	221.7	8.2	149.0	242.1	6.9
	200 STD	203.8	207.2	10.8	190.3	224.4	9.4	176.4	244.1	8.1	162.1	266.1	6.9
	225 STD	223.4	226.9	10.9	208.9	245.9	9.5	193.9	267.5	8.1	178.4	291.7	6.9
	250 STD	244.8	247.9	10.9	229.0	268.5	9.5	212.7	292.0	8.2	195.7	318.2	6.9
	275 STD	276.9	274.0	11.1	258.6	297.4	9.7	239.9	323.9	8.3	220.6	353.4	7.0
	300 STD	309.2	314.0	10.9	288.9	339.7	9.5	268.0	369.0	8.1	246.3	401.9	6.9
	350 STD	350.6	356.2	10.9	327.9	385.2	9.5	304.4	418.1	8.2	280.1	455.1	6.9
	400 STD	415.1	421.9	10.9	388.1	456.4	9.5	360.1	495.5	8.1	331.2	539.5	6.9
	450 STD	455.9	464.0	10.9	426.7	501.8	9.5	396.4	544.7	8.2	364.9	592.8	6.9
	500 STD	498.3	507.3	10.9	466.6	548.2	9.5	433.6	594.7	8.2	399.3	646.9	7.0
44	140 STD	148.4	146.0	11.3	138.2	158.6	9.7	127.7	172.9	8.3	116.9	188.7	7.0
	155 STD	162.9	158.8	11.3	151.9	172.6	9.8	140.5	188.2	8.4	128.9	205.4	7.1
	170 STD	177.9	172.0	11.4	166.2	187.0	9.9	154.1	203.9	8.5	141.8	222.6	7.2
	185 STD	193.9	191.4	11.2	181.2	207.6	9.7	168.0	226.0	8.3	154.5	246.4	7.1
	200 STD	211.0	211.8	11.0	197.2	229.2	9.6	182.8	248.9	8.2	168.0	271.1	7.0
	225 STD	231.3	232.1	11.0	216.4	251.2	9.6	200.9	272.9	8.3	184.8	297.3	7.0
	250 STD	253.5	253.8	11.1	237.2	274.6	9.6	220.3	298.2	8.3	202.7	324.5	7.1
	275 STD	286.8	279.9	11.3	268.0	303.4	9.8	248.7	330.1	8.4	228.8	359.8	7.2
	300 STD	320.2	321.0	11.0	299.2	346.9	9.6	277.6	376.3	8.3	255.3	409.4	7.0
	350 STD	363.1	364.6	11.0	339.6	393.8	9.6	315.3	426.9	8.3	290.1	464.0	7.1
	400 STD	429.5	431.3	11.0	401.7	465.9	9.6	372.9	505.3	8.3	343.1	549.6	7.0
	450 STD	471.8	474.7	11.0	441.6	512.7	9.6	410.3	555.9	8.3	377.8	604.3	7.1
	500 STD	515.8	519.3	11.0	483.0	560.6	9.6	448.8	607.4	8.3	413.3	659.7	7.1

Notes:
1. Ratings based on sea level altitude and evaporator fouling factor of 0.00010.
2. Consult Trane representative for performance at temperatures outside of the ranges shown.
3. kW input is for compressors only.
4. EER = Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
5. Ratings are based on an evaporator temperature drop of 10°F.
6. Ambient temperatures 115°F and greater reflect the high ambient condenser option.
7. Interpolation between points is permissible. Extrapolation is not permitted.
8. Rated in accordance with ARI Standard 550/590-98.

Table P-1 (Continued). 60 Hz standard efficiency machines in English units

Evaporator Leaving Water Temperature (F)	Unit Size Model RTAC	Condenser Entering Air Temperature (F) 85 Tons	85 kW input	85 EER	95 Tons	95 kW input	95 EER	105 Ton	105 kW input	105 EER	115 Tons	115 kW input	115 EER
46	140 STD	153.8	149.1	11.4	143.3	161.8	9.9	132.4	176.2	8.4	121.2	192.1	7.1
	155 STD	168.7	162.2	11.5	157.4	176.1	10.0	145.7	191.7	8.5	133.7	209.1	7.2
	170 STD	184.2	175.6	11.6	172.2	190.7	10.0	159.8	207.7	8.6	147.1	226.5	7.3
	185 STD	200.7	195.6	11.3	187.6	211.9	9.9	174.1	230.3	8.5	160.2	250.9	7.2
	200 STD	218.4	216.5	11.2	204.1	234.0	9.7	189.3	253.9	8.4	174.0	276.2	7.1
	225 STD	239.3	237.4	11.2	223.9	256.7	9.7	207.9	278.5	8.4	191.3	303.0	7.1
	250 STD	262.4	259.8	11.2	245.6	280.8	9.8	228.0	304.5	8.4	209.8	331.0	7.2
	275 STD	296.9	286.0	11.5	277.6	309.6	10.0	257.6	336.4	8.6	237.2	366.2	7.3
	300 STD	331.3	328.2	11.2	309.7	354.2	9.8	287.4	383.8	8.4	264.3	417.1	7.2
	350 STD	375.7	373.2	11.2	351.5	402.6	9.8	326.3	435.8	8.4	300.3	473.1	7.2
	400 STD	444.2	440.9	11.2	415.5	475.7	9.8	385.8	515.3	8.4	355.1	559.8	7.2
	450 STD	488.0	485.6	11.2	456.8	523.9	9.7	424.4	567.3	8.4	390.8	615.9	7.2
	500 STD	533.6	531.8	11.2	499.6	573.3	9.8	464.2	620.3	8.4	424.0	665.5	7.2
48	140 STD	159.2	152.4	11.6	148.4	165.2	10.0	137.1	179.6	8.6	125.6	195.6	7.3
	155 STD	174.7	165.7	11.7	163.0	179.7	10.1	151.0	195.4	8.7	138.6	212.8	7.4
	170 STD	190.6	179.3	11.8	178.2	194.5	10.2	165.5	211.6	8.8	152.4	230.5	7.5
	185 STD	207.6	199.8	11.5	194.1	216.2	10.0	180.2	234.8	8.6	165.9	255.4	7.3
	200 STD	225.8	221.3	11.3	211.1	238.9	9.9	195.9	258.9	8.5	180.1	281.3	7.2
	225 STD	247.5	242.8	11.3	231.6	262.2	9.9	215.1	284.2	8.5	197.9	308.8	7.3
	250 STD	271.4	266.0	11.4	254.0	287.1	9.9	235.8	311.0	8.5	216.9	337.6	7.3
	275 STD	307.2	292.2	11.6	287.2	316.0	10.1	266.7	342.8	8.7	245.6	372.8	7.4
	300 STD	342.6	335.6	11.3	320.3	361.7	9.9	297.3	391.5	8.5	273.5	424.9	7.3
	350 STD	388.6	382.1	11.3	363.5	411.6	9.9	337.5	445.0	8.5	304.5	469.5	7.3
	400 STD	459.1	450.7	11.3	429.5	485.7	9.9	398.9	525.6	8.5	367.2	570.2	7.3
	450 STD	504.3	496.8	11.3	472.1	535.3	9.9	438.7	578.9	8.5	394.8	608.1	7.3
	500 STD	551.6	544.5	11.3	516.4	586.3	9.9	479.8	633.5	8.5	427.8	655.7	7.4
50	140 STD	164.7	155.7	11.8	153.5	168.5	10.2	141.9	183.0	8.7	130.1	199.1	7.4
	155 STD	180.7	169.3	11.9	168.7	183.3	10.3	156.3	199.1	8.8	143.6	216.5	7.5
	170 STD	197.1	183.1	11.9	184.4	198.4	10.4	171.2	215.5	8.9	157.8	234.5	7.6
	185 STD	214.6	204.1	11.7	200.7	220.6	10.2	186.4	239.3	8.8	170.9	258.6	7.5
	200 STD	233.3	226.2	11.5	218.2	243.9	10.0	202.5	264.0	8.6	186.3	286.5	7.4
	225 STD	255.8	248.4	11.5	239.4	267.9	10.0	222.3	290.0	8.6	203.1	311.4	7.4
	250 STD	280.6	272.3	11.5	262.5	293.6	10.0	243.7	317.5	8.7	218.2	330.7	7.5
	275 STD	317.6	298.5	11.8	297.0	322.4	10.3	275.9	349.4	8.9	250.8	373.1	7.6
	300 STD	354.0	343.1	11.5	331.0	369.4	10.0	307.3	399.3	8.7	278.7	424.3	7.4
	350 STD	401.7	391.1	11.4	375.7	420.8	10.0	348.8	454.3	8.7	307.4	462.5	7.5
	400 STD	474.2	460.7	11.5	443.7	496.0	10.0	412.1	536.0	8.7	369.9	560.7	7.5
	450 STD	520.9	508.3	11.4	487.7	547.0	10.0	453.1	590.8	8.7	396.9	595.5	7.5
	500 STD	569.9	557.5	11.4	533.5	599.6	10.0	495.5	647.0	8.7	431.5	644.4	7.6

Notes:
1. Ratings based on sea level altitude and evaporator fouling factor of 0.00010.
2. Consult Trane representative for performance at temperatures outside of the ranges shown.
3. kW input is for compressors only.
4. EER = Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.
5. Ratings are based on an evaporator temperature drop of 10°F.
6. Ambient temperatures 115°F and greater reflect the high ambient condenser option.
7. Interpolation between points is permissible. Extrapolation is not permitted.
8. Rated in accordance with ARI Standard 550/590-98.

Table P-9. ARI part-load performance for 60 Hz standard efficiency machines in English units

Unit Size	Full Load Tons	Full Load EER	IPLV
140	138.2	9.7	**13.5**
155	151.9	9.8	**13.6**
170	166.2	9.9	**13.9**
185	181.2	9.7	**13.7**
200	197.2	9.6	**13.3**
225	216.4	9.6	**13.4**
250	237.2	9.6	**13.6**
275	268.0	9.8	**13.3**
300	299.2	9.6	**13.3**
350	339.6	9.6	**13.1**
400	401.7	9.6	**14.6**
450	441.6	9.6	**14.7**
500	483.0	9.6	**14.9**

Notes:
1. IPLV values are rated in accordance with ARI Standard 550/590-98.
2. EER and IPLV values include compressors, condenser fans and control kW.

Table P-10. ARI part-load performance for 60 Hz high efficiency machines in English units

Unit Size	Full Load Tons	Full Load EER	IPLV
140	143.9	10.3	**14.0**
155	157.1	10.4	**14.1**
170	171.2	10.4	**14.4**
185	187.1	10.3	**14.2**
200	204.1	10.1	**13.9**
225	223.9	10.2	14.0
250	243.2	10.1	**13.8**
275	277.1	13.7	**13.7**
300	308.8	10.2	**13.6**
350	349.7	10.5	**15.3**
400	415.5	10.1	**14.5**

Table P-11. ARI part-load performance for 50 Hz standard efficiency machines in English units

Unit Size	Full Load Tons	Full Load EER	IPLV
140	133.7	9.3	**14.2**
155	146.0	9.2	**14.1**
170	159.0	9.2	**13.9**
185	175.9	9.3	**13.8**
200	193.9	9.5	**14.2**
250	232.6	9.5	**14.3**
275	259.0	9.4	**14.4**
300	294.4	9.5	**14.0**
350	324.6	9.3	**15.9**
375	360.1	9.4	**16.0**
400	395.1	9.5	**16.1**

Notes:
1. IPLV values are rated in accordance with ARI Standard 550/590-98.
2. EER and IPLV values include compressors, condenser fans and control kW.

Table P-12. ARI part-load performance for 50 Hz high efficiency machines in English units

Unit Size	Full Load Tons	Full Load EER	IPLV
140	140.4	10.2	**15.0**
155	152.4	10.1	**14.9**
170	165.2	14.7	**14.7**
185	183.1	10.1	**14.6**
200	202.2	10.2	**14.9**
250	241.1	10.0	**14.3**
275	269.9	10.2	**14.9**
300	306.1	10.3	**14.5**
350	337.2	10.0	**16.1**
375	374.1	10.1	**16.1**
400	411.8	10.2	**16.2**

RETScreen® Energy Model - Solar Water Heating Project

Training & Support

Site Conditions		Estimate	Notes/Range
Project name		LA Fitness	See Online Manual
Project location		Houston, TX	
Nearest location for weather data		Houston, TX	Complete SR&HL sheet
Annual solar radiation (tilted surface)	MWh/m²	1.71	
Annual average temperature	°C	19.9	-20.0 to 30.0
Annual average wind speed	m/s	3.8	
Desired load temperature	°C	49	
Hot water use	L/d	1,500	
Number of months analysed	month	12.00	
Energy demand for months analysed	MWh	18.55	

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type	-	Natural gas - mmBtu	
Water heating system seasonal efficiency	%	50%	50% to 190%
Solar Collector			
Collector type	-	Unglazed	See Technical Note 1
Solar water heating collector manufacturer		Heliodyne	See Product Database
Solar water heating collector model		Heliodyne Mojave 410	
Gross area of one collector	m²	3.73	1.00 to 5.00
Aperture area of one collector	m²	3.56	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.73	0.50 to 0.90
Wind correction for Fr (tau alpha)	s/m	0.040	0.030 to 0.050
Fr UL coefficient	(W/m²)/°C	6.08	10.00 to 15.00
Wind correction for Fr UL	(J/m³)/°C	4.37	3.00 to 15.00
Suggested number of collectors		5	
Number of collectors		5	
Total gross collector area	m²	18.7	
Storage			
Ratio of storage capacity to coll. area	L/m²	63.8	37.5 to 100.0
Storage capacity	L	1,135	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	Yes	
Heat exchanger effectiveness	%	80%	50% to 85%
Suggested pipe diameter	mm	13	8 to 25 or PVC 35 to 50
Pipe diameter	mm	12	8 to 25 or PVC 35 to 50
Pumping power per collector area	W/m²	7	3 to 22, or 0
Piping and solar tank losses	%	6%	1% to 10%
Losses due to snow and/or dirt	%	3%	2% to 10%
Horz. dist. from mech. room to collector	m	5	5 to 20
# of floors from mech. room to collector	-	1	0 to 20

Annual Energy Production (12.00 months analysed)		Estimate	Notes/Range
SWH system capacity	kW_{th}	12	
	million Btu/h	0.043	
Pumping energy (electricity)	MWh	**0.15**	
Specific yield	kWh/m²	298	
System efficiency	%	17%	
Solar fraction	%	30%	
Renewable energy delivered	MWh	**5.55**	
	million Btu	18.94	

Complete Cost Analysis sheet

RETScreen® Solar Resource and Heating Load Calculation - Solar Water Heating Project

Site Latitude and Collector Orientation		Estimate	Notes/Range
Nearest location for weather data		Houston, TX	See Weather Database
Latitude of project location	°N	30.0	-90.0 to 90.0
Slope of solar collector	°	30.0	0.0 to 90.0
Azimuth of solar collector	°	0.0	0.0 to 180.0

Monthly Inputs

(Note: 1. Cells in grey are not used for energy calculations; 2. Revisit this table to check that all required inputs are filled if you change system type or solar collector type or pool type, or method for calculating cold water temperature).

Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m²/d)	Monthly average temperature (°C)	Monthly average relative humidity (%)	Monthly average wind speed (m/s)	Monthly average daily radiation in plane of solar collector (kWh/m²/d)
January	1.00	2.66	10.4	74.6	4.1	3.60
February	1.00	3.42	12.2	73.4	4.3	4.16
March	1.00	4.25	16.3	72.7	4.5	4.65
April	1.00	5.01	20.4	74.1	4.4	4.93
May	1.00	5.62	23.8	75.5	4.0	5.11
June	1.00	6.02	26.7	75.0	3.6	5.27
July	1.00	5.95	27.8	74.7	3.2	5.29
August	1.00	5.61	27.6	75.1	3.0	5.34
September	1.00	4.87	25.3	76.3	3.3	5.14
October	1.00	4.19	20.7	74.1	3.4	5.04
November	1.00	3.07	16.1	75.3	3.8	4.13
December	1.00	2.51	12.0	74.9	3.9	3.51

		Annual	Season of Use
Solar radiation (horizontal)	MWh/m²	1.62	1.62
Solar radiation (tilted surface)	MWh/m²	1.71	1.71
Average temperature	°C	19.9	19.9
Average wind speed	m/s	3.8	3.8

Water Heating Load Calculation		Estimate	Notes/Range
Application type	-	Service hot water	
System configuration	-	With storage	
Building or load type	-	School	
Number of units	Student	800	
Rate of occupancy	%	80%	50% to 100%
Estimated hot water use (at ~60 °C)	L/d	1,472	
Hot water use	L/d	1,500	
Desired water temperature	°C	49	
Days per week system is used	d	7	1 to 7
Cold water temperature	-	Auto	
Minimum	°C	16.6	1.0 to 10.0
Maximum	°C	22.7	5.0 to 15.0
Months SWH system in use	month	12.00	
Energy demand for months analysed	MWh	18.55	
	million Btu	63.28	

Return to Energy Model sheet

RETScreen® Cost Analysis - Solar Water Heating Project

Type of project: Pre-feasibility | Currency: $ | Cost references: None

Initial Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
Feasibility Study							
Other - Feasibility study	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Development							
Other - Development	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Engineering							
Other - Engineering	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Energy Equipment							
Solar collector	m²	18.7	$ 90	$ 1,679		-	-
Solar storage tank	L	1,135	$ -	$ -		-	-
Solar loop piping materials	m	19	$ 7.00	$ 135		-	-
Circulating pump(s)	W	125	$ 1.10	$ 137		-	-
Heat exchanger	kW	10.7	$ 15	$ 160		-	-
Transportation	project	1	$ 100	$ 100		-	-
Other - Energy equipment	Cost	0	$ -	$ -		-	-
Sub-total :				**$ 2,211**	46.5%		
Balance of System							
Collector support structure	m²	18.7	$ 70	$ 1,306		-	-
Plumbing and control	project	1	$ 200	$ 200		-	-
Collector installation	m²	18.7	$ 10	$ 187		-	-
Solar loop installation	m	19	$ 4.00	$ 77		-	-
Auxiliary equipment installation	project	1	$ 50	$ 50		-	-
Transportation	project	1	$ 50	$ 50		-	-
Other - Balance of system	Cost	0	$ -	$ -		-	-
Sub-total :				**$ 1,869**	39.3%		
Miscellaneous							
Training	p-h	4	$ 60	$ 240		-	-
Contingencies	%	10%	$ 4,320	$ 432		-	-
Sub-total :				**$ 672**	14.1%		
Initial Costs - Total				**$ 4,752**	100.0%		

Annual Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
O&M							
Property taxes/Insurance	project	0	$ -	$ -		-	-
O&M labour	project	1	$ 15	$ 15		-	-
Other - O&M	Cost	0	$ -	$ -		-	-
Contingencies	%	10%	$ 15	$ 2		-	-
Sub-total :				**$ 17**	57.7%		
Electricity	kWh	155	**$ 0.0780**	**$ 12**	42.3%	-	-
Annual Costs - Total				$ 29	100.0%		

Periodic Costs (Credits)		Period	Unit Cost	Amount	Interval Range	Unit Cost Range
Valves and fittings	Cost	10 yr	$ 250	**$ 250**	-	-
	Credit	10 yr		**$ -**	-	-
				$ -	-	-
End of project life		-		**$ -**		*Go to GHG Analysis sheet*

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance

Project name		LA Fitness	Electricity required	MWh	0.15
Project location		Houston, TX			
Renewable energy delivered	MWh	5.55			
Heating fuel displaced	-	atural gas - mmBtu			

Financial Parameters

Avoided cost of heating energy	$/mmBtu	14.480	Debt ratio	%	0.0%
			Income tax analysis?	yes/no	No
Retail price of electricity	$/kWh	0.078			
Energy cost escalation rate	%	3.0%			
Inflation	%	2.0%			
Discount rate	%	6.0%			
Project life	yr	20			

Project Costs and Savings

Initial Costs			
Feasibility study	0.0%	$	-
Development	0.0%	$	-
Engineering	0.0%	$	-
Energy equipment	46.5%	$	2,211
Balance of system	39.3%	$	1,869
Miscellaneous	14.1%	$	672
Initial Costs - Total	100.0%	**$**	**4,752**
Incentives/Grants		$	-
Periodic Costs (Credits)			
Valves and fittings		$	250
		$	-
		$	-
End of project life -		$	-

Annual Costs and Debt		
O&M	$	17
Electricity	$	12
Annual Costs and Debt -Total	**$**	**29**
Annual Savings or Income		
Heating energy savings/income	$	548
Annual Savings - Total	**$**	**548**
Schedule yr # 10,20		

Financial Feasibility

Pre-tax IRR and ROI	%	11.9%			
After-tax IRR and ROI	%	11.9%			
Simple Payback	yr	9.1	Project equity	$	4,752
Year-to-positive cash flow	yr	8.0			
Net Present Value - NPV	$	2,781			
Annual Life Cycle Savings	$	242			
Benefit-Cost (B-C) ratio	-	1.59			

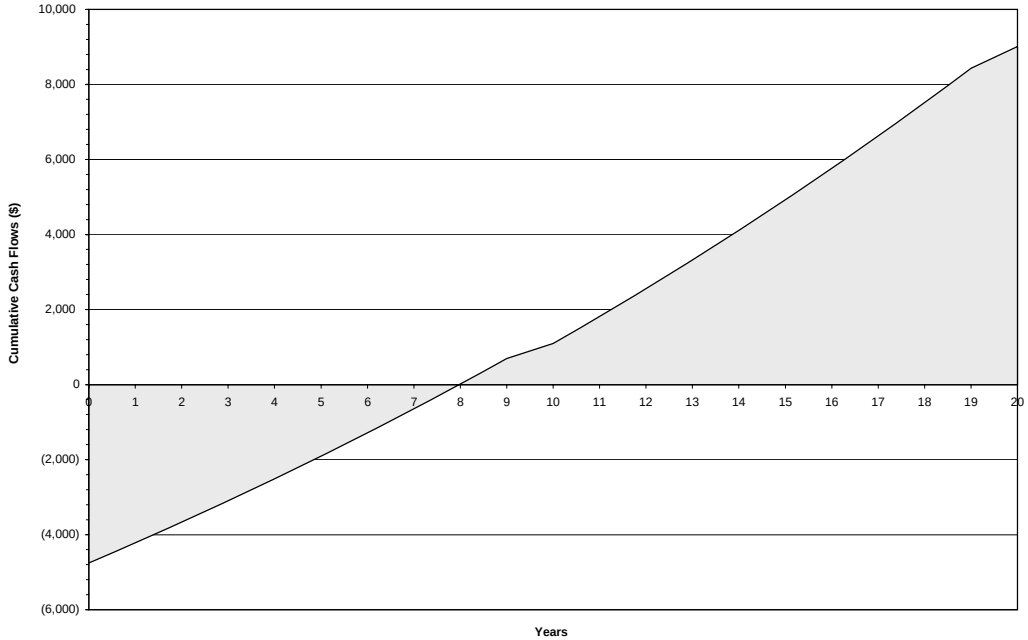
Yearly Cash Flows

Year #	Pre-tax $	After-tax $	Cumulative $
0	(4,752)	(4,752)	(4,752)
1	536	536	(4,217)
2	552	552	(3,665)
3	569	569	(3,096)
4	586	586	(2,510)
5	604	604	(1,907)
6	622	622	(1,285)
7	641	641	(644)
8	660	660	16
9	680	680	696
10	396	396	1,092
11	722	722	1,814
12	744	744	2,558
13	766	766	3,324
14	790	790	4,114
15	813	813	4,927
16	838	838	5,765
17	863	863	6,629
18	890	890	7,518
19	917	917	8,435
20	573	573	9,008

Cumulative Cash Flows Graph

SWH Project Cumulative Cash Flows
LA Fitness, Houston, TX

Renewable energy delivered (MWh/yr): 5.55 **Total Initial Costs: $ 4,752**



IRR and ROI: 11.9% **Year-to-positive cash flow: 8 yr** **Net Present Value: $ 2,781**

RETScreen® Energy Model - Solar Water Heating Project

Training & Support

Site Conditions		Estimate	Notes/Range
Project name		**LA Fitness**	See Online Manual
Project location		**Houston, TX**	
Nearest location for weather data		Houston, TX	Complete SR&HL sheet
Annual solar radiation (tilted surface)	MWh/m²	1.71	
Annual average temperature	°C	19.9	-20.0 to 30.0
Annual average wind speed	m/s	3.8	
Desired load temperature	°C	49	
Hot water use	L/d	1,500	
Number of months analysed	month	12.00	
Energy demand for months analysed	MWh	18.55	

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type	-	**Natural gas - mmBtu**	
Water heating system seasonal efficiency	%	50%	50% to 190%
Solar Collector			
Collector type	-	Glazed	See Technical Note 1
Solar water heating collector manufacturer		Heliodyne	See Product Database
Solar water heating collector model		Heliodyne Gobi 408	
Gross area of one collector	m²	3.00	1.00 to 5.00
Aperture area of one collector	m²	2.77	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.74	0.50 to 0.90
Fr UL coefficient	(W/m²)/°C	4.57	1.50 to 8.00
Temperature coefficient for Fr UL	(W/(m·°C)²)	0.00	0.000 to 0.010
Suggested number of collectors		5	
Number of collectors		5	
Total gross collector area	m²	15.0	
Storage			
Ratio of storage capacity to coll. area	L/m²	82.0	37.5 to 100.0
Storage capacity	L	1,135	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	Yes	
Heat exchanger effectiveness	%	80%	50% to 85%
Suggested pipe diameter	mm	13	8 to 25 or PVC 35 to 50
Pipe diameter	mm	12	8 to 25 or PVC 35 to 50
Pumping power per collector area	W/m²	7	3 to 22, or 0
Piping and solar tank losses	%	6%	1% to 10%
Losses due to snow and/or dirt	%	3%	2% to 10%
Horz. dist. from mech. room to collector	m	5	5 to 20
# of floors from mech. room to collector	-	1	0 to 20

Annual Energy Production (12.00 months analysed)		Estimate	Notes/Range
SWH system capacity	kW_{th}	10	
	MWth	0.010	
Pumping energy (electricity)	MWh	**0.22**	
Specific yield	kWh/m²	663	
System efficiency	%	39%	
Solar fraction	%	54%	
Renewable energy delivered	MWh	**9.95**	
	million Btu	33.94	

Complete Cost Analysis sheet

RETScreen® Solar Resource and Heating Load Calculation - Solar Water Heating Project

Site Latitude and Collector Orientation		Estimate	Notes/Range
Nearest location for weather data		Houston, TX	See Weather Database
Latitude of project location	°N	30.0	-90.0 to 90.0
Slope of solar collector	°	30.0	0.0 to 90.0
Azimuth of solar collector	°	0.0	0.0 to 180.0

Monthly Inputs

(Note: 1. Cells in grey are not used for energy calculations; 2. Revisit this table to check that all required inputs are filled if you change system type or solar collector type or pool type, or method for calculating cold water temperature).

Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m²/d)	Monthly average temperature (°C)	Monthly average relative humidity (%)	Monthly average wind speed (m/s)	Monthly average daily radiation in plane of solar collector (kWh/m²/d)
January	1.00	2.66	10.4	74.6	4.1	3.60
February	1.00	3.42	12.2	73.4	4.3	4.16
March	1.00	4.25	16.3	72.7	4.5	4.65
April	1.00	5.01	20.4	74.1	4.4	4.93
May	1.00	5.62	23.8	75.5	4.0	5.11
June	1.00	6.02	26.7	75.0	3.6	5.27
July	1.00	5.95	27.8	74.7	3.2	5.29
August	1.00	5.61	27.6	75.1	3.0	5.34
September	1.00	4.87	25.3	76.3	3.3	5.14
October	1.00	4.19	20.7	74.1	3.4	5.04
November	1.00	3.07	16.1	75.3	3.8	4.13
December	1.00	2.51	12.0	74.9	3.9	3.51

		Annual	Season of Use
Solar radiation (horizontal)	MWh/m²	1.62	1.62
Solar radiation (tilted surface)	MWh/m²	1.71	1.71
Average temperature	°C	19.9	19.9
Average wind speed	m/s	3.8	3.8

Water Heating Load Calculation		Estimate	Notes/Range
Application type	-	Service hot water	
System configuration	-	With storage	
Building or load type	-	School	
Number of units	Student	800	
Rate of occupancy	%	80%	50% to 100%
Estimated hot water use (at ~60 °C)	L/d	1,472	
Hot water use	L/d	1,500	
Desired water temperature	°C	49	
Days per week system is used	d	7	1 to 7
Cold water temperature	-	Auto	
Minimum	°C	16.6	1.0 to 10.0
Maximum	°C	22.7	5.0 to 15.0
Months SWH system in use	month	12.00	
Energy demand for months analysed	MWh	18.55	
	million Btu	63.28	

Return to Energy Model sheet

RETScreen® Cost Analysis - Solar Water Heating Project

Type of project: Pre-feasibility | Currency: $ | Cost references: None

Initial Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
Feasibility Study							
Other - Feasibility study	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Development							
Other - Development	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Engineering							
Other - Engineering	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Energy Equipment							
Solar collector	m²	15.0	$ 200	$ 3,000		-	-
Solar storage tank	L	1,135		$ -		-	-
Solar loop piping materials	m	19	$ 8.00	$ 155		-	-
Circulating pump(s)	W	97	$ 1.10	$ 107		-	-
Heat exchanger	kW	8.3	$ 15	$ 125		-	-
Transportation	project	1	$ 100	$ 100		-	-
Other - Energy equipment	Cost	0	$ -	$ -		-	-
Sub-total :				**$ 3,486**	62.4%		
Balance of System							
Collector support structure	m²	15.0	$ 70	$ 1,050		-	-
Plumbing and control	project	1	$ 220	$ 220		-	-
Collector installation	m²	15.0	$ 10	$ 150		-	-
Solar loop installation	m	19	$ 4.00	$ 77		-	-
Auxiliary equipment installation	project	1	$ 50	$ 50		-	-
Transportation	project	1	$ 50	$ 50		-	-
Other - Balance of system	Cost	0	$ -	$ -		-	-
Sub-total :				**$ 1,597**	28.6%		
Miscellaneous							
Training	p-h	4	$ 60	$ 240		-	-
Contingencies	%	5%	$ 5,323	$ 266		-	-
Sub-total :				**$ 506**	9.1%		
Initial Costs - Total				**$ 5,589**	100.0%		

Annual Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
O&M							
Property taxes/Insurance	project	0	$ -	$ -		-	-
O&M labour	project	1	$ 15	$ 15		-	-
Other - O&M	Cost	0	$ -	$ -		-	-
Contingencies	%	5%	$ 15	$ 1		-	-
Sub-total :				**$ 16**	48.2%		
Electricity	kWh	217	**$ 0.0780**	**$ 17**	51.8%	-	-
Annual Costs - Total				$ 33	100.0%		

Periodic Costs (Credits)		Period	Unit Cost	Amount	Interval Range	Unit Cost Range
Valves and fittings	Cost	10 yr	$ 250	**$ 250**	-	-
				$ -	-	-
				$ -	-	-
End of project life		-		**$ -**		Go to GHG Analysis sheet

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance

Project name		LA Fitness	Electricity required	MWh	0.22
Project location		Houston, TX			
Renewable energy delivered	MWh	9.95	Net GHG reduction	t_{CO2}/yr	3.94
Heating fuel displaced	-	atural gas - mmBtu	Net GHG emission reduction - 20 yrs	t_{CO2}	78.76

Financial Parameters

Avoided cost of heating energy	$/mmBtu	14.480	Debt ratio	%	0.0%
GHG emission reduction credit	$/$t_{CO2}$	-	Income tax analysis?	yes/no	No
Retail price of electricity	$/kWh	0.078			
Energy cost escalation rate	%	3.0%			
Inflation	%	2.0%			
Discount rate	%	6.0%			
Project life	yr	20			

Project Costs and Savings

Initial Costs			
Feasibility study	0.0%	$	-
Development	0.0%	$	-
Engineering	0.0%	$	-
Energy equipment	62.4%	$	3,486
Balance of system	28.6%	$	1,597
Miscellaneous	9.1%	$	506
Initial Costs - Total	100.0%	**$**	**5,589**
Incentives/Grants		$	
Periodic Costs (Credits)			
Valves and fittings		$	250
		$	-
		$	-
End of project life -		$	-

Annual Costs and Debt		
O&M	$	16
Electricity	$	17
Annual Costs and Debt -Total	**$**	**33**
Annual Savings or Income		
Heating energy savings/income	$	983
Annual Savings - Total	**$**	**983**
Schedule yr # 10,20		

Financial Feasibility

Pre-tax IRR and ROI	%	19.4%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	19.4%			
Simple Payback	yr	5.9	Project equity	$	5,589
Year-to-positive cash flow	yr	5.3			
Net Present Value - NPV	$	8,398			
Annual Life Cycle Savings	$	732			
Benefit-Cost (B-C) ratio	-	2.50			

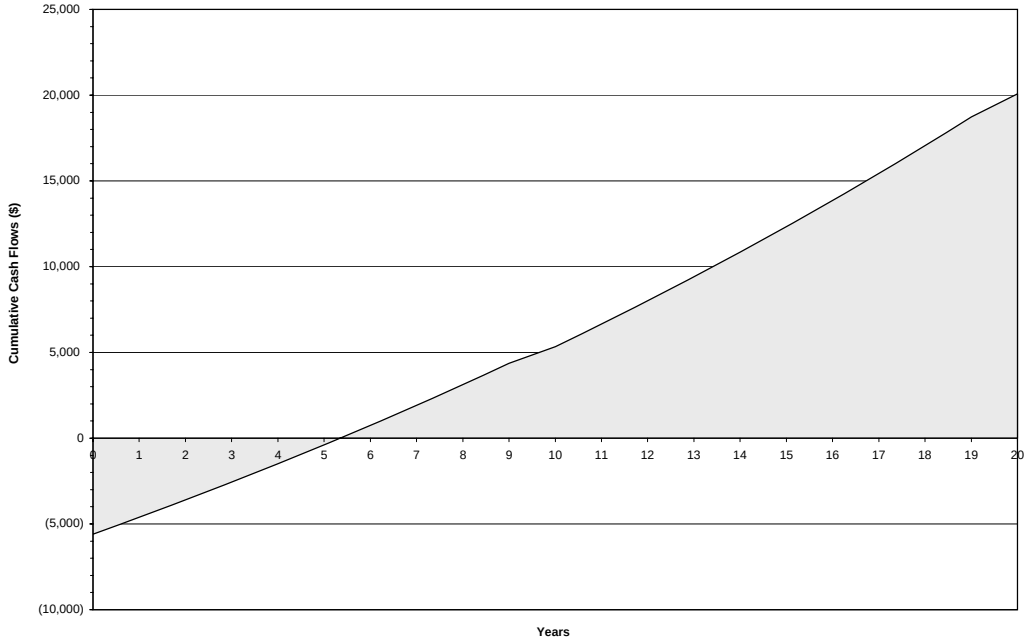
Yearly Cash Flows

Year #	Pre-tax $	After-tax $	Cumulative $
0	(5,589)	(5,589)	(5,589)
1	979	979	(4,610)
2	1,008	1,008	(3,602)
3	1,039	1,039	(2,563)
4	1,070	1,070	(1,493)
5	1,103	1,103	(390)
6	1,136	1,136	746
7	1,170	1,170	1,916
8	1,205	1,205	3,121
9	1,242	1,242	4,363
10	974	974	5,337
11	1,318	1,318	6,655
12	1,357	1,357	8,012
13	1,398	1,398	9,410
14	1,440	1,440	10,851
15	1,484	1,484	12,335
16	1,529	1,529	13,863
17	1,575	1,575	15,438
18	1,622	1,622	17,060
19	1,671	1,671	18,731
20	1,350	1,350	20,081

Cumulative Cash Flows Graph

SWH Project Cumulative Cash Flows
LA Fitness, Houston, TX

Renewable energy delivered (MWh/yr): 9.95 **Total Initial Costs: $ 5,589** **Net average GHG reduction (t_{CO2}/yr): 3.94**



IRR and ROI: 19.4% **Year-to-positive cash flow: 5.3 yr** **Net Present Value: $ 8,398**

RETScreen® Energy Model - Solar Water Heating Project

Training & Support

Site Conditions		Estimate	Notes/Range
Project name		**LA Fitness**	See Online Manual
Project location		**Houston, TX**	
Nearest location for weather data		Houston, TX	Complete SR&HL sheet
Annual solar radiation (tilted surface)	MWh/m²	1.71	
Annual average temperature	°C	19.9	-20.0 to 30.0
Annual average wind speed	m/s	3.8	
Desired load temperature	°C	49	
Hot water use	L/d	1,500	
Number of months analysed	month	12.00	
Energy demand for months analysed	MWh	18.55	

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type	-	**Natural gas - mmBtu**	
Water heating system seasonal efficiency	%	50%	50% to 190%
Solar Collector			
Collector type	-	Evacuated	See Technical Note 1
Solar water heating collector manufacturer		Thermomax	See Product Database
Solar water heating collector model		Mazdon 20 - TMA 600S	
Gross area of one collector	m²	3.03	1.00 to 5.00
Aperture area of one collector	m²	2.14	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.54	0.40 to 0.80
Fr UL coefficient	(W/m²)/°C	1.07	0.30 to 3.00
Temperature coefficient for Fr UL	(W/(m·°C)²)	0.00	0.000 to 0.010
Suggested number of collectors		7	
Number of collectors		7	
Total gross collector area	m²	21.2	
Storage			
Ratio of storage capacity to coll. area	L/m²	66.3	37.5 to 100.0
Storage capacity	L	993	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	Yes	
Heat exchanger effectiveness	%	80%	50% to 85%
Suggested pipe diameter	mm	13	8 to 25 or PVC 35 to 50
Pipe diameter	mm	12	8 to 25 or PVC 35 to 50
Pumping power per collector area	W/m²	7	3 to 22, or 0
Piping and solar tank losses	%	6%	1% to 10%
Losses due to snow and/or dirt	%	2%	2% to 10%
Horz. dist. from mech. room to collector	m	5	5 to 20
# of floors from mech. room to collector	-	1	0 to 20

Annual Energy Production (12.00 months analysed)		Estimate	Notes/Range
SWH system capacity	kW_{th}	10	
	MWth	0.010	
Pumping energy (electricity)	MWh	**0.36**	
Specific yield	kWh/m²	598	
System efficiency	%	35%	
Solar fraction	%	68%	
Renewable energy delivered	MWh	**12.68**	
	million Btu	43.26	

Complete Cost Analysis sheet

RETScreen® Solar Resource and Heating Load Calculation - Solar Water Heating Project

Site Latitude and Collector Orientation		Estimate	Notes/Range
Nearest location for weather data		Houston, TX	See Weather Database
Latitude of project location	°N	30.0	-90.0 to 90.0
Slope of solar collector	°	30.0	0.0 to 90.0
Azimuth of solar collector	°	0.0	0.0 to 180.0

Monthly Inputs

(Note: 1. Cells in grey are not used for energy calculations; 2. Revisit this table to check that all required inputs are filled if you change system type or solar collector type or pool type, or method for calculating cold water temperature).

Month	Fraction of month used (0 - 1)	Monthly average daily radiation on horizontal surface (kWh/m²/d)	Monthly average temperature (°C)	Monthly average relative humidity (%)	Monthly average wind speed (m/s)	Monthly average daily radiation in plane of solar collector (kWh/m²/d)
January	1.00	2.66	10.4	74.6	4.1	3.60
February	1.00	3.42	12.2	73.4	4.3	4.16
March	1.00	4.25	16.3	72.7	4.5	4.65
April	1.00	5.01	20.4	74.1	4.4	4.93
May	1.00	5.62	23.8	75.5	4.0	5.11
June	1.00	6.02	26.7	75.0	3.6	5.27
July	1.00	5.95	27.8	74.7	3.2	5.29
August	1.00	5.61	27.6	75.1	3.0	5.34
September	1.00	4.87	25.3	76.3	3.3	5.14
October	1.00	4.19	20.7	74.1	3.4	5.04
November	1.00	3.07	16.1	75.3	3.8	4.13
December	1.00	2.51	12.0	74.9	3.9	3.51

		Annual	Season of Use
Solar radiation (horizontal)	MWh/m²	1.62	1.62
Solar radiation (tilted surface)	MWh/m²	1.71	1.71
Average temperature	°C	19.9	19.9
Average wind speed	m/s	3.8	3.8

Water Heating Load Calculation		Estimate	Notes/Range
Application type	-	Service hot water	
System configuration	-	With storage	
Building or load type	-	School	
Number of units	Student	800	
Rate of occupancy	%	80%	50% to 100%
Estimated hot water use (at ~60 °C)	L/d	1,472	
Hot water use	L/d	1,500	
Desired water temperature	°C	49	
Days per week system is used	d	7	1 to 7
Cold water temperature	-	Auto	
Minimum	°C	16.6	1.0 to 10.0
Maximum	°C	22.7	5.0 to 15.0
Months SWH system in use	month	12.00	
Energy demand for months analysed	MWh	18.55	
	million Btu	63.28	

Return to Energy Model sheet

RETScreen® Cost Analysis - Solar Water Heating Project

Type of project: Pre-feasibility | Currency: $ | Cost references: None

Initial Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
Feasibility Study							
Other - Feasibility study	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Development							
Other - Development	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Engineering							
Other - Engineering	Cost	0	$ -	$ -		-	-
Sub-total :				**$ -**	0.0%		
Energy Equipment							
Solar collector	m²	21.2	$ 575	$ 12,196		-	-
Solar storage tank	L	993		$ -		-	-
Solar loop piping materials	m	19	$ 10.00	$ 193		-	-
Circulating pump(s)	W	105	$ 1.10	$ 115		-	-
Heat exchanger	kW	9.0	$ 15	$ 135		-	-
Transportation	project	1	$ 100	$ 100		-	-
Other - Energy equipment	Cost	0	$ -	$ -		-	-
Sub-total :				**$ 12,739**	76.4%		
Balance of System							
Collector support structure	m²	21.2	$ 70	$ 1,485		-	-
Plumbing and control	project	1	$ 300	$ 300		-	-
Collector installation	m²	21.2	$ 10	$ 212		-	-
Solar loop installation	m	19	$ 4.00	$ 77		-	-
Auxiliary equipment installation	project	1	$ 50	$ 50		-	-
Transportation	project	1	$ 50	$ 50		-	-
Other - Balance of system	Cost	0	$ -	$ -		-	-
Sub-total :				**$ 2,174**	13.0%		
Miscellaneous							
Training	p-h	4	$ 60	$ 240		-	-
Contingencies	%	10%	$ 15,153	$ 1,515		-	-
Sub-total :				**$ 1,755**	10.5%		
Initial Costs - Total				**$ 16,669**	100.0%		

Annual Costs (Credits)	Unit	Quantity	Unit Cost	Amount	Relative Costs	Quantity Range	Unit Cost Range
O&M							
Property taxes/Insurance	project	0	$ -	$ -		-	-
O&M labour	project	1	$ 15	$ 15		-	-
Other - O&M	Cost	0	$ -	$ -		-	-
Contingencies	%	10%	$ 15	$ 2		-	-
Sub-total :				**$ 17**	36.8%		
Electricity	kWh	364	**$ 0.0780**	**$ 28**	63.2%	-	-
Annual Costs - Total				$ 45	100.0%		

Periodic Costs (Credits)		Period	Unit Cost	Amount	Interval Range	Unit Cost Range
Valves and fittings	Cost	10 yr	$ 250	**$ 250**	-	-
				$ -	-	-
				$ -	-	-
End of project life		-		**$ -**		*Go to GHG Analysis sheet*

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance

Project name		LA Fitness	Electricity required	MWh	0.36
Project location		Houston, TX			
Renewable energy delivered	MWh	12.68			
Heating fuel displaced	-	atural gas - mmBtu			

Financial Parameters

Avoided cost of heating energy	$/mmBtu	14.480	Debt ratio	%	0.0%
			Income tax analysis?	yes/no	No
Retail price of electricity	$/kWh	0.078			
Energy cost escalation rate	%	3.0%			
Inflation	%	2.0%			
Discount rate	%	6.0%			
Project life	yr	20			

Project Costs and Savings

Initial Costs				**Annual Costs and Debt**		
Feasibility study	0.0%	$	-	O&M	$	17
Development	0.0%	$	-	Electricity	$	28
Engineering	0.0%	$	-			
Energy equipment	76.4%	$	12,739	**Annual Costs and Debt -Total**	**$**	**45**
Balance of system	13.0%	$	2,174			
Miscellaneous	10.5%	$	1,755	**Annual Savings or Income**		
Initial Costs - Total	100.0%	**$**	**16,669**	Heating energy savings/income	$	1,253
Incentives/Grants		$	-			
				Annual Savings - Total	**$**	**1,253**
Periodic Costs (Credits)						
Valves and fittings		$	250	Schedule yr # 10,20		
		$	-			
		$	-			
End of project life -		$	-			

Financial Feasibility

Pre-tax IRR and ROI	%	6.8%			
After-tax IRR and ROI	%	6.8%			
Simple Payback	yr	13.8	Project equity	$	16,669
Year-to-positive cash flow	yr	11.6			
Net Present Value - NPV	$	1,185			
Annual Life Cycle Savings	$	103			
Benefit-Cost (B-C) ratio	-	1.07			

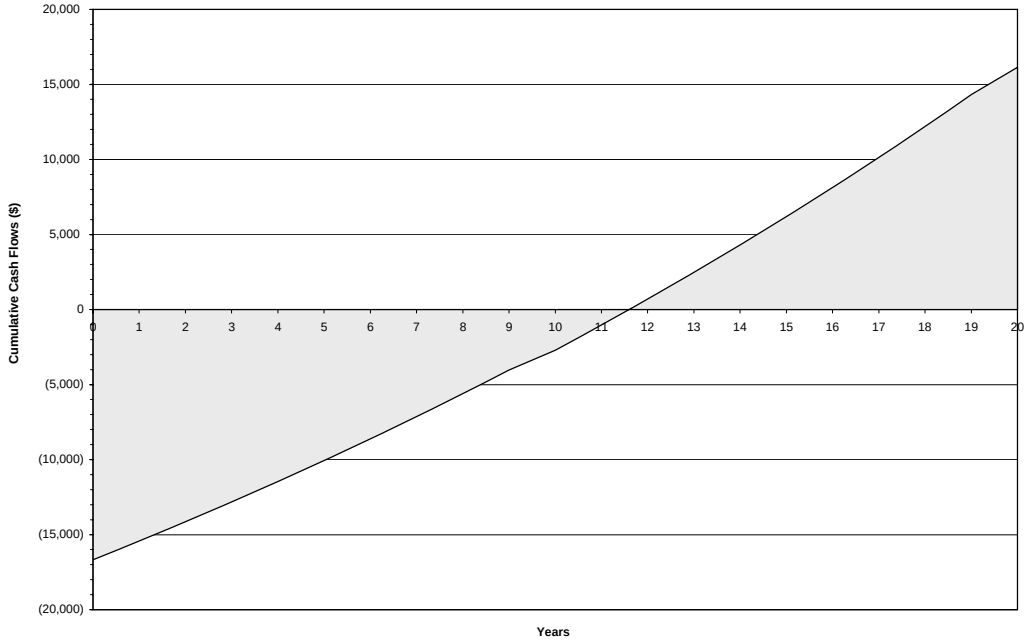
Yearly Cash Flows

Year #	Pre-tax $	After-tax $	Cumulative $
0	(16,669)	(16,669)	(16,669)
1	1,244	1,244	(15,424)
2	1,282	1,282	(14,142)
3	1,320	1,320	(12,822)
4	1,360	1,360	(11,462)
5	1,401	1,401	(10,060)
6	1,443	1,443	(8,617)
7	1,487	1,487	(7,130)
8	1,532	1,532	(5,598)
9	1,578	1,578	(4,020)
10	1,321	1,321	(2,699)
11	1,674	1,674	(1,025)
12	1,725	1,725	700
13	1,777	1,777	2,477
14	1,830	1,830	4,307
15	1,885	1,885	6,193
16	1,942	1,942	8,135
17	2,001	2,001	10,136
18	2,061	2,061	12,197
19	2,123	2,123	14,320
20	1,816	1,816	16,135

Cumulative Cash Flows Graph

SWH Project Cumulative Cash Flows
LA Fitness, Houston, TX

Renewable energy delivered (MWh/yr): 12.68 **Total Initial Costs: $ 16,669**



IRR and ROI: 6.8% **Year-to-positive cash flow: 11.6 yr** **Net Present Value: $ 1,185**

Appendix F: Lighting Power Density Spreadsheets

Existing Design:

Lighting Power Density Calculation				
Space	**Lamp ID**	**Number**	**Wattage/Type**	**Watts**
Aerobics	A	9	128	1152
	AX	9	128	1152
	BX	1	64	64
	H	5	32	160
Raquetball	D	10	192	9600
Storage	B	3	64	192
Restrooms	B	2	64	128
Kid's Club	A	8	128	1024
	AX	4	128	512
Free Weights	A	15	128	1920
	AX	5	128	640
Basketball	R	8	400	3200
	RX	4	400	1600
Storage	C	2	64	128
Special Exercise	A	13	128	1664
	AX	4	128	512
Equipment Room	C	2	64	128
Cardiovascular	A	39	128	4992
	AX	14	128	1792
	AA2	15	45	675
	B	19	64	1216
	BX	8	64	512
Mezzanine	B	19	64	1216
	BX	5	64	320
Spinning	B	17	64	1088
	BX	4	64	256
Pool Equipment	C	3	64	192
Pool and Spa	K	6	130	780
	L	15	298	4470
	L1	6	220	1320
	Y	10	190	1900
Locker Rooms	B	4	64	256
	G	36	64	2304
	H	12	32	384
	HX	12	32	384
	J	6	26	156
	P	8	28	224
	Z	18	36	648
Reception	K	8	130	1040
	V	2	130	260
	Y	5	190	950
Membership Sales	A	2	128	256
	AX	2	128	256
	AA2	10	45	450
Juice Bar	B	3	64	192
Stairs	E	26	32	832
Total			53097	W
Lighting Power Density			1.18	W/ft^2

Lighting Redesign:

Lighting Power Density Calculation				
Spaces	**Lamp ID**	**Number**	**Wattage/Type**	**Watts**
Aerobics	A	9	112	1008
	AX	9	112	1008
	BX	1	56	56
	H	5	32	160
Raquetball	D	6	168	5040
Storage	B	3	56	168
Restrooms	B	2	56	112
Kid's Club	A	8	112	896
	AX	4	112	448
Free Weights	A	15	112	1680
	AX	5	112	560
Basketball	R	8	350	2800
	RX	4	359	1436
Storage	C	2	56	112
Special Exercise	A	13	112	1456
	AX	4	112	448
Equipment Room	C	2	56	112
Cardiovascular	A	39	112	4368
	AX	14	112	1568
	AA2	15	45	675
	B	19	56	1064
	BX	8	56	448
Mezzanine	B	19	56	1064
	BX	5	56	280
Spinning	B	17	56	952
	BX	4	56	224
Pool Equipment	C	3	56	168
Pool and Spa	K	6	130	780
	L	15	298	4470
	L1	6	220	1320
	Y	10	190	1900
Locker Rooms	B	4	56	224
	G	36	56	2016
	H	12	32	384
	HX	12	32	384
	J	6	26	156
	P	8	28	224
	Z	18	36	648
Reception	K	8	130	1040
	V	2	130	260
	Y	5	190	950
Membership Sales	A	2	112	224
	AX	2	112	224
	AA2	10	45	450
Juice Bar	B	3	56	168
Stairs	E	13	28	364
Total			44497 W	
Lighting Power Density			0.989 W/ft^2	

Return to: Octron 800 XP | Print Page

Product Number: 21763

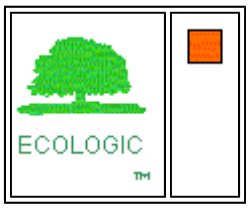
Order Abbreviation: FO32/835/XP/ECO

General Description: 32W, 48" MOL, T8 OCTRON XP Extended Performance fluorescent lamp, 3500K color temperature, rare earth phosphor, 85 CRI, suitable for IS or RS operation, ECOLOGIC

Product Information	
Abbrev. With Packaging Info.	FO32835XPECO 30/CS 1/SKU
Actual Length (in)	47.78
Actual Length (mm)	1213.6
Average Rated Life (hr)	24000
Base	Medium Bipin
Bulb	T8
Color Rendering Index (CRI)	85
Color Temperature/CCT (K)	3500
Diameter (in)	1.10
Diameter (mm)	27.9
Family Brand Name	OCTRON® 800 XP®, ECOLOGIC®
Industry Standards	ANSI C78.81 - 2001
Initial Lumens at 25C	3000
Mean Lumens at 25C	2850
Nominal Length (in)	48
Nominal Wattage (W)	32.00

Additional Product Information

- **Product Documents, Graphs, and Images**
- **Compatible Ballast**
- **Packaging Information**



Footnotes

- Approximate initial lumens after 100 hours operation.

Return to: Octron 800 XP Supersaver | Print Page

Product Number: 22060

Order Abbreviation: FO30/835/XP/SS/ECO

General Description: 30W, 48" MOL, T8 OCTRON SuperSaver fluorescent lamp, 3500K color temperature, rare earth phosphor, 82 CRI, suitable for use on instant ballasts or other T8 ballasts with minimum starting voltage of 550V, ECOLOGIC

Product Information

Abbrev. With Packaging Info.	FO30835XPSSECO 30/CS 1/SKU
Actual Length (in)	47.78
Actual Length (mm)	1213.6
Average Rated Life (hr)	18000
Base	Medium Bipin
Bulb	T8
Color Rendering Index (CRI)	82
Color Temperature/CCT (K)	3500
Diameter (in)	1.1
Diameter (mm)	27.9
Family Brand Name	OCTRON® 800 XP® SS, ECOLOGIC®
Industry Standards	ANSI C78.81 - 2001
Initial Lumens at 25C	2850
Mean Lumens at 25C	2710
Nominal Length (in)	48
Nominal Wattage (W)	30.00

Additional Product Information

Product Documents, Graphs, and Images

Packaging Information

Footnotes

- This lamp may also be operated by the OSRAM SYLVANIA QUICKTRONIC(R) PSN ballast (.88 BF), or the QUICTRONIC PSX ballast (.71 BF).
- Approximate initial lumens after 100 hours operation.
- The life ratings of fluorescent lamps are based on 3 hr. burning cycles under specified conditions and with ballast meeting ANSI specifications. If burning cycle is increased, there will be a corresponding increase in the average hours life.

Appendix G: Desiccant Integration, Performance, & Further Discussion

Design Integration

The addition of the desiccant dehumidification unit to the roof meant that duct work had to be run to each of the rooftop units. The duct runs were kept as short as possible to minimize cost; ductwork for exterior spaces has a higher first cost because it needs to be weather resistant. Figure G.1 shows a rough layout of the duct runs. These runs were used to estimate the first cost of a weatherproof duct system for the economic analysis.

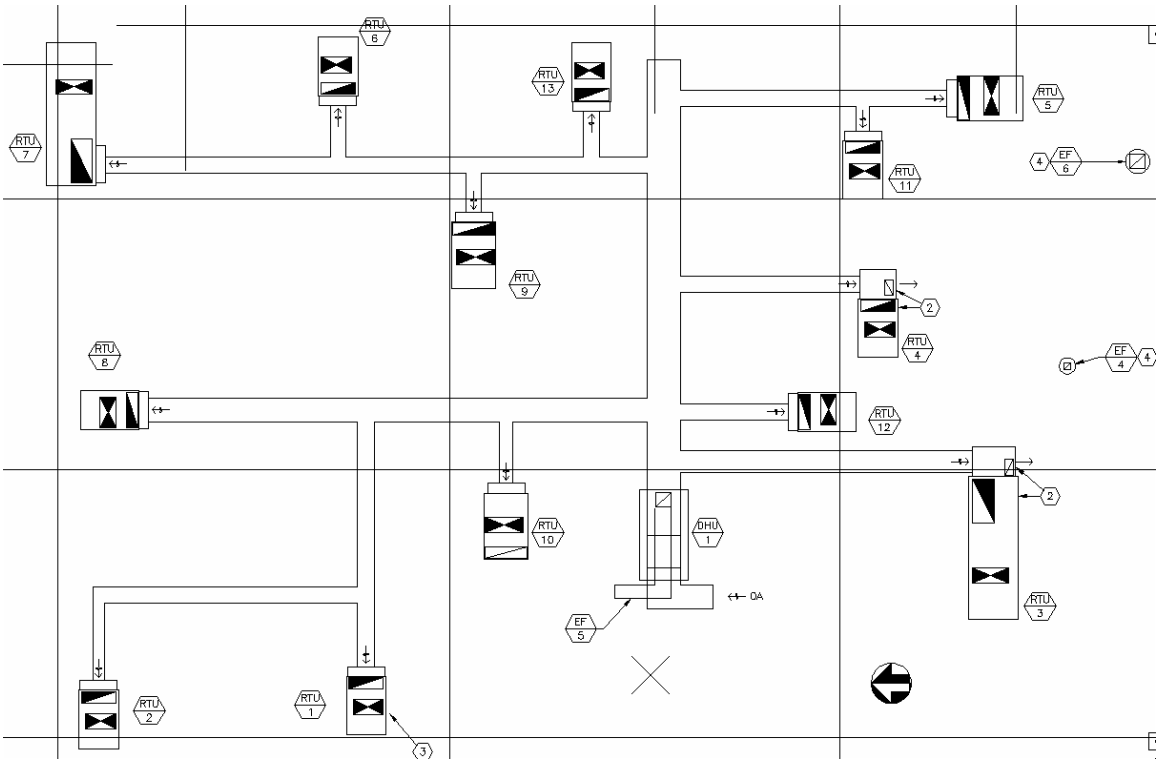


Figure G.1 – Roof Plan Including Desiccant Dehumidification Unit

ASHRAE Standard 62.1 requires that the exhaust outdoor air intakes should be kept 15 feet away from the exhaust outlet. The design provided allows for a 17 ft clearance between the exhaust air outlet and the outdoor air intake. Also, the prevailing winds in Houston are primarily from the south. The outdoor air intake opening is oriented to the south to take advantage of these winds; similarly, the exhaust outlet faces due north for the same advantage.

As each rooftop unit comes installed with fans, the largest fan that needed to be sized for this system only needs to provide enough pressure to overcome the longest roof duct run. This longest duct run for this building is 150 feet.

Performance:

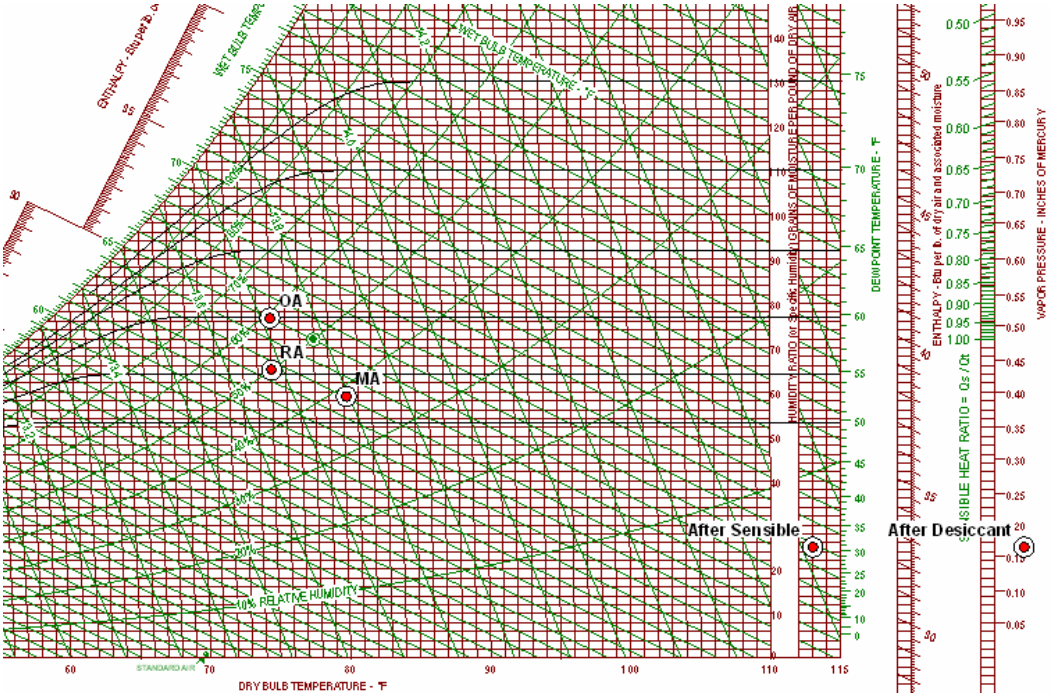


Figure G.2 – Desiccant System Typical January State Points

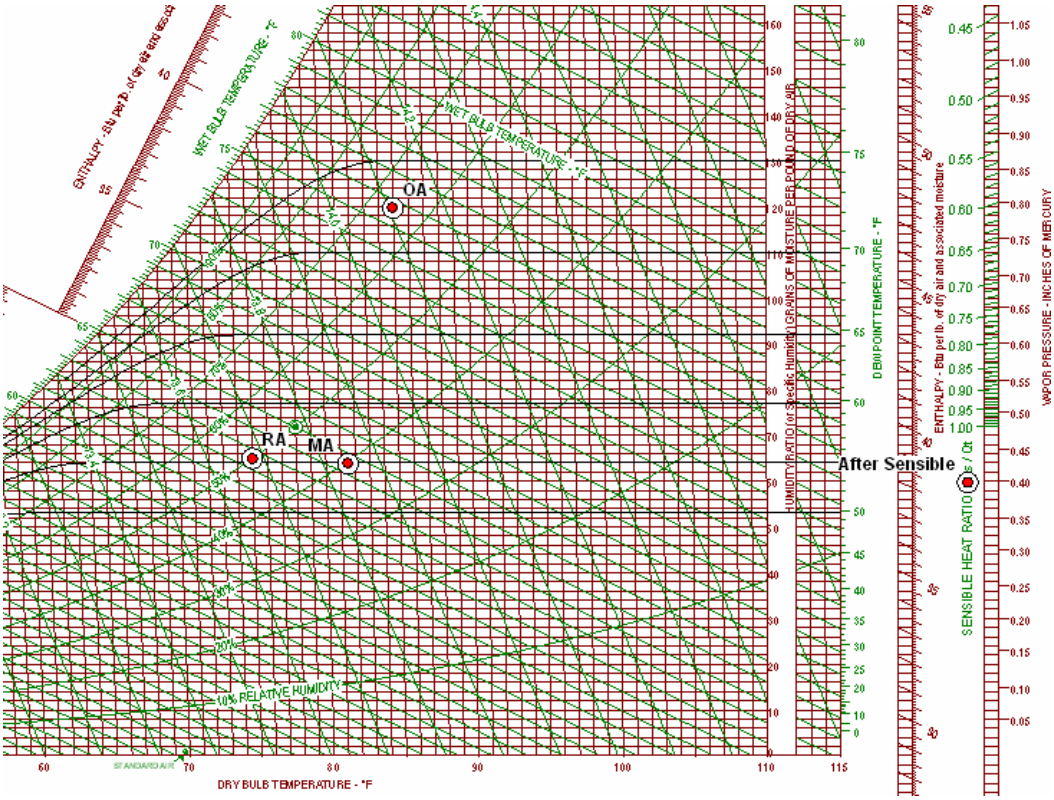


Figure G.3 – Desiccant System Typical April State Points

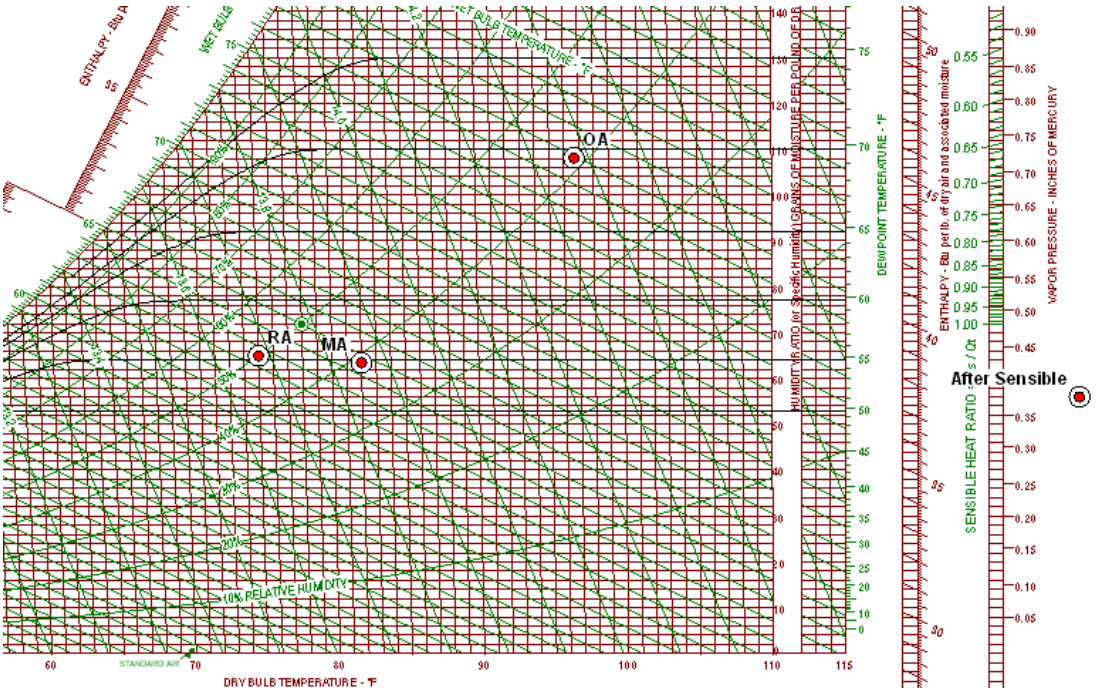


Figure G.4 – Desiccant System Typical July State Points

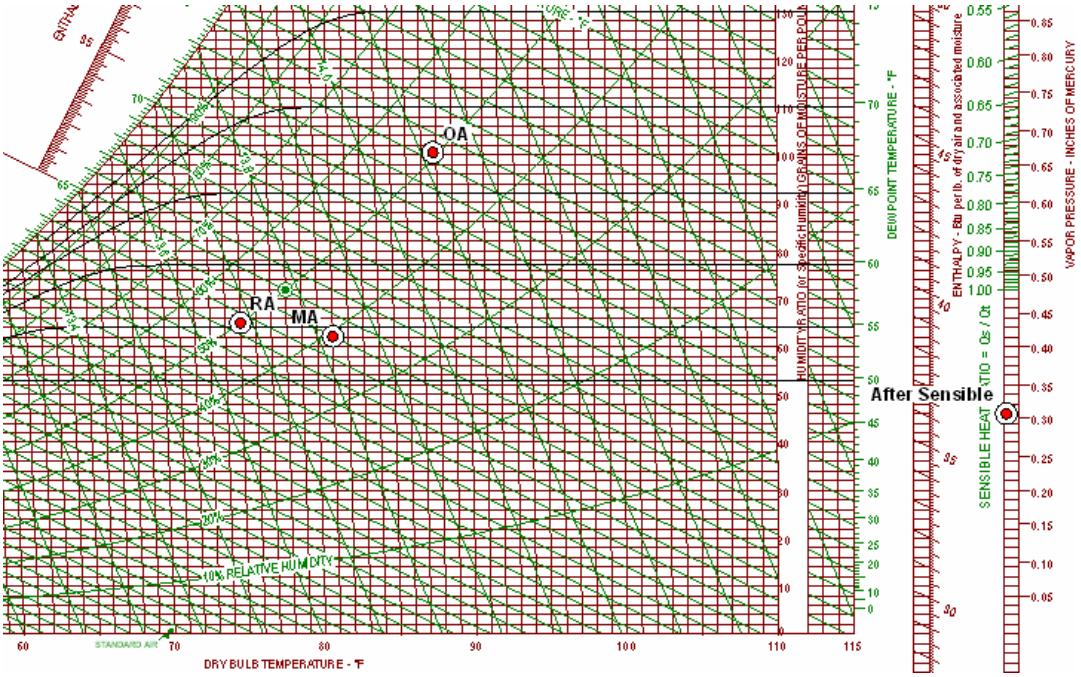


Figure G.5 – Desiccant System Typical October State Points