

**EVALUATION OF HFC-245ca FOR
COMMERCIAL USE IN LOW PRESSURE CHILLERS**

**FINAL REPORT
VOLUME II
CHILLER TEST DATA**

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Introduction to Chiller Test Data

The data presented here were taken under Trane Laboratory Test Order 23127 between May and October 1995. The chiller was a 200 nominal ton three stage direct drive centrifugal chiller with two economizers. Three sets of impellers, three refrigerants and two oils were tested in the chiller according to the following matrix. Trane 22 is a mineral oil and Solest 68 is a polyolester oil.

Chiller Test Matrix

Impeller Diameter inches	Impeller Diameter mm	Oil	CFC-11	HCFC-123	HFC-245ca
26/26/26	660/660/660	Trane 22	X		
26/26/26	660/660/660	Solest 68	X	X	X
25/25/24.5	635/635/622	Solest 68	X	X	X
24/24/24	610/610/610	Solest 68		X	

Runs 1 through 6 were to optimize the refrigerant charge using CFC-11. This was determined to be 360 lbm (163.3 Kg) and this value was used for all three refrigerants. The chiller takes a charge of six gallons of oil (22.7 liters).

These data which follow are divided into Large Impeller, Medium Impeller and Small Impeller sets further subdivided by Imperial and Metric presentation. The data were taken in Imperial units. These data are presented in four-page sets. Page 1 shows the reduced chiller test data. Page 2 shows some supporting calculations by curve fit, such as motor efficiency and motor speed. Pages 3 and 4 show the raw data as delivered by the laboratory. All following four-page sets are repetition of the form but for successive test runs.

Definition of Terms

Evaporator Approach	Evaporator Leaving Water Temperature minus Evaporator Saturation Temperature
Condenser Approach	Condenser Saturation Temperature minus Condenser Leaving Water Temperature
LMTD	Log Mean Temperature Difference - Cross flow model
ITD/Delta T	Inlet Temperature difference (water to refrigerant) divided by Evaporator Water Temperature Difference
Q/Ao	Heat Flux - Heat Flow divided by Surface Area
Uo	Overall Conductance - $Q/(A_o * LMTD)$
ho'	Refrigerant Side Heat Transfer Coefficient
Re	Reynolds Number
Pr	Prandtl Number
R, F	Intermediate terms in determining hi
hi	Water Side Heat Transfer Coefficient
A1, A2, A3, A4, A5	Curve fit coefficients

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		1	2	3	4	5
		Chg Opt	Chg Opt	Chg Opt	Chg Opt	Chg Opt
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	54	54	54	46	46
Capacity	Tons	195.20	208.00	218.80	211.00	217.00
Power	KW	162.00	171.12	178.02	173.10	176.10
KW/Ton	KW/Ton	0.830	0.820	0.810	0.820	0.810
Evaporator Leaving Water Temperature	Deg F	44.02	43.93	44.00	44.02	43.99
Condenser Entering Water Temperature	Deg F	84.97	84.92	84.96	84.98	85.00
Energy Balance	%	-0.70	-0.26	-0.69	-0.52	-0.75
Evaporator Entering Water Temperature	Deg F	53.73	54.29	54.88	54.53	54.78
Evaporator Leaving Water Temperature	Deg F	44.02	43.93	44.00	44.02	43.99
Evaporator Water Flow Rate	GPM	480.80	480.60	481.30	481.00	481.30
Condenser Entering Water Temperature	Deg F	84.97	84.92	84.96	84.98	85.00
Condenser Leaving Water Temperature	Deg F	94.68	95.22	95.81	95.44	95.75
Condenser Water Flow Rate	GPM	602.50	602.10	602.10	602.40	602.70
Evap Sat Press	Psia	5.88	6.11	6.38	6.39	6.54
Sat Temp	Deg F	32.38	34.00	35.84	35.91	36.91
Approach	Deg F	11.60	9.90	8.10	8.10	7.10
LMTD	Deg F	16.01	14.50	12.84	12.65	11.65
ITD/Delta T		2.20	1.96	1.75	1.77	1.66
Q/Ao	B/hr-ft2	14202.03	15131.84	15916.97	15352.26	15785.53
Uo	B/hr ft2 F	887.23	1043.70	1239.56	1214.07	1354.50
ho'	B/hr ft2 F	1256.99	1595.45	2100.36	2029.47	2453.06
Cond Sat Press	Psia	24.03	24.54	25.03	24.82	25.05
Sat Temp	Deg F	101.37	102.57	103.70	103.22	103.75
Approach	Deg F	6.70	7.40	7.90	7.80	8.00
Refrigerant Leaving Temp	Deg F	100.45	101.47	102.49	101.93	102.38
LMTD	Deg F	10.83	11.76	12.54	12.28	12.62
Q/Ao	B/hr-ft2	14122.39	14968.54	15767.80	15210.15	15638.09
Uo	B/hr ft2 F	1304.13	1273.10	1257.16	1239.00	1239.05
ho'	B/hr ft2 F	2065.24	1988.31	1947.76	1904.69	1903.86
Cond Sat Temp	Deg F	101.37	102.57	103.70	103.22	103.75
Evap Sat Temp	Deg F	32.38	34.00	35.84	35.91	36.91
Estimated Motor Efficiency (1)		0.935	0.933	0.932	0.933	0.932
Estimated Motor RPM (1)		3551	3547	3545	3547	3545
Compressor Suction CFM (2)	CFM	3297	3396	3425	3308	3332
Isentropic KW/T (2)		0.555	0.551	0.544	0.538	0.534
Adiabatic Efficiency (3)		0.669	0.672	0.672	0.656	0.659
Q/N (4)		0.929	0.957	0.966	0.933	0.940
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units	Value				
1	EVAP WATER FLOWMETER DELTA P	PSID	16.04	16.03	16.07	16.04	16.07
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.71	54.26	54.86	54.50	54.76
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.76	54.32	54.90	54.55	54.81
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.02	43.92	44.00	44.02	43.99
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.01	43.94	43.99	44.02	43.99
15	COND WATER FLOWMETER DELTA P	PSID	25.07	25.03	25.03	25.06	25.08
17	ENT COND WATER TEMP LOC 1	Deg F	84.99	84.94	84.97	84.99	85.01
18	ENT COND WATER TEMP LOC 2	Deg F	84.94	84.91	84.95	84.96	84.99
19	LVG COND WATER TEMP LOC 1	Deg F	94.68	95.22	95.81	95.44	95.75
20	LVG COND WATER TEMP LOC 2	Deg F	94.67	95.23	95.81	95.43	95.75
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	36.15	37.61	39.39	39.40	40.11
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	35.05	36.72	38.36	38.48	39.47
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	35.77	37.32	38.70	38.95	39.74
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.88	6.11	6.38	6.39	6.54
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.68	10.03	10.34	10.25	10.46
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.72	10.08	10.39	10.29	10.49
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.18	9.47	9.77	9.66	9.83
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	17.49	17.94	18.40	18.29	18.58
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.11	16.56	17.06	16.87	17.12
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.09	15.47	15.84	15.74	15.91
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.03	24.54	25.03	24.82	25.05
440	REFRIGERANT LVG COND TEMP	Deg F	100.45	101.47	102.49	101.93	102.38
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.67	16.07	16.48	16.44	16.69
485	HIGH PRESS ECONOMIZER TEMP	Deg F	77.60	78.93	80.30	80.16	80.91
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.72	10.03	10.39	10.33	10.51
487	LOW PRESS ECONOMIZER TEMP	Deg F	54.26	55.76	57.38	56.95	57.79
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	9.71	10.05	10.37	10.32	10.48
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	54.07	55.73	57.23	56.85	57.60
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.82	8.14	8.54	8.47	8.63
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	44.28	46.30	48.24	47.74	48.79
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	23.61	24.18	24.65	24.32	24.60
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	99.87	101.28	102.21	101.66	102.19
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	17.89	18.45	18.96	18.54	19.04
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	85.93	87.27	88.57	88.03	88.79
560	ATMOSPHERIC PRESS	PSIA	14.34	14.34	14.34	14.34	14.34
580	MOTOR VOLTAGE - AB	Volts	3.895	3.892	3.903	3.913	3.928
581	MOTOR VOLTAGE - AC	Volts	3.921	3.917	3.928	3.937	3.955
582	MOTOR VOLTAGE - CB	Volts	3.900	3.896	3.908	3.918	3.935
583	MOTOR CURRENT - A	Volts	2.181	2.308	2.399	2.335	2.354
584	MOTOR CURRENT - B	Volts	2.319	2.432	2.512	2.462	2.490
585	MOTOR CURRENT - C	Volts	2.208	2.325	2.402	2.325	2.374
586	MOTOR POWER - PHASE 1	Volts	0.979	1.034	1.082	1.058	1.066
587	MOTOR POWER - PHASE 3	Volts	1.721	1.818	1.885	1.827	1.869
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	94.73	95.39	95.80	95.42	95.71
601	MAXIMUM MOTOR TEMPERATURE	Deg F	145.00	145.00	155.50	149.50	151.50
605	1st STAGE VANE SETTING	Degrees	54.00	54.00	54.00	46.00	46.00
607	3rd STAGE VANE SETTING	Degrees	57.00	57.00	57.00	54.00	54.00
608	UNIT HOUR METER READING	Hr	330.30	331.10	331.50	332.20	332.40
609	UNIT START COUNTER READING		95	95	95	95	95
610	CURRENT REFRIGERANT CHARGE	Lbm	280	300	320	320	340
700	TIME (HOURS)	HOURS	0.00	0.58	1.29	1.85	2.17
701	ENERGY BALANCE	%	-0.70	-0.26	-0.69	-0.52	-0.75
702	EVAP CAPACITY	Tons	195.20	208.00	218.80	211.00	217.00

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0		6	7	8	9	10
Run Number						
	Chg Opt					
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	46	40	40	40	40
Capacity	Tons	218.50	209.90	218.10	221.70	213.50
Power	KW	177.30	168.48	169.92	167.94	159.24
KW/Ton	KW/Ton	0.810	0.800	0.780	0.760	0.750
Evaporator Leaving Water Temperature	Deg F	44.01	44.02	44.01	44.02	44.03
Condenser Entering Water Temperature	Deg F	84.96	84.97	79.98	74.97	69.93
Energy Balance	%	-0.86	-0.67	-1.14	-0.74	-0.91
Evaporator Entering Water Temperature	Deg F	54.89	54.79	54.92	55.08	54.70
Evaporator Leaving Water Temperature	Deg F	44.01	44.02	44.01	44.02	44.03
Evaporator Water Flow Rate	GPM	481.10	467.00	478.70	479.80	479.50
Condenser Entering Water Temperature	Deg F	84.96	84.97	79.98	74.97	69.93
Condenser Leaving Water Temperature	Deg F	95.81	95.35	90.75	85.84	80.40
Condenser Water Flow Rate	GPM	601.80	602.50	601.30	600.60	599.10
Evap Sat Press	Psia	6.58	6.52	6.43	6.25	5.85
Sat Temp	Deg F	37.18	36.78	36.18	34.97	32.16
Approach	Deg F	6.80	7.20	7.80	9.10	11.90
LMTD	Deg F	11.42	11.82	12.50	13.85	16.64
ITD/Delta T		1.63	1.67	1.72	1.82	2.10
Q/Ao	B/hr-ft2	15897.54	15274.33	15868.80	16129.42	15537.25
Uo	B/hr ft2 F	1392.21	1292.44	1269.36	1164.43	933.80
ho'	B/hr ft2 F	2580.26	2293.06	2192.93	1895.33	1352.60
Cond Sat Press	Psia	25.21	24.54	22.81	20.92	18.87
Sat Temp	Deg F	104.12	102.57	98.42	93.61	88.01
Approach	Deg F	8.30	7.20	7.70	7.80	7.60
Refrigerant Leaving Temp	Deg F	102.80	101.48	97.21	91.38	85.21
LMTD	Deg F	12.99	11.65	12.28	12.42	12.10
Q/Ao	B/hr-ft2	15761.52	15089.58	15651.71	15779.15	15178.45
Uo	B/hr ft2 F	1213.51	1295.33	1274.82	1270.23	1254.50
ho'	B/hr ft2 F	1845.32	2041.14	2014.09	2025.48	2011.04
Cond Sat Temp	Deg F	104.12	102.57	98.42	93.61	88.01
Evap Sat Temp	Deg F	37.18	36.78	36.18	34.97	32.16
Estimated Motor Efficiency (1)		0.932	0.934	0.933	0.934	0.936
Estimated Motor RPM (1)		3545	3548	3548	3548	3552
Compressor Suction CFM (2)	CFM	3336	3226	3383	3512	3575
Isentropic KW/T (2)		0.534	0.524	0.495	0.466	0.444
Adiabatic Efficiency (3)		0.659	0.655	0.635	0.613	0.592
Q/N (4)		0.941	0.909	0.954	0.990	1.007
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.06	15.13	15.90	15.97	15.95
3	ENT EVAP WATER TEMP LOC 1	Deg F	54.86	54.77	54.90	55.06	54.68
4	ENT EVAP WATER TEMP LOC 2	Deg F	54.91	54.80	54.94	55.10	54.72
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.02	44.01	44.02	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.01	44.02	44.01	44.01	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.01	25.07	24.99	24.96	24.85
17	ENT COND WATER TEMP LOC 1	Deg F	84.98	85.00	79.99	74.98	69.92
18	ENT COND WATER TEMP LOC 2	Deg F	84.94	84.94	79.97	74.97	69.93
19	LVG COND WATER TEMP LOC 1	Deg F	95.81	95.35	90.76	85.84	80.39
20	LVG COND WATER TEMP LOC 2	Deg F	95.81	95.34	90.75	85.84	80.40
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.46	39.82	38.90	38.29	35.46
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	39.96	39.24	38.73	37.34	34.50
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	40.03	38.87	38.33	37.20	34.50
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.58	6.52	6.43	6.25	5.85
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.50	10.26	9.88	9.42	8.72
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.57	10.28	9.93	9.46	8.76
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.89	9.68	9.26	8.75	8.06
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	18.68	18.31	17.50	16.62	15.41
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	17.21	16.14	15.31	14.40	13.26
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	16.01	15.69	14.77	13.76	12.56
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	25.21	24.54	22.81	20.92	18.87
440	REFRIGERANT LVG COND TEMP	Deg F	102.80	101.48	97.21	91.38	85.21
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.81	16.46	15.63	14.61	13.38
485	HIGH PRESS ECONOMIZER TEMP	Deg F	81.25	80.23	77.51	74.41	70.10
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	10.54	10.27	9.84	9.35	8.62
487	LOW PRESS ECONOMIZER TEMP	Deg F	58.07	56.76	54.93	52.45	48.77
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	10.57	10.39	10.09	9.74	8.99
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	57.99	57.01	55.20	52.77	49.04
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.71	8.29	8.14	7.86	7.32
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.40	46.99	46.32	44.81	41.58
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.81	24.41	22.96	21.30	19.28
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	102.53	101.63	97.16	90.95	84.92
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	19.04	18.37	17.29	16.12	14.84
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	89.16	86.63	83.74	80.22	75.37
560	ATMOSPHERIC PRESS	PSIA	14.33	14.35	14.35	14.35	14.36
580	MOTOR VOLTAGE - AB	Volts	3.927	3.915	3.896	3.890	3.898
581	MOTOR VOLTAGE - AC	Volts	3.955	3.936	3.922	3.915	3.923
582	MOTOR VOLTAGE - CB	Volts	3.931	3.920	3.901	3.896	3.906
583	MOTOR CURRENT - A	Volts	2.389	2.261	2.295	2.280	2.152
584	MOTOR CURRENT - B	Volts	2.506	2.406	2.425	2.399	2.281
585	MOTOR CURRENT - C	Volts	2.398	2.279	2.311	2.283	2.171
586	MOTOR POWER - PHASE 1	Volts	1.072	1.020	1.033	1.024	0.959
587	MOTOR POWER - PHASE 3	Volts	1.883	1.788	1.799	1.775	1.695
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	95.77	95.36	90.68	85.77	80.41
601	MAXIMUM MOTOR TEMPERATURE	Deg F	154.50	145.50	148.50	149.50	156.50
605	1st STAGE VANE SETTING	Degrees	46.00	40.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	54.00	50.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	333.30	335.50	336.50	337.10	337.50
609	UNIT START COUNTER READING		95	96	96	96	96
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	2.97	20.30	21.29	21.69	22.25
701	ENERGY BALANCE	%	-0.86	-0.67	-1.14	-0.74	-0.91
702	EVAP CAPACITY	Tons	218.50	209.90	218.10	221.70	213.50

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		11	12	13	14	15
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	40	40	40	40	10
Capacity	Tons	197.30	181.70	157.00	143.70	111.60
Power	KW	165.48	159.36	144.78	138.72	89.28
KW/Ton	KW/Ton	0.840	0.880	0.920	0.970	0.800
Evaporator Leaving Water Temperature	Deg F	44.00	44.03	44.02	44.01	44.04
Condenser Entering Water Temperature	Deg F	89.99	95.08	99.99	101.37	69.98
Energy Balance	%	-0.58	-0.63	-0.96	-0.50	-1.53
Evaporator Entering Water Temperature	Deg F	53.72	53.15	51.92	51.24	49.65
Evaporator Leaving Water Temperature	Deg F	44.00	44.03	44.02	44.01	44.04
Evaporator Water Flow Rate	GPM	486.10	477.20	476.10	475.80	476.30
Condenser Entering Water Temperature	Deg F	89.99	95.08	99.99	101.37	69.98
Condenser Leaving Water Temperature	Deg F	99.85	104.24	108.01	108.75	75.56
Condenser Water Flow Rate	GPM	601.20	602.00	602.10	602.20	597.70
Evap Sat Press	Psia	6.61	6.69	6.81	6.87	6.92
Sat Temp	Deg F	37.37	37.89	38.66	39.04	39.36
Approach	Deg F	6.60	6.10	5.40	5.00	4.70
LMTD	Deg F	10.77	10.02	8.72	8.05	7.12
ITD/Delta T		1.68	1.67	1.68	1.69	1.83
Q/Ao	B/hr-ft2	14353.29	13218.95	11425.94	10457.75	8119.19
Uo	B/hr ft2 F	1332.88	1319.59	1310.06	1298.92	1140.27
ho'	B/hr ft2 F	2374.55	2357.86	2335.38	2303.69	1850.81
Cond Sat Press	Psia	26.35	28.06	29.66	29.71	16.11
Sat Temp	Deg F	106.68	110.36	113.65	113.75	79.60
Approach	Deg F	6.80	6.10	5.60	5.00	4.00
Refrigerant Leaving Temp	Deg F	105.63	109.58	112.89	113.00	78.87
LMTD	Deg F	11.04	10.01	9.07	8.14	6.43
Q/Ao	B/hr-ft2	14288.42	13279.68	11625.11	10703.61	8072.40
Uo	B/hr ft2 F	1294.78	1326.49	1282.22	1314.96	1255.13
ho'	B/hr ft2 F	2021.10	2076.65	1952.13	2024.21	2026.20
Cond Sat Temp	Deg F	106.68	110.36	113.65	113.75	79.60
Evap Sat Temp	Deg F	37.37	37.89	38.66	39.04	39.36
Estimated Motor Efficiency (1)		0.934	0.936	0.939	0.941	0.948
Estimated Motor RPM (1)		3549	3551	3557	3559	3574
Compressor Suction CFM (2)	CFM	3007	2748	2342	2125	1584
Isentropic KW/T (2)		0.553	0.577	0.595	0.591	0.308
Adiabatic Efficiency (3)		0.658	0.656	0.647	0.609	0.385
Q/N (4)		0.847	0.774	0.659	0.597	0.443
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.40	15.80	15.73	15.71	15.75
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.69	53.12	51.89	51.21	49.62
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.74	53.17	51.94	51.27	49.67
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.00	44.03	44.02	44.01	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	44.03	44.02	44.01	44.04
15	COND WATER FLOWMETER DELTA P	PSID	24.93	24.97	24.95	24.95	24.74
17	ENT COND WATER TEMP LOC 1	Deg F	90.00	95.11	100.02	101.40	69.98
18	ENT COND WATER TEMP LOC 2	Deg F	89.98	95.05	99.95	101.33	69.98
19	LVG COND WATER TEMP LOC 1	Deg F	99.84	104.25	108.02	108.76	75.56
20	LVG COND WATER TEMP LOC 2	Deg F	99.85	104.22	107.99	108.74	75.56
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.16	40.89	41.76	42.15	42.08
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	39.84	40.41	41.12	41.47	41.80
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.40	40.34	41.22	41.68	41.58
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.61	6.69	6.81	6.87	6.92
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.65	11.04	11.39	11.48	7.27
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.69	11.10	11.48	11.60	7.32
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	10.16	10.65	11.12	11.23	7.07
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	19.06	19.62	20.20	20.23	11.07
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	17.03	17.96	18.95	19.15	10.35
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	16.70	17.69	18.67	18.85	10.67
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	26.35	28.06	29.66	29.71	16.11
440	REFRIGERANT LVG COND TEMP	Deg F	105.63	109.58	112.89	113.00	78.87
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	17.44	18.33	19.25	19.29	12.19
485	HIGH PRESS ECONOMIZER TEMP	Deg F	83.20	85.92	88.48	88.65	66.19
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.71	11.10	11.47	11.49	7.27
487	LOW PRESS ECONOMIZER TEMP	Deg F	58.75	60.52	62.15	62.20	41.08
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	10.77	11.13	11.49	11.50	7.44
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	58.79	60.48	62.00	62.11	41.35
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.39	8.39	8.38	8.29	7.19
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	47.67	47.72	47.37	46.94	40.56
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	26.18	27.80	29.45	29.49	15.85
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	105.85	109.46	112.82	112.81	78.60
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	19.25	20.09	21.07	20.88	12.91
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	89.29	91.88	94.05	93.48	68.14
560	ATMOSPHERIC PRESS	PSIA	14.36	14.36	14.36	14.37	14.37
580	MOTOR VOLTAGE - AB	Volts	3.878	3.890	3.870	3.861	3.931
581	MOTOR VOLTAGE - AC	Volts	3.898	3.913	3.899	3.878	3.956
582	MOTOR VOLTAGE - CB	Volts	3.880	3.899	3.871	3.864	3.938
583	MOTOR CURRENT - A	Volts	2.258	2.152	1.980	1.900	1.278
584	MOTOR CURRENT - B	Volts	2.393	2.292	2.095	2.030	1.390
585	MOTOR CURRENT - C	Volts	2.240	2.156	1.980	1.920	1.355
586	MOTOR POWER - PHASE 1	Volts	1.021	0.972	0.876	0.837	0.432
587	MOTOR POWER - PHASE 3	Volts	1.737	1.684	1.537	1.475	1.056
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	99.86	104.11	108.43	108.87	75.46
601	MAXIMUM MOTOR TEMPERATURE	Deg F	140.50	135.50	127.50	123.10	95.31
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	40.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	50.00	19.00
608	UNIT HOUR METER READING	Hr	338.30	338.50	339.20	340.00	341.10
609	UNIT START COUNTER READING		96	96	96	96	96
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	22.91	23.30	23.87	24.53	25.61
701	ENERGY BALANCE	%	-0.58	-0.63	-0.96	-0.50	-1.53
702	EVAP CAPACITY	Tons	197.30	181.70	157.00	143.70	111.60

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		16	17	18	19	20
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	10	10	10	10	90
Capacity	Tons	109.20	105.50	100.30	78.40	238.60
Power	KW	91.20	92.58	92.82	84.48	198.00
KW/Ton	KW/Ton	0.840	0.880	0.930	1.080	0.830
Evaporator Leaving Water Temperature	Deg F	43.99	44.00	44.00	44.00	44.00
Condenser Entering Water Temperature	Deg F	75.00	80.00	84.96	90.03	84.98
Energy Balance	%	-0.94	-0.68	-1.04	-0.15	-0.73
Evaporator Entering Water Temperature	Deg F	49.48	49.31	49.05	47.94	55.86
Evaporator Leaving Water Temperature	Deg F	43.99	44.00	44.00	44.00	44.00
Evaporator Water Flow Rate	GPM	475.70	475.40	475.40	475.20	481.90
Condenser Entering Water Temperature	Deg F	75.00	80.00	84.96	90.03	84.98
Condenser Leaving Water Temperature	Deg F	80.47	85.33	90.10	94.15	96.91
Condenser Water Flow Rate	GPM	598.50	598.60	599.70	600.60	599.70
Evap Sat Press	Psia	6.96	6.99	7.03	7.13	6.43
Sat Temp	Deg F	39.61	39.80	40.05	40.66	36.18
Approach	Deg F	4.40	4.20	3.90	3.30	7.80
LMTD	Deg F	6.76	6.50	6.13	5.06	12.85
ITD/Delta T		1.80	1.79	1.78	1.85	1.66
Q/Ao	B/hr-ft2	7942.79	7677.51	7294.59	5703.15	17362.49
Uo	B/hr ft2 F	1175.43	1181.64	1189.54	1127.83	1351.11
ho'	B/hr ft2 F	1947.02	1965.21	1987.74	1824.30	2435.97
Cond Sat Press	Psia	17.62	19.23	20.94	22.19	26.14
Sat Temp	Deg F	84.32	89.00	93.66	96.88	106.21
Approach	Deg F	3.90	3.70	3.60	2.70	9.30
Refrigerant Leaving Temp	Deg F	83.59	88.34	93.02	96.27	104.93
LMTD	Deg F	6.19	5.94	5.75	4.48	14.45
Q/Ao	B/hr-ft2	7923.25	7715.92	7432.79	5967.41	17268.02
Uo	B/hr ft2 F	1280.60	1298.58	1292.15	1332.45	1194.72
ho'	B/hr ft2 F	2067.92	2091.21	2049.92	2129.24	1803.27
Cond Sat Temp	Deg F	84.32	89.00	93.66	96.88	106.21
Evap Sat Temp	Deg F	39.61	39.80	40.05	40.66	36.18
Estimated Motor Efficiency (1)		0.948	0.948	0.948	0.948	0.928
Estimated Motor RPM (1)		3574	3573	3573	3576	3537
Compressor Suction CFM (2)	CFM	1549	1497	1422	1101	3733
Isentropic KW/T (2)		0.343	0.378	0.413	0.434	0.564
Adiabatic Efficiency (3)		0.408	0.430	0.444	0.402	0.680
Q/N (4)		0.433	0.419	0.398	0.308	1.055
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	15.71	15.69	15.69	15.68	16.11
3	ENT EVAP WATER TEMP LOC 1	Deg F	49.45	49.28	49.02	47.91	55.85
4	ENT EVAP WATER TEMP LOC 2	Deg F	49.51	49.34	49.07	47.97	55.88
5	LVG EVAP WATER TEMP LOC 1	Deg F	43.99	44.00	44.00	44.00	44.01
6	LVG EVAP WATER TEMP LOC 2	Deg F	43.99	44.00	44.00	43.99	44.00
15	COND WATER FLOWMETER DELTA P	PSID	24.78	24.77	24.83	24.88	24.83
17	ENT COND WATER TEMP LOC 1	Deg F	75.00	80.00	84.97	90.05	84.98
18	ENT COND WATER TEMP LOC 2	Deg F	75.00	79.99	84.95	90.01	84.97
19	LVG COND WATER TEMP LOC 1	Deg F	80.47	85.33	90.10	94.16	96.91
20	LVG COND WATER TEMP LOC 2	Deg F	80.48	85.33	90.09	94.14	96.90
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	42.39	42.56	43.01	43.56	39.34
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	41.84	42.03	42.44	43.27	38.24
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	41.78	42.10	42.30	42.74	38.33
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.96	6.99	7.03	7.13	6.43
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.70	8.17	8.71	9.07	10.80
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.80	8.32	8.89	9.29	10.85
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.51	8.00	8.56	8.95	10.09
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	12.02	13.05	14.19	15.34	18.40
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	11.21	12.07	13.02	13.99	17.45
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	11.57	12.55	13.63	14.58	16.27
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	17.62	19.23	20.94	22.19	26.14
440	REFRIGERANT LVG COND TEMP	Deg F	83.59	88.34	93.02	96.27	104.93
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.99	13.85	14.76	15.32	16.98
485	HIGH PRESS ECONOMIZER TEMP	Deg F	68.97	71.87	74.93	76.76	81.81
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	7.70	8.18	8.72	9.10	10.78
487	LOW PRESS ECONOMIZER TEMP	Deg F	43.54	46.24	49.14	51.13	59.20
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.81	8.24	8.72	9.07	10.85
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	43.66	46.29	49.14	50.92	59.27
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.29	7.40	7.55	7.71	8.89
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	41.24	41.69	42.50	43.44	50.58
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	17.36	18.94	20.67	21.90	25.92
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	83.30	87.91	92.61	95.82	104.97
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	13.72	14.65	15.60	16.10	19.70
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	71.35	74.53	77.78	79.08	90.75
560	ATMOSPHERIC PRESS	PSIA	14.37	14.37	14.37	14.37	14.30
580	MOTOR VOLTAGE - AB	Volts	3.936	3.923	3.918	3.942	3.864
581	MOTOR VOLTAGE - AC	Volts	3.959	3.947	3.942	3.970	3.888
582	MOTOR VOLTAGE - CB	Volts	3.942	3.927	3.922	3.946	3.865
583	MOTOR CURRENT - A	Volts	1.310	1.326	1.340	1.235	2.686
584	MOTOR CURRENT - B	Volts	1.418	1.432	1.427	1.332	2.810
585	MOTOR CURRENT - C	Volts	1.373	1.389	1.387	1.307	2.667
586	MOTOR POWER - PHASE 1	Volts	0.448	0.460	0.466	0.391	1.240
587	MOTOR POWER - PHASE 3	Volts	1.072	1.083	1.081	1.016	2.060
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	80.32	85.27	90.03	94.08	96.93
601	MAXIMUM MOTOR TEMPERATURE	Deg F	90.51	83.50	84.50	83.50	183.50
605	1st STAGE VANE SETTING	Degrees	10.00	10.00	10.00	10.00	90.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00	19.00	19.00	68.00
608	UNIT HOUR METER READING	Hr	341.30	341.50	342.10	342.30	350.10
609	UNIT START COUNTER READING		96	96	96	96	98
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	26.04	26.37	26.68	26.99	359.92
701	ENERGY BALANCE	%	-0.94	-0.68	-1.04	-0.15	-0.73
702	EVAP CAPACITY	Tons	109.20	105.50	100.30	78.40	238.60

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		21	22	23	24	25
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	224.20	206.50	260.40	256.90	250.50
Power	KW	192.60	184.62	203.64	196.98	203.76
KW/Ton	KW/Ton	0.860	0.890	0.780	0.770	0.810
Evaporator Leaving Water Temperature	Deg F	44.01	44.02	44.00	43.98	44.00
Condenser Entering Water Temperature	Deg F	89.96	94.99	74.97	69.85	79.76
Energy Balance	%	-0.48	-0.52	-1.04	-1.13	-1.14
Evaporator Entering Water Temperature	Deg F	55.16	54.30	56.94	56.70	56.48
Evaporator Leaving Water Temperature	Deg F	44.01	44.02	44.00	43.98	44.00
Evaporator Water Flow Rate	GPM	481.40	480.90	482.40	483.60	480.70
Condenser Entering Water Temperature	Deg F	89.96	94.99	74.97	69.85	79.76
Condenser Leaving Water Temperature	Deg F	101.21	105.45	87.83	82.55	92.28
Condenser Water Flow Rate	GPM	600.70	600.90	600.90	597.90	599.70
Evap Sat Press	Psia	6.51	6.60	6.29	6.00	6.32
Sat Temp	Deg F	36.72	37.31	35.24	33.23	35.43
Approach	Deg F	7.30	6.70	8.80	10.70	8.60
LMTD	Deg F	12.01	11.07	14.26	16.29	13.89
ITD/Delta T		1.65	1.65	1.68	1.85	1.69
Q/Ao	B/hr-ft2	16309.25	15024.19	18943.82	18690.26	18223.08
Uo	B/hr ft2 F	1357.42	1357.77	1327.99	1147.30	1312.17
ho'	B/hr ft2 F	2460.76	2467.32	2356.50	1840.43	2313.04
Cond Sat Press	Psia	27.83	29.56	22.66	20.61	24.38
Sat Temp	Deg F	109.87	113.45	98.05	92.78	102.20
Approach	Deg F	8.70	8.00	10.20	10.20	9.90
Refrigerant Leaving Temp	Deg F	108.78	112.47	96.97	91.64	101.12
LMTD	Deg F	13.51	12.51	15.79	15.73	15.34
Q/Ao	B/hr-ft2	16297.96	15138.50	18683.44	18380.77	18117.69
Uo	B/hr ft2 F	1206.06	1210.16	1183.51	1168.15	1181.26
ho'	B/hr ft2 F	1811.49	1804.25	1809.55	1795.62	1789.71
Cond Sat Temp	Deg F	109.87	113.45	98.05	92.78	102.20
Evap Sat Temp	Deg F	36.72	37.31	35.24	33.23	35.43
Estimated Motor Efficiency (1)		0.929	0.930	0.928	0.928	0.928
Estimated Motor RPM (1)		3539	3542	3535	3538	3535
Compressor Suction CFM (2)	CFM	3480	3176	4124	4227	3967
Isentropic KW/T (2)		0.590	0.614	0.504	0.479	0.537
Adiabatic Efficiency (3)		0.686	0.690	0.646	0.622	0.663
Q/N (4)		0.983	0.897	1.167	1.195	1.122
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.08	16.04	16.14	16.21	16.03
3	ENT EVAP WATER TEMP LOC 1	Deg F	55.14	54.27	56.92	56.69	56.47
4	ENT EVAP WATER TEMP LOC 2	Deg F	55.18	54.32	56.95	56.72	56.50
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.02	44.01	43.98	44.01
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.01	44.01	44.00	43.98	44.00
15	COND WATER FLOWMETER DELTA P	PSID	24.89	24.88	24.98	24.75	24.86
17	ENT COND WATER TEMP LOC 1	Deg F	89.98	95.02	74.97	69.83	79.76
18	ENT COND WATER TEMP LOC 2	Deg F	89.94	94.96	74.97	69.85	79.76
19	LVG COND WATER TEMP LOC 1	Deg F	101.20	105.45	87.83	82.55	92.28
20	LVG COND WATER TEMP LOC 2	Deg F	101.22	105.44	87.83	82.55	92.27
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	39.53	41.25	40.02	36.80	39.25
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.70	40.11	38.59	35.91	38.34
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	38.93	41.01	39.65	38.05	39.77
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.51	6.60	6.29	6.00	6.32
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	11.12	11.46	10.27	9.72	10.49
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	11.17	11.50	10.30	9.75	10.53
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	10.50	10.94	9.35	8.80	9.64
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	19.18	19.96	16.99	15.87	17.68
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	18.26	19.07	15.98	14.87	16.67
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	17.21	18.17	14.56	13.42	15.37
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	27.83	29.56	22.66	20.61	24.38
440	REFRIGERANT LVG COND TEMP	Deg F	108.78	112.47	96.97	91.64	101.12
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	17.89	18.82	15.22	14.05	16.06
485	HIGH PRESS ECONOMIZER TEMP	Deg F	84.56	87.26	76.10	72.07	78.86
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	11.16	11.50	10.09	9.51	10.42
487	LOW PRESS ECONOMIZER TEMP	Deg F	60.74	62.20	56.06	53.27	57.45
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	11.19	11.50	10.45	9.87	10.56
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	60.75	62.15	56.37	53.57	57.55
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.89	8.93	8.63	8.18	8.66
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	50.39	50.49	49.93	47.52	49.87
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	27.47	29.07	22.64	20.63	24.27
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	108.59	111.96	97.12	91.81	101.21
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	20.69	21.56	17.87	16.66	18.61
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	93.29	95.67	85.53	81.53	88.30
560	ATMOSPHERIC PRESS	PSIA	14.29	14.29	14.29	14.28	14.28
580	MOTOR VOLTAGE - AB	Volts	3.867	3.891	3.828	3.874	3.870
581	MOTOR VOLTAGE - AC	Volts	3.889	3.910	3.847	3.893	3.888
582	MOTOR VOLTAGE - CB	Volts	3.866	3.891	3.831	3.878	3.875
583	MOTOR CURRENT - A	Volts	2.622	2.509	2.794	2.674	2.768
584	MOTOR CURRENT - B	Volts	2.741	2.622	2.926	2.802	2.908
585	MOTOR CURRENT - C	Volts	2.589	2.470	2.754	2.639	2.717
586	MOTOR POWER - PHASE 1	Volts	1.209	1.156	1.289	1.234	1.291
587	MOTOR POWER - PHASE 3	Volts	2.000	1.921	2.105	2.049	2.105
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	101.24	105.46	87.76	82.76	92.29
601	MAXIMUM MOTOR TEMPERATURE	Deg F	174.50	164.50	212.50	239.50	193.40
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	351.00	351.00	353.30	354.00	354.30
609	UNIT START COUNTER READING		98	98	100	100	100
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	360.42	360.83	379.21	379.68	380.19
701	ENERGY BALANCE	%	-0.48	-0.52	-1.04	-1.13	-1.14
702	EVAP CAPACITY	Tons	224.20	206.50	260.40	256.90	250.50

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		26	27	28	29	30
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	Tons	242.80	254.70	257.80	228.00	213.80
Power	KW	193.68	198.54	194.64	187.68	182.76
KW/Ton	KW/Ton	0.800	0.780	0.760	0.820	0.850
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	44.00	43.99	44.02
Condenser Entering Water Temperature	Deg F	79.99	74.96	70.04	84.96	89.98
Energy Balance	%	-1.00	-0.92	-0.85	-0.95	-0.52
Evaporator Entering Water Temperature	Deg F	56.11	56.67	56.77	55.38	54.72
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	44.00	43.99	44.02
Evaporator Water Flow Rate	GPM	480.40	481.60	483.40	479.50	478.60
Condenser Entering Water Temperature	Deg F	79.99	74.96	70.04	84.96	89.98
Condenser Leaving Water Temperature	Deg F	92.04	87.58	82.74	96.35	100.71
Condenser Water Flow Rate	GPM	600.00	598.40	597.30	600.40	600.50
Evap Sat Press	Psia	6.34	6.34	6.19	6.36	6.44
Sat Temp	Deg F	35.58	35.58	34.56	35.71	36.25
Approach	Deg F	8.40	8.40	9.40	8.30	7.80
LMTD	Deg F	13.59	13.80	14.93	13.16	12.36
ITD/Delta T		1.70	1.66	1.74	1.73	1.73
Q/Ao	B/hr-ft2	17665.20	18534.77	18757.96	16592.35	15559.00
Uo	B/hr ft2 F	1300.13	1343.21	1256.78	1260.45	1259.08
ho'	B/hr ft2 F	2277.70	2407.99	2139.42	2163.02	2163.46
Cond Sat Press	Psia	24.10	22.54	20.70	25.72	27.43
Sat Temp	Deg F	101.54	97.76	93.02	105.27	109.02
Approach	Deg F	9.50	10.20	10.30	8.90	8.30
Refrigerant Leaving Temp	Deg F	100.39	96.66	91.80	104.09	108.11
LMTD	Deg F	14.71	15.65	15.79	13.84	12.94
Q/Ao	B/hr-ft2	17479.62	18250.25	18354.58	16506.24	15538.39
Uo	B/hr ft2 F	1188.16	1166.07	1162.59	1192.42	1200.62
ho'	B/hr ft2 F	1805.25	1772.45	1782.68	1797.97	1800.13
Cond Sat Temp	Deg F	101.54	97.76	93.02	105.27	109.02
Evap Sat Temp	Deg F	35.58	35.58	34.56	35.71	36.25
Estimated Motor Efficiency (1)		0.929	0.928	0.929	0.930	0.931
Estimated Motor RPM (1)		3539	3537	3539	3541	3543
Compressor Suction CFM (2)	CFM	3830	4003	4121	3599	3348
Isentropic KW/T (2)		0.530	0.499	0.468	0.559	0.585
Adiabatic Efficiency (3)		0.663	0.640	0.616	0.682	0.688
Q/N (4)		1.082	1.132	1.165	1.016	0.945
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.01	16.09	16.20	15.95	15.89
3	ENT EVAP WATER TEMP LOC 1	Deg F	56.08	56.66	56.76	55.36	54.70
4	ENT EVAP WATER TEMP LOC 2	Deg F	56.13	56.69	56.79	55.40	54.73
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.01	44.00	43.99	44.02
6	LVG EVAP WATER TEMP LOC 2	Deg F	43.99	44.00	44.00	43.99	44.01
15	COND WATER FLOWMETER DELTA P	PSID	24.88	24.77	24.70	24.89	24.87
17	ENT COND WATER TEMP LOC 1	Deg F	79.99	74.97	70.04	84.97	90.01
18	ENT COND WATER TEMP LOC 2	Deg F	79.98	74.94	70.04	84.95	89.95
19	LVG COND WATER TEMP LOC 1	Deg F	92.05	87.58	82.74	96.36	100.73
20	LVG COND WATER TEMP LOC 2	Deg F	92.04	87.57	82.74	96.34	100.69
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	39.43	39.16	38.86	39.75	39.79
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.86	38.79	38.18	39.24	39.65
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.84	39.95	39.56	39.99	40.00
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.34	6.34	6.19	6.36	6.44
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.34	10.18	9.83	10.56	10.90
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.36	10.20	9.84	10.59	10.93
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.55	9.31	8.89	9.89	10.32
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	17.51	16.87	16.02	18.15	18.94
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.62	16.03	15.18	17.32	18.12
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.31	14.58	13.66	16.09	17.03
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.10	22.54	20.70	25.72	27.43
440	REFRIGERANT LVG COND TEMP	Deg F	100.39	96.66	91.80	104.09	108.11
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.98	15.24	14.28	16.75	17.69
485	HIGH PRESS ECONOMIZER TEMP	Deg F	78.60	76.23	72.90	81.12	83.99
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.26	10.03	9.60	10.57	10.92
487	LOW PRESS ECONOMIZER TEMP	Deg F	56.83	55.79	53.70	58.12	59.78
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	10.34	10.36	9.97	10.60	10.96
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	56.96	56.08	53.99	58.14	59.75
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.56	8.57	8.29	8.56	8.68
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	48.81	49.49	48.28	48.50	49.15
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	23.93	22.42	20.68	25.45	27.02
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	100.41	96.71	91.99	103.99	107.72
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.61	17.53	16.69	19.35	20.20
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	87.63	85.13	81.97	89.82	92.36
560	ATMOSPHERIC PRESS	PSIA	14.28	14.27	14.27	14.27	14.27
580	MOTOR VOLTAGE - AB	Volts	3.890	3.857	3.864	3.902	3.873
581	MOTOR VOLTAGE - AC	Volts	3.907	3.874	3.884	3.919	3.888
582	MOTOR VOLTAGE - CB	Volts	3.898	3.857	3.868	3.900	3.871
583	MOTOR CURRENT - A	Volts	2.614	2.711	2.652	2.532	2.484
584	MOTOR CURRENT - B	Volts	2.761	2.833	2.768	2.672	2.608
585	MOTOR CURRENT - C	Volts	2.591	2.663	2.622	2.518	2.452
586	MOTOR POWER - PHASE 1	Volts	1.208	1.261	1.222	1.166	1.148
587	MOTOR POWER - PHASE 3	Volts	2.020	2.048	2.022	1.962	1.898
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	92.03	87.55	82.64	96.34	100.81
601	MAXIMUM MOTOR TEMPERATURE	Deg F	178.50	200.50	232.50	167.50	160.50
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	354.60	355.40	356.10	356.40	357.10
609	UNIT START COUNTER READING		100	100	100	100	100
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	380.61	381.32	381.85	382.26	382.77
701	ENERGY BALANCE	%	-1.00	-0.92	-0.85	-0.95	-0.52
702	EVAP CAPACITY	Tons	242.80	254.70	257.80	228.00	213.80

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0				
Run Number		31	32	
Refrigerant		11	11	
Oil		Trane 22	Trane 22	
1st Stage Guide Vane Setting		Degrees	70	10
Capacity		Tons	195.10	70.00
Power		KW	173.70	84.24
KW/Ton		KW/Ton	0.890	1.200
Evaporator Leaving Water Temperature		Deg F	44.00	44.02
Condenser Entering Water Temperature		Deg F	94.94	94.92
Energy Balance		%	-0.85	-1.35
Evaporator Entering Water Temperature		Deg F	53.63	47.45
Evaporator Leaving Water Temperature		Deg F	44.00	44.02
Evaporator Water Flow Rate		GPM	485.00	487.50
Condenser Entering Water Temperature		Deg F	94.94	94.92
Condenser Leaving Water Temperature		Deg F	104.85	98.73
Condenser Water Flow Rate		GPM	600.50	601.00
Evap Sat Press		Psia	6.54	7.11
Sat Temp		Deg F	36.91	40.54
Approach		Deg F	7.10	3.50
LMTD		Deg F	11.22	5.00
ITD/Delta T			1.74	2.01
Q/Ao		B/hr-ft2	14193.11	5094.34
Uo		B/hr ft2 F	1264.44	1018.78
ho'		B/hr ft2 F	2168.38	1541.65
Cond Sat Press		Psia	29.07	24.11
Sat Temp		Deg F	112.45	101.56
Approach		Deg F	7.60	2.80
Refrigerant Leaving Temp		Deg F	111.60	100.80
LMTD		Deg F	11.87	4.47
Q/Ao		B/hr-ft2	14326.20	5524.88
Uo		B/hr ft2 F	1206.56	1236.70
ho'		B/hr ft2 F	1797.42	1876.21
Cond Sat Temp		Deg F	112.45	101.56
Evap Sat Temp		Deg F	36.91	40.54
Estimated Motor Efficiency (1)			0.933	0.948
Estimated Motor RPM (1)			3546	3576
Compressor Suction CFM (2)		CFM	3021	990
Isentropic KW/T (2)			0.607	0.472
Adiabatic Efficiency (3)			0.682	0.393
Q/N (4)			0.852	0.277
(1) From motor curves at measured power input				
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split				
(3) Ratio of isentropic and test KW/T				
(4) CFM from cycle calculation / estimated motor RPM				
(5) Heat transfer coefficient calculations use bulk fluid properties				

Large Impellers - Imperial

ID	Description	Units		
1	EVAP WATER FLOWMETER DELTA P	PSID	16.32	16.50
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.61	47.42
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.65	47.48
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.00	44.02
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	44.01
15	COND WATER FLOWMETER DELTA P	PSID	24.85	24.89
17	ENT COND WATER TEMP LOC 1	Deg F	94.98	94.93
18	ENT COND WATER TEMP LOC 2	Deg F	94.91	94.90
19	LVG COND WATER TEMP LOC 1	Deg F	104.86	98.74
20	LVG COND WATER TEMP LOC 2	Deg F	104.83	98.72
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.34	43.63
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	40.22	43.25
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	40.57	44.14
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.54	7.11
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	11.26	9.84
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	11.29	10.03
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	10.77	9.72
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	19.70	16.26
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	18.95	15.36
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	17.96	15.79
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	29.07	24.11
440	REFRIGERANT LVG COND TEMP	Deg F	111.60	100.80
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	18.60	16.70
485	HIGH PRESS ECONOMIZER TEMP	Deg F	86.69	80.94
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	11.28	9.83
487	LOW PRESS ECONOMIZER TEMP	Deg F	61.35	54.71
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	11.26	9.72
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	61.20	54.13
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.68	8.02
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.23	45.23
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	28.63	23.64
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	111.05	100.16
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	21.12	17.95
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	94.84	84.82
560	ATMOSPHERIC PRESS	PSIA	14.26	14.25
580	MOTOR VOLTAGE - AB	Volts	3.854	3.916
581	MOTOR VOLTAGE - AC	Volts	3.874	3.932
582	MOTOR VOLTAGE - CB	Volts	3.858	3.918
583	MOTOR CURRENT - A	Volts	2.373	1.244
584	MOTOR CURRENT - B	Volts	2.502	1.338
585	MOTOR CURRENT - C	Volts	2.355	1.278
586	MOTOR POWER - PHASE 1	Volts	1.085	0.414
587	MOTOR POWER - PHASE 3	Volts	1.810	0.990
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	104.94	98.82
601	MAXIMUM MOTOR TEMPERATURE	Deg F	151.50	85.50
605	1st STAGE VANE SETTING	Degrees	70.00	10.00
607	3rd STAGE VANE SETTING	Degrees	63.00	19.00
608	UNIT HOUR METER READING	Hr	358.00	359.50
609	UNIT START COUNTER READING		100	100
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360
700	TIME (HOURS)	HOURS	383.73	385.48
701	ENERGY BALANCE	%	-0.85	-1.35
702	EVAP CAPACITY	Tons	195.10	70.00

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		39	40	41	42	43
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	256.20	256.00	244.80	231.60	218.90
Power	KW	198.24	201.18	197.88	192.96	189.66
KW/Ton	KW/Ton	0.770	0.790	0.810	0.830	0.870
Evaporator Leaving Water Temperature	Deg F	44.00	44.03	44.00	44.00	44.00
Condenser Entering Water Temperature	Deg F	69.99	75.00	79.97	84.97	89.98
Energy Balance	%	-0.86	-0.83	-1.02	-0.65	-1.04
Evaporator Entering Water Temperature	Deg F	56.66	56.70	56.19	55.55	54.94
Evaporator Leaving Water Temperature	Deg F	44.00	44.03	44.00	44.00	44.00
Evaporator Water Flow Rate	GPM	484.90	483.70	481.40	480.10	479.30
Condenser Entering Water Temperature	Deg F	69.99	75.00	79.97	84.97	89.98
Condenser Leaving Water Temperature	Deg F	82.55	87.58	92.09	96.46	100.96
Condenser Water Flow Rate	GPM	602.80	603.30	604.00	604.50	604.70
Evap Sat Press	Psia	6.04	6.29	6.30	6.33	6.47
Sat Temp	Deg F	33.50	35.24	35.31	35.50	36.45
Approach	Deg F	10.50	8.80	8.70	8.50	7.50
LMTD	Deg F	16.00	14.19	13.91	13.46	12.21
ITD/Delta T		1.83	1.69	1.71	1.74	1.69
Q/Ao	B/hr-ft2	18639.11	18629.61	17813.52	16853.44	15925.05
Uo	B/hr ft2 F	1164.65	1312.42	1281.02	1252.21	1303.82
ho'	B/hr ft2 F	1883.28	2305.03	2217.31	2136.98	2296.34
Cond Sat Press	Psia	20.67	22.63	24.29	25.94	27.76
Sat Temp	Deg F	92.94	97.98	101.99	105.77	109.72
Approach	Deg F	10.40	10.40	9.90	9.30	8.80
Refrigerant Leaving Temp	Deg F	91.83	96.96	100.79	104.63	108.64
LMTD	Deg F	15.85	15.87	15.16	14.29	13.51
Q/Ao	B/hr-ft2	18320.50	18357.05	17671.64	16764.58	16012.00
Uo	B/hr ft2 F	1155.93	1156.90	1165.59	1172.88	1184.79
ho'	B/hr ft2 F	1761.47	1746.05	1749.27	1749.51	1759.60
Cond Sat Temp	Deg F	92.94	97.98	101.99	105.77	109.72
Evap Sat Temp	Deg F	33.50	35.24	35.31	35.50	36.45
Estimated Motor Efficiency (1)		0.928	0.928	0.928	0.929	0.930
Estimated Motor RPM (1)		3537	3536	3537	3539	3540
Compressor Suction CFM (2)	CFM	4192	4054	3886	3675	3416
Isentropic KW/T (2)		0.478	0.504	0.537	0.566	0.590
Adiabatic Efficiency (3)		0.621	0.638	0.663	0.682	0.678
Q/N (4)		1.185	1.146	1.099	1.038	0.965
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.31	16.23	16.08	15.99	15.94
3	ENT EVAP WATER TEMP LOC 1	Deg F	56.64	56.68	56.16	55.53	54.90
4	ENT EVAP WATER TEMP LOC 2	Deg F	56.68	56.73	56.21	55.57	54.98
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.03	44.01	44.00	44.00
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	44.02	44.00	43.99	44.01
15	COND WATER FLOWMETER DELTA P	PSID	25.16	25.18	25.22	25.23	25.22
17	ENT COND WATER TEMP LOC 1	Deg F	69.99	75.00	79.99	84.97	89.99
18	ENT COND WATER TEMP LOC 2	Deg F	69.99	74.99	79.96	84.96	89.97
19	LVG COND WATER TEMP LOC 1	Deg F	82.55	87.58	92.10	96.46	100.95
20	LVG COND WATER TEMP LOC 2	Deg F	82.55	87.58	92.07	96.45	100.97
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	38.28	40.18	39.70	39.81	40.25
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	34.77	36.50	36.52	36.59	37.54
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	37.25	38.72	38.86	38.84	39.61
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.04	6.29	6.30	6.33	6.47
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.79	10.28	10.45	10.68	11.04
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.81	10.29	10.49	10.72	11.09
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.88	9.39	9.67	9.99	10.45
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	15.75	16.67	17.24	17.90	18.77
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	14.97	15.95	16.61	17.28	18.18
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	13.51	14.53	15.30	16.11	17.11
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	20.67	22.63	24.29	25.94	27.76
440	REFRIGERANT LVG COND TEMP	Deg F	91.83	96.96	100.79	104.63	108.64
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	14.15	15.23	16.04	16.82	17.79
485	HIGH PRESS ECONOMIZER TEMP	Deg F	72.43	76.24	78.79	81.29	84.29
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.58	10.14	10.38	10.67	11.08
487	LOW PRESS ECONOMIZER TEMP	Deg F	53.62	56.14	57.36	58.57	60.45
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	9.89	10.42	10.50	10.72	11.11
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	53.90	56.42	57.56	58.63	60.39
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.22	8.60	8.62	8.74	8.78
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	47.69	49.50	49.18	49.34	49.73
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	20.66	22.59	24.15	25.65	27.36
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	92.10	97.19	100.94	104.50	108.40
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	16.46	18.06	18.54	19.41	20.56
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	81.44	85.78	87.82	90.14	93.17
560	ATMOSPHERIC PRESS	PSIA	14.46	14.47	14.47	14.46	14.46
580	MOTOR VOLTAGE - AB	Volts	3.853	3.850	3.877	3.861	3.884
581	MOTOR VOLTAGE - AC	Volts	3.873	3.866	3.897	3.883	3.904
582	MOTOR VOLTAGE - CB	Volts	3.859	3.846	3.879	3.866	3.884
583	MOTOR CURRENT - A	Volts	2.701	2.757	2.679	2.612	2.563
584	MOTOR CURRENT - B	Volts	2.838	2.867	2.813	2.743	2.691
585	MOTOR CURRENT - C	Volts	2.666	2.713	2.669	2.616	2.559
586	MOTOR POWER - PHASE 1	Volts	1.257	1.266	1.233	1.200	1.175
587	MOTOR POWER - PHASE 3	Volts	2.046	2.087	2.065	2.016	1.986
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	82.56	87.51	92.12	96.49	100.86
601	MAXIMUM MOTOR TEMPERATURE	Deg F	213.50	208.50	188.50	177.50	170.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	389.20	389.50	390.10	390.50	391.10
609	UNIT START COUNTER READING		109	109	109	109	109
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	-	0.44	0.83	1.39	1.85
701	ENERGY BALANCE	%	-0.86	-0.83	-1.02	-0.65	-1.04
702	EVAP CAPACITY	Tons	256.20	256.00	244.80	231.60	218.90

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		44	45	46	47	48
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	70	70	70	70
Capacity	Tons	202.90	193.70	213.80	224.50	237.80
Power	KW	180.78	173.52	183.54	185.76	189.84
	KW/Ton	0.890	0.900	0.860	0.830	0.800
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	43.99	44.00	44.03
Condenser Entering Water Temperature	Deg F	94.98	95.86	89.97	84.97	80.04
Energy Balance	%	-1.07	-0.90	-0.88	-1.48	-0.80
Evaporator Entering Water Temperature	Deg F	53.93	53.48	54.44	55.22	55.87
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	43.99	44.00	44.03
Evaporator Water Flow Rate	GPM	489.10	488.80	489.90	479.50	481.00
Condenser Entering Water Temperature	Deg F	94.98	95.86	89.97	84.97	80.04
Condenser Leaving Water Temperature	Deg F	105.21	105.63	100.65	96.16	91.77
Condenser Water Flow Rate	GPM	605.80	605.50	605.00	604.30	603.40
Evap Sat Press	Psia	6.57	6.64	6.49	6.36	6.30
Sat Temp	Deg F	37.11	37.57	36.58	35.71	35.31
Approach	Deg F	6.90	6.40	7.40	8.30	8.70
LMTD	Deg F	11.13	10.46	11.88	13.11	13.80
ITD/Delta T		1.69	1.68	1.71	1.74	1.74
Q/Ao	B/hr-ft2	14759.90	14090.52	15555.22	16337.66	17300.79
Uo	B/hr ft2 F	1326.60	1346.59	1309.52	1246.26	1253.33
ho'	B/hr ft2 F	2346.07	2411.67	2289.63	2121.93	2137.50
Cond Sat Press	Psia	29.48	29.53	27.54	25.72	24.01
Sat Temp	Deg F	113.29	113.39	109.26	105.27	101.33
Approach	Deg F	8.10	7.80	8.60	9.10	9.60
Refrigerant Leaving Temp	Deg F	112.35	112.45	108.19	104.10	100.02
LMTD	Deg F	12.51	11.99	13.24	13.97	14.65
Q/Ao	B/hr-ft2	14926.87	14246.11	15591.09	16338.21	17092.83
Uo	B/hr ft2 F	1193.65	1188.29	1177.60	1169.88	1166.70
ho'	B/hr ft2 F	1762.34	1749.12	1744.00	1743.43	1752.54
Cond Sat Temp	Deg F	113.29	113.39	109.26	105.27	101.33
Evap Sat Temp	Deg F	37.11	37.57	36.58	35.71	35.31
Estimated Motor Efficiency (1)		0.931	0.933	0.931	0.930	0.930
Estimated Motor RPM (1)		3544	3546	3543	3542	3540
Compressor Suction CFM (2)	CFM	3132	2960	3325	3544	3771
Isentropic KW/T (2)		0.614	0.608	0.584	0.559	0.530
Adiabatic Efficiency (3)		0.690	0.676	0.679	0.673	0.663
Q/N (4)		0.884	0.835	0.939	1.001	1.065
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.60	16.58	16.65	15.95	16.04
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.91	53.45	54.41	55.18	55.86
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.96	53.51	54.47	55.25	55.89
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.00	43.99	43.99	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	43.99	43.99	44.01	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.29	25.26	25.25	25.22	25.17
17	ENT COND WATER TEMP LOC 1	Deg F	95.02	95.88	89.99	84.97	80.06
18	ENT COND WATER TEMP LOC 2	Deg F	94.95	95.84	89.94	84.96	80.01
19	LVG COND WATER TEMP LOC 1	Deg F	105.22	105.64	100.66	96.17	91.78
20	LVG COND WATER TEMP LOC 2	Deg F	105.20	105.61	100.64	96.16	91.75
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.95	41.56	40.48	39.99	39.71
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.28	38.78	37.81	36.84	36.41
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	40.34	40.86	39.91	38.96	38.71
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.57	6.64	6.49	6.36	6.30
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	11.43	11.44	10.97	10.56	10.30
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	11.46	11.46	11.00	10.59	10.34
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	10.92	10.96	10.38	9.89	9.55
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	19.59	19.64	18.64	17.74	17.00
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	19.03	19.25	18.24	17.35	16.57
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	18.09	18.20	17.04	16.04	15.18
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	29.48	29.53	27.54	25.72	24.01
440	REFRIGERANT LVG COND TEMP	Deg F	112.35	112.45	108.19	104.10	100.02
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	18.79	18.90	17.77	16.82	15.94
485	HIGH PRESS ECONOMIZER TEMP	Deg F	87.15	87.45	84.24	81.26	78.44
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	11.46	11.45	10.98	10.56	10.26
487	LOW PRESS ECONOMIZER TEMP	Deg F	62.09	62.01	60.04	58.16	56.67
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	11.46	11.44	11.00	10.64	10.34
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	61.94	61.87	59.92	58.21	56.81
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.87	8.78	8.72	8.58	8.51
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.98	49.51	49.36	48.68	48.52
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	29.05	29.02	27.17	25.39	23.74
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	111.89	111.80	107.86	103.92	100.09
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	21.37	21.40	20.34	19.28	18.44
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	95.45	95.54	92.74	89.66	86.98
560	ATMOSPHERIC PRESS	PSIA	14.46	14.46	14.46	14.45	14.45
580	MOTOR VOLTAGE - AB	Volts	3.851	3.854	3.862	3.850	3.853
581	MOTOR VOLTAGE - AC	Volts	3.868	3.869	3.876	3.866	3.869
582	MOTOR VOLTAGE - CB	Volts	3.850	3.855	3.862	3.850	3.853
583	MOTOR CURRENT - A	Volts	2.470	2.372	2.503	2.543	2.592
584	MOTOR CURRENT - B	Volts	2.589	2.496	2.631	2.666	2.718
585	MOTOR CURRENT - C	Volts	2.451	2.349	2.461	2.519	2.567
586	MOTOR POWER - PHASE 1	Volts	1.126	1.079	1.159	1.159	1.189
587	MOTOR POWER - PHASE 3	Volts	1.887	1.813	1.900	1.937	1.975
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	105.26	105.66	100.70	96.21	91.59
601	MAXIMUM MOTOR TEMPERATURE	Deg F	161.50	153.50	160.50	165.50	176.50
605	1st STAGE VANE SETTING	Degrees	90.00	70.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	68.00	64.00	64.00	64.00	64.00
608	UNIT HOUR METER READING	Hr	391.40	392.30	392.50	393.10	393.30
609	UNIT START COUNTER READING		109	109	109	109	109
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	2.24	3.15	3.44	3.78	4.14
701	ENERGY BALANCE	%	-1.07	-0.90	-0.88	-1.48	-0.80
702	EVAP CAPACITY	Tons	202.90	193.70	213.80	224.50	237.80

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		49	50	51	52	53
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	40	40	40
Capacity	Tons	250.40	255.10	231.40	221.60	212.30
Power	KW	194.52	193.14	172.44	169.80	167.04
KW/Ton	KW/Ton	0.780	0.760	0.750	0.770	0.790
Evaporator Leaving Water Temperature	Deg F	44.03	44.00	44.00	44.02	43.99
Condenser Entering Water Temperature	Deg F	75.01	70.10	69.96	74.97	79.94
Energy Balance	%	-1.03	-0.75	-1.16	-1.13	-0.74
Evaporator Entering Water Temperature	Deg F	56.46	56.65	55.48	55.04	54.59
Evaporator Leaving Water Temperature	Deg F	44.03	44.00	44.00	44.02	43.99
Evaporator Water Flow Rate	GPM	482.40	483.40	483.10	481.30	479.60
Condenser Entering Water Temperature	Deg F	75.01	70.10	69.96	74.97	79.94
Condenser Leaving Water Temperature	Deg F	87.33	82.57	81.26	85.84	90.38
Condenser Water Flow Rate	GPM	603.20	601.70	602.10	603.20	603.80
Evap Sat Press	Psia	6.30	6.17	6.40	6.37	6.40
Sat Temp	Deg F	35.31	34.41	35.98	35.78	35.98
Approach	Deg F	8.70	9.60	8.00	8.20	8.00
LMTD	Deg F	14.03	15.04	12.92	12.98	12.57
ITD/Delta T		1.70	1.76	1.70	1.75	1.76
Q/Ao	B/hr-ft2	18219.88	18559.95	16833.98	16121.38	15447.83
Uo	B/hr ft2 F	1298.73	1234.16	1302.84	1242.06	1228.55
ho'	B/hr ft2 F	2267.40	2075.01	2281.95	2107.18	2073.15
Cond Sat Press	Psia	22.48	20.71	19.83	21.33	22.94
Sat Temp	Deg F	97.61	93.05	90.67	94.68	98.74
Approach	Deg F	10.30	10.50	9.40	8.80	8.40
Refrigerant Leaving Temp	Deg F	96.47	91.92	89.62	93.54	97.65
LMTD	Deg F	15.64	15.91	14.32	13.56	12.88
Q/Ao	B/hr-ft2	17945.11	18156.57	16477.98	15852.72	15214.22
Uo	B/hr ft2 F	1147.42	1141.30	1150.31	1169.40	1180.99
ho'	B/hr ft2 F	1725.06	1728.52	1751.39	1777.75	1787.28
Cond Sat Temp	Deg F	97.61	93.05	90.67	94.68	98.74
Evap Sat Temp	Deg F	35.31	34.41	35.98	35.78	35.98
Estimated Motor Efficiency (1)		0.929	0.929	0.933	0.933	0.934
Estimated Motor RPM (1)		3539	3539	3547	3548	3549
Compressor Suction CFM (2)	CFM	3957	4092	3577	3454	3307
Isentropic KW/T (2)		0.499	0.469	0.433	0.468	0.499
Adiabatic Efficiency (3)		0.640	0.617	0.577	0.608	0.632
Q/N (4)		1.118	1.156	1.009	0.974	0.932
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.14	16.20	16.19	16.07	15.96
3	ENT EVAP WATER TEMP LOC 1	Deg F	56.44	56.62	55.45	55.02	54.56
4	ENT EVAP WATER TEMP LOC 2	Deg F	56.48	56.67	55.50	55.06	54.61
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.03	44.01	44.01	44.02	43.99
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.00	44.00	44.01	43.98
15	COND WATER FLOWMETER DELTA P	PSID	25.17	25.07	25.10	25.17	25.20
17	ENT COND WATER TEMP LOC 1	Deg F	75.03	70.10	69.96	74.97	79.94
18	ENT COND WATER TEMP LOC 2	Deg F	75.01	70.10	69.96	74.96	79.94
19	LVG COND WATER TEMP LOC 1	Deg F	87.33	82.57	81.26	85.84	90.37
20	LVG COND WATER TEMP LOC 2	Deg F	87.32	82.57	81.26	85.83	90.39
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	39.66	38.78	39.98	39.65	39.77
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	36.64	35.78	37.16	36.91	36.98
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	38.70	38.05	39.38	39.18	39.18
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.30	6.17	6.40	6.37	6.40
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.16	9.85	9.49	9.64	9.92
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.17	9.83	9.50	9.67	9.95
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.30	8.93	8.72	8.93	9.30
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	16.45	15.65	15.64	16.15	16.79
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	15.98	15.19	14.02	14.56	15.26
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	14.47	13.62	13.29	13.94	14.69
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	22.48	20.71	19.83	21.33	22.94
440	REFRIGERANT LVG COND TEMP	Deg F	96.47	91.92	89.62	93.54	97.65
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.24	14.36	14.41	15.00	15.73
485	HIGH PRESS ECONOMIZER TEMP	Deg F	76.21	73.11	73.53	75.36	77.82
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.02	9.63	9.35	9.56	9.83
487	LOW PRESS ECONOMIZER TEMP	Deg F	55.68	53.87	52.47	53.47	54.81
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	10.24	9.95	9.49	9.63	9.88
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	55.95	54.15	52.72	53.52	54.82
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.49	8.29	8.07	8.13	8.22
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	48.84	47.98	46.38	46.30	46.54
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	22.34	20.73	19.75	21.19	22.62
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	96.64	91.95	89.87	93.57	97.56
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	17.87	16.82	16.34	16.79	17.71
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	85.13	81.99	80.19	82.42	85.16
560	ATMOSPHERIC PRESS	PSIA	14.45	14.45	14.44	14.44	14.44
580	MOTOR VOLTAGE - AB	Volts	3.872	3.853	3.860	3.854	3.871
581	MOTOR VOLTAGE - AC	Volts	3.890	3.870	3.879	3.868	3.891
582	MOTOR VOLTAGE - CB	Volts	3.875	3.855	3.860	3.856	3.872
583	MOTOR CURRENT - A	Volts	2.644	2.629	2.351	2.320	2.284
584	MOTOR CURRENT - B	Volts	2.768	2.758	2.469	2.436	2.403
585	MOTOR CURRENT - C	Volts	2.623	2.601	2.347	2.315	2.280
586	MOTOR POWER - PHASE 1	Volts	1.216	1.213	1.064	1.048	1.027
587	MOTOR POWER - PHASE 3	Volts	2.026	2.006	1.810	1.782	1.757
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	87.26	82.42	81.19	85.78	90.33
601	MAXIMUM MOTOR TEMPERATURE	Deg F	193.50	225.50	198.50	165.50	149.50
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	64.00	64.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	393.50	394.20	394.50	395.00	395.20
609	UNIT START COUNTER READING		109	109	109	109	109
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	4.44	4.90	5.40	5.69	5.96
701	ENERGY BALANCE	%	-1.03	-0.75	-1.16	-1.13	-0.74
702	EVAP CAPACITY	Tons	250.40	255.10	231.40	221.60	212.30

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		54	55	56	57	58
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	10
Capacity	Tons	204.40	191.60	176.80	164.80	102.40
Power	KW	167.10	162.78	156.66	151.32	85.08
KW/Ton	KW/Ton	0.820	0.850	0.890	0.920	0.830
Evaporator Leaving Water Temperature	Deg F	44.01	44.00	44.00	44.00	44.02
Condenser Entering Water Temperature	Deg F	84.97	89.97	94.98	97.67	69.99
Energy Balance	%	-0.51	-1.12	-0.89	-0.52	-1.41
Evaporator Entering Water Temperature	Deg F	54.23	53.38	52.64	52.09	49.05
Evaporator Leaving Water Temperature	Deg F	44.01	44.00	44.00	44.00	44.02
Evaporator Water Flow Rate	GPM	479.10	489.40	489.80	488.20	487.10
Condenser Entering Water Temperature	Deg F	84.97	89.97	94.98	97.67	69.99
Condenser Leaving Water Temperature	Deg F	95.06	99.54	103.87	105.96	75.11
Condenser Water Flow Rate	GPM	604.60	605.10	606.10	608.40	602.10
Evap Sat Press	Psia	6.51	6.61	6.71	6.76	6.80
Sat Temp	Deg F	36.72	37.37	38.02	38.34	38.59
Approach	Deg F	7.30	6.60	6.00	5.70	5.40
LMTD	Deg F	11.66	10.64	9.66	9.11	7.67
ITD/Delta T		1.71	1.71	1.69	1.70	2.08
Q/Ao	B/hr-ft2	14873.15	13943.99	12863.78	11991.01	7451.60
Uo	B/hr ft2 F	1275.23	1310.57	1331.00	1315.62	971.25
ho'	B/hr ft2 F	2211.90	2297.50	2362.77	2321.08	1433.28
Cond Sat Press	Psia	24.82	26.53	28.29	29.05	15.97
Sat Temp	Deg F	103.22	107.07	110.84	112.41	79.15
Approach	Deg F	8.20	7.50	7.00	6.50	4.00
Refrigerant Leaving Temp	Deg F	102.25	106.17	110.05	111.63	78.39
LMTD	Deg F	12.54	11.67	10.81	10.03	6.25
Q/Ao	B/hr-ft2	14724.87	13974.18	12975.71	12147.40	7453.42
Uo	B/hr ft2 F	1174.66	1197.64	1200.05	1211.05	1191.68
ho'	B/hr ft2 F	1755.47	1790.15	1778.67	1791.88	1861.25
Cond Sat Temp	Deg F	103.22	107.07	110.84	112.41	79.15
Evap Sat Temp	Deg F	36.72	37.37	38.02	38.34	38.59
Estimated Motor Efficiency (1)		0.934	0.935	0.936	0.938	0.948
Estimated Motor RPM (1)		3549	3550	3552	3554	3576
Compressor Suction CFM (2)	CFM	3148	2921	2667	2472	1477
Isentropic KW/T (2)		0.530	0.555	0.580	0.589	0.311
Adiabatic Efficiency (3)		0.646	0.653	0.652	0.640	0.375
Q/N (4)		0.887	0.823	0.751	0.695	0.413
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	15.93	16.62	16.65	16.54	16.46
3	ENT EVAP WATER TEMP LOC 1	Deg F	54.20	53.35	52.61	52.06	49.01
4	ENT EVAP WATER TEMP LOC 2	Deg F	54.25	53.40	52.66	52.11	49.08
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.02	44.00	44.00	44.01	44.02
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	44.00	43.99	44.00	44.01
15	COND WATER FLOWMETER DELTA P	PSID	25.24	25.26	25.31	25.49	25.10
17	ENT COND WATER TEMP LOC 1	Deg F	84.99	89.97	94.99	97.69	69.99
18	ENT COND WATER TEMP LOC 2	Deg F	84.94	89.96	94.97	97.65	69.99
19	LVG COND WATER TEMP LOC 1	Deg F	95.08	99.55	103.87	105.97	75.10
20	LVG COND WATER TEMP LOC 2	Deg F	95.03	99.53	103.86	105.95	75.11
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.43	41.10	41.66	42.50	42.57
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	37.86	38.54	39.20	40.78	41.04
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.93	40.58	40.97	41.78	42.42
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.51	6.61	6.71	6.76	6.80
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.32	10.71	11.12	11.26	7.11
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.33	10.72	11.14	11.31	7.20
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.75	10.22	10.71	10.91	6.92
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	17.62	18.43	19.26	19.79	10.27
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.17	17.09	18.04	18.51	10.22
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.72	16.67	17.67	18.17	10.36
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.82	26.53	28.29	29.05	15.97
440	REFRIGERANT LVG COND TEMP	Deg F	102.25	106.17	110.05	111.63	78.39
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.69	17.62	18.54	18.95	12.00
485	HIGH PRESS ECONOMIZER TEMP	Deg F	80.91	83.70	86.45	87.59	65.08
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.30	10.72	11.12	11.24	7.09
487	LOW PRESS ECONOMIZER TEMP	Deg F	56.96	58.76	60.56	61.05	40.00
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	10.34	10.70	11.08	11.19	7.23
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	56.98	58.66	60.32	60.76	40.15
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.38	8.45	8.55	8.53	7.06
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	47.37	47.84	48.19	48.05	39.43
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.36	26.16	27.80	28.54	15.54
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	101.85	105.69	109.34	110.81	77.60
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.76	19.67	20.62	21.00	12.88
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	88.30	91.06	93.26	94.33	68.07
560	ATMOSPHERIC PRESS	PSIA	14.43	14.43	14.43	14.42	14.42
580	MOTOR VOLTAGE - AB	Volts	3.865	3.876	3.878	3.856	3.883
581	MOTOR VOLTAGE - AC	Volts	3.873	3.894	3.897	3.876	3.900
582	MOTOR VOLTAGE - CB	Volts	3.849	3.872	3.880	3.850	3.883
583	MOTOR CURRENT - A	Volts	2.276	2.221	2.128	2.086	1.254
584	MOTOR CURRENT - B	Volts	2.389	2.325	2.251	2.193	1.333
585	MOTOR CURRENT - C	Volts	2.275	2.221	2.139	2.064	1.287
586	MOTOR POWER - PHASE 1	Volts	1.021	0.992	0.950	0.930	0.428
587	MOTOR POWER - PHASE 3	Volts	1.763	1.721	1.661	1.592	0.990
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	95.01	99.54	103.86	106.06	74.99
601	MAXIMUM MOTOR TEMPERATURE	Deg F	145.50	140.50	136.50	131.50	91.50
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	40.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	50.00	19.00
608	UNIT HOUR METER READING	Hr	395.40	395.60	396.10	396.50	397.60
609	UNIT START COUNTER READING		109	109	109	111	111
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	6.25	6.54	6.80	24.42	25.52
701	ENERGY BALANCE	%	-0.51	-1.12	-0.89	-0.52	-1.41
702	EVAP CAPACITY	Tons	204.40	191.60	176.80	164.80	102.40

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		59	60	61	62	63
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	10	10	10	10	10
Capacity	Tons	100.60	97.40	91.40	78.10	74.00
Power	KW	87.06	88.56	88.32	84.24	83.58
KW/Ton	KW/Ton	0.870	0.910	0.970	1.080	1.130
Evaporator Leaving Water Temperature	Deg F	44.00	44.01	44.01	44.03	44.02
Condenser Entering Water Temperature	Deg F	74.99	80.00	84.96	89.96	91.54
Energy Balance	%	-1.43	-1.67	-0.64	-0.94	-1.07
Evaporator Entering Water Temperature	Deg F	48.95	48.80	48.50	47.86	47.64
Evaporator Leaving Water Temperature	Deg F	44.00	44.01	44.01	44.03	44.02
Evaporator Water Flow Rate	GPM	486.80	486.80	486.60	487.80	487.50
Condenser Entering Water Temperature	Deg F	74.99	80.00	84.96	89.96	91.54
Condenser Leaving Water Temperature	Deg F	80.05	84.96	89.63	94.06	95.47
Condenser Water Flow Rate	GPM	602.70	603.80	604.20	605.10	605.40
Evap Sat Press	Psia	6.94	7.02	7.08	7.16	7.18
Sat Temp	Deg F	39.49	39.99	40.36	40.84	40.97
Approach	Deg F	4.50	4.00	3.60	3.20	3.10
LMTD	Deg F	6.68	6.10	5.60	4.86	4.63
ITD/Delta T		1.91	1.84	1.81	1.83	1.84
Q/Ao	B/hr-ft2	7321.25	7084.50	6653.40	5683.36	5383.41
Uo	B/hr ft2 F	1095.64	1160.45	1188.52	1170.42	1163.65
ho'	B/hr ft2 F	1722.53	1888.63	1965.53	1916.10	1898.83
Cond Sat Press	Psia	17.52	19.14	20.79	22.33	22.81
Sat Temp	Deg F	84.01	88.75	93.26	97.23	98.42
Approach	Deg F	4.00	3.80	3.60	3.20	3.00
Refrigerant Leaving Temp	Deg F	83.23	88.00	92.53	96.43	97.64
LMTD	Deg F	6.15	5.93	5.65	4.94	4.64
Q/Ao	B/hr-ft2	7381.60	7228.23	6818.56	5983.67	5736.04
Uo	B/hr ft2 F	1200.90	1219.31	1207.52	1211.37	1235.97
ho'	B/hr ft2 F	1863.10	1886.90	1840.52	1830.73	1881.62
Cond Sat Temp	Deg F	84.01	88.75	93.26	97.23	98.42
Evap Sat Temp	Deg F	39.49	39.99	40.36	40.84	40.97
Estimated Motor Efficiency (1)		0.948	0.948	0.948	0.948	0.948
Estimated Motor RPM (1)		3575	3574	3575	3576	3576
Compressor Suction CFM (2)	CFM	1430	1377	1287	1093	1034
Isentropic KW/T (2)		0.341	0.375	0.407	0.435	0.443
Adiabatic Efficiency (3)		0.392	0.412	0.420	0.403	0.392
Q/N (4)		0.400	0.385	0.360	0.306	0.289
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.45	16.45	16.44	16.52	16.50
3	ENT EVAP WATER TEMP LOC 1	Deg F	48.91	48.76	48.47	47.82	47.61
4	ENT EVAP WATER TEMP LOC 2	Deg F	48.99	48.83	48.54	47.89	47.68
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.01	44.02	44.03	44.02
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	44.01	44.00	44.02	44.01
15	COND WATER FLOWMETER DELTA P	PSID	25.13	25.20	25.21	25.26	25.27
17	ENT COND WATER TEMP LOC 1	Deg F	74.99	80.00	84.97	89.98	91.55
18	ENT COND WATER TEMP LOC 2	Deg F	74.98	80.00	84.95	89.94	91.54
19	LVG COND WATER TEMP LOC 1	Deg F	80.05	84.96	89.64	94.06	95.48
20	LVG COND WATER TEMP LOC 2	Deg F	80.05	84.95	89.63	94.06	95.47
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	42.91	43.72	43.89	44.08	44.35
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	41.82	42.44	42.67	43.07	43.22
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	43.08	43.99	44.04	44.50	44.69
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.94	7.02	7.08	7.16	7.18
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.59	8.10	8.62	9.13	9.35
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.72	8.28	8.82	9.34	9.54
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.40	7.93	8.46	9.01	9.22
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	11.24	12.29	13.38	14.50	14.93
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	11.10	11.97	12.99	14.04	14.40
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	11.31	12.32	13.37	14.38	14.79
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	17.52	19.14	20.79	22.33	22.81
440	REFRIGERANT LVG COND TEMP	Deg F	83.23	88.00	92.53	96.43	97.64
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.84	13.77	14.66	15.49	15.81
485	HIGH PRESS ECONOMIZER TEMP	Deg F	68.08	71.26	74.15	76.94	78.00
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	7.55	8.08	8.59	9.12	9.32
487	LOW PRESS ECONOMIZER TEMP	Deg F	42.80	45.77	48.52	51.24	52.25
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.63	8.10	8.57	9.06	9.25
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	42.85	45.71	48.34	50.86	51.81
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.27	7.46	7.65	7.86	7.92
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	41.11	41.98	43.12	44.28	44.66
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	17.11	18.70	20.37	21.84	22.32
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	82.40	87.19	91.71	95.68	96.91
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	13.79	14.83	15.76	16.68	17.01
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	71.48	74.93	78.15	80.90	81.97
560	ATMOSPHERIC PRESS	PSIA	14.42	14.41	14.41	14.41	14.41
580	MOTOR VOLTAGE - AB	Volts	3.870	3.852	3.846	3.871	3.852
581	MOTOR VOLTAGE - AC	Volts	3.881	3.864	3.862	3.885	3.861
582	MOTOR VOLTAGE - CB	Volts	3.872	3.856	3.851	3.871	3.852
583	MOTOR CURRENT - A	Volts	1.268	1.286	1.278	1.243	1.235
584	MOTOR CURRENT - B	Volts	1.367	1.390	1.387	1.333	1.328
585	MOTOR CURRENT - C	Volts	1.307	1.316	1.315	1.261	1.254
586	MOTOR POWER - PHASE 1	Volts	0.447	0.470	0.465	0.435	0.433
587	MOTOR POWER - PHASE 3	Volts	1.003	1.006	1.007	0.969	0.960
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	79.97	84.82	89.62	94.06	95.41
601	MAXIMUM MOTOR TEMPERATURE	Deg F	87.50	81.50	82.50	83.50	83.50
605	1st STAGE VANE SETTING	Degrees	10.00	10.00	10.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00	19.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	398.40	399.10	399.30	399.50	400.00
609	UNIT START COUNTER READING		111	111	111	111	111
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	26.22	26.64	27.00	27.33	27.58
701	ENERGY BALANCE	%	-1.43	-1.67	-0.64	-0.94	-1.07
702	EVAP CAPACITY	Tons	100.60	97.40	91.40	78.10	74.00

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		64	65	66	67	68
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	226.40	232.10	227.60	221.00	217.80
Power	KW	199.32	198.30	190.80	181.92	197.28
KW/Ton	KW/Ton	0.880	0.850	0.840	0.820	0.910
Evaporator Leaving Water Temperature	Deg F	44.04	44.05	43.95	44.02	44.00
Condenser Entering Water Temperature	Deg F	85.21	80.17	74.69	70.04	89.83
Energy Balance	%	-0.90	-0.93	-0.90	-1.03	-0.91
Evaporator Entering Water Temperature	Deg F	55.16	55.46	55.13	55.37	54.73
Evaporator Leaving Water Temperature	Deg F	44.04	44.05	43.95	44.02	44.00
Evaporator Water Flow Rate	GPM	487.50	486.90	487.70	466.10	485.70
Condenser Entering Water Temperature	Deg F	85.21	80.17	74.69	70.04	89.83
Condenser Leaving Water Temperature	Deg F	96.52	91.72	85.98	80.98	100.79
Condenser Water Flow Rate	GPM	607.60	606.30	605.50	604.40	607.40
Evap Sat Press	Psia	5.17	5.11	4.83	4.57	5.22
Sat Temp	Deg F	35.27	34.79	32.53	30.33	35.66
Approach	Deg F	8.80	9.30	11.40	13.70	8.30
LMTD	Deg F	13.58	14.21	16.38	18.80	12.97
ITD/Delta T		1.79	1.81	2.02	2.21	1.78
Q/Ao	B/hr-ft2	16471.02	16887.06	16557.97	16078.64	15843.70
Uo	B/hr ft2 F	1212.93	1188.43	1010.93	855.37	1221.21
ho'	B/hr ft2 F	2012.02	1945.65	1511.16	1202.71	2039.86
Cond Sat Press	Psia	23.49	21.63	19.32	17.45	25.06
Sat Temp	Deg F	106.68	102.18	96.15	90.87	110.26
Approach	Deg F	10.20	10.50	10.20	9.90	9.50
Refrigerant Leaving Temp	Deg F	105.34	101.15	95.09	89.29	109.24
LMTD	Deg F	15.12	15.53	15.12	14.69	14.25
Q/Ao	B/hr-ft2	16593.67	16917.86	16523.50	16006.67	16055.71
Uo	B/hr ft2 F	1097.73	1089.68	1092.91	1089.84	1126.35
ho'	B/hr ft2 F	1584.05	1581.67	1605.04	1613.27	1631.66
Cond Sat Temp	Deg F	106.68	102.18	96.15	90.87	110.26
Evap Sat Temp	Deg F	35.27	34.79	32.53	30.33	35.66
Estimated Motor Efficiency (1)		0.928	0.928	0.929	0.931	0.928
Estimated Motor RPM (1)		3537	3537	3540	3543	3538
Compressor Suction CFM (2)	CFM	4200	4331	4445	4516	4020
Isentropic KW/T (2)		0.580	0.546	0.515	0.490	0.607
Adiabatic Efficiency (3)		0.659	0.642	0.613	0.598	0.667
Q/N (4)		1.188	1.224	1.256	1.275	1.136
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.49	16.45	16.50	15.07	16.37
3	ENT EVAP WATER TEMP LOC 1	Deg F	55.14	55.45	55.10	55.34	54.70
4	ENT EVAP WATER TEMP LOC 2	Deg F	55.18	55.47	55.16	55.40	54.76
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.05	43.96	44.02	44.00
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	44.04	43.95	44.01	43.99
15	COND WATER FLOWMETER DELTA P	PSID	25.49	25.41	25.37	25.29	25.45
17	ENT COND WATER TEMP LOC 1	Deg F	85.23	80.18	74.68	70.03	89.85
18	ENT COND WATER TEMP LOC 2	Deg F	85.18	80.15	74.71	70.04	89.81
19	LVG COND WATER TEMP LOC 1	Deg F	96.53	91.72	85.98	80.98	100.81
20	LVG COND WATER TEMP LOC 2	Deg F	96.51	91.71	85.98	80.98	100.77
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.63	39.97	38.18	36.47	41.01
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.02	37.33	35.18	33.25	38.53
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	38.50	37.97	36.12	34.06	38.99
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.17	5.11	4.83	4.57	5.22
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.91	8.64	8.10	7.64	9.12
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.97	8.70	8.13	7.65	9.20
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.10	7.79	7.20	6.75	8.39
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	15.43	14.81	13.95	13.10	15.94
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	14.62	14.05	12.74	11.81	15.52
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	13.65	12.92	11.80	10.86	14.46
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	23.49	21.63	19.32	17.45	25.06
440	REFRIGERANT LVG COND TEMP	Deg F	105.34	101.15	95.09	89.29	109.24
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	14.60	13.75	12.57	11.61	15.39
485	HIGH PRESS ECONOMIZER TEMP	Deg F	81.51	78.62	74.28	70.46	84.28
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.06	8.71	8.07	7.53	9.34
487	LOW PRESS ECONOMIZER TEMP	Deg F	58.99	57.44	54.03	50.96	60.61
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	9.39	9.14	8.51	7.94	9.46
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	59.36	57.70	54.37	51.39	60.84
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.69	7.57	7.07	6.62	7.83
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	52.37	52.07	49.18	46.38	52.90
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	23.29	21.43	19.48	17.70	24.89
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	105.43	101.00	95.04	89.31	109.33
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.09	17.11	15.50	14.21	18.95
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	92.79	90.32	85.72	81.40	95.66
560	ATMOSPHERIC PRESS	PSIA	14.40	14.40	14.40	14.40	14.40
580	MOTOR VOLTAGE - AB	Volts	3.887	3.855	3.884	3.883	3.895
581	MOTOR VOLTAGE - AC	Volts	3.902	3.866	3.895	3.891	3.904
582	MOTOR VOLTAGE - CB	Volts	3.886	3.855	3.883	3.887	3.894
583	MOTOR CURRENT - A	Volts	2.707	2.721	2.597	2.478	2.684
584	MOTOR CURRENT - B	Volts	2.831	2.845	2.731	2.608	2.818
585	MOTOR CURRENT - C	Volts	2.650	2.643	2.533	2.414	2.611
586	MOTOR POWER - PHASE 1	Volts	1.259	1.267	1.212	1.155	1.256
587	MOTOR POWER - PHASE 3	Volts	2.063	2.038	1.968	1.877	2.032
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	96.20	91.36	85.95	80.87	100.81
601	MAXIMUM MOTOR TEMPERATURE	Deg F	182.50	183.50	178.50	196.50	176.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	403.40	404.40	405.30	405.50	406.30
609	UNIT START COUNTER READING		112	112	112	112	112
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	0.00	0.95	1.77	2.19	2.84
701	ENERGY BALANCE	%	-0.90	-0.93	-0.90	-1.03	-0.91
702	EVAP CAPACITY	Tons	226.40	232.10	227.60	221.00	217.80

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0		69	70	71	73	73
Run Number						
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	70	70
Capacity	Tons	206.60	192.70	187.40	200.20	185.90
Power	KW	193.56	187.92	184.14	186.06	179.46
KW/Ton	KW/Ton	0.940	0.980	0.980	0.930	0.970
Evaporator Leaving Water Temperature	Deg F	44.03	44.00	43.99	44.00	43.99
Condenser Entering Water Temperature	Deg F	94.96	100.03	101.41	94.91	99.95
Energy Balance	%	-1.14	-0.37	-0.56	-1.02	-0.95
Evaporator Entering Water Temperature	Deg F	54.22	53.49	53.23	53.89	53.17
Evaporator Leaving Water Temperature	Deg F	44.03	44.00	43.99	44.00	43.99
Evaporator Water Flow Rate	GPM	485.10	486.00	485.20	484.80	484.70
Condenser Entering Water Temperature	Deg F	94.96	100.03	101.41	94.91	99.95
Condenser Leaving Water Temperature	Deg F	105.44	109.83	110.97	105.04	109.42
Condenser Water Flow Rate	GPM	608.10	609.20	609.20	608.40	609.30
Evap Sat Press	Psia	5.29	5.35	5.36	5.31	5.37
Sat Temp	Deg F	36.20	36.66	36.73	36.34	36.81
Approach	Deg F	7.80	7.30	7.30	7.60	7.20
LMTD	Deg F	12.23	11.44	11.25	11.93	11.15
ITD/Delta T		1.77	1.77	1.79	1.77	1.78
Q/Ao	B/hr-ft2	15029.29	14017.07	13634.69	14564.22	13522.21
Uo	B/hr ft2 F	1229.36	1225.68	1211.45	1220.86	1213.08
ho'	B/hr ft2 F	2065.19	2055.09	2017.82	2043.17	2023.65
Cond Sat Press	Psia	26.94	28.78	29.25	26.66	28.42
Sat Temp	Deg F	114.33	118.11	119.05	113.74	117.39
Approach	Deg F	8.90	8.30	8.10	8.70	8.00
Refrigerant Leaving Temp	Deg F	113.59	117.55	118.46	112.96	116.83
LMTD	Deg F	13.46	12.55	12.24	13.12	12.09
Q/Ao	B/hr-ft2	15363.69	14364.93	14016.26	14849.34	13891.00
Uo	B/hr ft2 F	1141.72	1144.74	1144.73	1131.85	1148.66
ho'	B/hr ft2 F	1649.24	1640.52	1637.32	1629.05	1649.72
Cond Sat Temp	Deg F	114.33	118.11	119.05	113.74	117.39
Evap Sat Temp	Deg F	36.20	36.66	36.73	36.34	36.81
Estimated Motor Efficiency (1)		0.929	0.930	0.931	0.930	0.931
Estimated Motor RPM (1)		3539	3541	3543	3542	3544
Compressor Suction CFM (2)	CFM	3783	3506	3407	3651	3367
Isentropic KW/T (2)		0.637	0.665	0.671	0.630	0.656
Adiabatic Efficiency (3)		0.678	0.679	0.685	0.677	0.676
Q/N (4)		1.069	0.990	0.962	1.031	0.950
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.33	16.39	16.34	16.31	16.29
3	ENT EVAP WATER TEMP LOC 1	Deg F	54.20	53.46	53.21	53.86	53.13
4	ENT EVAP WATER TEMP LOC 2	Deg F	54.24	53.51	53.26	53.91	53.20
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.03	44.00	44.00	44.01	43.99
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	43.99	43.98	43.99	43.98
15	COND WATER FLOWMETER DELTA P	PSID	25.48	25.54	25.53	25.50	25.55
17	ENT COND WATER TEMP LOC 1	Deg F	94.98	100.07	101.44	94.93	99.98
18	ENT COND WATER TEMP LOC 2	Deg F	94.93	99.99	101.38	94.89	99.92
19	LVG COND WATER TEMP LOC 1	Deg F	105.45	109.85	110.99	105.05	109.43
20	LVG COND WATER TEMP LOC 2	Deg F	105.43	109.80	110.95	105.03	109.41
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	41.05	41.53	41.88	41.44	42.24
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.98	39.29	39.64	39.09	39.64
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.43	39.95	40.16	39.56	40.18
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.29	5.35	5.36	5.31	5.37
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.42	9.74	9.83	9.32	9.64
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.50	9.82	9.89	9.38	9.71
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.81	9.22	9.35	8.72	9.14
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	16.95	17.70	17.69	16.36	17.12
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.03	16.76	16.95	15.97	16.79
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.07	15.85	16.08	14.81	15.70
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	26.94	28.78	29.25	26.66	28.42
440	REFRIGERANT LVG COND TEMP	Deg F	113.59	117.55	118.46	112.96	116.83
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.33	17.26	17.54	16.29	17.20
485	HIGH PRESS ECONOMIZER TEMP	Deg F	87.37	90.13	90.87	87.09	89.87
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.68	10.03	10.12	9.58	9.93
487	LOW PRESS ECONOMIZER TEMP	Deg F	62.27	63.78	64.18	61.71	63.31
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	9.78	10.12	10.18	9.67	9.97
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	62.43	63.83	64.14	61.84	63.26
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.89	7.88	7.88	7.76	7.76
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	53.31	52.99	53.00	52.37	52.20
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	26.62	28.32	28.89	26.29	28.01
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	113.63	117.21	118.17	112.83	116.61
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	19.79	20.71	21.03	19.59	20.43
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	98.51	100.79	101.31	97.77	100.03
560	ATMOSPHERIC PRESS	PSIA	14.41	14.41	14.40	14.40	14.40
580	MOTOR VOLTAGE - AB	Volts	3.903	3.901	3.873	3.907	3.919
581	MOTOR VOLTAGE - AC	Volts	3.911	3.904	3.878	3.916	3.930
582	MOTOR VOLTAGE - CB	Volts	3.901	3.902	3.869	3.907	3.920
583	MOTOR CURRENT - A	Volts	2.635	2.556	2.533	2.533	2.424
584	MOTOR CURRENT - B	Volts	2.766	2.691	2.651	2.672	2.566
585	MOTOR CURRENT - C	Volts	2.561	2.471	2.445	2.471	2.385
586	MOTOR POWER - PHASE 1	Volts	1.235	1.192	1.178	1.174	1.124
587	MOTOR POWER - PHASE 3	Volts	1.991	1.940	1.891	1.927	1.867
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	105.50	109.82	111.13	105.15	109.57
601	MAXIMUM MOTOR TEMPERATURE	Deg F	172.50	167.50	164.50	164.50	159.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	406.50	407.30	408.40	409.50	410.10
609	UNIT START COUNTER READING		112	112	112	113	113
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	3.22	3.83	4.99	6.23	6.59
701	ENERGY BALANCE	%	-1.14	-0.37	-0.56	-1.02	-0.95
702	EVAP CAPACITY	Tons	206.60	192.70	187.40	200.20	185.90

Large Impellers - Imperial

LTO 23127 Note: impeller diameters are 26.0/26.0/26.0						
Run Number		74	75	76	77	78
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	Tons	176.50	211.10	219.80	227.50	227.00
Power	KW	175.50	190.14	191.04	191.46	186.30
KW/Ton	KW/Ton	0.990	0.900	0.870	0.840	0.820
Evaporator Leaving Water Temperature	Deg F	44.02	44.03	44.03	44.03	44.03
Condenser Entering Water Temperature	Deg F	102.64	90.01	85.09	80.00	75.01
Energy Balance	%	-1.13	-1.13	-0.90	-0.65	-1.15
Evaporator Entering Water Temperature	Deg F	52.72	54.59	55.00	55.36	55.34
Evaporator Leaving Water Temperature	Deg F	44.02	44.03	44.03	44.03	44.03
Evaporator Water Flow Rate	GPM	485.50	478.90	479.90	480.50	481.10
Condenser Entering Water Temperature	Deg F	102.64	90.01	85.09	80.00	75.01
Condenser Leaving Water Temperature	Deg F	111.70	100.63	96.06	91.28	86.25
Condenser Water Flow Rate	GPM	609.80	608.00	607.10	605.70	605.60
Evap Sat Press	Psia	5.41	5.25	5.19	5.17	5.01
Sat Temp	Deg F	37.11	35.89	35.41	35.27	34.00
Approach	Deg F	6.90	8.10	8.60	8.80	10.00
LMTD	Deg F	10.68	12.70	13.36	13.65	14.98
ITD/Delta T		1.79	1.77	1.78	1.77	1.89
Q/Ao	B/hr-ft2	12839.56	15357.97	15988.97	16555.39	16517.59
Uo	B/hr ft2 F	1202.70	1209.63	1196.53	1212.83	1102.64
ho'	B/hr ft2 F	1994.62	2021.22	1982.00	2024.51	1734.20
Cond Sat Press	Psia	29.24	24.80	23.00	21.25	19.32
Sat Temp	Deg F	119.03	109.68	105.52	101.22	96.15
Approach	Deg F	7.30	9.00	9.50	9.90	9.90
Refrigerant Leaving Temp	Deg F	118.55	108.78	104.47	100.28	95.29
LMTD	Deg F	11.26	13.68	14.25	14.87	14.82
Q/Ao	B/hr-ft2	13292.43	15572.73	16067.99	16498.76	16449.84
Uo	B/hr ft2 F	1180.61	1138.38	1127.74	1109.25	1110.27
ho'	B/hr ft2 F	1707.59	1656.43	1648.77	1624.77	1641.83
Cond Sat Temp	Deg F	119.03	109.68	105.52	101.22	96.15
Evap Sat Temp	Deg F	37.11	35.89	35.41	35.27	34.00
Estimated Motor Efficiency (1)		0.932	0.929	0.929	0.929	0.930
Estimated Motor RPM (1)		3546	3540	3540	3540	3542
Compressor Suction CFM (2)	CFM	3180	3873	4058	4193	4283
Isentropic KW/T (2)		0.667	0.599	0.568	0.532	0.501
Adiabatic Efficiency (3)		0.674	0.666	0.653	0.633	0.611
Q/N (4)		0.897	1.094	1.146	1.185	1.209
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.36	15.91	15.98	16.02	16.06
3	ENT EVAP WATER TEMP LOC 1	Deg F	52.67	54.55	54.96	55.33	55.31
4	ENT EVAP WATER TEMP LOC 2	Deg F	52.76	54.62	55.03	55.40	55.36
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.03	44.04	44.03	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.03	44.02	44.02	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.57	25.50	25.45	25.36	25.37
17	ENT COND WATER TEMP LOC 1	Deg F	102.67	90.02	85.10	79.99	75.01
18	ENT COND WATER TEMP LOC 2	Deg F	102.61	90.00	85.09	80.01	75.01
19	LVG COND WATER TEMP LOC 1	Deg F	111.71	100.63	96.06	91.27	86.25
20	LVG COND WATER TEMP LOC 2	Deg F	111.69	100.63	96.06	91.28	86.24
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	43.55	42.03	41.62	41.40	39.78
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.65	38.79	38.43	38.18	36.66
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	40.75	39.50	39.03	38.99	37.39
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.41	5.25	5.19	5.17	5.01
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.83	9.01	8.75	8.54	8.14
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.88	9.07	8.78	8.56	8.16
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.38	8.33	7.98	7.68	7.27
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	17.33	15.31	14.58	14.27	13.42
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	17.51	15.83	14.98	14.26	13.32
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	16.45	14.17	13.69	12.92	11.99
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	29.24	24.80	23.00	21.25	19.32
440	REFRIGERANT LVG COND TEMP	Deg F	118.55	108.78	104.47	100.28	95.29
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	17.66	15.35	14.51	13.70	12.72
485	HIGH PRESS ECONOMIZER TEMP	Deg F	91.14	84.13	81.16	78.37	74.87
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.10	9.24	8.89	8.60	8.12
487	LOW PRESS ECONOMIZER TEMP	Deg F	63.93	60.02	58.25	56.84	54.38
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	10.13	9.35	9.12	9.00	8.57
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	63.93	60.27	58.71	57.19	54.71
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.73	7.68	7.61	7.49	7.16
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	52.01	51.79	52.09	51.68	49.81
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	28.89	24.55	22.79	21.28	19.37
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	118.19	108.71	104.54	100.46	95.36
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	20.99	18.36	17.87	16.71	15.55
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	101.22	94.75	92.12	89.31	85.73
560	ATMOSPHERIC PRESS	PSIA	14.45	14.46	14.46	14.46	14.46
580	MOTOR VOLTAGE - AB	Volts	3.848	3.903	3.890	3.875	3.885
581	MOTOR VOLTAGE - AC	Volts	3.856	3.911	3.903	3.886	3.898
582	MOTOR VOLTAGE - CB	Volts	3.843	3.902	3.892	3.875	3.884
583	MOTOR CURRENT - A	Volts	2.420	2.589	2.602	2.607	2.531
584	MOTOR CURRENT - B	Volts	2.516	2.717	2.738	2.738	2.663
585	MOTOR CURRENT - C	Volts	2.332	2.504	2.534	2.547	2.476
586	MOTOR POWER - PHASE 1	Volts	1.119	1.211	1.212	1.217	1.180
587	MOTOR POWER - PHASE 3	Volts	1.806	1.958	1.972	1.974	1.925
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	111.77	100.57	95.93	91.27	86.17
601	MAXIMUM MOTOR TEMPERATURE	Deg F	155.80	166.50	168.50	171.50	177.50
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	411.20	411.50	412.10	412.30	412.60
609	UNIT START COUNTER READING		114	114	114	114	114
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	23.56	24.09	24.46	24.74	25.22
701	ENERGY BALANCE	%	-1.13	-1.13	-0.90	-0.65	-1.15
702	EVAP CAPACITY	Tons	176.50	211.10	219.80	227.50	227.00

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		79	80	81	82	83
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	40	40	40	40
Capacity	Tons	221.40	209.70	205.50	199.90	193.90
Power	KW	178.26	164.58	165.78	166.38	165.78
KW/Ton	KW/Ton	0.810	0.780	0.810	0.830	0.850
Evaporator Leaving Water Temperature	Deg F	44.03	44.00	44.00	44.00	43.99
Condenser Entering Water Temperature	Deg F	70.00	69.87	74.87	79.96	84.94
Energy Balance	%	-1.11	-0.89	-0.91	-0.95	-0.98
Evaporator Entering Water Temperature	Deg F	55.02	54.44	54.25	54.02	53.71
Evaporator Leaving Water Temperature	Deg F	44.03	44.00	44.00	44.00	43.99
Evaporator Water Flow Rate	GPM	482.50	481.30	480.00	478.10	477.60
Condenser Entering Water Temperature	Deg F	70.00	69.87	74.87	79.96	84.94
Condenser Leaving Water Temperature	Deg F	80.94	80.17	85.00	89.87	94.59
Condenser Water Flow Rate	GPM	604.20	604.00	604.80	605.60	607.10
Evap Sat Press	Psia	4.75	5.25	5.26	5.28	5.32
Sat Temp	Deg F	31.87	35.89	35.97	36.12	36.43
Approach	Deg F	12.20	8.10	8.00	7.90	7.60
LMTD	Deg F	17.07	12.62	12.46	12.21	11.76
ITD/Delta T		2.10	1.78	1.78	1.79	1.78
Q/Ao	B/hr-ft2	16110.22	15259.64	14952.45	14542.93	14109.00
Uo	B/hr ft2 F	943.81	1209.33	1200.02	1190.83	1199.96
ho'	B/hr ft2 F	1370.68	2016.24	1993.31	1972.47	1999.51
Cond Sat Press	Psia	17.42	16.95	18.48	20.15	21.88
Sat Temp	Deg F	90.75	89.34	93.81	98.37	102.80
Approach	Deg F	9.80	9.20	8.80	8.50	8.20
Refrigerant Leaving Temp	Deg F	89.65	88.33	92.89	97.50	102.03
LMTD	Deg F	14.60	13.68	13.24	12.82	12.42
Q/Ao	B/hr-ft2	15981.59	15040.13	14814.59	14498.92	14141.34
Uo	B/hr ft2 F	1094.38	1099.44	1119.34	1130.69	1138.94
ho'	B/hr ft2 F	1623.41	1636.30	1664.63	1673.59	1674.97
Cond Sat Temp	Deg F	90.75	89.34	93.81	98.37	102.80
Evap Sat Temp	Deg F	31.87	35.89	35.97	36.12	36.43
Estimated Motor Efficiency (1)		0.932	0.935	0.934	0.934	0.934
Estimated Motor RPM (1)		3545	3550	3549	3549	3549
Compressor Suction CFM (2)	CFM	4362	3755	3692	3598	3482
Isentropic KW/T (2)		0.474	0.423	0.460	0.497	0.531
Adiabatic Efficiency (3)		0.585	0.542	0.568	0.599	0.625
Q/N (4)		1.231	1.058	1.040	1.014	0.981
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.15	16.07	15.99	15.86	15.83
3	ENT EVAP WATER TEMP LOC 1	Deg F	54.99	54.42	54.23	53.99	53.68
4	ENT EVAP WATER TEMP LOC 2	Deg F	55.05	54.46	54.27	54.04	53.73
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.03	44.01	44.01	44.01	43.99
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	44.00	43.99	44.00	43.98
15	COND WATER FLOWMETER DELTA P	PSID	25.28	25.26	25.31	25.35	25.45
17	ENT COND WATER TEMP LOC 1	Deg F	70.00	69.87	74.87	79.96	84.95
18	ENT COND WATER TEMP LOC 2	Deg F	70.01	69.89	74.87	79.94	84.92
19	LVG COND WATER TEMP LOC 1	Deg F	80.94	80.17	85.01	89.88	94.60
20	LVG COND WATER TEMP LOC 2	Deg F	80.93	80.17	85.00	89.85	94.57
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	37.96	41.24	41.44	41.61	41.73
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	34.62	38.43	38.50	38.74	38.97
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	35.40	39.16	39.25	39.48	39.61
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	4.75	5.25	5.26	5.28	5.32
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.67	7.64	7.83	8.06	8.34
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.68	7.67	7.87	8.10	8.37
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	6.79	6.88	7.11	7.39	7.73
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	12.60	13.05	13.42	13.79	14.49
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	12.00	11.71	12.24	12.88	13.61
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	11.04	11.10	11.73	12.46	13.24
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	17.42	16.95	18.48	20.15	21.88
440	REFRIGERANT LVG COND TEMP	Deg F	89.65	88.33	92.89	97.50	102.03
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	11.72	12.11	12.74	13.46	14.23
485	HIGH PRESS ECONOMIZER TEMP	Deg F	70.94	72.37	74.86	77.51	80.29
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	7.58	7.62	7.84	8.16	8.47
487	LOW PRESS ECONOMIZER TEMP	Deg F	51.32	51.44	52.79	54.52	56.13
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	8.00	7.94	8.10	8.27	8.60
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	51.69	51.79	53.23	54.66	56.34
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	6.72	6.82	6.92	7.01	7.14
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	47.10	47.69	48.31	48.14	48.74
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	17.70	16.98	18.45	20.01	21.67
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	89.46	88.37	93.13	97.53	101.92
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	14.52	14.24	14.75	15.58	16.58
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	81.35	80.36	83.21	86.08	89.23
560	ATMOSPHERIC PRESS	PSIA	14.46	14.45	14.45	14.45	14.45
580	MOTOR VOLTAGE - AB	Volts	3.905	3.852	3.840	3.839	3.847
581	MOTOR VOLTAGE - AC	Volts	3.917	3.863	3.848	3.853	3.862
582	MOTOR VOLTAGE - CB	Volts	3.907	3.852	3.839	3.844	3.850
583	MOTOR CURRENT - A	Volts	2.407	2.252	2.265	2.272	2.263
584	MOTOR CURRENT - B	Volts	2.550	2.386	2.403	2.414	2.410
585	MOTOR CURRENT - C	Volts	2.369	2.211	2.230	2.242	2.237
586	MOTOR POWER - PHASE 1	Volts	1.119	1.040	1.046	1.051	1.042
587	MOTOR POWER - PHASE 3	Volts	1.852	1.703	1.717	1.722	1.721
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	80.83	80.07	85.01	89.86	94.63
601	MAXIMUM MOTOR TEMPERATURE	Deg F	186.50	182.50	153.50	145.50	142.50
605	1st STAGE VANE SETTING	Degrees	70.00	40.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	63.00	50.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	413.10	414.00	414.20	414.40	415.10
609	UNIT START COUNTER READING		114	114	114	114	114
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	25.52	26.33	26.69	27.00	27.41
701	ENERGY BALANCE	%	-1.11	-0.89	-0.91	-0.95	-0.98
702	EVAP CAPACITY	Tons	221.40	209.70	205.50	199.90	193.90

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		84	85	86	87	88
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	10
Capacity	Tons	185.70	175.80	163.20	159.60	69.50
Power	KW	164.76	162.00	156.89	155.82	79.86
KW/Ton	KW/Ton	0.890	0.920	0.960	0.980	1.150
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	44.00	44.00	44.00
Condenser Entering Water Temperature	Deg F	90.01	94.93	99.97	101.02	89.91
Energy Balance	%	-0.88	-0.71	-0.68	-1.10	-1.04
Evaporator Entering Water Temperature	Deg F	53.14	52.66	51.99	51.82	47.41
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	44.00	44.00	44.00
Evaporator Water Flow Rate	GPM	486.00	485.70	489.40	488.90	488.20
Condenser Entering Water Temperature	Deg F	90.01	94.93	99.97	101.02	89.91
Condenser Leaving Water Temperature	Deg F	99.31	103.80	108.27	109.19	93.61
Condenser Water Flow Rate	GPM	607.30	608.00	608.50	608.90	607.10
Evap Sat Press	Psia	5.37	5.41	5.46	5.47	5.87
Sat Temp	Deg F	36.81	37.11	37.49	37.56	40.47
Approach	Deg F	7.20	6.90	6.50	6.40	3.50
LMTD	Deg F	11.14	10.64	9.98	9.84	5.04
ITD/Delta T		1.79	1.80	1.81	1.82	2.04
Q/Ao	B/hr-ft2	13507.99	12791.75	11871.25	11615.47	5057.45
Uo	B/hr ft2 F	1212.34	1202.35	1189.81	1180.75	1002.60
ho'	B/hr ft2 F	2019.08	1993.22	1954.33	1931.56	1504.14
Cond Sat Press	Psia	23.68	25.47	27.27	27.61	19.49
Sat Temp	Deg F	107.12	111.17	115.03	115.73	96.61
Approach	Deg F	7.80	7.40	6.80	6.50	3.00
Refrigerant Leaving Temp	Deg F	106.49	110.75	114.67	115.33	96.08
LMTD	Deg F	11.86	11.23	10.36	10.08	4.60
Q/Ao	B/hr-ft2	13628.21	12987.44	12158.00	11973.75	5409.66
Uo	B/hr ft2 F	1149.25	1156.80	1173.35	1187.98	1174.77
ho'	B/hr ft2 F	1682.46	1683.39	1703.26	1731.10	1746.89
Cond Sat Temp	Deg F	107.12	111.17	115.03	115.73	96.61
Evap Sat Temp	Deg F	36.81	37.11	37.49	37.56	40.47
Estimated Motor Efficiency (1)		0.935	0.935	0.936	0.937	0.947
Estimated Motor RPM (1)		3550	3551	3552	3553	3577
Compressor Suction CFM (2)	CFM	3322	3137	2899	2832	1128
Isentropic KW/T (2)		0.564	0.596	0.625	0.629	0.435
Adiabatic Efficiency (3)		0.634	0.648	0.651	0.642	0.378
Q/N (4)		0.936	0.884	0.816	0.797	0.315
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	16.39	16.37	16.62	16.59	16.54
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.12	52.64	51.96	51.79	47.37
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.16	52.69	52.01	51.85	47.44
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.00	44.01	44.01	44.01	44.01
6	LVG EVAP WATER TEMP LOC 2	Deg F	43.99	43.99	44.00	44.00	43.99
15	COND WATER FLOWMETER DELTA P	PSID	25.44	25.47	25.48	25.51	25.42
17	ENT COND WATER TEMP LOC 1	Deg F	90.04	94.96	100.01	101.05	89.94
18	ENT COND WATER TEMP LOC 2	Deg F	89.98	94.90	99.93	100.98	89.89
19	LVG COND WATER TEMP LOC 1	Deg F	99.34	103.81	108.30	109.20	93.62
20	LVG COND WATER TEMP LOC 2	Deg F	99.29	103.78	108.24	109.17	93.60
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	42.12	42.31	42.73	42.96	44.77
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	39.27	38.64	39.07	39.16	43.60
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.93	40.37	40.75	40.96	43.78
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.37	5.41	5.46	5.47	5.87
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.66	8.99	9.37	9.45	7.10
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.70	9.05	9.43	9.49	7.27
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.10	8.53	8.99	9.08	6.99
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	15.14	15.85	16.62	16.61	11.72
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	14.42	14.99	15.93	16.15	11.52
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	13.81	14.59	15.34	15.50	12.03
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	23.68	25.47	27.27	27.61	19.49
440	REFRIGERANT LVG COND TEMP	Deg F	106.49	110.75	114.67	115.33	96.08
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.12	16.00	16.92	17.07	12.93
485	HIGH PRESS ECONOMIZER TEMP	Deg F	83.34	86.18	89.04	89.52	75.60
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	8.85	9.20	9.57	9.62	7.13
487	LOW PRESS ECONOMIZER TEMP	Deg F	58.06	59.85	61.67	61.98	48.64
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	8.96	9.28	9.59	9.64	7.15
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	58.15	59.88	61.63	61.90	48.49
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.25	7.33	7.41	7.48	6.41
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.36	49.74	50.04	50.30	43.67
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	23.39	25.14	26.89	27.14	19.03
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	106.31	110.37	114.05	114.67	95.35
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	17.71	18.58	19.87	19.94	14.13
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	92.44	95.30	97.89	98.28	80.00
560	ATMOSPHERIC PRESS	PSIA	14.45	14.45	14.45	14.44	14.44
580	MOTOR VOLTAGE - AB	Volts	3.861	3.880	3.852	3.845	3.867
581	MOTOR VOLTAGE - AC	Volts	3.873	3.893	3.867	3.857	3.881
582	MOTOR VOLTAGE - CB	Volts	3.864	3.881	3.855	3.848	3.871
583	MOTOR CURRENT - A	Volts	2.249	2.202	2.141	2.132	1.171
584	MOTOR CURRENT - B	Volts	2.390	2.338	2.281	2.271	1.299
585	MOTOR CURRENT - C	Volts	2.217	2.174	2.131	2.114	1.212
586	MOTOR POWER - PHASE 1	Volts	1.035	1.011	0.975	0.970	0.406
587	MOTOR POWER - PHASE 3	Volts	1.711	1.689	1.640	1.627	0.925
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	99.31	103.90	108.40	109.14	93.65
601	MAXIMUM MOTOR TEMPERATURE	Deg F	141.50	140.50	137.80	137.20	82.80
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	40.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	50.00	19.00
608	UNIT HOUR METER READING	Hr	415.30	415.50	416.10	417.00	417.40
609	UNIT START COUNTER READING		114	114	114	114	114
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	27.72	28.10	28.43	29.35	29.99
701	ENERGY BALANCE	%	-0.88	-0.71	-0.68	-1.10	-1.04
702	EVAP CAPACITY	Tons	185.70	175.80	163.20	159.60	69.50

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0					
Run Number		89	90	91	92
Refrigerant		123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	10	10	10	10
Capacity	Tons	72.80	74.90	76.00	75.90
Power	KW	78.00	75.96	73.56	70.86
KW/Ton	KW/Ton	1.070	1.010	0.970	0.930
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	44.00	44.00
Condenser Entering Water Temperature	Deg F	85.02	79.97	75.00	70.01
Energy Balance	%	-1.38	-1.58	-1.44	-2.08
Evaporator Entering Water Temperature	Deg F	47.56	47.67	47.72	47.72
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	44.00	44.00
Evaporator Water Flow Rate	GPM	488.40	488.40	488.80	488.70
Condenser Entering Water Temperature	Deg F	85.02	79.97	75.00	70.01
Condenser Leaving Water Temperature	Deg F	88.84	83.87	78.90	73.91
Condenser Water Flow Rate	GPM	605.90	605.20	604.40	603.60
Evap Sat Press	Psia	5.85	5.82	5.77	5.68
Sat Temp	Deg F	40.32	40.11	39.75	39.11
Approach	Deg F	3.70	3.90	4.30	4.90
LMTD	Deg F	5.26	5.52	5.92	6.58
ITD/Delta T		2.03	2.06	2.14	2.31
Q/Ao	B/hr-ft2	5296.68	5452.60	5531.87	5522.67
Uo	B/hr ft2 F	1006.83	987.21	935.01	839.88
ho'	B/hr ft2 F	1513.28	1469.16	1356.13	1164.84
Cond Sat Press	Psia	17.84	16.23	14.71	13.30
Sat Temp	Deg F	91.98	87.12	82.18	77.22
Approach	Deg F	3.10	3.30	3.30	3.30
Refrigerant Leaving Temp	Deg F	91.37	86.65	81.74	76.74
LMTD	Deg F	4.80	4.95	4.98	5.01
Q/Ao	B/hr-ft2	5586.95	5688.26	5706.94	5683.28
Uo	B/hr ft2 F	1164.13	1149.99	1146.45	1134.50
ho'	B/hr ft2 F	1740.83	1726.34	1735.84	1725.51
Cond Sat Temp	Deg F	91.98	87.12	82.18	77.22
Evap Sat Temp	Deg F	40.32	40.11	39.75	39.11
Estimated Motor Efficiency (1)		0.947	0.947	0.946	0.946
Estimated Motor RPM (1)		3578	3578	3579	3580
Compressor Suction CFM (2)	CFM	1180	1213	1235	1245
Isentropic KW/T (2)		0.399	0.362	0.326	0.292
Adiabatic Efficiency (3)		0.373	0.358	0.336	0.314
Q/N (4)		0.330	0.339	0.345	0.348
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Large Impellers - Imperial

ID	Description	Units				
1	EVAP WATER FLOWMETER DELTA P	PSID	16.56	16.56	16.59	16.58
3	ENT EVAP WATER TEMP LOC 1	Deg F	47.52	47.64	47.69	47.68
4	ENT EVAP WATER TEMP LOC 2	Deg F	47.60	47.70	47.76	47.76
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.00	44.01	44.01	44.01
6	LVG EVAP WATER TEMP LOC 2	Deg F	43.99	43.99	44.00	44.00
15	COND WATER FLOWMETER DELTA P	PSID	25.35	25.32	25.27	25.23
17	ENT COND WATER TEMP LOC 1	Deg F	85.04	79.96	74.99	70.01
18	ENT COND WATER TEMP LOC 2	Deg F	84.99	79.99	75.00	70.03
19	LVG COND WATER TEMP LOC 1	Deg F	88.84	83.86	78.89	73.90
20	LVG COND WATER TEMP LOC 2	Deg F	88.83	83.87	78.91	73.92
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	44.98	44.75	44.48	43.54
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	43.19	42.51	42.45	41.50
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	43.60	43.47	42.90	42.21
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.85	5.82	5.77	5.68
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	6.54	6.05	5.59	5.16
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	6.76	6.22	5.72	5.25
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	6.45	5.93	5.46	5.02
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	10.71	9.45	8.46	7.60
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	10.42	9.47	8.64	7.94
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	10.93	9.93	9.03	8.17
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	17.84	16.23	14.71	13.30
440	REFRIGERANT LVG COND TEMP	Deg F	91.37	86.65	81.74	76.74
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	11.92	11.02	10.18	9.37
485	HIGH PRESS ECONOMIZER TEMP	Deg F	71.68	67.98	64.69	61.25
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	6.60	6.12	5.64	5.21
487	LOW PRESS ECONOMIZER TEMP	Deg F	45.36	42.13	38.84	35.62
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.66	6.20	5.87	5.74
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	45.41	42.25	39.18	36.05
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	6.25	6.10	5.94	5.82
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	42.70	41.54	39.21	36.03
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	17.37	15.84	14.35	12.94
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	90.57	85.83	80.96	75.91
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	13.00	12.04	11.10	10.18
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	76.19	72.51	68.82	64.90
560	ATMOSPHERIC PRESS	PSIA	14.44	14.44	14.44	14.44
580	MOTOR VOLTAGE - AB	Volts	3.869	3.881	3.903	3.958
581	MOTOR VOLTAGE - AC	Volts	3.884	3.897	3.920	3.976
582	MOTOR VOLTAGE - CB	Volts	3.872	3.886	3.909	3.961
583	MOTOR CURRENT - A	Volts	1.149	1.124	1.104	1.082
584	MOTOR CURRENT - B	Volts	1.274	1.251	1.223	1.194
585	MOTOR CURRENT - C	Volts	1.193	1.180	1.158	1.152
586	MOTOR POWER - PHASE 1	Volts	0.391	0.366	0.341	0.297
587	MOTOR POWER - PHASE 3	Volts	0.909	0.900	0.885	0.884
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	88.72	83.80	78.79	73.81
601	MAXIMUM MOTOR TEMPERATURE	Deg F	78.40	76.50	80.50	82.50
605	1st STAGE VANE SETTING	Degrees	10.00	10.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	418.00	418.20	418.40	418.60
609	UNIT START COUNTER READING		114	114	114	114
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360
700	TIME (HOURS)	HOURS	30.32	30.68	30.99	31.28
701	ENERGY BALANCE	%	-1.38	-1.58	-1.44	-2.08
702	EVAP CAPACITY	Tons	72.80	74.90	76.00	75.90

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		93	94	95	96	97
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	206.20	186.00	183.80	184.20	180.40
Power	KW	164.46	155.10	154.08	154.67	151.67
KW/Ton	KW/Ton	0.800	0.830	0.840	0.840	0.840
Evaporator Leaving Water Temperature	Deg F	43.99	43.99	44.00	44.00	43.97
Condenser Entering Water Temperature	Deg F	84.97	89.94	89.97	89.93	89.93
Energy Balance	%	-0.92	-0.94	-0.68	-0.94	-0.72
Evaporator Entering Water Temperature	Deg F	53.83	52.86	52.77	52.79	52.58
Evaporator Leaving Water Temperature	Deg F	43.99	43.99	44.00	44.00	43.97
Evaporator Water Flow Rate	GPM	501.90	501.60	501.40	501.30	501.70
Condenser Entering Water Temperature	Deg F	84.97	89.94	89.97	89.93	89.93
Condenser Leaving Water Temperature	Deg F	95.09	99.18	99.09	99.08	98.88
Condenser Water Flow Rate	GPM	606.60	605.90	605.70	606.10	606.20
Evap Sat Press	Psia	5.48	5.58	5.59	5.58	5.52
Sat Temp	Deg F	34.78	35.50	35.57	35.50	35.07
Approach	Deg F	9.20	8.50	8.40	8.50	8.90
LMTD	Deg F	13.54	12.40	12.30	12.38	12.72
ITD/Delta T		1.94	1.96	1.96	1.97	2.03
Q/Ao	B/hr-ft2	15001.09	13530.83	13374.66	13401.25	13123.39
Uo	B/hr ft2 F	1107.97	1091.13	1087.53	1082.56	1031.46
ho'	B/hr ft2 F	1721.97	1683.94	1675.63	1663.99	1546.28
Cond Sat Press	Psia	24.48	26.09	26.33	26.21	26.08
Sat Temp	Deg F	103.61	107.02	107.51	107.27	107.00
Approach	Deg F	8.50	7.80	8.40	8.20	8.10
Refrigerant Leaving Temp	Deg F	101.46	104.19	104.77	104.87	104.49
LMTD	Deg F	12.93	11.87	12.43	12.20	12.05
Q/Ao	B/hr-ft2	14832.95	13493.79	13323.10	13382.18	13085.13
Uo	B/hr ft2 F	1147.49	1137.14	1072.09	1097.05	1086.27
ho'	B/hr ft2 F	1693.44	1658.11	1523.49	1574.47	1552.27
Cond Sat Temp	Deg F	103.61	107.02	107.51	107.27	107.00
Evap Sat Temp	Deg F	34.78	35.50	35.57	35.50	35.07
Estimated Motor Efficiency (1)		0.935	0.937	0.937	0.937	0.938
Estimated Motor RPM (1)		3550	3553	3553	3553	3554
Compressor Suction CFM (2)	CFM	3545	3155	3115	3126	3091
Isentropic KW/T (2)		0.554	0.576	0.579	0.578	0.579
Adiabatic Efficiency (3)		0.693	0.694	0.689	0.688	0.689
Q/N (4)		0.999	0.888	0.877	0.880	0.870
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	17.48	17.45	17.45	17.44	17.46
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.80	52.83	52.74	52.76	52.54
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.85	52.89	52.80	52.82	52.61
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.00	43.99	44.00	44.00	43.98
6	LVG EVAP WATER TEMP LOC 2	Deg F	43.98	43.98	43.99	43.99	43.96
15	COND WATER FLOWMETER DELTA P	PSID	25.41	25.32	25.31	25.34	25.35
17	ENT COND WATER TEMP LOC 1	Deg F	84.98	89.98	90.00	89.95	89.95
18	ENT COND WATER TEMP LOC 2	Deg F	84.95	89.91	89.94	89.90	89.90
19	LVG COND WATER TEMP LOC 1	Deg F	95.11	99.20	99.11	99.09	98.89
20	LVG COND WATER TEMP LOC 2	Deg F	95.08	99.16	99.07	99.07	98.86
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	37.65	38.23	38.53	38.25	37.68
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	37.24	37.88	37.97	37.62	37.11
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	38.89	39.50	39.41	39.41	38.66
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.48	5.58	5.59	5.58	5.52
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.35	9.68	9.72	9.70	9.60
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.41	9.74	9.78	9.76	9.68
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.88	9.31	9.35	9.34	9.26
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	26.38	26.77	25.69	24.08	23.57
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	15.35	16.12	16.21	16.19	15.65
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	14.59	15.20	15.45	15.44	15.32
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.48	26.09	26.33	26.21	26.08
440	REFRIGERANT LVG COND TEMP	Deg F	101.46	104.19	104.77	104.87	104.49
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.38	16.21	16.43	16.37	16.24
485	HIGH PRESS ECONOMIZER TEMP	Deg F	79.55	82.10	82.42	82.37	81.96
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	9.51	9.83	9.84	9.87	9.76
487	LOW PRESS ECONOMOMIZER TEMP	Deg F	57.75	59.14	59.30	59.35	58.86
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	9.60	9.87	9.91	9.88	9.79
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	57.77	59.09	59.21	59.24	58.78
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.65	7.70	7.71	7.65	7.52
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	48.38	48.58	48.60	48.41	47.81
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.18	25.85	25.90	25.84	25.65
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	101.84	105.23	105.34	105.36	104.91
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.14	19.12	19.21	19.20	18.95
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	88.40	90.17	90.49	90.32	89.86
560	ATMOSPHERIC PRESS	PSIA	14.34	14.35	14.35	14.35	14.35
580	MOTOR VOLTAGE - AB	Volts	3.900	3.909	3.918	3.936	3.936
581	MOTOR VOLTAGE - AC	Volts	3.902	3.917	3.929	3.955	3.951
582	MOTOR VOLTAGE - CB	Volts	3.884	3.893	3.908	3.922	3.919
583	MOTOR CURRENT - A	Volts	2.277	2.137	2.119	2.118	2.085
584	MOTOR CURRENT - B	Volts	2.348	2.210	2.206	2.187	2.150
585	MOTOR CURRENT - C	Volts	2.190	2.088	2.076	2.100	2.064
586	MOTOR POWER - PHASE 1	Volts	1.038	0.960	0.947	0.928	0.914
587	MOTOR POWER - PHASE 3	Volts	1.703	1.625	1.621	1.650	1.614
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	95.11	99.28	99.10	99.23	98.98
601	MAXIMUM MOTOR TEMPERATURE	Deg F	130.50	125.50	124.50	124.50	123.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	419.60	420.30	421.40	423.10	423.30
609	UNIT START COUNTER READING		115	115	115	115	115
610	CURRENT REFRIGERANT CHARGE	Lbm	361	361	331	285	265
700	TIME (HOURS)	HOURS	0.00	0.59	1.76	3.14	3.49
701	ENERGY BALANCE	%	-0.92	-0.94	-0.68	-0.94	-0.72
702	EVAP CAPACITY	Tons	206.20	186.00	183.80	184.20	180.40

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		98	99	100	101	102
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	184.00	185.30	160.80	220.20	233.50
Power	KW	153.60	154.80	142.92	168.36	172.56
KW/Ton	KW/Ton	0.830	0.840	0.890	0.760	0.740
Evaporator Leaving Water Temperature	Deg F	43.98	44.02	44.00	43.99	44.01
Condenser Entering Water Temperature	Deg F	89.94	89.99	94.43	79.91	74.99
Energy Balance	%	-1.05	-1.00	-1.23	-0.95	-1.04
Evaporator Entering Water Temperature	Deg F	52.77	52.81	51.67	54.71	55.33
Evaporator Leaving Water Temperature	Deg F	43.98	44.02	44.00	43.99	44.01
Evaporator Water Flow Rate	GPM	501.20	504.70	501.70	491.80	494.00
Condenser Entering Water Temperature	Deg F	89.94	89.99	94.43	79.91	74.99
Condenser Leaving Water Temperature	Deg F	99.08	99.19	102.54	90.67	86.35
Condenser Water Flow Rate	GPM	606.10	606.60	605.80	604.90	604.00
Evap Sat Press	Psia	5.58	5.57	5.70	5.39	5.34
Sat Temp	Deg F	35.50	35.43	36.34	34.12	33.75
Approach	Deg F	8.50	8.60	7.60	9.90	10.30
LMTD	Deg F	12.36	12.47	11.06	14.58	15.22
ITD/Delta T		1.96	1.98	2.00	1.92	1.91
Q/Ao	B/hr-ft2	13389.83	13485.47	11698.56	16018.72	16989.21
Uo	B/hr ft2 F	1083.46	1081.17	1058.21	1098.76	1115.88
ho'	B/hr ft2 F	1666.25	1656.56	1608.77	1711.38	1748.88
Cond Sat Press	Psia	26.27	25.99	27.19	22.79	21.17
Sat Temp	Deg F	107.39	106.81	109.25	99.84	96.00
Approach	Deg F	8.30	7.60	6.70	9.20	9.60
Refrigerant Leaving Temp	Deg F	104.79	104.40	107.06	97.89	93.74
LMTD	Deg F	12.32	11.62	10.24	13.86	14.60
Q/Ao	B/hr-ft2	13367.57	13458.66	11839.53	15723.68	16589.94
Uo	B/hr ft2 F	1085.03	1158.31	1156.77	1134.40	1136.24
ho'	B/hr ft2 F	1549.40	1702.67	1687.99	1681.02	1700.52
Cond Sat Temp	Deg F	107.39	106.81	109.25	99.84	96.00
Evap Sat Temp	Deg F	35.50	35.43	36.34	34.12	33.75
Estimated Motor Efficiency (1)		0.937	0.937	0.940	0.934	0.933
Estimated Motor RPM (1)		3553	3553	3557	3548	3547
Compressor Suction CFM (2)	CFM	3123	3148	2680	3829	4079
Isentropic KW/T (2)		0.579	0.574	0.584	0.529	0.500
Adiabatic Efficiency (3)		0.698	0.683	0.656	0.696	0.676
Q/N (4)		0.879	0.886	0.753	1.079	1.150
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	17.43	17.68	17.46	16.78	16.93
3	ENT EVAP WATER TEMP LOC 1	Deg F	52.74	52.78	51.64	54.69	55.31
4	ENT EVAP WATER TEMP LOC 2	Deg F	52.80	52.84	51.71	54.73	55.35
5	LVG EVAP WATER TEMP LOC 1	Deg F	43.99	44.03	44.01	44.00	44.02
6	LVG EVAP WATER TEMP LOC 2	Deg F	43.97	44.01	44.00	43.98	44.00
15	COND WATER FLOWMETER DELTA P	PSID	25.34	25.38	25.29	25.29	25.24
17	ENT COND WATER TEMP LOC 1	Deg F	89.96	90.00	94.46	79.92	74.99
18	ENT COND WATER TEMP LOC 2	Deg F	89.91	89.97	94.39	79.90	74.98
19	LVG COND WATER TEMP LOC 1	Deg F	99.09	99.20	102.55	90.67	86.35
20	LVG COND WATER TEMP LOC 2	Deg F	99.07	99.17	102.52	90.67	86.34
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	38.55	42.23	42.71	40.55	40.59
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	37.84	39.14	39.62	37.68	37.46
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.28	40.28	40.84	38.84	38.57
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.58	5.57	5.70	5.39	5.34
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.71	9.68	9.96	9.03	8.81
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.77	9.72	10.04	9.09	8.87
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.34	9.31	9.70	8.47	8.14
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	23.12	20.07	20.77	18.64	17.96
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.19	16.25	16.85	14.90	14.18
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.48	15.45	16.18	13.97	13.18
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	26.27	25.99	27.19	22.79	21.17
440	REFRIGERANT LVG COND TEMP	Deg F	104.79	104.40	107.06	97.89	93.74
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.39	16.31	17.08	14.58	13.77
485	HIGH PRESS ECONOMIZER TEMP	Deg F	82.32	82.12	84.25	76.81	74.12
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.84	9.83	10.04	9.17	8.88
487	LOW PRESS ECONOMIZER TEMP	Deg F	59.26	59.12	60.12	56.18	54.84
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	9.89	9.85	10.04	9.25	9.02
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	59.24	59.05	59.94	56.27	55.03
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.64	7.64	7.59	7.58	7.45
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	48.19	48.43	48.00	47.99	47.66
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	25.96	25.73	26.84	22.56	21.04
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	105.34	105.13	107.33	98.12	94.46
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	19.20	19.09	19.53	17.37	16.53
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	90.31	90.07	91.21	85.94	83.52
560	ATMOSPHERIC PRESS	PSIA	14.35	14.36	14.36	14.36	14.36
580	MOTOR VOLTAGE - AB	Volts	3.915	3.894	3.905	3.868	3.869
581	MOTOR VOLTAGE - AC	Volts	3.910	3.899	3.906	3.870	3.872
582	MOTOR VOLTAGE - CB	Volts	3.891	3.880	3.890	3.855	3.857
583	MOTOR CURRENT - A	Volts	2.105	2.145	1.994	2.330	2.376
584	MOTOR CURRENT - B	Volts	2.179	2.222	2.071	2.420	2.470
585	MOTOR CURRENT - C	Volts	2.100	2.071	1.922	2.246	2.301
586	MOTOR POWER - PHASE 1	Volts	0.928	0.970	0.888	1.072	1.100
587	MOTOR POWER - PHASE 3	Volts	1.632	1.610	1.494	1.734	1.776
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	99.15	99.18	102.58	90.70	86.26
601	MAXIMUM MOTOR TEMPERATURE	Deg F	125.50	123.50	118.50	133.50	137.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	424.10	429.00	429.40	430.00	430.20
609	UNIT START COUNTER READING		115	119	119	119	119
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	4.11	95.24	95.80	96.23	96.55
701	ENERGY BALANCE	%	-1.05	-1.00	-1.23	-0.95	-1.04
702	EVAP CAPACITY	Tons	184.00	185.30	160.80	220.20	233.50

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		103	104	105	106	107
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	70	70	70	70
Capacity	Tons	245.20	239.30	228.80	216.50	200.40
Power	KW	176.46	169.38	167.22	164.04	158.10
KW/Ton	KW/Ton	0.720	0.710	0.730	0.760	0.790
Evaporator Leaving Water Temperature	Deg F	44.00	44.02	43.99	44.00	44.01
Condenser Entering Water Temperature	Deg F	69.98	69.98	74.94	79.97	84.96
Energy Balance	%	-1.13	-0.94	-1.12	-1.33	-0.92
Evaporator Entering Water Temperature	Deg F	55.84	55.57	55.11	54.54	53.54
Evaporator Leaving Water Temperature	Deg F	44.00	44.02	43.99	44.00	44.01
Evaporator Water Flow Rate	GPM	495.90	495.90	492.80	491.90	503.30
Condenser Entering Water Temperature	Deg F	69.98	69.98	74.94	79.97	84.96
Condenser Leaving Water Temperature	Deg F	81.89	81.55	86.07	90.56	94.82
Condenser Water Flow Rate	GPM	602.30	602.20	603.60	605.00	604.50
Evap Sat Press	Psia	5.28	5.32	5.38	5.44	5.52
Sat Temp	Deg F	33.31	33.61	34.05	34.49	35.07
Approach	Deg F	10.70	10.40	9.90	9.50	8.90
LMTD	Deg F	15.88	15.47	14.81	14.13	13.13
ITD/Delta T		1.90	1.90	1.89	1.90	1.94
Q/Ao	B/hr-ft2	17836.80	17407.93	16650.19	15754.61	14577.93
Uo	B/hr ft2 F	1123.14	1125.04	1124.20	1114.91	1109.96
ho'	B/hr ft2 F	1762.99	1768.18	1771.70	1751.00	1725.47
Cond Sat Press	Psia	19.65	19.40	20.96	22.64	24.23
Sat Temp	Deg F	92.19	91.54	95.49	99.49	103.07
Approach	Deg F	10.30	10.00	9.40	8.90	8.30
Refrigerant Leaving Temp	Deg F	90.12	89.47	93.23	97.51	101.10
LMTD	Deg F	15.50	15.04	14.27	13.54	12.54
Q/Ao	B/hr-ft2	17351.52	16860.04	16237.48	15485.66	14386.38
Uo	B/hr ft2 F	1119.47	1120.97	1137.97	1143.55	1147.19
ho'	B/hr ft2 F	1679.59	1683.76	1705.59	1701.08	1695.46
Cond Sat Temp	Deg F	92.19	91.54	95.49	99.49	103.07
Evap Sat Temp	Deg F	33.31	33.61	34.05	34.49	35.07
Estimated Motor Efficiency (1)		0.932	0.933	0.934	0.935	0.936
Estimated Motor RPM (1)		3545	3548	3549	3550	3552
Compressor Suction CFM (2)	CFM	4310	4173	3968	3730	3419
Isentropic KW/T (2)		0.473	0.464	0.493	0.522	0.546
Adiabatic Efficiency (3)		0.657	0.654	0.675	0.687	0.691
Q/N (4)		1.216	1.176	1.118	1.051	0.963
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	17.06	17.06	16.85	16.79	17.58
3	ENT EVAP WATER TEMP LOC 1	Deg F	55.82	55.55	55.09	54.52	53.52
4	ENT EVAP WATER TEMP LOC 2	Deg F	55.86	55.59	55.12	54.57	53.56
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.02	43.99	44.01	44.02
6	LVG EVAP WATER TEMP LOC 2	Deg F	43.99	44.01	43.98	44.00	44.00
15	COND WATER FLOWMETER DELTA P	PSID	25.12	25.11	25.21	25.30	25.23
17	ENT COND WATER TEMP LOC 1	Deg F	69.98	69.98	74.94	79.98	84.96
18	ENT COND WATER TEMP LOC 2	Deg F	69.99	69.98	74.94	79.96	84.93
19	LVG COND WATER TEMP LOC 1	Deg F	81.89	81.55	86.07	90.56	94.82
20	LVG COND WATER TEMP LOC 2	Deg F	81.89	81.55	86.06	90.57	94.81
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.15	40.32	40.34	41.15	41.32
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	37.20	37.37	37.59	38.12	38.50
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	38.25	38.48	38.79	39.38	39.75
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.28	5.32	5.38	5.44	5.52
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.58	8.47	8.71	8.99	9.29
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.60	8.49	8.75	9.03	9.34
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.80	7.76	8.09	8.45	8.84
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	17.76	17.78	18.11	18.95	19.35
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	13.52	13.51	14.21	14.98	15.68
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	12.37	12.37	13.15	13.98	14.73
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	19.65	19.40	20.96	22.64	24.23
440	REFRIGERANT LVG COND TEMP	Deg F	90.12	89.47	93.23	97.51	101.10
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.95	12.93	13.72	14.57	15.42
485	HIGH PRESS ECONOMIZER TEMP	Deg F	71.37	71.35	74.00	76.76	79.50
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	8.54	8.47	8.79	9.12	9.43
487	LOW PRESS ECONOMIZER TEMP	Deg F	53.21	52.89	54.44	55.96	57.48
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	8.87	8.71	8.92	9.22	9.51
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	53.50	53.17	54.61	56.05	57.46
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.45	7.35	7.43	7.50	7.56
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	47.62	46.87	47.34	47.88	48.01
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	19.62	19.37	20.84	22.37	23.94
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	90.78	90.19	93.97	97.79	101.38
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	15.63	15.37	16.08	17.09	17.94
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	81.07	80.37	82.72	85.47	87.88
560	ATMOSPHERIC PRESS	PSIA	14.36	14.36	14.37	14.37	14.36
580	MOTOR VOLTAGE - AB	Volts	3.881	3.879	3.887	3.918	3.878
581	MOTOR VOLTAGE - AC	Volts	3.881	3.880	3.886	3.917	3.880
582	MOTOR VOLTAGE - CB	Volts	3.864	3.864	3.867	3.900	3.863
583	MOTOR CURRENT - A	Volts	2.438	2.338	2.317	2.261	2.189
584	MOTOR CURRENT - B	Volts	2.516	2.427	2.385	2.339	2.270
585	MOTOR CURRENT - C	Volts	2.342	2.256	2.222	2.174	2.116
586	MOTOR POWER - PHASE 1	Volts	1.130	1.079	1.069	1.038	0.998
587	MOTOR POWER - PHASE 3	Volts	1.811	1.744	1.718	1.696	1.637
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	81.80	81.48	86.01	90.51	94.76
601	MAXIMUM MOTOR TEMPERATURE	Deg F	142.50	137.50	133.50	130.50	125.50
605	1st STAGE VANE SETTING	Degrees	90.00	70.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	68.00	63.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	430.40	430.60	431.10	431.30	432.00
609	UNIT START COUNTER READING		119	119	119	119	119
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	96.85	97.16	97.42	97.68	98.23
701	ENERGY BALANCE	%	-1.13	-0.94	-1.12	-1.33	-0.92
702	EVAP CAPACITY	Tons	245.20	239.30	228.80	216.50	200.40

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		108	109	110	111	112
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	40	40	40
Capacity	Tons	180.70	155.80	137.80	161.80	179.10
Power	KW	149.28	137.88	122.94	134.03	140.75
KW/Ton	KW/Ton	0.830	0.880	0.890	0.830	0.790
Evaporator Leaving Water Temperature	Deg F	44.02	44.00	44.00	44.01	43.99
Condenser Entering Water Temperature	Deg F	89.95	94.24	93.68	90.00	84.97
Energy Balance	%	-1.00	-1.02	-1.14	-0.75	-1.10
Evaporator Entering Water Temperature	Deg F	52.62	51.42	50.56	51.70	52.51
Evaporator Leaving Water Temperature	Deg F	44.02	44.00	44.00	44.01	43.99
Evaporator Water Flow Rate	GPM	503.00	502.60	502.70	503.40	503.40
Condenser Entering Water Temperature	Deg F	89.95	94.24	93.68	90.00	84.97
Condenser Leaving Water Temperature	Deg F	98.93	102.08	100.64	98.02	93.78
Condenser Water Flow Rate	GPM	604.70	605.30	605.40	604.80	604.80
Evap Sat Press	Psia	5.61	5.73	5.83	5.71	5.60
Sat Temp	Deg F	35.72	36.56	37.25	36.41	35.65
Approach	Deg F	8.30	7.40	6.70	7.60	8.30
LMTD	Deg F	12.09	10.73	9.66	11.00	12.10
ITD/Delta T		1.97	2.00	2.03	1.99	1.98
Q/Ao	B/hr-ft2	13149.43	11337.03	10026.91	11769.36	13030.84
Uo	B/hr ft2 F	1087.21	1057.01	1037.81	1069.88	1076.54
ho'	B/hr ft2 F	1673.06	1605.36	1562.75	1633.88	1647.80
Cond Sat Press	Psia	25.82	26.89	25.81	25.01	23.37
Sat Temp	Deg F	106.46	108.65	106.44	104.75	101.16
Approach	Deg F	7.50	6.60	5.80	6.70	7.40
Refrigerant Leaving Temp	Deg F	104.32	106.23	103.94	102.49	98.53
LMTD	Deg F	11.44	9.98	8.83	10.22	11.21
Q/Ao	B/hr-ft2	13095.35	11443.74	10147.79	11705.02	12869.37
Uo	B/hr ft2 F	1144.85	1146.43	1149.58	1145.21	1147.61
ho'	B/hr ft2 F	1676.21	1667.66	1677.25	1678.01	1697.61
Cond Sat Temp	Deg F	106.46	108.65	106.44	104.75	101.16
Evap Sat Temp	Deg F	35.72	36.56	37.25	36.41	35.65
Estimated Motor Efficiency (1)		0.938	0.941	0.944	0.942	0.940
Estimated Motor RPM (1)		3555	3559	3564	3560	3558
Compressor Suction CFM (2)	CFM	3047	2581	2239	2677	3005
Isentropic KW/T (2)		0.568	0.576	0.549	0.544	0.522
Adiabatic Efficiency (3)		0.684	0.655	0.617	0.655	0.661
Q/N (4)		0.857	0.725	0.628	0.752	0.845
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	17.56	17.53	17.54	17.59	17.59
3	ENT EVAP WATER TEMP LOC 1	Deg F	52.59	51.39	50.52	51.68	52.47
4	ENT EVAP WATER TEMP LOC 2	Deg F	52.65	51.45	50.60	51.72	52.54
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.03	44.01	44.01	44.02	44.00
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.01	43.99	43.99	44.00	43.98
15	COND WATER FLOWMETER DELTA P	PSID	25.22	25.25	25.26	25.23	25.26
17	ENT COND WATER TEMP LOC 1	Deg F	89.96	94.26	93.70	90.04	84.98
18	ENT COND WATER TEMP LOC 2	Deg F	89.93	94.21	93.66	89.95	84.95
19	LVG COND WATER TEMP LOC 1	Deg F	98.93	102.09	100.64	98.03	93.79
20	LVG COND WATER TEMP LOC 2	Deg F	98.92	102.07	100.63	98.01	93.77
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	42.19	42.20	42.80	41.92	41.41
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	39.36	39.78	40.64	39.71	39.07
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	40.23	40.66	41.37	40.59	40.00
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.61	5.73	5.83	5.71	5.60
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.63	9.87	9.71	9.43	9.07
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.68	9.96	9.82	9.49	9.10
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.28	9.64	9.51	9.17	8.71
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	19.98	20.66	20.03	19.68	18.83
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.50	16.74	16.41	15.67	14.87
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.44	16.11	15.61	15.03	14.16
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	25.82	26.89	25.81	25.01	23.37
440	REFRIGERANT LVG COND TEMP	Deg F	104.32	106.23	103.94	102.49	98.53
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.27	16.92	16.61	16.09	15.23
485	HIGH PRESS ECONOMIZER TEMP	Deg F	81.96	83.85	82.91	81.40	78.87
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.78	9.95	9.72	9.54	9.17
487	LOW PRESS ECONOMIZER TEMP	Deg F	58.94	59.74	58.71	57.92	56.28
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	9.81	9.92	9.71	9.56	9.22
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	58.83	59.49	58.49	57.65	56.22
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.62	7.53	7.40	7.35	7.33
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	48.26	47.59	46.99	46.72	46.66
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	25.51	26.49	25.45	24.61	23.10
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	104.63	106.58	104.37	102.73	99.32
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.93	19.35	18.59	18.37	17.54
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	89.70	90.56	88.64	88.23	86.01
560	ATMOSPHERIC PRESS	PSIA	14.36	14.37	14.37	14.37	14.37
580	MOTOR VOLTAGE - AB	Volts	3.852	3.851	3.870	3.900	3.903
581	MOTOR VOLTAGE - AC	Volts	3.853	3.854	3.870	3.902	3.907
582	MOTOR VOLTAGE - CB	Volts	3.839	3.838	3.858	3.887	3.894
583	MOTOR CURRENT - A	Volts	2.087	1.928	1.728	1.873	1.951
584	MOTOR CURRENT - B	Volts	2.158	2.010	1.818	1.951	2.045
585	MOTOR CURRENT - C	Volts	2.007	1.863	1.690	1.816	1.898
586	MOTOR POWER - PHASE 1	Volts	0.944	0.858	0.748	0.822	0.866
587	MOTOR POWER - PHASE 3	Volts	1.544	1.440	1.301	1.412	1.480
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	98.93	102.11	100.62	98.01	93.75
601	MAXIMUM MOTOR TEMPERATURE	Deg F	121.50	115.50	105.50	109.50	112.50
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	432.20	432.60	433.50	434.10	434.30
609	UNIT START COUNTER READING		119	119	119	119	119
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	98.50	99.15	100.09	100.35	100.62
701	ENERGY BALANCE	%	-1.00	-1.02	-1.14	-0.75	-1.10
702	EVAP CAPACITY	Tons	180.70	155.80	137.80	161.80	179.10

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0						
Run Number		113	114	115	116	117
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	10	10
Capacity	Tons	192.90	204.30	213.40	79.60	76.60
Power	KW	144.89	147.78	149.03	66.72	68.46
KW/Ton	KW/Ton	0.750	0.720	0.700	0.840	0.890
Evaporator Leaving Water Temperature	Deg F	43.98	44.00	43.97	43.99	44.00
Condenser Entering Water Temperature	Deg F	79.93	74.97	69.94	70.00	74.97
Energy Balance	%	-1.23	-1.25	-1.16	-1.37	-1.71
Evaporator Entering Water Temperature	Deg F	53.15	53.78	54.16	47.78	47.66
Evaporator Leaving Water Temperature	Deg F	43.98	44.00	43.97	43.99	44.00
Evaporator Water Flow Rate	GPM	503.30	500.00	501.20	502.10	502.20
Condenser Entering Water Temperature	Deg F	79.93	74.97	69.94	70.00	74.97
Condenser Leaving Water Temperature	Deg F	89.36	84.91	80.26	73.99	78.86
Condenser Water Flow Rate	GPM	604.50	602.90	602.60	602.00	602.80
Evap Sat Press	Psia	5.53	5.49	5.44	6.14	6.15
Sat Temp	Deg F	35.14	34.84	34.49	39.34	39.41
Approach	Deg F	8.80	9.10	9.50	4.60	4.60
LMTD	Deg F	12.89	13.46	13.96	6.36	6.24
ITD/Delta T		1.96	1.94	1.93	2.22	2.25
Q/Ao	B/hr-ft2	14035.55	14861.65	15527.35	5788.46	5576.29
Uo	B/hr ft2 F	1089.23	1103.88	1112.23	910.44	893.32
ho'	B/hr ft2 F	1676.71	1714.60	1732.57	1294.55	1260.26
Cond Sat Press	Psia	21.72	20.10	18.42	14.53	16.07
Sat Temp	Deg F	97.33	93.34	88.93	77.31	82.17
Approach	Deg F	8.00	8.40	8.70	3.30	3.30
Refrigerant Leaving Temp	Deg F	95.36	91.47	86.96	75.97	80.54
LMTD	Deg F	12.08	12.76	13.16	5.06	5.01
Q/Ao	B/hr-ft2	13764.79	14483.55	15033.38	5798.55	5670.45
Uo	B/hr ft2 F	1139.70	1134.97	1142.13	1147.04	1132.83
ho'	B/hr ft2 F	1695.17	1701.40	1733.82	1756.47	1706.41
Cond Sat Temp	Deg F	97.33	93.34	88.93	77.31	82.17
Evap Sat Temp	Deg F	35.14	34.84	34.49	39.34	39.41
Estimated Motor Efficiency (1)		0.939	0.939	0.938	0.945	0.945
Estimated Motor RPM (1)		3556	3555	3555	3581	3580
Compressor Suction CFM (2)	CFM	3262	3464	3631	1192	1152
Isentropic KW/T (2)		0.495	0.464	0.432	0.292	0.330
Adiabatic Efficiency (3)		0.660	0.644	0.617	0.348	0.371
Q/N (4)		0.917	0.974	1.021	0.333	0.322
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Imperial

ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	PSID	17.58	17.35	17.43	17.50	17.51
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.12	53.76	54.14	47.74	47.62
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.18	53.81	54.19	47.82	47.69
5	LVG EVAP WATER TEMP LOC 1	Deg F	43.98	44.01	43.98	44.00	44.01
6	LVG EVAP WATER TEMP LOC 2	Deg F	43.97	44.00	43.96	43.98	44.00
15	COND WATER FLOWMETER DELTA P	PSID	25.26	25.15	25.14	25.09	25.14
17	ENT COND WATER TEMP LOC 1	Deg F	79.92	74.98	69.94	70.00	74.97
18	ENT COND WATER TEMP LOC 2	Deg F	79.94	74.97	69.96	70.01	74.96
19	LVG COND WATER TEMP LOC 1	Deg F	89.35	84.91	80.26	73.98	78.85
20	LVG COND WATER TEMP LOC 2	Deg F	89.36	84.91	80.26	73.99	78.86
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.91	40.81	40.77	44.18	44.70
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.84	38.50	38.20	42.76	43.14
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.31	39.16	38.91	42.84	43.07
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.53	5.49	5.44	6.14	6.15
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.72	8.42	8.14	6.00	6.50
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.75	8.45	8.18	6.14	6.67
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.27	7.90	7.56	5.90	6.40
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	18.00	17.36	17.07	12.60	13.60
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	13.92	13.15	12.44	8.93	9.87
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	13.61	12.79	11.98	9.32	10.29
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	21.72	20.10	18.42	14.53	16.07
440	REFRIGERANT LVG COND TEMP	Deg F	95.36	91.47	86.96	75.97	80.54
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	14.38	13.58	12.83	10.24	11.14
485	HIGH PRESS ECONOMIZER TEMP	Deg F	76.18	73.51	70.86	61.16	64.55
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	8.82	8.49	8.18	6.03	6.53
487	LOW PRESS ECONOMOMIZER TEMP	Deg F	54.62	52.88	51.30	39.11	42.24
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	8.89	8.57	8.21	6.24	6.60
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	54.56	52.95	51.35	39.37	42.28
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.23	7.15	7.03	6.31	6.47
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	46.19	45.76	45.31	39.46	41.52
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	21.40	19.79	18.24	14.20	15.70
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	95.63	91.67	87.45	75.73	80.46
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	16.73	15.68	14.91	11.12	12.07
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	83.57	80.90	78.15	64.64	68.28
560	ATMOSPHERIC PRESS	PSIA	14.37	14.37	14.37	14.37	14.36
580	MOTOR VOLTAGE - AB	Volts	3.872	3.858	3.846	3.875	3.884
581	MOTOR VOLTAGE - AC	Volts	3.874	3.862	3.852	3.877	3.888
582	MOTOR VOLTAGE - CB	Volts	3.856	3.849	3.841	3.866	3.877
583	MOTOR CURRENT - A	Volts	2.017	2.053	2.064	1.049	1.076
584	MOTOR CURRENT - B	Volts	2.097	2.152	2.168	1.140	1.154
585	MOTOR CURRENT - C	Volts	1.958	1.991	2.016	1.051	1.072
586	MOTOR POWER - PHASE 1	Volts	0.905	0.931	0.934	0.319	0.329
587	MOTOR POWER - PHASE 3	Volts	1.510	1.532	1.550	0.793	0.812
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	89.31	84.85	80.23	73.90	78.82
601	MAXIMUM MOTOR TEMPERATURE	Deg F	113.50	116.50	117.50	77.50	70.50
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	434.50	435.10	435.30	435.60	436.20
609	UNIT START COUNTER READING		119	119	119	119	119
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	100.94	101.32	101.69	102.16	102.51
701	ENERGY BALANCE	%	-1.23	-1.25	-1.16	-1.37	-1.71
702	EVAP CAPACITY	Tons	192.90	204.30	213.40	79.60	76.60

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0					
Run Number		118	119	120	
Refrigerant		245ca	245ca	245ca	
Oil		Solest 68	Solest 68	Solest 68	
1st Stage Guide Vane Setting	Degrees	10	10	10	
Capacity	Tons	71.50	65.20	55.80	
Power	KW	69.54	70.62	69.54	
KW/Ton	KW/Ton	0.970	1.080	1.250	
Evaporator Leaving Water Temperature	Deg F	44.01	43.99	44.01	
Condenser Entering Water Temperature	Deg F	79.92	84.93	90.02	
Energy Balance	%	-1.77	-1.64	-0.96	
Evaporator Entering Water Temperature	Deg F	47.42	47.09	46.67	
Evaporator Leaving Water Temperature	Deg F	44.01	43.99	44.01	
Evaporator Water Flow Rate	GPM	502.10	502.30	501.60	
Condenser Entering Water Temperature	Deg F	79.92	84.93	90.02	
Condenser Leaving Water Temperature	Deg F	83.61	88.37	93.04	
Condenser Water Flow Rate	GPM	604.00	605.40	606.20	
Evap Sat Press	Psia	6.19	6.22	6.28	
Sat Temp	Deg F	39.68	39.88	40.27	
Approach	Deg F	4.30	4.10	3.70	
LMTD	Deg F	5.87	5.52	4.95	
ITD/Delta T		2.27	2.33	2.41	
Q/Ao	B/hr-ft2	5200.64	4745.36	4059.65	
Uo	B/hr ft2 F	885.84	860.36	819.88	
ho'	B/hr ft2 F	1245.76	1196.22	1120.13	
Cond Sat Press	Psia	17.65	19.35	21.14	
Sat Temp	Deg F	86.79	91.41	95.93	
Approach	Deg F	3.20	3.00	2.90	
Refrigerant Leaving Temp	Deg F	84.91	89.37	93.53	
LMTD	Deg F	4.79	4.55	4.22	
Q/Ao	B/hr-ft2	5385.13	5027.32	4429.91	
Uo	B/hr ft2 F	1124.14	1106.10	1049.37	
ho'	B/hr ft2 F	1670.31	1615.67	1484.44	
Cond Sat Temp	Deg F	86.79	91.41	95.93	
Evap Sat Temp	Deg F	39.68	39.88	40.27	
Estimated Motor Efficiency (1)		0.945	0.946	0.945	
Estimated Motor RPM (1)		3580	3580	3580	
Compressor Suction CFM (2)	CFM	1074	980	835	
Isentropic KW/T (2)		0.364	0.400	0.433	
Adiabatic Efficiency (3)		0.375	0.370	0.346	
Q/N (4)		0.300	0.274	0.233	
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Large Impellers - Imperial

ID	Description	Units			
1	EVAP WATER FLOWMETER DELTA P	PSID	17.50	17.52	17.46
3	ENT EVAP WATER TEMP LOC 1	Deg F	47.38	47.06	46.64
4	ENT EVAP WATER TEMP LOC 2	Deg F	47.45	47.13	46.70
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.02	44.00	44.02
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	43.98	44.00
15	COND WATER FLOWMETER DELTA P	PSID	25.22	25.31	25.35
17	ENT COND WATER TEMP LOC 1	Deg F	79.93	84.95	90.04
18	ENT COND WATER TEMP LOC 2	Deg F	79.90	84.91	89.99
19	LVG COND WATER TEMP LOC 1	Deg F	83.61	88.37	93.05
20	LVG COND WATER TEMP LOC 2	Deg F	83.60	88.37	93.04
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	44.41	44.66	44.99
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	42.93	43.14	43.56
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	43.49	43.85	43.88
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.19	6.22	6.28
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.08	7.73	8.42
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.28	7.92	8.57
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.01	7.66	8.41
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	14.76	16.00	17.21
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	10.94	12.17	13.43
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	11.40	12.61	13.80
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	17.65	19.35	21.14
440	REFRIGERANT LVG COND TEMP	Deg F	84.91	89.37	93.53
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.14	13.26	14.37
485	HIGH PRESS ECONOMIZER TEMP	Deg F	68.37	72.33	76.06
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	7.10	7.74	8.46
487	LOW PRESS ECONOMOMIZER TEMP	Deg F	45.65	49.13	52.77
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.13	7.73	8.42
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	45.56	48.84	52.34
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	6.65	6.84	7.10
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	42.50	43.64	45.06
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	17.25	18.95	20.71
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	85.06	89.64	94.02
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	13.24	14.43	15.56
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	72.19	76.19	79.85
560	ATMOSPHERIC PRESS	PSIA	14.36	14.36	14.36
580	MOTOR VOLTAGE - AB	Volts	3.879	3.907	3.899
581	MOTOR VOLTAGE - AC	Volts	3.885	3.912	3.905
582	MOTOR VOLTAGE - CB	Volts	3.872	3.899	3.892
583	MOTOR CURRENT - A	Volts	1.090	1.104	1.085
584	MOTOR CURRENT - B	Volts	1.165	1.179	1.166
585	MOTOR CURRENT - C	Volts	1.087	1.107	1.095
586	MOTOR POWER - PHASE 1	Volts	0.335	0.333	0.326
587	MOTOR POWER - PHASE 3	Volts	0.824	0.844	0.833
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	83.66	88.42	93.09
601	MAXIMUM MOTOR TEMPERATURE	Deg F	71.50	74.50	77.50
605	1st STAGE VANE SETTING	Degrees	10.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	436.40	437.00	437.30
609	UNIT START COUNTER READING		119	119	119
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360
700	TIME (HOURS)	HOURS	102.82	103.24	103.73
701	ENERGY BALANCE	%	-1.77	-1.64	-0.96
702	EVAP CAPACITY	Tons	71.50	65.20	55.80

Large Impellers - Imperial

LTO 23127 Note: Impeller diameters are 26.0/26.0/26.0		Full Load Performance Comparison at 44/85			
Run Number		20	42	64	93
Refrigerant		11	11	123	245ca
Oil		Trane 22	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90
Capacity	Tons	238.60	231.60	226.40	206.20
Power	KW	198.00	192.96	199.32	164.46
KW/Ton	KW/Ton	0.830	0.830	0.880	0.800
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	44.04	43.99
Condenser Entering Water Temperature	Deg F	84.98	84.97	85.21	84.97
Energy Balance	%	-0.73	-0.65	-0.90	-0.92
Evaporator Entering Water Temperature	Deg F	55.86	55.55	55.16	53.83
Evaporator Leaving Water Temperature	Deg F	44.00	44.00	44.04	43.99
Evaporator Water Flow Rate	GPM	481.90	480.10	487.50	501.90
Condenser Entering Water Temperature	Deg F	84.98	84.97	85.21	84.97
Condenser Leaving Water Temperature	Deg F	96.91	96.46	96.52	95.09
Condenser Water Flow Rate	GPM	599.70	604.50	607.60	606.60
Evap Sat Press	Psia	6.43	6.33	5.17	5.48
Sat Temp	Deg F	36.18	35.50	35.27	34.78
Approach	Deg F	7.80	8.50	8.80	9.20
LMTD	Deg F	12.85	13.46	13.58	13.54
ITD/Delta T		1.66	1.74	1.79	1.94
Q/Ao	B/hr-ft2	17362.49	16853.44	16471.02	15001.09
Uo	B/hr ft2 F	1351.11	1252.21	1212.93	1107.97
ho'	B/hr ft2 F	2435.97	2136.98	2012.02	1721.97
Cond Sat Press	Psia	26.14	25.94	23.49	24.48
Sat Temp	Deg F	106.21	105.77	106.68	103.61
Approach	Deg F	9.30	9.30	10.20	8.50
Refrigerant Leaving Temp	Deg F	104.93	104.63	105.34	101.46
LMTD	Deg F	14.45	14.29	15.12	12.93
Q/Ao	B/hr-ft2	17268.02	16764.58	16593.67	14832.95
Uo	B/hr ft2 F	1194.72	1172.88	1097.73	1147.49
ho'	B/hr ft2 F	1803.27	1749.51	1584.05	1693.44
Cond Sat Temp	Deg F	106.21	105.77	106.68	103.61
Evap Sat Temp	Deg F	36.18	35.50	35.27	34.78
Estimated Motor Efficiency (1)		0.928	0.929	0.928	0.935
Estimated Motor RPM (1)		3537	3539	3537	3550
Compressor Suction CFM (2)	CFM	3733	3675	4200	3545
Isentropic KW/T (2)		0.564	0.566	0.580	0.554
Adiabatic Efficiency (3)		0.680	0.682	0.659	0.693
Q/N (4)		1.055	1.038	1.188	0.999
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Large Impellers - Imperial

ID	Description	Units				
1	EVAP WATER FLOWMETER DELTA P	PSID	16.11	15.99	16.49	17.48
3	ENT EVAP WATER TEMP LOC 1	Deg F	55.85	55.53	55.14	53.80
4	ENT EVAP WATER TEMP LOC 2	Deg F	55.88	55.57	55.18	53.85
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.01	44.00	44.05	44.00
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	43.99	44.03	43.98
15	COND WATER FLOWMETER DELTA P	PSID	24.83	25.23	25.49	25.41
17	ENT COND WATER TEMP LOC 1	Deg F	84.98	84.97	85.23	84.98
18	ENT COND WATER TEMP LOC 2	Deg F	84.97	84.96	85.18	84.95
19	LVG COND WATER TEMP LOC 1	Deg F	96.91	96.46	96.53	95.11
20	LVG COND WATER TEMP LOC 2	Deg F	96.90	96.45	96.51	95.08
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	39.34	39.81	40.63	37.65
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.24	36.59	38.02	37.24
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	38.33	38.84	38.50	38.89
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.43	6.33	5.17	5.48
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.80	10.68	8.91	9.35
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.85	10.72	8.97	9.41
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	10.09	9.99	8.10	8.88
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	18.40	17.90	15.43	26.38
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	17.45	17.28	14.62	15.35
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	16.27	16.11	13.65	14.59
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	26.14	25.94	23.49	24.48
440	REFRIGERANT LVG COND TEMP	Deg F	104.93	104.63	105.34	101.46
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.98	16.82	14.60	15.38
485	HIGH PRESS ECONOMIZER TEMP	Deg F	81.81	81.29	81.51	79.55
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.78	10.67	9.06	9.51
487	LOW PRESS ECONOMIZER TEMP	Deg F	59.20	58.57	58.99	57.75
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	10.85	10.72	9.39	9.60
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	59.27	58.63	59.36	57.77
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.89	8.74	7.69	7.65
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	50.58	49.34	52.37	48.38
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	25.92	25.65	23.29	24.18
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	104.97	104.50	105.43	101.84
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	19.70	19.41	18.09	18.14
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	90.75	90.14	92.79	88.40
560	ATMOSPHERIC PRESS	PSIA	14.30	14.46	14.40	14.34
580	MOTOR VOLTAGE - AB	Volts	3.864	3.861	3.887	3.900
581	MOTOR VOLTAGE - AC	Volts	3.888	3.883	3.902	3.902
582	MOTOR VOLTAGE - CB	Volts	3.865	3.866	3.886	3.884
583	MOTOR CURRENT - A	Volts	2.686	2.612	2.707	2.277
584	MOTOR CURRENT - B	Volts	2.810	2.743	2.831	2.348
585	MOTOR CURRENT - C	Volts	2.667	2.616	2.650	2.190
586	MOTOR POWER - PHASE 1	Volts	1.240	1.200	1.259	1.038
587	MOTOR POWER - PHASE 3	Volts	2.060	2.016	2.063	1.703
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	96.93	96.49	96.20	95.11
601	MAXIMUM MOTOR TEMPERATURE	Deg F	183.50	177.50	182.50	130.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	350.10	390.50	403.40	419.60
609	UNIT START COUNTER READING		98	109	112	115
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	361
700	TIME (HOURS)	HOURS	359.92	1.39	0.00	0.00
701	ENERGY BALANCE	%	-0.73	-0.65	-0.90	-0.92
702	EVAP CAPACITY	Tons	238.60	231.60	226.40	206.20

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		121	122	123	124	125
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	187.90	177.40	159.90	122.70	184.50
Power	KW	151.62	149.82	140.52	122.34	145.74
KW/Ton	KW/Ton	0.810	0.840	0.880	1.000	0.790
TOE	Deg F	44.03	44.02	44.04	44.02	44.00
TIC	Deg F	85.02	90.02	95.02	99.74	80.03
Energy Balance	%	-1.38	-1.15	-0.78	-0.71	-1.09
TIE	Deg F	53.06	52.55	51.75	49.88	52.78
TOE	Deg F	44.03	44.02	44.04	44.02	44.00
GPME	GPM	497.80	497.30	496.80	501.00	502.30
TIC	Deg F	85.02	90.02	95.02	99.74	80.03
TOC	Deg F	94.37	98.90	103.08	106.08	89.15
GPMC	GPM	602.20	602.90	603.20	603.40	601.80
Evap Sat Press	Psia	6.04	6.27	6.47	6.82	5.58
Sat Temp	Deg F	33.50	35.11	36.45	38.73	30.18
Approach	Deg F	10.50	8.90	7.60	5.30	13.80
LMTD	Deg F	14.58	12.70	11.00	7.86	17.85
ITD/Delta T		2.17	2.04	1.98	1.90	2.57
Q/Ao	B/hr-ft2	13671.36	12908.17	11637.01	8927.13	13420.53
Uo	B/hr ft2 F	937.55	1016.30	1058.08	1135.88	751.78
ho'	B/hr ft2 F	1346.84	1516.99	1614.00	1800.32	992.21
Cond Sat Press	Psia	24.33	26.04	27.59	28.29	21.82
Sat Temp	Deg F	102.08	105.99	109.36	110.84	95.94
Approach	Deg F	7.70	7.10	6.30	4.80	6.80
Refrigerant Leaving Temp	Deg F	100.77	104.16	108.12	109.04	95.63
LMTD	Deg F	11.77	10.94	9.76	7.49	10.71
Q/Ao	B/hr-ft2	13597.94	12925.39	11707.64	9217.25	13265.71
Uo	B/hr ft2 F	1155.05	1181.96	1199.35	1230.95	1238.57
ho'	B/hr ft2 F	1715.64	1758.93	1781.80	1838.06	1927.61
Cond Sat Temp	Deg F	102.08	105.99	109.36	110.84	95.94
Evap Sat Temp	Deg F	33.50	35.11	36.45	38.73	30.18
Estimated Motor Efficiency (1)		0.938	0.938	0.940	0.944	0.939
Estimated Motor RPM (1)		3554	3555	3558	3564	3556
Compressor Suction CFM (2)	CFM	3097	2834	2489	1820	3251
Isentropic KW/T (2)		0.548	0.566	0.580	0.568	0.527
Adiabatic Efficiency (3)		0.677	0.674	0.659	0.568	0.667
Q/N (4)		0.871	0.797	0.700	0.511	0.914
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.20	17.16	17.12	17.42	17.51
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.09	52.58	51.76	49.91	52.81
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.04	52.53	51.73	49.84	52.76
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.04	44.03	44.06	44.03	44.01
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.00	44.02	44.00	43.98
15	COND WATER FLOWMETER DELTA P	PSID	25.04	25.07	25.07	25.06	25.03
17	ENT COND WATER TEMP LOC 1	Deg F	85.01	89.99	95.00	99.70	80.03
18	ENT COND WATER TEMP LOC 2	Deg F	85.02	90.04	95.04	99.77	80.01
19	LVG COND WATER TEMP LOC 1	Deg F	94.37	98.89	103.07	106.06	89.15
20	LVG COND WATER TEMP LOC 2	Deg F	94.37	98.92	103.08	106.10	89.15
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	38.99	39.96	41.07	42.95	35.64
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	36.74	38.00	38.91	41.11	33.31
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	36.99	38.23	39.56	42.05	33.87
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.04	6.27	6.47	6.82	5.58
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.09	10.57	11.01	11.28	9.22
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.14	10.62	11.06	11.41	9.28
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.64	10.18	10.71	11.09	8.76
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	15.76	16.70	17.54	18.03	14.33
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.21	17.16	18.03	18.56	14.69
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.52	16.54	17.51	18.14	13.98
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.33	26.04	27.59	28.29	21.82
440	REFRIGERANT LVG COND TEMP	Deg F	100.77	104.16	108.12	109.04	95.63
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.96	17.01	17.94	18.45	14.41
485	HIGH PRESS ECONOMIZER TEMP	Deg F	78.49	81.83	84.70	86.16	73.26
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.06	10.57	10.96	11.17	9.18
487	LOW PRESS ECONOMIZER TEMP	Deg F	55.80	58.18	59.94	60.82	51.50
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.87	8.10	8.22	8.34	7.18
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	55.72	57.96	59.69	60.30	51.35
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	10.08	10.54	10.91	11.05	9.21
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	44.64	45.86	46.59	47.06	40.91
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.29	26.01	27.43	28.13	21.80
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	101.51	105.36	108.44	109.85	95.57
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.37	19.37	20.17	20.20	16.65
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	86.31	89.12	91.33	91.48	81.05
560	ATMOSPHERIC PRESS	PSIA	14.38	14.38	14.38	14.38	14.43
580	MOTOR VOLTAGE - AB	Volts	3.850	3.897	3.900	3.898	3.885
581	MOTOR VOLTAGE - AC	Volts	3.858	3.907	3.911	3.912	3.887
582	MOTOR VOLTAGE - CB	Volts	3.840	3.887	3.891	3.886	3.874
583	MOTOR CURRENT - A	Volts	2.115	2.074	1.957	1.723	2.033
584	MOTOR CURRENT - B	Volts	2.187	2.146	2.017	1.780	2.118
585	MOTOR CURRENT - C	Volts	2.067	2.019	1.923	1.702	1.955
586	MOTOR POWER - PHASE 1	Volts	0.941	0.924	0.843	0.716	0.913
587	MOTOR POWER - PHASE 3	Volts	1.586	1.573	1.499	1.323	1.516
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	94.38	98.93	103.09	106.16	89.14
601	MAXIMUM MOTOR TEMPERATURE	Deg F	130.50	127.50	123.30	110.30	119.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	453.40	454.00	454.30	454.50	456.50
609	UNIT START COUNTER READING		124	124	124	124	125
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	0.00	0.46	0.85	1.30	18.81
701	ENERGY BALANCE	%	-1.38	-1.15	-0.78	-0.71	-1.09
702	EVAP CAPACITY	Tons	187.90	177.40	159.90	122.70	184.50
703	EVAP WATER FLOWRATE	GPM	497.80	497.30	496.80	501.00	502.30
704	COND WATER FLOWRATE	GPM	602.20	602.90	603.20	603.40	601.80

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	53.06	52.55	51.75	49.88	52.78
711	AVE LVG EVAP WATER TEMP	Deg F	44.03	44.02	44.04	44.02	44.00
712	AVE ENT COND WATER TEMP	Deg F	85.02	90.02	95.02	99.74	80.03
713	AVE LVG COND WATER TEMP	Deg F	94.37	98.90	103.08	106.08	89.15
715	MOTOR VOLTAGE - AB	Volts	462.00	467.60	468.00	467.80	466.20
716	MOTOR VOLTAGE - AC	Volts	463.00	468.80	469.30	469.40	466.40
717	MOTOR VOLTAGE - CB	Volts	460.80	466.40	466.90	466.30	464.90
718	MOTOR CURRENT - A	Amps	211.50	207.40	195.70	172.30	203.30
719	MOTOR CURRENT - B	Amps	218.70	214.60	201.70	178.00	211.80
720	MOTOR CURRENT - C	Amps	206.70	201.90	192.30	170.20	195.50
721	UNIT POWER	KW	151.62	149.82	140.52	122.34	145.74
722	AVERAGE VOLTAGE	Volts	461.90	467.60	468.10	467.80	465.80
723	AVERAGE CURRENT	Amps	212.30	207.97	196.57	173.50	203.53
725	KW/TON	KW/Ton	0.81	0.84	0.88	1.00	0.79
730	EVAP DELTA T	Deg F	9.03	8.54	7.70	5.86	8.79
731	COND DELTA T	Deg F	9.35	8.89	8.06	6.35	9.13
735	EVAP WATER FLOWRATE	Lbm/min	4154.40	4149.60	4146.00	4181.00	4191.70
736	COND WATER FLOWRATE	Lbm/min	5006.30	5007.60	5005.80	5002.80	5006.80
740	EVAP CAPACITY	Btu/min	37580.30	35482.40	31988.20	24539.20	36890.80
741	COND CAPACITY	Btu/min	46724.80	44413.80	40229.40	31672.00	45583.20
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	33.50	35.11	36.45	38.73	30.18
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	102.08	105.99	109.36	110.84	95.94
750	RUNNING TIME	Hr	124.50	125.10	125.40	125.60	127.60
751	STARTS		29	29	29	29	30
752	EVAP APPROACH TEMP	Deg F	10.50	8.90	7.60	5.30	13.80
753	COND APPROACH TEMP	Deg F	7.70	7.10	6.30	4.80	6.80
800	EVAP AVG H2O TEMP	Deg F	48.55	48.29	47.89	46.95	48.39
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.44	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-l	0.000893	0.000897	0.000902	0.000916	0.000895
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0012	1.0013	1.0014	1.0016	1.0012
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3385	0.3383	0.3380	0.3376	0.3384
810	COND AVG H2O TEMP	Deg F	89.69	94.46	99.05	102.91	84.59
811	COND WATER DENSITY	Lbm/Ft3	62.14	62.08	62.02	61.97	62.19
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-l	0.000513	0.000486	0.000462	0.000443	0.000545
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9977	0.9978	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3588	0.3609	0.3628	0.3644	0.3565
815	ITD/DELTA T		2.17	2.04	1.98	1.90	2.57
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.01	-0.05	-0.04	-0.07	0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.00	-0.03	-0.01	-0.04	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.05	0.05	0.03	0.07	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.02	0.03	0.04	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	-0.01	-0.04	-0.02	-0.10	0.01

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		126	127	128	129	130
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	70	70	70
Capacity	Tons	200.80	220.20	215.20	190.70	179.20
Power	KW	152.64	160.67	156.12	142.92	139.32
KW/Ton	KW/Ton	0.760	0.730	0.730	0.750	0.780
TOE	Deg F	44.05	43.97	44.02	44.00	44.03
TIC	Deg F	75.05	70.03	70.03	75.03	80.06
Energy Balance	%	-1.15	-1.44	-1.22	-1.57	-0.93
TIE	Deg F	53.65	54.50	54.30	53.15	52.62
TOE	Deg F	44.05	43.97	44.02	44.00	44.03
GPME	GPM	500.30	501.10	501.10	499.40	499.30
TIC	Deg F	75.05	70.03	70.03	75.03	80.06
TOC	Deg F	84.90	80.80	80.53	84.41	88.88
GPMC	GPM	602.60	600.80	600.80	601.40	601.90
Evap Sat Press	Psia	5.50	5.65	5.69	5.47	5.59
Sat Temp	Deg F	29.58	30.70	31.00	29.35	30.26
Approach	Deg F	14.50	13.30	13.00	14.60	13.80
LMTD	Deg F	18.86	18.03	17.66	18.86	17.72
ITD/Delta T		2.51	2.26	2.27	2.60	2.60
Q/Ao	B/hr-ft2	14612.24	16024.80	15659.63	13874.43	13036.51
Uo	B/hr ft2 F	774.58	889.02	886.52	735.79	735.72
ho'	B/hr ft2 F	1032.68	1245.08	1240.50	965.56	965.74
Cond Sat Press	Psia	20.48	19.28	19.10	20.07	21.64
Sat Temp	Deg F	92.44	89.14	88.64	91.33	95.48
Approach	Deg F	7.50	8.30	8.10	6.90	6.60
Refrigerant Leaving Temp	Deg F	91.98	88.75	88.33	90.99	95.10
LMTD	Deg F	11.79	12.99	12.64	10.95	10.39
Q/Ao	B/hr-ft2	14351.02	15664.23	15264.54	13639.12	12832.18
Uo	B/hr ft2 F	1217.54	1205.94	1207.50	1245.77	1234.62
ho'	B/hr ft2 F	1893.87	1886.38	1890.77	1965.85	1918.45
Cond Sat Temp	Deg F	92.44	89.14	88.64	91.33	95.48
Evap Sat Temp	Deg F	29.58	30.70	31.00	29.35	30.26
Estimated Motor Efficiency (1)		0.937	0.935	0.937	0.940	0.941
Estimated Motor RPM (1)		3554	3551	3553	3557	3558
Compressor Suction CFM (2)	CFM	3575	3813	3698	3407	3149
Isentropic KW/T (2)		0.505	0.468	0.460	0.496	0.521
Adiabatic Efficiency (3)		0.664	0.641	0.630	0.661	0.668
Q/N (4)		1.006	1.074	1.041	0.958	0.885
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.37	17.42	17.42	17.31	17.29
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.68	54.51	54.32	53.17	52.65
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.63	54.48	54.28	53.12	52.59
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.06	43.99	44.03	44.01	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	43.95	44.00	44.00	44.02
15	COND WATER FLOWMETER DELTA P	PSID	25.12	24.99	24.99	25.02	25.04
17	ENT COND WATER TEMP LOC 1	Deg F	75.05	70.03	70.03	75.01	80.05
18	ENT COND WATER TEMP LOC 2	Deg F	75.05	70.01	70.01	75.03	80.07
19	LVG COND WATER TEMP LOC 1	Deg F	84.91	80.80	80.53	84.41	88.89
20	LVG COND WATER TEMP LOC 2	Deg F	84.89	80.80	80.51	84.40	88.88
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	35.38	35.61	35.90	34.81	35.57
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	33.23	33.29	33.70	32.34	33.04
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	33.34	34.02	34.34	33.88	34.43
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.50	5.65	5.69	5.47	5.59
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.99	9.02	8.97	8.82	9.14
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.08	9.06	9.00	8.85	9.20
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.46	8.33	8.32	8.30	8.71
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	13.71	13.30	13.33	13.51	14.28
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	14.08	13.72	13.77	13.95	14.70
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	13.23	12.70	12.78	13.13	14.00
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	20.48	19.28	19.10	20.07	21.64
440	REFRIGERANT LVG COND TEMP	Deg F	91.98	88.75	88.33	90.99	95.10
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	13.65	13.15	13.21	13.51	14.40
485	HIGH PRESS ECONOMIZER TEMP	Deg F	70.60	68.76	68.91	70.11	73.24
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	8.92	8.85	8.79	8.72	9.10
487	LOW PRESS ECONOMIZER TEMP	Deg F	50.30	49.99	49.70	49.31	51.15
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.26	7.38	7.40	7.00	7.17
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	50.30	50.01	49.83	49.27	51.02
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.97	8.93	8.89	8.77	9.10
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	41.33	42.45	42.25	39.88	40.56
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	20.52	19.37	19.19	20.12	21.56
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	92.16	89.12	88.56	91.08	94.94
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	15.92	15.48	15.34	15.55	16.51
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	78.72	77.33	77.00	77.75	80.65
560	ATMOSPHERIC PRESS	PSIA	14.43	14.43	14.43	14.43	14.43
580	MOTOR VOLTAGE - AB	Volts	3.886	3.896	3.900	3.883	3.906
581	MOTOR VOLTAGE - AC	Volts	3.892	3.901	3.902	3.897	3.911
582	MOTOR VOLTAGE - CB	Volts	3.876	3.886	3.886	3.880	3.895
583	MOTOR CURRENT - A	Volts	2.113	2.219	2.156	1.990	1.940
584	MOTOR CURRENT - B	Volts	2.188	2.296	2.229	2.056	2.007
585	MOTOR CURRENT - C	Volts	2.050	2.154	2.096	1.946	1.892
586	MOTOR POWER - PHASE 1	Volts	0.945	1.003	0.971	0.868	0.845
587	MOTOR POWER - PHASE 3	Volts	1.599	1.674	1.631	1.514	1.477
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	84.83	80.69	80.47	84.30	86.86
601	MAXIMUM MOTOR TEMPERATURE	Deg F	127.50	153.50	152.50	120.50	116.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	457.10	457.40	458.10	458.30	458.50
609	UNIT START COUNTER READING		125	125	125	125	125
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	19.16	19.54	20.06	20.40	20.74
701	ENERGY BALANCE	%	-1.15	-1.44	-1.22	-1.57	-0.93
702	EVAP CAPACITY	Tons	200.80	220.20	215.20	190.70	179.20
703	EVAP WATER FLOWRATE	GPM	500.30	501.10	501.10	499.40	499.30
704	COND WATER FLOWRATE	GPM	602.60	600.80	600.80	601.40	601.90

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	53.65	54.50	54.30	53.15	52.62
711	AVE LVG EVAP WATER TEMP	Deg F	44.05	43.97	44.02	44.00	44.03
712	AVE ENT COND WATER TEMP	Deg F	75.05	70.03	70.03	75.03	80.06
713	AVE LVG COND WATER TEMP	Deg F	84.90	80.80	80.53	84.41	88.88
715	MOTOR VOLTAGE - AB	Volts	466.30	467.50	468.00	466.00	468.70
716	MOTOR VOLTAGE - AC	Volts	467.00	468.10	468.20	467.60	469.30
717	MOTOR VOLTAGE - CB	Volts	465.10	466.30	466.30	465.60	467.40
718	MOTOR CURRENT - A	Amps	211.30	221.90	215.60	199.00	194.00
719	MOTOR CURRENT - B	Amps	218.80	229.60	222.90	205.60	200.80
720	MOTOR CURRENT - C	Amps	205.00	215.40	209.60	194.60	189.20
721	UNIT POWER	KW	152.64	160.67	156.12	142.92	139.32
722	AVERAGE VOLTAGE	Volts	466.10	467.30	467.50	466.40	468.50
723	AVERAGE CURRENT	Amps	211.70	222.30	216.03	199.73	194.67
725	KW/TON	KW/Ton	0.76	0.73	0.73	0.75	0.78
730	EVAP DELTA T	Deg F	9.60	10.53	10.28	9.14	8.59
731	COND DELTA T	Deg F	9.85	10.77	10.50	9.38	8.82
735	EVAP WATER FLOWRATE	Lbm/min	4174.90	4180.80	4180.80	4167.70	4166.50
736	COND WATER FLOWRATE	Lbm/min	5017.20	5005.30	5005.30	5007.20	5007.80
740	EVAP CAPACITY	Btu/min	40166.60	44049.50	43045.70	38138.50	35835.20
741	COND CAPACITY	Btu/min	49312.50	53824.90	52451.50	46866.30	44093.50
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	29.58	30.70	31.00	29.35	30.26
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	92.44	89.14	88.64	91.33	95.48
750	RUNNING TIME	Hr	128.20	128.50	129.20	129.40	129.60
751	STARTS		30	30	30	30	30
752	EVAP APPROACH TEMP	Deg F	14.50	13.30	13.00	14.60	13.80
753	COND APPROACH TEMP	Deg F	7.50	8.30	8.10	6.90	6.60
800	EVAP AVG H2O TEMP	Deg F	48.85	49.24	49.16	48.58	48.33
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000889	0.000883	0.000885	0.000893	0.000896
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0010	1.0010	1.0010	1.0012	1.0013
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3386	0.3389	0.3388	0.3385	0.3384
810	COND AVG H2O TEMP	Deg F	79.97	75.41	75.28	79.72	84.47
811	COND WATER DENSITY	Lbm/Ft3	62.24	62.28	62.28	62.24	62.19
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000576	0.000611	0.000612	0.000578	0.000546
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9978	0.9980	0.9980	0.9978	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3544	0.3523	0.3522	0.3543	0.3565
815	ITD/DELTA T		2.51	2.26	2.27	2.60	2.60
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.00	0.01	0.01	-0.01	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.02	0.00	0.01	0.01	0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.05	0.03	0.04	0.05	0.06
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.04	0.03	0.01	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.08	0.11	0.06	0.11	0.03

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		131	132	133	134	135
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	Tons	179.80	170.40	153.40	118.00	105.00
Power	KW	145.25	141.66	135.17	118.02	111.00
KW/Ton	KW/Ton	0.810	0.830	0.880	1.000	1.050
TOE	Deg F	44.03	44.02	44.04	44.02	44.03
TIC	Deg F	84.99	90.01	95.04	100.04	101.01
Energy Balance	%	-1.08	-1.03	-1.12	-0.77	-0.87
TIE	Deg F	52.60	52.14	51.34	49.65	49.05
TOE	Deg F	44.03	44.02	44.04	44.02	44.03
GPME	GPM	502.20	502.70	502.10	501.80	500.90
TIC	Deg F	84.99	90.01	95.04	100.04	101.01
TOC	Deg F	93.93	98.52	102.80	106.14	106.53
GPMC	GPM	601.90	602.60	602.80	604.30	602.90
Evap Sat Press	Psia	5.96	6.21	6.48	6.84	6.91
Sat Temp	Deg F	32.95	34.68	36.52	38.84	39.30
Approach	Deg F	11.10	9.30	7.50	5.20	4.70
LMTD	Deg F	14.96	12.98	10.76	7.65	6.94
ITD/Delta T		2.29	2.15	2.03	1.92	1.94
Q/Ao	B/hr-ft2	13081.11	12401.44	11159.43	8584.11	7640.62
Uo	B/hr ft2 F	874.52	955.47	1037.08	1121.68	1100.95
ho'	B/hr ft2 F	1218.02	1381.26	1560.39	1764.18	1715.91
Cond Sat Press	Psia	23.69	25.52	27.14	28.05	27.99
Sat Temp	Deg F	100.56	104.82	108.40	110.34	110.21
Approach	Deg F	6.60	6.30	5.60	4.20	3.70
Refrigerant Leaving Temp	Deg F	99.62	103.44	107.17	108.82	108.65
LMTD	Deg F	10.47	9.96	8.92	6.80	6.02
Q/Ao	B/hr-ft2	12982.29	12367.94	11264.59	8873.58	8002.84
Uo	B/hr ft2 F	1239.77	1242.25	1262.18	1304.94	1328.43
ho'	B/hr ft2 F	1910.52	1896.99	1924.60	2006.00	2061.06
Cond Sat Temp	Deg F	100.56	104.82	108.40	110.34	110.21
Evap Sat Temp	Deg F	32.95	34.68	36.52	38.84	39.30
Estimated Motor Efficiency (1)		0.939	0.940	0.942	0.945	0.946
Estimated Motor RPM (1)		3556	3558	3560	3565	3568
Compressor Suction CFM (2)	CFM	2994	2744	2381	1745	1538
Isentropic KW/T (2)		0.540	0.558	0.570	0.562	0.556
Adiabatic Efficiency (3)		0.667	0.672	0.648	0.562	0.530
Q/N (4)		0.842	0.771	0.669	0.489	0.431
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.50	17.54	17.50	17.48	17.42
3	ENT EVAP WATER TEMP LOC 1	Deg F	52.62	52.17	51.37	49.68	49.09
4	ENT EVAP WATER TEMP LOC 2	Deg F	52.58	52.11	51.32	49.62	49.00
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.04	44.04	44.05	44.04	44.05
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.01	44.02	44.01	44.01
15	COND WATER FLOWMETER DELTA P	PSID	25.02	25.05	25.04	25.13	25.01
17	ENT COND WATER TEMP LOC 1	Deg F	84.98	89.98	95.00	99.99	100.97
18	ENT COND WATER TEMP LOC 2	Deg F	85.00	90.04	95.08	100.09	101.05
19	LVG COND WATER TEMP LOC 1	Deg F	93.92	98.51	102.78	106.12	106.51
20	LVG COND WATER TEMP LOC 2	Deg F	93.93	98.53	102.81	106.16	106.54
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	37.59	39.56	40.66	42.83	43.73
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	35.43	37.20	38.84	41.20	41.87
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	36.75	38.14	39.77	41.95	42.64
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.96	6.21	6.48	6.84	6.91
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.84	10.38	10.88	11.24	11.30
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.89	10.43	10.94	11.38	11.49
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.43	10.03	10.61	11.05	11.13
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	15.51	16.50	17.43	17.95	17.89
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	15.95	17.00	17.91	18.45	18.48
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.26	16.33	17.28	17.94	18.03
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	23.69	25.52	27.14	28.05	27.99
440	REFRIGERANT LVG COND TEMP	Deg F	99.62	103.44	107.17	108.82	108.65
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.67	16.77	17.77	18.39	18.36
485	HIGH PRESS ECONOMIZER TEMP	Deg F	77.62	81.11	84.22	86.03	86.01
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	9.82	10.36	10.83	11.12	11.19
487	LOW PRESS ECONOMOMIZER TEMP	Deg F	54.76	57.25	59.36	60.58	60.94
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.67	7.90	8.14	8.31	8.35
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	54.66	57.05	59.05	60.09	60.25
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	9.83	10.33	10.77	11.01	11.04
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	43.51	44.74	46.01	46.89	47.20
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	23.64	25.44	27.00	27.86	27.97
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	99.99	104.11	107.60	109.49	109.39
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	17.59	18.71	19.65	19.96	19.89
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	85.21	88.30	90.74	91.25	90.88
560	ATMOSPHERIC PRESS	PSIA	14.43	14.43	14.43	14.43	14.43
580	MOTOR VOLTAGE - AB	Volts	3.893	3.897	3.879	3.900	3.868
581	MOTOR VOLTAGE - AC	Volts	3.901	3.902	3.892	3.913	3.877
582	MOTOR VOLTAGE - CB	Volts	3.881	3.884	3.875	3.891	3.860
583	MOTOR CURRENT - A	Volts	2.023	1.982	1.890	1.658	1.572
584	MOTOR CURRENT - B	Volts	2.089	2.040	1.974	1.749	1.642
585	MOTOR CURRENT - C	Volts	1.962	1.923	1.847	1.655	1.559
586	MOTOR POWER - PHASE 1	Volts	0.894	0.866	0.825	0.686	0.629
587	MOTOR POWER - PHASE 3	Volts	1.527	1.495	1.428	1.281	1.221
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	93.98	98.52	102.82	106.17	106.55
601	MAXIMUM MOTOR TEMPERATURE	Deg F	120.50	120.50	117.50	109.20	105.50
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	459.10	459.30	459.50	460.10	460.30
609	UNIT START COUNTER READING		125	125	125	125	125
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	21.12	21.39	21.69	22.03	22.45
701	ENERGY BALANCE	%	-1.08	-1.03	-1.12	-0.77	-0.87
702	EVAP CAPACITY	Tons	179.80	170.40	153.40	118.00	105.00
703	EVAP WATER FLOWRATE	GPM	502.20	502.70	502.10	501.80	500.90
704	COND WATER FLOWRATE	GPM	601.90	602.60	602.80	604.30	602.90

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	52.60	52.14	51.34	49.65	49.05
711	AVE LVG EVAP WATER TEMP	Deg F	44.03	44.02	44.04	44.02	44.03
712	AVE ENT COND WATER TEMP	Deg F	84.99	90.01	95.04	100.04	101.01
713	AVE LVG COND WATER TEMP	Deg F	93.93	98.52	102.80	106.14	106.53
715	MOTOR VOLTAGE - AB	Volts	467.20	467.60	465.50	468.00	464.20
716	MOTOR VOLTAGE - AC	Volts	468.10	468.20	467.00	469.60	465.20
717	MOTOR VOLTAGE - CB	Volts	465.70	466.10	465.00	466.90	463.20
718	MOTOR CURRENT - A	Amps	202.40	198.20	189.00	165.80	157.20
719	MOTOR CURRENT - B	Amps	208.90	204.00	197.40	174.90	164.20
720	MOTOR CURRENT - C	Amps	196.20	192.30	184.70	165.50	155.89
721	UNIT POWER	KW	145.25	141.66	135.17	118.02	111.00
722	AVERAGE VOLTAGE	Volts	467.00	467.30	465.80	466.20	464.20
723	AVERAGE CURRENT	Amps	202.50	198.17	190.37	168.73	159.10
725	KW/TON	KW/Ton	0.81	0.83	0.88	1.00	1.05
730	EVAP DELTA T	Deg F	8.57	8.12	7.31	5.63	5.02
731	COND DELTA T	Deg F	8.93	8.51	7.76	6.10	5.51
735	EVAP WATER FLOWRATE	Lbm/min	4190.50	4195.30	4190.50	4188.20	4181.00
736	COND WATER FLOWRATE	Lbm/min	5004.30	5005.60	5002.70	5009.70	4997.30
740	EVAP CAPACITY	Btu/min	35957.80	34089.50	30675.40	23596.30	21002.80
741	COND CAPACITY	Btu/min	44609.30	42498.30	38707.00	30491.10	27499.10
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	32.95	34.68	36.52	38.84	39.30
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	100.56	104.82	108.40	110.34	110.21
750	RUNNING TIME	Hr	130.20	130.40	130.60	131.20	131.40
751	STARTS		30	30	30	30	30
752	EVAP APPROACH TEMP	Deg F	11.10	9.30	7.50	5.20	4.70
753	COND APPROACH TEMP	Deg F	6.60	6.30	5.60	4.20	3.70
800	EVAP AVG H2O TEMP	Deg F	48.31	48.08	47.69	46.84	46.54
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.44	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-I	0.000896	0.000900	0.000905	0.000917	0.000922
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0013	1.0013	1.0014	1.0016	1.0017
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3383	0.3382	0.3380	0.3375	0.3374
810	COND AVG H2O TEMP	Deg F	89.46	94.26	98.92	103.09	103.77
811	COND WATER DENSITY	Lbm/Ft3	62.14	62.08	62.03	61.97	61.96
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-I	0.000514	0.000487	0.000462	0.000442	0.000439
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9977	0.9978	0.9978
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3587	0.3608	0.3628	0.3644	0.3648
815	ITD/DELTA T		2.29	2.15	2.03	1.92	1.94
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.02	-0.06	-0.08	-0.10	-0.08
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.01	-0.02	-0.03	-0.04	-0.03
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.04	0.06	0.05	0.06	0.09
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.02	0.03	0.03	0.03	0.04
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	-0.06	-0.01	-0.04	-0.05	-0.04

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		136	137	138	139	140
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	40
Capacity	Tons	154.10	135.80	87.20	161.70	167.40
Power	KW	129.06	120.00	98.34	129.00	129.36
KW/Ton	KW/Ton	0.840	0.880	1.130	0.800	0.770
TOE	Deg F	44.05	44.02	44.02	44.03	44.02
TIC	Deg F	90.01	95.00	100.81	84.90	79.93
Energy Balance	%	-1.40	-1.53	-1.13	-1.39	-1.61
TIE	Deg F	51.39	50.50	48.17	51.73	52.00
TOE	Deg F	44.05	44.02	44.02	44.03	44.02
GPME	GPM	502.10	501.40	501.50	502.60	502.70
TIC	Deg F	90.01	95.00	100.81	84.90	79.93
TOC	Deg F	97.74	101.91	105.46	92.94	88.20
GPMC	GPM	602.90	602.10	603.50	601.70	602.70
Evap Sat Press	Psia	6.39	6.63	7.03	6.08	5.81
Sat Temp	Deg F	35.91	37.50	40.05	33.79	31.88
Approach	Deg F	8.10	6.50	4.00	10.20	12.10
LMTD	Deg F	11.42	9.39	5.80	13.73	15.80
ITD/Delta T		2.10	2.01	1.96	2.33	2.52
Q/Ao	B/hr-ft2	11212.79	9879.39	6345.93	11764.41	12180.04
Uo	B/hr ft2 F	981.90	1052.09	1094.20	856.71	771.11
ho'	B/hr ft2 F	1438.73	1596.84	1700.58	1184.36	1026.57
Cond Sat Press	Psia	24.83	26.38	27.12	22.90	21.11
Sat Temp	Deg F	103.24	106.74	108.36	98.65	94.11
Approach	Deg F	5.50	4.80	2.90	5.70	5.90
Refrigerant Leaving Temp	Deg F	102.02	105.96	106.97	97.68	93.60
LMTD	Deg F	8.81	7.78	4.86	9.15	9.45
Q/Ao	B/hr-ft2	11231.56	10010.78	6761.69	11677.49	12042.29
Uo	B/hr ft2 F	1275.34	1286.70	1391.36	1276.42	1274.40
ho'	B/hr ft2 F	1976.26	1985.61	2219.18	2002.01	2016.53
Cond Sat Temp	Deg F	103.24	106.74	108.36	98.65	94.11
Evap Sat Temp	Deg F	35.91	37.50	40.05	33.79	31.88
Estimated Motor Efficiency (1)		0.943	0.945	0.948	0.943	0.943
Estimated Motor RPM (1)		3562	3565	3571	3562	3562
Compressor Suction CFM (2)	CFM	2411	2060	1254	2637	2834
Isentropic KW/T (2)		0.532	0.545	0.532	0.513	0.493
Adiabatic Efficiency (3)		0.633	0.619	0.471	0.641	0.640
Q/N (4)		0.677	0.578	0.351	0.740	0.796
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.50	17.45	17.45	17.53	17.54
3	ENT EVAP WATER TEMP LOC 1	Deg F	51.41	50.54	48.20	51.76	52.02
4	ENT EVAP WATER TEMP LOC 2	Deg F	51.37	50.47	48.15	51.70	51.97
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.06	44.04	44.03	44.05	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	44.01	44.00	44.01	44.01
15	COND WATER FLOWMETER DELTA P	PSID	25.07	24.98	25.06	25.00	25.11
17	ENT COND WATER TEMP LOC 1	Deg F	89.98	94.97	100.78	84.89	79.93
18	ENT COND WATER TEMP LOC 2	Deg F	90.04	95.04	100.83	84.91	79.93
19	LVG COND WATER TEMP LOC 1	Deg F	97.74	101.88	105.45	92.93	88.21
20	LVG COND WATER TEMP LOC 2	Deg F	97.73	101.93	105.47	92.95	88.19
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.04	41.49	43.80	38.53	36.57
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.47	39.91	42.59	37.05	35.14
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.57	40.84	42.99	37.81	35.63
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.39	6.63	7.03	6.08	5.81
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.32	10.78	11.24	9.70	9.14
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.35	10.86	11.46	9.74	9.17
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	10.01	10.58	11.14	9.35	8.75
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	16.33	17.14	17.45	15.21	14.21
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.28	17.33	17.93	15.12	14.04
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	16.20	17.15	17.98	14.99	13.90
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.83	26.38	27.12	22.90	21.11
440	REFRIGERANT LVG COND TEMP	Deg F	102.02	105.96	106.97	97.68	93.60
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.79	17.69	18.31	15.64	14.55
485	HIGH PRESS ECONOMIZER TEMP	Deg F	81.23	83.97	85.74	77.51	73.83
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.25	10.73	11.14	9.66	9.08
487	LOW PRESS ECONOMIZER TEMP	Deg F	56.78	58.93	60.73	53.96	51.08
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.88	8.12	8.39	7.49	7.18
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	56.50	58.50	60.11	53.74	51.00
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	10.22	10.64	11.02	9.63	9.07
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	44.55	45.80	47.30	42.33	40.53
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.72	26.18	26.98	22.84	21.02
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	102.55	105.87	107.71	98.02	93.61
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.70	19.24	19.85	17.51	16.34
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	87.19	89.57	90.17	83.69	80.23
560	ATMOSPHERIC PRESS	PSIA	14.43	14.42	14.41	14.41	14.41
580	MOTOR VOLTAGE - AB	Volts	3.881	3.896	3.896	3.895	3.906
581	MOTOR VOLTAGE - AC	Volts	3.895	3.903	3.906	3.909	3.915
582	MOTOR VOLTAGE - CB	Volts	3.872	3.879	3.885	3.885	3.895
583	MOTOR CURRENT - A	Volts	1.805	1.720	1.434	1.806	1.802
584	MOTOR CURRENT - B	Volts	1.881	1.757	1.503	1.870	1.885
585	MOTOR CURRENT - C	Volts	1.783	1.671	1.417	1.788	1.776
586	MOTOR POWER - PHASE 1	Volts	0.769	0.708	0.540	0.758	0.774
587	MOTOR POWER - PHASE 3	Volts	1.382	1.292	1.099	1.392	1.382
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	97.72	101.95	105.59	92.87	88.16
601	MAXIMUM MOTOR TEMPERATURE	Deg F	111.50	108.50	98.50	109.50	108.30
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	460.60	461.20	462.00	462.30	462.40
609	UNIT START COUNTER READING		125	125	125	125	125
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	22.85	23.24	23.93	24.34	24.66
701	ENERGY BALANCE	%	-1.40	-1.53	-1.13	-1.39	-1.61
702	EVAP CAPACITY	Tons	154.10	135.80	87.20	161.70	167.40
703	EVAP WATER FLOWRATE	GPM	502.10	501.40	501.50	502.60	502.70
704	COND WATER FLOWRATE	GPM	602.90	602.10	603.50	601.70	602.70

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	51.39	50.50	48.17	51.73	52.00
711	AVE LVG EVAP WATER TEMP	Deg F	44.05	44.02	44.02	44.03	44.02
712	AVE ENT COND WATER TEMP	Deg F	90.01	95.00	100.81	84.90	79.93
713	AVE LVG COND WATER TEMP	Deg F	97.74	101.91	105.46	92.94	88.20
715	MOTOR VOLTAGE - AB	Volts	465.70	467.50	467.50	467.40	468.70
716	MOTOR VOLTAGE - AC	Volts	467.40	468.40	468.70	469.10	469.80
717	MOTOR VOLTAGE - CB	Volts	464.60	465.50	466.20	466.20	467.40
718	MOTOR CURRENT - A	Amps	180.50	172.00	143.39	180.60	180.20
719	MOTOR CURRENT - B	Amps	188.10	175.70	150.30	187.00	188.50
720	MOTOR CURRENT - C	Amps	178.30	167.10	141.70	178.80	177.60
721	UNIT POWER	KW	129.06	120.00	98.34	129.00	129.36
722	AVERAGE VOLTAGE	Volts	465.90	467.10	467.50	467.60	468.60
723	AVERAGE CURRENT	Amps	182.30	171.60	145.13	182.13	182.10
725	KW/TON	KW/Ton	0.84	0.88	1.13	0.80	0.77
730	EVAP DELTA T	Deg F	7.34	6.48	4.16	7.70	7.97
731	COND DELTA T	Deg F	7.73	6.90	4.66	8.04	8.27
735	EVAP WATER FLOWRATE	Lbm/min	4190.50	4184.60	4185.80	4194.10	4195.30
736	COND WATER FLOWRATE	Lbm/min	5007.60	4996.80	5002.40	5002.40	5014.90
740	EVAP CAPACITY	Btu/min	30822.10	27156.80	17443.90	32338.40	33480.90
741	COND CAPACITY	Btu/min	38593.50	34398.70	23234.30	40125.80	41379.30
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	35.91	37.50	40.05	33.79	31.88
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	103.24	106.74	108.36	98.65	94.11
750	RUNNING TIME	Hr	131.70	132.30	133.10	133.40	133.50
751	STARTS		30	30	30	30	30
752	EVAP APPROACH TEMP	Deg F	8.10	6.50	4.00	10.20	12.10
753	COND APPROACH TEMP	Deg F	5.50	4.80	2.90	5.70	5.90
800	EVAP AVG H2O TEMP	Deg F	47.72	47.26	46.09	47.88	48.01
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.44	62.44	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000905	0.000911	0.000928	0.000902	0.000901
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0014	1.0015	1.0017	1.0014	1.0013
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3380	0.3378	0.3371	0.3380	0.3382
810	COND AVG H2O TEMP	Deg F	93.87	98.46	103.14	88.92	84.07
811	COND WATER DENSITY	Lbm/Ft3	62.09	62.03	61.97	62.14	62.20
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000489	0.000465	0.000442	0.000518	0.000548
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9978	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3607	0.3626	0.3644	0.3585	0.3563
815	ITD/DELTA T		2.10	2.01	1.96	2.33	2.52
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.06	-0.07	-0.05	-0.02	0.00
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.01	-0.05	-0.02	-0.02	0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.04	0.07	0.05	0.06	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.03	0.04	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.02	-0.07	-0.14	0.06	0.05

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		141	142	143	144	145
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	10	10
Capacity	Tons	166.60	173.90	113.70	81.70	81.70
Power	KW	124.68	125.34	110.88	68.51	71.58
KW/Ton	KW/Ton	0.750	0.720	0.980	0.840	0.880
TOE	Deg F	44.02	44.02	44.02	44.02	44.02
TIC	Deg F	74.92	69.94	97.94	70.08	75.06
Energy Balance	%	-1.47	-1.59	-1.63	-2.15	-1.80
TIE	Deg F	52.00	52.33	49.45	47.94	47.94
TOE	Deg F	44.02	44.02	44.02	44.02	44.02
GPME	GPM	499.40	500.70	502.10	499.60	499.30
TIC	Deg F	74.92	69.94	97.94	70.08	75.06
TOC	Deg F	83.09	78.43	103.81	74.19	79.19
GPMC	GPM	602.20	602.00	605.30	601.50	601.40
Evap Sat Press	Psia	5.48	5.39	6.83	6.45	6.73
Sat Temp	Deg F	29.43	28.74	38.79	36.32	38.15
Approach	Deg F	14.60	15.30	5.20	7.70	5.90
LMTD	Deg F	18.29	19.14	7.63	9.53	7.66
ITD/Delta T		2.83	2.84	1.96	2.96	2.50
Q/Ao	B/hr-ft2	12122.71	12655.91	8276.20	5942.52	5946.67
Uo	B/hr ft2 F	662.78	661.39	1085.34	623.82	775.96
ho'	B/hr ft2 F	844.15	841.29	1675.99	783.63	1039.83
Cond Sat Press	Psia	19.19	17.67	26.87	15.47	16.76
Sat Temp	Deg F	88.89	84.47	107.81	77.50	81.67
Approach	Deg F	5.80	6.00	4.00	3.30	2.50
Refrigerant Leaving Temp	Deg F	88.75	84.45	106.31	76.62	81.40
LMTD	Deg F	9.29	9.67	6.50	5.09	4.21
Q/Ao	B/hr-ft2	11903.88	12360.52	8564.37	5990.43	6027.68
Uo	B/hr ft2 F	1280.80	1278.00	1317.78	1176.56	1430.77
ho'	B/hr ft2 F	2056.47	2072.56	2045.19	1826.74	2487.35
Cond Sat Temp	Deg F	88.89	84.47	107.81	77.50	81.67
Evap Sat Temp	Deg F	29.43	28.74	38.79	36.32	38.15
Estimated Motor Efficiency (1)		0.944	0.944	0.946	0.945	0.946
Estimated Motor RPM (1)		3563	3563	3568	3580	3580
Compressor Suction CFM (2)	CFM	2962	3126	1679	1236	1193
Isentropic KW/T (2)		0.472	0.442	0.541	0.318	0.335
Adiabatic Efficiency (3)		0.629	0.614	0.552	0.379	0.381
Q/N (4)		0.831	0.877	0.471	0.345	0.333
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.31	17.40	17.50	17.33	17.31
3	ENT EVAP WATER TEMP LOC 1	Deg F	52.02	52.36	49.48	47.97	47.98
4	ENT EVAP WATER TEMP LOC 2	Deg F	51.98	52.31	49.41	47.90	47.90
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.03	44.03	44.04	44.04	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	44.01	44.01	44.01	44.01
15	COND WATER FLOWMETER DELTA P	PSID	25.09	25.09	25.23	25.05	25.02
17	ENT COND WATER TEMP LOC 1	Deg F	74.92	69.94	97.91	70.08	75.05
18	ENT COND WATER TEMP LOC 2	Deg F	74.92	69.93	97.96	70.08	75.06
19	LVG COND WATER TEMP LOC 1	Deg F	83.10	78.44	103.80	74.21	79.21
20	LVG COND WATER TEMP LOC 2	Deg F	83.09	78.41	103.82	74.19	79.19
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	33.93	33.46	41.55	39.25	40.78
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	32.80	32.04	41.43	39.41	41.10
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	33.50	32.79	41.77	39.97	41.31
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.48	5.39	6.83	6.45	6.73
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.49	8.16	10.98	6.90	7.49
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.52	8.18	11.14	7.05	7.65
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.09	7.69	10.81	6.80	7.38
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	13.16	12.45	17.39	9.33	10.37
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	12.91	12.13	17.81	9.89	10.83
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	12.74	11.90	17.20	10.37	11.38
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	19.19	17.67	26.87	15.47	16.76
440	REFRIGERANT LVG COND TEMP	Deg F	88.75	84.45	106.31	76.62	81.40
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	13.37	12.59	18.03	11.43	12.41
485	HIGH PRESS ECONOMIZER TEMP	Deg F	69.58	66.97	84.92	62.55	66.24
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	8.43	8.05	10.87	6.86	7.45
487	LOW PRESS ECONOMIZER TEMP	Deg F	47.66	45.65	59.54	38.68	42.19
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.75	6.60	8.21	6.71	7.06
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	47.63	45.63	58.99	38.64	42.16
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.47	8.12	10.75	6.92	7.48
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	37.97	37.22	46.35	37.63	39.83
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	19.12	17.69	26.74	15.09	16.66
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	88.49	84.30	107.02	76.08	81.11
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	15.11	14.28	19.46	12.25	13.31
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	75.98	73.01	89.83	65.55	69.62
560	ATMOSPHERIC PRESS	PSIA	14.41	14.41	14.34	14.30	14.30
580	MOTOR VOLTAGE - AB	Volts	3.914	3.928	3.901	3.882	3.886
581	MOTOR VOLTAGE - AC	Volts	3.922	3.937	3.911	3.896	3.897
582	MOTOR VOLTAGE - CB	Volts	3.903	3.915	3.894	3.871	3.872
583	MOTOR CURRENT - A	Volts	1.741	1.757	1.582	1.085	1.127
584	MOTOR CURRENT - B	Volts	1.816	1.817	1.646	1.127	1.159
585	MOTOR CURRENT - C	Volts	1.733	1.742	1.566	1.106	1.127
586	MOTOR POWER - PHASE 1	Volts	0.731	0.728	0.627	0.304	0.333
587	MOTOR POWER - PHASE 3	Volts	1.347	1.361	1.221	0.838	0.860
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	83.08	78.33	103.88	74.11	79.15
601	MAXIMUM MOTOR TEMPERATURE	Deg F	105.50	117.50	104.50	82.50	79.50
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	463.10	463.30	465.00	466.20	466.50
609	UNIT START COUNTER READING		125	125	126	127	127
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	25.12	25.41	44.66	47.84	48.29
701	ENERGY BALANCE	%	-1.47	-1.59	-1.63	-2.15	-1.80
702	EVAP CAPACITY	Tons	166.60	173.90	113.70	81.70	81.70
703	EVAP WATER FLOWRATE	GPM	499.40	500.70	502.10	499.60	499.30
704	COND WATER FLOWRATE	GPM	602.20	602.00	605.30	601.50	601.40

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	52.00	52.33	49.45	47.94	47.94
711	AVE LVG EVAP WATER TEMP	Deg F	44.02	44.02	44.02	44.02	44.02
712	AVE ENT COND WATER TEMP	Deg F	74.92	69.94	97.94	70.08	75.06
713	AVE LVG COND WATER TEMP	Deg F	83.09	78.43	103.81	74.19	79.19
715	MOTOR VOLTAGE - AB	Volts	469.70	471.40	468.10	465.80	466.30
716	MOTOR VOLTAGE - AC	Volts	470.60	472.40	469.30	467.50	467.60
717	MOTOR VOLTAGE - CB	Volts	468.40	469.80	467.30	464.50	464.60
718	MOTOR CURRENT - A	Amps	174.10	175.70	158.20	108.50	112.70
719	MOTOR CURRENT - B	Amps	181.60	181.70	164.60	112.70	115.90
720	MOTOR CURRENT - C	Amps	173.30	174.20	156.60	110.60	112.70
721	UNIT POWER	KW	124.68	125.34	110.88	68.51	71.58
722	AVERAGE VOLTAGE	Volts	469.60	471.20	468.20	465.90	466.20
723	AVERAGE CURRENT	Amps	176.33	177.20	159.80	110.60	113.77
725	KW/TON	KW/Ton	0.75	0.72	0.98	0.84	0.88
730	EVAP DELTA T	Deg F	7.98	8.32	5.42	3.91	3.91
731	COND DELTA T	Deg F	8.17	8.49	5.88	4.11	4.14
735	EVAP WATER FLOWRATE	Lbm/min	4167.70	4178.50	4190.60	4170.20	4167.80
736	COND WATER FLOWRATE	Lbm/min	5014.20	5015.30	5020.50	5011.30	5007.20
740	EVAP CAPACITY	Btu/min	33323.30	34789.00	22749.90	16335.00	16346.40
741	COND CAPACITY	Btu/min	40903.70	42472.80	29428.60	20584.10	20712.10
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	29.43	28.74	38.79	36.32	38.15
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	88.89	84.47	107.81	77.50	81.67
750	RUNNING TIME	Hr	134.20	134.40	136.10	137.30	137.60
751	STARTS		30	30	31	32	32
752	EVAP APPROACH TEMP	Deg F	14.60	15.30	5.20	7.70	5.90
753	COND APPROACH TEMP	Deg F	5.80	6.00	4.00	3.30	2.50
800	EVAP AVG H2O TEMP	Deg F	48.01	48.17	46.73	45.98	45.98
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.44	62.44	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-I	0.000901	0.000898	0.000919	0.000930	0.000930
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0013	1.0013	1.0016	1.0017	1.0017
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3382	0.3383	0.3375	0.3371	0.3371
810	COND AVG H2O TEMP	Deg F	79.00	74.19	100.88	72.15	77.12
811	COND WATER DENSITY	Lbm/Ft3	62.25	62.29	62.00	62.30	62.26
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-I	0.000583	0.000620	0.000453	0.000637	0.000597
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9979	0.9981	0.9977	0.9982	0.9979
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3540	0.3517	0.3635	0.3507	0.3531
815	ITD/DELTA T		2.83	2.84	1.96	2.96	2.50
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.00	0.02	-0.05	0.01	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.01	0.03	-0.02	0.02	0.02
852	RTD DIFFERENCE CHECK - EEW	Deg F	0.04	0.05	0.07	0.07	0.08
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.02	0.03	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.02	0.10	-0.08	0.10	0.06

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5					
Run Number		146	147	148	149
Refrigerant		11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	10	10	10	10
Capacity	Tons	78.70	74.40	67.90	60.20
Power	KW	72.90	73.62	73.01	72.42
KW/Ton	KW/Ton	0.930	0.990	1.080	1.200
TOE	Deg F	44.04	44.03	44.05	44.05
TIC	Deg F	80.04	84.99	90.05	93.72
Energy Balance	%	-1.80	-1.36	-1.64	-1.93
TIE	Deg F	47.81	47.59	47.31	46.93
TOE	Deg F	44.04	44.03	44.05	44.05
GPME	GPM	498.70	498.90	499.00	499.30
TIC	Deg F	80.04	84.99	90.05	93.72
TOC	Deg F	84.08	88.84	93.64	97.00
GPMC	GPM	602.20	602.40	603.70	604.70
Evap Sat Press	Psia	6.86	6.97	7.07	7.14
Sat Temp	Deg F	38.98	39.66	40.30	40.73
Approach	Deg F	5.10	4.40	3.80	3.30
LMTD	Deg F	6.77	5.97	5.21	4.61
ITD/Delta T		2.33	2.22	2.15	2.15
Q/Ao	B/hr-ft2	5727.38	5410.59	4941.70	4382.70
Uo	B/hr ft2 F	845.87	905.65	948.29	950.47
ho'	B/hr ft2 F	1169.90	1287.54	1375.72	1380.45
Cond Sat Press	Psia	18.28	19.95	21.66	22.92
Sat Temp	Deg F	86.28	91.00	95.53	98.70
Approach	Deg F	2.20	2.20	1.90	1.70
Refrigerant Leaving Temp	Deg F	86.06	90.48	94.81	97.92
LMTD	Deg F	3.88	3.76	3.37	3.05
Q/Ao	B/hr-ft2	5870.99	5605.81	5226.87	4772.67
Uo	B/hr ft2 F	1515.01	1490.00	1549.90	1563.93
ho'	B/hr ft2 F	2711.13	2595.27	2737.77	2750.91
Cond Sat Temp	Deg F	86.28	91.00	95.53	98.70
Evap Sat Temp	Deg F	38.98	39.66	40.30	40.73
Estimated Motor Efficiency (1)		0.946	0.946	0.946	0.946
Estimated Motor RPM (1)		3579	3579	3579	3579
Compressor Suction CFM (2)	CFM	1134	1061	960	846
Isentropic KW/T (2)		0.365	0.396	0.427	0.449
Adiabatic Efficiency (3)		0.392	0.400	0.395	0.374
Q/N (4)		0.317	0.296	0.268	0.236
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.27	17.28	17.29	17.31
3	ENT EVAP WATER TEMP LOC 1	Deg F	47.85	47.64	47.34	46.97
4	ENT EVAP WATER TEMP LOC 2	Deg F	47.77	47.55	47.28	46.89
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.05	44.07	44.06
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.01	44.04	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.07	25.06	25.14	25.20
17	ENT COND WATER TEMP LOC 1	Deg F	80.03	84.98	90.03	93.69
18	ENT COND WATER TEMP LOC 2	Deg F	80.06	85.00	90.07	93.76
19	LVG COND WATER TEMP LOC 1	Deg F	84.08	88.85	93.63	96.98
20	LVG COND WATER TEMP LOC 2	Deg F	84.08	88.84	93.65	97.02
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	41.66	42.77	43.34	43.85
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	41.78	42.80	43.27	43.75
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	42.28	43.23	43.78	44.38
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.86	6.97	7.07	7.14
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.08	8.71	9.28	9.75
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.25	8.87	9.45	9.93
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.96	8.59	9.17	9.68
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	11.45	12.51	13.73	14.65
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	11.87	12.92	14.09	14.95
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	12.44	13.51	14.67	15.52
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	18.28	19.95	21.66	22.92
440	REFRIGERANT LVG COND TEMP	Deg F	86.06	90.48	94.81	97.92
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	13.38	14.39	15.45	16.16
485	HIGH PRESS ECONOMIZER TEMP	Deg F	69.62	73.23	76.82	79.19
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	8.02	8.64	9.22	9.72
487	LOW PRESS ECONOMIZER TEMP	Deg F	45.53	48.79	51.81	54.29
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.31	7.56	7.78	7.98
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	45.33	48.47	51.29	53.71
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.02	8.60	9.14	9.60
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	41.20	42.65	43.93	45.05
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	18.23	19.86	21.57	22.79
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	85.95	90.60	95.14	98.25
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	14.35	15.49	16.62	17.44
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	73.24	77.00	80.71	83.17
560	ATMOSPHERIC PRESS	PSIA	14.30	14.29	14.29	14.29
580	MOTOR VOLTAGE - AB	Volts	3.881	3.874	3.897	3.909
581	MOTOR VOLTAGE - AC	Volts	3.896	3.891	3.912	3.926
582	MOTOR VOLTAGE - CB	Volts	3.873	3.864	3.887	3.900
583	MOTOR CURRENT - A	Volts	1.134	1.142	1.140	1.130
584	MOTOR CURRENT - B	Volts	1.179	1.181	1.184	1.184
585	MOTOR CURRENT - C	Volts	1.150	1.171	1.159	1.147
586	MOTOR POWER - PHASE 1	Volts	0.340	0.341	0.330	0.329
587	MOTOR POWER - PHASE 3	Volts	0.875	0.886	0.887	0.878
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	84.06	88.84	93.62	97.07
601	MAXIMUM MOTOR TEMPERATURE	Deg F	75.50	77.50	80.50	82.50
605	1st STAGE VANE SETTING	Degrees	10.00	10.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	467.10	467.30	467.50	468.20
609	UNIT START COUNTER READING		127	127	127	127
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360
700	TIME (HOURS)	HOURS	48.68	49.04	49.34	49.78
701	ENERGY BALANCE	%	-1.80	-1.36	-1.64	-1.93
702	EVAP CAPACITY	Tons	78.70	74.40	67.90	60.20
703	EVAP WATER FLOWRATE	GPM	498.70	498.90	499.00	499.30
704	COND WATER FLOWRATE	GPM	602.20	602.40	603.70	604.70

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	47.81	47.59	47.31	46.93
711	AVE LVG EVAP WATER TEMP	Deg F	44.04	44.03	44.05	44.05
712	AVE ENT COND WATER TEMP	Deg F	80.04	84.99	90.05	93.72
713	AVE LVG COND WATER TEMP	Deg F	84.08	88.84	93.64	97.00
715	MOTOR VOLTAGE - AB	Volts	465.70	464.90	467.60	469.10
716	MOTOR VOLTAGE - AC	Volts	467.50	466.90	469.40	471.10
717	MOTOR VOLTAGE - CB	Volts	464.80	463.70	466.40	468.00
718	MOTOR CURRENT - A	Amps	113.40	114.20	114.00	113.00
719	MOTOR CURRENT - B	Amps	117.90	118.10	118.40	118.40
720	MOTOR CURRENT - C	Amps	115.00	117.10	115.90	114.70
721	UNIT POWER	KW	72.90	73.62	73.01	72.42
722	AVERAGE VOLTAGE	Volts	466.00	465.20	467.80	469.40
723	AVERAGE CURRENT	Amps	115.43	116.47	116.10	115.37
725	KW/TON	KW/Ton	0.93	0.99	1.08	1.20
730	EVAP DELTA T	Deg F	3.77	3.56	3.26	2.88
731	COND DELTA T	Deg F	4.03	3.85	3.59	3.28
735	EVAP WATER FLOWRATE	Lbm/min	4162.90	4164.20	4165.40	4167.80
736	COND WATER FLOWRATE	Lbm/min	5010.80	5008.30	5014.60	5019.20
740	EVAP CAPACITY	Btu/min	15743.60	14872.80	13583.90	12047.30
741	COND CAPACITY	Btu/min	20173.70	19262.50	17960.40	16399.70
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	38.98	39.66	40.30	40.73
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	86.28	91.00	95.53	98.70
750	RUNNING TIME	Hr	138.20	138.40	138.60	139.30
751	STARTS		32	32	32	32
752	EVAP APPROACH TEMP	Deg F	5.10	4.40	3.80	3.30
753	COND APPROACH TEMP	Deg F	2.20	2.20	1.90	1.70
800	EVAP AVG H2O TEMP	Deg F	45.92	45.81	45.68	45.49
801	EVAP WATER DENSITY	Lbm/Ft3	62.44	62.44	62.44	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000931	0.000933	0.000935	0.000937
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0017	1.0017	1.0019	1.0019
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3370	0.3370	0.3369	0.3368
810	COND AVG H2O TEMP	Deg F	82.06	86.91	91.84	95.36
811	COND WATER DENSITY	Lbm/Ft3	62.22	62.17	62.11	62.07
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000562	0.000530	0.000500	0.000481
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9978	0.9977	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3554	0.3576	0.3598	0.3613
815	ITD/DELTA T		2.33	2.22	2.15	2.15
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.03	-0.02	-0.04	-0.07
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.00	0.01	-0.02	-0.04
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.08	0.09	0.06	0.08
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.04	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.02	0.01	0.01	-0.09

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		150	151	152	153	154
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	202.40	208.70	214.10	216.20	208.10
Power	KW	155.16	164.22	171.78	174.72	173.04
KW/Ton	KW/Ton	0.770	0.790	0.800	0.810	0.830
TOE	Deg F	44.05	44.06	44.05	44.05	44.05
TIC	Deg F	65.12	70.07	75.03	80.08	85.07
Energy Balance	%	-1.46	-1.39	-1.27	-1.10	-1.20
TIE	Deg F	53.75	54.09	54.37	54.33	53.95
TOE	Deg F	44.05	44.06	44.05	44.05	44.05
GPME	GPM	500.00	498.50	496.70	503.80	503.50
TIC	Deg F	65.12	70.07	75.03	80.08	85.07
TOC	Deg F	75.08	80.37	85.63	90.79	95.44
GPMC	GPM	601.60	602.30	603.00	603.40	604.10
Evap Sat Press	Psia	4.41	4.69	4.94	5.18	5.23
Sat Temp	Deg F	28.93	31.36	33.50	35.34	35.73
Approach	Deg F	15.10	12.70	10.50	8.70	8.30
LMTD	Deg F	19.57	17.23	15.13	13.19	12.63
ITD/Delta T		2.56	2.27	2.02	1.85	1.84
Q/Ao	B/hr-ft2	14724.87	15185.17	15577.08	15729.62	15139.84
Uo	B/hr ft2 F	752.38	881.26	1029.70	1192.64	1198.74
ho'	B/hr ft2 F	993.60	1232.12	1544.69	1930.99	1948.63
Cond Sat Press	Psia	15.39	16.92	18.73	20.66	22.33
Sat Temp	Deg F	84.44	89.25	94.52	99.71	103.90
Approach	Deg F	9.40	8.90	8.90	8.90	8.50
Refrigerant Leaving Temp	Deg F	83.30	88.70	93.84	98.86	103.01
LMTD	Deg F	13.74	13.38	13.50	13.58	12.96
Q/Ao	B/hr-ft2	14519.76	15034.57	15463.19	15613.27	15121.44
Uo	B/hr ft2 F	1056.47	1124.04	1145.11	1149.88	1166.70
ho'	B/hr ft2 F	1558.17	1692.31	1722.81	1716.38	1737.21
Cond Sat Temp	Deg F	84.44	89.25	94.52	99.71	103.90
Evap Sat Temp	Deg F	28.93	31.36	33.50	35.34	35.73
Estimated Motor Efficiency (1)		0.937	0.935	0.933	0.932	0.933
Estimated Motor RPM (1)		3553	3550	3547	3546	3547
Compressor Suction CFM (2)	CFM	4241	4152	4077	3969	3803
Isentropic KW/T (2)		0.445	0.464	0.490	0.517	0.548
Adiabatic Efficiency (3)		0.578	0.587	0.613	0.638	0.660
Q/N (4)		1.194	1.170	1.149	1.119	1.072
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.35	17.24	17.12	17.61	17.59
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.77	54.11	54.39	54.35	53.97
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.72	54.07	54.35	54.31	53.93
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.07	44.08	44.06	44.07	44.07
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.04	44.05	44.04	44.04	44.04
15	COND WATER FLOWMETER DELTA P	PSID	25.08	25.12	25.16	25.17	25.2
17	ENT COND WATER TEMP LOC 1	Deg F	65.12	70.08	75.01	80.08	85.04
18	ENT COND WATER TEMP LOC 2	Deg F	65.1	70.06	75.03	80.08	85.1
19	LVG COND WATER TEMP LOC 1	Deg F	75.08	80.39	85.63	90.8	95.43
20	LVG COND WATER TEMP LOC 2	Deg F	75.07	80.37	85.63	90.78	95.45
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	30.89	33.24	35.46	37.15	37.73
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	32.12	34.64	36.54	38.61	38.9
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	33.91	35.98	37.9	39.37	39.99
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	4.41	4.69	4.94	5.18	5.23
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.17	7.68	8.16	8.63	8.85
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.18	7.71	8.21	8.67	8.93
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	6.4	6.9	7.41	7.88	8.2
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	10.88	11.84	12.74	13.78	14.05
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	10.64	11.52	12.48	13.87	14.58
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	9.85	10.81	11.78	12.79	13.64
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	15.39	16.92	18.73	20.66	22.33
440	REFRIGERANT LVG COND TEMP	Deg F	83.3	88.7	93.84	98.86	103.01
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	10.54	11.6	12.61	13.48	14.32
485	HIGH PRESS ECONOMIZER TEMP	Deg F	65.87	70.33	74.31	77.5	80.44
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	7.02	7.59	8.14	8.64	8.92
487	LOW PRESS ECONOMIZER TEMP	Deg F	47.91	51.26	54.35	56.93	58.46
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.1	6.55	7	7.37	7.5
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	48.2	51.56	54.64	57.22	58.8
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.25	7.82	8.39	8.87	9.06
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	42.99	45.86	48.63	50.74	50.94
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	15.58	17.25	19.1	20.88	22.5
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	83.56	89.08	94.74	99.81	103.91
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	12.96	14.02	15.29	16.32	17.17
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	75.75	80.62	84.83	88.05	90.77
560	ATMOSPHERIC PRESS	PSIA	14.51	14.5	14.5	14.5	14.5
580	MOTOR VOLTAGE - AB	Volts	3.899	3.877	3.871	3.877	3.880
581	MOTOR VOLTAGE - AC	Volts	3.902	3.882	3.877	3.883	3.884
582	MOTOR VOLTAGE - CB	Volts	3.890	3.871	3.864	3.871	3.874
583	MOTOR CURRENT - A	Volts	2.144	2.266	2.365	2.398	2.383
584	MOTOR CURRENT - B	Volts	2.238	2.369	2.470	2.504	2.482
585	MOTOR CURRENT - C	Volts	2.066	2.184	2.286	2.319	2.294
586	MOTOR POWER - PHASE 1	Volts	0.979	1.046	1.096	1.116	1.108
587	MOTOR POWER - PHASE 3	Volts	1.607	1.691	1.767	1.796	1.776
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	74.94	80.21	85.66	90.75	95.38
601	MAXIMUM MOTOR TEMPERATURE	Deg F	168.50	169.50	158.50	153.50	150.20
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	468.60	469.20	469.40	470.00	470.20
609	UNIT START COUNTER READING		128	128	128	128	128
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	0.00	0.36	0.66	1.09	1.35
701	ENERGY BALANCE	%	-1.46	-1.39	-1.27	-1.10	-1.20
702	EVAP CAPACITY	Tons	202.40	208.70	214.10	216.20	208.10
703	EVAP WATER FLOWRATE	GPM	500.00	498.50	496.70	503.80	503.50
704	COND WATER FLOWRATE	GPM	601.60	602.30	603.00	603.40	604.10

Medium Impellers - Imperial

710	AVERAGE ENT EVAP WATER TEMP	Deg F	53.75	54.09	54.37	54.33	53.95
711	AVERAGE LVG EVAP WATER TEMP	Deg F	44.05	44.06	44.05	44.05	44.05
712	AVERAGE ENT COND WATER TEMP	Deg F	65.12	70.07	75.03	80.08	85.07
713	AVERAGE LVG COND WATER TEMP	Deg F	75.08	80.37	85.63	90.79	95.44
715	MOTOR VOLTAGE - AB	Volts	467.90	465.20	464.50	465.20	465.60
716	MOTOR VOLTAGE - AC	Volts	468.20	465.80	465.20	466.00	466.10
717	MOTOR VOLTAGE - CB	Volts	466.80	464.50	463.70	464.50	464.90
718	MOTOR CURRENT - A	Amps	214.40	226.60	236.50	239.80	238.30
719	MOTOR CURRENT - B	Amps	223.80	236.90	247.00	250.40	248.20
720	MOTOR CURRENT - C	Amps	206.60	218.40	228.60	231.90	229.40
721	UNIT POWER	KW	155.16	164.22	171.78	174.72	173.04
722	AVERAGE VOLTAGE	Volts	467.60	465.20	464.50	465.20	465.50
723	AVERAGE CURRENT	Amps	214.93	227.30	237.37	240.70	238.63
725	KW/TON	KW/Ton	0.77	0.79	0.80	0.81	0.83
730	EVAP DELTA T	Deg F	9.68	10.03	10.32	10.27	9.89
731	COND DELTA T	Deg F	9.97	10.31	10.60	10.71	10.37
735	EVAP WATER FLOWRATE	Lbm/min	4172.40	4159.20	4144.70	4203.60	4201.20
736	COND WATER FLOWRATE	Lbm/min	5015.20	5018.30	5021.20	5020.80	5022.30
740	EVAP CAPACITY	Btu/min	40476.20	41741.50	42818.80	43238.10	41616.90
741	COND CAPACITY	Btu/min	49892.30	51661.30	53134.10	53649.80	51959.80
743	EVAP SATN TEMP (BASED ON ID #61)	Deg F	28.93	31.36	33.50	35.34	35.73
744	COND SATN TEMP (BASED ON ID #431)	Deg F	84.44	89.25	94.52	99.71	103.90
750	RUNNING TIME	Hr	139.70	140.30	140.50	141.10	141.30
751	STARTS		33	33	33	33	33
752	EVAP APPROACH TEMP	Deg F	15.10	12.70	10.50	8.70	8.30
753	COND APPROACH TEMP	Deg F	9.40	8.90	8.90	8.90	8.50
800	EVAP AVG H2O TEMP	Deg F	48.90	49.08	49.21	49.19	49.00
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000888	0.000886	0.000884	0.000884	0.000887
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0010	1.0010	1.0010	1.0010	1.0010
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3387	0.3388	0.3388	0.3388	0.3387
810	COND AVG H2O TEMP	Deg F	70.10	75.22	80.33	85.44	90.25
811	COND WATER DENSITY	Lbm/Ft3	62.32	62.28	62.23	62.18	62.13
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000654	0.000612	0.000574	0.000539	0.000509
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9983	0.9980	0.9978	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3497	0.3522	0.3546	0.3569	0.3591
815	ITD/DELTA T		2.56	2.27	2.02	1.85	1.84
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.03	0.02	-0.01	0.00	-0.06
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.02	0.01	0.00	0.02	-0.02
852	RTD DIFFERENCE CHECK - EEW	Deg F	0.05	0.04	0.04	0.04	0.04
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.02	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.15	0.18	-0.03	0.05	0.05

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		155	156	157	158	159
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	70
Capacity	Tons	197.00	182.30	165.00	143.00	158.30
Power	KW	168.90	162.36	154.38	142.25	147.60
KW/Ton	KW/Ton	0.860	0.890	0.940	0.990	0.930
TOE	Deg F	44.05	44.05	44.05	44.05	44.05
TIC	Deg F	90.13	95.06	100.04	104.17	99.97
Energy Balance	%	-0.81	-1.13	-0.75	-1.07	-0.63
TIE	Deg F	53.42	52.72	51.89	50.84	51.58
TOE	Deg F	44.05	44.05	44.05	44.05	44.05
GPME	GPM	503.50	503.60	503.40	503.30	503.90
TIC	Deg F	90.13	95.06	100.04	104.17	99.97
TOC	Deg F	99.97	104.27	108.44	111.57	108.01
GPMC	GPM	604.80	604.70	604.90	605.30	606.10
Evap Sat Press	Psia	5.28	5.35	5.42	5.52	5.45
Sat Temp	Deg F	36.12	36.66	37.18	37.93	37.41
Approach	Deg F	7.90	7.40	6.90	6.10	6.60
LMTD	Deg F	12.01	11.17	10.30	9.10	9.93
ITD/Delta T		1.85	1.85	1.88	1.90	1.88
Q/Ao	B/hr-ft2	14329.75	13263.45	12006.29	10405.25	11519.14
Uo	B/hr ft2 F	1192.95	1187.44	1165.96	1143.87	1159.59
ho'	B/hr ft2 F	1934.37	1921.60	1868.24	1814.80	1852.00
Cond Sat Press	Psia	24.08	25.74	27.28	28.33	26.98
Sat Temp	Deg F	108.05	111.76	115.05	117.20	114.42
Approach	Deg F	8.10	7.50	6.60	5.60	6.40
Refrigerant Leaving Temp	Deg F	107.27	110.12	114.33	116.29	113.75
LMTD	Deg F	12.35	11.49	10.24	8.82	9.89
Q/Ao	B/hr-ft2	14352.10	13418.30	12231.83	10767.55	11716.31
Uo	B/hr ft2 F	1161.77	1168.22	1194.25	1221.02	1184.51
ho'	B/hr ft2 F	1710.82	1710.46	1751.50	1796.24	1730.04
Cond Sat Temp	Deg F	108.05	111.76	115.05	117.20	114.42
Evap Sat Temp	Deg F	36.12	36.66	37.18	37.93	37.41
Estimated Motor Efficiency (1)		0.934	0.935	0.937	0.940	0.939
Estimated Motor RPM (1)		3548	3550	3553	3557	3556
Compressor Suction CFM (2)	CFM	3584	3289	2951	2519	2813
Isentropic KW/T (2)		0.579	0.605	0.627	0.636	0.618
Adiabatic Efficiency (3)		0.673	0.680	0.667	0.642	0.665
Q/N (4)		1.010	0.926	0.831	0.708	0.791
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.59	17.6	17.59	17.58	17.62
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.44	52.74	51.92	50.87	51.6
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.39	52.7	51.86	50.82	51.55
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.07	44.07	44.06	44.06	44.07
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	44.04	44.03	44.03	44.04
15	COND WATER FLOWMETER DELTA P	PSID	25.23	25.19	25.18	25.19	25.28
17	ENT COND WATER TEMP LOC 1	Deg F	90.12	95.03	100.01	104.15	99.97
18	ENT COND WATER TEMP LOC 2	Deg F	90.14	95.09	100.07	104.19	99.98
19	LVG COND WATER TEMP LOC 1	Deg F	99.96	104.26	108.43	111.55	108
20	LVG COND WATER TEMP LOC 2	Deg F	99.98	104.28	108.45	111.58	108.01
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	38.13	38.72	39.22	41.68	39.63
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	39.37	39.86	40.41	41.76	40.5
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	40.2	40.8	41.51	42.77	41.58
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.28	5.35	5.42	5.52	5.45
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.12	9.42	9.72	10.01	9.63
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.2	9.5	9.79	10.04	9.71
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.54	8.95	9.34	9.7	9.3
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	14.84	15.49	16.11	16.6	15.84
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	15.23	15.78	16.57	17.21	16.58
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	14.4	15.03	15.72	16.36	15.65
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.08	25.74	27.28	28.33	26.98
440	REFRIGERANT LVG COND TEMP	Deg F	107.27	110.12	114.33	116.29	113.75
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.14	16.06	16.87	17.59	16.81
485	HIGH PRESS ECONOMIZER TEMP	Deg F	83.29	86.21	88.82	90.89	88.58
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	9.28	9.6	9.92	10.08	9.8
487	LOW PRESS ECONOMIZER TEMP	Deg F	60.03	61.68	63.06	63.96	62.54
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.56	7.51	7.53	7.52	7.43
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	60.42	61.66	62.94	63.84	62.42
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	9.3	9.64	9.88	10.07	9.78
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	50.86	51.08	50.98	50.42	50.64
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.17	25.72	27.2	28.28	26.84
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	107.85	111.57	114.72	116.84	113.91
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	17.99	19	19.7	20.37	19.67
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	93.26	96.16	98.04	98.73	97.39
560	ATMOSPHERIC PRESS	PSIA	14.5	14.49	14.49	14.49	14.48
580	MOTOR VOLTAGE - AB	Volts	3.902	3.881	3.881	3.911	3.885
581	MOTOR VOLTAGE - AC	Volts	3.906	3.887	3.884	3.916	3.889
582	MOTOR VOLTAGE - CB	Volts	3.895	3.872	3.871	3.904	3.878
583	MOTOR CURRENT - A	Volts	2.324	2.248	2.140	1.982	2.036
584	MOTOR CURRENT - B	Volts	2.428	2.342	2.235	2.075	2.134
585	MOTOR CURRENT - C	Volts	2.242	2.173	2.061	1.914	1.974
586	MOTOR POWER - PHASE 1	Volts	1.073	1.030	0.966	0.880	0.923
587	MOTOR POWER - PHASE 3	Volts	1.742	1.676	1.607	1.491	1.537
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	99.84	104.28	108.38	111.61	108.02
601	MAXIMUM MOTOR TEMPERATURE	Deg F	146.30	142.50	135.50	127.50	129.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	70.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	63.00
608	UNIT HOUR METER READING	Hr	470.40	471.00	471.20	471.50	472.10
609	UNIT START COUNTER READING		128	128	128	128	128
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	1.72	2.05	2.41	2.84	3.22
701	ENERGY BALANCE	%	-0.81	-1.13	-0.75	-1.07	-0.63
702	EVAP CAPACITY	Tons	197.00	182.30	165.00	143.00	158.30
703	EVAP WATER FLOWRATE	GPM	503.50	503.60	503.40	503.30	503.90
704	COND WATER FLOWRATE	GPM	604.80	604.70	604.90	605.30	606.10

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	53.42	52.72	51.89	50.84	51.58
711	AVE LVG EVAP WATER TEMP	Deg F	44.05	44.05	44.05	44.05	44.05
712	AVE ENT COND WATER TEMP	Deg F	90.13	95.06	100.04	104.17	99.97
713	AVE LVG COND WATER TEMP	Deg F	99.97	104.27	108.44	111.57	108.01
715	MOTOR VOLTAGE - AB	Volts	468.20	465.70	465.70	469.30	466.20
716	MOTOR VOLTAGE - AC	Volts	468.70	466.40	466.10	469.90	466.70
717	MOTOR VOLTAGE - CB	Volts	467.40	464.60	464.50	468.50	465.40
718	MOTOR CURRENT - A	Amps	232.40	224.80	214.00	198.20	203.60
719	MOTOR CURRENT - B	Amps	242.80	234.20	223.50	207.50	213.40
720	MOTOR CURRENT - C	Amps	224.20	217.30	206.10	191.40	197.40
721	UNIT POWER	KW	168.90	162.36	154.38	142.25	147.60
722	AVERAGE VOLTAGE	Volts	468.10	465.60	465.40	469.20	466.10
723	AVERAGE CURRENT	Amps	233.13	225.43	214.53	199.03	204.80
725	KW/TON	KW/Ton	0.86	0.89	0.94	0.99	0.93
730	EVAP DELTA T	Deg F	9.37	8.66	7.84	6.80	7.52
731	COND DELTA T	Deg F	9.84	9.21	8.39	7.39	8.03
735	EVAP WATER FLOWRATE	Lbm/min	4201.20	4202.40	4201.30	4200.10	4204.90
736	COND WATER FLOWRATE	Lbm/min	5023.50	5017.70	5014.70	5013.90	5024.70
740	EVAP CAPACITY	Btu/min	39390.10	36459.00	33003.30	28602.30	31664.20
741	COND CAPACITY	Btu/min	49316.20	46107.50	42030.60	36999.10	40259.20
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	36.12	36.66	37.18	37.93	37.41
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	108.05	111.76	115.05	117.20	114.42
750	RUNNING TIME	Hr	141.50	142.10	142.30	142.60	143.20
751	STARTS		33	33	33	33	33
752	EVAP APPROACH TEMP	Deg F	7.90	7.40	6.90	6.10	6.60
753	COND APPROACH TEMP	Deg F	8.10	7.50	6.60	5.60	6.40
800	EVAP AVG H2O TEMP	Deg F	48.74	48.39	47.97	47.45	47.81
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000890	0.000895	0.000901	0.000909	0.000903
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0012	1.0012	1.0013	1.0015	1.0014
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3386	0.3384	0.3382	0.3379	0.3380
810	COND AVG H2O TEMP	Deg F	95.05	99.67	104.24	107.87	103.99
811	COND WATER DENSITY	Lbm/Ft3	62.07	62.02	61.96	61.91	61.96
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000483	0.000459	0.000437	0.000420	0.000438
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9978	0.9979	0.9978
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3612	0.3631	0.3650	0.3664	0.3649
815	ITD/DELTA T		1.85	1.85	1.88	1.90	1.88
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.02	-0.06	-0.06	-0.04	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.02	-0.02	-0.02	-0.03	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.05	0.04	0.06	0.05	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.04	0.03	0.03	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.12	-0.02	0.05	-0.06	-0.02

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		160	161	162	163	164
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	Tons	137.40	175.60	189.90	200.90	210.40
Power	KW	136.08	155.88	161.34	165.48	167.64
KW/Ton	KW/Ton	0.990	0.890	0.850	0.820	0.800
TOE	Deg F	44.04	44.05	44.05	44.05	44.06
TIC	Deg F	103.96	94.97	89.95	85.00	80.00
Energy Balance	%	-0.97	-1.13	-1.20	-1.00	-1.10
TIE	Deg F	50.56	52.40	53.06	53.66	54.11
TOE	Deg F	44.04	44.05	44.05	44.05	44.06
GPME	GPM	503.50	503.40	503.90	499.90	501.50
TIC	Deg F	103.96	94.97	89.95	85.00	80.00
TOC	Deg F	111.04	103.85	99.46	94.98	90.40
GPMC	GPM	606.00	604.40	604.10	603.30	603.80
Evap Sat Press	Psia	5.54	5.37	5.31	5.26	5.22
Sat Temp	Deg F	38.08	36.81	36.34	35.97	35.66
Approach	Deg F	6.00	7.20	7.70	8.10	8.40
LMTD	Deg F	8.82	10.89	11.64	12.26	12.77
ITD/Delta T		1.91	1.87	1.85	1.84	1.84
Q/Ao	B/hr-ft2	9998.13	12778.44	13814.22	14614.45	15307.62
Uo	B/hr ft2 F	1133.31	1173.79	1186.84	1191.68	1198.46
ho'	B/hr ft2 F	1788.74	1887.40	1918.76	1936.63	1950.78
Cond Sat Press	Psia	27.95	25.39	23.75	22.09	20.45
Sat Temp	Deg F	116.43	110.99	107.28	103.32	99.16
Approach	Deg F	5.40	7.10	7.80	8.30	8.80
Refrigerant Leaving Temp	Deg F	115.20	109.32	106.66	102.53	98.39
LMTD	Deg F	8.44	10.99	11.95	12.68	13.29
Q/Ao	B/hr-ft2	10328.63	12917.77	13854.45	14547.02	15155.87
Uo	B/hr ft2 F	1223.65	1175.58	1159.28	1147.04	1140.52
ho'	B/hr ft2 F	1802.75	1727.25	1706.84	1695.80	1696.15
Cond Sat Temp	Deg F	116.43	110.99	107.28	103.32	99.16
Evap Sat Temp	Deg F	38.08	36.81	36.34	35.97	35.66
Estimated Motor Efficiency (1)		0.941	0.937	0.935	0.934	0.934
Estimated Motor RPM (1)		3559	3553	3551	3549	3549
Compressor Suction CFM (2)	CFM	2409	3153	3434	3649	3830
Isentropic KW/T (2)		0.627	0.596	0.570	0.540	0.508
Adiabatic Efficiency (3)		0.633	0.670	0.671	0.659	0.635
Q/N (4)		0.677	0.887	0.967	1.028	1.079
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.6	17.59	17.62	17.34	17.45
3	ENT EVAP WATER TEMP LOC 1	Deg F	50.6	52.42	53.09	53.69	54.13
4	ENT EVAP WATER TEMP LOC 2	Deg F	50.53	52.37	53.04	53.64	54.08
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.06	44.06	44.06	44.07
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.03	44.03	44.03	44.05
15	COND WATER FLOWMETER DELTA P	PSID	25.25	25.17	25.17	25.13	25.2
17	ENT COND WATER TEMP LOC 1	Deg F	103.94	94.95	89.93	84.99	80
18	ENT COND WATER TEMP LOC 2	Deg F	103.97	95	89.96	85	80.01
19	LVG COND WATER TEMP LOC 1	Deg F	111.03	103.82	99.45	94.98	90.39
20	LVG COND WATER TEMP LOC 2	Deg F	111.05	103.87	99.46	94.99	90.4
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.29	39.04	38.59	38.02	37.79
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	41.05	40.18	39.66	39.24	38.89
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	42.32	40.86	40.48	40.23	39.96
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.54	5.37	5.31	5.26	5.22
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.92	9.32	9.01	8.75	8.52
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.96	9.38	9.08	8.81	8.56
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.64	8.87	8.47	8.12	7.81
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	16.26	14.73	13.97	13.19	12.41
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	17.15	15.85	15.21	14.73	14.15
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	16.29	14.74	13.93	13.26	12.8
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	27.95	25.39	23.75	22.09	20.45
440	REFRIGERANT LVG COND TEMP	Deg F	115.2	109.32	106.66	102.53	98.39
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	17.45	15.95	15.08	14.24	13.45
485	HIGH PRESS ECONOMIZER TEMP	Deg F	90.51	85.98	83.15	80.32	77.53
486	LOW PRESS ECONONOMIZER STATIC PRESS	PSIA	10	9.5	9.18	8.88	8.59
487	LOW PRESS ECONOMIZER TEMP	Deg F	63.55	61.2	59.65	58.08	56.57
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.43	7.45	7.41	7.35	7.3
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	63.24	61.18	59.72	58.27	56.84
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	9.97	9.53	9.25	8.95	8.72
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	50.13	50.36	50.37	50.19	50.19
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	27.86	25.32	23.77	22.21	20.64
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	115.92	110.75	107.29	103.29	99.22
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	19.79	19	17.87	16.86	15.9
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	97.95	95.41	92.88	90.21	87.36
560	ATMOSPHERIC PRESS	PSIA	14.47	14.47	14.47	14.46	14.46
580	MOTOR VOLTAGE - AB	Volts	3.862	3.872	3.874	3.874	3.881
581	MOTOR VOLTAGE - AC	Volts	3.870	3.877	3.879	3.881	3.890
582	MOTOR VOLTAGE - CB	Volts	3.859	3.866	3.865	3.867	3.876
583	MOTOR CURRENT - A	Volts	1.908	2.162	2.229	2.269	2.296
584	MOTOR CURRENT - B	Volts	2.007	2.263	2.326	2.384	2.409
585	MOTOR CURRENT - C	Volts	1.833	2.092	2.161	2.214	2.239
586	MOTOR POWER - PHASE 1	Volts	0.840	0.985	1.023	1.044	1.057
587	MOTOR POWER - PHASE 3	Volts	1.428	1.613	1.666	1.714	1.737
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	111.09	103.79	99.44	94.95	90.30
601	MAXIMUM MOTOR TEMPERATURE	Deg F	122.50	134.50	138.50	141.50	143.50
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	472.40	473.10	473.20	473.50	474.00
609	UNIT START COUNTER READING		128	128	128	128	128
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	3.77	4.15	4.42	4.80	5.10
701	ENERGY BALANCE	%	-0.97	-1.13	-1.20	-1.00	-1.10
702	EVAP CAPACITY	Tons	137.40	175.60	189.90	200.90	210.40
703	EVAP WATER FLOWRATE	GPM	503.50	503.40	503.90	499.90	501.50
704	COND WATER FLOWRATE	GPM	606.00	604.40	604.10	603.30	603.80

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	50.56	52.40	53.06	53.66	54.11
711	AVE LVG EVAP WATER TEMP	Deg F	44.04	44.05	44.05	44.05	44.06
712	AVE ENT COND WATER TEMP	Deg F	103.96	94.97	89.95	85.00	80.00
713	AVE LVG COND WATER TEMP	Deg F	111.04	103.85	99.46	94.98	90.40
715	MOTOR VOLTAGE - AB	Volts	463.40	464.60	464.90	464.90	465.70
716	MOTOR VOLTAGE - AC	Volts	464.40	465.20	465.50	465.70	466.80
717	MOTOR VOLTAGE - CB	Volts	463.10	463.90	463.80	464.00	465.10
718	MOTOR CURRENT - A	Amps	190.80	216.20	222.90	226.90	229.60
719	MOTOR CURRENT - B	Amps	200.70	226.30	232.60	238.40	240.90
720	MOTOR CURRENT - C	Amps	183.30	209.20	216.10	221.40	223.90
721	UNIT POWER	KW	136.08	155.88	161.34	165.48	167.64
722	AVERAGE VOLTAGE	Volts	463.60	464.60	464.70	464.90	465.90
723	AVERAGE CURRENT	Amps	191.60	217.23	223.87	228.90	231.47
725	KW/TON	KW/Ton	0.99	0.89	0.85	0.82	0.80
730	EVAP DELTA T	Deg F	6.53	8.35	9.02	9.62	10.05
731	COND DELTA T	Deg F	7.09	8.87	9.51	9.99	10.39
735	EVAP WATER FLOWRATE	Lbm/min	4202.50	4201.30	4204.80	4171.20	4184.40
736	COND WATER FLOWRATE	Lbm/min	5020.00	5015.70	5017.60	5015.30	5023.80
740	EVAP CAPACITY	Btu/min	27483.20	35125.80	37973.00	40172.70	42078.10
741	COND CAPACITY	Btu/min	35490.90	44387.60	47606.20	49986.00	52078.10
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	38.08	36.81	36.34	35.97	35.66
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	116.43	110.99	107.28	103.32	99.16
750	RUNNING TIME	Hr	143.50	144.20	144.30	144.60	145.10
751	STARTS		33	33	33	33	33
752	EVAP APPROACH TEMP	Deg F	6.00	7.20	7.70	8.10	8.40
753	COND APPROACH TEMP	Deg F	5.40	7.10	7.80	8.30	8.80
800	EVAP AVG H2O TEMP	Deg F	47.30	48.23	48.56	48.86	49.09
801	EVAP WATER DENSITY	Lbm/Ft3	62.44	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000911	0.000898	0.000893	0.000889	0.000886
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0015	1.0013	1.0012	1.0010	1.0010
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3378	0.3383	0.3385	0.3387	0.3388
810	COND AVG H2O TEMP	Deg F	107.50	99.41	94.71	89.99	85.20
811	COND WATER DENSITY	Lbm/Ft3	61.91	62.02	62.08	62.13	62.18
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000422	0.000460	0.000484	0.000511	0.000541
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9979	0.9977	0.9977	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3662	0.3630	0.3610	0.3590	0.3568
815	ITD/DELTA T		1.91	1.87	1.85	1.84	1.84
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.03	-0.05	-0.03	-0.01	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.02	-0.05	-0.01	-0.01	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.07	0.05	0.05	0.05	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.03	0.03	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	-0.06	0.03	0.01	0.03	0.09

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		165	166	167	168	169
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	40	40	40
Capacity	Tons	214.40	210.50	194.70	189.50	182.90
Power	KW	166.14	161.46	145.62	145.56	145.38
KW/Ton	KW/Ton	0.770	0.770	0.750	0.770	0.790
TOE	Deg F	44.04	44.05	44.05	44.05	44.05
TIC	Deg F	75.05	70.08	70.05	75.05	80.07
Energy Balance	%	-1.20	-1.17	-1.37	-1.34	-1.42
TIE	Deg F	54.26	54.07	53.32	53.09	52.78
TOE	Deg F	44.04	44.05	44.05	44.05	44.05
GPME	GPM	501.90	502.80	502.90	501.90	501.20
TIC	Deg F	75.05	70.08	70.05	75.05	80.07
TOC	Deg F	85.59	80.42	79.58	84.38	89.14
GPMC	GPM	603.90	602.60	602.10	601.70	602.50
Evap Sat Press	Psia	5.11	4.87	5.26	5.28	5.31
Sat Temp	Deg F	34.79	32.86	35.97	36.12	36.34
Approach	Deg F	9.30	11.20	8.10	7.90	7.70
LMTD	Deg F	13.73	15.67	12.13	11.88	11.53
ITD/Delta T		1.91	2.11	1.87	1.88	1.88
Q/Ao	B/hr-ft2	15602.76	15316.68	14168.34	13789.81	13305.94
Uo	B/hr ft2 F	1136.24	977.47	1168.01	1160.53	1154.09
ho'	B/hr ft2 F	1790.30	1424.84	1870.84	1853.97	1839.36
Cond Sat Press	Psia	18.76	16.92	16.23	17.75	19.36
Sat Temp	Deg F	94.60	89.25	87.12	91.72	96.26
Approach	Deg F	9.00	8.80	7.50	7.30	7.10
Refrigerant Leaving Temp	Deg F	93.90	88.82	87.06	91.35	96.00
LMTD	Deg F	13.61	13.34	11.66	11.37	11.04
Q/Ao	B/hr-ft2	15382.23	15069.73	13899.73	13589.10	13201.54
Uo	B/hr ft2 F	1130.52	1129.78	1191.76	1194.72	1195.69
ho'	B/hr ft2 F	1689.08	1705.04	1852.37	1841.32	1824.89
Cond Sat Temp	Deg F	94.60	89.25	87.12	91.72	96.26
Evap Sat Temp	Deg F	34.79	32.86	35.97	36.12	36.34
Estimated Motor Efficiency (1)		0.934	0.935	0.939	0.939	0.939
Estimated Motor RPM (1)		3549	3551	3556	3556	3556
Compressor Suction CFM (2)	CFM	3962	4044	3470	3383	3265
Isentropic KW/T (2)		0.478	0.450	0.402	0.439	0.474
Adiabatic Efficiency (3)		0.621	0.584	0.536	0.570	0.600
Q/N (4)		1.116	1.139	0.976	0.951	0.918
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.48	17.54	17.54	17.48	17.43
3	ENT EVAP WATER TEMP LOC 1	Deg F	54.29	54.1	53.35	53.12	52.81
4	ENT EVAP WATER TEMP LOC 2	Deg F	54.24	54.04	53.29	53.06	52.75
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.06	44.06	44.07	44.06
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.03	44.04	44.03	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.23	25.14	25.1	25.05	25.09
17	ENT COND WATER TEMP LOC 1	Deg F	75.05	70.1	70.05	75.05	80.05
18	ENT COND WATER TEMP LOC 2	Deg F	75.05	70.07	70.04	75.04	80.08
19	LVG COND WATER TEMP LOC 1	Deg F	85.59	80.43	79.58	84.39	89.13
20	LVG COND WATER TEMP LOC 2	Deg F	85.58	80.41	79.58	84.38	89.15
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	36.77	34.66	42.82	38.62	38.89
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	37.9	35.87	39.77	39.91	39.74
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.08	37.25	40.95	41.12	41.26
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.11	4.87	5.26	5.28	5.31
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.22	7.76	7.79	7.99	8.22
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.24	7.77	7.81	8.03	8.26
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.46	6.99	7.14	7.39	7.68
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	12.1	11.06	11.24	11.75	12.34
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	13.02	11.86	11.01	11.51	12.21
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	11.97	11.01	11.19	11.74	12.47
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	18.76	16.92	16.23	17.75	19.36
440	REFRIGERANT LVG COND TEMP	Deg F	93.9	88.82	87.06	91.35	96
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.65	11.73	12.25	12.86	13.54
485	HIGH PRESS ECONOMIZER TEMP	Deg F	74.47	70.89	73.21	75.26	77.76
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	8.2	7.68	7.77	8	8.28
487	LOW PRESS ECONOMIZER TEMP	Deg F	54.64	51.77	52.27	53.58	55.11
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.07	6.68	6.77	6.86	6.9
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	54.97	52.1	52.41	53.7	55.18
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.43	7.92	7.88	8.1	8.37
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.29	46.85	46.96	47.23	47.69
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	19.03	17.29	16.51	17.95	19.48
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	94.63	89.36	87.74	92.06	96.43
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	15.29	14.25	13.71	14.52	15.34
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	84.46	80.75	79.69	82.33	85.24
560	ATMOSPHERIC PRESS	PSIA	14.45	14.45	14.31	14.31	14.32
580	MOTOR VOLTAGE - AB	Volts	3.914	3.965	3.859	3.858	3.862
581	MOTOR VOLTAGE - AC	Volts	3.924	3.976	3.862	3.860	3.866
582	MOTOR VOLTAGE - CB	Volts	3.907	3.953	3.853	3.850	3.857
583	MOTOR CURRENT - A	Volts	2.268	2.204	2.025	2.036	2.016
584	MOTOR CURRENT - B	Volts	2.373	2.287	2.130	2.124	2.117
585	MOTOR CURRENT - C	Volts	2.218	2.145	1.953	1.952	1.954
586	MOTOR POWER - PHASE 1	Volts	1.037	0.993	0.920	0.919	0.913
587	MOTOR POWER - PHASE 3	Volts	1.732	1.698	1.507	1.507	1.510
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	85.47	80.24	79.46	84.34	89.04
601	MAXIMUM MOTOR TEMPERATURE	Deg F	144.50	147.59	151.28	127.59	123.59
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	474.30	474.50	475.40	475.60	477.00
609	UNIT START COUNTER READING		128	128	129	129	129
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	5.49	5.79	118.73	119.12	120.20
701	ENERGY BALANCE	%	-1.20	-1.17	-1.37	-1.34	-1.42
702	EVAP CAPACITY	Tons	214.40	210.50	194.70	189.50	182.90
703	EVAP WATER FLOWRATE	GPM	501.90	502.80	502.90	501.90	501.20
704	COND WATER FLOWRATE	GPM	603.90	602.60	602.10	601.70	602.50

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	54.26	54.07	53.32	53.09	52.78
711	AVE LVG EVAP WATER TEMP	Deg F	44.04	44.05	44.05	44.05	44.05
712	AVE ENT COND WATER TEMP	Deg F	75.05	70.08	70.05	75.05	80.07
713	AVE LVG COND WATER TEMP	Deg F	85.59	80.42	79.58	84.38	89.14
715	MOTOR VOLTAGE - AB	Volts	469.70	475.80	463.10	463.00	463.40
716	MOTOR VOLTAGE - AC	Volts	470.90	477.10	463.40	463.20	463.90
717	MOTOR VOLTAGE - CB	Volts	468.80	474.40	462.40	462.00	462.80
718	MOTOR CURRENT - A	Amps	226.80	220.40	202.50	203.60	201.60
719	MOTOR CURRENT - B	Amps	237.30	228.70	213.00	212.40	211.70
720	MOTOR CURRENT - C	Amps	221.80	214.50	195.30	195.20	195.40
721	UNIT POWER	KW	166.14	161.46	145.62	145.56	145.38
722	AVERAGE VOLTAGE	Volts	469.80	475.80	463.00	462.70	463.40
723	AVERAGE CURRENT	Amps	228.63	221.20	203.60	203.73	202.90
725	KW/TON	KW/Ton	0.77	0.77	0.75	0.77	0.79
730	EVAP DELTA T	Deg F	10.22	10.02	9.27	9.04	8.72
731	COND DELTA T	Deg F	10.54	10.33	9.54	9.34	9.07
735	EVAP WATER FLOWRATE	Lbm/min	4188.00	4195.20	4196.40	4188.10	4182.10
736	COND WATER FLOWRATE	Lbm/min	5028.10	5020.30	5016.30	5010.20	5012.80
740	EVAP CAPACITY	Btu/min	42889.40	42103.00	38946.40	37905.90	36575.80
741	COND CAPACITY	Btu/min	52855.90	51782.10	47761.80	46694.40	45362.70
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	34.79	32.86	35.97	36.12	36.34
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	94.60	89.25	87.12	91.72	96.26
750	RUNNING TIME	Hr	145.40	145.60	146.50	146.70	148.10
751	STARTS		33	33	34	34	34
752	EVAP APPROACH TEMP	Deg F	9.30	11.20	8.10	7.90	7.70
753	COND APPROACH TEMP	Deg F	9.00	8.80	7.50	7.30	7.10
800	EVAP AVG H2O TEMP	Deg F	49.15	49.06	48.69	48.57	48.42
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000885	0.000886	0.000891	0.000893	0.000895
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0010	1.0010	1.0012	1.0012	1.0012
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3388	0.3388	0.3386	0.3385	0.3384
810	COND AVG H2O TEMP	Deg F	80.32	75.25	74.82	79.72	84.61
811	COND WATER DENSITY	Lbm/Ft3	62.23	62.28	62.28	62.24	62.19
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000574	0.000612	0.000615	0.000578	0.000545
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9978	0.9980	0.9980	0.9978	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3546	0.3522	0.3520	0.3543	0.3565
815	ITD/DELTA T		1.91	2.11	1.87	1.88	1.88
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.00	0.03	0.01	0.01	-0.04
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.01	0.02	0.01	0.01	-0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.05	0.06	0.06	0.06	0.06
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.02	0.04	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.12	0.19	0.13	0.05	0.09

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		170	171	172	173	174
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	40
Capacity	Tons	174.60	164.80	152.10	135.00	80.00
Power	KW	143.39	140.39	135.36	127.92	100.26
KW/Ton	KW/Ton	0.820	0.850	0.890	0.950	1.250
TOE	Deg F	44.04	44.05	44.04	44.04	44.04
TIC	Deg F	85.03	90.01	95.04	100.06	104.92
Energy Balance	%	-1.28	-0.96	-0.92	-0.88	-0.50
TIE	Deg F	52.39	51.88	51.26	50.45	47.84
TOE	Deg F	44.04	44.05	44.04	44.04	44.04
GPME	GPM	499.90	504.00	503.70	503.80	502.90
TIC	Deg F	85.03	90.01	95.04	100.06	104.92
TOC	Deg F	93.74	98.27	102.74	106.97	109.28
GPME	GPM	602.40	602.70	602.60	604.20	603.90
Evap Sat Press	Psia	5.35	5.40	5.45	5.53	5.80
Sat Temp	Deg F	36.66	37.03	37.41	38.00	39.97
Approach	Deg F	7.40	7.00	6.60	6.00	4.10
LMTD	Deg F	11.03	10.45	9.80	8.86	5.76
ITD/Delta T		1.88	1.90	1.92	1.94	2.07
Q/Ao	B/hr-ft2	12702.37	11989.38	11064.51	9820.13	5821.27
Uo	B/hr ft2 F	1151.27	1147.24	1128.95	1108.12	1010.17
ho'	B/hr ft2 F	1835.08	1819.75	1776.09	1726.38	1505.11
Cond Sat Press	Psia	20.96	22.64	24.30	25.86	25.84
Sat Temp	Deg F	100.48	104.66	108.55	112.02	111.98
Approach	Deg F	6.70	6.40	5.80	5.00	2.70
Refrigerant Leaving Temp	Deg F	100.22	103.75	107.43	110.69	110.43
LMTD	Deg F	10.50	9.96	9.12	8.01	4.54
Q/Ao	B/hr-ft2	12665.48	12007.01	11172.97	10042.67	6340.00
Uo	B/hr ft2 F	1206.27	1206.09	1224.46	1253.05	1397.70
ho'	B/hr ft2 F	1832.05	1814.37	1838.47	1884.30	2213.65
Cond Sat Temp	Deg F	100.48	104.66	108.55	112.02	111.98
Evap Sat Temp	Deg F	36.66	37.03	37.41	38.00	39.97
Estimated Motor Efficiency (1)		0.940	0.940	0.942	0.943	0.947
Estimated Motor RPM (1)		3557	3558	3560	3562	3571
Compressor Suction CFM (2)	CFM	3108	2922	2684	2359	1338
Isentropic KW/T (2)		0.506	0.538	0.565	0.588	0.569
Adiabatic Efficiency (3)		0.617	0.633	0.635	0.619	0.455
Q/N (4)		0.874	0.821	0.754	0.662	0.375
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.34	17.62	17.61	17.62	17.56
3	ENT EVAP WATER TEMP LOC 1	Deg F	52.43	51.9	51.3	50.48	47.88
4	ENT EVAP WATER TEMP LOC 2	Deg F	52.36	51.85	51.22	50.41	47.8
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.07	44.05	44.05	44.05
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.03	44.02	44.02	44.02
15	COND WATER FLOWMETER DELTA P	PSID	25.06	25.06	25.02	25.12	25.07
17	ENT COND WATER TEMP LOC 1	Deg F	85.02	89.99	95.02	100.02	104.88
18	ENT COND WATER TEMP LOC 2	Deg F	85.03	90.02	95.06	100.1	104.95
19	LVG COND WATER TEMP LOC 1	Deg F	93.73	98.26	102.72	106.95	109.27
20	LVG COND WATER TEMP LOC 2	Deg F	93.74	98.27	102.75	106.98	109.29
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	39.3	39.54	40.04	40.59	42.49
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	40.23	40.16	40.72	41.06	42.97
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	41.46	41.54	42.21	42.69	44.34
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.35	5.4	5.45	5.53	5.8
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.49	8.79	9.12	9.47	9.67
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.52	8.84	9.18	9.53	9.89
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8	8.38	8.8	9.22	9.62
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	13.05	13.31	14.15	14.87	14.85
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	13	13.9	14.85	15.53	15.95
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	13.27	13.99	14.64	15.52	16.11
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	20.96	22.64	24.3	25.86	25.84
440	REFRIGERANT LVG COND TEMP	Deg F	100.22	103.75	107.43	110.69	110.43
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	14.26	15.05	15.88	16.68	16.87
485	HIGH PRESS ECONOMIZER TEMP	Deg F	80.31	83.06	85.72	88.19	88.77
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	8.58	8.89	9.25	9.55	9.7
487	LOW PRESS ECONOMIZER TEMP	Deg F	56.59	58.34	59.97	61.42	62.09
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.01	7.1	7.15	7.2	7.17
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	56.67	58.3	59.91	61.15	61.48
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.64	8.97	9.27	9.51	9.57
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	48.13	48.48	48.76	48.83	48.67
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	21.03	22.6	24.29	25.81	25.67
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	100.66	104.64	108.4	111.71	111.53
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	16.27	17.12	17.94	18.67	18.5
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	88.15	90.86	93.35	95.19	93.63
560	ATMOSPHERIC PRESS	PSIA	14.32	14.32	14.32	14.32	14.32
580	MOTOR VOLTAGE - AB	Volts	3.845	3.831	3.856	3.864	3.863
581	MOTOR VOLTAGE - AC	Volts	3.849	3.836	3.861	3.867	3.865
582	MOTOR VOLTAGE - CB	Volts	3.837	3.824	3.848	3.858	3.859
583	MOTOR CURRENT - A	Volts	2.003	1.962	1.899	1.793	1.451
584	MOTOR CURRENT - B	Volts	2.095	2.062	1.987	1.888	1.540
585	MOTOR CURRENT - C	Volts	1.934	1.902	1.836	1.735	1.417
586	MOTOR POWER - PHASE 1	Volts	0.903	0.885	0.842	0.785	0.591
587	MOTOR POWER - PHASE 3	Volts	1.487	1.455	1.414	1.347	1.080
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	93.70	98.31	102.72	106.93	109.32
601	MAXIMUM MOTOR TEMPERATURE	Deg F	122.50	120.50	119.50	115.50	102.50
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	477.20	477.40	477.60	478.20	478.40
609	UNIT START COUNTER READING		129	129	129	129	129
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	120.52	120.83	121.10	121.39	121.79
701	ENERGY BALANCE	%	-1.28	-0.96	-0.92	-0.88	-0.50
702	EVAP CAPACITY	Tons	174.60	164.80	152.10	135.00	80.00
703	EVAP WATER FLOWRATE	GPM	499.90	504.00	503.70	503.80	502.90
704	COND WATER FLOWRATE	GPM	602.40	602.70	602.60	604.20	603.90

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	52.39	51.88	51.26	50.45	47.84
711	AVE LVG EVAP WATER TEMP	Deg F	44.04	44.05	44.04	44.04	44.04
712	AVE ENT COND WATER TEMP	Deg F	85.03	90.01	95.04	100.06	104.92
713	AVE LVG COND WATER TEMP	Deg F	93.74	98.27	102.74	106.97	109.28
715	MOTOR VOLTAGE - AB	Volts	461.40	459.70	462.70	463.70	463.60
716	MOTOR VOLTAGE - AC	Volts	461.90	460.30	463.30	464.00	463.80
717	MOTOR VOLTAGE - CB	Volts	460.40	458.90	461.80	463.00	463.10
718	MOTOR CURRENT - A	Amps	200.30	196.20	189.90	179.30	145.10
719	MOTOR CURRENT - B	Amps	209.50	206.20	198.70	188.80	154.00
720	MOTOR CURRENT - C	Amps	193.40	190.20	183.60	173.50	141.70
721	UNIT POWER	KW	143.39	140.39	135.36	127.92	100.26
722	AVERAGE VOLTAGE	Volts	461.20	459.60	462.60	463.60	463.50
723	AVERAGE CURRENT	Amps	201.07	197.53	190.73	180.53	146.92
725	KW/TON	KW/Ton	0.82	0.85	0.89	0.95	1.25
730	EVAP DELTA T	Deg F	8.35	7.83	7.23	6.41	3.81
731	COND DELTA T	Deg F	8.71	8.26	7.70	6.91	4.36
735	EVAP WATER FLOWRATE	Lbm/min	4171.30	4206.10	4203.70	4204.90	4197.80
736	COND WATER FLOWRATE	Lbm/min	5008.30	5006.60	5000.70	5008.70	5001.60
740	EVAP CAPACITY	Btu/min	34916.70	32956.80	30414.50	26993.90	16001.70
741	COND CAPACITY	Btu/min	43520.70	41258.10	38392.20	34508.30	21785.30
743	EVAP SATN TEMP (BASED ON ID #61)	Deg F	36.66	37.03	37.41	38.00	39.97
744	COND SATN TEMP (BASED ON ID #431)	Deg F	100.48	104.66	108.55	112.02	111.98
750	RUNNING TIME	Hr	148.30	148.50	148.70	149.30	149.50
751	STARTS		34	34	34	34	34
752	EVAP APPROACH TEMP	Deg F	7.40	7.00	6.60	6.00	4.10
753	COND APPROACH TEMP	Deg F	6.70	6.40	5.80	5.00	2.70
800	EVAP AVG H2O TEMP	Deg F	48.22	47.97	47.65	47.25	45.94
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.44	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000898	0.000901	0.000906	0.000911	0.000931
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0013	1.0013	1.0014	1.0015	1.0017
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3383	0.3382	0.3380	0.3378	0.3370
810	COND AVG H2O TEMP	Deg F	89.38	94.14	98.89	103.52	107.10
811	COND WATER DENSITY	Lbm/Ft3	62.14	62.08	62.03	61.97	61.92
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000515	0.000488	0.000462	0.000440	0.000424
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9977	0.9978	0.9979
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3587	0.3608	0.3628	0.3647	0.3661
815	ITD/DELTA T		1.88	1.90	1.92	1.94	2.07
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.01	-0.03	-0.04	-0.08	-0.07
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.01	-0.01	-0.03	-0.03	-0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.07	0.05	0.08	0.07	0.08
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.04	0.03	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.03	-0.05	0.00	0.02	-0.05

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5!						
Run Number		175	176	177	178	179
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	10	10	10	10
Capacity	Tons	65.50	57.30	64.30	69.00	72.70
Power	KW	90.72	74.10	73.01	72.48	71.40
KW/Ton	KW/Ton	1.390	1.290	1.140	1.040	0.980
TOE	Deg F	44.02	44.05	44.04	44.04	44.05
TIC	Deg F	106.40	95.03	90.03	85.03	80.08
Energy Balance	%	-1.48	-3.24	-3.05	-2.67	-2.63
TIE	Deg F	47.14	46.77	47.09	47.32	47.51
TOE	Deg F	44.02	44.05	44.04	44.04	44.05
GPME	GPM	502.20	502.50	502.50	502.60	502.60
TIC	Deg F	106.40	95.03	90.03	85.03	80.08
TOC	Deg F	110.11	98.24	93.52	88.69	83.88
GPMC	GPM	603.80	603.40	602.60	601.90	601.90
Evap Sat Press	Psia	6.19	5.91	5.87	5.84	5.82
Sat Temp	Deg F	42.68	40.75	40.47	40.25	40.11
Approach	Deg F	1.30	3.30	3.60	3.80	3.90
LMTD	Deg F	2.59	4.52	4.94	5.26	5.49
ITD/Delta T		1.43	2.21	2.17	2.16	2.14
Q/Ao	B/hr-ft2	4766.86	4165.95	4677.91	5023.15	5290.61
Uo	B/hr ft2 F	1837.19	920.74	947.13	954.85	963.78
ho'	B/hr ft2 F	4587.21	1316.42	1370.53	1386.41	1405.01
Cond Sat Press	Psia	25.84	20.58	18.96	17.32	15.77
Sat Temp	Deg F	111.98	99.50	95.18	90.45	85.67
Approach	Deg F	1.90	1.30	1.70	1.80	1.80
Refrigerant Leaving Temp	Deg F	110.58	98.78	94.52	90.19	85.77
LMTD	Deg F	3.39	2.53	3.08	3.25	3.34
Q/Ao	B/hr-ft2	5371.36	4667.26	5064.89	5325.27	5525.75
Uo	B/hr ft2 F	1582.82	1841.14	1643.08	1636.55	1655.93
ho'	B/hr ft2 F	2708.14	3729.55	3046.53	3076.50	3199.22
Cond Sat Temp	Deg F	111.98	99.50	95.18	90.45	85.67
Evap Sat Temp	Deg F	42.68	40.75	40.47	40.25	40.11
Estimated Motor Efficiency (1)		0.948	0.946	0.946	0.946	0.946
Estimated Motor RPM (1)		3574	3579	3579	3579	3580
Compressor Suction CFM (2)	CFM	1030	928	1043	1119	1176
Isentropic KW/T (2)		0.544	0.457	0.424	0.388	0.351
Adiabatic Efficiency (3)		0.391	0.354	0.372	0.373	0.358
Q/N (4)		0.288	0.259	0.291	0.313	0.329
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

11	EVAP WATER FLOWMETER DELTA P	PSID	17.51	17.53	17.53	17.54	17.54
3	ENT EVAP WATER TEMP LOC 1	Deg F	47.21	46.81	47.13	47.36	47.54
4	ENT EVAP WATER TEMP LOC 2	Deg F	47.08	46.73	47.06	47.28	47.48
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.04	44.04	44.05	44.05	44.07
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.01	44.05	44.02	44.02	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.05	25.09	25.05	25.02	25.04
17	ENT COND WATER TEMP LOC 1	Deg F	106.37	94.98	90.02	85.02	80.06
18	ENT COND WATER TEMP LOC 2	Deg F	106.44	95.08	90.04	85.04	80.1
19	LVG COND WATER TEMP LOC 1	Deg F	110.08	98.21	93.51	88.69	83.88
20	LVG COND WATER TEMP LOC 2	Deg F	110.13	98.27	93.52	88.7	83.88
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	42.97	46.07	46.01	45.58	45.38
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	43.43	43.74	43.49	43.48	43.08
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	44.85	45.33	45.09	44.84	44.47
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.19	5.91	5.87	5.84	5.82
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.91	8.22	7.69	7.19	6.74
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.97	8.38	7.84	7.36	6.88
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.71	8.14	7.59	7.08	6.62
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	14.87	11.71	10.39	9.26	8.26
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	15.92	12.73	11.51	10.44	9.51
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	16.24	13.47	12.31	11.23	10.27
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	25.84	20.58	18.96	17.32	15.77
440	REFRIGERANT LVG COND TEMP	Deg F	110.58	98.78	94.52	90.19	85.77
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.92	14.55	13.62	12.71	11.9
485	HIGH PRESS ECONOMIZER TEMP	Deg F	88.92	81.36	78.01	74.73	71.85
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	9.81	8.22	7.69	7.18	6.73
487	LOW PRESS ECONOMIZER TEMP	Deg F	63.45	54.7	51.78	48.87	46.13
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.63	6.71	6.54	6.38	6.23
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	63.61	54.18	51.4	48.65	46.05
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	9.6	8.12	7.63	7.18	6.76
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.07	45.79	44.62	43.67	42.71
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	25.66	20.49	18.89	17.28	15.77
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	111.64	99.43	95.09	90.45	85.8
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.39	15.7	14.64	13.65	12.74
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	93.41	85.18	81.83	78.35	75.12
560	ATMOSPHERIC PRESS	PSIA	14.32	14.32	14.32	14.32	14.32
580	MOTOR VOLTAGE - AB	Volts	3.863	3.889	3.864	3.865	3.862
581	MOTOR VOLTAGE - AC	Volts	3.865	3.892	3.868	3.868	3.867
582	MOTOR VOLTAGE - CB	Volts	3.858	3.881	3.859	3.857	3.859
583	MOTOR CURRENT - A	Volts	1.321	1.139	1.120	1.120	1.101
584	MOTOR CURRENT - B	Volts	1.433	1.227	1.216	1.207	1.198
585	MOTOR CURRENT - C	Volts	1.318	1.128	1.121	1.108	1.098
586	MOTOR POWER - PHASE 1	Volts	0.517	0.373	0.368	0.368	0.358
587	MOTOR POWER - PHASE 3	Volts	0.995	0.862	0.849	0.840	0.832
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	110.00	98.07	93.52	88.61	83.82
601	MAXIMUM MOTOR TEMPERATURE	Deg F	98.50	85.50	82.50	79.50	76.50
605	1st STAGE VANE SETTING	Degrees	40.00	10.00	10.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	19.00	19.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	478.50	479.30	479.50	480.20	480.40
609	UNIT START COUNTER READING		129	129	129	129	129
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	122.02	122.71	123.03	123.41	123.75
701	ENERGY BALANCE	%	-1.48	-3.24	-3.05	-2.67	-2.63
702	EVAP CAPACITY	Tons	65.50	57.30	64.30	69.00	72.70
703	EVAP WATER FLOWRATE	GPM	502.20	502.50	502.50	502.60	502.60
704	COND WATER FLOWRATE	GPM	603.80	603.40	602.60	601.90	601.90

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	47.14	46.77	47.09	47.32	47.51
711	AVE LVG EVAP WATER TEMP	Deg F	44.02	44.05	44.04	44.04	44.05
712	AVE ENT COND WATER TEMP	Deg F	106.40	95.03	90.03	85.03	80.08
713	AVE LVG COND WATER TEMP	Deg F	110.11	98.24	93.52	88.69	83.88
715	MOTOR VOLTAGE - AB	Volts	463.60	466.70	463.70	463.80	463.40
716	MOTOR VOLTAGE - AC	Volts	463.80	467.00	464.20	464.20	464.00
717	MOTOR VOLTAGE - CB	Volts	463.00	465.70	463.10	462.80	463.10
718	MOTOR CURRENT - A	Amps	132.10	113.90	112.00	112.00	110.10
719	MOTOR CURRENT - B	Amps	143.30	122.70	121.60	120.70	119.80
720	MOTOR CURRENT - C	Amps	131.80	112.80	112.10	110.80	109.80
721	UNIT POWER	KW	90.72	74.10	73.01	72.48	71.40
722	AVERAGE VOLTAGE	Volts	463.50	466.50	463.70	463.60	463.50
723	AVERAGE CURRENT	Amps	135.73	116.47	115.23	114.50	113.23
725	KW/TON	KW/Ton	1.39	1.29	1.14	1.04	0.98
730	EVAP DELTA T	Deg F	3.12	2.73	3.06	3.28	3.46
731	COND DELTA T	Deg F	3.70	3.21	3.48	3.66	3.80
735	EVAP WATER FLOWRATE	Lbm/min	4191.80	4194.20	4194.20	4195.40	4195.40
736	COND WATER FLOWRATE	Lbm/min	4998.90	5007.70	5005.60	5004.30	5007.80
740	EVAP CAPACITY	Btu/min	13103.30	11451.50	12858.80	13807.80	14543.00
741	COND CAPACITY	Btu/min	18456.90	16037.50	17403.80	18298.50	18987.40
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	42.68	40.75	40.47	40.25	40.11
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	111.98	99.50	95.18	90.45	85.67
750	RUNNING TIME	Hr	149.60	150.40	150.60	151.30	151.50
751	STARTS		34	34	34	34	34
752	EVAP APPROACH TEMP	Deg F	1.30	3.30	3.60	3.80	3.90
753	COND APPROACH TEMP	Deg F	1.90	1.30	1.70	1.80	1.80
800	EVAP AVG H2O TEMP	Deg F	45.58	45.41	45.56	45.68	45.78
801	EVAP WATER DENSITY	Lbm/Ft3	62.44	62.44	62.44	62.44	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000936	0.000939	0.000936	0.000935	0.000933
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0019	1.0020	1.0019	1.0019	1.0019
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3368	0.3367	0.3368	0.3369	0.3369
810	COND AVG H2O TEMP	Deg F	108.26	96.64	91.78	86.86	81.98
811	COND WATER DENSITY	Lbm/Ft3	61.90	62.05	62.11	62.17	62.22
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000419	0.000474	0.000500	0.000530	0.000562
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9979	0.9977	0.9977	0.9977	0.9978
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3666	0.3617	0.3597	0.3576	0.3554
815	ITD/DELTA T		1.43	2.21	2.17	2.16	2.14
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.07	-0.10	-0.02	-0.02	-0.04
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.05	-0.06	-0.01	-0.01	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.13	0.08	0.07	0.08	0.06
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	-0.01	0.03	0.03	0.04
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.08	0.14	-0.01	0.08	0.06

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5				
Run Number		180	181	
Refrigerant		123	123	
Oil		Solest 68	Solest 68	
1st Stage Guide Vane Setting	Degrees	10	10	
Capacity	Tons	75.30	77.50	
Power	KW	69.83	68.46	
KW/Ton	KW/Ton	0.930	0.880	
TOE	Deg F	44.05	44.04	
TIC	Deg F	75.04	70.03	
Energy Balance	%	-2.40	-2.04	
TIE	Deg F	47.63	47.72	
TOE	Deg F	44.05	44.04	
GPME	GPM	503.10	503.50	
TIC	Deg F	75.04	70.03	
TOC	Deg F	78.93	73.98	
GPMC	GPM	600.80	599.80	
Evap Sat Press	Psia	5.81	5.77	
Sat Temp	Deg F	40.04	39.75	
Approach	Deg F	4.00	4.30	
LMTD	Deg F	5.61	5.94	
ITD/Delta T		2.11	2.17	
Q/Ao	B/hr-ft2	5478.62	5636.43	
Uo	B/hr ft2 F	976.42	948.69	
ho'	B/hr ft2 F	1431.37	1372.23	
Cond Sat Press	Psia	14.27	13.25	
Sat Temp	Deg F	80.67	77.03	
Approach	Deg F	1.70	3.00	
Refrigerant Leaving Temp	Deg F	81.08	76.49	
LMTD	Deg F	3.31	4.75	
Q/Ao	B/hr-ft2	5643.96	5734.21	
Uo	B/hr ft2 F	1703.67	1206.03	
ho'	B/hr ft2 F	3452.39	1901.53	
Cond Sat Temp	Deg F	80.67	77.03	
Evap Sat Temp	Deg F	40.04	39.75	
Estimated Motor Efficiency (1)		0.945	0.945	
Estimated Motor RPM (1)		3580	3580	
Compressor Suction CFM (2)	CFM	1214	1254	
Isentropic KW/T (2)		0.312	0.288	
Adiabatic Efficiency (3)		0.335	0.327	
Q/N (4)		0.339	0.350	
(1) From motor curves at measured power input				
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split				
(3) Ratio of isentropic and test KW/T				
(4) CFM from cycle calculation / estimated motor RPM				
(5) Heat transfer coefficient calculations use bulk fluid properties				

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.57	17.60
3	ENT EVAP WATER TEMP LOC 1	Deg F	47.66	47.75
4	ENT EVAP WATER TEMP LOC 2	Deg F	47.59	47.68
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.06	44.05
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	44.02
15	COND WATER FLOWMETER DELTA P	PSID	24.97	24.91
17	ENT COND WATER TEMP LOC 1	Deg F	75.04	70.04
18	ENT COND WATER TEMP LOC 2	Deg F	75.04	70.01
19	LVG COND WATER TEMP LOC 1	Deg F	78.93	73.99
20	LVG COND WATER TEMP LOC 2	Deg F	78.92	73.97
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	45.34	44.94
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	43.02	42.98
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	44.26	43.91
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.81	5.77
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	6.38	6.01
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	6.53	6.13
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	6.27	5.89
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	7.36	6.50
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	8.55	7.80
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	9.38	8.57
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	14.27	13.25
440	REFRIGERANT LVG COND TEMP	Deg F	81.08	76.49
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	11.17	10.49
485	HIGH PRESS ECONOMIZER TEMP	Deg F	69.24	66.69
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	6.39	6.03
487	LOW PRESS ECONOMIZER TEMP	Deg F	43.91	41.51
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.13	6.00
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	43.94	41.58
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	6.44	6.13
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	42.31	41.08
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	14.29	12.92
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	80.89	76.08
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	11.91	11.15
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	72.06	68.93
560	ATMOSPHERIC PRESS	PSIA	14.32	14.31
580	MOTOR VOLTAGE - AB	Volts	3.866	3.872
581	MOTOR VOLTAGE - AC	Volts	3.869	3.875
582	MOTOR VOLTAGE - CB	Volts	3.862	3.868
583	MOTOR CURRENT - A	Volts	1.081	1.068
584	MOTOR CURRENT - B	Volts	1.187	1.166
585	MOTOR CURRENT - C	Volts	1.084	1.071
586	MOTOR POWER - PHASE 1	Volts	0.346	0.332
587	MOTOR POWER - PHASE 3	Volts	0.818	0.809
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	78.83	73.89
601	MAXIMUM MOTOR TEMPERATURE	Deg F	77.50	82.50
605	1st STAGE VANE SETTING	Degrees	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00
608	UNIT HOUR METER READING	Hr	480.60	481.30
609	UNIT START COUNTER READING		129	129
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360
700	TIME (HOURS)	HOURS	124.11	124.61
701	ENERGY BALANCE	%	-2.40	-2.04
702	EVAP CAPACITY	Tons	75.30	77.50
703	EVAP WATER FLOWRATE	GPM	503.10	503.50
704	COND WATER FLOWRATE	GPM	600.80	599.80

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	47.63	47.72
711	AVE LVG EVAP WATER TEMP	Deg F	44.05	44.04
712	AVE ENT COND WATER TEMP	Deg F	75.04	70.03
713	AVE LVG COND WATER TEMP	Deg F	78.93	73.98
715	MOTOR VOLTAGE - AB	Volts	463.90	464.60
716	MOTOR VOLTAGE - AC	Volts	464.30	465.00
717	MOTOR VOLTAGE - CB	Volts	463.40	464.20
718	MOTOR CURRENT - A	Amps	108.10	106.80
719	MOTOR CURRENT - B	Amps	118.70	116.60
720	MOTOR CURRENT - C	Amps	108.40	107.10
721	UNIT POWER	KW	69.83	68.46
722	AVERAGE VOLTAGE	Volts	463.90	464.60
723	AVERAGE CURRENT	Amps	111.73	110.17
725	KW/TON	KW/Ton	0.93	0.88
730	EVAP DELTA T	Deg F	3.58	3.68
731	COND DELTA T	Deg F	3.89	3.95
735	EVAP WATER FLOWRATE	Lbm/min	4198.90	4202.50
736	COND WATER FLOWRATE	Lbm/min	5002.20	4997.30
740	EVAP CAPACITY	Btu/min	15059.80	15493.60
741	COND CAPACITY	Btu/min	19393.60	19703.70
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	40.04	39.75
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	80.67	77.03
750	RUNNING TIME	Hr	151.70	152.40
751	STARTS		34	34
752	EVAP APPROACH TEMP	Deg F	4.00	4.30
753	COND APPROACH TEMP	Deg F	1.70	3.00
800	EVAP AVG H2O TEMP	Deg F	45.84	45.88
801	EVAP WATER DENSITY	Lbm/Ft3	62.44	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000932	0.000932
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0017	1.0017
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3370	0.3370
810	COND AVG H2O TEMP	Deg F	76.99	72.00
811	COND WATER DENSITY	Lbm/Ft3	62.26	62.31
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000598	0.000638
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9979	0.9982
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3529	0.3506
815	ITD/DELTA T		2.11	2.17
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.00	0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.01	0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.07	0.07
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.10	0.10

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		182	183	184	185	186
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	223.10	211.40	196.40	178.20	149.10
Power	KW	151.92	148.86	143.39	136.38	122.82
KW/Ton	KW/Ton	0.680	0.700	0.730	0.770	0.820
TOE	Deg F	44.05	44.05	44.08	44.05	44.04
TIC	Deg F	70.07	75.05	80.14	85.05	90.06
Energy Balance	%	-1.13	-1.12	-1.42	-1.29	-1.51
TIE	Deg F	55.10	54.56	53.67	52.77	51.34
TOE	Deg F	44.05	44.05	44.08	44.05	44.04
GPME	GPM	483.50	481.70	489.70	489.40	488.30
TIC	Deg F	70.07	75.05	80.14	85.05	90.06
TOC	Deg F	80.86	85.31	89.75	93.83	97.52
GPMC	GPM	599.60	601.30	601.50	601.80	602.50
Evap Sat Press	Psia	5.38	5.46	5.54	5.62	5.78
Sat Temp	Deg F	34.05	34.64	35.22	35.79	36.91
Approach	Deg F	10.00	9.40	8.90	8.30	7.10
LMTD	Deg F	14.85	14.01	13.07	12.10	10.35
ITD/Delta T		1.90	1.90	1.92	1.95	1.98
Q/Ao	B/hr-ft2	16233.03	15383.58	14286.82	12963.46	10844.96
Uo	B/hr ft2 F	1093.44	1097.71	1092.77	1071.29	1047.35
ho'	B/hr ft2 F	1709.02	1723.00	1701.40	1652.17	1599.77
Cond Sat Press	Psia	18.96	20.52	22.06	23.53	24.70
Sat Temp	Deg F	90.40	94.40	98.14	101.52	104.09
Approach	Deg F	9.50	9.10	8.40	7.70	6.60
Refrigerant Leaving Temp	Deg F	88.99	93.02	96.89	99.31	101.83
LMTD	Deg F	14.26	13.58	12.59	11.53	9.83
Q/Ao	B/hr-ft2	15647.41	14908.24	13965.13	12761.78	10839.75
Uo	B/hr ft2 F	1097.21	1097.80	1109.26	1107.02	1102.41
ho'	B/hr ft2 F	1634.04	1619.93	1630.94	1612.63	1590.26
Cond Sat Temp	Deg F	90.40	94.40	98.14	101.52	104.09
Evap Sat Temp	Deg F	34.05	34.64	35.22	35.79	36.91
Estimated Motor Efficiency (1)		0.938	0.938	0.940	0.941	0.944
Estimated Motor RPM (1)		3554	3555	3557	3559	3564
Compressor Suction CFM (2)	CFM	3842	3606	3318	2981	2435
Isentropic KW/T (2)		0.448	0.476	0.500	0.523	0.532
Adiabatic Efficiency (3)		0.659	0.680	0.685	0.679	0.649
Q/N (4)		1.081	1.014	0.933	0.838	0.683
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.21	16.10	16.64	16.62	16.54
3	ENT EVAP WATER TEMP LOC 1	Deg F	55.12	54.58	53.70	52.79	51.37
4	ENT EVAP WATER TEMP LOC 2	Deg F	55.08	54.55	53.65	52.74	51.32
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.06	44.07	44.09	44.07	44.05
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.04	44.04	44.06	44.03	44.03
15	COND WATER FLOWMETER DELTA P	PSID	24.89	25.01	25.01	25.01	25.04
17	ENT COND WATER TEMP LOC 1	Deg F	70.07	75.05	80.12	85.03	90.03
18	ENT COND WATER TEMP LOC 2	Deg F	70.07	75.05	80.15	85.06	90.09
19	LVG COND WATER TEMP LOC 1	Deg F	80.86	85.31	89.75	93.82	97.50
20	LVG COND WATER TEMP LOC 2	Deg F	80.85	85.30	89.74	93.84	97.54
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	36.45	36.91	37.57	38.25	42.57
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	36.07	36.62	37.25	37.93	40.07
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	36.25	36.80	37.38	38.09	41.39
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.38	5.46	5.54	5.62	5.78
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.60	8.85	9.14	9.43	9.74
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.66	8.92	9.21	9.50	9.80
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.01	8.33	8.70	9.09	9.50
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	12.10	12.66	13.15	13.74	14.44
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	13.35	14.03	14.74	15.49	16.12
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	12.42	13.21	14.00	14.81	15.31
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	18.96	20.52	22.06	23.53	24.70
440	REFRIGERANT LVG COND TEMP	Deg F	88.99	93.02	96.89	99.31	101.83
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.96	13.73	14.55	15.35	16.07
485	HIGH PRESS ECONOMIZER TEMP	Deg F	71.10	73.78	76.51	79.05	81.22
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	8.59	8.92	9.18	9.53	9.77
487	LOW PRESS ECONOMIZER TEMP	Deg F	53.23	54.70	56.23	57.72	58.73
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.24	7.28	7.37	7.45	7.42
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	53.37	54.79	56.22	57.65	58.54
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.74	8.97	9.25	9.55	9.74
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	46.63	46.98	47.21	47.43	47.17
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	19.12	20.57	22.08	23.52	24.61
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	89.60	93.41	97.10	100.27	102.63
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	15.32	16.19	16.95	17.73	18.23
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	79.56	82.07	84.35	86.48	87.59
560	ATMOSPHERIC PRESS	PSIA	14.39	14.39	14.39	14.39	14.39
580	MOTOR VOLTAGE - AB	Volts	3.943	3.921	3.920	3.922	3.933
581	MOTOR VOLTAGE - AC	Volts	3.953	3.931	3.928	3.931	3.942
582	MOTOR VOLTAGE - CB	Volts	3.930	3.906	3.909	3.908	3.919
583	MOTOR CURRENT - A	Volts	2.093	2.063	1.990	1.899	1.767
584	MOTOR CURRENT - B	Volts	2.165	2.122	2.064	1.971	1.810
585	MOTOR CURRENT - C	Volts	2.035	2.007	1.932	1.854	1.695
586	MOTOR POWER - PHASE 1	Volts	0.931	0.913	0.876	0.824	0.726
587	MOTOR POWER - PHASE 3	Volts	1.601	1.568	1.514	1.449	1.321
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	80.76	85.24	89.64	93.75	97.51
601	MAXIMUM MOTOR TEMPERATURE	Deg F	120.50	118.50	113.50	111.50	105.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	486.40	486.60	487.30	487.50	488.20
609	UNIT START COUNTER READING		131	131	131	131	131
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	0.00	0.35	0.81	1.18	1.79
701	ENERGY BALANCE	%	-1.13	-1.12	-1.42	-1.29	-1.51
702	EVAP CAPACITY	Tons	223.10	211.40	196.40	178.20	149.10
703	EVAP WATER FLOWRATE	GPM	483.50	481.70	489.70	489.40	488.30
704	COND WATER FLOWRATE	GPM	599.60	601.30	601.50	601.80	602.50

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	55.10	54.56	53.67	52.77	51.34
711	AVE LVG EVAP WATER TEMP	Deg F	44.05	44.05	44.08	44.05	44.04
712	AVE ENT COND WATER TEMP	Deg F	70.07	75.05	80.14	85.05	90.06
713	AVE LVG COND WATER TEMP	Deg F	80.86	85.31	89.75	93.83	97.52
715	MOTOR VOLTAGE - AB	Volts	473.20	470.50	470.40	470.60	472.00
716	MOTOR VOLTAGE - AC	Volts	474.40	471.70	471.40	471.70	473.00
717	MOTOR VOLTAGE - CB	Volts	471.60	468.70	469.10	469.00	470.30
718	MOTOR CURRENT - A	Amps	209.30	206.30	199.00	189.90	176.70
719	MOTOR CURRENT - B	Amps	216.50	212.20	206.40	197.10	181.00
720	MOTOR CURRENT - C	Amps	203.50	200.70	193.20	185.40	169.50
721	UNIT POWER	KW	151.92	148.86	143.39	136.38	122.82
722	AVERAGE VOLTAGE	Volts	473.10	470.30	470.30	470.40	471.80
723	AVERAGE CURRENT	Amps	209.77	206.40	199.53	190.80	175.73
725	KW/TON	KW/Ton	0.68	0.70	0.73	0.77	0.82
730	EVAP DELTA T	Deg F	11.05	10.51	9.60	8.72	7.30
731	COND DELTA T	Deg F	10.78	10.26	9.60	8.79	7.46
735	EVAP WATER FLOWRATE	Lbm/min	4034.20	4019.30	4086.20	4083.80	4075.20
736	COND WATER FLOWRATE	Lbm/min	4995.30	5006.20	5004.80	5003.30	5004.60
740	EVAP CAPACITY	Btu/min	44621.90	42286.90	39272.10	35634.40	29811.00
741	COND CAPACITY	Btu/min	53767.10	51227.20	47986.50	43851.60	37247.20
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	34.05	34.64	35.22	35.79	36.91
744	COND SATN TEMP (BASED ON ID #431)	Deg F	90.40	94.40	98.14	101.52	104.09
750	RUNNING TIME	Hr	157.50	157.70	158.40	158.60	159.30
751	STARTS		36	36	36	36	36
752	EVAP APPROACH TEMP	Deg F	10.00	9.40	8.90	8.30	7.10
753	COND APPROACH TEMP	Deg F	9.50	9.10	8.40	7.70	6.60
800	EVAP AVG H2O TEMP	Deg F	49.58	49.31	48.88	48.41	47.69
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000879	0.000883	0.000888	0.000895	0.000905
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0010	1.0010	1.0010	1.0012	1.0014
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3389	0.3389	0.3387	0.3384	0.3380
810	COND AVG H2O TEMP	Deg F	75.47	80.18	84.94	89.44	93.79
811	COND WATER DENSITY	Lbm/Ft3	62.28	62.23	62.19	62.14	62.09
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000610	0.000575	0.000543	0.000514	0.000489
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9980	0.9978	0.9977	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3523	0.3545	0.3567	0.3587	0.3606
815	ITD/DELTA T		1.90	1.90	1.92	1.95	1.98
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.00	0.00	-0.03	-0.03	-0.06
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.01	0.01	0.01	-0.02	-0.04
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.04	0.03	0.05	0.05	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.02	0.03	0.03	0.04	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.10	0.07	0.11	0.07	-0.01

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		187	188	189	190	191
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	Tons	143.20	171.60	190.10	205.40	218.80
Power	KW	117.96	131.03	138.60	143.39	147.12
KW/Ton	KW/Ton	0.820	0.760	0.730	0.700	0.670
TOE	Deg F	44.05	44.04	44.05	44.02	44.05
TIC	Deg F	90.06	85.05	80.00	75.04	69.94
Energy Balance	%	-1.55	-1.34	-1.32	-1.23	-1.28
TIE	Deg F	51.06	52.43	53.39	54.10	54.81
TOE	Deg F	44.05	44.04	44.05	44.02	44.05
GPME	GPM	488.30	489.20	486.90	488.10	486.90
TIC	Deg F	90.06	85.05	80.00	75.04	69.94
TOC	Deg F	97.24	93.51	89.30	85.00	80.51
GPMC	GPM	602.10	601.50	601.30	601.40	600.00
Evap Sat Press	Psia	5.82	5.65	5.56	5.48	5.41
Sat Temp	Deg F	37.18	36.00	35.36	34.78	34.27
Approach	Deg F	6.90	8.00	8.70	9.20	9.80
LMTD	Deg F	9.97	11.74	12.80	13.67	14.50
ITD/Delta T		1.98	1.96	1.93	1.92	1.91
Q/Ao	B/hr-ft2	10422.17	12483.99	13828.16	14943.21	15919.15
Uo	B/hr ft2 F	1045.61	1063.42	1080.59	1093.46	1097.82
ho'	B/hr ft2 F	1596.26	1634.30	1676.47	1704.63	1715.53
Cond Sat Press	Psia	24.42	23.34	21.84	20.33	18.61
Sat Temp	Deg F	103.48	101.09	97.62	93.92	89.44
Approach	Deg F	6.20	7.60	8.30	8.90	8.90
Refrigerant Leaving Temp	Deg F	101.26	98.91	95.79	92.67	88.38
LMTD	Deg F	9.38	11.29	12.39	13.28	13.53
Q/Ao	B/hr-ft2	10419.37	12289.57	13502.05	14475.08	15333.39
Uo	B/hr ft2 F	1111.25	1088.88	1089.42	1089.71	1132.96
ho'	B/hr ft2 F	1609.53	1575.06	1589.12	1602.61	1715.00
Cond Sat Temp	Deg F	103.48	101.09	97.62	93.92	89.44
Evap Sat Temp	Deg F	37.18	36.00	35.36	34.78	34.27
Estimated Motor Efficiency (1)		0.945	0.942	0.941	0.940	0.939
Estimated Motor RPM (1)		3565	3561	3559	3557	3556
Compressor Suction CFM (2)	CFM	2322	2855	3198	3489	3743
Isentropic KW/T (2)		0.524	0.517	0.494	0.469	0.437
Adiabatic Efficiency (3)		0.639	0.680	0.677	0.670	0.652
Q/N (4)		0.651	0.802	0.899	0.981	1.053
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.54	16.61	16.45	16.53	16.45
3	ENT EVAP WATER TEMP LOC 1	Deg F	51.09	52.45	53.41	54.12	54.82
4	ENT EVAP WATER TEMP LOC 2	Deg F	51.04	52.41	53.37	54.08	54.80
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.06	44.05	44.06	44.04	44.06
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	44.02	44.03	44.01	44.04
15	COND WATER FLOWMETER DELTA P	PSID	25.01	24.98	24.99	25.02	24.93
17	ENT COND WATER TEMP LOC 1	Deg F	90.03	85.04	80.00	75.05	69.94
18	ENT COND WATER TEMP LOC 2	Deg F	90.09	85.05	80.01	75.03	69.94
19	LVG COND WATER TEMP LOC 1	Deg F	97.23	93.50	89.31	85.00	80.51
20	LVG COND WATER TEMP LOC 2	Deg F	97.24	93.52	89.29	84.99	80.51
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	42.82	41.86	41.23	40.84	40.15
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	40.22	39.32	38.56	38.24	37.47
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	41.54	40.34	39.87	39.39	38.43
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.82	5.65	5.56	5.48	5.41
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.70	9.39	9.05	8.78	8.52
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.76	9.45	9.12	8.84	8.56
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.47	9.06	8.64	8.29	7.93
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	14.31	13.79	13.04	12.92	12.15
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.08	15.51	14.81	14.16	13.36
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.27	14.65	13.94	13.21	12.28
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.42	23.34	21.84	20.33	18.61
440	REFRIGERANT LVG COND TEMP	Deg F	101.26	98.91	95.79	92.67	88.38
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.01	15.34	14.49	13.71	12.87
485	HIGH PRESS ECONOMIZER TEMP	Deg F	81.11	79.08	76.43	73.76	70.87
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.72	9.46	9.13	8.84	8.50
487	LOW PRESS ECONOMIZER TEMP	Deg F	58.60	57.45	55.97	54.47	52.92
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.39	7.37	7.35	7.29	7.28
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	58.26	57.35	55.90	54.53	53.13
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	9.67	9.47	9.16	8.89	8.55
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	47.01	47.06	46.83	46.49	46.04
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.33	23.32	21.82	20.40	18.76
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	101.98	99.91	96.60	93.00	88.92
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.00	17.54	16.91	16.07	15.10
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	86.80	86.01	84.14	81.55	78.92
560	ATMOSPHERIC PRESS	PSIA	14.39	14.39	14.39	14.39	14.49
580	MOTOR VOLTAGE - AB	Volts	3.937	3.943	3.955	3.948	3.894
581	MOTOR VOLTAGE - AC	Volts	3.945	3.953	3.963	3.956	3.911
582	MOTOR VOLTAGE - CB	Volts	3.921	3.930	3.941	3.931	3.889
583	MOTOR CURRENT - A	Volts	1.696	1.837	1.926	1.994	2.028
584	MOTOR CURRENT - B	Volts	1.739	1.901	1.992	2.051	2.115
585	MOTOR CURRENT - C	Volts	1.635	1.786	1.872	1.934	1.999
586	MOTOR POWER - PHASE 1	Volts	0.684	0.781	0.830	0.869	0.898
587	MOTOR POWER - PHASE 3	Volts	1.282	1.403	1.480	1.521	1.554
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	97.16	93.47	89.27	84.94	80.44
601	MAXIMUM MOTOR TEMPERATURE	Deg F	103.50	107.50	110.50	112.50	115.50
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	488.60	489.10	489.30	489.50	492.10
609	UNIT START COUNTER READING		131	131	131	131	132
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	2.30	2.57	2.84	3.15	21.05
701	ENERGY BALANCE	%	-1.55	-1.34	-1.32	-1.23	-1.28
702	EVAP CAPACITY	Tons	143.20	171.60	190.10	205.40	218.80
703	EVAP WATER FLOWRATE	GPM	488.30	489.20	486.90	488.10	486.90
704	COND WATER FLOWRATE	GPM	602.10	601.50	601.30	601.40	600.00

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	51.06	52.43	53.39	54.10	54.81
711	AVE LVG EVAP WATER TEMP	Deg F	44.05	44.04	44.05	44.02	44.05
712	AVE ENT COND WATER TEMP	Deg F	90.06	85.05	80.00	75.04	69.94
713	AVE LVG COND WATER TEMP	Deg F	97.24	93.51	89.30	85.00	80.51
715	MOTOR VOLTAGE - AB	Volts	472.40	473.20	474.60	473.80	467.30
716	MOTOR VOLTAGE - AC	Volts	473.40	474.40	475.60	474.70	469.30
717	MOTOR VOLTAGE - CB	Volts	470.50	471.60	472.90	471.70	466.70
718	MOTOR CURRENT - A	Amps	169.60	183.70	192.60	199.40	202.80
719	MOTOR CURRENT - B	Amps	173.90	190.10	199.20	205.10	211.50
720	MOTOR CURRENT - C	Amps	163.50	178.60	187.20	193.40	199.90
721	UNIT POWER	KW	117.96	131.03	138.60	143.39	147.12
722	AVERAGE VOLTAGE	Volts	472.10	473.10	474.40	473.40	467.80
723	AVERAGE CURRENT	Amps	169.00	184.13	193.00	199.30	204.73
725	KW/TON	KW/Ton	0.82	0.76	0.73	0.70	0.67
730	EVAP DELTA T	Deg F	7.02	8.39	9.34	10.08	10.76
731	COND DELTA T	Deg F	7.18	8.46	9.30	9.96	10.56
735	EVAP WATER FLOWRATE	Lbm/min	4075.20	4082.50	4062.80	4072.60	4062.70
736	COND WATER FLOWRATE	Lbm/min	5001.60	5000.30	5002.80	5007.20	4999.30
740	EVAP CAPACITY	Btu/min	28648.80	34316.40	38011.30	41076.40	43759.10
741	COND CAPACITY	Btu/min	35802.70	42229.00	46395.30	49738.80	52688.10
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	37.18	36.00	35.36	34.78	34.27
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	103.48	101.09	97.62	93.92	89.44
750	RUNNING TIME	Hr	159.70	160.20	160.40	160.60	163.20
751	STARTS		36	36	36	36	37
752	EVAP APPROACH TEMP	Deg F	6.90	8.00	8.70	9.20	9.80
753	COND APPROACH TEMP	Deg F	6.20	7.60	8.30	8.90	8.90
800	EVAP AVG H2O TEMP	Deg F	47.56	48.24	48.72	49.06	49.43
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000907	0.000897	0.000891	0.000886	0.000881
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0014	1.0013	1.0012	1.0010	1.0010
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3379	0.3383	0.3386	0.3388	0.3389
810	COND AVG H2O TEMP	Deg F	93.65	89.28	84.65	80.01	75.23
811	COND WATER DENSITY	Lbm/Ft3	62.09	62.14	62.19	62.24	62.28
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000490	0.000515	0.000544	0.000576	0.000612
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9977	0.9978	0.9980
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3606	0.3587	0.3565	0.3545	0.3522
815	ITD/DELTA T		1.98	1.96	1.93	1.92	1.91
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.06	-0.01	-0.01	0.02	0.00
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.01	-0.02	0.02	0.01	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.05	0.04	0.04	0.04	0.02
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.03	0.03	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.07	0.03	0.04	0.06	0.07

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		192	193	194	195	196
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	40
Capacity	Tons	195.90	185.70	172.70	155.50	124.80
Power	KW	130.67	128.39	124.86	118.44	105.54
KW/Ton	KW/Ton	0.670	0.690	0.720	0.760	0.850
TOE	Deg F	44.05	44.05	44.04	44.05	44.05
TIC	Deg F	70.03	74.97	79.94	85.05	90.06
Energy Balance	%	-1.46	-1.23	-1.04	-1.26	-1.32
TIE	Deg F	53.70	53.21	52.56	51.67	50.18
TOE	Deg F	44.05	44.05	44.04	44.05	44.05
GPME	GPM	485.90	485.40	484.60	487.90	487.30
TIC	Deg F	70.03	74.97	79.94	85.05	90.06
TOC	Deg F	79.47	83.97	88.37	92.71	96.33
GPMC	GPM	600.90	600.90	600.90	601.80	601.90
Evap Sat Press	Psia	5.53	5.58	5.65	5.74	5.92
Sat Temp	Deg F	35.14	35.50	36.00	36.63	37.88
Approach	Deg F	8.90	8.60	8.00	7.40	6.20
LMTD	Deg F	13.15	12.58	11.79	10.79	8.89
ITD/Delta T		1.92	1.93	1.94	1.97	2.01
Q/Ao	B/hr-ft2	14255.79	13513.30	12565.84	11316.73	9082.58
Uo	B/hr ft2 F	1084.08	1074.27	1065.68	1049.30	1022.20
ho'	B/hr ft2 F	1685.47	1663.64	1645.49	1604.38	1544.82
Cond Sat Press	Psia	17.79	19.34	20.89	22.45	23.50
Sat Temp	Deg F	87.19	91.38	95.32	99.05	101.45
Approach	Deg F	7.70	7.40	7.00	6.30	5.10
Refrigerant Leaving Temp	Deg F	86.34	90.47	93.89	97.40	99.95
LMTD	Deg F	11.82	11.32	10.61	9.67	7.84
Q/Ao	B/hr-ft2	13733.91	13068.98	12223.77	11127.57	9108.75
Uo	B/hr ft2 F	1162.10	1154.51	1151.80	1150.79	1161.59
ho'	B/hr ft2 F	1783.41	1749.25	1727.64	1709.21	1719.21
Cond Sat Temp	Deg F	87.19	91.38	95.32	99.05	101.45
Evap Sat Temp	Deg F	35.14	35.50	36.00	36.63	37.88
Estimated Motor Efficiency (1)		0.943	0.943	0.944	0.945	0.947
Estimated Motor RPM (1)		3561	3562	3563	3565	3569
Compressor Suction CFM (2)	CFM	3273	3091	2853	2542	1986
Isentropic KW/T (2)		0.409	0.440	0.467	0.492	0.499
Adiabatic Efficiency (3)		0.610	0.638	0.649	0.647	0.587
Q/N (4)		0.919	0.868	0.801	0.713	0.556
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.37	16.35	16.29	16.52	16.48
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.72	53.22	52.59	51.70	50.20
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.68	53.19	52.54	51.65	50.15
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.06	44.06	44.05	44.06	44.06
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	44.03	44.02	44.03	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.00	24.98	24.96	25.01	24.99
17	ENT COND WATER TEMP LOC 1	Deg F	70.03	74.98	79.94	85.04	90.03
18	ENT COND WATER TEMP LOC 2	Deg F	70.01	74.97	79.96	85.06	90.08
19	LVG COND WATER TEMP LOC 1	Deg F	79.48	83.98	88.38	92.71	96.32
20	LVG COND WATER TEMP LOC 2	Deg F	79.46	83.96	88.36	92.71	96.34
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.90	38.38	38.89	39.50	40.64
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	38.15	38.50	39.00	39.53	40.66
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.07	39.52	40.04	40.55	41.66
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.53	5.58	5.65	5.74	5.92
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.30	8.58	8.89	9.22	9.53
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.35	8.62	8.93	9.29	9.63
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.83	8.16	8.54	8.97	9.35
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	11.77	12.40	13.21	13.60	13.91
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	11.90	12.66	13.52	14.43	15.31
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	11.99	12.78	13.62	14.53	15.15
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	17.79	19.34	20.89	22.45	23.50
440	REFRIGERANT LVG COND TEMP	Deg F	86.34	90.47	93.89	97.40	99.95
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.91	13.65	14.40	15.20	15.79
485	HIGH PRESS ECONOMIZER TEMP	Deg F	71.08	73.53	76.08	78.62	80.46
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	8.32	8.60	8.95	9.27	9.50
487	LOW PRESS ECONOMIZER TEMP	Deg F	51.95	53.40	55.01	56.55	57.68
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.99	7.12	7.15	7.23	7.29
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	51.89	53.57	55.00	56.42	57.35
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.38	8.66	8.97	9.25	9.43
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	45.15	45.41	45.85	46.05	46.35
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	17.84	19.37	20.85	22.43	23.41
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	86.60	90.68	94.34	97.87	100.11
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	14.66	15.43	16.34	17.12	17.45
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	77.23	79.79	82.41	84.68	85.36
560	ATMOSPHERIC PRESS	PSIA	14.50	14.50	14.50	14.50	14.50
580	MOTOR VOLTAGE - AB	Volts	3.893	3.881	3.894	3.888	3.891
581	MOTOR VOLTAGE - AC	Volts	3.908	3.895	3.907	3.901	3.906
582	MOTOR VOLTAGE - CB	Volts	3.887	3.874	3.886	3.880	3.882
583	MOTOR CURRENT - A	Volts	1.816	1.792	1.746	1.665	1.506
584	MOTOR CURRENT - B	Volts	1.907	1.877	1.828	1.746	1.579
585	MOTOR CURRENT - C	Volts	1.799	1.774	1.730	1.653	1.506
586	MOTOR POWER - PHASE 1	Volts	0.779	0.765	0.736	0.690	0.591
587	MOTOR POWER - PHASE 3	Volts	1.399	1.375	1.345	1.284	1.168
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	79.30	83.87	88.31	92.70	96.30
601	MAXIMUM MOTOR TEMPERATURE	Deg F	105.50	103.50	102.50	100.50	96.50
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	492.40	493.00	493.30	493.60	494.20
609	UNIT START COUNTER READING		132	132	132	132	132
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	21.47	21.85	22.23	22.76	23.06
701	ENERGY BALANCE	%	-1.46	-1.23	-1.04	-1.26	-1.32
702	EVAP CAPACITY	Tons	195.90	185.70	172.70	155.50	124.80
703	EVAP WATER FLOWRATE	GPM	485.90	485.40	484.60	487.90	487.30
704	COND WATER FLOWRATE	GPM	600.90	600.90	600.90	601.80	601.90

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	53.70	53.21	52.56	51.67	50.18
711	AVE LVG EVAP WATER TEMP	Deg F	44.05	44.05	44.04	44.05	44.05
712	AVE ENT COND WATER TEMP	Deg F	70.03	74.97	79.94	85.05	90.06
713	AVE LVG COND WATER TEMP	Deg F	79.47	83.97	88.37	92.71	96.33
715	MOTOR VOLTAGE - AB	Volts	467.20	465.70	467.30	466.60	466.90
716	MOTOR VOLTAGE - AC	Volts	469.00	467.40	468.80	468.10	468.70
717	MOTOR VOLTAGE - CB	Volts	466.40	464.90	466.30	465.60	465.80
718	MOTOR CURRENT - A	Amps	181.60	179.20	174.60	166.50	150.60
719	MOTOR CURRENT - B	Amps	190.70	187.70	182.80	174.60	157.89
720	MOTOR CURRENT - C	Amps	179.90	177.40	173.00	165.30	150.60
721	UNIT POWER	KW	130.67	128.39	124.86	118.44	105.54
722	AVERAGE VOLTAGE	Volts	467.50	466.00	467.50	466.80	467.10
723	AVERAGE CURRENT	Amps	184.07	181.43	176.80	168.80	153.03
725	KW/TON	KW/Ton	0.67	0.69	0.72	0.76	0.85
730	EVAP DELTA T	Deg F	9.66	9.16	8.53	7.63	6.13
731	COND DELTA T	Deg F	9.43	9.00	8.42	7.66	6.28
735	EVAP WATER FLOWRATE	Lbm/min	4054.10	4050.40	4044.30	4071.50	4066.60
736	COND WATER FLOWRATE	Lbm/min	5006.30	5003.20	4999.80	5003.30	4999.60
740	EVAP CAPACITY	Btu/min	39186.80	37145.80	34541.40	31107.80	24966.50
741	COND CAPACITY	Btu/min	47192.00	44907.20	42002.90	38236.20	31299.20
743	EVAP SATN TEMP (BASED ON ID #61)	Deg F	35.14	35.50	36.00	36.63	37.88
744	COND SATN TEMP (BASED ON ID #431)	Deg F	87.19	91.38	95.32	99.05	101.45
750	RUNNING TIME	Hr	163.50	164.10	164.40	164.70	165.30
751	STARTS		37	37	37	37	37
752	EVAP APPROACH TEMP	Deg F	8.90	8.60	8.00	7.40	6.20
753	COND APPROACH TEMP	Deg F	7.70	7.40	7.00	6.30	5.10
800	EVAP AVG H2O TEMP	Deg F	48.88	48.63	48.30	47.86	47.12
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000888	0.000892	0.000897	0.000903	0.000913
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0010	1.0012	1.0013	1.0014	1.0015
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3387	0.3385	0.3383	0.3380	0.3377
810	COND AVG H2O TEMP	Deg F	74.75	79.47	84.16	88.88	93.19
811	COND WATER DENSITY	Lbm/Ft3	62.28	62.24	62.19	62.14	62.10
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000616	0.000580	0.000548	0.000518	0.000493
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9980	0.9979	0.9977	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3520	0.3542	0.3564	0.3585	0.3604
815	ITD/DELTA T		1.92	1.93	1.94	1.97	2.01
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.01	0.01	-0.02	-0.02	-0.05
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.02	0.02	0.02	0.00	-0.02
852	RTD DIFFERENCE CHECK - EEW T	Deg F	0.04	0.03	0.05	0.05	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.03	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.18	0.11	0.07	0.01	0.02

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5						
Run Number		197	198	199	200	201
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	10	10	10	10
Capacity	Tons	100.90	69.90	57.20	51.00	76.70
Power	KW	96.96	70.14	66.18	63.00	69.78
KW/Ton	KW/Ton	0.960	1.000	1.160	1.240	0.910
TOE	Deg F	44.04	44.05	44.04	44.02	44.04
TIC	Deg F	92.60	84.95	89.94	91.99	79.94
Energy Balance	%	-1.00	-1.91	-1.24	-2.26	-2.42
TIE	Deg F	48.99	47.48	46.85	46.53	47.81
TOE	Deg F	44.04	44.05	44.04	44.02	44.04
GPME	GPM	487.10	486.60	486.00	486.00	486.60
TIC	Deg F	92.60	84.95	89.94	91.99	79.94
TOC	Deg F	97.78	88.61	93.02	94.80	83.88
GPMC	GPM	602.90	601.50	601.30	602.20	600.90
Evap Sat Press	Psia	6.05	6.22	6.28	6.33	6.18
Sat Temp	Deg F	38.75	39.88	40.27	40.59	39.62
Approach	Deg F	5.30	4.20	3.80	3.40	4.40
LMTD	Deg F	7.49	5.71	5.05	4.57	6.11
ITD/Delta T		2.07	2.22	2.33	2.36	2.17
Q/Ao	B/hr-ft2	7340.50	5085.03	4162.42	3711.57	5580.73
Uo	B/hr ft2 F	979.45	889.85	825.02	812.03	913.01
ho'	B/hr ft2 F	1451.22	1265.00	1138.84	1114.59	1312.00
Cond Sat Press	Psia	23.71	19.27	20.88	21.54	17.54
Sat Temp	Deg F	101.92	91.20	95.29	96.90	86.51
Approach	Deg F	4.10	2.60	2.30	2.10	2.60
Refrigerant Leaving Temp	Deg F	100.08	90.00	93.82	95.26	85.70
LMTD	Deg F	6.38	4.15	3.59	3.31	4.30
Q/Ao	B/hr-ft2	7535.78	5306.49	4466.43	4079.23	5727.46
Uo	B/hr ft2 F	1180.51	1277.22	1243.23	1232.97	1330.88
ho'	B/hr ft2 F	1753.32	2013.77	1910.83	1879.37	2176.11
Cond Sat Temp	Deg F	101.92	91.20	95.29	96.90	86.51
Evap Sat Temp	Deg F	38.75	39.88	40.27	40.59	39.62
Estimated Motor Efficiency (1)		0.948	0.946	0.945	0.944	0.945
Estimated Motor RPM (1)		3572	3580	3581	3582	3580
Compressor Suction CFM (2)	CFM	1574	1050	856	759	1153
Isentropic KW/T (2)		0.494	0.398	0.428	0.439	0.363
Adiabatic Efficiency (3)		0.515	0.398	0.369	0.354	0.399
Q/N (4)		0.441	0.293	0.239	0.212	0.322
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.46	16.44	16.40	16.40	16.44
3	ENT EVAP WATER TEMP LOC 1	Deg F	49.02	47.50	46.88	46.57	47.84
4	ENT EVAP WATER TEMP LOC 2	Deg F	48.96	47.46	46.82	46.50	47.78
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.06	44.05	44.04	44.05
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.03	44.02	44.01	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.06	24.98	24.94	25.00	24.96
17	ENT COND WATER TEMP LOC 1	Deg F	92.58	84.93	89.91	91.96	79.93
18	ENT COND WATER TEMP LOC 2	Deg F	92.62	84.97	89.96	92.02	79.94
19	LVG COND WATER TEMP LOC 1	Deg F	97.79	88.61	93.02	94.80	83.89
20	LVG COND WATER TEMP LOC 2	Deg F	97.78	88.60	93.01	94.80	83.88
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	43.98	44.64	45.43	45.27	44.54
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	41.71	42.62	43.11	43.10	42.41
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	42.61	43.39	43.98	44.00	43.12
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.05	6.22	6.28	6.33	6.18
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.66	8.54	8.93	9.10	7.99
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.80	8.71	9.10	9.28	8.14
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.53	8.47	8.88	9.08	7.89
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	14.51	11.16	12.28	12.75	9.99
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	15.52	12.21	13.31	13.79	11.04
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.52	13.01	14.01	14.38	11.85
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	23.71	19.27	20.88	21.54	17.54
440	REFRIGERANT LVG COND TEMP	Deg F	100.08	90.00	93.82	95.26	85.70
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.97	14.27	14.99	15.26	13.32
485	HIGH PRESS ECONOMIZER TEMP	Deg F	80.94	75.73	77.94	78.82	72.49
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	9.60	8.51	8.93	9.12	7.95
487	LOW PRESS ECONOMOMIZER TEMP	Deg F	58.03	52.92	54.92	55.87	50.07
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.33	7.03	7.20	7.30	6.83
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	57.57	52.51	54.41	55.37	49.79
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	9.50	8.43	8.83	9.02	7.90
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	46.54	44.83	45.82	46.36	43.76
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	23.60	19.20	20.79	21.40	17.51
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	100.53	90.34	94.25	95.70	85.79
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	17.51	15.23	16.07	16.37	14.17
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	85.31	78.85	81.31	82.26	75.47
560	ATMOSPHERIC PRESS	PSIA	14.49	14.49	14.50	14.49	14.49
580	MOTOR VOLTAGE - AB	Volts	3.936	3.888	3.885	3.892	3.906
581	MOTOR VOLTAGE - AC	Volts	3.946	3.899	3.895	3.904	3.919
582	MOTOR VOLTAGE - CB	Volts	3.927	3.871	3.874	3.882	3.897
583	MOTOR CURRENT - A	Volts	1.407	1.106	1.060	1.039	1.093
584	MOTOR CURRENT - B	Volts	1.465	1.155	1.116	1.091	1.157
585	MOTOR CURRENT - C	Volts	1.375	1.113	1.066	1.052	1.114
586	MOTOR POWER - PHASE 1	Volts	0.521	0.323	0.295	0.276	0.314
587	MOTOR POWER - PHASE 3	Volts	1.095	0.846	0.808	0.774	0.849
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	97.76	88.60	93.02	94.91	83.79
601	MAXIMUM MOTOR TEMPERATURE	Deg F	92.50	79.50	79.50	79.50	75.50
605	1st STAGE VANE SETTING	Degrees	40.00	10.00	10.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	19.00	19.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	495.10	495.40	496.00	496.20	496.40
609	UNIT START COUNTER READING		132	132	132	132	132
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	23.92	24.44	24.85	25.14	25.52
701	ENERGY BALANCE	%	-1.00	-1.91	-1.24	-2.26	-2.42
702	EVAP CAPACITY	Tons	100.90	69.90	57.20	51.00	76.70
703	EVAP WATER FLOWRATE	GPM	487.10	486.60	486.00	486.00	486.60
704	COND WATER FLOWRATE	GPM	602.90	601.50	601.30	602.20	600.90

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	48.99	47.48	46.85	46.53	47.81
711	AVE LVG EVAP WATER TEMP	Deg F	44.04	44.05	44.04	44.02	44.04
712	AVE ENT COND WATER TEMP	Deg F	92.60	84.95	89.94	91.99	79.94
713	AVE LVG COND WATER TEMP	Deg F	97.78	88.61	93.02	94.80	83.88
715	MOTOR VOLTAGE - AB	Volts	472.30	466.60	466.20	467.00	468.70
716	MOTOR VOLTAGE - AC	Volts	473.50	467.90	467.40	468.50	470.30
717	MOTOR VOLTAGE - CB	Volts	471.20	464.50	464.90	465.80	467.60
718	MOTOR CURRENT - A	Amps	140.70	110.60	106.00	103.90	109.30
719	MOTOR CURRENT - B	Amps	146.50	115.50	111.60	109.10	115.70
720	MOTOR CURRENT - C	Amps	137.50	111.30	106.60	105.20	111.40
721	UNIT POWER	KW	96.96	70.14	66.18	63.00	69.78
722	AVERAGE VOLTAGE	Volts	472.30	466.30	466.20	467.10	468.90
723	AVERAGE CURRENT	Amps	141.57	112.47	108.07	106.07	112.13
725	KW/TON	KW/Ton	0.96	1.00	1.16	1.24	0.91
730	EVAP DELTA T	Deg F	4.94	3.44	2.81	2.51	3.77
731	COND DELTA T	Deg F	5.19	3.66	3.08	2.81	3.94
735	EVAP WATER FLOWRATE	Lbm/min	4065.40	4061.70	4056.70	4056.70	4061.70
736	COND WATER FLOWRATE	Lbm/min	5005.70	5000.30	4994.60	4999.90	4999.80
740	EVAP CAPACITY	Btu/min	20177.80	13977.90	11441.80	10202.50	15340.50
741	COND CAPACITY	Btu/min	25894.20	18234.00	15347.40	14016.90	19680.50
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	38.75	39.88	40.27	40.59	39.62
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	101.92	91.20	95.29	96.90	86.51
750	RUNNING TIME	Hr	166.20	166.50	167.10	167.30	167.50
751	STARTS		37	37	37	37	37
752	EVAP APPROACH TEMP	Deg F	5.30	4.20	3.80	3.40	4.40
753	COND APPROACH TEMP	Deg F	4.10	2.60	2.30	2.10	2.60
800	EVAP AVG H2O TEMP	Deg F	46.52	45.77	45.45	45.28	45.92
801	EVAP WATER DENSITY	Lbm/Ft3	62.44	62.44	62.44	62.44	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000922	0.000933	0.000938	0.000941	0.000931
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0017	1.0019	1.0019	1.0020	1.0017
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3374	0.3369	0.3368	0.3367	0.3370
810	COND AVG H2O TEMP	Deg F	95.19	86.78	91.48	93.39	81.91
811	COND WATER DENSITY	Lbm/Ft3	62.07	62.17	62.11	62.09	62.22
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000482	0.000531	0.000501	0.000492	0.000563
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9977	0.9977	0.9978
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3612	0.3574	0.3596	0.3604	0.3553
815	ITD/DELTA T		2.07	2.22	2.33	2.36	2.17
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.04	-0.04	-0.05	-0.06	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.01	0.01	0.01	0.00	0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.06	0.04	0.06	0.07	0.06
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.03	0.03	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.03	0.01	0.00	-0.11	0.10

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5					
Run Number		202	203	204	
					ARI
Refrigerant		245ca	245ca	245ca	
Oil		Solest 68	Solest 68	Solest 68	
1st Stage Guide Vane Setting	Degrees	10	10	90	
Capacity	Tons	83.10	87.80	173.50	
Power	KW	69.42	68.82	134.10	
KW/Ton	KW/Ton	0.840	0.780	0.770	
TOE	Deg F	44.05	44.05	44.05	
TIC	Deg F	74.98	69.97	85.08	
Energy Balance	%	-1.96	-2.03	-0.63	
TIE	Deg F	48.13	48.36	53.91	
TOE	Deg F	44.05	44.05	44.05	
GPME	GPM	487.10	487.20	421.20	
TIC	Deg F	74.98	69.97	85.08	
TOC	Deg F	79.17	74.35	95.02	
GPMC	GPM	600.00	599.90	516.20	
Evap Sat Press	Psia	6.15	6.13	5.64	
Sat Temp	Deg F	39.41	39.29	35.93	
Approach	Deg F	4.60	4.80	8.10	
LMTD	Deg F	6.47	6.69	12.40	
ITD/Delta T		2.13	2.09	1.82	
Q/Ao	B/hr-ft2	6044.89	6387.36	12620.48	
Uo	B/hr ft2 F	934.74	955.47	1017.48	
ho'	B/hr ft2 F	1356.37	1400.21	1615.04	
Cond Sat Press	Psia	15.97	14.43	23.82	
Sat Temp	Deg F	81.87	76.98	102.16	
Approach	Deg F	2.70	2.60	7.10	
Refrigerant Leaving Temp	Deg F	81.33	77.00	100.25	
LMTD	Deg F	4.47	4.47	11.40	
Q/Ao	B/hr-ft2	6079.74	6352.40	12379.09	
Uo	B/hr ft2 F	1359.34	1421.83	1086.22	
ho'	B/hr ft2 F	2282.37	2498.53	1655.25	
Cond Sat Temp	Deg F	81.87	76.98	102.16	
Evap Sat Temp	Deg F	39.41	39.29	35.93	
Estimated Motor Efficiency (1)		0.945	0.945	0.942	
Estimated Motor RPM (1)		3580	3580	3560	
Compressor Suction CFM (2)	CFM	1249	1316	2894	
Isentropic KW/T (2)		0.327	0.289	0.526	
Adiabatic Efficiency (3)		0.389	0.371	0.683	
Q/N (4)		0.349	0.368	0.813	
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.46	16.48	12.31
3	ENT EVAP WATER TEMP LOC 1	Deg F	48.15	48.38	53.93
4	ENT EVAP WATER TEMP LOC 2	Deg F	48.10	48.33	53.88
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.06	44.06	44.06
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.03	44.03	44.03
15	COND WATER FLOWMETER DELTA P	PSID	24.91	24.92	18.40
17	ENT COND WATER TEMP LOC 1	Deg F	74.98	69.97	85.07
18	ENT COND WATER TEMP LOC 2	Deg F	74.98	69.97	85.09
19	LVG COND WATER TEMP LOC 1	Deg F	79.18	74.35	95.00
20	LVG COND WATER TEMP LOC 2	Deg F	79.16	74.33	95.03
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	44.18	43.88	41.78
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	42.62	42.17	39.02
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	42.92	42.81	40.34
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.15	6.13	5.64
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.54	7.10	9.50
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.67	7.22	9.56
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.42	7.00	9.17
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	8.91	7.93	13.91
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	10.02	9.06	15.65
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	10.82	9.87	15.05
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	15.97	14.43	23.82
440	REFRIGERANT LVG COND TEMP	Deg F	81.33	77.00	100.25
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.53	11.78	15.51
485	HIGH PRESS ECONOMIZER TEMP	Deg F	70.01	67.57	79.65
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	7.49	7.06	9.59
487	LOW PRESS ECONOMIZER TEMP	Deg F	47.59	45.31	57.96
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.68	6.54	7.44
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	47.45	45.25	57.90
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.49	7.09	9.59
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	42.82	42.02	47.44
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	15.94	14.43	23.79
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	81.29	76.66	100.94
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	13.30	12.45	17.84
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	72.64	69.73	86.86
560	ATMOSPHERIC PRESS	PSIA	14.50	14.50	14.37
580	MOTOR VOLTAGE - AB	Volts	3.891	3.911	3.901
581	MOTOR VOLTAGE - AC	Volts	3.904	3.926	3.908
582	MOTOR VOLTAGE - CB	Volts	3.881	3.906	3.889
583	MOTOR CURRENT - A	Volts	1.090	1.086	1.873
584	MOTOR CURRENT - B	Volts	1.148	1.152	1.938
585	MOTOR CURRENT - C	Volts	1.109	1.104	1.833
586	MOTOR POWER - PHASE 1	Volts	0.315	0.306	0.808
587	MOTOR POWER - PHASE 3	Volts	0.842	0.841	1.427
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	79.03	74.19	94.97
601	MAXIMUM MOTOR TEMPERATURE	Deg F	77.50	82.50	110.00
605	1st STAGE VANE SETTING	Degrees	10.00	10.00	90.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00	68.00
608	UNIT HOUR METER READING	Hr	497.10	497.40	500.50
609	UNIT START COUNTER READING		132	132	133
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360
700	TIME (HOURS)	HOURS	25.95	26.47	0.00
701	ENERGY BALANCE	%	-1.96	-2.03	-0.63
702	EVAP CAPACITY	Tons	83.10	87.80	173.50
703	EVAP WATER FLOWRATE	GPM	487.10	487.20	421.20
704	COND WATER FLOWRATE	GPM	600.00	599.90	516.20

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	48.13	48.36	53.91
711	AVE LVG EVAP WATER TEMP	Deg F	44.05	44.05	44.05
712	AVE ENT COND WATER TEMP	Deg F	74.98	69.97	85.08
713	AVE LVG COND WATER TEMP	Deg F	79.17	74.35	95.02
715	MOTOR VOLTAGE - AB	Volts	466.90	469.30	468.10
716	MOTOR VOLTAGE - AC	Volts	468.50	471.10	469.00
717	MOTOR VOLTAGE - CB	Volts	465.70	468.70	466.70
718	MOTOR CURRENT - A	Amps	109.00	108.60	187.30
719	MOTOR CURRENT - B	Amps	114.80	115.20	193.80
720	MOTOR CURRENT - C	Amps	110.90	110.40	183.30
721	UNIT POWER	KW	69.42	68.82	134.10
722	AVERAGE VOLTAGE	Volts	467.00	469.70	467.90
723	AVERAGE CURRENT	Amps	111.57	111.40	188.13
725	KW/TON	KW/Ton	0.84	0.78	0.77
730	EVAP DELTA T	Deg F	4.08	4.31	9.85
731	COND DELTA T	Deg F	4.19	4.38	9.93
735	EVAP WATER FLOWRATE	Lbm/min	4065.40	4066.60	3514.50
736	COND WATER FLOWRATE	Lbm/min	4996.20	4998.30	4291.50
740	EVAP CAPACITY	Btu/min	16616.40	17557.80	34691.60
741	COND CAPACITY	Btu/min	20891.00	21827.90	42536.60
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	39.41	39.29	35.93
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	81.87	76.98	102.16
750	RUNNING TIME	Hr	168.20	168.50	171.60
751	STARTS		37	37	38
752	EVAP APPROACH TEMP	Deg F	4.60	4.80	8.10
753	COND APPROACH TEMP	Deg F	2.70	2.60	7.10
800	EVAP AVG H2O TEMP	Deg F	46.09	46.21	48.98
801	EVAP WATER DENSITY	Lbm/Ft3	62.44	62.44	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000928	0.000927	0.000887
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0017	1.0017	1.0010
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3371	0.3371	0.3387
810	COND AVG H2O TEMP	Deg F	77.08	72.16	90.05
811	COND WATER DENSITY	Lbm/Ft3	62.26	62.30	62.13
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000598	0.000637	0.000511
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9979	0.9982	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3531	0.3507	0.3590
815	ITD/DELTA T		2.13	2.09	1.82
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.00	0.00	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.02	0.01	-0.03
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.05	0.05	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.15	0.15	0.03

Medium Impellers - Imperial

LTO 23127 Note: Impeller diameters are 25.0/25.0/24.5		Full Load Performance Comparison at 44/85			
Run Number		121	154	185	204
					ARI
Refrigerant		11	123	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90
Capacity	Tons	187.90	208.10	178.20	173.50
Power	KW	151.62	173.04	136.38	134.10
KW/Ton	KW/Ton	0.810	0.830	0.770	0.770
TOE	Deg F	44.03	44.05	44.05	44.05
TIC	Deg F	85.02	85.07	85.05	85.08
Energy Balance	%	-1.38	-1.20	-1.29	-0.63
TIE	Deg F	53.06	53.95	52.77	53.91
TOE	Deg F	44.03	44.05	44.05	44.05
GPME	GPM	497.80	503.50	489.40	421.20
TIC	Deg F	85.02	85.07	85.05	85.08
TOC	Deg F	94.37	95.44	93.83	95.02
GPMC	GPM	602.20	604.10	601.80	516.20
Evap Sat Press	Psia	6.04	5.23	5.62	5.64
Sat Temp	Deg F	33.50	35.73	35.79	35.93
Approach	Deg F	10.50	8.30	8.30	8.10
LMTD	Deg F	14.58	12.63	12.10	12.40
ITD/Delta T		2.17	1.84	1.95	1.82
Q/Ao	B/hr-ft2	13671.36	15139.84	12963.46	12620.48
Uo	B/hr ft2 F	937.55	1198.74	1071.29	1017.48
ho'	B/hr ft2 F	1346.84	1948.63	1652.17	1615.04
Cond Sat Press	Psia	24.33	22.33	23.53	23.82
Sat Temp	Deg F	102.08	103.90	101.52	102.16
Approach	Deg F	7.70	8.50	7.70	7.10
Refrigerant Leaving Temp	Deg F	100.77	103.01	99.31	100.25
LMTD	Deg F	11.77	12.96	11.53	11.40
Q/Ao	B/hr-ft2	13597.94	15121.44	12761.78	12379.09
Uo	B/hr ft2 F	1155.05	1166.70	1107.02	1086.22
ho'	B/hr ft2 F	1715.64	1737.21	1612.63	1655.25
Cond Sat Temp	Deg F	102.08	103.90	101.52	102.16
Evap Sat Temp	Deg F	33.50	35.73	35.79	35.93
Estimated Motor Efficiency (1)		0.938	0.933	0.941	0.942
Estimated Motor RPM (1)		3554	3547	3559	3560
Compressor Suction CFM (2)	CFM	3097	3803	2981	2894
Isentropic KW/T (2)		0.548	0.548	0.523	0.526
Adiabatic Efficiency (3)		0.677	0.660	0.679	0.683
Q/N (4)		0.871	1.072	0.838	0.813
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Medium Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	17.20	17.59	16.62	12.31
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.09	53.97	52.79	53.93
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.04	53.93	52.74	53.88
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.04	44.07	44.07	44.06
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.04	44.03	44.03
15	COND WATER FLOWMETER DELTA P	PSID	25.04	25.20	25.01	18.40
17	ENT COND WATER TEMP LOC 1	Deg F	85.01	85.04	85.03	85.07
18	ENT COND WATER TEMP LOC 2	Deg F	85.02	85.10	85.06	85.09
19	LVG COND WATER TEMP LOC 1	Deg F	94.37	95.43	93.82	95.00
20	LVG COND WATER TEMP LOC 2	Deg F	94.37	95.45	93.84	95.03
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	38.99	37.73	38.25	41.78
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	36.74	38.90	37.93	39.02
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	36.99	39.99	38.09	40.34
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	6.04	5.23	5.62	5.64
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	10.09	8.85	9.43	9.50
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	10.14	8.93	9.50	9.56
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.64	8.20	9.09	9.17
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	15.76	14.05	13.74	13.91
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	16.21	14.58	15.49	15.65
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.52	13.64	14.81	15.05
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.33	22.33	23.53	23.82
440	REFRIGERANT LVG COND TEMP	Deg F	100.77	103.01	99.31	100.25
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.96	14.32	15.35	15.51
485	HIGH PRESS ECONOMIZER TEMP	Deg F	78.49	80.44	79.05	79.65
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	10.06	8.92	9.53	9.59
487	LOW PRESS ECONOMIZER TEMP	Deg F	55.80	58.46	57.72	57.96
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.87	7.50	7.45	7.44
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	55.72	58.80	57.65	57.90
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	10.08	9.06	9.55	9.59
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	44.64	50.94	47.43	47.44
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.29	22.50	23.52	23.79
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	101.51	103.91	100.27	100.94
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	18.37	17.17	17.73	17.84
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	86.31	90.77	86.48	86.86
560	ATMOSPHERIC PRESS	PSIA	14.38	14.50	14.39	14.37
580	MOTOR VOLTAGE - AB	Volts	3.850	3.880	3.922	3.901
581	MOTOR VOLTAGE - AC	Volts	3.858	3.884	3.931	3.908
582	MOTOR VOLTAGE - CB	Volts	3.840	3.874	3.908	3.889
583	MOTOR CURRENT - A	Volts	2.115	2.383	1.899	1.873
584	MOTOR CURRENT - B	Volts	2.187	2.482	1.971	1.938
585	MOTOR CURRENT - C	Volts	2.067	2.294	1.854	1.833
586	MOTOR POWER - PHASE 1	Volts	0.941	1.108	0.824	0.808
587	MOTOR POWER - PHASE 3	Volts	1.586	1.776	1.449	1.427
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	94.38	95.38	93.75	94.97
601	MAXIMUM MOTOR TEMPERATURE	Deg F	130.50	150.2	111.50	110.00
605	1st STAGE VANE SETTING	Degrees	90.00	90	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68	68.00	68.00
608	UNIT HOUR METER READING	Hr	453.40	470.2	487.50	500.50
609	UNIT START COUNTER READING		124	128	131	133
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360
700	TIME (HOURS)	HOURS	0.00	1.3509	1.18	0.00
701	ENERGY BALANCE	%	-1.38	-1.2	-1.29	-0.63
702	EVAP CAPACITY	Tons	187.90	208.1	178.20	173.50
703	EVAP WATER FLOWRATE	GPM	497.80	503.5	489.40	421.20
704	COND WATER FLOWRATE	GPM	602.20	604.1	601.80	516.20

Medium Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	53.06	53.95	52.77	53.91
711	AVE LVG EVAP WATER TEMP	Deg F	44.03	44.05	44.05	44.05
712	AVE ENT COND WATER TEMP	Deg F	85.02	85.07	85.05	85.08
713	AVE LVG COND WATER TEMP	Deg F	94.37	95.44	93.83	95.02
715	MOTOR VOLTAGE - AB	Volts	462.00	465.6	470.60	468.10
716	MOTOR VOLTAGE - AC	Volts	463.00	466.1	471.70	469.00
717	MOTOR VOLTAGE - CB	Volts	460.80	464.9	469.00	466.70
718	MOTOR CURRENT - A	Amps	211.50	238.3	189.90	187.30
719	MOTOR CURRENT - B	Amps	218.70	248.2	197.10	193.80
720	MOTOR CURRENT - C	Amps	206.70	229.4	185.40	183.30
721	UNIT POWER	KW	151.62	173.04	136.38	134.10
722	AVERAGE VOLTAGE	Volts	461.90	465.5	470.40	467.90
723	AVERAGE CURRENT	Amps	212.30	238.63	190.80	188.13
725	KW/TON	KW/Ton	0.81	0.83	0.77	0.77
730	EVAP DELTA T	Deg F	9.03	9.89	8.72	9.85
731	COND DELTA T	Deg F	9.35	10.37	8.79	9.93
735	EVAP WATER FLOWRATE	Lbm/min	4154.40	4201.2	4083.80	3514.50
736	COND WATER FLOWRATE	Lbm/min	5006.30	5022.3	5003.30	4291.50
740	EVAP CAPACITY	Btu/min	37580.30	41616.9	35634.40	34691.60
741	COND CAPACITY	Btu/min	46724.80	51959.8	43851.60	42536.60
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	33.50	35.73	35.79	35.93
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	102.08	103.9	101.52	102.16
750	RUNNING TIME	Hr	124.50	141.3	158.60	171.60
751	STARTS		29	33	36	38
752	EVAP APPROACH TEMP	Deg F	10.50	8.3	8.30	8.10
753	COND APPROACH TEMP	Deg F	7.70	8.5	7.70	7.10
800	EVAP AVG H2O TEMP	Deg F	48.55	49	48.41	48.98
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.4311	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000893	0.000887	0.000895	0.000887
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0012	1.0010	1.0012	1.0010
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3385	0.3387	0.3384	0.3387
810	COND AVG H2O TEMP	Deg F	89.69	90.25	89.44	90.05
811	COND WATER DENSITY	Lbm/Ft3	62.14	62.13	62.14	62.13
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000513	0.000509	0.000514	0.000511
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3588	0.3591	0.3587	0.3590
815	ITD/DELTA T		2.17	1.84	1.95	1.82
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.01	-0.06	-0.03	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.00	-0.02	-0.02	-0.03
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.05	0.04	0.05	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.02	0.03	0.04	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	-0.01	0.05	0.07	0.03

Small Impellers - Imperial

LTO 23127 Note: Impeller diameters are 24.0/24.0/24.0						
Run Number		205	206	207	208	209
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	Tons	205.50	209.90	203.40	192.40	179.00
Power	KW	150.60	154.86	154.20	151.02	146.28
KW/Ton	KW/Ton	0.733	0.738	0.758	0.785	0.817
TOE	Deg F	44.04	44.04	44.04	44.02	44.02
TIC	Deg F	69.96	74.96	79.93	84.98	90.06
Energy Balance	%	-1.13	-1.20	-1.33	-1.25	-0.90
TIE	Deg F	54.09	54.33	54.02	53.43	52.78
TOE	Deg F	44.04	44.04	44.04	44.02	44.02
GPME	GPM	489.40	488.20	487.90	490.00	489.40
TIC	Deg F	69.96	74.96	79.93	84.98	90.06
TOC	Deg F	79.91	85.17	89.87	94.45	98.91
GPMC	GPM	605.70	604.70	605.80	605.70	605.60
Evap Sat Press	Psia	4.91	5.19	5.27	5.32	5.38
Sat Temp	Deg F	33.18	35.41	36.04	36.43	36.88
Approach	Deg F	10.90	8.60	8.00	7.60	7.10
LMTD	Deg F	15.34	13.11	12.32	11.67	10.94
ITD/Delta T		2.08	1.84	1.80	1.81	1.82
Q/Ao	B/hr-ft2	14954.20	15273.97	14798.06	13997.83	13022.98
Uo	B/hr ft2 F	974.84	1165.18	1200.78	1199.53	1190.21
ho'	B/hr ft2 F	1431.58	1884.80	1981.13	1975.61	1953.16
Cond Sat Press	Psia	16.54	18.40	20.02	21.64	23.21
Sat Temp	Deg F	88.09	93.59	98.03	102.20	106.02
Approach	Deg F	8.20	8.40	8.20	7.80	7.10
Refrigerant Leaving Temp	Deg F	88.02	93.30	97.63	101.85	105.29
LMTD	Deg F	12.50	12.86	12.48	11.86	10.95
Q/Ao	B/hr-ft2	14590.74	14928.55	14548.30	13837.25	12933.39
Uo	B/hr ft2 F	1167.08	1161.19	1166.01	1166.56	1181.66
ho'	B/hr ft2 F	1788.81	1758.51	1751.97	1737.43	1755.34
Cond Sat Temp	Deg F	88.09	93.59	98.03	102.20	106.02
Evap Sat Temp	Deg F	33.18	35.41	36.04	36.43	36.88
Estimated Motor Efficiency (1)		0.938	0.937	0.937	0.938	0.939
Estimated Motor RPM (1)		3555	3553	3553	3554	3556
Compressor Suction CFM (2)	CFM	4102	3818	3664	3450	3190
Isentropic KW/T (2)		0.436	0.462	0.493	0.524	0.551
Adiabatic Efficiency (3)		0.595	0.626	0.650	0.668	0.674
Q/N (4)		1.154	1.075	1.031	0.971	0.897
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.62	16.54	16.52	16.66	16.62
3	ENT EVAP WATER TEMP LOC 1	Deg F	54.11	54.35	54.03	53.44	52.80
4	ENT EVAP WATER TEMP LOC 2	Deg F	54.07	54.32	54.00	53.41	52.75
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.06	44.05	44.04	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.02	44.02	44.01	44.00
15	COND WATER FLOWMETER DELTA P	PSID	25.40	25.30	25.37	25.33	25.30
17	ENT COND WATER TEMP LOC 1	Deg F	69.96	74.94	79.91	84.98	90.04
18	ENT COND WATER TEMP LOC 2	Deg F	69.96	74.97	79.94	84.99	90.07
19	LVG COND WATER TEMP LOC 1	Deg F	79.92	85.17	89.86	94.45	98.91
20	LVG COND WATER TEMP LOC 2	Deg F	79.91	85.17	89.88	94.45	98.91
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	37.24	39.16	40.09	40.20	40.61
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	35.84	37.90	38.84	39.09	39.58
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	36.21	38.23	39.32	39.68	40.18
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	4.91	5.19	5.27	5.32	5.38
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.80	8.30	8.55	8.77	9.04
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.85	8.34	8.60	8.85	9.10
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.11	7.60	7.91	8.24	8.58
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	10.51	11.67	12.36	12.93	13.52
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	11.33	12.50	13.45	14.05	14.66
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	10.65	11.65	12.49	13.26	14.03
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	16.54	18.40	20.02	21.64	23.21
440	REFRIGERANT LVG COND TEMP	Deg F	88.02	93.30	97.63	101.85	105.29
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	11.38	12.30	13.10	13.90	14.72
485	HIGH PRESS ECONOMIZER TEMP	Deg F	69.49	73.19	76.19	79.08	81.92
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	7.68	8.22	8.53	8.83	9.13
487	LOW PRESS ECONOMIZER TEMP	Deg F	51.90	54.86	56.46	58.01	59.46
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.66	7.08	7.21	7.29	7.32
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	52.16	55.12	56.71	58.14	59.51
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.87	8.43	8.68	8.93	9.18
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	46.56	49.00	49.69	49.74	49.82
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	16.89	18.64	20.24	21.78	23.15
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	88.69	94.05	98.41	102.34	105.98
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	13.61	14.78	15.40	16.43	17.29
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	79.36	83.27	85.97	88.71	91.39
560	ATMOSPHERIC PRESS	PSIA	14.41	14.41	14.41	14.41	14.41
580	MOTOR VOLTAGE - AB	Volts	3.871	3.848	3.861	3.831	3.846
581	MOTOR VOLTAGE - AC	Volts	3.880	3.860	3.864	3.833	3.850
582	MOTOR VOLTAGE - CB	Volts	3.862	3.841	3.851	3.823	3.839
583	MOTOR CURRENT - A	Volts	2.089	2.150	2.138	2.109	2.030
584	MOTOR CURRENT - B	Volts	2.178	2.241	2.239	2.203	2.140
585	MOTOR CURRENT - C	Volts	2.033	2.095	2.071	2.040	1.971
586	MOTOR POWER - PHASE 1	Volts	0.938	0.971	0.975	0.959	0.923
587	MOTOR POWER - PHASE 3	Volts	1.572	1.610	1.595	1.558	1.515
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	79.86	85.14	89.87	94.46	98.89
601	MAXIMUM MOTOR TEMPERATURE	Deg F	141.50	136.50	133.50	131.50	127.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	504.30	505.10	505.50	506.20	506.40
609	UNIT START COUNTER READING		134	134	134	134	134
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	382.42	383.03	383.74	384.16	384.55
701	ENERGY BALANCE	%	-1.13	-1.20	-1.33	-1.25	-0.90
702	EVAP CAPACITY	Tons	205.50	209.90	203.40	192.40	179.00
703	EVAP WATER FLOWRATE	GPM	489.40	488.20	487.90	490.00	489.40
704	COND WATER FLOWRATE	GPM	605.70	604.70	605.80	605.70	605.60

Small Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	54.09	54.33	54.02	53.43	52.78
711	AVE LVG EVAP WATER TEMP	Deg F	44.04	44.04	44.04	44.02	44.02
712	AVE ENT COND WATER TEMP	Deg F	69.96	74.96	79.93	84.98	90.06
713	AVE LVG COND WATER TEMP	Deg F	79.91	85.17	89.87	94.45	98.91
715	MOTOR VOLTAGE - AB	Volts	464.50	461.80	463.30	459.70	461.50
716	MOTOR VOLTAGE - AC	Volts	465.60	463.20	463.70	460.00	462.00
717	MOTOR VOLTAGE - CB	Volts	463.40	460.90	462.10	458.80	460.70
718	MOTOR CURRENT - A	Amps	208.90	215.00	213.80	210.90	203.00
719	MOTOR CURRENT - B	Amps	217.80	224.10	223.90	220.30	214.00
720	MOTOR CURRENT - C	Amps	203.30	209.50	207.10	204.00	197.10
721	UNIT POWER	KW	150.60	154.86	154.20	151.02	146.28
722	AVERAGE VOLTAGE	Volts	464.50	462.00	463.00	459.50	461.40
723	AVERAGE CURRENT	Amps	210.00	216.20	214.93	211.73	204.70
725	KW/TON	KW/Ton	0.73	0.74	0.76	0.78	0.82
730	EVAP DELTA T	Deg F	10.06	10.29	9.97	9.39	8.76
731	COND DELTA T	Deg F	9.95	10.21	9.93	9.47	8.85
735	EVAP WATER FLOWRATE	Lbm/min	4083.70	4073.90	4071.40	4088.60	4083.80
736	COND WATER FLOWRATE	Lbm/min	5046.20	5035.10	5040.70	5035.20	5030.50
740	EVAP CAPACITY	Btu/min	41106.60	41985.60	40677.40	38477.70	35798.00
741	COND CAPACITY	Btu/min	50136.20	51297.00	49990.40	47547.10	44441.30
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	33.18	35.41	36.04	36.43	36.88
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	88.09	93.59	98.03	102.20	106.02
750	RUNNING TIME	Hr	175.40	176.20	176.60	177.30	177.50
751	STARTS		39.00	39.00	39.00	39.00	39.00
752	EVAP APPROACH TEMP	Deg F	10.90	8.60	8.00	7.60	7.10
753	COND APPROACH TEMP	Deg F	8.20	8.40	8.20	7.80	7.10
800	EVAP AVG H2O TEMP	Deg F	49.06	49.19	49.03	48.73	48.40
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000886	0.000884	0.000886	0.000891	0.000895
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0010	1.0010	1.0010	1.0012	1.0012
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3388	0.3388	0.3387	0.3386	0.3384
810	COND AVG H2O TEMP	Deg F	74.94	80.06	84.90	89.72	94.48
811	COND WATER DENSITY	Lbm/Ft3	62.28	62.24	62.19	62.13	62.08
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000614	0.000576	0.000543	0.000513	0.000486
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9980	0.9978	0.9977	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3521	0.3545	0.3567	0.3588	0.3609
815	ITD/DELTA T		2.08	1.84	1.80	1.81	1.82
850	RTD DIFFERENCE CHECK - ECWT	Deg F	0.00	-0.02	-0.04	-0.01	-0.03
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.01	0.00	-0.02	0.00	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.04	0.03	0.03	0.03	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.04	0.03	0.03	0.04
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.06	0.03	-0.01	-0.01	0.02

Small Impellers - Imperial

LTO 23127 Note: impeller diameters are 24.0/24.0/24.0						
Run Number		210	211	212	213	214
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	70	70	70
Capacity	Tons	162.60	141.10	206.10	206.40	197.60
Power	KW	138.84	128.58	147.66	150.60	148.67
KW/Ton	KW/Ton	0.854	0.911	0.716	0.730	0.752
TOE	Deg F	44.02	44.02	44.02	44.05	44.02
TIC	Deg F	95.00	100.02	70.03	75.06	80.01
Energy Balance	%	-1.23	-1.19	-1.30	-0.97	-1.36
TIE	Deg F	51.96	50.91	54.11	54.17	53.73
TOE	Deg F	44.02	44.02	44.02	44.05	44.02
GPME	GPM	490.50	489.90	489.30	488.40	487.30
TIC	Deg F	95.00	100.02	70.03	75.06	80.01
TOC	Deg F	103.14	107.17	80.00	85.06	89.66
GPMC	GPM	606.10	606.30	604.40	604.80	605.50
Evap Sat Press	Psia	5.44	5.54	5.05	5.25	5.29
Sat Temp	Deg F	37.34	38.08	34.32	35.89	36.20
Approach	Deg F	6.70	5.90	9.70	8.20	7.80
LMTD	Deg F	10.14	8.95	14.15	12.55	12.03
ITD/Delta T		1.84	1.86	1.96	1.81	1.81
Q/Ao	B/hr-ft ²	11832.62	10263.26	14994.40	15019.03	14373.44
Uo	B/hr ft ² F	1167.28	1147.10	1059.64	1197.02	1194.92
ho'	B/hr ft ² F	1892.37	1843.19	1622.36	1969.49	1966.95
Cond Sat Press	Psia	24.77	26.14	16.61	18.29	19.81
Sat Temp	Deg F	109.61	112.63	88.30	93.27	97.47
Approach	Deg F	6.50	5.50	8.30	8.20	7.80
Refrigerant Leaving Temp	Deg F	108.36	112.04	88.21	93.05	97.24
LMTD	Deg F	9.99	8.54	12.64	12.55	11.99
Q/Ao	B/hr-ft ²	11880.36	10436.19	14595.74	14624.41	14115.47
Uo	B/hr ft ² F	1188.81	1221.75	1155.08	1165.01	1176.79
ho'	B/hr ft ² F	1755.46	1811.96	1762.20	1767.18	1776.73
Cond Sat Temp	Deg F	109.61	112.63	88.30	93.27	97.47
Evap Sat Temp	Deg F	37.34	38.08	34.32	35.89	36.20
Estimated Motor Efficiency (1)		0.941	0.943	0.939	0.938	0.938
Estimated Motor RPM (1)		3559	3562	3556	3555	3555
Compressor Suction CFM (2)	CFM	2878	2463	3821	3711	3544
Isentropic KW/T (2)		0.576	0.593	0.427	0.454	0.486
Adiabatic Efficiency (3)		0.675	0.651	0.596	0.622	0.646
Q/N (4)		0.809	0.691	1.075	1.044	0.997
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.70	16.66	16.61	16.54	16.48
3	ENT EVAP WATER TEMP LOC 1	Deg F	51.98	50.94	54.13	54.19	53.75
4	ENT EVAP WATER TEMP LOC 2	Deg F	51.94	50.89	54.09	54.15	53.71
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.04	44.04	44.04	44.07	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.01	44.01	44.01	44.03	44.01
15	COND WATER FLOWMETER DELTA P	PSID	25.31	25.30	25.29	25.31	25.34
17	ENT COND WATER TEMP LOC 1	Deg F	94.97	99.99	70.03	75.05	80.00
18	ENT COND WATER TEMP LOC 2	Deg F	95.04	100.05	70.01	75.07	80.01
19	LVG COND WATER TEMP LOC 1	Deg F	103.13	107.15	80.01	85.06	89.66
20	LVG COND WATER TEMP LOC 2	Deg F	103.15	107.19	80.00	85.06	89.66
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	41.21	41.90	38.38	39.61	40.07
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	40.09	40.83	37.04	38.57	38.86
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	40.78	41.41	37.55	39.21	39.39
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.44	5.54	5.05	5.25	5.29
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.32	9.64	7.88	8.27	8.47
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.38	9.71	7.89	8.29	8.51
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.96	9.39	7.17	7.59	7.86
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	14.00	14.87	10.71	11.59	12.22
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	15.23	15.79	11.72	12.89	13.49
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	14.63	15.53	10.82	11.72	12.46
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.77	26.14	16.61	18.29	19.81
440	REFRIGERANT LVG COND TEMP	Deg F	108.36	112.04	88.21	93.05	97.24
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	15.53	16.40	11.53	12.35	13.07
485	HIGH PRESS ECONOMIZER TEMP	Deg F	84.65	87.45	70.04	73.36	76.15
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.43	9.72	7.75	8.18	8.47
487	LOW PRESS ECONOMIZER TEMP	Deg F	60.95	62.34	52.27	54.68	56.19
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.34	7.34	6.75	7.07	7.15
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	60.89	62.16	52.54	54.91	56.30
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	9.45	9.71	7.94	8.37	8.57
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.82	49.70	47.17	49.00	49.02
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.72	26.06	16.98	18.50	20.02
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	109.37	112.34	88.81	93.70	97.81
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	17.92	18.69	13.65	14.67	15.56
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	93.52	95.20	79.55	82.90	85.72
560	ATMOSPHERIC PRESS	PSIA	14.40	14.40	14.40	14.39	14.39
580	MOTOR VOLTAGE - AB	Volts	3.878	3.913	3.898	3.885	3.881
581	MOTOR VOLTAGE - AC	Volts	3.881	3.919	3.900	3.889	3.885
582	MOTOR VOLTAGE - CB	Volts	3.870	3.905	3.886	3.875	3.873
583	MOTOR CURRENT - A	Volts	1.934	1.801	2.038	2.085	2.064
584	MOTOR CURRENT - B	Volts	2.030	1.895	2.134	2.173	2.158
585	MOTOR CURRENT - C	Volts	1.881	1.769	1.985	2.028	2.006
586	MOTOR POWER - PHASE 1	Volts	0.860	0.774	0.915	0.937	0.929
587	MOTOR POWER - PHASE 3	Volts	1.454	1.369	1.546	1.573	1.549
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	103.19	107.23	79.89	85.00	89.66
601	MAXIMUM MOTOR TEMPERATURE	Deg F	123.50	118.50	134.50	131.50	127.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	507.00	507.30	508.20	508.50	509.10
609	UNIT START COUNTER READING		134	134	134	134	134
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	384.96	385.46	386.21	386.70	387.11
701	ENERGY BALANCE	%	-1.23	-1.19	-1.30	-0.97	-1.36
702	EVAP CAPACITY	Tons	162.60	141.10	206.10	206.40	197.60
703	EVAP WATER FLOWRATE	GPM	490.50	489.90	489.30	488.40	487.30
704	COND WATER FLOWRATE	GPM	606.10	606.30	604.40	604.80	605.50

Small Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	51.96	50.91	54.11	54.17	53.73
711	AVE LVG EVAP WATER TEMP	Deg F	44.02	44.02	44.02	44.05	44.02
712	AVE ENT COND WATER TEMP	Deg F	95.00	100.02	70.03	75.06	80.01
713	AVE LVG COND WATER TEMP	Deg F	103.14	107.17	80.00	85.06	89.66
715	MOTOR VOLTAGE - AB	Volts	465.40	469.60	467.80	466.20	465.70
716	MOTOR VOLTAGE - AC	Volts	465.70	470.30	468.00	466.70	466.20
717	MOTOR VOLTAGE - CB	Volts	464.40	468.60	466.30	465.00	464.80
718	MOTOR CURRENT - A	Amps	193.40	180.10	203.80	208.50	206.40
719	MOTOR CURRENT - B	Amps	203.00	189.50	213.40	217.30	215.80
720	MOTOR CURRENT - C	Amps	188.10	176.90	198.50	202.80	200.60
721	UNIT POWER	KW	138.84	128.58	147.66	150.60	148.67
722	AVERAGE VOLTAGE	Volts	465.20	469.50	467.40	466.00	465.60
723	AVERAGE CURRENT	Amps	194.83	182.17	205.23	209.53	207.60
725	KW/TON	KW/Ton	0.85	0.91	0.72	0.73	0.75
730	EVAP DELTA T	Deg F	7.94	6.89	10.09	10.12	9.71
731	COND DELTA T	Deg F	8.14	7.15	9.97	10.00	9.64
735	EVAP WATER FLOWRATE	Lbm/min	4093.60	4088.70	4082.50	4075.10	4066.50
736	COND WATER FLOWRATE	Lbm/min	5029.70	5026.60	5035.30	5036.10	5037.70
740	EVAP CAPACITY	Btu/min	32525.90	28212.00	41217.10	41284.80	39510.20
741	COND CAPACITY	Btu/min	40822.90	35860.50	50153.40	50251.90	48503.10
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	37.34	38.08	34.32	35.89	36.20
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	109.61	112.63	88.30	93.27	97.47
750	RUNNING TIME	Hr	178.10	178.40	179.30	179.60	180.20
751	STARTS		39.00	39.00	39.00	39.00	39.00
752	EVAP APPROACH TEMP	Deg F	6.70	5.90	9.70	8.20	7.80
753	COND APPROACH TEMP	Deg F	6.50	5.50	8.30	8.20	7.80
800	EVAP AVG H2O TEMP	Deg F	47.99	47.47	49.06	49.11	48.88
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000901	0.000908	0.000886	0.000885	0.000888
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0013	1.0015	1.0010	1.0010	1.0010
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3382	0.3379	0.3388	0.3388	0.3387
810	COND AVG H2O TEMP	Deg F	99.07	103.60	75.01	80.06	84.84
811	COND WATER DENSITY	Lbm/Ft3	62.02	61.96	62.28	62.24	62.19
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000462	0.000440	0.000614	0.000576	0.000543
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9978	0.9980	0.9978	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3628	0.3647	0.3521	0.3545	0.3567
815	ITD/DELTA T		1.84	1.86	1.96	1.81	1.81
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.07	-0.06	0.01	-0.02	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.02	-0.04	0.01	0.00	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.04	0.05	0.04	0.04	0.04
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.03	0.04	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	-0.06	-0.08	0.12	0.06	0.00

Small Impellers - Imperial

LTO 23127 Note: Impeller diameters are 24.0/24.0/24.0						
Run Number		215	216	217	218	219
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	40
Capacity	Tons	186.80	173.40	157.00	134.50	189.20
Power	KW	145.74	140.75	134.10	123.84	132.53
KW/Ton	KW/Ton	0.780	0.812	0.854	0.921	0.700
TOE	Deg F	44.02	44.02	44.03	44.02	44.04
TIC	Deg F	85.02	90.01	95.02	99.70	70.05
Energy Balance	%	-1.37	-1.22	-1.05	-1.79	-1.22
TIE	Deg F	53.21	52.48	51.69	50.59	53.24
TOE	Deg F	44.02	44.02	44.03	44.02	44.04
GPME	GPM	486.70	490.50	490.40	489.90	492.20
TIC	Deg F	85.02	90.01	95.02	99.70	70.05
TOC	Deg F	94.20	98.59	102.86	106.56	79.14
GPMC	GPM	606.10	606.60	606.20	607.10	606.60
Evap Sat Press	Psia	5.34	5.40	5.47	5.57	5.31
Sat Temp	Deg F	36.58	37.03	37.56	38.30	36.34
Approach	Deg F	7.40	7.00	6.50	5.70	7.70
LMTD	Deg F	11.43	10.67	9.81	8.59	11.70
ITD/Delta T		1.81	1.83	1.84	1.87	1.84
Q/Ao	B/hr-ft2	13587.69	12614.77	11419.54	9786.99	13769.41
Uo	B/hr ft2 F	1189.24	1182.64	1164.50	1139.31	1176.53
ho'	B/hr ft2 F	1954.21	1931.68	1886.14	1824.14	1910.74
Cond Sat Press	Psia	21.43	22.99	24.52	25.71	15.93
Sat Temp	Deg F	101.67	105.49	109.05	111.70	86.18
Approach	Deg F	7.50	6.90	6.20	5.10	7.00
Refrigerant Leaving Temp	Deg F	101.41	104.53	107.94	111.00	86.40
LMTD	Deg F	11.45	10.62	9.58	8.09	10.96
Q/Ao	B/hr-ft2	13431.28	12544.33	11451.57	10019.65	13344.03
Uo	B/hr ft2 F	1172.70	1181.37	1195.20	1238.37	1217.07
ho'	B/hr ft2 F	1750.63	1754.24	1769.30	1849.49	1909.39
Cond Sat Temp	Deg F	101.67	105.49	109.05	111.70	86.18
Evap Sat Temp	Deg F	36.58	37.03	37.56	38.30	36.34
Estimated Motor Efficiency (1)		0.939	0.940	0.942	0.944	0.942
Estimated Motor RPM (1)		3556	3558	3560	3563	3561
Compressor Suction CFM (2)	CFM	3336	3077	2763	2333	3338
Isentropic KW/T (2)		0.517	0.545	0.568	0.582	0.390
Adiabatic Efficiency (3)		0.663	0.671	0.665	0.632	0.557
Q/N (4)		0.938	0.865	0.776	0.655	0.937
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.44	16.70	16.69	16.66	16.81
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.23	52.50	51.71	50.62	53.26
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.18	52.46	51.67	50.56	53.22
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.04	44.04	44.05	44.04	44.05
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	44.00	44.01	44.00	44.02
15	COND WATER FLOWMETER DELTA P	PSID	25.37	25.38	25.32	25.37	25.48
17	ENT COND WATER TEMP LOC 1	Deg F	85.01	89.98	94.99	99.69	70.06
18	ENT COND WATER TEMP LOC 2	Deg F	85.03	90.04	95.05	99.72	70.04
19	LVG COND WATER TEMP LOC 1	Deg F	94.20	98.57	102.84	106.55	79.15
20	LVG COND WATER TEMP LOC 2	Deg F	94.20	98.60	102.88	106.57	79.12
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.52	41.23	41.51	42.05	39.81
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	39.30	39.77	40.23	40.87	38.81
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.88	40.45	41.07	41.75	39.61
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.34	5.40	5.47	5.57	5.31
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.71	8.97	9.27	9.58	7.72
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.77	9.03	9.32	9.60	7.73
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.18	8.54	8.92	9.31	7.11
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	12.79	13.51	14.10	14.61	11.00
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	14.13	14.75	15.35	16.03	10.99
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	13.25	14.05	14.83	15.42	10.74
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	21.43	22.99	24.52	25.71	15.93
440	REFRIGERANT LVG COND TEMP	Deg F	101.41	104.53	107.94	111.00	86.40
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	13.89	14.69	15.51	16.25	11.68
485	HIGH PRESS ECONOMIZER TEMP	Deg F	79.00	81.83	84.56	86.93	70.69
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	8.77	9.06	9.37	9.62	7.63
487	LOW PRESS ECONOMIZER TEMP	Deg F	57.64	59.14	60.63	61.73	51.57
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.15	7.22	7.27	7.22	6.69
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	57.75	59.12	60.54	61.53	51.73
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.84	9.10	9.38	9.55	7.75
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.38	49.32	49.45	49.17	46.50
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	21.49	22.97	24.54	25.61	16.18
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	101.77	105.53	109.01	111.34	86.99
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	15.95	17.04	17.83	18.57	13.24
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	88.14	91.04	93.00	94.03	78.01
560	ATMOSPHERIC PRESS	PSIA	14.38	14.38	14.38	14.38	14.38
580	MOTOR VOLTAGE - AB	Volts	3.877	3.882	3.894	3.907	3.900
581	MOTOR VOLTAGE - AC	Volts	3.885	3.889	3.898	3.911	3.915
582	MOTOR VOLTAGE - CB	Volts	3.868	3.873	3.882	3.894	3.892
583	MOTOR CURRENT - A	Volts	2.020	1.963	1.878	1.742	1.836
584	MOTOR CURRENT - B	Volts	2.109	2.046	1.956	1.822	1.926
585	MOTOR CURRENT - C	Volts	1.976	1.907	1.820	1.695	1.817
586	MOTOR POWER - PHASE 1	Volts	0.900	0.867	0.822	0.741	0.790
587	MOTOR POWER - PHASE 3	Volts	1.529	1.479	1.413	1.323	1.419
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	94.16	98.65	102.88	106.60	79.14
601	MAXIMUM MOTOR TEMPERATURE	Deg F	125.50	123.50	120.50	114.40	138.50
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	70.00	70.00	40.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	63.00	63.00	50.00
608	UNIT HOUR METER READING	Hr	510.30	510.60	511.20	511.40	512.20
609	UNIT START COUNTER READING		134	134	134	134	134
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	388.48	388.88	389.18	389.54	405.69
701	ENERGY BALANCE	%	-1.37	-1.22	-1.05	-1.79	-1.22
702	EVAP CAPACITY	Tons	186.80	173.40	157.00	134.50	189.20
703	EVAP WATER FLOWRATE	GPM	486.70	490.50	490.40	489.90	492.20
704	COND WATER FLOWRATE	GPM	606.10	606.60	606.20	607.10	606.60

Small Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	53.21	52.48	51.69	50.59	53.24
711	AVE LVG EVAP WATER TEMP	Deg F	44.02	44.02	44.03	44.02	44.04
712	AVE ENT COND WATER TEMP	Deg F	85.02	90.01	95.02	99.70	70.05
713	AVE LVG COND WATER TEMP	Deg F	94.20	98.59	102.86	106.56	79.14
715	MOTOR VOLTAGE - AB	Volts	465.20	465.80	467.30	468.80	468.00
716	MOTOR VOLTAGE - AC	Volts	466.20	466.70	467.80	469.30	469.80
717	MOTOR VOLTAGE - CB	Volts	464.20	464.80	465.80	467.30	467.00
718	MOTOR CURRENT - A	Amps	202.00	196.30	187.80	174.20	183.60
719	MOTOR CURRENT - B	Amps	210.90	204.70	195.60	182.20	192.60
720	MOTOR CURRENT - C	Amps	197.60	190.70	182.00	169.50	181.70
721	UNIT POWER	KW	145.74	140.75	134.10	123.84	132.53
722	AVERAGE VOLTAGE	Volts	465.20	465.80	467.00	468.50	468.30
723	AVERAGE CURRENT	Amps	203.50	197.23	188.47	175.30	185.97
725	KW/TON	KW/Ton	0.78	0.81	0.85	0.92	0.70
730	EVAP DELTA T	Deg F	9.18	8.46	7.66	6.57	9.20
731	COND DELTA T	Deg F	9.18	8.58	7.84	6.86	9.09
735	EVAP WATER FLOWRATE	Lbm/min	4061.60	4093.60	4092.40	4088.70	4107.00
736	COND WATER FLOWRATE	Lbm/min	5039.20	5038.50	5030.60	5033.70	5054.10
740	EVAP CAPACITY	Btu/min	37350.30	34675.90	31390.40	26902.80	37849.80
741	COND CAPACITY	Btu/min	46152.10	43104.40	39349.50	34429.20	45852.30
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	36.58	37.03	37.56	38.30	36.34
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	101.67	105.49	109.05	111.70	86.18
750	RUNNING TIME	Hr	181.40	181.70	182.30	182.50	183.30
751	STARTS		39.00	39.00	39.00	39.00	39.00
752	EVAP APPROACH TEMP	Deg F	7.40	7.00	6.50	5.70	7.70
753	COND APPROACH TEMP	Deg F	7.50	6.90	6.20	5.10	7.00
800	EVAP AVG H2O TEMP	Deg F	48.62	48.25	47.86	47.31	48.64
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.44	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000892	0.000897	0.000903	0.000911	0.000892
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0012	1.0013	1.0014	1.0015	1.0012
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3385	0.3383	0.3380	0.3378	0.3385
810	COND AVG H2O TEMP	Deg F	89.61	94.30	98.94	103.13	74.60
811	COND WATER DENSITY	Lbm/Ft3	62.14	62.08	62.02	61.97	62.28
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000513	0.000487	0.000462	0.000442	0.000617
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9977	0.9978	0.9981
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3588	0.3608	0.3628	0.3644	0.3519
815	ITD/DELTA T		1.81	1.83	1.84	1.87	1.84
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.02	-0.06	-0.06	-0.03	0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.00	-0.03	-0.04	-0.02	0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.05	0.04	0.04	0.06	0.04
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.04	0.04	0.04	0.04	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.04	-0.08	-0.04	-0.05	0.01

Small Impellers - Imperial

LTO 23127 Note: Impeller diameters are 24.0/24.0/24.0						
Run Number		220	221	222	223	224
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	40
Capacity	Tons	183.10	175.50	166.00	154.20	139.60
Power	KW	131.88	130.74	128.52	125.10	119.28
KW/Ton	KW/Ton	0.720	0.745	0.774	0.811	0.854
TOE	Deg F	44.03	44.03	44.02	44.02	44.04
TIC	Deg F	75.01	80.05	85.03	90.09	94.95
Energy Balance	%	-1.38	-0.95	-1.51	-1.02	-1.52
TIE	Deg F	52.95	52.60	52.08	51.51	50.81
TOE	Deg F	44.03	44.03	44.02	44.02	44.04
GPME	GPM	491.00	490.30	493.20	493.00	492.60
TIC	Deg F	75.01	80.05	85.03	90.09	94.95
TOC	Deg F	83.87	88.57	93.19	97.70	101.93
GPMC	GPM	606.20	606.60	606.60	606.80	607.30
Evap Sat Press	Psia	5.34	5.37	5.42	5.47	5.54
Sat Temp	Deg F	36.58	36.81	37.18	37.56	38.08
Approach	Deg F	7.50	7.20	6.80	6.50	6.00
LMTD	Deg F	11.33	10.95	10.35	9.73	8.92
ITD/Delta T		1.84	1.84	1.85	1.86	1.88
Q/Ao	B/hr-ft2	13319.14	12770.84	12075.96	11218.90	10154.09
Uo	B/hr ft2 F	1175.48	1166.10	1166.50	1153.12	1138.23
ho'	B/hr ft2 F	1910.79	1887.97	1885.60	1852.60	1816.53
Cond Sat Press	Psia	17.41	18.96	20.53	22.13	23.61
Sat Temp	Deg F	90.72	95.18	99.37	103.41	106.96
Approach	Deg F	6.80	6.60	6.20	5.70	5.00
Refrigerant Leaving Temp	Deg F	90.73	95.15	99.14	102.69	106.22
LMTD	Deg F	10.67	10.29	9.69	8.98	8.02
Q/Ao	B/hr-ft2	12985.55	12477.63	11933.76	11136.83	10220.90
Uo	B/hr ft2 F	1216.55	1212.75	1231.01	1239.61	1274.42
ho'	B/hr ft2 F	1889.01	1861.04	1885.12	1886.86	1949.47
Cond Sat Temp	Deg F	90.72	95.18	99.37	103.41	106.96
Evap Sat Temp	Deg F	36.58	36.81	37.18	37.56	38.08
Estimated Motor Efficiency (1)		0.942	0.943	0.943	0.944	0.945
Estimated Motor RPM (1)		3561	3561	3562	3563	3565
Compressor Suction CFM (2)	CFM	3229	3093	2915	2695	2420
Isentropic KW/T (2)		0.425	0.459	0.490	0.520	0.544
Adiabatic Efficiency (3)		0.590	0.616	0.633	0.641	0.637
Q/N (4)		0.907	0.869	0.818	0.756	0.679
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.73	16.68	16.87	16.87	16.84
3	ENT EVAP WATER TEMP LOC 1	Deg F	52.97	52.62	52.10	51.53	50.84
4	ENT EVAP WATER TEMP LOC 2	Deg F	52.94	52.58	52.06	51.48	50.79
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.05	44.04	44.04	44.05
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.01	44.01	44.01	44.00	44.02
15	COND WATER FLOWMETER DELTA P	PSID	25.42	25.43	25.41	25.40	25.41
17	ENT COND WATER TEMP LOC 1	Deg F	75.01	80.05	85.04	90.07	94.93
18	ENT COND WATER TEMP LOC 2	Deg F	75.01	80.05	85.03	90.11	94.97
19	LVG COND WATER TEMP LOC 1	Deg F	83.88	88.58	93.19	97.70	101.93
20	LVG COND WATER TEMP LOC 2	Deg F	83.87	88.55	93.18	97.70	101.94
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.03	41.19	41.22	41.52	41.37
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	39.02	39.54	39.79	40.21	40.43
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.68	40.00	40.49	40.81	41.47
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.34	5.37	5.42	5.47	5.54
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.91	8.16	8.43	8.75	9.06
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.94	8.20	8.47	8.80	9.12
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.37	7.67	8.01	8.39	8.79
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	11.49	12.07	12.73	13.36	13.69
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	11.56	12.23	13.02	13.90	14.73
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	11.40	12.13	12.92	13.79	14.33
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	17.41	18.96	20.53	22.13	23.61
440	REFRIGERANT LVG COND TEMP	Deg F	90.73	95.15	99.14	102.69	106.22
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	12.30	13.00	13.76	14.58	15.34
485	HIGH PRESS ECONOMIZER TEMP	Deg F	73.19	75.80	78.56	81.44	83.99
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	7.88	8.20	8.50	8.83	9.12
487	LOW PRESS ECONOMIZER TEMP	Deg F	52.96	54.58	56.18	57.94	59.44
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.77	6.84	6.95	7.03	7.02
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	53.16	54.55	56.17	57.83	59.28
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.97	8.25	8.54	8.87	9.13
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	46.49	47.09	47.52	47.95	47.90
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	17.57	19.07	20.51	22.10	23.56
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	91.19	95.49	99.51	103.30	106.77
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	14.02	14.86	15.64	16.58	17.50
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	80.82	83.66	86.51	89.21	91.12
560	ATMOSPHERIC PRESS	PSIA	14.38	14.37	14.37	14.37	14.36
580	MOTOR VOLTAGE - AB	Volts	3.839	3.845	3.855	3.864	3.860
581	MOTOR VOLTAGE - AC	Volts	3.849	3.855	3.863	3.872	3.867
582	MOTOR VOLTAGE - CB	Volts	3.836	3.842	3.848	3.856	3.856
583	MOTOR CURRENT - A	Volts	1.841	1.826	1.804	1.754	1.667
584	MOTOR CURRENT - B	Volts	1.951	1.928	1.900	1.846	1.784
585	MOTOR CURRENT - C	Volts	1.807	1.793	1.761	1.724	1.650
586	MOTOR POWER - PHASE 1	Volts	0.811	0.802	0.787	0.756	0.713
587	MOTOR POWER - PHASE 3	Volts	1.387	1.377	1.355	1.329	1.275
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	83.84	88.55	93.13	97.63	101.92
601	MAXIMUM MOTOR TEMPERATURE	Deg F	116.50	113.50	112.50	110.40	108.50
605	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	512.50	513.20	513.40	514.00	514.40
609	UNIT START COUNTER READING		135	135	135	135	135
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	406.18	406.66	407.08	407.40	408.02
701	ENERGY BALANCE	%	-1.38	-0.95	-1.51	-1.02	-1.52
702	EVAP CAPACITY	Tons	183.10	175.50	166.00	154.20	139.60
703	EVAP WATER FLOWRATE	GPM	491.00	490.30	493.20	493.00	492.60
704	COND WATER FLOWRATE	GPM	606.20	606.60	606.60	606.80	607.30

Small Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	52.95	52.60	52.08	51.51	50.81
711	AVE LVG EVAP WATER TEMP	Deg F	44.03	44.03	44.02	44.02	44.04
712	AVE ENT COND WATER TEMP	Deg F	75.01	80.05	85.03	90.09	94.95
713	AVE LVG COND WATER TEMP	Deg F	83.87	88.57	93.19	97.70	101.93
715	MOTOR VOLTAGE - AB	Volts	460.70	461.40	462.60	463.70	463.20
716	MOTOR VOLTAGE - AC	Volts	461.90	462.60	463.60	464.60	464.00
717	MOTOR VOLTAGE - CB	Volts	460.30	461.00	461.80	462.70	462.70
718	MOTOR CURRENT - A	Amps	184.10	182.60	180.40	175.40	166.70
719	MOTOR CURRENT - B	Amps	195.10	192.80	190.00	184.60	178.40
720	MOTOR CURRENT - C	Amps	180.70	179.30	176.10	172.40	165.00
721	UNIT POWER	KW	131.88	130.74	128.52	125.10	119.28
722	AVERAGE VOLTAGE	Volts	461.00	461.70	462.70	463.70	463.30
723	AVERAGE CURRENT	Amps	186.63	184.90	182.17	177.47	170.03
725	KW/TON	KW/Ton	0.72	0.74	0.77	0.81	0.85
730	EVAP DELTA T	Deg F	8.92	8.57	8.05	7.49	6.78
731	COND DELTA T	Deg F	8.85	8.52	8.14	7.61	6.99
735	EVAP WATER FLOWRATE	Lbm/min	4097.20	4091.10	4115.60	4114.40	4110.80
736	COND WATER FLOWRATE	Lbm/min	5047.00	5046.70	5043.20	5040.40	5039.60
740	EVAP CAPACITY	Btu/min	36612.10	35104.90	33194.80	30838.90	27911.90
741	COND CAPACITY	Btu/min	44620.50	42875.20	41006.40	38268.00	35120.70
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	36.58	36.81	37.18	37.56	38.08
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	90.72	95.18	99.37	103.41	106.96
750	RUNNING TIME	Hr	183.60	184.30	184.50	185.10	185.50
751	STARTS		40.00	40.00	40.00	40.00	40.00
752	EVAP APPROACH TEMP	Deg F	7.50	7.20	6.80	6.50	6.00
753	COND APPROACH TEMP	Deg F	6.80	6.60	6.20	5.70	5.00
800	EVAP AVG H2O TEMP	Deg F	48.49	48.31	48.05	47.77	47.43
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43	62.43	62.43	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000894	0.000896	0.000900	0.000904	0.000909
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0012	1.0013	1.0013	1.0014	1.0015
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3384	0.3383	0.3382	0.3380	0.3379
810	COND AVG H2O TEMP	Deg F	79.44	84.31	89.11	93.90	98.44
811	COND WATER DENSITY	Lbm/Ft3	62.24	62.19	62.14	62.09	62.03
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000580	0.000547	0.000516	0.000489	0.000465
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9979	0.9977	0.9977	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3542	0.3564	0.3586	0.3607	0.3626
815	ITD/DELTA T		1.84	1.84	1.85	1.86	1.88
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.01	0.00	0.01	-0.04	-0.04
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.01	0.03	0.01	0.00	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.03	0.04	0.04	0.05	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.04	0.04	0.03	0.04	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	0.04	0.03	0.06	0.07	0.01

Small Impellers - Imperial

LTO 23127 Note: Impeller diameters are 24.0/24.0/24.0						
Run Number		225	226	227	228	229
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	10	10	10	10
Capacity	Tons	82.50	79.90	78.10	74.70	70.10
Power	KW	94.08	63.36	65.22	67.26	67.26
KW/Ton	KW/Ton	1.140	0.793	0.835	0.900	0.959
TOE	Deg F	44.04	44.04	44.04	44.03	44.04
TIC	Deg F	101.93	70.00	74.99	80.01	85.02
Energy Balance	%	-1.41	-2.77	-2.51	-2.54	-2.56
TIE	Deg F	48.05	47.92	47.83	47.66	47.44
TOE	Deg F	44.04	44.04	44.04	44.03	44.04
GPME	GPM	491.50	492.60	492.40	492.10	492.20
TIC	Deg F	101.93	70.00	74.99	80.01	85.02
TOC	Deg F	106.32	73.98	78.91	83.83	88.63
GPMC	GPM	608.40	604.30	604.80	606.00	607.00
Evap Sat Press	Psia	5.80	5.77	5.81	5.84	5.86
Sat Temp	Deg F	39.97	39.75	40.04	40.25	40.39
Approach	Deg F	4.10	4.30	4.00	3.80	3.60
LMTD	Deg F	5.85	6.02	5.69	5.39	5.16
ITD/Delta T		2.01	2.10	2.06	2.04	2.07
Q/Ao	B/hr-ft2	6002.51	5814.61	5683.98	5433.65	5098.60
Uo	B/hr ft2 F	1026.49	965.38	999.64	1007.56	987.18
ho'	B/hr ft2 F	1553.66	1416.94	1492.50	1510.72	1465.65
Cond Sat Press	Psia	24.48	13.30	14.38	15.78	17.29
Sat Temp	Deg F	108.96	77.22	81.05	85.70	90.36
Approach	Deg F	2.60	3.20	2.10	1.90	1.70
Refrigerant Leaving Temp	Deg F	108.01	76.58	81.28	85.85	90.43
LMTD	Deg F	4.48	4.97	3.77	3.43	3.20
Q/Ao	B/hr-ft2	6426.99	5829.00	5740.73	5570.48	5296.48
Uo	B/hr ft2 F	1433.86	1173.53	1524.37	1622.69	1653.65
ho'	B/hr ft2 F	2313.63	1816.68	2777.86	3065.46	3121.35
Cond Sat Temp	Deg F	108.96	77.22	81.05	85.70	90.36
Evap Sat Temp	Deg F	39.97	39.75	40.04	40.25	40.39
Estimated Motor Efficiency (1)		0.948	0.944	0.944	0.945	0.945
Estimated Motor RPM (1)		3573	3582	3581	3581	3581
Compressor Suction CFM (2)	CFM	1373	1293	1259	1205	1133
Isentropic KW/T (2)		0.541	0.290	0.315	0.350	0.386
Adiabatic Efficiency (3)		0.474	0.366	0.377	0.389	0.402
Q/N (4)		0.384	0.361	0.352	0.337	0.316
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.77	16.85	16.83	16.81	16.82
3	ENT EVAP WATER TEMP LOC 1	Deg F	48.08	47.94	47.86	47.69	47.47
4	ENT EVAP WATER TEMP LOC 2	Deg F	48.02	47.89	47.80	47.63	47.41
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.05	44.05	44.05	44.05	44.05
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.02	44.02	44.02	44.01	44.02
15	COND WATER FLOWMETER DELTA P	PSID	25.46	25.29	25.31	25.38	25.44
17	ENT COND WATER TEMP LOC 1	Deg F	101.88	70.00	74.98	80.01	85.00
18	ENT COND WATER TEMP LOC 2	Deg F	101.97	69.99	74.99	80.03	85.04
19	LVG COND WATER TEMP LOC 1	Deg F	106.30	73.99	78.92	83.83	88.63
20	LVG COND WATER TEMP LOC 2	Deg F	106.33	73.97	78.90	83.82	88.64
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	43.32	41.35	41.87	42.10	42.32
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	42.40	41.89	42.34	42.76	42.87
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	43.32	42.55	43.03	43.17	43.83
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.80	5.77	5.81	5.84	5.86
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	9.49	5.73	6.16	6.61	7.06
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	9.68	5.79	6.25	6.72	7.20
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	9.38	5.62	6.04	6.50	6.95
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	14.18	6.71	7.59	8.54	9.51
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	15.48	8.06	8.87	9.72	10.74
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	15.35	8.56	9.41	10.29	11.25
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	24.48	13.30	14.38	15.78	17.29
440	REFRIGERANT LVG COND TEMP	Deg F	108.01	76.58	81.28	85.85	90.43
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	16.03	9.68	10.45	11.26	12.11
485	HIGH PRESS ECONOMIZER TEMP	Deg F	86.23	62.55	65.51	68.93	72.48
486	LOW PRESS ECONOMIZER STATIC PRESS	PSIA	9.43	5.73	6.15	6.57	7.03
487	LOW PRESS ECONOMIZER TEMP	Deg F	60.94	39.52	42.42	45.17	48.04
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.10	5.91	6.08	6.21	6.36
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	60.39	39.77	42.50	45.19	47.86
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	9.32	5.92	6.25	6.62	7.03
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	48.23	39.87	41.56	42.74	43.56
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	24.36	12.93	14.35	15.80	17.29
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	108.66	76.22	81.08	85.79	90.45
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	17.60	10.45	11.35	12.22	13.16
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	91.10	66.16	69.79	73.07	76.51
560	ATMOSPHERIC PRESS	PSIA	14.36	14.35	14.35	14.34	14.33
580	MOTOR VOLTAGE - AB	Volts	3.849	3.878	3.879	3.887	3.890
581	MOTOR VOLTAGE - AC	Volts	3.855	3.885	3.885	3.893	3.893
582	MOTOR VOLTAGE - CB	Volts	3.842	3.870	3.871	3.877	3.882
583	MOTOR CURRENT - A	Volts	1.370	1.025	1.047	1.070	1.072
584	MOTOR CURRENT - B	Volts	1.457	1.089	1.106	1.142	1.140
585	MOTOR CURRENT - C	Volts	1.360	1.041	1.058	1.069	1.069
586	MOTOR POWER - PHASE 1	Volts	0.530	0.275	0.290	0.312	0.311
587	MOTOR POWER - PHASE 3	Volts	1.038	0.781	0.797	0.809	0.810
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	106.36	73.87	78.86	83.77	88.62
601	MAXIMUM MOTOR TEMPERATURE	Deg F	98.50	83.50	82.50	76.50	76.00
605	1st STAGE VANE SETTING	Degrees	40.00	10.00	10.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	19.00	19.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	515.20	515.50	516.10	516.40	517.10
609	UNIT START COUNTER READING		135	135	135	135	135
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360	360	360
700	TIME (HOURS)	HOURS	408.66	409.21	409.58	410.08	410.62
701	ENERGY BALANCE	%	-1.41	-2.77	-2.51	-2.54	-2.56
702	EVAP CAPACITY	Tons	82.50	79.90	78.10	74.70	70.10
703	EVAP WATER FLOWRATE	GPM	491.50	492.60	492.40	492.10	492.20
704	COND WATER FLOWRATE	GPM	608.40	604.30	604.80	606.00	607.00

Small Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	48.05	47.92	47.83	47.66	47.44
711	AVE LVG EVAP WATER TEMP	Deg F	44.04	44.04	44.04	44.03	44.04
712	AVE ENT COND WATER TEMP	Deg F	101.93	70.00	74.99	80.01	85.02
713	AVE LVG COND WATER TEMP	Deg F	106.32	73.98	78.91	83.83	88.63
715	MOTOR VOLTAGE - AB	Volts	461.90	465.40	465.50	466.40	466.80
716	MOTOR VOLTAGE - AC	Volts	462.60	466.20	466.20	467.20	467.20
717	MOTOR VOLTAGE - CB	Volts	461.00	464.40	464.50	465.20	465.80
718	MOTOR CURRENT - A	Amps	137.00	102.50	104.70	107.00	107.20
719	MOTOR CURRENT - B	Amps	145.70	108.90	110.60	114.20	114.00
720	MOTOR CURRENT - C	Amps	136.00	104.10	105.80	106.90	106.90
721	UNIT POWER	KW	94.08	63.36	65.22	67.26	67.26
722	AVERAGE VOLTAGE	Volts	461.80	465.30	465.40	466.30	466.60
723	AVERAGE CURRENT	Amps	139.57	105.17	107.03	109.37	109.37
725	KW/TON	KW/Ton	1.14	0.79	0.84	0.90	0.96
730	EVAP DELTA T	Deg F	4.01	3.88	3.79	3.63	3.40
731	COND DELTA T	Deg F	4.39	3.98	3.92	3.80	3.61
735	EVAP WATER FLOWRATE	Lbm/min	4102.20	4112.00	4109.60	4107.10	4108.40
736	COND WATER FLOWRATE	Lbm/min	5041.70	5035.30	5036.10	5041.70	5046.10
740	EVAP CAPACITY	Btu/min	16499.90	15983.40	15624.30	14936.20	14015.20
741	COND CAPACITY	Btu/min	22084.20	20029.40	19726.10	19141.10	18199.60
743	EVAP SATN TEMP (BASED ON ID #61)	Deg F	39.97	39.75	40.04	40.25	40.39
744	COND SATN TEMP (BASED ON ID #431)	Deg F	108.96	77.22	81.05	85.70	90.36
750	RUNNING TIME	Hr	186.30	186.60	187.20	187.50	188.20
751	STARTS		40.00	40.00	40.00	40.00	40.00
752	EVAP APPROACH TEMP	Deg F	4.10	4.30	4.00	3.80	3.60
753	COND APPROACH TEMP	Deg F	2.60	3.20	2.10	1.90	1.70
900	EVAP AVG H2O TEMP	Deg F	46.05	45.98	45.94	45.85	45.74
801	EVAP WATER DENSITY	Lbm/Ft3	62.44	62.44	62.44	62.44	62.44
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000929	0.000930	0.000931	0.000932	0.000934
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0017	1.0017	1.0017	1.0017	1.0019
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3371	0.3371	0.3370	0.3370	0.3369
810	COND AVG H2O TEMP	Deg F	104.12	71.99	76.94	81.93	86.82
811	COND WATER DENSITY	Lbm/Ft3	61.96	62.31	62.26	62.22	62.17
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000437	0.000638	0.000599	0.000563	0.000531
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9978	0.9982	0.9979	0.9978	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3649	0.3506	0.3529	0.3553	0.3576
815	ITD/DELTA T		2.01	2.10	2.06	2.04	2.07
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.09	0.01	-0.01	-0.02	-0.04
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.03	0.02	0.02	0.01	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.06	0.05	0.06	0.06	0.06
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.03	0.03	0.04	0.03
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	-0.06	0.11	0.06	0.06	0.01

Small Impellers - Imperial

LTO 23127 Note: Impeller diameters are 24.0/24.0/24.0				
Run Number		230	231	232
				ARI
Refrigerant		123	123	123
Oil		Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	10	10	90
Capacity	Tons	64.00	59.90	191.40
Power	KW	68.16	68.51	151.08
KW/Ton	KW/Ton	1.065	1.144	0.789
TOE	Deg F	44.02	44.01	44.02
TIC	Deg F	90.05	93.01	85.03
Energy Balance	%	-2.22	-1.35	-1.21
TIE	Deg F	47.14	46.92	54.06
TOE	Deg F	44.02	44.01	44.02
GPME	GPM	491.50	491.80	456.30
TIC	Deg F	90.05	93.01	85.03
TOC	Deg F	93.42	96.20	95.11
GPMC	GPM	607.40	607.40	566.40
Evap Sat Press	Psia	5.90	5.92	5.30
Sat Temp	Deg F	40.68	40.82	36.27
Approach	Deg F	3.30	3.20	7.80
LMTD	Deg F	4.73	4.49	12.08
ITD/Delta T		2.07	2.09	1.77
Q/Ao	B/hr-ft ²	4657.50	4361.27	13923.14
Uo	B/hr ft ² F	984.73	971.57	1152.33
ho'	B/hr ft ² F	1461.42	1432.65	1907.71
Cond Sat Press	Psia	18.87	19.93	21.75
Sat Temp	Deg F	94.93	97.79	102.48
Approach	Deg F	1.50	1.60	7.40
Refrigerant Leaving Temp	Deg F	94.60	97.37	102.28
LMTD	Deg F	2.87	2.90	11.69
Q/Ao	B/hr-ft ²	4936.69	4670.18	13773.34
Uo	B/hr ft ² F	1718.37	1611.44	1177.73
ho'	B/hr ft ² F	3297.37	2899.99	1807.24
Cond Sat Temp	Deg F	94.93	97.79	102.48
Evap Sat Temp	Deg F	40.68	40.82	36.27
Estimated Motor Efficiency (1)		0.945	0.945	0.938
Estimated Motor RPM (1)		3581	3580	3554
Compressor Suction CFM (2)	CFM	1033	967	3446
Isentropic KW/T (2)		0.421	0.443	0.528
Adiabatic Efficiency (3)		0.395	0.387	0.669
Q/N (4)		0.289	0.270	0.970
(1) From motor curves at measured power input				
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split				
(3) Ratio of isentropic and test KW/T				
(4) CFM from cycle calculation / estimated motor RPM				
(5) Heat transfer coefficient calculations use bulk fluid properties				

Small Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.77	16.79	14.45
3	ENT EVAP WATER TEMP LOC 1	Deg F	47.17	46.97	54.09
4	ENT EVAP WATER TEMP LOC 2	Deg F	47.10	46.87	54.03
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.04	44.03	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.00	43.98	44.00
15	COND WATER FLOWMETER DELTA P	PSID	25.45	25.43	22.15
17	ENT COND WATER TEMP LOC 1	Deg F	90.03	93.00	85.03
18	ENT COND WATER TEMP LOC 2	Deg F	90.06	93.02	85.04
19	LVG COND WATER TEMP LOC 1	Deg F	93.40	96.20	95.11
20	LVG COND WATER TEMP LOC 2	Deg F	93.43	96.20	95.11
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	42.59	42.75	38.38
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	42.93	43.13	39.00
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	43.87	44.10	40.07
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.90	5.92	5.30
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	7.55	7.89	8.75
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	7.71	8.05	8.81
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	7.47	7.82	8.21
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	10.55	11.25	12.78
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	11.71	12.49	14.12
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	12.24	12.97	13.23
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	18.87	19.93	21.75
440	REFRIGERANT LVG COND TEMP	Deg F	94.60	97.37	102.28
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	13.01	13.63	13.87
485	HIGH PRESS ECONOMIZER TEMP	Deg F	75.86	78.08	78.98
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	7.53	7.87	8.78
487	LOW PRESS ECONOMOMIZER TEMP	Deg F	51.02	52.91	57.82
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	6.52	6.63	7.31
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	50.67	52.53	57.93
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	7.51	7.83	8.91
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	44.63	45.28	49.67
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	18.83	19.82	21.88
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	94.96	97.63	102.76
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	14.18	14.81	16.62
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	80.25	82.40	89.08
560	ATMOSPHERIC PRESS	PSIA	14.33	14.32	14.31
580	MOTOR VOLTAGE - AB	Volts	3.872	3.861	3.879
581	MOTOR VOLTAGE - AC	Volts	3.875	3.869	3.882
582	MOTOR VOLTAGE - CB	Volts	3.862	3.857	3.870
583	MOTOR CURRENT - A	Volts	1.076	1.077	2.096
584	MOTOR CURRENT - B	Volts	1.158	1.158	2.188
585	MOTOR CURRENT - C	Volts	1.069	1.078	2.033
586	MOTOR POWER - PHASE 1	Volts	0.330	0.329	0.943
587	MOTOR POWER - PHASE 3	Volts	0.806	0.813	1.575
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	93.41	96.30	95.10
601	MAXIMUM MOTOR TEMPERATURE	Deg F	78.50	80.50	130.50
605	1st STAGE VANE SETTING	Degrees	10.00	10.00	90.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00	68.00
608	UNIT HOUR METER READING	Hr	517.40	518.10	519.00
609	UNIT START COUNTER READING		135	135	135
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360	360
700	TIME (HOURS)	HOURS	411.01	411.61	412.38
701	ENERGY BALANCE	%	-2.22	-1.35	-1.21
702	EVAP CAPACITY	Tons	64.00	59.90	191.40
703	EVAP WATER FLOWRATE	GPM	491.50	491.80	456.30
704	COND WATER FLOWRATE	GPM	607.40	607.40	566.40

Small Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	47.14	46.92	54.06
711	AVE LVG EVAP WATER TEMP	Deg F	44.02	44.01	44.02
712	AVE ENT COND WATER TEMP	Deg F	90.05	93.01	85.03
713	AVE LVG COND WATER TEMP	Deg F	93.42	96.20	95.11
715	MOTOR VOLTAGE - AB	Volts	464.60	463.30	465.50
716	MOTOR VOLTAGE - AC	Volts	465.00	464.30	465.80
717	MOTOR VOLTAGE - CB	Volts	463.40	462.80	464.40
718	MOTOR CURRENT - A	Amps	107.60	107.70	209.60
719	MOTOR CURRENT - B	Amps	115.80	115.80	218.80
720	MOTOR CURRENT - C	Amps	106.90	107.80	203.40
721	UNIT POWER	KW	68.16	68.51	151.08
722	AVERAGE VOLTAGE	Volts	464.30	463.50	465.20
723	AVERAGE CURRENT	Amps	110.10	110.43	210.60
725	KW/TON	KW/Ton	1.05	1.14	0.79
730	EVAP DELTA T	Deg F	3.12	2.91	10.04
731	COND DELTA T	Deg F	3.37	3.19	10.08
735	EVAP WATER FLOWRATE	Lbm/min	4102.20	4104.70	3807.80
736	COND WATER FLOWRATE	Lbm/min	5045.40	5042.30	4708.50
740	EVAP CAPACITY	Btu/min	12802.70	11988.40	38272.40
741	COND CAPACITY	Btu/min	16963.30	16047.50	47327.50
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	40.68	40.82	36.27
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	94.93	97.79	102.48
750	RUNNING TIME	Hr	188.50	189.20	190.10
751	STARTS		40.00	40.00	40.00
752	EVAP APPROACH TEMP	Deg F	3.30	3.20	7.80
753	COND APPROACH TEMP	Deg F	1.50	1.60	7.40
800	EVAP AVG H2O TEMP	Deg F	45.58	45.47	49.04
801	EVAP WATER DENSITY	Lbm/Ft3	62.44	62.44	62.43
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000936	0.000938	0.000886
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0019	1.0019	1.0010
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3368	0.3368	0.3388
810	COND AVG H2O TEMP	Deg F	91.73	94.61	90.07
811	COND WATER DENSITY	Lbm/Ft3	62.11	62.08	62.13
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000500	0.000485	0.000511
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977	0.9977
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3597	0.3610	0.3590
815	ITD/DELTA T		2.07	2.09	1.77
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.03	-0.02	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg F	-0.03	0.00	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.07	0.10	0.06
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.04	0.05	0.04
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	-0.01	-0.10	0.01

Small Impellers - Imperial

LTO 23127	Note: Impeller diameters are 24.0/24.0/24.0	Full Load Performance Comparison at 44/85	
Run Number		208	232
			ARI
Refrigerant		123	123
Oil		Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90
Capacity	Tons	192.40	191.40
Power	KW	151.02	151.08
KW/Ton	KW/Ton	0.785	0.789
TOE	Deg F	44.02	44.02
TIC	Deg F	84.98	85.03
Energy Balance	%	-1.25	-1.21
TIE	Deg F	53.43	54.06
TOE	Deg F	44.02	44.02
GPME	GPM	490.00	456.30
TIC	Deg F	84.98	85.03
TOC	Deg F	94.45	95.11
GPMC	GPM	605.70	566.40
Evap Sat Press	Psia	5.32	5.30
Sat Temp	Deg F	36.43	36.27
Approach	Deg F	7.60	7.80
LMTD	Deg F	11.67	12.08
ITD/Delta T		1.81	1.77
Q/Ao	B/hr-ft2	13997.83	13923.14
Uo	B/hr ft2 F	1199.53	1152.33
ho'	B/hr ft2 F	1975.61	1907.71
Cond Sat Press	Psia	21.64	21.75
Sat Temp	Deg F	102.20	102.48
Approach	Deg F	7.80	7.40
Refrigerant Leaving Temp	Deg F	101.85	102.28
LMTD	Deg F	11.86	11.69
Q/Ao	B/hr-ft2	13837.25	13773.34
Uo	B/hr ft2 F	1166.56	1177.73
ho'	B/hr ft2 F	1737.43	1807.24
Cond Sat Temp	Deg F	102.20	102.48
Evap Sat Temp	Deg F	36.43	36.27
Estimated Motor Efficiency (1)		0.938	0.938
Estimated Motor RPM (1)		3554	3554
Compressor Suction CFM (2)	CFM	3450	3446
Isentropic KW/T (2)		0.524	0.528
Adiabatic Efficiency (3)		0.668	0.669
Q/N (4)		0.971	0.970
(1) From motor curves at measured power input			
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split			
(3) Ratio of isentropic and test KW/T			
(4) CFM from cycle calculation / estimated motor RPM			
(5) Heat transfer coefficient calculations use bulk fluid properties			

Small Impellers - Imperial

1	EVAP WATER FLOWMETER DELTA P	PSID	16.66	14.45
3	ENT EVAP WATER TEMP LOC 1	Deg F	53.44	54.09
4	ENT EVAP WATER TEMP LOC 2	Deg F	53.41	54.03
5	LVG EVAP WATER TEMP LOC 1	Deg F	44.04	44.04
6	LVG EVAP WATER TEMP LOC 2	Deg F	44.01	44.00
15	COND WATER FLOWMETER DELTA P	PSID	25.33	22.15
17	ENT COND WATER TEMP LOC 1	Deg F	84.98	85.03
18	ENT COND WATER TEMP LOC 2	Deg F	84.99	85.04
19	LVG COND WATER TEMP LOC 1	Deg F	94.45	95.11
20	LVG COND WATER TEMP LOC 2	Deg F	94.45	95.11
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg F	40.20	38.38
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg F	39.09	39.00
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg F	39.68	40.07
61	EVAP SHELL STATIC PRESS - AVERAGE	PSIA	5.32	5.30
215	ENT 2nd IMPELLER TOTAL PRESS #1	PSIA	8.77	8.75
216	ENT 2nd IMPELLER TOTAL PRESS #2	PSIA	8.85	8.81
218	ENT 2nd IMP SHROUD STATIC PRESS #1	PSIA	8.24	8.21
315	ENT 3rd IMPELLER TOTAL PRESS #1	PSIA	12.93	12.78
316	ENT 3rd IMPELLER TOTAL PRESS #2	PSIA	14.05	14.12
318	ENT 3rd IMP SHROUD STATIC PRESS #1	PSIA	13.26	13.23
431	COND SHELL STATIC PRESS - AVERAGE	PSIA	21.64	21.75
440	REFRIGERANT LVG COND TEMP	Deg F	101.85	102.28
484	HIGH PRESS ECONOMIZER STATIC PRESS	PSIA	13.90	13.87
485	HIGH PRESS ECONOMIZER TEMP	Deg F	79.08	78.98
486	LOW PRESS ECONOMOMIZER STATIC PRESS	PSIA	8.83	8.78
487	LOW PRESS ECONOMIZER TEMP	Deg F	58.01	57.82
530	ENT EVAP ORIFICE ASS'Y PRESS	PSIA	7.29	7.31
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg F	58.14	57.93
532	LVG EVAP ORIFICE ASS'Y PRESS	PSIA	8.93	8.91
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg F	49.74	49.67
534	ENT COND ORIFICE ASS'Y PRESS	PSIA	21.78	21.88
535	ENT COND ORIFICE ASS'Y TEMP	Deg F	102.34	102.76
536	LVG COND ORIFICE ASS'Y PRESS	PSIA	16.43	16.62
537	LVG COND ORIFICE ASS'Y TEMP	Deg F	88.71	89.08
560	ATMOSPHERIC PRESS	PSIA	14.41	14.31
580	MOTOR VOLTAGE - AB	Volts	3.831	3.879
581	MOTOR VOLTAGE - AC	Volts	3.833	3.882
582	MOTOR VOLTAGE - CB	Volts	3.823	3.870
583	MOTOR CURRENT - A	Volts	2.109	2.096
584	MOTOR CURRENT - B	Volts	2.203	2.188
585	MOTOR CURRENT - C	Volts	2.040	2.033
586	MOTOR POWER - PHASE 1	Volts	0.959	0.943
587	MOTOR POWER - PHASE 3	Volts	1.558	1.575
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg F	94.46	95.10
601	MAXIMUM MOTOR TEMPERATURE	Deg F	131.50	130.50
605	1st STAGE VANE SETTING	Degrees	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00
608	UNIT HOUR METER READING	Hr	506.20	519.00
609	UNIT START COUNTER READING		134	135
610	CURRENT REFRIGERANT CHARGE	Lbm	360	360
700	TIME (HOURS)	HOURS	384.16	412.38
701	ENERGY BALANCE	%	-1.25	-1.21
702	EVAP CAPACITY	Tons	192.40	191.40
703	EVAP WATER FLOWRATE	GPM	490.00	456.30
704	COND WATER FLOWRATE	GPM	605.70	566.40

Small Impellers - Imperial

710	AVE ENT EVAP WATER TEMP	Deg F	53.43	54.06		
711	AVE LVG EVAP WATER TEMP	Deg F	44.02	44.02		
712	AVE ENT COND WATER TEMP	Deg F	84.98	85.03		
713	AVE LVG COND WATER TEMP	Deg F	94.45	95.11		
715	MOTOR VOLTAGE - AB	Volts	459.70	465.50		
716	MOTOR VOLTAGE - AC	Volts	460.00	465.80		
717	MOTOR VOLTAGE - CB	Volts	458.80	464.40		
718	MOTOR CURRENT - A	Amps	210.90	209.60		
719	MOTOR CURRENT - B	Amps	220.30	218.80		
720	MOTOR CURRENT - C	Amps	204.00	203.40		
721	UNIT POWER	KW	151.02	151.08		
722	AVERAGE VOLTAGE	Volts	459.50	465.20		
723	AVERAGE CURRENT	Amps	211.73	210.60		
725	KW/TON	KW/Ton	0.78	0.79		
730	EVAP DELTA T	Deg F	9.39	10.04		
731	COND DELTA T	Deg F	9.47	10.08		
735	EVAP WATER FLOWRATE	Lbm/min	4088.60	3807.80		
736	COND WATER FLOWRATE	Lbm/min	5035.20	4708.50		
740	EVAP CAPACITY	Btu/min	38477.70	38272.40		
741	COND CAPACITY	Btu/min	47547.10	47327.50		
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg F	36.43	36.27		
744	COND SAT'N TEMP (BASED ON ID #431)	Deg F	102.20	102.48		
750	RUNNING TIME	Hr	177.30	190.10		
751	STARTS		39.00	40.00		
752	EVAP APPROACH TEMP	Deg F	7.60	7.80		
753	COND APPROACH TEMP	Deg F	7.80	7.40		
800	EVAP AVG H2O TEMP	Deg F	48.73	49.04		
801	EVAP WATER DENSITY	Lbm/Ft3	62.43	62.43		
802	EVAP H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000891	0.000886		
803	EVAP H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	1.0012	1.0010		
804	EVAP H2O CON(K) (BTU/HR-FT-F)		0.3386	0.3388		
810	COND AVG H2O TEMP	Deg F	89.72	90.07		
811	COND WATER DENSITY	Lbm/Ft3	62.13	62.13		
812	COND H2O VISCOSITY(LBM/SEC-FT)	Lbm/Sec-F	0.000513	0.000511		
813	COND H2O SPECIFIC HEAT (Cp)	Btu/lbm-F	0.9977	0.9977		
814	COND H2O CON(K) (BTU/HR-FT-F)		0.3588	0.3590		
815	ITD/DELTA T		1.81	1.77		
850	RTD DIFFERENCE CHECK - ECWT	Deg F	-0.01	-0.01		
851	RTD DIFFERENCE CHECK - LCWT	Deg F	0.00	0.00		
852	RTD DIFFERENCE CHECK - EEWT	Deg F	0.03	0.06		
853	RTD DIFFERENCE CHECK - LEWT	Deg F	0.03	0.04		
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg F	-0.01	0.01		

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		1	2	3	4	5
		Chg Opt	Chg Opt	Chg Opt	Chg Opt	Chg Opt
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	54	54	54	46	46
Capacity	KW	686.3	731.3	769.3	741.9	763.0
Power	KW	162.0	171.1	178.0	173.1	176.1
Coefficient of Performance (COP)		4.237	4.274	4.321	4.286	4.333
Evaporator Leaving Water Temperature	Deg C	6.68	6.63	6.67	6.68	6.66
Condenser Entering Water Temperature	Deg C	29.43	29.40	29.42	29.43	29.44
Energy Balance	%	-0.70	-0.26	-0.69	-0.52	-0.75
Evaporator Entering Water Temperature	Deg C	12.07	12.38	12.71	12.52	12.66
Evaporator Leaving Water Temperature	Deg C	6.68	6.63	6.67	6.68	6.66
Evaporator Water Flow Rate	L/S	30.34	30.32	30.37	30.35	30.37
Condenser Entering Water Temperature	Deg C	29.43	29.40	29.42	29.43	29.44
Condenser Leaving Water Temperature	Deg C	34.82	35.12	35.45	35.24	35.42
Condenser Water Flow Rate	L/S	38.01	37.99	37.99	38.01	38.03
Evap Sat Press	kPa	40.54	42.13	43.99	44.06	45.09
Sat Temp	Deg C	0.21	1.11	2.13	2.17	2.73
Approach	Deg C	6.44	5.50	4.50	4.50	3.94
LMTD	Deg C	8.89	8.05	7.13	7.03	6.47
ITD/Delta T		2.20	1.96	1.75	1.77	1.66
Q/Ao	kW/m2	44.79	47.72	50.20	48.42	49.78
Uo	kW/m2 C	5.04	5.92	7.04	6.89	7.69
ho'	kW/m2 C	7.14	9.06	11.92	11.52	13.93
Cond Sat Press	kPa	165.68	169.20	172.58	171.13	172.71
Sat Temp	Deg C	38.54	39.21	39.83	39.57	39.86
Approach	Deg C	3.72	4.11	4.39	4.33	4.44
Refrigerant Leaving Temp	Deg C	38.03	38.59	39.16	38.85	39.10
LMTD	Deg C	6.02	6.53	6.97	6.82	7.01
Q/Ao	kW/m2	44.54	47.21	49.73	47.97	49.32
Uo	kW/m2 C	7.40	7.23	7.14	7.03	7.03
ho'	kW/m2 C	11.72	11.29	11.06	10.81	10.81
Cond Sat Temp	Deg C	38.54	39.21	39.83	39.57	39.86
Evap Sat Temp	Deg C	0.21	1.11	2.13	2.17	2.73
Estimated Motor Efficiency (1)		0.94	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		59.18	59.12	59.08	59.11	59.09
Compressor Suction Flow Rate (2)	m3/sec	1.556	1.603	1.616	1.561	1.573
Isentropic COP (2)		6.335	6.381	6.463	6.535	6.584
Adiabatic Efficiency (3)		0.669	0.672	0.672	0.656	0.659
Q/N - m3/rev (4)		0.0263	0.0271	0.0274	0.0264	0.0266
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers -Metric

Data as received from Laboratory							
ID	Description	Units	Value				
1	EVAP WATER FLOWMETER DELTA P	kPa	110.6	110.5	110.8	110.6	110.8
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.06	12.37	12.70	12.50	12.64
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.09	12.40	12.72	12.53	12.67
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.68	6.62	6.67	6.68	6.66
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.63	6.66	6.68	6.66
15	COND WATER FLOWMETER DELTA P	kPa	172.9	172.6	172.6	172.8	172.9
17	ENT COND WATER TEMP LOC 1	Deg C	29.44	29.41	29.43	29.44	29.45
18	ENT COND WATER TEMP LOC 2	Deg C	29.41	29.39	29.42	29.42	29.44
19	LVG COND WATER TEMP LOC 1	Deg C	34.82	35.12	35.45	35.24	35.42
20	LVG COND WATER TEMP LOC 2	Deg C	34.82	35.13	35.45	35.24	35.42
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	2.31	3.12	4.11	4.11	4.51
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	1.69	2.62	3.53	3.60	4.15
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	2.09	2.96	3.72	3.86	4.30
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	40.5	42.1	44.0	44.1	45.1
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	66.7	69.2	71.3	70.7	72.1
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	67.0	69.5	71.6	70.9	72.3
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	63.3	65.3	67.4	66.6	67.8
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	120.6	123.7	126.9	126.1	128.1
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	111.1	114.2	117.6	116.3	118.0
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	104.0	106.7	109.2	108.5	109.7
431	COND SHELL STATIC PRESS - AVERAGE	kPa	165.7	169.2	172.6	171.1	172.7
440	REFRIGERANT LVG COND TEMP	Deg C	38.03	38.59	39.16	38.85	39.10
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	108.0	110.8	113.6	113.3	115.1
485	HIGH PRESS ECONOMIZER TEMP	Deg C	25.33	26.07	26.83	26.76	27.17
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	67.0	69.2	71.6	71.2	72.5
487	LOW PRESS ECONOMIZER TEMP	Deg C	12.37	13.20	14.10	13.86	14.33
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	66.9	69.3	71.5	71.2	72.3
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	12.26	13.18	14.02	13.81	14.22
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	53.9	56.1	58.9	58.4	59.5
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	6.82	7.94	9.02	8.74	9.33
534	ENT COND ORIFICE ASS'Y PRESS	kPa	162.8	166.7	170.0	167.7	169.6
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	37.71	38.49	39.01	38.70	38.99
536	LVG COND ORIFICE ASS'Y PRESS	kPa	123.3	127.2	130.7	127.8	131.3
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	29.96	30.71	31.43	31.13	31.55
560	ATMOSPHERIC PRESS	kPa	98.9	98.9	98.9	98.9	98.9
580	MOTOR VOLTAGE - AB	Volts	3.895	3.892	3.903	3.913	3.928
581	MOTOR VOLTAGE - AC	Volts	3.921	3.917	3.928	3.937	3.955
582	MOTOR VOLTAGE - CB	Volts	3.900	3.896	3.908	3.918	3.935
583	MOTOR CURRENT - A	Volts	2.181	2.308	2.399	2.335	2.354
584	MOTOR CURRENT - B	Volts	2.319	2.432	2.512	2.462	2.490
585	MOTOR CURRENT - C	Volts	2.208	2.325	2.402	2.325	2.374
586	MOTOR POWER - PHASE 1	Volts	0.979	1.034	1.082	1.058	1.066
587	MOTOR POWER - PHASE 3	Volts	1.721	1.818	1.885	1.827	1.869
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	34.85	35.22	35.44	35.23	35.39
601	MAXIMUM MOTOR TEMPERATURE	Deg C	62.78	62.78	68.61	65.28	66.39
605	1st STAGE VANE SETTING	Degrees	54	54	54	46	46
607	3rd STAGE VANE SETTING	Degrees	57	57	57	54	54
608	UNIT HOUR METER READING	Hr	330	331	332	332	332
609	UNIT START COUNTER READING		95	95	95	95	95
610	CURRENT REFRIGERANT CHARGE	Kg	127.0	136.1	145.2	145.2	154.2
700	TIME (HOURS)	HOURS	0	1	1	2	2
701	ENERGY BALANCE	%	-0.70	-0.26	-0.69	-0.52	-0.75

Large Impellers - Metric

702	EVAP CAPACITY	KW	686.3	731.3	769.3	741.9	763.0
703	EVAP WATER FLOWRATE	L/S	30.34	30.32	30.37	30.35	30.37
704	COND WATER FLOWRATE	L/S	38.01	37.99	37.99	38.01	38.03
710	AVE ENT EVAP WATER TEMP	Deg C	12.07	12.38	12.71	12.52	12.66
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.63	6.67	6.68	6.66
712	AVE ENT COND WATER TEMP	Deg C	29.43	29.40	29.42	29.43	29.44
713	AVE LVG COND WATER TEMP	Deg C	34.82	35.12	35.45	35.24	35.42
715	MOTOR VOLTAGE - AB	Volts	467	467	468	470	471
716	MOTOR VOLTAGE - AC	Volts	471	470	471	472	475
717	MOTOR VOLTAGE - CB	Volts	468	468	469	470	472
718	MOTOR CURRENT - A	Amps	218	231	240	234	235
719	MOTOR CURRENT - B	Amps	232	243	251	246	249
720	MOTOR CURRENT - C	Amps	221	233	240	233	237
721	UNIT POWER	KW	162	171	178	173	176
722	AVERAGE VOLTAGE	Volts	469	468	470	471	473
723	AVERAGE CURRENT	Amps	224	236	244	237	241
725	Coefficient of Performance		4.237	4.274	4.321	4.286	4.333
730	EVAP DELTA T	Deg C	5.40	5.76	6.04	5.84	5.99
731	COND DELTA T	Deg C	5.39	5.72	6.03	5.81	5.97
735	EVAP WATER FLOWRATE	Kg/Sec	30.33	30.32	30.36	30.34	30.36
736	COND WATER FLOWRATE	Kg/Sec	37.87	37.84	37.84	37.86	37.88
740	EVAP CAPACITY	KW	686.30	731.23	769.17	741.88	762.82
741	COND CAPACITY	KW	853.10	904.21	952.49	918.80	944.65
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	0.21	1.11	2.13	2.17	2.73
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	38.54	39.21	39.83	39.57	39.86
750	RUNNING TIME	Hr	1	2	3	3	4
751	STARTS		0	0	0	0	0
752	EVAP APPROACH TEMP	Deg C	6.44	5.50	4.50	4.50	3.94
753	COND APPROACH TEMP	Deg C	3.72	4.11	4.39	4.33	4.44
800	EVAP AVG H2O TEMP	Deg C	9.38	9.51	9.69	9.60	9.66
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.321	1.317	1.311	1.314	1.311
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.191	4.191	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	32.12	32.26	32.44	32.34	32.43
811	COND WATER DENSITY	Kg/M3	995.7	995.7	995.6	995.7	995.6
812	COND H2O VISCOSITY	cp	0.762	0.760	0.756	0.757	0.756
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.621	0.621	0.621	0.621	0.621
815	ITD/DELTA T		2.20	1.96	1.75	1.77	1.66
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.028	0.017	0.011	0.017	0.011
851	RTD DIFFERENCE CHECK - LWWT	Deg C	0.006	-0.006	0.000	0.006	0.000
852	RTD DIFFERENCE CHECK - EEWWT	Deg C	-0.028	-0.033	-0.022	-0.028	-0.028
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	-0.011	0.006	0.000	0.000
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.028	-0.094	0.006	0.011	0.022

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	110.7	104.3	109.6	110.1	110.0
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.70	12.65	12.72	12.81	12.60
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.73	12.67	12.74	12.83	12.62
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.68	6.67	6.68	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.68	6.67	6.67	6.68
15	COND WATER FLOWMETER DELTA P	kPa	172.4	172.9	172.3	172.1	171.3
17	ENT COND WATER TEMP LOC 1	Deg C	29.43	29.44	26.66	23.88	21.07
18	ENT COND WATER TEMP LOC 2	Deg C	29.41	29.41	26.65	23.87	21.07
19	LVG COND WATER TEMP LOC 1	Deg C	35.45	35.19	32.64	29.91	26.88
20	LVG COND WATER TEMP LOC 2	Deg C	35.45	35.19	32.64	29.91	26.89
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.70	4.34	3.83	3.49	1.92
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.42	4.02	3.74	2.97	1.39
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.46	3.82	3.52	2.89	1.39
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	45.4	45.0	44.3	43.1	40.3
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	72.4	70.7	68.1	64.9	60.1
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	72.9	70.9	68.5	65.2	60.4
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	68.2	66.7	63.8	60.3	55.6
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	128.8	126.2	120.7	114.6	106.2
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	118.7	111.3	105.6	99.3	91.4
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	110.4	108.2	101.8	94.9	86.6
431	COND SHELL STATIC PRESS - AVERAGE	kPa	173.8	169.2	157.3	144.2	130.1
440	REFRIGERANT LVG COND TEMP	Deg C	39.33	38.60	36.23	32.99	29.56
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	115.9	113.5	107.8	100.7	92.3
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.36	26.79	25.28	23.56	21.17
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	72.7	70.8	67.8	64.5	59.4
487	LOW PRESS ECONOMOMIZER TEMP	Deg C	14.48	13.76	12.74	11.36	9.32
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	72.9	71.6	69.6	67.2	62.0
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	14.44	13.89	12.89	11.54	9.47
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	60.1	57.2	56.1	54.2	50.5
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.67	8.33	7.96	7.12	5.32
534	ENT COND ORIFICE ASS'Y PRESS	kPa	171.1	168.3	158.3	146.9	132.9
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	39.18	38.68	36.20	32.75	29.40
536	LVG COND ORIFICE ASS'Y PRESS	kPa	131.3	126.7	119.2	111.1	102.3
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	31.76	30.35	28.74	26.79	24.09
560	ATMOSPHERIC PRESS	kPa	98.8	98.9	98.9	98.9	99.0
580	MOTOR VOLTAGE - AB	Volts	3.927	3.915	3.896	3.890	3.898
581	MOTOR VOLTAGE - AC	Volts	3.955	3.936	3.922	3.915	3.923
582	MOTOR VOLTAGE - CB	Volts	3.931	3.920	3.901	3.896	3.906
583	MOTOR CURRENT - A	Volts	2.389	2.261	2.295	2.280	2.152
584	MOTOR CURRENT - B	Volts	2.506	2.406	2.425	2.399	2.281
585	MOTOR CURRENT - C	Volts	2.398	2.279	2.311	2.283	2.171
586	MOTOR POWER - PHASE 1	Volts	1.072	1.020	1.033	1.024	0.959
587	MOTOR POWER - PHASE 3	Volts	1.883	1.788	1.799	1.775	1.695
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	35.43	35.20	32.60	29.87	26.89
601	MAXIMUM MOTOR TEMPERATURE	Deg C	68.06	63.06	64.72	65.28	69.17
605	1st STAGE VANE SETTING	Degrees	46	40	40	40	40
607	3rd STAGE VANE SETTING	Degrees	54	50	50	50	50
608	UNIT HOUR METER READING	Hr	333	336	337	337	338
609	UNIT START COUNTER READING		95	96	96	96	96
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	3	20	21	22	22
701	ENERGY BALANCE	%	-0.86	-0.67	-1.14	-0.74	-0.91

Large Impellers - Metric

702	EVAP CAPACITY	KW	768.2	738.0	766.8	779.5	750.7
703	EVAP WATER FLOWRATE	L/S	30.35	29.47	30.20	30.27	30.25
704	COND WATER FLOWRATE	L/S	37.97	38.01	37.94	37.89	37.80
710	AVERAGE EVAP WATER TEMP	Deg C	12.72	12.66	12.73	12.82	12.61
711	AVERAGE LVG EVAP WATER TEMP	Deg C	6.67	6.68	6.67	6.68	6.68
712	AVERAGE COND WATER TEMP	Deg C	29.42	29.43	26.66	23.87	21.07
713	AVERAGE LVG COND WATER TEMP	Deg C	35.45	35.19	32.64	29.91	26.89
715	MOTOR VOLTAGE - AB	Volts	471	470	468	467	468
716	MOTOR VOLTAGE - AC	Volts	475	472	471	470	471
717	MOTOR VOLTAGE - CB	Volts	472	470	468	468	469
718	MOTOR CURRENT - A	Amps	239	226	230	228	215
719	MOTOR CURRENT - B	Amps	251	241	243	240	228
720	MOTOR CURRENT - C	Amps	240	228	231	228	217
721	UNIT POWER	KW	177	168	170	168	159
722	AVERAGE VOLTAGE	Volts	473	471	469	468	469
723	AVERAGE CURRENT	Amps	243	232	234	232	220
725	Coefficient of Performance		4.333	4.380	4.513	4.641	4.714
730	EVAP DELTA T	Deg C	6.04	5.98	6.06	6.14	5.93
731	COND DELTA T	Deg C	6.03	5.77	5.99	6.04	5.82
735	EVAP WATER FLOWRATE	Kg/Sec	30.35	29.46	30.20	30.26	30.24
736	COND WATER FLOWRATE	Kg/Sec	37.82	37.87	37.82	37.81	37.73
740	EVAP CAPACITY	KW	768.23	738.12	766.85	779.44	750.82
741	COND CAPACITY	KW	952.11	911.52	945.48	953.18	916.89
743	EVAP SATN TEMP (BASED ON ID #61)	Deg C	2.88	2.66	2.32	1.65	0.09
744	COND SATN TEMP (BASED ON ID #431)	Deg C	40.07	39.21	36.90	34.23	31.12
750	RUNNING TIME	Hr	4	7	8	8	9
751	STARTS		0	1	1	1	1
752	EVAP APPROACH TEMP	Deg C	3.78	4.00	4.33	5.06	6.61
753	COND APPROACH TEMP	Deg C	4.61	4.00	4.28	4.33	4.22
800	EVAP AVG H2O TEMP	Deg C	9.69	9.67	9.71	9.75	9.65
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.311	1.311	1.310	1.308	1.313
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.191	4.191	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	32.44	32.31	29.65	26.89	23.98
811	COND WATER DENSITY	Kg/M3	995.6	995.7	996.5	997.3	998.1
812	COND H2O VISCOSITY	cp	0.756	0.757	0.804	0.853	0.911
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.178
814	COND H2O CON(K)	W/M C	0.621	0.621	0.618	0.614	0.609
815	ITD/DELTA T		1.63	1.67	1.72	1.82	2.10
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.022	0.033	0.011	0.006	-0.006
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.000	0.006	0.006	0.000	-0.006
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.028	-0.017	-0.022	-0.022	-0.022
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.000	0.000	0.000	0.006	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.022	-0.006	0.044	0.039	-0.011

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		11	12	13	14	15
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	40	40	40	40	10
Capacity	KW	693.7	638.9	552.0	505.2	392.4
Power	KW	165.5	159.4	144.8	138.7	89.3
Coefficient of Performance (COP)		4.192	4.009	3.813	3.642	4.395
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	6.68	6.67	6.69
Condenser Entering Water Temperature	Deg C	32.22	35.04	37.77	38.54	21.10
Energy Balance	%	-0.58	-0.63	-0.96	-0.50	-1.53
Evaporator Entering Water Temperature	Deg C	12.07	11.75	11.07	10.69	9.81
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	6.68	6.67	6.69
Evaporator Water Flow Rate	L/S	30.67	30.11	30.04	30.02	30.05
Condenser Entering Water Temperature	Deg C	32.22	35.04	37.77	38.54	21.10
Condenser Leaving Water Temperature	Deg C	37.69	40.13	42.23	42.64	24.20
Condenser Water Flow Rate	L/S	37.93	37.98	37.99	38.00	37.71
Evap Sat Press	kPa	45.57	46.13	46.95	47.37	47.71
Sat Temp	Deg C	2.98	3.27	3.70	3.91	4.09
Approach	Deg C	3.67	3.39	3.00	2.78	2.61
LMTD	Deg C	5.98	5.57	4.85	4.47	3.96
ITD/Delta T		1.68	1.67	1.68	1.69	1.83
Q/Ao	kW/m2	45.27	41.69	36.04	32.98	25.61
Uo	kW/m2 C	7.57	7.49	7.44	7.37	6.47
ho'	kW/m2 C	13.48	13.39	13.26	13.08	10.51
Cond Sat Press	kPa	181.68	193.47	204.50	204.84	111.07
Sat Temp	Deg C	41.49	43.53	45.36	45.42	26.44
Approach	Deg C	3.78	3.39	3.11	2.78	2.22
Refrigerant Leaving Temp	Deg C	40.91	43.10	44.94	45.00	26.04
LMTD	Deg C	6.13	5.56	5.04	4.52	3.57
Q/Ao	kW/m2	45.06	41.88	36.66	33.76	25.46
Uo	kW/m2 C	7.35	7.53	7.28	7.46	7.13
ho'	kW/m2 C	11.47	11.79	11.08	11.49	11.50
Cond Sat Temp	Deg C	41.49	43.53	45.36	45.42	26.44
Evap Sat Temp	Deg C	2.98	3.27	3.70	3.91	4.09
Estimated Motor Efficiency (1)		0.93	0.94	0.94	0.94	0.95
Estimated Motor Rev/Sec (1)		59.16	59.19	59.28	59.31	59.57
Compressor Suction Flow Rate (2)	m3/sec	1.419	1.297	1.105	1.003	0.748
Isentropic COP (2)		6.358	6.094	5.909	5.949	11.415
Adiabatic Efficiency (3)		0.658	0.656	0.647	0.609	0.385
Q/N - m3/rev (4)		0.0240	0.0219	0.0186	0.0169	0.0125
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	113.1	108.9	108.5	108.3	108.6
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.05	11.73	11.05	10.67	9.79
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.08	11.76	11.08	10.71	9.82
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.68	6.68	6.67	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.68	6.68	6.67	6.69
15	COND WATER FLOWMETER DELTA P	kPa	171.9	172.2	172.0	172.0	170.6
17	ENT COND WATER TEMP LOC 1	Deg C	32.22	35.06	37.79	38.56	21.10
18	ENT COND WATER TEMP LOC 2	Deg C	32.21	35.03	37.75	38.52	21.10
19	LVG COND WATER TEMP LOC 1	Deg C	37.69	40.14	42.23	42.64	24.20
20	LVG COND WATER TEMP LOC 2	Deg C	37.69	40.12	42.22	42.63	24.20
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.53	4.94	5.42	5.64	5.60
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.36	4.67	5.07	5.26	5.44
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.11	4.63	5.12	5.38	5.32
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	45.6	46.1	47.0	47.4	47.7
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	73.4	76.1	78.5	79.2	50.1
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	73.7	76.5	79.2	80.0	50.5
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	70.1	73.4	76.7	77.4	48.7
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	131.4	135.3	139.3	139.5	76.3
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	117.4	123.8	130.7	132.0	71.4
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	115.1	122.0	128.7	130.0	73.6
431	COND SHELL STATIC PRESS - AVERAGE	kPa	181.7	193.5	204.5	204.8	111.1
440	REFRIGERANT LVG COND TEMP	Deg C	40.91	43.10	44.94	45.00	26.04
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	120.2	126.4	132.7	133.0	84.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	28.44	29.96	31.38	31.47	18.99
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	73.8	76.5	79.1	79.2	50.1
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.86	15.84	16.75	16.78	5.04
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	74.3	76.7	79.2	79.3	51.3
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	14.88	15.82	16.67	16.73	5.19
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	57.8	57.8	57.8	57.2	49.6
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.71	8.73	8.54	8.30	4.76
534	ENT COND ORIFICE ASS'Y PRESS	kPa	180.5	191.7	203.0	203.3	109.3
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	41.03	43.03	44.90	44.89	25.89
536	LVG COND ORIFICE ASS'Y PRESS	kPa	132.7	138.5	145.3	144.0	89.0
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	31.83	33.27	34.47	34.16	20.08
560	ATMOSPHERIC PRESS	kPa	99.0	99.0	99.0	99.1	99.1
580	MOTOR VOLTAGE - AB	Volts	3.878	3.890	3.870	3.861	3.931
581	MOTOR VOLTAGE - AC	Volts	3.898	3.913	3.889	3.878	3.956
582	MOTOR VOLTAGE - CB	Volts	3.880	3.899	3.871	3.864	3.938
583	MOTOR CURRENT - A	Volts	2.258	2.152	1.980	1.900	1.278
584	MOTOR CURRENT - B	Volts	2.393	2.292	2.095	2.030	1.390
585	MOTOR CURRENT - C	Volts	2.240	2.156	1.980	1.920	1.355
586	MOTOR POWER - PHASE 1	Volts	1.021	0.972	0.876	0.837	0.432
587	MOTOR POWER - PHASE 3	Volts	1.737	1.684	1.537	1.475	1.056
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	37.70	40.06	42.46	42.71	24.14
601	MAXIMUM MOTOR TEMPERATURE	Deg C	60.28	57.50	53.06	50.61	35.17
605	1st STAGE VANE SETTING	Degrees	40	40	40	40	10
607	3rd STAGE VANE SETTING	Degrees	50	50	50	50	19
608	UNIT HOUR METER READING	Hr	338	339	339	340	341
609	UNIT START COUNTER READING		96	96	96	96	96
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	23	23	24	25	26
701	ENERGY BALANCE	%	-0.58	-0.63	-0.96	-0.50	-1.53

Large Impellers - Metric

702	EVAP CAPACITY	KW	693.7	638.9	552.0	505.2	392.4
703	EVAP WATER FLOWRATE	L/S	30.67	30.11	30.04	30.02	30.05
704	COND WATER FLOWRATE	L/S	37.93	37.98	37.99	38.00	37.71
710	AVE ENT EVAP WATER TEMP	Deg C	12.07	11.75	11.07	10.69	9.81
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.68	6.68	6.67	6.69
712	AVE ENT COND WATER TEMP	Deg C	32.22	35.04	37.77	38.54	21.10
713	AVE LVG COND WATER TEMP	Deg C	37.69	40.13	42.23	42.64	24.20
715	MOTOR VOLTAGE - AB	Volts	465	467	464	463	472
716	MOTOR VOLTAGE - AC	Volts	468	470	467	465	475
717	MOTOR VOLTAGE - CB	Volts	466	468	465	464	473
718	MOTOR CURRENT - A	Amps	226	215	198	190	128
719	MOTOR CURRENT - B	Amps	239	229	210	203	139
720	MOTOR CURRENT - C	Amps	224	216	198	192	136
721	UNIT POWER	KW	165	159	145	139	89
722	AVERAGE VOLTAGE	Volts	466	468	465	464	473
723	AVERAGE CURRENT	Amps	230	220	202	195	134
725	Coefficient of Performance		4.192	4.009	3.813	3.642	4.395
730	EVAP DELTA T	Deg C	5.40	5.07	4.38	4.02	3.12
731	COND DELTA T	Deg C	5.47	5.09	4.46	4.10	3.10
735	EVAP WATER FLOWRATE	Kg/Sec	30.67	30.10	30.03	30.02	30.05
736	COND WATER FLOWRATE	Kg/Sec	37.75	37.77	37.74	37.73	37.65
740	EVAP CAPACITY	KW	693.61	638.79	552.15	505.36	392.35
741	COND CAPACITY	KW	863.12	802.19	702.24	646.58	487.63
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.98	3.27	3.70	3.91	4.09
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	41.49	43.53	45.36	45.42	26.44
750	RUNNING TIME	Hr	9	10	10	11	12
751	STARTS		1	1	1	1	1
752	EVAP APPROACH TEMP	Deg C	3.67	3.39	3.00	2.78	2.61
753	COND APPROACH TEMP	Deg C	3.78	3.39	3.11	2.78	2.22
800	EVAP AVG H2O TEMP	Deg C	9.37	9.22	8.87	8.68	8.24
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.6	1000.6
802	EVAP H2O VISCOSITY	cp	1.323	1.327	1.341	1.348	1.365
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.192	4.192	4.192	4.193
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.585	0.585	0.584
810	COND AVG H2O TEMP	Deg C	34.96	37.59	40.00	40.59	22.64
811	COND WATER DENSITY	Kg/M3	994.8	993.8	992.9	992.7	998.4
812	COND H2O VISCOSITY	cp	0.719	0.683	0.652	0.644	0.940
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.179
814	COND H2O CON(K)	W/M C	0.625	0.628	0.631	0.632	0.607
815	ITD/DELTA T		1.68	1.67	1.68	1.69	1.83
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.011	0.033	0.039	0.039	0.000
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.006	0.017	0.017	0.011	0.000
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.028	-0.028	-0.028	-0.033	-0.028
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.000	0.000	0.000	0.000	0.000
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.011	0.078	-0.228	-0.061	0.056

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		16	17	18	19	20
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	10	10	10	10	90
Capacity	KW	383.9	370.9	352.7	275.7	838.9
Power	KW	91.2	92.6	92.8	84.5	198.0
Coefficient of Performance (COP)		4.210	4.007	3.799	3.263	4.237
Evaporator Leaving Water Temperature	Deg C	6.66	6.67	6.67	6.67	6.67
Condenser Entering Water Temperature	Deg C	23.89	26.67	29.42	32.24	29.43
Energy Balance	%	-0.94	-0.68	-1.04	-0.15	-0.73
Evaporator Entering Water Temperature	Deg C	9.71	9.62	9.47	8.86	13.26
Evaporator Leaving Water Temperature	Deg C	6.66	6.67	6.67	6.67	6.67
Evaporator Water Flow Rate	L/S	30.01	30.00	30.00	29.98	30.41
Condenser Entering Water Temperature	Deg C	23.89	26.67	29.42	32.24	29.43
Condenser Leaving Water Temperature	Deg C	26.93	29.63	32.28	34.53	36.06
Condenser Water Flow Rate	L/S	37.76	37.77	37.84	37.89	37.84
Evap Sat Press	kPa	47.99	48.19	48.47	49.16	44.33
Sat Temp	Deg C	4.23	4.33	4.47	4.81	2.32
Approach	Deg C	2.44	2.33	2.17	1.83	4.33
LMTD	Deg C	3.75	3.61	3.41	2.81	7.14
ITD/Delta T		1.80	1.79	1.78	1.85	1.66
Q/Ao	kW/m2	25.05	24.21	23.01	17.99	54.76
Uo	kW/m2 C	6.67	6.71	6.75	6.40	7.67
ho'	kW/m2 C	11.05	11.16	11.28	10.36	13.83
Cond Sat Press	kPa	121.49	132.59	144.38	152.99	180.23
Sat Temp	Deg C	29.07	31.67	34.26	36.04	41.23
Approach	Deg C	2.17	2.06	2.00	1.50	5.17
Refrigerant Leaving Temp	Deg C	28.66	31.30	33.90	35.71	40.52
LMTD	Deg C	3.44	3.30	3.20	2.49	8.03
Q/Ao	kW/m2	24.99	24.33	23.44	18.82	54.46
Uo	kW/m2 C	7.27	7.37	7.34	7.56	6.78
ho'	kW/m2 C	11.74	11.87	11.64	12.09	10.24
Cond Sat Temp	Deg C	29.07	31.67	34.26	36.04	41.23
Evap Sat Temp	Deg C	4.23	4.33	4.47	4.81	2.32
Estimated Motor Efficiency (1)		0.95	0.95	0.95	0.95	0.93
Estimated Motor Rev/Sec (1)		59.56	59.55	59.55	59.59	58.95
Compressor Suction Flow Rate (2)	m3/sec	0.731	0.707	0.671	0.520	1.762
Isentropic COP (2)		10.251	9.302	8.513	8.101	6.234
Adiabatic Efficiency (3)		0.408	0.430	0.444	0.402	0.680
Q/N - m3/rev (4)		0.0123	0.0119	0.0113	0.0087	0.0299
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	108.3	108.2	108.2	108.1	111.1
3	ENT EVAP WATER TEMP LOC 1	Deg C	9.69	9.60	9.46	8.84	13.25
4	ENT EVAP WATER TEMP LOC 2	Deg C	9.73	9.63	9.48	8.87	13.27
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.66	6.67	6.67	6.67	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.66	6.67	6.67	6.66	6.67
15	COND WATER FLOWMETER DELTA P	kPa	170.9	170.8	171.2	171.5	171.2
17	ENT COND WATER TEMP LOC 1	Deg C	23.89	26.67	29.43	32.25	29.43
18	ENT COND WATER TEMP LOC 2	Deg C	23.89	26.66	29.42	32.23	29.43
19	LVG COND WATER TEMP LOC 1	Deg C	26.93	29.63	32.28	34.53	36.06
20	LVG COND WATER TEMP LOC 2	Deg C	26.93	29.63	32.27	34.52	36.06
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	5.77	5.87	6.12	6.42	4.08
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	5.47	5.57	5.80	6.26	3.47
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	5.43	5.61	5.72	5.97	3.52
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	48.0	48.2	48.5	49.2	44.3
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	53.1	56.3	60.1	62.5	74.5
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	53.8	57.4	61.3	64.1	74.8
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	51.8	55.2	59.0	61.7	69.6
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	82.9	90.0	97.8	105.8	126.9
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	77.3	83.2	89.8	96.5	120.3
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	79.8	86.5	94.0	100.5	112.2
431	COND SHELL STATIC PRESS - AVERAGE	kPa	121.5	132.6	144.4	153.0	180.2
440	REFRIGERANT LVG COND TEMP	Deg C	28.66	31.30	33.90	35.71	40.52
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	89.6	95.5	101.8	105.6	117.1
485	HIGH PRESS ECONOMIZER TEMP	Deg C	20.54	22.15	23.85	24.87	27.67
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	53.1	56.4	60.1	62.7	74.3
487	LOW PRESS ECONOMIZER TEMP	Deg C	6.41	7.91	9.52	10.63	15.11
530	ENT EVAP ORIFICE ASSY PRESS	kPa	53.8	56.8	60.1	62.5	74.8
531	ENT EVAP ORIFICE ASSY TEMP	Deg C	6.48	7.94	9.52	10.51	15.15
532	LVG EVAP ORIFICE ASSY PRESS	kPa	50.3	51.0	52.1	53.2	61.3
533	LVG EVAP ORIFICE ASSY TEMP	Deg C	5.13	5.38	5.83	6.36	10.32
534	ENT COND ORIFICE ASSY PRESS	kPa	119.7	130.6	142.5	151.0	178.7
535	ENT COND ORIFICE ASSY TEMP	Deg C	28.50	31.06	33.67	35.46	40.54
536	LVG COND ORIFICE ASSY PRESS	kPa	94.6	101.0	107.6	111.0	135.8
537	LVG COND ORIFICE ASSY TEMP	Deg C	21.86	23.63	25.43	26.16	32.64
560	ATMOSPHERIC PRESS	kPa	99.1	99.1	99.1	99.1	98.6
580	MOTOR VOLTAGE - AB	Volts	3.936	3.923	3.918	3.942	3.864
581	MOTOR VOLTAGE - AC	Volts	3.959	3.947	3.942	3.970	3.888
582	MOTOR VOLTAGE - CB	Volts	3.942	3.927	3.922	3.946	3.865
583	MOTOR CURRENT - A	Volts	1.310	1.326	1.340	1.235	2.686
584	MOTOR CURRENT - B	Volts	1.418	1.432	1.427	1.332	2.810
585	MOTOR CURRENT - C	Volts	1.373	1.389	1.387	1.307	2.667
586	MOTOR POWER - PHASE 1	Volts	0.448	0.460	0.466	0.391	1.240
587	MOTOR POWER - PHASE 3	Volts	1.072	1.083	1.081	1.016	2.060
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	26.84	29.59	32.24	34.49	36.07
601	MAXIMUM MOTOR TEMPERATURE	Deg C	32.51	28.61	29.17	28.61	84.17
605	1st STAGE VANE SETTING	Degrees	10	10	10	10	90
607	3rd STAGE VANE SETTING	Degrees	19	19	19	19	68
608	UNIT HOUR METER READING	Hr	341	342	342	342	350
609	UNIT START COUNTER READING		96	96	96	96	98
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	26	26	27	27	360
701	ENERGY BALANCE	%	-0.94	-0.68	-1.04	-0.15	-0.73

Large Impellers - Metric

702	EVAP CAPACITY	KW	383.9	370.9	352.7	275.7	838.9
703	EVAP WATER FLOWRATE	LS	30.01	30.00	30.00	29.98	30.41
704	COND WATER FLOWRATE	LS	37.76	37.77	37.84	37.89	37.84
710	AVE ENT EVAP WATER TEMP	Deg C	9.71	9.62	9.47	8.86	13.26
711	AVE LVG EVAP WATER TEMP	Deg C	6.66	6.67	6.67	6.67	6.67
712	AVE ENT COND WATER TEMP	Deg C	23.89	26.67	29.42	32.24	29.43
713	AVE LVG COND WATER TEMP	Deg C	26.93	29.63	32.28	34.53	36.06
715	MOTOR VOLTAGE - AB	Volts	472	471	470	473	464
716	MOTOR VOLTAGE - AC	Volts	475	474	473	476	467
717	MOTOR VOLTAGE - CB	Volts	473	471	471	474	464
718	MOTOR CURRENT - A	Amps	131	133	134	124	269
719	MOTOR CURRENT - B	Amps	142	143	143	133	281
720	MOTOR CURRENT - C	Amps	137	139	139	131	267
721	UNIT POWER	KW	91	93	93	84	198
722	AVERAGE VOLTAGE	Volts	474	472	471	474	465
723	AVERAGE CURRENT	Amps	137	138	138	129	272
725	Coefficient of Performance		4.210	4.007	3.799	3.263	4.237
730	EVAP DELTA T	Deg C	3.05	2.95	2.81	2.19	6.59
731	COND DELTA T	Deg C	3.04	2.96	2.85	2.29	6.63
735	EVAP WATER FLOWRATE	Kg/Sec	30.02	30.00	30.00	29.99	30.39
736	COND WATER FLOWRATE	Kg/Sec	37.67	37.65	37.69	37.71	37.69
740	EVAP CAPACITY	KW	383.83	371.01	352.50	275.60	839.03
741	COND CAPACITY	KW	478.62	466.10	448.99	360.47	1043.11
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	4.23	4.33	4.47	4.81	2.32
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	29.07	31.67	34.26	36.04	41.23
750	RUNNING TIME	Hr	12	13	13	13	21
751	STARTS		1	1	1	1	3
752	EVAP APPROACH TEMP	Deg C	2.44	2.33	2.17	1.83	4.33
753	COND APPROACH TEMP	Deg C	2.17	2.06	2.00	1.50	5.17
800	EVAP AVG H2O TEMP	Deg C	8.18	8.14	8.07	7.76	9.96
801	EVAP WATER DENSITY	Kg/M3	1000.6	1000.6	1000.6	1000.6	1000.5
802	EVAP H2O VISCOSITY	cp	1.368	1.369	1.372	1.384	1.301
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.193	4.193	4.194	4.194	4.190
804	EVAP H2O CON(K)	W/M C	0.584	0.584	0.584	0.583	0.587
810	COND AVG H2O TEMP	Deg C	25.41	28.14	30.85	33.38	32.74
811	COND WATER DENSITY	Kg/M3	997.7	996.9	996.1	995.3	995.5
812	COND H2O VISCOSITY	cp	0.882	0.830	0.783	0.743	0.753
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.178	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.611	0.615	0.619	0.623	0.622
815	ITD/DELTA T		1.80	1.79	1.78	1.85	1.66
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.000	0.006	0.011	0.022	0.006
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.006	0.000	0.006	0.011	0.006
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.033	-0.033	-0.028	-0.033	-0.017
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.000	0.000	0.000	0.006	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.083	0.033	0.039	0.044	-0.011

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		21	22	23	24	25
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	788.3	726.0	915.6	903.3	880.8
Power	KW	192.6	184.6	203.6	197.0	203.8
Coefficient of Performance (COP)		4.093	3.933	4.496	4.586	4.322
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	6.67	6.66	6.67
Condenser Entering Water Temperature	Deg C	32.20	34.99	23.87	21.03	26.53
Energy Balance	%	-0.48	-0.52	-1.04	-1.13	-1.14
Evaporator Entering Water Temperature	Deg C	12.87	12.39	13.86	13.72	13.60
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	6.67	6.66	6.67
Evaporator Water Flow Rate	L/S	30.37	30.34	30.44	30.51	30.33
Condenser Entering Water Temperature	Deg C	32.20	34.99	23.87	21.03	26.53
Condenser Leaving Water Temperature	Deg C	38.45	40.81	31.02	28.08	33.49
Condenser Water Flow Rate	L/S	37.90	37.91	37.91	37.72	37.84
Evap Sat Press	kPa	44.88	45.51	43.37	41.37	43.57
Sat Temp	Deg C	2.62	2.95	1.80	0.68	1.91
Approach	Deg C	4.06	3.72	4.89	5.94	4.78
LMTD	Deg C	6.67	6.15	7.92	9.05	7.72
ITD/Delta T		1.65	1.65	1.68	1.85	1.69
Q/Ao	kW/m2	51.44	47.38	59.74	58.95	57.47
Uo	kW/m2 C	7.71	7.71	7.54	6.51	7.45
ho'	kW/m2 C	13.97	14.01	13.38	10.45	13.13
Cond Sat Press	kPa	191.88	203.81	156.23	142.10	168.09
Sat Temp	Deg C	43.26	45.25	36.69	33.77	39.00
Approach	Deg C	4.83	4.44	5.67	5.67	5.50
Refrigerant Leaving Temp	Deg C	42.66	44.71	36.09	33.13	38.40
LMTD	Deg C	7.51	6.95	8.77	8.74	8.52
Q/Ao	kW/m2	51.40	47.74	58.92	57.97	57.14
Uo	kW/m2 C	6.85	6.87	6.72	6.63	6.71
ho'	kW/m2 C	10.28	10.24	10.27	10.19	10.16
Cond Sat Temp	Deg C	43.26	45.25	36.69	33.77	39.00
Evap Sat Temp	Deg C	2.62	2.95	1.80	0.68	1.91
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		58.99	59.04	58.92	58.96	58.92
Compressor Suction Flow Rate (2)	m3/sec	1.642	1.499	1.946	1.995	1.872
Isentropic COP (2)		5.959	5.726	6.976	7.340	6.547
Adiabatic Efficiency (3)		0.686	0.690	0.646	0.622	0.663
Q/N - m3/rev (4)		0.0278	0.0254	0.0330	0.0338	0.0318
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	110.9	110.6	111.3	111.8	110.5
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.86	12.37	13.84	13.72	13.59
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.88	12.40	13.86	13.73	13.61
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.68	6.67	6.66	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67	6.67	6.66	6.67
15	COND WATER FLOWMETER DELTA P	kPa	171.6	171.5	172.2	170.6	171.4
17	ENT COND WATER TEMP LOC 1	Deg C	32.21	35.01	23.87	21.02	26.53
18	ENT COND WATER TEMP LOC 2	Deg C	32.19	34.98	23.87	21.03	26.53
19	LVG COND WATER TEMP LOC 1	Deg C	38.44	40.81	31.02	28.08	33.49
20	LVG COND WATER TEMP LOC 2	Deg C	38.46	40.80	31.02	28.08	33.48
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.18	5.14	4.46	2.67	4.03
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.72	4.51	3.66	2.17	3.52
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	3.85	5.01	4.25	3.36	4.32
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	44.9	45.5	43.4	41.4	43.6
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	76.7	79.0	70.8	67.0	72.3
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	77.0	79.3	71.0	67.2	72.6
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	72.4	75.4	64.5	60.7	66.5
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	132.2	137.6	117.1	109.4	121.9
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	125.9	131.5	110.2	102.5	114.9
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	118.7	125.3	100.4	92.5	106.0
431	COND SHELL STATIC PRESS - AVERAGE	kPa	191.9	203.8	156.2	142.1	168.1
440	REFRIGERANT LVG COND TEMP	Deg C	42.66	44.71	36.09	33.13	38.40
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	123.3	129.8	104.9	96.9	110.7
485	HIGH PRESS ECONOMIZER TEMP	Deg C	29.20	30.70	24.50	22.26	26.03
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	76.9	79.3	69.6	65.6	71.8
487	LOW PRESS ECONOMIZER TEMP	Deg C	15.97	16.78	13.37	11.82	14.14
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	77.2	79.3	72.0	68.1	72.8
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	15.97	16.75	13.54	11.98	14.19
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	61.3	61.6	59.5	56.4	59.7
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	10.22	10.27	9.96	8.62	9.93
534	ENT COND ORIFICE ASS'Y PRESS	kPa	189.4	200.4	156.1	142.2	167.3
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	42.55	44.42	36.18	33.23	38.45
536	LVG COND ORIFICE ASS'Y PRESS	kPa	142.7	148.7	123.2	114.9	128.3
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	34.05	35.37	29.74	27.52	31.28
560	ATMOSPHERIC PRESS	kPa	98.5	98.5	98.5	98.5	98.5
580	MOTOR VOLTAGE - AB	Volts	3.867	3.891	3.828	3.874	3.870
581	MOTOR VOLTAGE - AC	Volts	3.889	3.910	3.847	3.893	3.888
582	MOTOR VOLTAGE - CB	Volts	3.866	3.891	3.831	3.878	3.875
583	MOTOR CURRENT - A	Volts	2.622	2.509	2.794	2.674	2.768
584	MOTOR CURRENT - B	Volts	2.741	2.622	2.926	2.802	2.908
585	MOTOR CURRENT - C	Volts	2.589	2.470	2.754	2.639	2.717
586	MOTOR POWER - PHASE 1	Volts	1.209	1.156	1.289	1.234	1.291
587	MOTOR POWER - PHASE 3	Volts	2.000	1.921	2.105	2.049	2.105
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	38.47	40.81	30.98	28.20	33.49
601	MAXIMUM MOTOR TEMPERATURE	Deg C	79.17	73.61	100.28	115.28	89.67
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	68
608	UNIT HOUR METER READING	Hr	351	351	353	354	354
609	UNIT START COUNTER READING		98	98	100	100	100
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	360	361	379	380	380
701	ENERGY BALANCE	%	-0.48	-0.52	-1.04	-1.13	-1.14

Large Impellers - Metric

702	EVAP CAPACITY	KW	788.3	726.0	915.6	903.3	880.8
703	EVAP WATER FLOWRATE	L/S	30.37	30.34	30.44	30.51	30.33
704	COND WATER FLOWRATE	L/S	37.90	37.91	37.91	37.72	37.84
710	AVE ENT EVAP WATER TEMP	Deg C	12.87	12.39	13.86	13.72	13.60
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.68	6.67	6.66	6.67
712	AVE ENT COND WATER TEMP	Deg C	32.20	34.99	23.87	21.03	26.53
713	AVE LVG COND WATER TEMP	Deg C	38.45	40.81	31.02	28.08	33.49
715	MOTOR VOLTAGE - AB	Volts	464	467	459	465	464
716	MOTOR VOLTAGE - AC	Volts	467	469	462	467	467
717	MOTOR VOLTAGE - CB	Volts	464	467	460	465	465
718	MOTOR CURRENT - A	Amps	262	251	279	267	277
719	MOTOR CURRENT - B	Amps	274	262	293	280	291
720	MOTOR CURRENT - C	Amps	259	247	275	264	272
721	UNIT POWER	KW	193	185	204	197	204
722	AVERAGE VOLTAGE	Volts	465	468	460	466	465
723	AVERAGE CURRENT	Amps	265	253	282	271	280
725	Coefficient of Performance		4.093	3.933	4.496	4.586	4.322
730	EVAP DELTA T	Deg C	6.19	5.71	7.18	7.07	6.93
731	COND DELTA T	Deg C	6.25	5.81	7.14	7.06	6.95
735	EVAP WATER FLOWRATE	Kg/Sec	30.37	30.34	30.42	30.50	30.32
736	COND WATER FLOWRATE	Kg/Sec	37.72	37.70	37.82	37.66	37.72
740	EVAP CAPACITY	KW	788.13	726.03	915.44	903.19	880.61
741	COND CAPACITY	KW	984.52	914.48	1128.62	1110.33	1094.44
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.62	2.95	1.80	0.68	1.91
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	43.26	45.25	36.69	33.77	39.00
750	RUNNING TIME	Hr	22	22	24	25	25
751	STARTS		3	3	5	5	5
752	EVAP APPROACH TEMP	Deg C	4.06	3.72	4.89	5.94	4.78
753	COND APPROACH TEMP	Deg C	4.83	4.44	5.67	5.67	5.50
800	EVAP AVG H2O TEMP	Deg C	9.77	9.53	10.26	10.19	10.13
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.4	1000.4	1000.4
802	EVAP H2O VISCOSITY	cp	1.308	1.317	1.290	1.293	1.295
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.191	4.190	4.190	4.190
804	EVAP H2O CON(K)	W/M C	0.587	0.586	0.587	0.587	0.587
810	COND AVG H2O TEMP	Deg C	35.33	37.90	27.44	24.55	30.02
811	COND WATER DENSITY	Kg/M3	994.7	993.7	997.1	997.9	996.4
812	COND H2O VISCOSITY	cp	0.714	0.679	0.842	0.899	0.798
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.178	4.177
814	COND H2O CON(K)	W/M C	0.625	0.629	0.614	0.610	0.618
815	ITD/DELTA T		1.65	1.65	1.68	1.85	1.69
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.022	0.033	0.000	-0.006	0.000
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.011	0.006	0.000	0.000	0.006
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.022	-0.028	-0.017	-0.017	-0.017
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.000	0.006	0.006	0.000	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.022	-0.006	0.039	-0.117	-0.006

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		26	27	28	29	30
Refrigerant		11	11	11	11	11
Oil		Trane 22	Trane 22	Trane 22	Trane 22	Trane 22
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	KW	853.7	895.5	906.4	801.6	751.7
Power	KW	193.7	198.5	194.6	187.7	182.8
Coefficient of Performance (COP)		4.408	4.511	4.657	4.271	4.113
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.66	6.68
Condenser Entering Water Temperature	Deg C	26.66	23.87	21.13	29.42	32.21
Energy Balance	%	-1.00	-0.92	-0.85	-0.95	-0.52
Evaporator Entering Water Temperature	Deg C	13.39	13.71	13.76	12.99	12.62
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.66	6.68
Evaporator Water Flow Rate	L/S	30.31	30.39	30.50	30.25	30.20
Condenser Entering Water Temperature	Deg C	26.66	23.87	21.13	29.42	32.21
Condenser Leaving Water Temperature	Deg C	33.36	30.88	28.19	35.75	38.17
Condenser Water Flow Rate	L/S	37.86	37.76	37.69	37.88	37.89
Evap Sat Press	kPa	43.71	43.71	42.68	43.85	44.40
Sat Temp	Deg C	1.99	1.99	1.42	2.06	2.36
Approach	Deg C	4.67	4.67	5.22	4.61	4.33
LMTD	Deg C	7.55	7.67	8.29	7.31	6.87
ITD/Delta T		1.70	1.66	1.74	1.73	1.73
Q/Ao	kW/m2	55.71	58.45	59.16	52.33	49.07
Uo	kW/m2 C	7.38	7.63	7.13	7.16	7.15
ho'	kW/m2 C	12.93	13.67	12.15	12.28	12.28
Cond Sat Press	kPa	166.16	155.41	142.72	177.33	189.12
Sat Temp	Deg C	38.63	36.53	33.90	40.71	42.79
Approach	Deg C	5.28	5.67	5.72	4.94	4.61
Refrigerant Leaving Temp	Deg C	37.99	35.92	33.22	40.05	42.28
LMTD	Deg C	8.17	8.70	8.77	7.69	7.19
Q/Ao	kW/m2	55.13	57.56	57.89	52.06	49.00
Uo	kW/m2 C	6.74	6.62	6.60	6.77	6.82
ho'	kW/m2 C	10.25	10.06	10.12	10.21	10.22
Cond Sat Temp	Deg C	38.63	36.53	33.90	40.71	42.79
Evap Sat Temp	Deg C	1.99	1.99	1.42	2.06	2.36
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		58.98	58.95	58.98	59.02	59.05
Compressor Suction Flow Rate (2)	m3/sec	1.808	1.889	1.945	1.699	1.580
Isentropic COP (2)		6.634	7.046	7.513	6.290	6.010
Adiabatic Efficiency (3)		0.663	0.640	0.616	0.682	0.688
Q/N - m3/rev (4)		0.0306	0.0320	0.0330	0.0288	0.0268
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	110.4	110.9	111.7	110.0	109.6
3	ENT EVAP WATER TEMP LOC 1	Deg C	13.38	13.70	13.76	12.98	12.61
4	ENT EVAP WATER TEMP LOC 2	Deg C	13.41	13.72	13.77	13.00	12.63
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.67	6.67	6.66	6.68
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.66	6.67	6.67	6.66	6.67
15	COND WATER FLOWMETER DELTA P	kPa	171.5	170.8	170.3	171.6	171.5
17	ENT COND WATER TEMP LOC 1	Deg C	26.66	23.87	21.13	29.43	32.23
18	ENT COND WATER TEMP LOC 2	Deg C	26.66	23.86	21.13	29.42	32.19
19	LVG COND WATER TEMP LOC 1	Deg C	33.36	30.88	28.19	35.76	38.18
20	LVG COND WATER TEMP LOC 2	Deg C	33.36	30.87	28.19	35.74	38.16
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.13	3.98	3.81	4.31	4.33
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.81	3.77	3.43	4.02	4.25
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.36	4.42	4.20	4.44	4.44
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	43.7	43.7	42.7	43.9	44.4
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	71.3	70.2	67.8	72.8	75.2
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	71.4	70.3	67.8	73.0	75.4
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	65.8	64.2	61.3	68.2	71.2
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	120.7	116.3	110.5	125.1	130.6
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	114.6	110.5	104.7	119.4	124.9
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	105.6	100.5	94.2	110.9	117.4
431	COND SHELL STATIC PRESS - AVERAGE	kPa	166.2	155.4	142.7	177.3	189.1
440	REFRIGERANT LVG COND TEMP	Deg C	37.99	35.92	33.22	40.05	42.28
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	110.2	105.1	98.5	115.5	122.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	25.89	24.57	22.72	27.29	28.88
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	70.7	69.2	66.2	72.9	75.3
487	LOW PRESS ECONOMIZER TEMP	Deg C	13.79	13.22	12.06	14.51	15.43
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	71.3	71.4	68.7	73.1	75.6
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	13.87	13.38	12.22	14.52	15.42
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	59.0	59.1	57.2	59.0	59.8
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.34	9.72	9.04	9.17	9.53
534	ENT COND ORIFICE ASS'Y PRESS	kPa	165.0	154.6	142.6	175.5	186.3
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	38.01	35.95	33.33	39.99	42.07
536	LVG COND ORIFICE ASS'Y PRESS	kPa	128.3	120.9	115.1	133.4	139.3
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	30.91	29.52	27.76	32.12	33.53
560	ATMOSPHERIC PRESS	kPa	98.5	98.4	98.4	98.4	98.4
580	MOTOR VOLTAGE - AB	Volts	3.890	3.857	3.864	3.902	3.873
581	MOTOR VOLTAGE - AC	Volts	3.907	3.874	3.884	3.919	3.888
582	MOTOR VOLTAGE - CB	Volts	3.898	3.857	3.868	3.900	3.871
583	MOTOR CURRENT - A	Volts	2.614	2.711	2.652	2.532	2.484
584	MOTOR CURRENT - B	Volts	2.761	2.833	2.768	2.672	2.608
585	MOTOR CURRENT - C	Volts	2.591	2.663	2.622	2.518	2.452
586	MOTOR POWER - PHASE 1	Volts	1.208	1.261	1.222	1.166	1.148
587	MOTOR POWER - PHASE 3	Volts	2.020	2.048	2.022	1.962	1.898
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	33.35	30.86	28.13	35.74	38.23
601	MAXIMUM MOTOR TEMPERATURE	Deg C	81.39	93.61	111.39	75.28	71.39
605	1st STAGE VANE SETTING	Degrees	70	70	70	70	70
607	3rd STAGE VANE SETTING	Degrees	63	63	63	63	63
608	UNIT HOUR METER READING	Hr	355	355	356	356	357
609	UNIT START COUNTER READING		100	100	100	100	100
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	381	381	382	382	383
701	ENERGY BALANCE	%	-1.00	-0.92	-0.85	-0.95	-0.52

Large Impellers - Metric

702	EVAP CAPACITY	KW	853.7	895.5	906.4	801.6	751.7
703	EVAP WATER FLOWRATE	L/S	30.31	30.39	30.50	30.25	30.20
704	COND WATER FLOWRATE	L/S	37.86	37.76	37.69	37.88	37.89
710	AVE ENT EVAP WATER TEMP	Deg C	13.39	13.71	13.76	12.99	12.62
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.67	6.67	6.66	6.68
712	AVE ENT COND WATER TEMP	Deg C	26.66	23.87	21.13	29.42	32.21
713	AVE LVG COND WATER TEMP	Deg C	33.36	30.88	28.19	35.75	38.17
715	MOTOR VOLTAGE - AB	Volts	467	463	464	468	465
716	MOTOR VOLTAGE - AC	Volts	469	465	466	470	467
717	MOTOR VOLTAGE - CB	Volts	468	463	464	468	465
718	MOTOR CURRENT - A	Amps	261	271	265	253	248
719	MOTOR CURRENT - B	Amps	276	283	277	267	261
720	MOTOR CURRENT - C	Amps	259	266	262	252	245
721	UNIT POWER	KW	194	199	195	188	183
722	AVERAGE VOLTAGE	Volts	468	464	465	469	465
723	AVERAGE CURRENT	Amps	266	274	268	257	251
725	Coefficient of Performance		4.408	4.511	4.657	4.271	4.113
730	EVAP DELTA T	Deg C	6.73	7.04	7.09	6.33	5.94
731	COND DELTA T	Deg C	6.70	7.01	7.06	6.33	5.96
735	EVAP WATER FLOWRATE	Kg/Sec	30.30	30.38	30.49	30.24	30.19
736	COND WATER FLOWRATE	Kg/Sec	37.74	37.66	37.62	37.73	37.71
740	EVAP CAPACITY	KW	853.65	895.68	906.46	801.81	751.87
741	COND CAPACITY	KW	1055.90	1102.45	1108.75	997.10	938.63
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.99	1.99	1.42	2.06	2.36
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	38.63	36.53	33.90	40.71	42.79
750	RUNNING TIME	Hr	26	27	27	28	28
751	STARTS		5	5	5	5	5
752	EVAP APPROACH TEMP	Deg C	4.67	4.67	5.22	4.61	4.33
753	COND APPROACH TEMP	Deg C	5.28	5.67	5.72	4.94	4.61
800	EVAP AVG H2O TEMP	Deg C	10.03	10.18	10.22	9.83	9.65
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.4	1000.4	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.298	1.293	1.292	1.305	1.313
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.190	4.190	4.190	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.587	0.587	0.587	0.587	0.586
810	COND AVG H2O TEMP	Deg C	30.01	27.37	24.66	32.59	35.19
811	COND WATER DENSITY	Kg/M3	996.4	997.2	997.9	995.6	994.7
812	COND H2O VISCOSITY	cp	0.798	0.844	0.897	0.754	0.716
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.178	4.177	4.177
814	COND H2O CON(K)	W/M C	0.618	0.614	0.610	0.622	0.625
815	ITD/DELTA T		1.70	1.66	1.74	1.73	1.73
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.006	0.011	0.000	0.011	0.033
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.006	0.006	0.000	0.011	0.022
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.028	-0.017	-0.017	-0.022	-0.017
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.011	0.006	0.000	0.000	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.011	0.017	0.056	0.011	-0.044

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		31	32	0	0	0
Refrigerant		11	11	0	0	0
Oil		Trane 22	Trane 22	0	0	0
1st Stage Guide Vane Setting	Degrees	70	10	0	0	0
Capacity	KW	686.0	246.1	0.0	0.0	0.0
Power	KW	173.7	84.2	0.0	0.0	0.0
Coefficient of Performance (COP)		3.949	2.922	#DIV/0!	#DIV/0!	#DIV/0!
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	-17.78	-17.78	-17.78
Condenser Entering Water Temperature	Deg C	34.97	34.96	-17.78	-17.78	-17.78
Energy Balance	%	-0.85	-1.35	0.00	0.00	0.00
Evaporator Entering Water Temperature	Deg C	12.02	8.58	-17.78	-17.78	-17.78
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	-17.78	-17.78	-17.78
Evaporator Water Flow Rate	L/S	30.60	30.76	0.00	0.00	0.00
Condenser Entering Water Temperature	Deg C	34.97	34.96	-17.78	-17.78	-17.78
Condenser Leaving Water Temperature	Deg C	40.47	37.07	-17.78	-17.78	-17.78
Condenser Water Flow Rate	L/S	37.89	37.92	0.00	0.00	0.00
Evap Sat Press	kPa	45.09	49.02	0.00	0.00	0.00
Sat Temp	Deg C	2.73	4.74	-17.78	-17.78	-17.78
Approach	Deg C	3.94	1.94	0.00	0.00	0.00
LMTD	Deg C	6.24	2.78	0.00	0.00	0.00
ITD/Delta T		1.74	2.01	0.00	0.00	0.00
Q/Ao	kW/m2	44.76	16.07	0.00	0.00	0.00
Uo	kW/m2 C	7.18	5.78	0.00	0.00	0.00
ho'	kW/m2 C	12.31	8.75	0.00	0.00	0.00
Cond Sat Press	kPa	200.43	166.23	0.00	0.00	0.00
Sat Temp	Deg C	44.69	38.64	-17.78	-17.78	-17.78
Approach	Deg C	4.22	1.56	0.00	0.00	0.00
Refrigerant Leaving Temp	Deg C	44.22	38.22	-17.78	-17.78	-17.78
LMTD	Deg C	6.60	2.48	0.00	0.00	0.00
Q/Ao	kW/m2	45.18	17.42	0.00	0.00	0.00
Uo	kW/m2 C	6.85	7.02	0.00	0.00	0.00
ho'	kW/m2 C	10.20	10.65	0.00	0.00	0.00
Cond Sat Temp	Deg C	44.69	38.64	-17.78	-17.78	-17.78
Evap Sat Temp	Deg C	2.73	4.74	-17.78	-17.78	-17.78
Estimated Motor Efficiency (1)		0.93	0.95	0.00	0.00	0.00
Estimated Motor Rev/Sec (1)		59.11	59.60	0.00	0.00	0.00
Compressor Suction Flow Rate (2)	m3/sec	1.426	0.467	0.000	0.000	0.000
Isentropic COP (2)		5.792	7.449	#DIV/0!	#DIV/0!	#DIV/0!
Adiabatic Efficiency (3)		0.682	0.393	0.000	0.000	0.000
Q/N - m3/rev (4)		0.0241	0.0078	0.0000	0.0000	0.0000
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	112.5	113.8	0.0	0.0	0.0
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.01	8.57	-17.78	-17.78	-17.78
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.03	8.60	-17.78	-17.78	-17.78
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.68	-17.78	-17.78	-17.78
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67	-17.78	-17.78	-17.78
15	COND WATER FLOWMETER DELTA P	kPa	171.3	171.6	0.0	0.0	0.0
17	ENT COND WATER TEMP LOC 1	Deg C	34.99	34.96	-17.78	-17.78	-17.78
18	ENT COND WATER TEMP LOC 2	Deg C	34.95	34.94	-17.78	-17.78	-17.78
19	LVG COND WATER TEMP LOC 1	Deg C	40.48	37.08	-17.78	-17.78	-17.78
20	LVG COND WATER TEMP LOC 2	Deg C	40.46	37.07	-17.78	-17.78	-17.78
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.63	6.46	-17.78	-17.78	-17.78
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.57	6.25	-17.78	-17.78	-17.78
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.76	6.74	-17.78	-17.78	-17.78
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	45.1	49.0	0.0	0.0	0.0
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	77.6	67.8	0.0	0.0	0.0
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	77.8	69.2	0.0	0.0	0.0
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	74.3	67.0	0.0	0.0	0.0
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	135.8	112.1	0.0	0.0	0.0
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	130.7	105.9	0.0	0.0	0.0
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	123.8	108.9	0.0	0.0	0.0
431	COND SHELL STATIC PRESS - AVERAGE	kPa	200.4	166.2	0.0	0.0	0.0
440	REFRIGERANT LVG COND TEMP	Deg C	44.22	38.22	-17.78	-17.78	-17.78
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	128.2	115.1	0.0	0.0	0.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	30.38	27.19	-17.78	-17.78	-17.78
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	77.8	67.8	0.0	0.0	0.0
487	LOW PRESS ECONOMIZER TEMP	Deg C	16.31	12.62	-17.78	-17.78	-17.78
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	77.6	67.0	0.0	0.0	0.0
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	16.22	12.29	-17.78	-17.78	-17.78
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	59.8	55.3	0.0	0.0	0.0
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.57	7.35	-17.78	-17.78	-17.78
534	ENT COND ORIFICE ASS'Y PRESS	kPa	197.4	163.0	0.0	0.0	0.0
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	43.92	37.87	-17.78	-17.78	-17.78
536	LVG COND ORIFICE ASS'Y PRESS	kPa	145.6	123.8	0.0	0.0	0.0
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	34.91	29.34	-17.78	-17.78	-17.78
560	ATMOSPHERIC PRESS	kPa	98.3	98.2	0.0	0.0	0.0
580	MOTOR VOLTAGE - AB	Volts	3.854	3.916	0.000	0.000	0.000
581	MOTOR VOLTAGE - AC	Volts	3.874	3.932	0.000	0.000	0.000
582	MOTOR VOLTAGE - CB	Volts	3.858	3.918	0.000	0.000	0.000
583	MOTOR CURRENT - A	Volts	2.373	1.244	0.000	0.000	0.000
584	MOTOR CURRENT - B	Volts	2.502	1.338	0.000	0.000	0.000
585	MOTOR CURRENT - C	Volts	2.355	1.278	0.000	0.000	0.000
586	MOTOR POWER - PHASE 1	Volts	1.085	0.414	0.000	0.000	0.000
587	MOTOR POWER - PHASE 3	Volts	1.810	0.990	0.000	0.000	0.000
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	40.52	37.12	-17.78	-17.78	-17.78
601	MAXIMUM MOTOR TEMPERATURE	Deg C	66.39	29.72	-17.78	-17.78	-17.78
605	1st STAGE VANE SETTING	Degrees	70	10	0	0	0
607	3rd STAGE VANE SETTING	Degrees	63	19	0	0	0
608	UNIT HOUR METER READING	Hr	358	360	0	0	0
609	UNIT START COUNTER READING		100	100	0	0	0
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	0.0	0.0	0.0
700	TIME (HOURS)	HOURS	384	385	0	0	0
701	ENERGY BALANCE	%	-0.85	-1.35	0.00	0.00	0.00

Large Impellers - Metric

702	EVAP CAPACITY	KW	686.0	246.1	0.0	0.0	0.0
703	EVAP WATER FLOWRATE	L/S	30.60	30.76	0.00	0.00	0.00
704	COND WATER FLOWRATE	L/S	37.89	37.92	0.00	0.00	0.00
710	AVE ENT EVAP WATER TEMP	Deg C	12.02	8.58	-17.78	-17.78	-17.78
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.68	-17.78	-17.78	-17.78
712	AVE ENT COND WATER TEMP	Deg C	34.97	34.96	-17.78	-17.78	-17.78
713	AVE LVG COND WATER TEMP	Deg C	40.47	37.07	-17.78	-17.78	-17.78
715	MOTOR VOLTAGE - AB	Volts	463	470	0	0	0
716	MOTOR VOLTAGE - AC	Volts	465	472	0	0	0
717	MOTOR VOLTAGE - CB	Volts	463	470	0	0	0
718	MOTOR CURRENT - A	Amps	237	124	0	0	0
719	MOTOR CURRENT - B	Amps	250	134	0	0	0
720	MOTOR CURRENT - C	Amps	236	128	0	0	0
721	UNIT POWER	KW	174	84	0	0	0
722	AVERAGE VOLTAGE	Volts	464	471	0	0	0
723	AVERAGE CURRENT	Amps	241	129	0	0	0
725	Coefficient of Performance		3.949	2.922	#DIV/0!	#DIV/0!	#DIV/0!
730	EVAP DELTA T	Deg C	5.35	1.91	0.00	0.00	0.00
731	COND DELTA T	Deg C	5.49	2.12	0.00	0.00	0.00
735	EVAP WATER FLOWRATE	Kg/Sec	30.59	30.76	0.00	0.00	0.00
736	COND WATER FLOWRATE	Kg/Sec	37.68	37.71	0.00	0.00	0.00
740	EVAP CAPACITY	KW	685.87	246.18	0.00	0.00	0.00
741	COND CAPACITY	KW	865.41	333.74	0.00	0.00	0.00
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.73	4.74	-17.78	-17.78	-17.78
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	44.69	38.64	-17.78	-17.78	-17.78
750	RUNNING TIME	Hr	29	31	0	0	0
751	STARTS		5	5	0	0	0
752	EVAP APPROACH TEMP	Deg C	3.94	1.94	0.00	0.00	0.00
753	COND APPROACH TEMP	Deg C	4.22	1.56	0.00	0.00	0.00
800	EVAP AVG H2O TEMP	Deg C	9.34	7.63	-17.78	-17.78	-17.78
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.6	0.0	0.0	0.0
802	EVAP H2O VISCOSITY	cp	1.323	1.390	0.000	0.000	0.000
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.194	0.000	0.000	0.000
804	EVAP H2O CON(K)	W/M C	0.586	0.583	0.000	0.000	0.000
810	COND AVG H2O TEMP	Deg C	37.72	36.02	-17.78	-17.78	-17.78
811	COND WATER DENSITY	Kg/M3	993.8	994.4	0.0	0.0	0.0
812	COND H2O VISCOSITY	cp	0.680	0.704	0.000	0.000	0.000
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	0.000	0.000	0.000
814	COND H2O CON(K)	W/M C	0.628	0.626	0.000	0.000	0.000
815	ITD/DELTA T		1.74	2.01	0.00	0.00	0.00
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.039	0.017	0.000	0.000	0.000
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.017	0.011	0.000	0.000	0.000
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.022	-0.033	0.000	0.000	0.000
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.000	0.006	0.000	0.000	0.000
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.044	-0.044	0.000	0.000	0.000

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		39	40	41	42	43
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	900.8	900.1	860.7	814.3	769.6
Power	KW	198.2	201.2	197.9	193.0	189.7
Coefficient of Performance (COP)		4.544	4.474	4.350	4.220	4.058
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	6.67	6.67	6.67
Condenser Entering Water Temperature	Deg C	21.11	23.89	26.65	29.43	32.21
Energy Balance	%	-0.86	-0.83	-1.02	-0.65	-1.04
Evaporator Entering Water Temperature	Deg C	13.70	13.72	13.44	13.08	12.74
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	6.67	6.67	6.67
Evaporator Water Flow Rate	L/S	30.59	30.52	30.37	30.29	30.24
Condenser Entering Water Temperature	Deg C	21.11	23.89	26.65	29.43	32.21
Condenser Leaving Water Temperature	Deg C	28.08	30.88	33.38	35.81	38.31
Condenser Water Flow Rate	L/S	38.03	38.06	38.11	38.14	38.15
Evap Sat Press	kPa	41.64	43.37	43.44	43.64	44.61
Sat Temp	Deg C	0.83	1.80	1.84	1.94	2.47
Approach	Deg C	5.83	4.89	4.83	4.72	4.17
LMTD	Deg C	8.89	7.89	7.73	7.48	6.79
ITD/Delta T		1.83	1.69	1.71	1.74	1.69
Q/Ao	kW/m2	58.78	58.75	56.18	53.15	50.22
Uo	kW/m2 C	6.61	7.45	7.27	7.11	7.40
ho'	kW/m2 C	10.69	13.09	12.59	12.13	13.04
Cond Sat Press	kPa	142.51	156.03	167.47	178.85	191.40
Sat Temp	Deg C	33.86	36.66	38.88	40.98	43.18
Approach	Deg C	5.78	5.78	5.50	5.17	4.89
Refrigerant Leaving Temp	Deg C	33.24	36.09	38.22	40.35	42.58
LMTD	Deg C	8.81	8.82	8.42	7.94	7.51
Q/Ao	kW/m2	57.78	57.89	55.73	52.87	50.50
Uo	kW/m2 C	6.56	6.57	6.62	6.66	6.73
ho'	kW/m2 C	10.00	9.91	9.93	9.93	9.99
Cond Sat Temp	Deg C	33.86	36.66	38.88	40.98	43.18
Evap Sat Temp	Deg C	0.83	1.80	1.84	1.94	2.47
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		58.95	58.93	58.95	58.99	59.01
Compressor Suction Flow Rate (2)	m3/sec	1.978	1.913	1.834	1.734	1.612
Isentropic COP (2)		7.356	6.976	6.547	6.212	5.959
Adiabatic Efficiency (3)		0.621	0.638	0.663	0.682	0.678
Q/N - m3/rev (4)		0.0336	0.0325	0.0311	0.0294	0.0273
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	112.5	111.9	110.9	110.2	109.9
3	ENT EVAP WATER TEMP LOC 1	Deg C	13.69	13.71	13.42	13.07	12.72
4	ENT EVAP WATER TEMP LOC 2	Deg C	13.71	13.74	13.45	13.09	12.77
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.68	6.67	6.67	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.68	6.67	6.66	6.67
15	COND WATER FLOWMETER DELTA P	kPa	173.5	173.6	173.9	174.0	173.9
17	ENT COND WATER TEMP LOC 1	Deg C	21.11	23.89	26.66	29.43	32.22
18	ENT COND WATER TEMP LOC 2	Deg C	21.11	23.88	26.64	29.42	32.21
19	LVG COND WATER TEMP LOC 1	Deg C	28.08	30.88	33.39	35.81	38.31
20	LVG COND WATER TEMP LOC 2	Deg C	28.08	30.88	33.37	35.81	38.32
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	3.49	4.54	4.28	4.34	4.58
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	1.54	2.50	2.51	2.55	3.08
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	2.92	3.73	3.81	3.80	4.23
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	41.6	43.4	43.4	43.6	44.6
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	67.5	70.9	72.0	73.6	76.1
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	67.6	70.9	72.3	73.9	76.5
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	61.2	64.7	66.7	68.9	72.0
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	108.6	114.9	118.9	123.4	129.4
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	103.2	110.0	114.5	119.1	125.3
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	93.1	100.2	105.5	111.1	118.0
431	COND SHELL STATIC PRESS - AVERAGE	kPa	142.5	156.0	167.5	178.8	191.4
440	REFRIGERANT LVG COND TEMP	Deg C	33.24	36.09	38.22	40.35	42.58
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	97.6	105.0	110.6	116.0	122.7
485	HIGH PRESS ECONOMIZER TEMP	Deg C	22.46	24.58	25.99	27.38	29.05
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	66.1	69.9	71.6	73.6	76.4
487	LOW PRESS ECONOMIZER TEMP	Deg C	12.01	13.41	14.09	14.76	15.81
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	68.2	71.8	72.4	73.9	76.6
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	12.17	13.57	14.20	14.79	15.77
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	56.7	59.3	59.4	60.3	60.5
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.72	9.72	9.54	9.63	9.85
534	ENT COND ORIFICE ASS'Y PRESS	kPa	142.4	155.8	166.5	176.8	188.6
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	33.39	36.22	38.30	40.28	42.44
536	LVG COND ORIFICE ASS'Y PRESS	kPa	113.5	124.5	127.8	133.8	141.8
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	27.47	29.88	31.01	32.30	33.98
560	ATMOSPHERIC PRESS	kPa	99.7	99.8	99.8	99.7	99.7
580	MOTOR VOLTAGE - AB	Volts	3.853	3.850	3.877	3.861	3.884
581	MOTOR VOLTAGE - AC	Volts	3.873	3.866	3.897	3.883	3.904
582	MOTOR VOLTAGE - CB	Volts	3.859	3.846	3.879	3.866	3.884
583	MOTOR CURRENT - A	Volts	2.701	2.757	2.679	2.612	2.563
584	MOTOR CURRENT - B	Volts	2.838	2.867	2.813	2.743	2.691
585	MOTOR CURRENT - C	Volts	2.666	2.713	2.669	2.616	2.559
586	MOTOR POWER - PHASE 1	Volts	1.257	1.266	1.233	1.200	1.175
587	MOTOR POWER - PHASE 3	Volts	2.046	2.087	2.065	2.016	1.986
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	28.09	30.84	33.40	35.83	38.26
601	MAXIMUM MOTOR TEMPERATURE	Deg C	100.83	98.06	86.94	80.83	76.94
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	68
608	UNIT HOUR METER READING	Hr	389	390	390	391	391
609	UNIT START COUNTER READING		109	109	109	109	109
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	-	0	1	1	2
701	ENERGY BALANCE	%	-0.86	-0.83	-1.02	-0.65	-1.04

Large Impellers - Metric

702	EVAP CAPACITY	KW	900.8	900.1	860.7	814.3	769.6
703	EVAP WATER FLOWRATE	L/S	30.59	30.52	30.37	30.29	30.24
704	COND WATER FLOWRATE	L/S	38.03	38.06	38.11	38.14	38.15
710	AVE ENT EVAP WATER TEMP	Deg C	13.70	13.72	13.44	13.08	12.74
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.68	6.67	6.67	6.67
712	AVE ENT COND WATER TEMP	Deg C	21.11	23.89	26.65	29.43	32.21
713	AVE LVG COND WATER TEMP	Deg C	28.08	30.88	33.38	35.81	38.31
715	MOTOR VOLTAGE - AB	Volts	462	462	465	463	466
716	MOTOR VOLTAGE - AC	Volts	465	464	468	466	469
717	MOTOR VOLTAGE - CB	Volts	463	462	466	464	466
718	MOTOR CURRENT - A	Amps	270	276	268	261	256
719	MOTOR CURRENT - B	Amps	284	287	281	274	269
720	MOTOR CURRENT - C	Amps	267	271	267	262	256
721	UNIT POWER	KW	198	201	198	193	190
722	AVERAGE VOLTAGE	Volts	463	463	466	464	467
723	AVERAGE CURRENT	Amps	274	278	272	266	260
725	Coefficient of Performance		4.544	4.474	4.350	4.220	4.058
730	EVAP DELTA T	Deg C	7.03	7.04	6.77	6.42	6.08
731	COND DELTA T	Deg C	6.98	6.99	6.73	6.38	6.10
735	EVAP WATER FLOWRATE	Kg/Sec	30.58	30.51	30.37	30.28	30.23
736	COND WATER FLOWRATE	Kg/Sec	37.97	37.98	37.99	37.99	37.97
740	EVAP CAPACITY	KW	900.72	900.26	860.82	814.43	769.56
741	COND CAPACITY	KW	1106.69	1108.90	1067.50	1012.70	967.24
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	0.83	1.80	1.84	1.94	2.47
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	33.86	36.66	38.88	40.98	43.18
750	RUNNING TIME	Hr	60	61	61	62	62
751	STARTS		14	14	14	14	14
752	EVAP APPROACH TEMP	Deg C	5.83	4.89	4.83	4.72	4.17
753	COND APPROACH TEMP	Deg C	5.78	5.78	5.50	5.17	4.89
800	EVAP AVG H2O TEMP	Deg C	10.18	10.21	10.06	9.88	9.71
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.293	1.292	1.298	1.304	1.310
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.190	4.190	4.190	4.190	4.191
804	EVAP H2O CON(K)	W/M C	0.587	0.587	0.587	0.587	0.586
810	COND AVG H2O TEMP	Deg C	24.59	27.38	30.02	32.62	35.26
811	COND WATER DENSITY	Kg/M3	997.9	997.1	996.5	995.5	994.7
812	COND H2O VISCOSITY	cp	0.899	0.844	0.798	0.754	0.714
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.178	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.610	0.614	0.618	0.622	0.625
815	ITD/DELTA T		1.83	1.69	1.71	1.74	1.69
850	RTD DIFFERENCE CHECK - ECWT	Deg C	#VALUE!	0.006	0.017	0.006	0.011
851	RTD DIFFERENCE CHECK - LCWT	Deg C	#VALUE!	#VALUE!	0.017	0.006	-0.011
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.022	-0.028	-0.028	-0.022	-0.044
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	0.006	0.006	0.006	-0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.006	0.039	-0.011	-0.017	0.050

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		44	45	46	47	48
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	70	70	70	70
Capacity	KW	713.4	681.0	751.7	789.3	836.1
Power	KW	180.8	173.5	183.5	185.8	189.8
Coefficient of Performance (COP)		3.946	3.925	4.096	4.249	4.404
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.66	6.67	6.68
Condenser Entering Water Temperature	Deg C	34.99	35.48	32.21	29.43	26.69
Energy Balance	%	-1.07	-0.90	-0.88	-1.48	-0.80
Evaporator Entering Water Temperature	Deg C	12.18	11.93	12.47	12.90	13.26
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.66	6.67	6.68
Evaporator Water Flow Rate	L/S	30.86	30.84	30.91	30.25	30.35
Condenser Entering Water Temperature	Deg C	34.99	35.48	32.21	29.43	26.69
Condenser Leaving Water Temperature	Deg C	40.67	40.91	38.14	35.64	33.21
Condenser Water Flow Rate	L/S	38.22	38.20	38.17	38.13	38.07
Evap Sat Press	kPa	45.30	45.78	44.75	43.85	43.44
Sat Temp	Deg C	2.84	3.09	2.54	2.06	1.84
Approach	Deg C	3.83	3.56	4.11	4.61	4.83
LMTD	Deg C	6.18	5.81	6.60	7.28	7.67
ITD/Delta T		1.69	1.68	1.71	1.74	1.74
Q/Ao	kW/m2	46.55	44.44	49.06	51.53	54.56
Uo	kW/m2 C	7.53	7.64	7.43	7.07	7.11
ho'	kW/m2 C	13.32	13.69	13.00	12.05	12.13
Cond Sat Press	kPa	203.26	203.60	189.88	177.33	165.54
Sat Temp	Deg C	45.16	45.22	42.92	40.71	38.52
Approach	Deg C	4.50	4.33	4.78	5.06	5.33
Refrigerant Leaving Temp	Deg C	44.64	44.69	42.33	40.06	37.79
LMTD	Deg C	6.95	6.66	7.36	7.76	8.14
Q/Ao	kW/m2	47.08	44.93	49.17	51.53	53.91
Uo	kW/m2 C	6.78	6.75	6.69	6.64	6.62
ho'	kW/m2 C	10.00	9.93	9.90	9.90	9.95
Cond Sat Temp	Deg C	45.16	45.22	42.92	40.71	38.52
Evap Sat Temp	Deg C	2.84	3.09	2.54	2.06	1.84
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		59.06	59.11	59.05	59.03	59.01
Compressor Suction Flow Rate (2)	m3/sec	1.478	1.397	1.569	1.673	1.780
Isentropic COP (2)		5.726	5.783	6.020	6.290	6.634
Adiabatic Efficiency (3)		0.690	0.676	0.679	0.673	0.663
Q/N - m3/rev (4)		0.0250	0.0236	0.0266	0.0283	0.0302
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	114.5	114.3	114.8	110.0	110.6
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.17	11.92	12.45	12.88	13.26
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.20	11.95	12.48	12.92	13.27
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.67	6.66	6.66	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.66	6.66	6.67	6.68
15	COND WATER FLOWMETER DELTA P	kPa	174.4	174.2	174.1	173.9	173.5
17	ENT COND WATER TEMP LOC 1	Deg C	35.01	35.49	32.22	29.43	26.70
18	ENT COND WATER TEMP LOC 2	Deg C	34.97	35.47	32.19	29.42	26.67
19	LVG COND WATER TEMP LOC 1	Deg C	40.68	40.91	38.14	35.65	33.21
20	LVG COND WATER TEMP LOC 2	Deg C	40.67	40.69	38.13	35.64	33.19
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.97	5.31	4.71	4.44	4.28
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.49	3.77	3.23	2.69	2.45
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.63	4.92	4.39	3.87	3.73
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	45.3	45.8	44.7	43.9	43.4
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	78.8	78.9	75.6	72.8	71.0
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	79.0	79.0	75.8	73.0	71.3
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	75.3	75.6	71.6	68.2	65.8
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	135.1	135.4	128.5	122.3	117.2
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	131.2	132.7	125.8	119.6	114.2
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	124.7	125.5	117.5	110.6	104.7
431	COND SHELL STATIC PRESS - AVERAGE	kPa	203.3	203.6	189.9	177.3	165.5
440	REFRIGERANT LVG COND TEMP	Deg C	44.64	44.69	42.33	40.06	37.79
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	129.6	130.3	122.5	116.0	109.9
485	HIGH PRESS ECONOMIZER TEMP	Deg C	30.64	30.81	29.02	27.37	25.80
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	79.0	78.9	75.7	72.8	70.7
487	LOW PRESS ECONOMIZER TEMP	Deg C	16.72	16.67	15.58	14.53	13.71
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	79.0	78.9	75.8	73.4	71.3
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	16.63	16.59	15.51	14.56	13.78
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	61.2	60.5	60.1	59.2	58.7
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.99	9.73	9.64	9.27	9.18
534	ENT COND ORIFICE ASS'Y PRESS	kPa	200.3	200.1	187.3	175.1	163.7
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	44.38	44.33	42.14	39.96	37.83
536	LVG COND ORIFICE ASS'Y PRESS	kPa	147.3	147.5	140.2	132.9	127.1
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	35.25	35.30	33.74	32.03	30.54
560	ATMOSPHERIC PRESS	kPa	99.7	99.7	99.7	99.6	99.6
580	MOTOR VOLTAGE - AB	Volts	3.851	3.854	3.862	3.850	3.853
581	MOTOR VOLTAGE - AC	Volts	3.868	3.869	3.876	3.866	3.869
582	MOTOR VOLTAGE - CB	Volts	3.850	3.855	3.862	3.850	3.853
583	MOTOR CURRENT - A	Volts	2.470	2.372	2.503	2.543	2.592
584	MOTOR CURRENT - B	Volts	2.589	2.496	2.631	2.666	2.718
585	MOTOR CURRENT - C	Volts	2.451	2.349	2.461	2.519	2.567
586	MOTOR POWER - PHASE 1	Volts	1.126	1.079	1.159	1.159	1.189
587	MOTOR POWER - PHASE 3	Volts	1.887	1.813	1.900	1.937	1.975
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	40.70	40.92	38.17	35.67	33.11
601	MAXIMUM MOTOR TEMPERATURE	Deg C	71.94	67.50	71.39	74.17	80.28
605	1st STAGE VANE SETTING	Degrees	90	70	70	70	70
607	3rd STAGE VANE SETTING	Degrees	68	64	64	64	64
608	UNIT HOUR METER READING	Hr	391	392	393	393	393
609	UNIT START COUNTER READING		109	109	109	109	109
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	2	3	3	4	4
701	ENERGY BALANCE	%	-1.07	-0.90	-0.88	-1.48	-0.80

Large Impellers - Metric

702	EVAP CAPACITY	KW	713.4	681.0	751.7	789.3	836.1
703	EVAP WATER FLOWRATE	L/S	30.86	30.84	30.91	30.25	30.35
704	COND WATER FLOWRATE	L/S	38.22	38.20	38.17	38.13	38.07
710	AVE ENT EVAP WATER TEMP	Deg C	12.18	11.93	12.47	12.90	13.26
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.67	6.66	6.67	6.68
712	AVE ENT COND WATER TEMP	Deg C	34.99	35.48	32.21	29.43	26.69
713	AVE LVG COND WATER TEMP	Deg C	40.67	40.91	38.14	35.64	33.21
715	MOTOR VOLTAGE - AB	Volts	462	463	463	462	462
716	MOTOR VOLTAGE - AC	Volts	464	464	465	464	464
717	MOTOR VOLTAGE - CB	Volts	462	463	463	462	462
718	MOTOR CURRENT - A	Amps	247	237	250	254	259
719	MOTOR CURRENT - B	Amps	259	250	263	267	272
720	MOTOR CURRENT - C	Amps	245	235	246	252	257
721	UNIT POWER	KW	181	174	184	186	190
722	AVERAGE VOLTAGE	Volts	463	463	464	463	463
723	AVERAGE CURRENT	Amps	250	241	253	258	263
725	Coefficient of Performance		3.946	3.925	4.096	4.249	4.404
730	EVAP DELTA T	Deg C	5.52	5.27	5.81	6.23	6.58
731	COND DELTA T	Deg C	5.68	5.43	5.94	6.22	6.52
735	EVAP WATER FLOWRATE	Kg/Sec	30.85	30.84	30.90	30.24	30.34
736	COND WATER FLOWRATE	Kg/Sec	38.01	37.98	37.99	37.98	37.96
740	EVAP CAPACITY	KW	713.26	680.91	751.69	789.50	836.04
741	COND CAPACITY	KW	901.69	860.57	941.82	986.95	1032.53
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.84	3.09	2.54	2.06	1.84
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	45.16	45.22	42.92	40.71	38.52
750	RUNNING TIME	Hr	63	63	64	64	64
751	STARTS		14	14	14	14	14
752	EVAP APPROACH TEMP	Deg C	3.83	3.56	4.11	4.61	4.83
753	COND APPROACH TEMP	Deg C	4.50	4.33	4.78	5.06	5.33
800	EVAP AVG H2O TEMP	Deg C	9.43	9.30	9.57	9.78	9.97
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.320	1.324	1.315	1.307	1.301
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.192	4.191	4.191	4.190
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.587	0.587
810	COND AVG H2O TEMP	Deg C	37.83	38.19	35.17	32.53	29.94
811	COND WATER DENSITY	Kg/M3	993.8	993.6	994.7	995.7	996.5
812	COND H2O VISCOSITY	cp	0.679	0.674	0.716	0.756	0.798
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.629	0.629	0.625	0.622	0.618
815	ITD/DELTA T		1.69	1.68	1.71	1.74	1.74
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.039	0.022	0.028	0.006	0.022
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.011	0.017	0.011	0.006	0.017
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.028	-0.033	-0.033	-0.039	-0.017
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	0.006	#VALUE!	-0.011	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.022	-0.011	-0.022	-0.022	0.106

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		49	50	51	52	53
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	40	40	40
Capacity	KW	880.4	896.9	813.6	779.1	746.4
Power	KW	194.5	193.1	172.4	169.8	167.0
Coefficient of Performance (COP)		4.526	4.644	4.718	4.589	4.469
Evaporator Leaving Water Temperature	Deg C	6.68	6.67	6.67	6.68	6.66
Condenser Entering Water Temperature	Deg C	23.89	21.17	21.09	23.87	26.63
Energy Balance	%	-1.03	-0.75	-1.16	-1.13	-0.74
Evaporator Entering Water Temperature	Deg C	13.59	13.69	13.04	12.80	12.55
Evaporator Leaving Water Temperature	Deg C	6.68	6.67	6.67	6.68	6.66
Evaporator Water Flow Rate	L/S	30.44	30.50	30.48	30.37	30.26
Condenser Entering Water Temperature	Deg C	23.89	21.17	21.09	23.87	26.63
Condenser Leaving Water Temperature	Deg C	30.74	28.09	27.37	29.91	32.43
Condenser Water Flow Rate	L/S	38.06	37.96	37.99	38.06	38.10
Evap Sat Press	kPa	43.44	42.54	44.13	43.92	44.13
Sat Temp	Deg C	1.84	1.34	2.21	2.10	2.21
Approach	Deg C	4.83	5.33	4.44	4.56	4.44
LMTD	Deg C	7.79	8.35	7.18	7.21	6.99
ITD/Delta T		1.70	1.76	1.70	1.75	1.76
Q/Ao	kW/m2	57.46	58.53	53.09	50.84	48.72
Uo	kW/m2 C	7.37	7.01	7.40	7.05	6.97
ho'	kW/m2 C	12.87	11.78	12.95	11.96	11.77
Cond Sat Press	kPa	154.99	142.79	136.72	147.06	158.17
Sat Temp	Deg C	36.45	33.92	32.59	34.82	37.08
Approach	Deg C	5.72	5.83	5.22	4.89	4.67
Refrigerant Leaving Temp	Deg C	35.82	33.29	32.01	34.19	36.47
LMTD	Deg C	8.69	8.84	7.96	7.53	7.16
Q/Ao	kW/m2	56.60	57.26	51.97	50.00	47.98
Uo	kW/m2 C	6.51	6.48	6.53	6.64	6.70
ho'	kW/m2 C	9.79	9.81	9.94	10.09	10.15
Cond Sat Temp	Deg C	36.45	33.92	32.59	34.82	37.08
Evap Sat Temp	Deg C	1.84	1.34	2.21	2.10	2.21
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		58.98	58.99	59.11	59.13	59.15
Compressor Suction Flow Rate (2)	m3/sec	1.867	1.931	1.688	1.630	1.561
Isentropic COP (2)		7.046	7.497	8.120	7.513	7.046
Adiabatic Efficiency (3)		0.640	0.617	0.577	0.608	0.632
Q/N - m3/rev (4)		0.0317	0.0327	0.0286	0.0276	0.0264
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	111.3	111.7	111.6	110.8	110.0
3	ENT EVAP WATER TEMP LOC 1	Deg C	13.58	13.68	13.03	12.79	12.53
4	ENT EVAP WATER TEMP LOC 2	Deg C	13.60	13.71	13.06	12.81	12.56
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.68	6.67	6.67	6.68	6.66
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.67	6.67	6.67	6.66
15	COND WATER FLOWMETER DELTA P	kPa	173.5	172.9	173.1	173.5	173.7
17	ENT COND WATER TEMP LOC 1	Deg C	23.91	21.17	21.09	23.87	26.63
18	ENT COND WATER TEMP LOC 2	Deg C	23.89	21.17	21.09	23.87	26.63
19	LVG COND WATER TEMP LOC 1	Deg C	30.74	28.09	27.37	29.91	32.43
20	LVG COND WATER TEMP LOC 2	Deg C	30.73	28.09	27.37	29.91	32.44
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.26	3.77	4.43	4.25	4.32
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	2.58	2.10	2.87	2.73	2.77
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	3.72	3.36	4.10	3.99	3.99
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	43.4	42.5	44.1	43.9	44.1
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	70.1	67.9	65.4	66.5	68.4
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	70.1	67.8	65.5	66.7	68.6
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	64.1	61.6	60.1	61.6	64.1
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	113.4	107.9	107.8	111.3	115.8
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	110.2	104.7	96.7	100.4	105.2
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	99.8	93.9	91.6	96.1	101.3
431	COND SHELL STATIC PRESS - AVERAGE	kPa	155.0	142.8	136.7	147.1	158.2
440	REFRIGERANT LVG COND TEMP	Deg C	35.82	33.29	32.01	34.19	36.47
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	105.1	99.0	99.4	103.4	108.5
485	HIGH PRESS ECONOMIZER TEMP	Deg C	24.56	22.84	23.07	24.09	25.46
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	69.1	66.4	64.5	65.9	67.8
487	LOW PRESS ECONOMIZER TEMP	Deg C	13.16	12.15	11.37	11.93	12.67
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	70.6	68.6	65.4	66.4	68.1
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	13.31	12.31	11.51	11.96	12.68
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	58.5	57.2	55.6	56.1	56.7
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.36	8.88	7.99	7.94	8.08
534	ENT COND ORIFICE ASS'Y PRESS	kPa	154.0	142.9	136.2	146.1	156.0
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	35.91	33.31	32.15	34.21	36.42
536	LVG COND ORIFICE ASS'Y PRESS	kPa	123.2	116.0	112.7	115.8	122.1
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	29.52	27.77	26.77	28.01	29.53
560	ATMOSPHERIC PRESS	kPa	99.6	99.6	99.6	99.6	99.6
580	MOTOR VOLTAGE - AB	Volts	3.872	3.853	3.860	3.854	3.871
581	MOTOR VOLTAGE - AC	Volts	3.890	3.870	3.879	3.868	3.891
582	MOTOR VOLTAGE - CB	Volts	3.875	3.855	3.860	3.856	3.872
583	MOTOR CURRENT - A	Volts	2.644	2.629	2.351	2.320	2.284
584	MOTOR CURRENT - B	Volts	2.768	2.758	2.469	2.436	2.403
585	MOTOR CURRENT - C	Volts	2.623	2.601	2.347	2.315	2.280
586	MOTOR POWER - PHASE 1	Volts	1.216	1.213	1.064	1.048	1.027
587	MOTOR POWER - PHASE 3	Volts	2.026	2.006	1.810	1.782	1.757
585	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	30.70	28.01	27.33	29.88	32.41
601	MAXIMUM MOTOR TEMPERATURE	Deg C	89.72	107.50	92.50	74.17	65.28
605	1st STAGE VANE SETTING	Degrees	70	70	40	40	40
607	3rd STAGE VANE SETTING	Degrees	64	64	50	50	50
608	UNIT HOUR METER READING	Hr	394	394	395	395	395
609	UNIT START COUNTER READING		109	109	109	109	109
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	4	5	5	6	6
701	ENERGY BALANCE	%	-1.03	-0.75	-1.16	-1.13	-0.74

Large Impellers - Metric

702	EVAP CAPACITY	KW	880.4	896.9	813.6	779.1	746.4
703	EVAP WATER FLOWRATE	L/S	30.44	30.50	30.48	30.37	30.26
704	COND WATER FLOWRATE	L/S	38.06	37.96	37.99	38.06	38.10
710	AVE ENT EVAP WATER TEMP	Deg C	13.59	13.69	13.04	12.80	12.55
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.67	6.67	6.68	6.66
712	AVE ENT COND WATER TEMP	Deg C	23.89	21.17	21.09	23.87	26.63
713	AVE LVG COND WATER TEMP	Deg C	30.74	28.09	27.37	29.91	32.43
715	MOTOR VOLTAGE - AB	Volts	465	462	463	463	465
716	MOTOR VOLTAGE - AC	Volts	467	464	466	464	467
717	MOTOR VOLTAGE - CB	Volts	465	463	463	463	465
718	MOTOR CURRENT - A	Amps	264	263	235	232	228
719	MOTOR CURRENT - B	Amps	277	276	247	244	240
720	MOTOR CURRENT - C	Amps	262	260	235	232	228
721	UNIT POWER	KW	195	193	172	170	167
722	AVERAGE VOLTAGE	Volts	466	463	464	463	465
723	AVERAGE CURRENT	Amps	268	266	239	236	232
725	Coefficient of Performance		4.526	4.644	4.718	4.589	4.469
730	EVAP DELTA T	Deg C	6.91	7.02	6.37	6.13	5.89
731	COND DELTA T	Deg C	6.83	6.93	6.28	6.04	5.79
735	EVAP WATER FLOWRATE	Kg/Sec	30.42	30.49	30.47	30.36	30.25
736	COND WATER FLOWRATE	Kg/Sec	37.97	37.90	37.92	37.97	37.98
740	EVAP CAPACITY	KW	880.46	896.89	813.49	779.05	746.50
741	COND CAPACITY	KW	1084.02	1096.79	995.39	957.62	919.05
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.84	1.34	2.21	2.10	2.21
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	36.45	33.92	32.59	34.82	37.08
750	RUNNING TIME	Hr	65	65	66	66	66
751	STARTS		14	14	14	14	14
752	EVAP APPROACH TEMP	Deg C	4.83	5.33	4.44	4.56	4.44
753	COND APPROACH TEMP	Deg C	5.72	5.83	5.22	4.89	4.67
800	EVAP AVG H2O TEMP	Deg C	10.14	10.18	9.86	9.74	9.61
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.295	1.293	1.305	1.310	1.314
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.190	4.190	4.191	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.587	0.587	0.587	0.586	0.586
810	COND AVG H2O TEMP	Deg C	27.32	24.63	24.23	26.89	29.53
811	COND WATER DENSITY	Kg/M3	997.1	997.9	998.1	997.3	996.5
812	COND H2O VISCOSITY	cp	0.845	0.897	0.906	0.853	0.805
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.178	4.178	4.177	4.177
814	COND H2O CON(K)	W/M C	0.614	0.610	0.610	0.614	0.617
815	ITD/DELTA T		1.70	1.76	1.70	1.75	1.76
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.011	#VALUE!	#VALUE!	0.006	#VALUE!
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.006	#VALUE!	#VALUE!	0.006	-0.011
852	RTD DIFFERENCE CHECK - EEW	Deg C	-0.022	-0.028	-0.028	-0.022	-0.028
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	0.006	0.006	0.006	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.039	0.083	0.039	0.033	0.022

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		54	55	56	57	58
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	10
Capacity	KW	718.7	673.7	621.6	579.4	360.0
Power	KW	167.1	162.8	156.7	151.3	85.1
Coefficient of Performance (COP)		4.301	4.138	3.968	3.829	4.232
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.67	6.68
Condenser Entering Water Temperature	Deg C	29.43	32.21	34.99	36.48	21.11
Energy Balance	%	-0.51	-1.12	-0.89	-0.52	-1.41
Evaporator Entering Water Temperature	Deg C	12.35	11.88	11.47	11.16	9.47
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.67	6.68
Evaporator Water Flow Rate	L/S	30.23	30.88	30.90	30.80	30.73
Condenser Entering Water Temperature	Deg C	29.43	32.21	34.99	36.48	21.11
Condenser Leaving Water Temperature	Deg C	35.03	37.52	39.93	41.09	23.95
Condenser Water Flow Rate	L/S	38.15	38.18	38.24	38.39	37.99
Evap Sat Press	kPa	44.88	45.57	46.26	46.61	46.88
Sat Temp	Deg C	2.62	2.98	3.34	3.52	3.66
Approach	Deg C	4.06	3.67	3.33	3.17	3.00
LMTD	Deg C	6.48	5.91	5.37	5.06	4.26
ITD/Delta T		1.71	1.71	1.69	1.70	2.08
Q/Ao	kW/m2	46.91	43.98	40.57	37.82	23.50
Uo	kW/m2 C	7.24	7.44	7.56	7.47	5.51
ho'	kW/m2 C	12.56	13.04	13.41	13.18	8.14
Cond Sat Press	kPa	171.13	182.92	195.05	200.29	110.11
Sat Temp	Deg C	39.57	41.71	43.80	44.67	26.19
Approach	Deg C	4.56	4.17	3.89	3.61	2.22
Refrigerant Leaving Temp	Deg C	39.03	41.21	43.36	44.24	25.77
LMTD	Deg C	6.96	6.48	6.01	5.57	3.47
Q/Ao	kW/m2	46.44	44.07	40.92	38.31	23.51
Uo	kW/m2 C	6.67	6.80	6.81	6.87	6.76
ho'	kW/m2 C	9.97	10.16	10.10	10.17	10.57
Cond Sat Temp	Deg C	39.57	41.71	43.80	44.67	26.19
Evap Sat Temp	Deg C	2.62	2.98	3.34	3.52	3.66
Estimated Motor Efficiency (1)		0.93	0.93	0.94	0.94	0.95
Estimated Motor Rev/Sec (1)		59.15	59.17	59.21	59.24	59.59
Compressor Suction Flow Rate (2)	m3/sec	1.486	1.379	1.259	1.167	0.697
Isentropic COP (2)		6.634	6.335	6.062	5.969	11.305
Adiabatic Efficiency (3)		0.646	0.653	0.652	0.640	0.375
Q/N - m3/rev (4)		0.0251	0.0233	0.0213	0.0197	0.0117
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	109.8	114.6	114.8	114.0	113.5
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.33	11.86	11.45	11.14	9.45
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.36	11.89	11.48	11.17	9.49
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.68	6.67	6.67	6.67	6.68
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67	6.66	6.67	6.67
15	COND WATER FLOWMETER DELTA P	kPa	174.0	174.2	174.5	175.7	173.1
17	ENT COND WATER TEMP LOC 1	Deg C	29.44	32.21	34.99	36.49	21.11
18	ENT COND WATER TEMP LOC 2	Deg C	29.41	32.20	34.98	36.47	21.11
19	LVG COND WATER TEMP LOC 1	Deg C	35.04	37.53	39.93	41.09	23.94
20	LVG COND WATER TEMP LOC 2	Deg C	35.02	37.52	39.92	41.08	23.95
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.68	5.06	5.37	5.83	5.87
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.26	3.63	4.00	4.88	5.02
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.41	4.77	4.98	5.43	5.79
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	44.9	45.6	46.3	46.6	46.9
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	71.2	73.8	76.7	77.6	49.0
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	71.2	73.9	76.8	78.0	49.6
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	67.2	70.5	73.8	75.2	47.7
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	121.5	127.1	132.8	136.4	70.8
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	111.5	117.8	124.4	127.6	70.5
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	108.4	114.9	121.8	125.3	71.4
431	COND SHELL STATIC PRESS - AVERAGE	kPa	171.1	182.9	195.1	200.3	110.1
440	REFRIGERANT LVG COND TEMP	Deg C	39.03	41.21	43.36	44.24	25.77
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	115.1	121.5	127.8	130.7	82.7
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.17	28.72	30.25	30.88	18.38
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	71.0	73.9	76.7	77.5	48.9
487	LOW PRESS ECONOMIZER TEMP	Deg C	13.87	14.87	15.87	16.14	4.44
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	71.3	73.8	76.4	77.2	49.8
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	13.88	14.81	15.73	15.98	4.53
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	57.8	58.3	58.9	58.8	48.7
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.54	8.80	8.99	8.92	4.13
534	ENT COND ORIFICE ASS'Y PRESS	kPa	168.0	180.4	191.7	196.8	107.1
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	38.81	40.94	42.97	43.78	25.33
536	LVG COND ORIFICE ASS'Y PRESS	kPa	129.3	135.6	142.2	144.8	88.8
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	31.28	32.81	34.03	34.63	20.04
560	ATMOSPHERIC PRESS	kPa	99.5	99.5	99.5	99.4	99.4
580	MOTOR VOLTAGE - AB	Volts	3.865	3.876	3.878	3.856	3.883
581	MOTOR VOLTAGE - AC	Volts	3.873	3.894	3.897	3.876	3.900
582	MOTOR VOLTAGE - CB	Volts	3.849	3.872	3.880	3.850	3.883
583	MOTOR CURRENT - A	Volts	2.276	2.221	2.128	2.086	1.254
584	MOTOR CURRENT - B	Volts	2.389	2.325	2.251	2.193	1.333
585	MOTOR CURRENT - C	Volts	2.275	2.221	2.139	2.064	1.287
586	MOTOR POWER - PHASE 1	Volts	1.021	0.992	0.950	0.930	0.428
587	MOTOR POWER - PHASE 3	Volts	1.763	1.721	1.661	1.592	0.990
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	35.01	37.52	39.92	41.14	23.88
601	MAXIMUM MOTOR TEMPERATURE	Deg C	63.06	60.28	58.06	55.28	33.06
605	1st STAGE VANE SETTING	Degrees	40	40	40	40	10
607	3rd STAGE VANE SETTING	Degrees	50	50	50	50	19
608	UNIT HOUR METER READING	Hr	395	396	396	397	398
609	UNIT START COUNTER READING		109	109	109	111	111
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	6	7	7	24	26
701	ENERGY BALANCE	%	-0.51	-1.12	-0.89	-0.52	-1.41

Large Impellers - Metric

702	EVAP CAPACITY	KW	718.7	673.7	621.6	579.4	360.0
703	EVAP WATER FLOWRATE	L/S	30.23	30.88	30.90	30.80	30.73
704	COND WATER FLOWRATE	L/S	38.15	38.18	38.24	38.39	37.99
710	AVE ENT EVAP WATER TEMP	Deg C	12.35	11.88	11.47	11.16	9.47
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.67	6.67	6.67	6.68
712	AVE ENT COND WATER TEMP	Deg C	29.43	32.21	34.99	36.48	21.11
713	AVE LVG COND WATER TEMP	Deg C	35.03	37.52	39.93	41.09	23.95
715	MOTOR VOLTAGE - AB	Volts	464	465	465	463	466
716	MOTOR VOLTAGE - AC	Volts	465	467	468	465	468
717	MOTOR VOLTAGE - CB	Volts	462	465	466	462	466
718	MOTOR CURRENT - A	Amps	228	222	213	209	125
719	MOTOR CURRENT - B	Amps	239	233	225	219	133
720	MOTOR CURRENT - C	Amps	228	222	214	206	129
721	UNIT POWER	KW	167	163	157	151	85
722	AVERAGE VOLTAGE	Volts	464	466	466	463	467
723	AVERAGE CURRENT	Amps	231	226	217	211	129
725	Coefficient of Performance		4.301	4.138	3.968	3.829	4.232
730	EVAP DELTA T	Deg C	5.67	5.21	4.80	4.49	2.79
731	COND DELTA T	Deg C	5.61	5.32	4.94	4.61	2.84
735	EVAP WATER FLOWRATE	Kg/Sec	30.22	30.87	30.90	30.80	30.73
736	COND WATER FLOWRATE	Kg/Sec	38.00	38.00	38.02	38.15	37.92
740	EVAP CAPACITY	KW	718.73	673.83	621.63	579.45	360.09
741	COND CAPACITY	KW	889.49	844.14	783.83	733.79	450.24
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.62	2.98	3.34	3.52	3.66
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	39.57	41.71	43.80	44.67	26.19
750	RUNNING TIME	Hr	67	67	67	68	69
751	STARTS		14	14	14	16	16
752	EVAP APPROACH TEMP	Deg C	4.06	3.67	3.33	3.17	3.00
753	COND APPROACH TEMP	Deg C	4.56	4.17	3.89	3.61	2.22
800	EVAP AVG H2O TEMP	Deg C	9.51	9.27	9.07	8.92	8.08
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.6
802	EVAP H2O VISCOSITY	cp	1.317	1.326	1.333	1.339	1.372
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.192	4.192	4.192	4.194
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.585	0.584
810	COND AVG H2O TEMP	Deg C	32.23	34.87	37.46	38.79	22.53
811	COND WATER DENSITY	Kg/M3	995.7	994.9	993.9	993.4	998.4
812	COND H2O VISCOSITY	cp	0.760	0.720	0.685	0.667	0.943
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.179
814	COND H2O CON(K)	W/M C	0.621	0.625	0.628	0.630	0.607
815	ITD/DELTA T		1.71	1.71	1.69	1.70	2.08
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.028	0.006	0.011	0.022	#VALUE!
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.028	0.011	0.006	0.011	-0.006
852	RTD DIFFERENCE CHECK - EEW	Deg C	-0.028	-0.028	-0.028	-0.028	-0.039
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.011	#VALUE!	0.006	0.006	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.039	0.006	0.006	-0.050	0.061

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		59	60	61	62	63
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	10	10	10	10	10
Capacity	KW	353.7	342.5	321.4	274.6	260.2
Power	KW	87.1	88.6	88.3	84.2	83.6
Coefficient of Performance (COP)		4.063	3.867	3.639	3.260	3.113
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.68	6.68
Condenser Entering Water Temperature	Deg C	23.88	26.67	29.42	32.20	33.08
Energy Balance	%	-1.43	-1.67	-0.64	-0.94	-1.07
Evaporator Entering Water Temperature	Deg C	9.42	9.33	9.17	8.81	8.69
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.68	6.68
Evaporator Water Flow Rate	L/S	30.71	30.71	30.70	30.78	30.76
Condenser Entering Water Temperature	Deg C	23.88	26.67	29.42	32.20	33.08
Condenser Leaving Water Temperature	Deg C	26.69	29.42	32.02	34.48	35.26
Condenser Water Flow Rate	L/S	38.03	38.10	38.12	38.18	38.20
Evap Sat Press	kPa	47.85	48.40	48.81	49.37	49.50
Sat Temp	Deg C	4.16	4.44	4.64	4.91	4.98
Approach	Deg C	2.50	2.22	2.00	1.78	1.72
LMTD	Deg C	3.71	3.39	3.11	2.70	2.57
ITD/Delta T		1.91	1.84	1.81	1.83	1.84
Q/Ao	kW/m2	23.09	22.34	20.98	17.92	16.98
Uo	kW/m2 C	6.22	6.59	6.75	6.64	6.61
ho'	kW/m2 C	9.78	10.72	11.16	10.88	10.78
Cond Sat Press	kPa	120.80	131.97	143.34	153.96	157.27
Sat Temp	Deg C	28.89	31.53	34.03	36.24	36.90
Approach	Deg C	2.22	2.11	2.00	1.78	1.67
Refrigerant Leaving Temp	Deg C	28.46	31.11	33.63	35.79	36.47
LMTD	Deg C	3.41	3.29	3.14	2.74	2.58
Q/Ao	kW/m2	23.28	22.80	21.50	18.87	18.09
Uo	kW/m2 C	6.82	6.92	6.85	6.88	7.02
ho'	kW/m2 C	10.58	10.71	10.45	10.39	10.68
Cond Sat Temp	Deg C	28.89	31.53	34.03	36.24	36.90
Evap Sat Temp	Deg C	4.16	4.44	4.64	4.91	4.98
Estimated Motor Efficiency (1)		0.95	0.95	0.95	0.95	0.95
Estimated Motor Rev/Sec (1)		59.58	59.57	59.58	59.60	59.60
Compressor Suction Flow Rate (2)	m3/sec	0.675	0.650	0.607	0.516	0.488
Isentropic COP (2)		10.311	9.376	8.639	8.083	7.937
Adiabatic Efficiency (3)		0.392	0.412	0.420	0.403	0.392
Q/N - m3/rev (4)		0.0113	0.0109	0.0102	0.0087	0.0082
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	113.4	113.4	113.3	113.9	113.8
3	ENT EVAP WATER TEMP LOC 1	Deg C	9.39	9.31	9.15	8.79	8.67
4	ENT EVAP WATER TEMP LOC 2	Deg C	9.44	9.35	9.19	8.83	8.71
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.67	6.68	6.68	6.68
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67	6.67	6.68	6.67
15	COND WATER FLOWMETER DELTA P	kPa	173.3	173.7	173.8	174.2	174.2
17	ENT COND WATER TEMP LOC 1	Deg C	23.88	26.67	29.43	32.21	33.08
18	ENT COND WATER TEMP LOC 2	Deg C	23.88	26.67	29.42	32.19	33.08
19	LVG COND WATER TEMP LOC 1	Deg C	26.69	29.42	32.02	34.48	35.27
20	LVG COND WATER TEMP LOC 2	Deg C	26.69	29.42	32.02	34.48	35.26
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	6.06	6.51	6.61	6.71	6.86
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	5.46	5.80	5.93	6.15	6.23
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	6.16	6.66	6.69	6.94	7.05
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	47.8	48.4	48.8	49.4	49.5
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	52.3	55.8	59.4	62.9	64.5
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	53.2	57.1	60.8	64.4	65.8
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	51.0	54.7	58.3	62.1	63.6
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	77.5	84.7	92.3	100.0	102.9
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	76.5	82.5	89.6	96.8	99.3
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	78.0	84.9	92.2	99.1	102.0
431	COND SHELL STATIC PRESS - AVERAGE	kPa	120.8	132.0	143.3	154.0	157.3
440	REFRIGERANT LVG COND TEMP	Deg C	28.46	31.11	33.63	35.79	36.47
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	88.5	94.9	101.1	106.8	109.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	20.04	21.81	23.42	24.97	25.56
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	52.1	55.7	59.2	62.9	64.3
487	LOW PRESS ECONOMIZER TEMP	Deg C	6.00	7.65	9.18	10.69	11.25
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	52.6	55.8	59.1	62.5	63.8
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	6.03	7.62	9.08	10.48	11.01
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	50.1	51.4	52.7	54.2	54.6
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	5.06	5.54	6.18	6.82	7.03
534	ENT COND ORIFICE ASS'Y PRESS	kPa	118.0	128.9	140.4	150.6	153.9
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	28.00	30.66	33.17	35.38	36.06
536	LVG COND ORIFICE ASS'Y PRESS	kPa	95.1	102.2	108.7	115.0	117.3
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	21.93	23.85	25.64	27.17	27.76
560	ATMOSPHERIC PRESS	kPa	99.4	99.4	99.4	99.4	99.4
580	MOTOR VOLTAGE - AB	Volts	3.870	3.852	3.846	3.871	3.852
581	MOTOR VOLTAGE - AC	Volts	3.881	3.864	3.862	3.885	3.861
582	MOTOR VOLTAGE - CB	Volts	3.872	3.856	3.851	3.871	3.852
583	MOTOR CURRENT - A	Volts	1.268	1.286	1.278	1.243	1.235
584	MOTOR CURRENT - B	Volts	1.367	1.390	1.387	1.333	1.328
585	MOTOR CURRENT - C	Volts	1.307	1.316	1.315	1.261	1.254
586	MOTOR POWER - PHASE 1	Volts	0.447	0.470	0.465	0.435	0.433
587	MOTOR POWER - PHASE 3	Volts	1.003	1.006	1.007	0.969	0.960
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	26.65	29.34	32.01	34.48	35.23
601	MAXIMUM MOTOR TEMPERATURE	Deg C	30.83	27.50	28.06	28.61	28.61
605	1st STAGE VANE SETTING	Degrees	10	10	10	10	10
607	3rd STAGE VANE SETTING	Degrees	19	19	19	19	19
608	UNIT HOUR METER READING	Hr	398	399	399	400	400
609	UNIT START COUNTER READING		111	111	111	111	111
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	26	27	27	27	28
701	ENERGY BALANCE	%	-1.43	-1.67	-0.64	-0.94	-1.07

Large Impellers - Metric

702	EVAP CAPACITY	KW	353.7	342.5	321.4	274.6	260.2
703	EVAP WATER FLOWRATE	L/S	30.71	30.71	30.70	30.78	30.76
704	COND WATER FLOWRATE	L/S	38.03	38.10	38.12	38.18	38.20
710	AVE ENT EVAP WATER TEMP	Deg C	9.42	9.33	9.17	8.81	8.69
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.67	6.67	6.68	6.68
712	AVE ENT COND WATER TEMP	Deg C	23.88	26.67	29.42	32.20	33.08
713	AVE LVG COND WATER TEMP	Deg C	26.69	29.42	32.02	34.48	35.26
715	MOTOR VOLTAGE - AB	Volts	464	462	462	465	462
716	MOTOR VOLTAGE - AC	Volts	466	464	463	466	463
717	MOTOR VOLTAGE - CB	Volts	465	463	462	465	462
718	MOTOR CURRENT - A	Amps	127	129	128	124	124
719	MOTOR CURRENT - B	Amps	137	139	139	133	133
720	MOTOR CURRENT - C	Amps	131	132	132	126	125
721	UNIT POWER	KW	87	89	88	84	84
722	AVERAGE VOLTAGE	Volts	465	463	462	465	463
723	AVERAGE CURRENT	Amps	131	133	133	128	127
725	Coefficient of Performance		4.063	3.867	3.639	3.260	3.113
730	EVAP DELTA T	Deg C	2.74	2.66	2.49	2.13	2.02
731	COND DELTA T	Deg C	2.81	2.76	2.59	2.28	2.18
735	EVAP WATER FLOWRATE	Kg/Sec	30.72	30.72	30.71	30.78	30.76
736	COND WATER FLOWRATE	Kg/Sec	37.94	37.98	37.98	38.00	38.00
740	EVAP CAPACITY	KW	353.79	342.35	321.52	274.64	260.15
741	COND CAPACITY	KW	445.90	436.64	411.89	361.46	346.50
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	4.16	4.44	4.64	4.91	4.98
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	28.89	31.53	34.03	36.24	36.90
750	RUNNING TIME	Hr	70	70	70	71	71
751	STARTS		16	16	16	16	16
752	EVAP APPROACH TEMP	Deg C	2.50	2.22	2.00	1.78	1.72
753	COND APPROACH TEMP	Deg C	2.22	2.11	2.00	1.78	1.67
800	EVAP AVG H2O TEMP	Deg C	8.04	8.01	7.92	7.75	7.68
801	EVAP WATER DENSITY	Kg/M3	1000.6	1000.6	1000.6	1000.6	1000.6
802	EVAP H2O VISCOSITY	cp	1.374	1.375	1.378	1.385	1.387
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.194	4.194	4.194	4.194	4.194
804	EVAP H2O CON(K)	W/M C	0.584	0.584	0.583	0.583	0.583
810	COND AVG H2O TEMP	Deg C	25.28	28.04	30.72	33.34	34.17
811	COND WATER DENSITY	Kg/M3	997.8	997.0	996.2	995.4	995.0
812	COND H2O VISCOSITY	cp	0.884	0.832	0.786	0.743	0.731
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.178	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.611	0.615	0.619	0.623	0.624
815	ITD/DELTA T		1.91	1.84	1.81	1.83	1.84
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.006	#VALUE!	0.011	0.022	0.006
851	RTD DIFFERENCE CHECK - LCWT	Deg C	#VALUE!	0.006	0.006	#VALUE!	0.006
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.044	-0.039	-0.039	-0.039	-0.039
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	#VALUE!	0.011	0.006	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.044	0.078	0.011	#VALUE!	0.039

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		64	65	66	67	68
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	796.0	816.1	800.2	777.0	765.8
Power	KW	199.3	198.3	190.8	181.9	197.3
Coefficient of Performance (COP)		3.994	4.115	4.194	4.271	3.882
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.64	6.68	6.67
Condenser Entering Water Temperature	Deg C	29.56	26.76	23.72	21.13	32.13
Energy Balance	%	-0.90	-0.93	-0.90	-1.03	-0.91
Evaporator Entering Water Temperature	Deg C	12.87	13.03	12.85	12.98	12.63
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.64	6.68	6.67
Evaporator Water Flow Rate	L/S	30.76	30.72	30.77	29.41	30.65
Condenser Entering Water Temperature	Deg C	29.56	26.76	23.72	21.13	32.13
Condenser Leaving Water Temperature	Deg C	35.84	33.18	29.99	27.21	38.22
Condenser Water Flow Rate	L/S	38.34	38.25	38.20	38.13	38.32
Evap Sat Press	kPa	35.65	35.23	33.30	31.51	35.99
Sat Temp	Deg C	1.82	1.55	0.29	-0.93	2.03
Approach	Deg C	4.89	5.17	6.33	7.61	4.61
LMTD	Deg C	7.54	7.89	9.10	10.44	7.21
ITD/Delta T		1.79	1.81	2.02	2.21	1.78
Q/Ao	kW/m2	51.95	53.26	52.22	50.71	49.97
Uo	kW/m2 C	6.89	6.75	5.74	4.86	6.93
ho'	kW/m2 C	11.42	11.05	8.58	6.83	11.58
Cond Sat Press	kPa	161.96	149.13	133.21	120.31	172.78
Sat Temp	Deg C	41.49	38.99	35.64	32.71	43.48
Approach	Deg C	5.67	5.83	5.67	5.50	5.28
Refrigerant Leaving Temp	Deg C	40.74	38.42	35.05	31.83	42.91
LMTD	Deg C	8.40	8.63	8.40	8.16	7.92
Q/Ao	kW/m2	52.33	53.36	52.11	50.48	50.64
Uo	kW/m2 C	6.23	6.19	6.20	6.19	6.39
ho'	kW/m2 C	8.99	8.98	9.11	9.16	9.26
Cond Sat Temp	Deg C	41.49	38.99	35.64	32.71	43.48
Evap Sat Temp	Deg C	1.82	1.55	0.29	-0.93	2.03
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		58.95	58.95	59.00	59.06	58.96
Compressor Suction Flow Rate (2)	m3/sec	1.982	2.044	2.098	2.131	1.897
Isentropic COP (2)		6.062	6.440	6.827	7.175	5.792
Adiabatic Efficiency (3)		0.659	0.642	0.613	0.598	0.667
Q/N - m3/rev (4)		0.0336	0.0347	0.0356	0.0361	0.0322
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	113.7	113.4	113.8	103.9	112.9
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.86	13.03	12.83	12.97	12.61
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.88	13.04	12.87	13.00	12.64
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69	6.64	6.68	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.69	6.64	6.67	6.66
15	COND WATER FLOWMETER DELTA P	kPa	175.7	175.2	174.9	174.4	175.5
17	ENT COND WATER TEMP LOC 1	Deg C	29.57	26.77	23.71	21.13	32.14
18	ENT COND WATER TEMP LOC 2	Deg C	29.54	26.75	23.73	21.13	32.12
19	LVG COND WATER TEMP LOC 1	Deg C	35.85	33.18	29.99	27.21	38.23
20	LVG COND WATER TEMP LOC 2	Deg C	35.84	33.17	29.99	27.21	38.21
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.79	4.43	3.43	2.48	5.01
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.34	2.96	1.77	0.69	3.63
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	3.61	3.32	2.29	1.14	3.88
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	35.6	35.2	33.3	31.5	36.0
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	61.4	59.6	55.8	52.7	62.9
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	61.8	60.0	56.1	52.7	63.4
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	55.8	53.7	49.6	46.5	57.8
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	106.4	102.1	96.2	90.3	109.9
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	100.8	96.9	87.8	81.4	107.0
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	94.1	89.1	81.4	74.9	99.7
431	COND SHELL STATIC PRESS - AVERAGE	kPa	162.0	149.1	133.2	120.3	172.8
440	REFRIGERANT LVG COND TEMP	Deg C	40.74	38.42	35.05	31.83	42.91
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	100.7	94.8	86.7	80.0	106.1
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.51	25.90	23.49	21.37	29.04
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	62.5	60.1	55.6	51.9	64.4
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.99	14.13	12.24	10.53	15.89
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	64.7	63.0	58.7	54.7	65.2
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	15.20	14.28	12.43	10.77	16.02
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	53.0	52.2	48.7	45.6	54.0
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	11.32	11.15	9.54	7.99	11.61
534	ENT COND ORIFICE ASS'Y PRESS	kPa	160.6	147.8	134.3	122.0	171.6
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	40.79	38.33	35.02	31.84	42.96
536	LVG COND ORIFICE ASS'Y PRESS	kPa	124.7	118.0	106.9	98.0	130.7
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	33.77	32.40	29.84	27.44	35.37
560	ATMOSPHERIC PRESS	kPa	99.3	99.3	99.3	99.3	99.3
580	MOTOR VOLTAGE - AB	Volts	3.887	3.855	3.884	3.883	3.895
581	MOTOR VOLTAGE - AC	Volts	3.902	3.866	3.895	3.891	3.904
582	MOTOR VOLTAGE - CB	Volts	3.886	3.855	3.883	3.887	3.894
583	MOTOR CURRENT - A	Volts	2.707	2.721	2.597	2.478	2.684
584	MOTOR CURRENT - B	Volts	2.831	2.845	2.731	2.608	2.818
585	MOTOR CURRENT - C	Volts	2.650	2.643	2.533	2.414	2.611
586	MOTOR POWER - PHASE 1	Volts	1.259	1.267	1.212	1.155	1.256
587	MOTOR POWER - PHASE 3	Volts	2.063	2.038	1.968	1.877	2.032
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	35.67	32.98	29.97	27.15	38.23
601	MAXIMUM MOTOR TEMPERATURE	Deg C	83.61	84.17	81.39	91.39	80.28
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	68
608	UNIT HOUR METER READING	Hr	403	404	405	406	406
609	UNIT START COUNTER READING		112	112	112	112	112
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	0	1	2	2	3
701	ENERGY BALANCE	%	-0.90	-0.93	-0.90	-1.03	-0.91

Large Impellers - Metric

702	EVAP CAPACITY	KW	796.0	816.1	800.2	777.0	765.8
703	EVAP WATER FLOWRATE	L/S	30.76	30.72	30.77	29.41	30.65
704	COND WATER FLOWRATE	L/S	38.34	38.25	38.20	38.13	38.32
710	AVE ENT EVAP WATER TEMP	Deg C	12.87	13.03	12.85	12.98	12.63
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.64	6.68	6.67
712	AVE ENT COND WATER TEMP	Deg C	29.56	26.76	23.72	21.13	32.13
713	AVE LVG COND WATER TEMP	Deg C	35.84	33.18	29.99	27.21	38.22
715	MOTOR VOLTAGE - AB	Volts	466	463	466	466	467
716	MOTOR VOLTAGE - AC	Volts	468	464	467	467	469
717	MOTOR VOLTAGE - CB	Volts	466	463	466	466	467
718	MOTOR CURRENT - A	Amps	271	272	260	248	268
719	MOTOR CURRENT - B	Amps	283	285	273	261	282
720	MOTOR CURRENT - C	Amps	265	264	253	241	261
721	UNIT POWER	KW	199	198	191	182	197
722	AVERAGE VOLTAGE	Volts	467	463	467	466	468
723	AVERAGE CURRENT	Amps	273	274	262	250	270
725	Coefficient of Performance		3.994	4.115	4.194	4.271	3.882
730	EVAP DELTA T	Deg C	6.18	6.34	6.21	6.31	5.97
731	COND DELTA T	Deg C	6.28	6.42	6.27	6.08	6.09
735	EVAP WATER FLOWRATE	Kg/Sec	30.75	30.71	30.76	29.40	30.64
736	COND WATER FLOWRATE	Kg/Sec	38.19	38.14	38.12	38.07	38.14
740	EVAP CAPACITY	KW	795.95	816.05	800.15	776.99	765.63
741	COND CAPACITY	KW	1002.36	1021.96	998.14	966.92	969.88
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.82	1.55	0.29	-0.93	2.03
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	41.49	38.99	35.64	32.71	43.48
750	RUNNING TIME	Hr	75	76	76	77	77
751	STARTS		17	17	17	17	17
752	EVAP APPROACH TEMP	Deg C	4.89	5.17	6.33	7.61	4.61
753	COND APPROACH TEMP	Deg C	5.67	5.83	5.67	5.50	5.28
800	EVAP AVG H2O TEMP	Deg C	9.78	9.87	9.74	9.83	9.65
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.308	1.304	1.308	1.305	1.313
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.190	4.191	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.587	0.587	0.586	0.587	0.586
810	COND AVG H2O TEMP	Deg C	32.71	29.97	26.85	24.17	35.17
811	COND WATER DENSITY	Kg/M3	995.5	996.5	997.3	998.1	994.7
812	COND H2O VISCOSITY	cp	0.753	0.798	0.854	0.908	0.716
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.178	4.177
814	COND H2O CON(K)	W/M C	0.622	0.618	0.614	0.610	0.625
815	ITD/DELTA T		1.79	1.81	2.02	2.21	1.78
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.028	0.017	-0.017	-0.006	0.022
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.011	0.006	0.000	0.000	0.022
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.022	-0.011	-0.033	-0.033	-0.033
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.011	0.006	0.006	0.006	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.183	0.200	0.017	0.056	0.000

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		69	70	71	73	73
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	70	70
Capacity	KW	726.4	677.5	658.9	703.9	653.6
Power	KW	193.6	187.9	184.1	186.1	179.5
Coefficient of Performance (COP)		3.753	3.605	3.578	3.783	3.642
Evaporator Leaving Water Temperature	Deg C	6.68	6.67	6.66	6.67	6.66
Condenser Entering Water Temperature	Deg C	34.98	37.79	38.56	34.95	37.75
Energy Balance	%	-1.14	-0.37	-0.56	-1.02	-0.95
Evaporator Entering Water Temperature	Deg C	12.34	11.94	11.79	12.16	11.76
Evaporator Leaving Water Temperature	Deg C	6.68	6.67	6.66	6.67	6.66
Evaporator Water Flow Rate	L/S	30.61	30.66	30.61	30.59	30.58
Condenser Entering Water Temperature	Deg C	34.98	37.79	38.56	34.95	37.75
Condenser Leaving Water Temperature	Deg C	40.80	43.24	43.87	40.58	43.01
Condenser Water Flow Rate	L/S	38.37	38.44	38.44	38.39	38.44
Evap Sat Press	kPa	36.47	36.89	36.96	36.61	37.02
Sat Temp	Deg C	2.33	2.59	2.63	2.41	2.67
Approach	Deg C	4.33	4.06	4.06	4.22	4.00
LMTD	Deg C	6.79	6.35	6.25	6.63	6.19
ITD/Delta T		1.77	1.77	1.79	1.77	1.78
Q/Ao	kW/m2	47.40	44.21	43.00	45.93	42.65
Uo	kW/m2 C	6.98	6.96	6.88	6.93	6.89
ho'	kW/m2 C	11.72	11.67	11.45	11.60	11.49
Cond Sat Press	kPa	185.74	198.43	201.67	183.81	195.95
Sat Temp	Deg C	45.74	47.84	48.36	45.41	47.44
Approach	Deg C	4.94	4.61	4.50	4.83	4.44
Refrigerant Leaving Temp	Deg C	45.33	47.53	48.03	44.98	47.13
LMTD	Deg C	7.48	6.97	6.80	7.29	6.72
Q/Ao	kW/m2	48.45	45.30	44.20	46.83	43.81
Uo	kW/m2 C	6.48	6.50	6.50	6.43	6.52
ho'	kW/m2 C	9.36	9.31	9.29	9.25	9.37
Cond Sat Temp	Deg C	45.74	47.84	48.36	45.41	47.44
Evap Sat Temp	Deg C	2.33	2.59	2.63	2.41	2.67
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		58.98	59.02	59.04	59.03	59.07
Compressor Suction Flow Rate (2)	m3/sec	1.785	1.655	1.608	1.723	1.589
Isentropic COP (2)		5.520	5.287	5.240	5.581	5.360
Adiabatic Efficiency (3)		0.678	0.679	0.685	0.677	0.676
Q/N - m3/rev (4)		0.0303	0.0280	0.0272	0.0292	0.0269
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	112.6	113.0	112.7	112.5	112.3
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.33	11.92	11.78	12.14	11.74
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.36	11.95	11.81	12.17	11.78
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.68	6.67	6.67	6.67	6.66
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.66	6.66	6.66	6.66
15	COND WATER FLOWMETER DELTA P	kPa	175.7	176.1	176.0	175.8	176.2
17	ENT COND WATER TEMP LOC 1	Deg C	34.99	37.82	38.58	34.96	37.77
18	ENT COND WATER TEMP LOC 2	Deg C	34.96	37.77	38.54	34.94	37.73
19	LVG COND WATER TEMP LOC 1	Deg C	40.81	43.25	43.88	40.58	43.02
20	LVG COND WATER TEMP LOC 2	Deg C	40.79	43.22	43.86	40.57	43.01
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	5.03	5.29	5.49	5.24	5.69
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.88	4.05	4.24	3.94	4.24
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.13	4.42	4.53	4.20	4.54
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	36.5	36.9	37.0	36.6	37.0
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	64.9	67.2	67.8	64.3	66.5
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	65.5	67.7	68.2	64.7	66.9
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	60.7	63.6	64.5	60.1	63.0
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	116.9	122.0	122.0	112.8	118.0
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	110.5	115.6	116.9	110.1	115.8
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	103.9	109.3	110.9	102.1	108.2
431	COND SHELL STATIC PRESS - AVERAGE	kPa	185.7	198.4	201.7	183.8	195.9
440	REFRIGERANT LVG COND TEMP	Deg C	45.33	47.53	48.03	44.98	47.13
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	112.6	119.0	120.9	112.3	118.6
485	HIGH PRESS ECONOMIZER TEMP	Deg C	30.76	32.29	32.71	30.61	32.15
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	66.7	69.2	69.8	66.1	68.5
487	LOW PRESS ECONOMIZER TEMP	Deg C	16.82	17.66	17.88	16.51	17.39
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	67.4	69.8	70.2	66.7	68.7
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	16.91	17.68	17.86	16.58	17.37
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	54.4	54.3	54.3	53.5	53.5
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	11.84	11.66	11.67	11.32	11.22
534	ENT COND ORIFICE ASS'Y PRESS	kPa	183.5	195.3	199.2	181.3	193.1
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	45.35	47.34	47.87	44.91	47.01
536	LVG COND ORIFICE ASS'Y PRESS	kPa	136.4	142.8	145.0	135.1	140.9
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	36.95	38.22	38.51	36.54	37.79
560	ATMOSPHERIC PRESS	kPa	99.4	99.4	99.3	99.3	99.3
580	MOTOR VOLTAGE - AB	Volts	3.903	3.901	3.873	3.907	3.919
581	MOTOR VOLTAGE - AC	Volts	3.911	3.904	3.878	3.916	3.930
582	MOTOR VOLTAGE - CB	Volts	3.901	3.902	3.869	3.907	3.920
583	MOTOR CURRENT - A	Volts	2.635	2.556	2.533	2.533	2.424
584	MOTOR CURRENT - B	Volts	2.766	2.691	2.651	2.672	2.566
585	MOTOR CURRENT - C	Volts	2.561	2.471	2.445	2.471	2.385
586	MOTOR POWER - PHASE 1	Volts	1.235	1.192	1.178	1.174	1.124
587	MOTOR POWER - PHASE 3	Volts	1.991	1.940	1.891	1.927	1.867
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	40.83	43.23	43.96	40.64	43.09
601	MAXIMUM MOTOR TEMPERATURE	Deg C	78.06	75.28	73.61	73.61	70.83
605	1st STAGE VANE SETTING	Degrees	90	90	90	70	70
607	3rd STAGE VANE SETTING	Degrees	68	68	68	63	63
608	UNIT HOUR METER READING	Hr	407	407	408	410	410
609	UNIT START COUNTER READING		112	112	112	113	113
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	3	4	5	6	7
701	ENERGY BALANCE	%	-1.14	-0.37	-0.56	-1.02	-0.95

Large Impellers - Metric

702	EVAP CAPACITY	KW	726.4	677.5	658.9	703.9	653.6
703	EVAP WATER FLOWRATE	L/S	30.61	30.66	30.61	30.59	30.58
704	COND WATER FLOWRATE	L/S	38.37	38.44	38.44	38.39	38.44
710	AVE ENT EVAP WATER TEMP	Deg C	12.34	11.94	11.79	12.16	11.76
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.67	6.66	6.67	6.66
712	AVE ENT COND WATER TEMP	Deg C	34.98	37.79	38.56	34.95	37.75
713	AVE LVG COND WATER TEMP	Deg C	40.80	43.24	43.87	40.58	43.01
715	MOTOR VOLTAGE - AB	Volts	468	468	465	469	470
716	MOTOR VOLTAGE - AC	Volts	469	469	465	470	472
717	MOTOR VOLTAGE - CB	Volts	468	468	464	469	470
718	MOTOR CURRENT - A	Amps	254	256	253	253	242
719	MOTOR CURRENT - B	Amps	277	269	265	267	257
720	MOTOR CURRENT - C	Amps	256	247	245	247	239
721	UNIT POWER	KW	194	188	184	186	179
722	AVERAGE VOLTAGE	Volts	469	468	465	469	471
723	AVERAGE CURRENT	Amps	265	257	254	256	246
725	Coefficient of Performance		3.753	3.605	3.578	3.783	3.642
730	EVAP DELTA T	Deg C	5.66	5.27	5.13	5.49	5.10
731	COND DELTA T	Deg C	5.82	5.44	5.31	5.63	5.26
735	EVAP WATER FLOWRATE	Kg/Sec	30.60	30.66	30.61	30.58	30.57
736	COND WATER FLOWRATE	Kg/Sec	38.15	38.18	38.17	38.17	38.19
740	EVAP CAPACITY	KW	726.28	677.36	658.88	703.80	653.45
741	COND CAPACITY	KW	928.08	867.75	846.68	897.01	839.12
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.33	2.59	2.63	2.41	2.67
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	45.74	47.84	48.36	45.41	47.44
750	RUNNING TIME	Hr	78	78	80	81	81
751	STARTS		17	17	17	18	18
752	EVAP APPROACH TEMP	Deg C	4.33	4.06	4.06	4.22	4.00
753	COND APPROACH TEMP	Deg C	4.94	4.61	4.50	4.83	4.44
800	EVAP AVG H2O TEMP	Deg C	9.52	9.31	9.23	9.41	9.21
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.317	1.324	1.327	1.321	1.329
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.192	4.192	4.191	4.192
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	37.89	40.52	41.22	37.76	40.38
811	COND WATER DENSITY	Kg/M3	993.8	992.8	992.5	993.8	992.8
812	COND H2O VISCOSITY	cp	0.679	0.644	0.637	0.680	0.647
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.629	0.632	0.633	0.628	0.632
815	ITD/DELTA T		1.77	1.77	1.79	1.77	1.78
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.028	0.044	0.033	0.022	0.033
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.011	0.028	0.022	0.011	0.011
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.022	-0.028	-0.028	-0.028	-0.039
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	0.006	0.011	0.011	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.028	0.017	-0.078	-0.056	-0.078

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		74	75	76	77	78
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	KW	620.6	742.2	772.8	799.9	798.1
Power	KW	175.5	190.1	191.0	191.5	186.3
Coefficient of Performance (COP)		3.536	3.904	4.045	4.178	4.284
Evaporator Leaving Water Temperature	Deg C	6.68	6.68	6.68	6.68	6.68
Condenser Entering Water Temperature	Deg C	39.24	32.23	29.49	26.67	23.89
Energy Balance	%	-1.13	-1.13	-0.90	-0.65	-1.15
Evaporator Entering Water Temperature	Deg C	11.51	12.55	12.78	12.98	12.97
Evaporator Leaving Water Temperature	Deg C	6.68	6.68	6.68	6.68	6.68
Evaporator Water Flow Rate	L/S	30.63	30.22	30.28	30.32	30.35
Condenser Entering Water Temperature	Deg C	39.24	32.23	29.49	26.67	23.89
Condenser Leaving Water Temperature	Deg C	44.28	38.13	35.59	32.93	30.14
Condenser Water Flow Rate	L/S	38.48	38.36	38.30	38.22	38.21
Evap Sat Press	kPa	37.30	36.20	35.78	35.65	34.54
Sat Temp	Deg C	2.84	2.16	1.89	1.82	1.11
Approach	Deg C	3.83	4.50	4.78	4.89	5.56
LMTD	Deg C	5.93	7.05	7.42	7.58	8.32
ITD/Delta T		1.79	1.77	1.78	1.77	1.89
Q/Ao	kW/m2	40.49	48.44	50.43	52.21	52.09
Uo	kW/m2 C	6.83	6.87	6.79	6.89	6.26
ho'	kW/m2 C	11.32	11.47	11.25	11.49	9.84
Cond Sat Press	kPa	201.60	170.99	158.58	146.51	133.21
Sat Temp	Deg C	48.35	43.16	40.84	38.46	35.64
Approach	Deg C	4.06	5.00	5.28	5.50	5.50
Refrigerant Leaving Temp	Deg C	48.08	42.66	40.26	37.93	35.16
LMTD	Deg C	6.25	7.60	7.92	8.26	8.23
Q/Ao	kW/m2	41.92	49.11	50.68	52.03	51.88
Uo	kW/m2 C	6.70	6.46	6.40	6.30	6.30
ho'	kW/m2 C	9.69	9.40	9.36	9.22	9.32
Cond Sat Temp	Deg C	48.35	43.16	40.84	38.46	35.64
Evap Sat Temp	Deg C	2.84	2.16	1.89	1.82	1.11
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		59.09	59.00	59.00	59.00	59.03
Compressor Suction Flow Rate (2)	m3/sec	1.501	1.828	1.915	1.979	2.021
Isentropic COP (2)		5.271	5.870	6.190	6.609	7.018
Adiabatic Efficiency (3)		0.674	0.666	0.653	0.633	0.611
Q/N - m3/rev (4)		0.0254	0.0310	0.0325	0.0335	0.0342
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	112.8	109.7	110.2	110.5	110.7
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.48	12.53	12.76	12.96	12.95
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.53	12.57	12.79	13.00	12.98
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.68	6.69	6.68	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	176.3	175.8	175.5	174.9	174.9
17	ENT COND WATER TEMP LOC 1	Deg C	39.26	32.23	29.50	26.66	23.89
18	ENT COND WATER TEMP LOC 2	Deg C	39.23	32.22	29.49	26.67	23.89
19	LVG COND WATER TEMP LOC 1	Deg C	44.28	38.13	35.59	32.93	30.14
20	LVG COND WATER TEMP LOC 2	Deg C	44.27	38.13	35.59	32.93	30.13
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	6.42	5.57	5.34	5.22	4.32
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.69	3.77	3.57	3.43	2.59
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.86	4.17	3.91	3.88	2.99
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	37.3	36.2	35.8	35.6	34.5
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	67.8	62.1	60.3	58.9	56.1
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	68.1	62.5	60.5	59.0	56.3
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	64.7	57.4	55.0	53.0	50.1
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	119.5	105.6	100.5	98.4	92.5
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	120.7	109.1	103.3	98.3	91.8
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	113.4	97.7	94.4	89.1	82.7
431	COND SHELL STATIC PRESS - AVERAGE	kPa	201.6	171.0	158.6	146.5	133.2
440	REFRIGERANT LVG COND TEMP	Deg C	48.08	42.66	40.26	37.93	35.16
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	121.8	105.8	100.0	94.5	87.7
485	HIGH PRESS ECONOMIZER TEMP	Deg C	32.86	28.96	27.31	25.76	23.82
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	69.6	63.7	61.3	59.3	56.0
487	LOW PRESS ECONOMIZER TEMP	Deg C	17.74	15.57	14.58	13.80	12.43
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	69.8	64.5	62.9	62.1	59.1
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	17.74	15.71	14.84	13.99	12.62
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	53.3	53.0	52.5	51.6	49.4
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	11.12	10.99	11.16	10.93	9.89
534	ENT COND ORIFICE ASS'Y PRESS	kPa	199.2	169.3	157.1	146.7	133.6
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	47.88	42.62	40.30	38.03	35.20
536	LVG COND ORIFICE ASS'Y PRESS	kPa	144.7	126.6	123.2	115.2	107.2
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	38.46	34.86	33.40	31.84	29.85
560	ATMOSPHERIC PRESS	kPa	99.6	99.7	99.7	99.7	99.7
580	MOTOR VOLTAGE - AB	Volts	3.848	3.903	3.890	3.875	3.885
581	MOTOR VOLTAGE - AC	Volts	3.856	3.911	3.903	3.886	3.898
582	MOTOR VOLTAGE - CB	Volts	3.843	3.902	3.892	3.875	3.884
583	MOTOR CURRENT - A	Volts	2.420	2.589	2.602	2.607	2.531
584	MOTOR CURRENT - B	Volts	2.516	2.717	2.738	2.738	2.663
585	MOTOR CURRENT - C	Volts	2.332	2.504	2.534	2.547	2.476
586	MOTOR POWER - PHASE 1	Volts	1.119	1.211	1.212	1.217	1.180
587	MOTOR POWER - PHASE 3	Volts	1.806	1.958	1.972	1.974	1.925
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	44.32	38.09	35.52	32.93	30.09
601	MAXIMUM MOTOR TEMPERATURE	Deg C	68.78	74.72	75.83	77.50	80.83
605	1st STAGE VANE SETTING	Degrees	70	70	70	70	70
607	3rd STAGE VANE SETTING	Degrees	63	63	63	63	63
608	UNIT HOUR METER READING	Hr	411	412	412	412	413
609	UNIT START COUNTER READING		114	114	114	114	114
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	24	24	24	25	25
701	ENERGY BALANCE	%	-1.13	-1.13	-0.90	-0.65	-1.15

Large Impellers - Metric

702	EVAP CAPACITY	KW	620.6	742.2	772.8	799.9	798.1
703	EVAP WATER FLOWRATE	L/S	30.63	30.22	30.28	30.32	30.35
704	COND WATER FLOWRATE	L/S	38.48	38.36	38.30	38.22	38.21
710	AVE ENT EVAP WATER TEMP	Deg C	11.51	12.55	12.78	12.98	12.97
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.68	6.68	6.68	6.68
712	AVE ENT COND WATER TEMP	Deg C	39.24	32.23	29.49	26.67	23.89
713	AVE LVG COND WATER TEMP	Deg C	44.28	38.13	35.59	32.93	30.14
715	MOTOR VOLTAGE - AB	Volts	462	468	467	465	466
716	MOTOR VOLTAGE - AC	Volts	463	469	468	466	468
717	MOTOR VOLTAGE - CB	Volts	461	468	467	465	466
718	MOTOR CURRENT - A	Amps	242	259	260	261	253
719	MOTOR CURRENT - B	Amps	252	272	274	274	266
720	MOTOR CURRENT - C	Amps	233	250	253	255	248
721	UNIT POWER	KW	176	190	191	191	186
722	AVERAGE VOLTAGE	Volts	462	469	467	465	467
723	AVERAGE CURRENT	Amps	242	260	262	263	256
725	Coefficient of Performance		3.536	3.904	4.045	4.178	4.284
730	EVAP DELTA T	Deg C	4.83	5.87	6.09	6.30	6.28
731	COND DELTA T	Deg C	5.03	5.90	6.09	6.27	6.24
735	EVAP WATER FLOWRATE	Kg/Sec	30.63	30.21	30.27	30.31	30.35
736	COND WATER FLOWRATE	Kg/Sec	38.19	38.18	38.16	38.10	38.12
740	EVAP CAPACITY	KW	620.46	742.16	772.65	800.02	798.20
741	COND CAPACITY	KW	802.96	940.71	970.62	996.65	993.69
743	EVAP SATN TEMP (BASED ON ID #61)	Deg C	2.84	2.16	1.89	1.82	1.11
744	COND SATN TEMP (BASED ON ID #431)	Deg C	48.35	43.16	40.84	38.46	35.64
750	RUNNING TIME	Hr	82	83	83	83	84
751	STARTS		19	19	19	19	19
752	EVAP APPROACH TEMP	Deg C	3.83	4.50	4.78	4.89	5.56
753	COND APPROACH TEMP	Deg C	4.06	5.00	5.28	5.50	5.50
800	EVAP AVG H2O TEMP	Deg C	9.09	9.62	9.73	9.83	9.83
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.333	1.314	1.310	1.305	1.305
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.192	4.191	4.191	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.587	0.587
810	COND AVG H2O TEMP	Deg C	41.76	35.18	32.54	29.80	27.01
811	COND WATER DENSITY	Kg/M3	992.3	994.7	995.7	996.5	997.3
812	COND H2O VISCOSITY	cp	0.629	0.716	0.756	0.801	0.851
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.178	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.633	0.625	0.622	0.618	0.614
815	ITD/DELTA T		1.79	1.77	1.78	1.77	1.89
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.033	0.011	0.006	-0.011	0.000
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.011	0.000	0.000	-0.006	0.006
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.050	-0.039	-0.039	-0.039	-0.028
853	RTD DIFFERENCE CHECK - LEWT	Deg C	-0.006	0.000	0.011	0.006	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.033	0.033	0.072	0.000	0.044

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		79	80	81	82	83
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	40	40	40	40
Capacity	KW	778.4	737.3	722.5	702.8	681.7
Power	KW	178.3	164.6	165.8	166.4	165.8
Coefficient of Performance (COP)		4.367	4.480	4.358	4.224	4.112
Evaporator Leaving Water Temperature	Deg C	6.68	6.67	6.67	6.67	6.66
Condenser Entering Water Temperature	Deg C	21.11	21.04	23.82	26.64	29.41
Energy Balance	%	-1.11	-0.89	-0.91	-0.95	-0.98
Evaporator Entering Water Temperature	Deg C	12.79	12.47	12.36	12.23	12.06
Evaporator Leaving Water Temperature	Deg C	6.68	6.67	6.67	6.67	6.66
Evaporator Water Flow Rate	L/S	30.44	30.37	30.29	30.17	30.13
Condenser Entering Water Temperature	Deg C	21.11	21.04	23.82	26.64	29.41
Condenser Leaving Water Temperature	Deg C	27.19	26.76	29.44	32.15	34.77
Condenser Water Flow Rate	L/S	38.12	38.11	38.16	38.21	38.30
Evap Sat Press	kPa	32.75	36.20	36.27	36.40	36.68
Sat Temp	Deg C	-0.07	2.16	2.21	2.29	2.46
Approach	Deg C	6.78	4.50	4.44	4.39	4.22
LMTD	Deg C	9.48	7.01	6.92	6.78	6.53
ITD/Delta T		2.10	1.78	1.78	1.79	1.78
Q/Ao	kW/m2	50.81	48.13	47.16	45.87	44.50
Uo	kW/m2 C	5.36	6.87	6.81	6.76	6.81
ho'	kW/m2 C	7.78	11.45	11.32	11.20	11.35
Cond Sat Press	kPa	120.11	116.87	127.41	138.93	150.86
Sat Temp	Deg C	32.64	31.86	34.34	36.87	39.33
Approach	Deg C	5.44	5.11	4.89	4.72	4.56
Refrigerant Leaving Temp	Deg C	32.03	31.29	33.83	36.39	38.91
LMTD	Deg C	8.11	7.60	7.35	7.12	6.90
Q/Ao	kW/m2	50.40	47.43	46.72	45.73	44.60
Uo	kW/m2 C	6.21	6.24	6.35	6.42	6.47
ho'	kW/m2 C	9.22	9.28	9.45	9.50	9.51
Cond Sat Temp	Deg C	32.64	31.86	34.34	36.87	39.33
Evap Sat Temp	Deg C	-0.07	2.16	2.21	2.29	2.46
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		59.08	59.16	59.15	59.15	59.15
Compressor Suction Flow Rate (2)	m3/sec	2.059	1.772	1.742	1.698	1.643
Isentropic COP (2)		7.418	8.312	7.643	7.074	6.621
Adiabatic Efficiency (3)		0.585	0.542	0.568	0.599	0.625
Q/N - m3/rev (4)		0.0348	0.0300	0.0295	0.0287	0.0278
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	111.3	110.8	110.2	109.4	109.1
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.77	12.46	12.35	12.22	12.04
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.81	12.48	12.37	12.24	12.07
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.68	6.67	6.67	6.67	6.66
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.67	6.66	6.67	6.66
15	COND WATER FLOWMETER DELTA P	kPa	174.3	174.2	174.5	174.8	175.5
17	ENT COND WATER TEMP LOC 1	Deg C	21.11	21.04	23.82	26.64	29.42
18	ENT COND WATER TEMP LOC 2	Deg C	21.12	21.05	23.82	26.63	29.40
19	LVG COND WATER TEMP LOC 1	Deg C	27.19	26.76	29.45	32.16	34.78
20	LVG COND WATER TEMP LOC 2	Deg C	27.18	26.76	29.44	32.14	34.76
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	3.31	5.13	5.24	5.34	5.41
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	1.46	3.57	3.61	3.74	3.87
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	1.89	3.98	4.03	4.16	4.23
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	32.7	36.2	36.3	36.4	36.7
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	52.9	52.7	54.0	55.6	57.5
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	53.0	52.9	54.3	55.8	57.7
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	46.8	47.4	49.0	51.0	53.3
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	86.9	90.0	92.5	95.1	99.9
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	82.7	80.7	84.4	88.8	93.8
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	76.1	76.5	80.9	85.9	91.3
431	COND SHELL STATIC PRESS - AVERAGE	kPa	120.1	116.9	127.4	138.9	150.9
440	REFRIGERANT LVG COND TEMP	Deg C	32.03	31.29	33.83	36.39	38.91
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	80.8	83.5	87.8	92.8	98.1
485	HIGH PRESS ECONOMIZER TEMP	Deg C	21.63	22.43	23.81	25.28	26.83
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	52.3	52.5	54.1	56.3	58.4
487	LOW PRESS ECONOMIZER TEMP	Deg C	10.73	10.80	11.55	12.51	13.41
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	55.2	54.7	55.8	57.0	59.3
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	10.94	10.99	11.79	12.59	13.52
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	46.3	47.0	47.7	48.3	49.2
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.39	8.72	9.06	8.97	9.30
534	ENT COND ORIFICE ASS'Y PRESS	kPa	122.0	117.1	127.2	138.0	149.4
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	31.92	31.32	33.96	36.41	38.84
536	LVG COND ORIFICE ASS'Y PRESS	kPa	100.1	98.2	101.7	107.4	114.3
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	27.42	26.87	28.45	30.04	31.79
560	ATMOSPHERIC PRESS	kPa	99.7	99.6	99.6	99.6	99.6
580	MOTOR VOLTAGE - AB	Volts	3.905	3.852	3.840	3.839	3.847
581	MOTOR VOLTAGE - AC	Volts	3.917	3.863	3.848	3.853	3.862
582	MOTOR VOLTAGE - CB	Volts	3.907	3.852	3.839	3.844	3.850
583	MOTOR CURRENT - A	Volts	2.407	2.252	2.265	2.272	2.263
584	MOTOR CURRENT - B	Volts	2.550	2.386	2.403	2.414	2.410
585	MOTOR CURRENT - C	Volts	2.369	2.211	2.230	2.242	2.237
586	MOTOR POWER - PHASE 1	Volts	1.119	1.040	1.046	1.051	1.042
587	MOTOR POWER - PHASE 3	Volts	1.852	1.703	1.717	1.722	1.721
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	27.13	26.71	29.45	32.14	34.79
601	MAXIMUM MOTOR TEMPERATURE	Deg C	85.83	83.61	67.50	63.06	61.39
605	1st STAGE VANE SETTING	Degrees	70	40	40	40	40
607	3rd STAGE VANE SETTING	Degrees	63	50	50	50	50
608	UNIT HOUR METER READING	Hr	413	414	414	414	415
609	UNIT START COUNTER READING		114	114	114	114	114
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	26	26	27	27	27
701	ENERGY BALANCE	%	-1.11	-0.89	-0.91	-0.95	-0.98

Large Impellers - Metric

702	EVAP CAPACITY	KW	778.4	737.3	722.5	702.8	681.7
703	EVAP WATER FLOWRATE	L/S	30.44	30.37	30.29	30.17	30.13
704	COND WATER FLOWRATE	L/S	38.12	38.11	38.16	38.21	38.30
710	AVE ENT EVAP WATER TEMP	Deg C	12.79	12.47	12.36	12.23	12.06
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.67	6.67	6.67	6.66
712	AVE ENT COND WATER TEMP	Deg C	21.11	21.04	23.82	26.64	29.41
713	AVE LVG COND WATER TEMP	Deg C	27.19	26.76	29.44	32.15	34.77
715	MOTOR VOLTAGE - AB	Volts	469	462	461	461	462
716	MOTOR VOLTAGE - AC	Volts	470	464	462	462	463
717	MOTOR VOLTAGE - CB	Volts	469	462	461	461	462
718	MOTOR CURRENT - A	Amps	241	225	227	227	226
719	MOTOR CURRENT - B	Amps	255	239	240	241	241
720	MOTOR CURRENT - C	Amps	237	221	223	224	224
721	UNIT POWER	KW	178	165	166	166	166
722	AVERAGE VOLTAGE	Volts	469	463	461	462	462
723	AVERAGE CURRENT	Amps	244	228	230	231	230
725	Coefficient of Performance		4.367	4.480	4.358	4.224	4.112
730	EVAP DELTA T	Deg C	6.11	5.80	5.69	5.56	5.40
731	COND DELTA T	Deg C	6.07	5.72	5.63	5.51	5.36
735	EVAP WATER FLOWRATE	Kg/Sec	30.43	30.36	30.28	30.16	30.13
736	COND WATER FLOWRATE	Kg/Sec	38.06	38.04	38.07	38.09	38.16
740	EVAP CAPACITY	KW	778.51	737.41	722.56	702.77	681.80
741	COND CAPACITY	KW	965.40	908.53	894.91	875.84	854.24
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	-0.07	2.16	2.21	2.29	2.46
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	32.64	31.86	34.34	36.87	39.33
750	RUNNING TIME	Hr	84	85	85	86	86
751	STARTS		19	19	19	19	19
752	EVAP APPROACH TEMP	Deg C	6.78	4.50	4.44	4.39	4.22
753	COND APPROACH TEMP	Deg C	5.44	5.11	4.89	4.72	4.56
800	EVAP AVG H2O TEMP	Deg C	9.74	9.57	9.52	9.45	9.36
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.310	1.315	1.317	1.320	1.323
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.191	4.191	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	24.15	23.91	26.63	29.40	32.09
811	COND WATER DENSITY	Kg/M3	998.1	998.1	997.4	996.6	995.7
812	COND H2O VISCOSITY	cp	0.908	0.914	0.859	0.808	0.762
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.178	4.178	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.610	0.609	0.613	0.617	0.621
815	ITD/DELTA T		2.10	1.78	1.78	1.79	1.78
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.006	-0.011	0.006	0.006	0.017
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.006	0.000	0.006	0.017	0.017
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.033	-0.022	-0.022	-0.028	-0.028
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.000	0.006	0.011	0.006	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.056	0.056	0.000	0.011	-0.017

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		84	85	86	87	88
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	10
Capacity	KW	652.9	618.1	573.8	561.1	244.4
Power	KW	164.8	162.0	156.9	155.8	79.9
Coefficient of Performance (COP)		3.963	3.815	3.657	3.601	3.060
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.67	6.67
Condenser Entering Water Temperature	Deg C	32.23	34.96	37.76	38.34	32.17
Energy Balance	%	-0.88	-0.71	-0.68	-1.10	-1.04
Evaporator Entering Water Temperature	Deg C	11.74	11.48	11.11	11.01	8.56
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.67	6.67
Evaporator Water Flow Rate	L/S	30.66	30.65	30.88	30.85	30.80
Condenser Entering Water Temperature	Deg C	32.23	34.96	37.76	38.34	32.17
Condenser Leaving Water Temperature	Deg C	37.39	39.89	42.37	42.88	34.23
Condenser Water Flow Rate	L/S	38.32	38.36	38.39	38.42	38.30
Evap Sat Press	kPa	37.02	37.30	37.65	37.71	40.47
Sat Temp	Deg C	2.67	2.84	3.05	3.09	4.71
Approach	Deg C	4.00	3.83	3.61	3.56	1.94
LMTD	Deg C	6.19	5.91	5.54	5.47	2.80
ITD/Delta T		1.79	1.80	1.81	1.82	2.04
Q/Ao	kW/m2	42.60	40.34	37.44	36.63	15.95
Uo	kW/m2 C	6.88	6.83	6.75	6.70	5.69
ho'	kW/m2 C	11.46	11.32	11.09	10.97	8.54
Cond Sat Press	kPa	163.27	175.61	188.02	190.36	134.38
Sat Temp	Deg C	41.73	43.98	46.13	46.52	35.89
Approach	Deg C	4.33	4.11	3.78	3.61	1.67
Refrigerant Leaving Temp	Deg C	41.38	43.75	45.93	46.29	35.60
LMTD	Deg C	6.59	6.24	5.76	5.60	2.56
Q/Ao	kW/m2	42.98	40.96	38.34	37.76	17.06
Uo	kW/m2 C	6.52	6.57	6.66	6.74	6.67
ho'	kW/m2 C	9.55	9.56	9.67	9.83	9.92
Cond Sat Temp	Deg C	41.73	43.98	46.13	46.52	35.89
Evap Sat Temp	Deg C	2.67	2.84	3.05	3.09	4.71
Estimated Motor Efficiency (1)		0.93	0.94	0.94	0.94	0.95
Estimated Motor Rev/Sec (1)		59.16	59.18	59.21	59.21	59.62
Compressor Suction Flow Rate (2)	m3/sec	1.568	1.480	1.368	1.337	0.532
Isentropic COP (2)		6.234	5.899	5.626	5.590	8.083
Adiabatic Efficiency (3)		0.634	0.648	0.651	0.642	0.378
Q/N - m3/rev (4)		0.0265	0.0250	0.0231	0.0226	0.0089
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	113.0	112.9	114.6	114.4	114.0
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.73	11.47	11.09	10.99	8.54
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.76	11.49	11.12	11.03	8.58
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.67	6.67	6.67	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.66	6.66	6.67	6.67	6.66
15	COND WATER FLOWMETER DELTA P	kPa	175.4	175.6	175.7	175.9	175.3
17	ENT COND WATER TEMP LOC 1	Deg C	32.24	34.98	37.78	38.36	32.19
18	ENT COND WATER TEMP LOC 2	Deg C	32.21	34.94	37.74	38.32	32.16
19	LVG COND WATER TEMP LOC 1	Deg C	37.41	39.89	42.39	42.89	34.23
20	LVG COND WATER TEMP LOC 2	Deg C	37.38	39.88	42.36	42.87	34.22
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	5.62	5.73	5.96	6.09	7.09
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.04	3.69	3.93	3.98	6.44
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.41	4.65	4.86	4.98	6.54
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	37.0	37.3	37.6	37.7	40.5
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	59.7	62.0	64.6	65.2	49.0
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	60.0	62.4	65.0	65.4	50.1
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	55.8	58.8	62.0	62.6	48.2
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	104.4	109.3	114.6	114.5	80.8
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	99.4	103.4	109.8	111.3	79.4
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	95.2	100.6	105.8	106.9	82.9
431	COND SHELL STATIC PRESS - AVERAGE	kPa	163.3	175.6	188.0	190.4	134.4
440	REFRIGERANT LVG COND TEMP	Deg C	41.38	43.75	45.93	46.29	35.60
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	104.2	110.3	116.7	117.7	89.1
485	HIGH PRESS ECONOMIZER TEMP	Deg C	28.52	30.10	31.69	31.96	24.22
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	61.0	63.4	66.0	66.3	49.2
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.48	15.47	16.48	16.66	9.24
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	61.8	64.0	66.1	66.5	49.3
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	14.53	15.49	16.46	16.61	9.16
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	50.0	50.5	51.1	51.6	44.2
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.64	9.86	10.02	10.17	6.48
534	ENT COND ORIFICE ASS'Y PRESS	kPa	161.3	173.3	185.4	187.1	131.2
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	41.28	43.54	45.58	45.93	35.19
536	LVG COND ORIFICE ASS'Y PRESS	kPa	122.1	128.1	137.0	137.5	97.4
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	33.58	35.17	36.61	36.82	26.67
560	ATMOSPHERIC PRESS	kPa	99.6	99.6	99.6	99.6	99.6
580	MOTOR VOLTAGE - AB	Volts	3.861	3.880	3.852	3.845	3.867
581	MOTOR VOLTAGE - AC	Volts	3.873	3.893	3.867	3.857	3.881
582	MOTOR VOLTAGE - CB	Volts	3.864	3.881	3.855	3.848	3.871
583	MOTOR CURRENT - A	Volts	2.249	2.202	2.141	2.132	1.171
584	MOTOR CURRENT - B	Volts	2.390	2.338	2.281	2.271	1.299
585	MOTOR CURRENT - C	Volts	2.217	2.174	2.131	2.114	1.212
586	MOTOR POWER - PHASE 1	Volts	1.035	1.011	0.975	0.970	0.406
587	MOTOR POWER - PHASE 3	Volts	1.711	1.689	1.640	1.627	0.925
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	37.39	39.94	42.44	42.86	34.25
601	MAXIMUM MOTOR TEMPERATURE	Deg C	60.83	60.28	58.78	58.44	28.22
605	1st STAGE VANE SETTING	Degrees	40	40	40	40	10
607	3rd STAGE VANE SETTING	Degrees	50	50	50	50	19
608	UNIT HOUR METER READING	Hr	415	416	416	417	417
609	UNIT START COUNTER READING		114	114	114	114	114
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	28	28	28	29	30
701	ENERGY BALANCE	%	-0.88	-0.71	-0.68	-1.10	-1.04

Large Impellers - Metric

702	EVAP CAPACITY	KW	652.9	618.1	573.8	561.1	244.4
703	EVAP WATER FLOWRATE	L/S	30.66	30.65	30.88	30.85	30.80
704	COND WATER FLOWRATE	L/S	38.32	38.36	38.39	38.42	38.30
710	AVE ENT EVAP WATER TEMP	Deg C	11.74	11.48	11.11	11.01	8.56
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.67	6.67	6.67	6.67
712	AVE ENT COND WATER TEMP	Deg C	32.23	34.96	37.76	38.34	32.17
713	AVE LVG COND WATER TEMP	Deg C	37.39	39.89	42.37	42.88	34.23
715	MOTOR VOLTAGE - AB	Volts	463	466	462	461	464
716	MOTOR VOLTAGE - AC	Volts	465	467	464	463	466
717	MOTOR VOLTAGE - CB	Volts	464	466	463	462	465
718	MOTOR CURRENT - A	Amps	225	220	214	213	117
719	MOTOR CURRENT - B	Amps	239	234	228	227	130
720	MOTOR CURRENT - C	Amps	222	217	213	211	121
721	UNIT POWER	KW	165	162	157	156	80
722	AVERAGE VOLTAGE	Volts	464	466	463	462	465
723	AVERAGE CURRENT	Amps	229	224	218	217	123
725	Coefficient of Performance		3.963	3.815	3.657	3.601	3.060
730	EVAP DELTA T	Deg C	5.08	4.81	4.43	4.34	1.89
731	COND DELTA T	Deg C	5.17	4.93	4.61	4.54	2.06
735	EVAP WATER FLOWRATE	Kg/Sec	30.66	30.64	30.87	30.85	30.81
736	COND WATER FLOWRATE	Kg/Sec	38.14	38.14	38.14	38.16	38.12
740	EVAP CAPACITY	KW	652.76	618.15	573.67	561.31	244.40
741	COND CAPACITY	KW	823.24	784.54	734.43	723.30	326.78
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.67	2.84	3.05	3.09	4.71
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	41.73	43.98	46.13	46.52	35.89
750	RUNNING TIME	Hr	86	87	87	88	89
751	STARTS		19	19	19	19	19
752	EVAP APPROACH TEMP	Deg C	4.00	3.83	3.61	3.56	1.94
753	COND APPROACH TEMP	Deg C	4.33	4.11	3.78	3.61	1.67
800	EVAP AVG H2O TEMP	Deg C	9.21	9.07	8.89	8.84	7.62
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.6
802	EVAP H2O VISCOSITY	cp	1.329	1.333	1.341	1.342	1.390
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.192	4.192	4.192	4.192	4.194
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.585	0.585	0.583
810	COND AVG H2O TEMP	Deg C	34.81	37.43	40.07	40.62	33.20
811	COND WATER DENSITY	Kg/M3	994.9	993.9	992.9	992.6	995.4
812	COND H2O VISCOSITY	cp	0.722	0.685	0.650	0.644	0.744
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.625	0.628	0.631	0.632	0.622
815	ITD/DELTA T		1.79	1.80	1.81	1.82	2.04
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.033	0.033	0.044	0.039	0.028
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.028	0.017	0.033	0.017	0.011
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.022	-0.028	-0.028	-0.033	-0.039
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	0.011	0.006	0.006	0.011
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.017	-0.050	-0.056	0.033	-0.017

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		89	90	91	92	0
Refrigerant		123	123	123	123	0
Oil		Solest 68	Solest 68	Solest 68	Solest 68	0
1st Stage Guide Vane Setting	Degrees	10	10	10	10	0
Capacity	KW	256.0	263.3	267.2	266.9	0.0
Power	KW	78.0	76.0	73.6	70.9	0.0
Coefficient of Performance (COP)		3.282	3.467	3.633	3.766	#DIV/0!
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.67	-17.78
Condenser Entering Water Temperature	Deg C	29.46	26.65	23.89	21.12	-17.78
Energy Balance	%	-1.38	-1.58	-1.44	-2.08	0.00
Evaporator Entering Water Temperature	Deg C	8.64	8.71	8.73	8.73	-17.78
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.67	6.67	-17.78
Evaporator Water Flow Rate	L/S	30.82	30.82	30.84	30.83	0.00
Condenser Entering Water Temperature	Deg C	29.46	26.65	23.89	21.12	-17.78
Condenser Leaving Water Temperature	Deg C	31.58	28.82	26.06	23.28	-17.78
Condenser Water Flow Rate	L/S	38.23	38.18	38.13	38.08	0.00
Evap Sat Press	kPa	40.33	40.13	39.78	39.16	0.00
Sat Temp	Deg C	4.62	4.51	4.31	3.95	-17.78
Approach	Deg C	2.06	2.17	2.39	2.72	0.00
LMTD	Deg C	2.92	3.07	3.29	3.65	0.00
ITD/Delta T		2.03	2.06	2.14	2.31	0.00
Q/Ao	kW/m2	16.70	17.20	17.45	17.42	0.00
Uo	kW/m2 C	5.72	5.60	5.31	4.77	0.00
ho'	kW/m2 C	8.59	8.34	7.70	6.61	0.00
Cond Sat Press	kPa	123.00	111.90	101.42	91.70	0.00
Sat Temp	Deg C	33.32	30.62	27.88	25.12	-17.78
Approach	Deg C	1.72	1.83	1.83	1.83	0.00
Refrigerant Leaving Temp	Deg C	32.98	30.36	27.63	24.86	-17.78
LMTD	Deg C	2.67	2.75	2.77	2.78	0.00
Q/Ao	kW/m2	17.62	17.94	18.00	17.92	0.00
Uo	kW/m2 C	6.61	6.53	6.51	6.44	0.00
ho'	kW/m2 C	9.88	9.80	9.85	9.80	0.00
Cond Sat Temp	Deg C	33.32	30.62	27.88	25.12	-17.78
Evap Sat Temp	Deg C	4.62	4.51	4.31	3.95	-17.78
Estimated Motor Efficiency (1)		0.95	0.95	0.95	0.95	0.00
Estimated Motor Rev/Sec (1)		59.63	59.64	59.65	59.66	0.00
Compressor Suction Flow Rate (2)	m3/sec	0.557	0.572	0.583	0.588	0.000
Isentropic COP (2)		8.812	9.713	10.785	12.041	#DIV/0!
Adiabatic Efficiency (3)		0.373	0.358	0.336	0.314	0.000
Q/N - m3/rev (4)		0.0093	0.0096	0.0098	0.0098	0.0000
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	114.2	114.2	114.4	114.3	0.0
3	ENT EVAP WATER TEMP LOC 1	Deg C	8.62	8.69	8.72	8.71	-17.78
4	ENT EVAP WATER TEMP LOC 2	Deg C	8.67	8.72	8.76	8.76	-17.78
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.67	6.67	6.67	-17.78
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.66	6.66	6.67	6.67	-17.78
15	COND WATER FLOWMETER DELTA P	kPa	174.8	174.6	174.2	174.0	0.0
17	ENT COND WATER TEMP LOC 1	Deg C	29.47	26.64	23.88	21.12	-17.78
18	ENT COND WATER TEMP LOC 2	Deg C	29.44	26.66	23.89	21.13	-17.78
19	LVG COND WATER TEMP LOC 1	Deg C	31.58	28.81	26.05	23.28	-17.78
20	LVG COND WATER TEMP LOC 2	Deg C	31.57	28.82	26.06	23.29	-17.78
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	7.21	7.08	6.93	6.41	-17.78
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	6.22	5.84	5.81	5.28	-17.78
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	6.44	6.37	6.06	5.67	-17.78
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	40.3	40.1	39.8	39.2	0.0
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	45.1	41.7	38.5	35.6	0.0
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	46.6	42.9	39.4	36.2	0.0
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	44.5	40.9	37.6	34.6	0.0
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	73.8	65.2	58.3	52.4	0.0
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	71.8	65.3	59.6	54.7	0.0
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	75.4	68.5	62.3	56.3	0.0
431	COND SHELL STATIC PRESS - AVERAGE	kPa	123.0	111.9	101.4	91.7	0.0
440	REFRIGERANT LVG COND TEMP	Deg C	32.98	30.36	27.63	24.86	-17.78
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	82.2	76.0	70.2	64.6	0.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	22.04	19.99	18.16	16.25	-17.78
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	45.5	42.2	38.9	35.9	0.0
487	LOW PRESS ECONOMIZER TEMP	Deg C	7.42	5.63	3.80	2.01	-17.78
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	45.9	42.7	40.5	39.6	0.0
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	7.45	5.69	3.99	2.25	-17.78
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	43.1	42.1	41.0	40.1	0.0
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	5.94	5.30	4.01	2.24	-17.78
534	ENT COND ORIFICE ASS'Y PRESS	kPa	119.8	109.2	98.9	89.2	0.0
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	32.54	29.91	27.20	24.39	-17.78
536	LVG COND ORIFICE ASS'Y PRESS	kPa	89.6	83.0	76.5	70.2	0.0
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	24.55	22.51	20.46	18.28	-17.78
560	ATMOSPHERIC PRESS	kPa	99.6	99.6	99.6	99.6	0.0
580	MOTOR VOLTAGE - AB	Volts	3.869	3.881	3.903	3.958	0.000
581	MOTOR VOLTAGE - AC	Volts	3.884	3.897	3.920	3.976	0.000
582	MOTOR VOLTAGE - CB	Volts	3.872	3.886	3.909	3.961	0.000
583	MOTOR CURRENT - A	Volts	1.149	1.124	1.104	1.082	0.000
584	MOTOR CURRENT - B	Volts	1.274	1.251	1.223	1.194	0.000
585	MOTOR CURRENT - C	Volts	1.193	1.180	1.158	1.152	0.000
586	MOTOR POWER - PHASE 1	Volts	0.391	0.366	0.341	0.297	0.000
587	MOTOR POWER - PHASE 3	Volts	0.909	0.900	0.885	0.884	0.000
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	31.51	28.78	25.99	23.23	-17.78
601	MAXIMUM MOTOR TEMPERATURE	Deg C	25.78	24.72	26.94	28.06	-17.78
605	1st STAGE VANE SETTING	Degrees	10	10	10	10	0
607	3rd STAGE VANE SETTING	Degrees	19	19	19	19	0
608	UNIT HOUR METER READING	Hr	418	418	418	419	0
609	UNIT START COUNTER READING		114	114	114	114	0
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	0.0
700	TIME (HOURS)	HOURS	30	31	31	31	0
701	ENERGY BALANCE	%	-1.38	-1.58	-1.44	-2.08	0.00

Large Impellers - Metric

702	EVAP CAPACITY	KW	256.0	263.3	267.2	266.9	0.0
703	EVAP WATER FLOWRATE	L/S	30.82	30.82	30.84	30.83	0.00
704	COND WATER FLOWRATE	L/S	38.23	38.18	38.13	38.08	0.00
710	AVE ENT EVAP WATER TEMP	Deg C	8.64	8.71	8.73	8.73	-17.78
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.67	6.67	6.67	-17.78
712	AVE ENT COND WATER TEMP	Deg C	29.46	26.65	23.89	21.12	-17.78
713	AVE LVG COND WATER TEMP	Deg C	31.58	28.82	26.06	23.28	-17.78
715	MOTOR VOLTAGE - AB	Volts	464	466	468	475	0
716	MOTOR VOLTAGE - AC	Volts	466	468	470	477	0
717	MOTOR VOLTAGE - CB	Volts	465	466	469	475	0
718	MOTOR CURRENT - A	Amps	115	112	110	108	0
719	MOTOR CURRENT - B	Amps	127	125	122	119	0
720	MOTOR CURRENT - C	Amps	119	118	116	115	0
721	UNIT POWER	KW	78	76	74	71	0
722	AVERAGE VOLTAGE	Volts	465	467	469	476	0
723	AVERAGE CURRENT	Amps	121	119	116	114	0
725	Coefficient of Performance		3.282	3.467	3.633	3.766	#DIV/0!
730	EVAP DELTA T	Deg C	1.98	2.04	2.07	2.07	0.00
731	COND DELTA T	Deg C	2.12	2.16	2.17	2.16	0.00
735	EVAP WATER FLOWRATE	Kg/Sec	30.82	30.82	30.85	30.84	0.00
736	COND WATER FLOWRATE	Kg/Sec	38.08	38.07	38.04	38.02	0.00
740	EVAP CAPACITY	KW	255.96	263.49	267.32	266.88	0.00
741	COND CAPACITY	KW	337.49	343.61	344.74	343.31	0.00
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	4.62	4.51	4.31	3.95	-17.78
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	33.32	30.62	27.88	25.12	-17.78
750	RUNNING TIME	Hr	89	89	90	90	0
751	STARTS		19	19	19	19	0
752	EVAP APPROACH TEMP	Deg C	2.06	2.17	2.39	2.72	0.00
753	COND APPROACH TEMP	Deg C	1.72	1.83	1.83	1.83	0.00
800	EVAP AVG H2O TEMP	Deg C	7.66	7.69	7.70	7.70	-17.78
801	EVAP WATER DENSITY	Kg/M3	1000.6	1000.6	1000.6	1000.6	0.0
802	EVAP H2O VISCOSITY	cp	1.388	1.387	1.387	1.387	0.000
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.194	4.194	4.194	4.194	0.000
804	EVAP H2O CON(K)	W/M C	0.583	0.583	0.583	0.583	0.000
810	COND AVG H2O TEMP	Deg C	30.52	27.73	24.97	22.21	-17.78
811	COND WATER DENSITY	Kg/M3	996.3	997.1	997.8	998.6	0.0
812	COND H2O VISCOSITY	cp	0.789	0.838	0.891	0.949	0.000
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.178	4.179	0.000
814	COND H2O CON(K)	W/M C	0.619	0.615	0.611	0.607	0.000
815	ITD/DELTA T		2.03	2.06	2.14	2.31	0.00
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.028	-0.017	-0.006	-0.011	0.000
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.006	-0.006	-0.011	-0.011	0.000
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.044	-0.033	-0.039	-0.044	0.000
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	0.011	0.006	0.006	0.000
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.067	0.033	0.056	0.050	0.000

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		93	94	95	96	97
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	725.0	654.0	646.2	647.6	634.3
Power	KW	164.5	155.1	154.1	154.7	151.7
Coefficient of Performance (COP)		4.408	4.216	4.194	4.187	4.182
Evaporator Leaving Water Temperature	Deg C	6.66	6.66	6.67	6.67	6.65
Condenser Entering Water Temperature	Deg C	29.43	32.19	32.21	32.18	32.18
Energy Balance	%	-0.92	-0.94	-0.68	-0.94	-0.72
Evaporator Entering Water Temperature	Deg C	12.13	11.59	11.54	11.55	11.43
Evaporator Leaving Water Temperature	Deg C	6.66	6.66	6.67	6.67	6.65
Evaporator Water Flow Rate	L/S	31.67	31.65	31.64	31.63	31.65
Condenser Entering Water Temperature	Deg C	29.43	32.19	32.21	32.18	32.18
Condenser Leaving Water Temperature	Deg C	35.05	37.32	37.27	37.27	37.16
Condenser Water Flow Rate	L/S	38.27	38.23	38.22	38.24	38.25
Evap Sat Press	kPa	37.78	38.47	38.54	38.47	38.06
Sat Temp	Deg C	1.54	1.94	1.98	1.94	1.71
Approach	Deg C	5.11	4.72	4.67	4.72	4.94
LMTD	Deg C	7.52	6.89	6.83	6.88	7.07
ITD/Delta T		1.94	1.96	1.96	1.97	2.03
Q/Ao	kW/m2	47.31	42.67	42.18	42.26	41.39
Uo	kW/m2 C	6.29	6.19	6.17	6.15	5.86
ho'	kW/m2 C	9.78	9.56	9.51	9.45	8.78
Cond Sat Press	kPa	168.78	179.88	181.54	180.71	179.81
Sat Temp	Deg C	39.78	41.68	41.95	41.82	41.67
Approach	Deg C	4.72	4.33	4.67	4.56	4.50
Refrigerant Leaving Temp	Deg C	38.59	40.11	40.43	40.48	40.27
LMTD	Deg C	7.18	6.59	6.90	6.78	6.69
Q/Ao	kW/m2	46.78	42.56	42.02	42.20	41.27
Uo	kW/m2 C	6.51	6.46	6.09	6.23	6.17
ho'	kW/m2 C	9.61	9.41	8.65	8.94	8.81
Cond Sat Temp	Deg C	39.78	41.68	41.95	41.82	41.67
Evap Sat Temp	Deg C	1.54	1.94	1.98	1.94	1.71
Estimated Motor Efficiency (1)		0.93	0.94	0.94	0.94	0.94
Estimated Motor Rev/Sec (1)		59.16	59.22	59.22	59.22	59.24
Compressor Suction Flow Rate (2)	m3/sec	1.673	1.489	1.470	1.475	1.459
Isentropic COP (2)		6.347	6.104	6.072	6.083	6.072
Adiabatic Efficiency (3)		0.693	0.694	0.689	0.688	0.689
Q/N - m3/rev (4)		0.0283	0.0251	0.0248	0.0249	0.0246
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	120.5	120.3	120.3	120.2	120.4
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.11	11.57	11.52	11.53	11.41
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.14	11.61	11.56	11.57	11.45
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.66	6.67	6.67	6.66
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.66	6.66	6.66	6.66	6.64
15	COND WATER FLOWMETER DELTA P	kPa	175.2	174.6	174.5	174.7	174.8
17	ENT COND WATER TEMP LOC 1	Deg C	29.43	32.21	32.22	32.19	32.19
18	ENT COND WATER TEMP LOC 2	Deg C	29.42	32.17	32.19	32.17	32.17
19	LVG COND WATER TEMP LOC 1	Deg C	35.06	37.33	37.28	37.27	37.16
20	LVG COND WATER TEMP LOC 2	Deg C	35.04	37.31	37.26	37.26	37.14
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	3.14	3.46	3.63	3.47	3.16
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	2.91	3.27	3.32	3.12	2.84
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	3.83	4.17	4.12	4.12	3.70
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	37.8	38.5	38.5	38.5	38.1
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	64.5	66.7	67.0	66.9	66.2
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	64.9	67.2	67.4	67.3	66.7
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	61.2	64.2	64.5	64.4	63.8
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	181.9	184.6	177.1	166.0	162.5
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	105.8	111.1	111.8	111.6	107.9
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	100.6	104.8	106.5	106.5	105.6
431	COND SHELL STATIC PRESS - AVERAGE	kPa	168.8	179.9	181.5	180.7	179.8
440	REFRIGERANT LVG COND TEMP	Deg C	38.59	40.11	40.43	40.48	40.27
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	106.0	111.8	113.3	112.9	112.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	26.42	27.83	28.01	27.98	27.76
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	65.6	67.8	67.8	68.1	67.3
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.31	15.08	15.17	15.19	14.92
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	66.2	68.1	68.3	68.1	67.5
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	14.32	15.05	15.12	15.13	14.88
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	52.7	53.1	53.2	52.7	51.8
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.10	9.21	9.22	9.12	8.78
534	ENT COND ORIFICE ASS'Y PRESS	kPa	166.7	178.2	178.6	178.2	176.8
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	38.80	40.68	40.74	40.76	40.51
536	LVG COND ORIFICE ASS'Y PRESS	kPa	125.1	131.8	132.4	132.4	130.7
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	31.33	32.32	32.49	32.40	32.14
560	ATMOSPHERIC PRESS	kPa	98.9	98.9	98.9	98.9	98.9
580	MOTOR VOLTAGE - AB	Volts	3.900	3.909	3.918	3.936	3.936
581	MOTOR VOLTAGE - AC	Volts	3.902	3.917	3.929	3.955	3.951
582	MOTOR VOLTAGE - CB	Volts	3.884	3.893	3.908	3.922	3.919
583	MOTOR CURRENT - A	Volts	2.277	2.137	2.119	2.118	2.085
584	MOTOR CURRENT - B	Volts	2.348	2.210	2.206	2.187	2.150
585	MOTOR CURRENT - C	Volts	2.190	2.088	2.076	2.100	2.064
586	MOTOR POWER - PHASE 1	Volts	1.038	0.960	0.947	0.928	0.914
587	MOTOR POWER - PHASE 3	Volts	1.703	1.625	1.621	1.650	1.614
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	35.06	37.38	37.28	37.35	37.21
601	MAXIMUM MOTOR TEMPERATURE	Deg C	54.72	51.94	51.39	51.39	50.83
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	68
608	UNIT HOUR METER READING	Hr	420	420	421	423	423
609	UNIT START COUNTER READING		115	115	115	115	115
610	CURRENT REFRIGERANT CHARGE	Kg	163.7	163.7	150.1	129.3	120.2
700	TIME (HOURS)	HOURS	0	1	2	3	3
701	ENERGY BALANCE	%	-0.92	-0.94	-0.68	-0.94	-0.72

Large Impellers - Metric

702	EVAP CAPACITY	KW	725.0	654.0	646.2	647.6	634.3
703	EVAP WATER FLOWRATE	L/S	31.67	31.65	31.64	31.63	31.65
704	COND WATER FLOWRATE	L/S	38.27	38.23	38.22	38.24	38.25
710	AVE ENT EVAP WATER TEMP	Deg C	12.13	11.59	11.54	11.55	11.43
711	AVE LVG EVAP WATER TEMP	Deg C	6.66	6.66	6.67	6.67	6.65
712	AVE ENT COND WATER TEMP	Deg C	29.43	32.19	32.21	32.18	32.18
713	AVE LVG COND WATER TEMP	Deg C	35.05	37.32	37.27	37.27	37.16
715	MOTOR VOLTAGE - AB	Volts	468	469	470	472	472
716	MOTOR VOLTAGE - AC	Volts	468	470	472	475	474
717	MOTOR VOLTAGE - CB	Volts	466	467	469	471	470
718	MOTOR CURRENT - A	Amps	228	214	212	212	209
719	MOTOR CURRENT - B	Amps	235	221	221	219	215
720	MOTOR CURRENT - C	Amps	219	209	208	210	206
721	UNIT POWER	KW	164	155	154	155	152
722	AVERAGE VOLTAGE	Volts	467	469	470	473	472
723	AVERAGE CURRENT	Amps	227	215	213	214	210
725	Coefficient of Performance		4.408	4.216	4.194	4.187	4.182
730	EVAP DELTA T	Deg C	5.47	4.93	4.87	4.88	4.78
731	COND DELTA T	Deg C	5.63	5.13	5.07	5.09	4.97
735	EVAP WATER FLOWRATE	Kg/Sec	31.66	31.64	31.63	31.63	31.65
736	COND WATER FLOWRATE	Kg/Sec	38.13	38.05	38.04	38.06	38.07
740	EVAP CAPACITY	KW	724.91	653.86	646.32	647.60	634.18
741	COND CAPACITY	KW	896.02	815.12	804.81	808.38	790.44
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.54	1.94	1.98	1.94	1.71
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	39.78	41.68	41.95	41.82	41.67
750	RUNNING TIME	Hr	91	91	93	94	94
751	STARTS		20	20	20	20	20
752	EVAP APPROACH TEMP	Deg C	5.11	4.72	4.67	4.72	4.94
753	COND APPROACH TEMP	Deg C	4.72	4.33	4.67	4.56	4.50
800	EVAP AVG H2O TEMP	Deg C	9.39	9.12	9.11	9.11	9.04
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.321	1.332	1.332	1.332	1.335
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.191	4.192	4.192	4.192	4.192
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.586	0.585
810	COND AVG H2O TEMP	Deg C	32.24	34.76	34.74	34.72	34.67
811	COND WATER DENSITY	Kg/M3	995.7	994.9	994.9	994.9	994.9
812	COND H2O VISCOSITY	cp	0.760	0.722	0.722	0.723	0.723
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.621	0.624	0.624	0.624	0.624
815	ITD/DELTA T		1.94	1.96	1.96	1.97	2.03
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.017	0.039	0.033	0.028	0.028
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.017	0.022	0.022	0.011	0.017
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.028	-0.033	-0.033	-0.033	-0.039
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.011	0.006	0.006	0.006	0.011
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.000	-0.044	0.006	-0.078	-0.050

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		98	99	100	101	102
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	646.9	651.5	565.4	774.2	821.0
Power	KW	153.6	154.8	142.9	168.4	172.6
Coefficient of Performance (COP)		4.212	4.209	3.956	4.599	4.758
Evaporator Leaving Water Temperature	Deg C	6.66	6.68	6.67	6.66	6.67
Condenser Entering Water Temperature	Deg C	32.19	32.22	34.68	26.62	23.88
Energy Balance	%	-1.05	-1.00	-1.23	-0.95	-1.04
Evaporator Entering Water Temperature	Deg C	11.54	11.56	10.93	12.62	12.96
Evaporator Leaving Water Temperature	Deg C	6.66	6.68	6.67	6.66	6.67
Evaporator Water Flow Rate	L/S	31.62	31.84	31.65	31.03	31.17
Condenser Entering Water Temperature	Deg C	32.19	32.22	34.68	26.62	23.88
Condenser Leaving Water Temperature	Deg C	37.27	37.33	39.19	32.59	30.19
Condenser Water Flow Rate	L/S	38.24	38.27	38.22	38.17	38.11
Evap Sat Press	kPa	38.47	38.40	39.30	37.16	35.82
Sat Temp	Deg C	1.94	1.91	2.41	1.18	0.97
Approach	Deg C	4.72	4.78	4.22	5.50	5.72
LMTD	Deg C	6.87	6.93	6.14	8.10	8.46
ITD/Delta T		1.96	1.98	2.00	1.92	1.91
Q/Ao	kW/m2	42.23	42.53	36.89	50.52	53.58
Uo	kW/m2 C	6.15	6.14	6.01	6.24	6.33
ho'	kW/m2 C	9.46	9.40	9.13	9.72	9.93
Cond Sat Press	kPa	181.12	179.19	187.47	157.13	145.96
Sat Temp	Deg C	41.88	41.56	42.92	37.69	35.56
Approach	Deg C	4.61	4.22	3.72	5.11	5.33
Refrigerant Leaving Temp	Deg C	40.44	40.22	41.70	36.61	34.30
LMTD	Deg C	6.84	6.46	5.69	7.70	8.11
Q/Ao	kW/m2	42.16	42.45	37.34	49.59	52.32
Uo	kW/m2 C	6.16	6.58	6.57	6.44	6.45
ho'	kW/m2 C	8.80	9.67	9.58	9.54	9.65
Cond Sat Temp	Deg C	41.88	41.56	42.92	37.69	35.56
Evap Sat Temp	Deg C	1.94	1.91	2.41	1.18	0.97
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.93	0.93
Estimated Motor Rev/Sec (1)		59.22	59.22	59.29	59.14	59.11
Compressor Suction Flow Rate (2)	m3/sec	1.474	1.486	1.265	1.807	1.925
Isentropic COP (2)		6.072	6.125	6.020	6.646	7.032
Adiabatic Efficiency (3)		0.698	0.683	0.656	0.696	0.676
Q/N - m3/rev (4)		0.0249	0.0251	0.0213	0.0306	0.0326
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	120.2	121.9	120.4	115.7	116.7
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.52	11.54	10.91	12.61	12.95
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.56	11.58	10.95	12.63	12.97
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.66	6.68	6.67	6.67	6.68
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.65	6.67	6.67	6.66	6.67
15	COND WATER FLOWMETER DELTA P	kPa	174.7	175.0	174.4	174.4	174.0
17	ENT COND WATER TEMP LOC 1	Deg C	32.20	32.22	34.70	26.62	23.88
18	ENT COND WATER TEMP LOC 2	Deg C	32.17	32.21	34.66	26.61	23.88
19	LVG COND WATER TEMP LOC 1	Deg C	37.27	37.33	39.19	32.59	30.19
20	LVG COND WATER TEMP LOC 2	Deg C	37.26	37.32	39.18	32.59	30.19
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	3.64	5.68	5.95	4.75	4.77
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.24	3.97	4.23	3.16	3.03
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.04	4.60	4.91	3.80	3.65
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	38.5	38.4	39.3	37.2	36.8
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	66.9	66.7	68.7	62.3	60.7
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	67.4	67.0	69.2	62.7	61.2
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	64.4	64.2	66.9	58.4	56.1
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	159.4	138.4	143.2	128.5	123.8
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	111.6	112.0	116.2	102.7	97.8
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	106.7	106.5	111.6	96.3	90.9
431	COND SHELL STATIC PRESS - AVERAGE	kPa	181.1	179.2	187.5	157.1	146.0
440	REFRIGERANT LVG COND TEMP	Deg C	40.44	40.22	41.70	36.61	34.30
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	113.0	112.5	117.8	100.5	94.9
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.96	27.84	29.03	24.89	23.40
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	67.8	67.8	69.2	63.2	61.2
487	LOW PRESS ECONOMIZER TEMP	Deg C	15.14	15.07	15.62	13.43	12.69
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	68.2	67.9	69.2	63.8	62.2
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	15.13	15.03	15.52	13.48	12.79
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	52.7	52.7	52.3	52.3	51.4
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.99	9.13	8.89	8.88	8.70
534	ENT COND ORIFICE ASS'Y PRESS	kPa	179.0	177.4	185.1	155.5	145.1
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	40.74	40.63	41.85	36.73	34.70
536	LVG COND ORIFICE ASS'Y PRESS	kPa	132.4	131.6	134.7	119.8	114.0
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	32.39	32.26	32.89	29.97	28.62
560	ATMOSPHERIC PRESS	kPa	98.9	99.0	99.0	99.0	99.0
580	MOTOR VOLTAGE - AB	Volts	3.915	3.894	3.905	3.868	3.869
581	MOTOR VOLTAGE - AC	Volts	3.910	3.899	3.906	3.870	3.872
582	MOTOR VOLTAGE - CB	Volts	3.891	3.880	3.890	3.855	3.857
583	MOTOR CURRENT - A	Volts	2.105	2.145	1.994	2.330	2.376
584	MOTOR CURRENT - B	Volts	2.179	2.222	2.071	2.420	2.470
585	MOTOR CURRENT - C	Volts	2.100	2.071	1.922	2.246	2.301
586	MOTOR POWER - PHASE 1	Volts	0.928	0.970	0.888	1.072	1.100
587	MOTOR POWER - PHASE 3	Volts	1.632	1.610	1.494	1.734	1.776
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	37.31	37.32	39.21	32.61	30.14
601	MAXIMUM MOTOR TEMPERATURE	Deg C	51.94	50.83	48.06	56.39	58.61
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	68
608	UNIT HOUR METER READING	Hr	424	429	429	430	430
609	UNIT START COUNTER READING		115	119	119	119	119
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	4	95	96	96	97
701	ENERGY BALANCE	%	-1.05	-1.00	-1.23	-0.95	-1.04

Large Impellers - Metric

702	EVAP CAPACITY	KW	646.9	651.5	565.4	774.2	821.0
703	EVAP WATER FLOWRATE	L/S	31.62	31.84	31.65	31.03	31.17
704	COND WATER FLOWRATE	L/S	38.24	38.27	38.22	38.17	38.11
710	AVE ENT EVAP WATER TEMP	Deg C	11.54	11.56	10.93	12.62	12.96
711	AVE LVG EVAP WATER TEMP	Deg C	6.66	6.68	6.67	6.66	6.67
712	AVE ENT COND WATER TEMP	Deg C	32.19	32.22	34.68	26.62	23.88
713	AVE LVG COND WATER TEMP	Deg C	37.27	37.33	39.19	32.59	30.19
715	MOTOR VOLTAGE - AB	Volts	470	467	469	464	464
716	MOTOR VOLTAGE - AC	Volts	469	468	469	464	465
717	MOTOR VOLTAGE - CB	Volts	467	466	467	463	463
718	MOTOR CURRENT - A	Amps	211	215	199	233	238
719	MOTOR CURRENT - B	Amps	218	222	207	242	247
720	MOTOR CURRENT - C	Amps	210	207	192	225	230
721	UNIT POWER	KW	154	155	143	168	173
722	AVERAGE VOLTAGE	Volts	469	467	468	464	464
723	AVERAGE CURRENT	Amps	213	215	200	233	238
725	Coefficient of Performance		4.212	4.209	3.956	4.599	4.758
730	EVAP DELTA T	Deg C	4.88	4.88	4.26	5.96	6.29
731	COND DELTA T	Deg C	5.08	5.11	4.50	5.98	6.31
735	EVAP WATER FLOWRATE	Kg/Sec	31.62	31.84	31.65	31.02	31.16
736	COND WATER FLOWRATE	Kg/Sec	38.06	38.09	38.01	38.05	38.02
740	EVAP CAPACITY	KW	647.05	651.67	565.32	774.09	820.99
741	COND CAPACITY	KW	807.50	813.00	715.19	949.82	1002.15
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.94	1.91	2.41	1.18	0.97
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	41.88	41.56	42.92	37.69	35.56
750	RUNNING TIME	Hr	95	100	101	101	101
751	STARTS		20	24	24	24	24
752	EVAP APPROACH TEMP	Deg C	4.72	4.78	4.22	5.50	5.72
753	COND APPROACH TEMP	Deg C	4.61	4.22	3.72	5.11	5.33
800	EVAP AVG H2O TEMP	Deg C	9.10	9.12	8.79	9.64	9.82
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.332	1.332	1.344	1.313	1.307
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.192	4.192	4.192	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.585	0.586	0.587
810	COND AVG H2O TEMP	Deg C	34.73	34.77	36.94	29.61	27.04
811	COND WATER DENSITY	Kg/M3	994.9	994.8	994.1	996.5	997.3
812	COND H2O VISCOSITY	cp	0.722	0.722	0.690	0.804	0.850
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.624	0.625	0.627	0.618	0.614
815	ITD/DELTA T		1.96	1.98	2.00	1.92	1.91
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.028	0.017	0.039	0.011	0.006
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.011	0.017	0.017	0.000	0.006
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.033	-0.033	-0.039	-0.022	-0.022
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.011	0.011	0.006	0.011	0.011
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.033	0.011	-0.017	-0.017	0.050

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		103	104	105	106	107
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	70	70	70	70
Capacity	KW	862.1	841.4	804.5	761.2	704.6
Power	KW	176.5	169.4	167.2	164.0	158.1
Coefficient of Performance (COP)		4.886	4.967	4.811	4.640	4.457
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	6.66	6.67	6.67
Condenser Entering Water Temperature	Deg C	21.10	21.10	23.86	26.65	29.42
Energy Balance	%	-1.13	-0.94	-1.12	-1.33	-0.92
Evaporator Entering Water Temperature	Deg C	13.24	13.09	12.84	12.52	11.97
Evaporator Leaving Water Temperature	Deg C	6.67	6.68	6.66	6.67	6.67
Evaporator Water Flow Rate	L/S	31.29	31.29	31.09	31.04	31.76
Condenser Entering Water Temperature	Deg C	21.10	21.10	23.86	26.65	29.42
Condenser Leaving Water Temperature	Deg C	27.72	27.53	30.04	32.53	34.90
Condenser Water Flow Rate	L/S	38.00	38.00	38.08	38.17	38.14
Evap Sat Press	kPa	36.40	36.68	37.09	37.51	38.06
Sat Temp	Deg C	0.73	0.89	1.14	1.38	1.71
Approach	Deg C	5.94	5.78	5.50	5.28	4.94
LMTD	Deg C	8.82	8.60	8.23	7.85	7.30
ITD/Delta T		1.90	1.90	1.89	1.90	1.94
Q/Ao	kW/m2	56.25	54.90	52.51	49.69	45.98
Uo	kW/m2 C	6.38	6.39	6.38	6.33	6.30
ho'	kW/m2 C	10.01	10.04	10.06	9.94	9.80
Cond Sat Press	kPa	135.48	133.76	144.51	156.10	167.06
Sat Temp	Deg C	33.44	33.08	35.27	37.49	39.48
Approach	Deg C	5.72	5.56	5.22	4.94	4.61
Refrigerant Leaving Temp	Deg C	32.29	31.93	34.02	36.39	38.39
LMTD	Deg C	8.61	8.36	7.93	7.52	6.97
Q/Ao	kW/m2	54.72	53.17	51.21	48.84	45.37
Uo	kW/m2 C	6.36	6.36	6.46	6.49	6.51
ho'	kW/m2 C	9.53	9.56	9.68	9.66	9.62
Cond Sat Temp	Deg C	33.44	33.08	35.27	37.49	39.48
Evap Sat Temp	Deg C	0.73	0.89	1.14	1.38	1.71
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93	0.94
Estimated Motor Rev/Sec (1)		59.09	59.13	59.14	59.16	59.20
Compressor Suction Flow Rate (2)	m3/sec	2.034	1.969	1.873	1.760	1.614
Isentropic COP (2)		7.433	7.578	7.132	6.736	6.440
Adiabatic Efficiency (3)		0.657	0.654	0.675	0.687	0.691
Q/N - m3/rev (4)		0.0344	0.0333	0.0317	0.0298	0.0273
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	117.6	117.6	116.2	115.8	121.2
3	ENT EVAP WATER TEMP LOC 1	Deg C	13.23	13.08	12.83	12.51	11.96
4	ENT EVAP WATER TEMP LOC 2	Deg C	13.26	13.11	12.84	12.54	11.98
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.68	6.66	6.67	6.68
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.66	6.67	6.66	6.67	6.67
15	COND WATER FLOWMETER DELTA P	kPa	173.2	173.1	173.8	174.4	174.0
17	ENT COND WATER TEMP LOC 1	Deg C	21.10	21.10	23.86	26.66	29.43
18	ENT COND WATER TEMP LOC 2	Deg C	21.11	21.10	23.86	26.64	29.41
19	LVG COND WATER TEMP LOC 1	Deg C	27.72	27.53	30.04	32.53	34.90
20	LVG COND WATER TEMP LOC 2	Deg C	27.72	27.53	30.03	32.54	34.89
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.53	4.62	4.63	5.08	5.18
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	2.89	2.98	3.11	3.40	3.61
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	3.47	3.60	3.77	4.10	4.31
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	36.4	36.7	37.1	37.5	38.1
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	59.2	58.4	60.1	62.0	64.1
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	59.3	58.5	60.3	62.3	64.4
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	53.8	53.5	55.8	58.3	60.9
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	122.5	122.6	124.9	130.7	133.4
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	93.2	93.1	98.0	103.3	108.1
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	85.3	85.3	90.7	96.4	101.6
431	COND SHELL STATIC PRESS - AVERAGE	kPa	135.5	133.8	144.5	156.1	167.1
440	REFRIGERANT LVG COND TEMP	Deg C	32.29	31.93	34.02	36.39	38.39
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	89.3	89.1	94.6	100.5	106.3
485	HIGH PRESS ECONOMIZER TEMP	Deg C	21.87	21.86	23.33	24.87	26.39
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	58.9	58.4	60.6	62.9	65.0
487	LOW PRESS ECONOMIZER TEMP	Deg C	11.78	11.61	12.47	13.31	14.16
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	61.2	60.1	61.5	63.6	65.6
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	11.94	11.76	12.56	13.36	14.14
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	51.4	50.7	51.2	51.7	52.1
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.68	8.26	8.52	8.82	8.89
534	ENT COND ORIFICE ASS'Y PRESS	kPa	135.3	133.6	143.7	154.2	165.1
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	32.66	32.33	34.43	36.55	38.54
536	LVG COND ORIFICE ASS'Y PRESS	kPa	107.8	106.0	110.9	117.8	123.7
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	27.26	26.87	28.18	29.71	31.04
560	ATMOSPHERIC PRESS	kPa	99.0	99.0	99.1	99.1	99.0
580	MOTOR VOLTAGE - AB	Volts	3.881	3.879	3.887	3.918	3.878
581	MOTOR VOLTAGE - AC	Volts	3.881	3.880	3.886	3.917	3.880
582	MOTOR VOLTAGE - CB	Volts	3.864	3.864	3.867	3.900	3.863
583	MOTOR CURRENT - A	Volts	2.438	2.338	2.317	2.261	2.189
584	MOTOR CURRENT - B	Volts	2.516	2.427	2.385	2.339	2.270
585	MOTOR CURRENT - C	Volts	2.342	2.256	2.222	2.174	2.116
586	MOTOR POWER - PHASE 1	Volts	1.130	1.079	1.069	1.038	0.998
587	MOTOR POWER - PHASE 3	Volts	1.811	1.744	1.718	1.696	1.637
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	27.67	27.49	30.01	32.51	34.87
601	MAXIMUM MOTOR TEMPERATURE	Deg C	61.39	58.61	56.39	54.72	51.94
605	1st STAGE VANE SETTING	Degrees	90	70	70	70	70
607	3rd STAGE VANE SETTING	Degrees	68	63	63	63	63
608	UNIT HOUR METER READING	Hr	430	431	431	431	432
609	UNIT START COUNTER READING		119	119	119	119	119
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	97	97	97	98	98
701	ENERGY BALANCE	%	-1.13	-0.94	-1.12	-1.33	-0.92

Large Impellers - Metric

702	EVAP CAPACITY	KW	862.1	841.4	804.5	761.2	704.6
703	EVAP WATER FLOWRATE	L/S	31.29	31.29	31.09	31.04	31.76
704	COND WATER FLOWRATE	L/S	38.00	38.00	38.08	38.17	38.14
710	AVE ENT EVAP WATER TEMP	Deg C	13.24	13.09	12.84	12.52	11.97
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.68	6.66	6.67	6.67
712	AVE ENT COND WATER TEMP	Deg C	21.10	21.10	23.86	26.65	29.42
713	AVE LVG COND WATER TEMP	Deg C	27.72	27.53	30.04	32.53	34.90
715	MOTOR VOLTAGE - AB	Volts	466	466	466	470	465
716	MOTOR VOLTAGE - AC	Volts	466	466	466	470	466
717	MOTOR VOLTAGE - CB	Volts	464	464	464	468	464
718	MOTOR CURRENT - A	Amps	244	234	232	226	219
719	MOTOR CURRENT - B	Amps	252	243	239	234	227
720	MOTOR CURRENT - C	Amps	234	226	222	217	212
721	UNIT POWER	KW	176	169	167	164	158
722	AVERAGE VOLTAGE	Volts	465	465	466	469	465
723	AVERAGE CURRENT	Amps	243	234	231	226	219
725	Coefficient of Performance		4.886	4.967	4.811	4.640	4.457
730	EVAP DELTA T	Deg C	6.58	6.42	6.18	5.86	5.29
731	COND DELTA T	Deg C	6.62	6.43	6.18	5.88	5.47
735	EVAP WATER FLOWRATE	Kg/Sec	31.28	31.28	31.09	31.03	31.75
736	COND WATER FLOWRATE	Kg/Sec	37.94	37.93	38.00	38.06	37.99
740	EVAP CAPACITY	KW	861.95	841.22	804.60	761.33	704.46
741	COND CAPACITY	KW	1048.16	1018.47	980.86	935.45	869.04
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	0.73	0.89	1.14	1.38	1.71
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	33.44	33.08	35.27	37.49	39.48
750	RUNNING TIME	Hr	102	102	102	102	103
751	STARTS		24	24	24	24	24
752	EVAP APPROACH TEMP	Deg C	5.94	5.78	5.50	5.28	4.94
753	COND APPROACH TEMP	Deg C	5.72	5.56	5.22	4.94	4.61
800	EVAP AVG H2O TEMP	Deg C	9.96	9.89	9.75	9.59	9.32
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.301	1.304	1.308	1.314	1.324
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.190	4.190	4.191	4.191	4.192
804	EVAP H2O CON(K)	W/M C	0.587	0.587	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	24.41	24.31	26.94	29.59	32.16
811	COND WATER DENSITY	Kg/M3	998.0	998.0	997.3	996.5	995.7
812	COND H2O VISCOSITY	cp	0.902	0.905	0.853	0.804	0.762
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.178	4.178	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.610	0.610	0.614	0.618	0.621
815	ITD/DELTA T		1.90	1.90	1.89	1.90	1.94
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.006	0.000	0.000	0.011	0.028
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.000	0.000	0.006	-0.006	0.006
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.022	-0.022	-0.017	-0.028	-0.022
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.011	0.006	0.006	0.006	0.011
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.050	0.039	0.033	0.028	0.033

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		108	109	110	111	112
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	40	40	40
Capacity	KW	635.3	547.8	484.5	568.9	629.7
Power	KW	149.3	137.9	122.9	134.0	140.8
Coefficient of Performance (COP)		4.256	3.973	3.941	4.244	4.474
Evaporator Leaving Water Temperature	Deg C	6.68	6.67	6.67	6.67	6.66
Condenser Entering Water Temperature	Deg C	32.19	34.58	34.27	32.22	29.43
Energy Balance	%	-1.00	-1.02	-1.14	-0.75	-1.10
Evaporator Entering Water Temperature	Deg C	11.46	10.79	10.31	10.94	11.39
Evaporator Leaving Water Temperature	Deg C	6.68	6.67	6.67	6.67	6.66
Evaporator Water Flow Rate	L/S	31.74	31.71	31.72	31.76	31.76
Condenser Entering Water Temperature	Deg C	32.19	34.58	34.27	32.22	29.43
Condenser Leaving Water Temperature	Deg C	37.18	38.93	38.13	36.68	34.32
Condenser Water Flow Rate	L/S	38.15	38.19	38.20	38.16	38.16
Evap Sat Press	kPa	38.68	39.51	40.20	39.37	38.61
Sat Temp	Deg C	2.07	2.53	2.92	2.45	2.03
Approach	Deg C	4.61	4.11	3.72	4.22	4.61
LMTD	Deg C	6.72	5.96	5.37	6.11	6.72
ITD/Delta T		1.97	2.00	2.03	1.99	1.98
Q/Ao	kW/m2	41.47	35.75	31.62	37.12	41.10
Uo	kW/m2 C	6.17	6.00	5.89	6.07	6.11
ho'	kW/m2 C	9.50	9.11	8.87	9.28	9.35
Cond Sat Press	kPa	178.02	185.40	177.95	172.44	161.13
Sat Temp	Deg C	41.37	42.58	41.36	40.42	38.42
Approach	Deg C	4.17	3.67	3.22	3.72	4.11
Refrigerant Leaving Temp	Deg C	40.18	41.24	39.97	39.16	36.96
LMTD	Deg C	6.35	5.55	4.90	5.68	6.23
Q/Ao	kW/m2	41.30	36.09	32.00	36.92	40.59
Uo	kW/m2 C	6.50	6.51	6.53	6.50	6.51
ho'	kW/m2 C	9.52	9.47	9.52	9.53	9.64
Cond Sat Temp	Deg C	41.37	42.58	41.36	40.42	38.42
Evap Sat Temp	Deg C	2.07	2.53	2.92	2.45	2.03
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.94
Estimated Motor Rev/Sec (1)		59.25	59.31	59.40	59.34	59.30
Compressor Suction Flow Rate (2)	m3/sec	1.438	1.218	1.057	1.263	1.418
Isentropic COP (2)		6.190	6.104	6.404	6.463	6.736
Adiabatic Efficiency (3)		0.684	0.655	0.617	0.655	0.661
Q/N - m3/rev (4)		0.0243	0.0205	0.0178	0.0213	0.0239
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	121.1	120.9	120.9	121.3	121.3
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.44	10.77	10.29	10.93	11.37
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.47	10.81	10.33	10.96	11.41
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.68	6.67	6.67	6.68	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.66	6.66	6.67	6.66
15	COND WATER FLOWMETER DELTA P	kPa	173.9	174.1	174.2	174.0	174.2
17	ENT COND WATER TEMP LOC 1	Deg C	32.20	34.59	34.28	32.24	29.43
18	ENT COND WATER TEMP LOC 2	Deg C	32.18	34.56	34.26	32.19	29.42
19	LVG COND WATER TEMP LOC 1	Deg C	37.18	38.94	38.13	36.68	34.33
20	LVG COND WATER TEMP LOC 2	Deg C	37.18	38.93	38.13	36.67	34.32
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	5.66	5.67	6.00	5.51	5.23
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.09	4.32	4.80	4.28	3.93
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.57	4.81	5.21	4.77	4.44
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	38.7	39.5	40.2	39.4	38.6
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	66.4	68.1	66.9	65.0	62.5
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	66.7	68.7	67.7	65.4	62.7
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	64.0	66.5	65.6	63.2	60.1
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	137.8	142.4	138.1	135.7	129.8
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	113.8	115.4	113.1	108.0	102.5
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	106.5	111.1	107.6	103.6	97.6
431	COND SHELL STATIC PRESS - AVERAGE	kPa	178.0	185.4	178.0	172.4	161.1
440	REFRIGERANT LVG COND TEMP	Deg C	40.18	41.24	39.97	39.16	36.96
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	112.2	116.7	114.5	110.9	105.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.76	28.81	28.28	27.44	26.04
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	67.4	68.6	67.0	65.8	63.2
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.97	15.41	14.84	14.40	13.49
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	67.6	68.4	66.9	65.9	63.6
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	14.91	15.27	14.72	14.25	13.46
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	52.5	51.9	51.0	50.7	50.5
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.03	8.66	8.33	8.18	8.14
534	ENT COND ORIFICE ASS'Y PRESS	kPa	175.9	182.6	175.5	169.7	159.3
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	40.35	41.43	40.21	39.29	37.40
536	LVG COND ORIFICE ASS'Y PRESS	kPa	130.5	133.4	128.2	126.7	120.9
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	32.06	32.53	31.47	31.24	30.01
560	ATMOSPHERIC PRESS	kPa	99.0	99.1	99.1	99.1	99.1
580	MOTOR VOLTAGE - AB	Volts	3.852	3.851	3.870	3.900	3.903
581	MOTOR VOLTAGE - AC	Volts	3.853	3.854	3.870	3.902	3.907
582	MOTOR VOLTAGE - CB	Volts	3.839	3.838	3.858	3.887	3.894
583	MOTOR CURRENT - A	Volts	2.087	1.928	1.728	1.873	1.951
584	MOTOR CURRENT - B	Volts	2.158	2.010	1.818	1.951	2.045
585	MOTOR CURRENT - C	Volts	2.007	1.863	1.690	1.816	1.898
586	MOTOR POWER - PHASE 1	Volts	0.944	0.858	0.748	0.822	0.866
587	MOTOR POWER - PHASE 3	Volts	1.544	1.440	1.301	1.412	1.480
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	37.18	38.95	38.12	36.67	34.31
601	MAXIMUM MOTOR TEMPERATURE	Deg C	49.72	46.39	40.83	43.06	44.72
605	1st STAGE VANE SETTING	Degrees	70	70	40	40	40
607	3rd STAGE VANE SETTING	Degrees	63	63	50	50	50
608	UNIT HOUR METER READING	Hr	432	433	434	434	434
609	UNIT START COUNTER READING		119	119	119	119	119
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	98	99	100	100	101
701	ENERGY BALANCE	%	-1.00	-1.02	-1.14	-0.75	-1.10

Large Impellers - Metric

702	EVAP CAPACITY	KW	635.3	547.8	484.5	568.9	629.7
703	EVAP WATER FLOWRATE	L/S	31.74	31.71	31.72	31.76	31.76
704	COND WATER FLOWRATE	L/S	38.15	38.19	38.20	38.16	38.16
710	AVE ENT EVAP WATER TEMP	Deg C	11.46	10.79	10.31	10.94	11.39
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.67	6.67	6.67	6.66
712	AVE ENT COND WATER TEMP	Deg C	32.19	34.58	34.27	32.22	29.43
713	AVE LVG COND WATER TEMP	Deg C	37.18	38.93	38.13	36.68	34.32
715	MOTOR VOLTAGE - AB	Volts	462	462	464	468	468
716	MOTOR VOLTAGE - AC	Volts	462	463	464	468	469
717	MOTOR VOLTAGE - CB	Volts	461	461	463	466	467
718	MOTOR CURRENT - A	Amps	209	193	173	187	195
719	MOTOR CURRENT - B	Amps	216	201	182	195	205
720	MOTOR CURRENT - C	Amps	201	186	169	182	190
721	UNIT POWER	KW	149	138	123	134	141
722	AVERAGE VOLTAGE	Volts	462	462	464	468	468
723	AVERAGE CURRENT	Amps	208	193	175	188	196
725	Coefficient of Performance		4.256	3.973	3.941	4.244	4.474
730	EVAP DELTA T	Deg C	4.78	4.12	3.64	4.27	4.73
731	COND DELTA T	Deg C	4.98	4.36	3.87	4.46	4.89
735	EVAP WATER FLOWRATE	Kg/Sec	31.73	31.71	31.72	31.76	31.76
736	COND WATER FLOWRATE	Kg/Sec	37.97	37.98	37.99	37.98	38.01
740	EVAP CAPACITY	KW	635.43	547.85	484.54	568.74	629.70
741	COND CAPACITY	KW	791.05	691.29	613.00	707.07	777.40
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.07	2.53	2.92	2.45	2.03
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	41.37	42.58	41.36	40.42	38.42
750	RUNNING TIME	Hr	103	104	105	105	105
751	STARTS		24	24	24	24	24
752	EVAP APPROACH TEMP	Deg C	4.61	4.11	3.72	4.22	4.61
753	COND APPROACH TEMP	Deg C	4.17	3.67	3.22	3.72	4.11
800	EVAP AVG H2O TEMP	Deg C	9.07	8.73	8.49	8.81	9.03
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.6	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.333	1.347	1.356	1.344	1.335
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.192	4.192	4.193	4.192	4.192
804	EVAP H2O CON(K)	W/M C	0.586	0.585	0.584	0.585	0.585
810	COND AVG H2O TEMP	Deg C	34.69	36.76	36.20	34.45	31.88
811	COND WATER DENSITY	Kg/M3	994.9	994.1	994.3	995.0	995.8
812	COND H2O VISCOSITY	cp	0.723	0.693	0.701	0.726	0.766
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.624	0.627	0.626	0.624	0.621
815	ITD/DELTA T		1.97	2.00	2.03	1.99	1.98
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.017	0.028	0.022	0.050	0.017
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.006	0.011	0.006	0.011	0.011
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.033	-0.033	-0.044	-0.022	-0.039
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.011	0.011	0.011	0.011	0.011
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.000	-0.011	0.011	0.011	0.022

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm						
Run Number		113	114	115	116	117
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	10	10
Capacity	KW	678.2	718.3	750.3	279.9	269.3
Power	KW	144.9	147.8	149.0	66.7	68.5
Coefficient of Performance (COP)		4.681	4.861	5.035	4.195	3.934
Evaporator Leaving Water Temperature	Deg C	6.66	6.67	6.65	6.66	6.67
Condenser Entering Water Temperature	Deg C	26.63	23.87	21.08	21.11	23.87
Energy Balance	%	-1.23	-1.25	-1.16	-1.37	-1.71
Evaporator Entering Water Temperature	Deg C	11.75	12.10	12.31	8.77	8.70
Evaporator Leaving Water Temperature	Deg C	6.66	6.67	6.65	6.66	6.67
Evaporator Water Flow Rate	L/S	31.76	31.55	31.62	31.68	31.69
Condenser Entering Water Temperature	Deg C	26.63	23.87	21.08	21.11	23.87
Condenser Leaving Water Temperature	Deg C	31.87	29.39	26.81	23.33	26.03
Condenser Water Flow Rate	L/S	38.14	38.04	38.02	37.98	38.03
Evap Sat Press	kPa	38.13	37.85	37.51	42.33	42.40
Sat Temp	Deg C	1.74	1.58	1.38	4.08	4.12
Approach	Deg C	4.89	5.06	5.28	2.56	2.56
LMTD	Deg C	7.16	7.48	7.76	3.53	3.47
ITD/Delta T		1.96	1.94	1.93	2.22	2.25
Q/Ao	kW/m2	44.27	46.87	48.97	18.26	17.59
Uo	kW/m2 C	6.18	6.27	6.31	5.17	5.07
ho'	kW/m2 C	9.52	9.73	9.84	7.35	7.15
Cond Sat Press	kPa	149.75	138.58	127.00	100.18	110.80
Sat Temp	Deg C	36.29	34.08	31.63	25.17	27.87
Approach	Deg C	4.44	4.67	4.83	1.83	1.83
Refrigerant Leaving Temp	Deg C	35.20	33.04	30.53	24.43	26.97
LMTD	Deg C	6.71	7.09	7.31	2.81	2.78
Q/Ao	kW/m2	43.41	45.68	47.41	18.29	17.88
Uo	kW/m2 C	5.47	6.44	6.48	6.51	6.43
ho'	kW/m2 C	9.62	9.66	9.84	9.97	9.69
Cond Sat Temp	Deg C	36.29	34.08	31.63	25.17	27.87
Evap Sat Temp	Deg C	1.74	1.58	1.38	4.08	4.12
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.95
Estimated Motor Rev/Sec (1)		59.27	59.26	59.25	59.68	59.67
Compressor Suction Flow Rate (2)	m3/sec	1.539	1.635	1.714	0.563	0.544
Isentropic COP (2)		7.103	7.578	8.139	12.041	10.654
Adiabatic Efficiency (3)		0.660	0.644	0.617	0.348	0.371
Q/N - m3/rev (4)		0.0260	0.0276	0.0289	0.0094	0.0091
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	121.2	119.6	120.2	120.7	120.7
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.73	12.09	12.30	8.74	8.68
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.77	12.12	12.33	8.79	8.72
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.66	6.67	6.66	6.67	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.65	6.67	6.64	6.66	6.67
15	COND WATER FLOWMETER DELTA P	kPa	174.2	173.4	173.3	173.0	173.3
17	ENT COND WATER TEMP LOC 1	Deg C	26.62	23.88	21.08	21.11	23.87
18	ENT COND WATER TEMP LOC 2	Deg C	26.63	23.87	21.09	21.12	23.87
19	LVG COND WATER TEMP LOC 1	Deg C	31.86	29.39	26.81	23.32	26.03
20	LVG COND WATER TEMP LOC 2	Deg C	31.87	29.39	26.81	23.33	26.03
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.95	4.89	4.87	6.77	7.06
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.80	3.61	3.44	5.98	6.19
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.06	3.98	3.84	6.02	6.15
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	38.1	37.9	37.5	42.3	42.4
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	60.1	58.1	56.1	41.4	44.8
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	60.3	58.3	56.4	42.3	46.0
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	57.0	54.5	52.1	40.7	44.1
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	124.1	119.7	117.7	86.9	93.8
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	96.0	90.7	85.8	61.6	68.1
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	93.8	88.2	82.6	64.3	70.9
431	COND SHELL STATIC PRESS - AVERAGE	kPa	149.8	138.6	127.0	100.2	110.8
440	REFRIGERANT LVG COND TEMP	Deg C	35.20	33.04	30.53	24.43	26.97
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	99.1	93.6	88.5	70.6	76.8
485	HIGH PRESS ECONOMIZER TEMP	Deg C	24.54	23.06	21.59	16.20	18.08
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	60.8	58.5	56.4	41.6	45.0
487	LOW PRESS ECONOMIZER TEMP	Deg C	12.57	11.60	10.72	3.95	5.69
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	61.3	59.1	56.6	43.0	45.5
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	12.53	11.64	10.75	4.09	5.71
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	49.8	49.3	48.5	43.5	44.6
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	7.88	7.64	7.39	4.14	5.29
534	ENT COND ORIFICE ASS'Y PRESS	kPa	147.5	136.4	125.8	97.9	108.2
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	35.35	33.15	30.81	24.29	26.92
536	LVG COND ORIFICE ASS'Y PRESS	kPa	115.3	108.1	102.8	76.7	83.2
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	28.65	27.17	25.64	18.13	20.16
560	ATMOSPHERIC PRESS	kPa	99.1	99.1	99.1	99.1	99.0
580	MOTOR VOLTAGE - AB	Volts	3.872	3.858	3.846	3.875	3.884
581	MOTOR VOLTAGE - AC	Volts	3.874	3.862	3.852	3.877	3.888
582	MOTOR VOLTAGE - CB	Volts	3.856	3.849	3.841	3.866	3.877
583	MOTOR CURRENT - A	Volts	2.017	2.053	2.064	1.049	1.076
584	MOTOR CURRENT - B	Volts	2.097	2.152	2.168	1.140	1.154
585	MOTOR CURRENT - C	Volts	1.958	1.991	2.016	1.051	1.072
586	MOTOR POWER - PHASE 1	Volts	0.905	0.931	0.934	0.319	0.329
587	MOTOR POWER - PHASE 3	Volts	1.510	1.532	1.550	0.793	0.812
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	31.84	29.36	26.79	23.28	26.01
601	MAXIMUM MOTOR TEMPERATURE	Deg C	45.28	46.94	47.50	25.28	21.39
605	1st STAGE VANE SETTING	Degrees	40	40	40	10	10
607	3rd STAGE VANE SETTING	Degrees	50	50	50	19	19
608	UNIT HOUR METER READING	Hr	435	435	435	436	436
609	UNIT START COUNTER READING		119	119	119	119	119
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	101	101	102	102	103
701	ENERGY BALANCE	%	-1.23	-1.25	-1.16	-1.37	-1.71

Large Impellers - Metric

702	EVAP CAPACITY	KW	678.2	718.3	750.3	279.9	269.3
703	EVAP WATER FLOWRATE	L/S	31.76	31.55	31.62	31.68	31.69
704	COND WATER FLOWRATE	L/S	38.14	38.04	38.02	37.98	38.03
710	AVE ENT EVAP WATER TEMP	Deg C	11.75	12.10	12.31	8.77	8.70
711	AVE LVG EVAP WATER TEMP	Deg C	6.66	6.67	6.65	6.66	6.67
712	AVE ENT COND WATER TEMP	Deg C	26.63	23.87	21.08	21.11	23.87
713	AVE LVG COND WATER TEMP	Deg C	31.87	29.39	26.81	23.33	26.03
715	MOTOR VOLTAGE - AB	Volts	465	463	462	465	466
716	MOTOR VOLTAGE - AC	Volts	465	463	462	465	467
717	MOTOR VOLTAGE - CB	Volts	463	462	461	464	465
718	MOTOR CURRENT - A	Amps	202	205	206	105	108
719	MOTOR CURRENT - B	Amps	210	215	217	114	115
720	MOTOR CURRENT - C	Amps	196	199	202	105	107
721	UNIT POWER	KW	145	148	149	67	68
722	AVERAGE VOLTAGE	Volts	464	463	462	465	466
723	AVERAGE CURRENT	Amps	202	207	208	108	110
725	Coefficient of Performance		4.681	4.861	5.035	4.195	3.934
730	EVAP DELTA T	Deg C	5.10	5.43	5.66	2.11	2.03
731	COND DELTA T	Deg C	5.23	5.52	5.73	2.21	2.16
735	EVAP WATER FLOWRATE	Kg/Sec	31.75	31.54	31.62	31.68	31.69
736	COND WATER FLOWRATE	Kg/Sec	38.03	37.95	37.95	37.92	37.94
740	EVAP CAPACITY	KW	678.25	718.18	750.34	279.72	269.47
741	COND CAPACITY	KW	831.49	874.91	908.13	350.27	342.54
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.74	1.58	1.38	4.08	4.12
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	36.29	34.08	31.63	25.17	27.87
750	RUNNING TIME	Hr	106	106	106	107	107
751	STARTS		24	24	24	24	24
752	EVAP APPROACH TEMP	Deg C	4.89	5.06	5.28	2.56	2.56
753	COND APPROACH TEMP	Deg C	4.44	4.67	4.83	1.83	1.83
800	EVAP AVG H2O TEMP	Deg C	9.20	9.38	9.48	7.72	7.68
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.6	1000.6
802	EVAP H2O VISCOSITY	cp	1.329	1.321	1.318	1.385	1.387
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.192	4.191	4.191	4.194	4.194
804	EVAP H2O CON(K)	W/M C	0.586	0.586	0.586	0.583	0.583
810	COND AVG H2O TEMP	Deg C	29.25	26.63	23.95	22.22	24.95
811	COND WATER DENSITY	Kg/M3	996.6	997.4	998.1	998.5	997.8
812	COND H2O VISCOSITY	cp	0.810	0.859	0.912	0.949	0.891
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.178	4.179	4.178
814	COND H2O CON(K)	W/M C	0.617	0.613	0.609	0.607	0.611
815	ITD/DELTA T		1.96	1.94	1.93	2.22	2.25
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.011	0.006	-0.011	-0.006	0.006
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.006	0.000	0.000	-0.006	-0.006
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.033	-0.028	-0.028	-0.044	-0.039
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	0.006	0.011	0.011	0.006
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.022	0.033	0.017	0.044	0.017

Large Impellers - Metric

LTO 23127 Note: impeller diameters are 660/660/660 mm						
Run Number		118	119	120	0	0
Refrigerant		245ca	245ca	245ca	0	0
Oil		Solest 68	Solest 68	Solest 68	0	0
1st Stage Guide Vane Setting	Degrees	10	10	10	0	0
Capacity	KW	251.4	229.2	196.2	0.0	0.0
Power	KW	69.5	70.6	69.5	0.0	0.0
Coefficient of Performance (COP)		3.615	3.246	2.821	#DIV/0!	#DIV/0!
Evaporator Leaving Water Temperature	Deg C	6.67	6.66	6.67	-17.78	-17.78
Condenser Entering Water Temperature	Deg C	26.62	29.41	32.23	-17.78	-17.78
Energy Balance	%	-1.77	-1.64	-0.96	0.00	0.00
Evaporator Entering Water Temperature	Deg C	8.57	8.38	8.15	-17.78	-17.78
Evaporator Leaving Water Temperature	Deg C	6.67	6.66	6.67	-17.78	-17.78
Evaporator Water Flow Rate	L/S	31.68	31.69	31.65	0.00	0.00
Condenser Entering Water Temperature	Deg C	26.62	29.41	32.23	-17.78	-17.78
Condenser Leaving Water Temperature	Deg C	28.67	31.32	33.91	-17.78	-17.78
Condenser Water Flow Rate	L/S	38.11	38.20	38.25	0.00	0.00
Evap Sat Press	kPa	42.68	42.89	43.30	0.00	0.00
Sat Temp	Deg C	4.27	4.38	4.59	-17.78	-17.78
Approach	Deg C	2.39	2.28	2.06	0.00	0.00
LMTD	Deg C	3.26	3.06	2.75	0.00	0.00
ITD/Delta T		2.27	2.33	2.41	0.00	0.00
Q/Ao	kW/m2	16.40	14.97	12.80	0.00	0.00
Uo	kW/m2 C	5.03	4.88	4.65	0.00	0.00
ho'	kW/m2 C	7.07	6.79	6.36	0.00	0.00
Cond Sat Press	kPa	121.69	133.41	145.75	0.00	0.00
Sat Temp	Deg C	30.44	33.01	35.52	-17.78	-17.78
Approach	Deg C	1.78	1.67	1.61	0.00	0.00
Refrigerant Leaving Temp	Deg C	29.39	31.87	34.18	-17.78	-17.78
LMTD	Deg C	2.66	2.53	2.35	0.00	0.00
Q/Ao	kW/m2	16.98	15.86	13.97	0.00	0.00
Uo	kW/m2 C	6.38	6.28	5.96	0.00	0.00
ho'	kW/m2 C	9.48	9.17	8.43	0.00	0.00
Cond Sat Temp	Deg C	30.44	33.01	35.52	-17.78	-17.78
Evap Sat Temp	Deg C	4.27	4.38	4.59	-17.78	-17.78
Estimated Motor Efficiency (1)		0.95	0.95	0.95	0.00	0.00
Estimated Motor Rev/Sec (1)		59.67	59.66	59.67	0.00	0.00
Compressor Suction Flow Rate (2)	m3/sec	0.507	0.463	0.394	0.000	0.000
Isentropic COP (2)		9.659	8.790	8.120	#DIV/0!	#DIV/0!
Adiabatic Efficiency (3)		0.375	0.370	0.346	0.000	0.000
Q/N - m3/rev (4)		0.0085	0.0078	0.0066	0.0000	0.0000
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of test and isentropic COP						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Large Impellers - Metric

Data as received from Laboratory							
ID	Description	Units					
1	EVAP WATER FLOWMETER DELTA P	kPa	120.7	120.8	120.4	0.0	0.0
3	ENT EVAP WATER TEMP LOC 1	Deg C	8.54	8.37	8.13	-17.78	-17.78
4	ENT EVAP WATER TEMP LOC 2	Deg C	8.58	8.41	8.17	-17.78	-17.78
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.68	6.67	6.68	-17.78	-17.78
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.66	6.67	-17.78	-17.78
15	COND WATER FLOWMETER DELTA P	kPa	173.9	174.5	174.8	0.0	0.0
17	ENT COND WATER TEMP LOC 1	Deg C	26.63	29.42	32.24	-17.78	-17.78
18	ENT COND WATER TEMP LOC 2	Deg C	26.61	29.39	32.22	-17.78	-17.78
19	LVG COND WATER TEMP LOC 1	Deg C	28.67	31.32	33.92	-17.78	-17.78
20	LVG COND WATER TEMP LOC 2	Deg C	28.67	31.32	33.91	-17.78	-17.78
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	6.89	7.03	7.22	-17.78	-17.78
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	6.07	6.19	6.42	-17.78	-17.78
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	6.38	6.58	6.60	-17.78	-17.78
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	42.7	42.9	43.3	0.0	0.0
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	48.8	53.3	58.1	0.0	0.0
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	50.2	54.6	59.1	0.0	0.0
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	48.3	52.8	58.0	0.0	0.0
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	101.8	110.3	118.7	0.0	0.0
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	75.4	83.9	92.6	0.0	0.0
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	78.6	86.9	95.1	0.0	0.0
431	COND SHELL STATIC PRESS - AVERAGE	kPa	121.7	133.4	145.8	0.0	0.0
440	REFRIGERANT LVG COND TEMP	Deg C	29.39	31.87	34.18	-17.78	-17.78
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	83.7	91.4	99.1	0.0	0.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	20.21	22.41	24.48	-17.78	-17.78
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	49.0	53.4	58.3	0.0	0.0
487	LOW PRESS ECONOMIZER TEMP	Deg C	7.58	9.52	11.54	-17.78	-17.78
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	49.2	53.3	58.1	0.0	0.0
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	7.53	9.36	11.30	-17.78	-17.78
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	45.8	47.2	49.0	0.0	0.0
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	5.83	6.47	7.26	-17.78	-17.78
534	ENT COND ORIFICE ASS'Y PRESS	kPa	118.9	130.7	142.8	0.0	0.0
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	29.48	32.02	34.46	-17.78	-17.78
536	LVG COND ORIFICE ASS'Y PRESS	kPa	91.3	99.5	107.3	0.0	0.0
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	22.33	24.55	26.58	-17.78	-17.78
560	ATMOSPHERIC PRESS	kPa	99.0	99.0	99.0	0.0	0.0
580	MOTOR VOLTAGE - AB	Volts	3.879	3.907	3.899	0.000	0.000
581	MOTOR VOLTAGE - AC	Volts	3.885	3.912	3.905	0.000	0.000
582	MOTOR VOLTAGE - CB	Volts	3.872	3.899	3.892	0.000	0.000
583	MOTOR CURRENT - A	Volts	1.090	1.104	1.085	0.000	0.000
584	MOTOR CURRENT - B	Volts	1.165	1.179	1.166	0.000	0.000
585	MOTOR CURRENT - C	Volts	1.087	1.107	1.095	0.000	0.000
586	MOTOR POWER - PHASE 1	Volts	0.335	0.333	0.326	0.000	0.000
587	MOTOR POWER - PHASE 3	Volts	0.824	0.844	0.833	0.000	0.000
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	28.70	31.34	33.94	-17.78	-17.78
601	MAXIMUM MOTOR TEMPERATURE	Deg C	21.94	23.61	25.28	-17.78	-17.78
605	1st STAGE VANE SETTING	Degrees	10	10	10	0	0
607	3rd STAGE VANE SETTING	Degrees	19	19	19	0	0
608	UNIT HOUR METER READING	Hr	436	437	437	0	0
609	UNIT START COUNTER READING		119	119	119	0	0
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	0.0	0.0
700	TIME (HOURS)	HOURS	103	103	104	0	0
701	ENERGY BALANCE	%	-1.77	-1.64	-0.96	0.00	0.00

Large Impellers - Metric

702	EVAP CAPACITY	KW	251.4	229.2	196.2	0.0	0.0
703	EVAP WATER FLOWRATE	L/S	31.68	31.69	31.65	0.00	0.00
704	COND WATER FLOWRATE	L/S	38.11	38.20	38.25	0.00	0.00
710	AVE ENT EVAP WATER TEMP	Deg C	8.57	8.38	8.15	-17.78	-17.78
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.66	6.67	-17.78	-17.78
712	AVE ENT COND WATER TEMP	Deg C	26.62	29.41	32.23	-17.78	-17.78
713	AVE LVG COND WATER TEMP	Deg C	28.67	31.32	33.91	-17.78	-17.78
715	MOTOR VOLTAGE - AB	Volts	466	469	468	0	0
716	MOTOR VOLTAGE - AC	Volts	466	469	469	0	0
717	MOTOR VOLTAGE - CB	Volts	465	468	467	0	0
718	MOTOR CURRENT - A	Amps	109	110	109	0	0
719	MOTOR CURRENT - B	Amps	117	118	117	0	0
720	MOTOR CURRENT - C	Amps	109	111	110	0	0
721	UNIT POWER	KW	70	71	70	0	0
722	AVERAGE VOLTAGE	Volts	465	469	468	0	0
723	AVERAGE CURRENT	Amps	111	113	112	0	0
725	Coefficient of Performance		3.615	3.246	2.821	#DIV/0!	#DIV/0!
730	EVAP DELTA T	Deg C	1.89	1.72	1.48	0.00	0.00
731	COND DELTA T	Deg C	2.05	1.91	1.68	0.00	0.00
735	EVAP WATER FLOWRATE	Kg/Sec	31.68	31.70	31.65	0.00	0.00
736	COND WATER FLOWRATE	Kg/Sec	37.99	38.05	38.07	0.00	0.00
740	EVAP CAPACITY	KW	251.32	229.31	196.18	0.00	0.00
741	COND CAPACITY	KW	325.30	303.69	267.60	0.00	0.00
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	4.27	4.38	4.59	-17.78	-17.78
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	30.44	33.01	35.52	-17.78	-17.78
750	RUNNING TIME	Hr	108	108	108	0	0
751	STARTS		24	24	24	0	0
752	EVAP APPROACH TEMP	Deg C	2.39	2.28	2.06	0.00	0.00
753	COND APPROACH TEMP	Deg C	1.78	1.67	1.61	0.00	0.00
800	EVAP AVG H2O TEMP	Deg C	7.62	7.52	7.41	-17.78	-17.78
801	EVAP WATER DENSITY	Kg/M3	1000.6	1000.6	1000.6	0.0	0.0
802	EVAP H2O VISCOSITY	cp	1.390	1.394	1.399	0.000	0.000
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.194	4.194	4.195	0.000	0.000
804	EVAP H2O CON(K)	W/M C	0.583	0.583	0.583	0.000	0.000
810	COND AVG H2O TEMP	Deg C	27.64	30.36	33.07	-17.78	-17.78
811	COND WATER DENSITY	Kg/M3	997.1	996.3	995.4	0.0	0.0
812	COND H2O VISCOSITY	cp	0.839	0.792	0.746	0.000	0.000
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	0.000	0.000
814	COND H2O CON(K)	W/M C	0.615	0.618	0.622	0.000	0.000
815	ITD/DELTA T		2.27	2.33	2.41	0.00	0.00
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.017	0.022	0.028	0.000	0.000
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.006	0.000	0.006	0.000	0.000
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.039	-0.039	-0.033	0.000	0.000
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.011	0.011	0.011	0.000	0.000
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.028	-0.028	-0.022	0.000	0.000

Large Impellers - Metric

LTO 23127 Note: Impeller diameters are 660/660/660 mm					
Run Number		20	42	64	93
Refrigerant		11	11	123	245ca
Oil		Trane 22	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90
Capacity	KW	838.9	814.3	796.0	725.0
Power	KW	198.0	193.0	199.3	164.5
Coefficient of Performance (COP)		4.237	4.220	3.994	4.408
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.69	6.66
Condenser Entering Water Temperature	Deg C	29.43	29.43	29.56	29.43
Energy Balance	%	-0.73	-0.65	-0.90	-0.92
Evaporator Entering Water Temperature	Deg C	13.26	13.08	12.87	12.13
Evaporator Leaving Water Temperature	Deg C	6.67	6.67	6.69	6.66
Evaporator Water Flow Rate	L/S	30.41	30.29	30.76	31.67
Condenser Entering Water Temperature	Deg C	29.43	29.43	29.56	29.43
Condenser Leaving Water Temperature	Deg C	36.06	35.81	35.84	35.05
Condenser Water Flow Rate	L/S	37.84	38.14	38.34	38.27
Evap Sat Press	kPa	44.33	43.64	35.65	37.78
Sat Temp	Deg C	2.32	1.94	1.82	1.54
Approach	Deg C	4.33	4.72	4.89	5.11
LMTD	Deg C	7.14	7.48	7.54	7.52
ITD/Delta T		1.66	1.74	1.79	1.94
Q/Ao	kW/m2	54.76	53.15	51.95	47.31
Uo	kW/m2 C	7.67	7.11	6.89	6.29
ho'	kW/m2 C	13.83	12.13	11.42	9.78
Cond Sat Press	kPa	180.23	178.85	161.96	168.78
Sat Temp	Deg C	41.23	40.98	41.49	39.78
Approach	Deg C	5.17	5.17	5.67	4.72
Refrigerant Leaving Temp	Deg C	40.52	40.35	40.74	38.59
LMTD	Deg C	8.03	7.94	8.40	7.18
Q/Ao	kW/m2	54.46	52.87	52.33	46.78
Uo	kW/m2 C	6.78	6.66	6.23	6.51
ho'	kW/m2 C	10.24	9.93	8.99	9.61
Cond Sat Temp	Deg C	41.23	40.98	41.49	39.78
Evap Sat Temp	Deg C	2.32	1.94	1.82	1.54
Estimated Motor Efficiency (1)		0.93	0.93	0.93	0.93
Estimated Motor Rev/Sec (1)		58.95	58.99	58.95	59.16
Compressor Suction Flow Rate (2)	m3/sec	1.762	1.734	1.982	1.673
Isentropic COP (2)		6.234	6.212	6.062	6.347
Adiabatic Efficiency (3)		0.680	0.682	0.659	0.693
Q/N - m3/rev (4)		0.0299	0.0294	0.0336	0.0283
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of test and isentropic COP					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Large Impellers - Metric

Data as received from Laboratory						
ID	Description	Units				
1	EVAP WATER FLOWMETER DELTA P	kPa	111.1	110.2	113.7	120.5
3	ENT EVAP WATER TEMP LOC 1	Deg C	13.25	13.07	12.86	12.11
4	ENT EVAP WATER TEMP LOC 2	Deg C	13.27	13.09	12.88	12.14
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.67	6.67	6.69	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.66	6.68	6.66
15	COND WATER FLOWMETER DELTA P	kPa	171.2	174.0	175.7	175.2
17	ENT COND WATER TEMP LOC 1	Deg C	29.43	29.43	29.57	29.43
18	ENT COND WATER TEMP LOC 2	Deg C	29.43	29.42	29.54	29.42
19	LVG COND WATER TEMP LOC 1	Deg C	36.06	35.81	35.85	35.06
20	LVG COND WATER TEMP LOC 2	Deg C	36.06	35.81	35.84	35.04
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.08	4.34	4.79	3.14
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.47	2.55	3.34	2.91
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	3.52	3.80	3.61	3.83
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	44.3	43.6	35.6	37.8
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	74.5	73.6	61.4	64.5
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	74.8	73.9	61.8	64.9
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	69.6	68.9	55.8	61.2
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	126.9	123.4	106.4	181.9
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	120.3	119.1	100.8	105.8
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	112.2	111.1	94.1	100.6
431	COND SHELL STATIC PRESS - AVERAGE	kPa	180.2	178.8	162.0	168.8
440	REFRIGERANT LVG COND TEMP	Deg C	40.52	40.35	40.74	38.59
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	117.1	116.0	100.7	106.0
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.67	27.38	27.51	26.42
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	74.3	73.6	62.5	65.6
487	LOW PRESS ECONOMIZER TEMP	Deg C	15.11	14.76	14.99	14.31
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	74.8	73.9	64.7	66.2
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	15.15	14.79	15.20	14.32
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	61.3	60.3	53.0	52.7
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	10.32	9.63	11.32	9.10
534	ENT COND ORIFICE ASS'Y PRESS	kPa	178.7	176.8	160.6	166.7
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	40.54	40.28	40.79	38.80
536	LVG COND ORIFICE ASS'Y PRESS	kPa	135.8	133.8	124.7	125.1
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	32.64	32.30	33.77	31.33
560	ATMOSPHERIC PRESS	kPa	98.6	99.7	99.3	98.9
580	MOTOR VOLTAGE - AB	Volts	3.864	3.861	3.887	3.900
581	MOTOR VOLTAGE - AC	Volts	3.888	3.883	3.902	3.902
582	MOTOR VOLTAGE - CB	Volts	3.865	3.866	3.886	3.884
583	MOTOR CURRENT - A	Volts	2.686	2.612	2.707	2.277
584	MOTOR CURRENT - B	Volts	2.810	2.743	2.831	2.348
585	MOTOR CURRENT - C	Volts	2.667	2.616	2.650	2.190
586	MOTOR POWER - PHASE 1	Volts	1.240	1.200	1.259	1.038
587	MOTOR POWER - PHASE 3	Volts	2.060	2.016	2.063	1.703
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	36.07	35.83	35.67	35.06
601	MAXIMUM MOTOR TEMPERATURE	Deg C	84.17	80.83	83.61	54.72
605	1st STAGE VANE SETTING	Degrees	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68
608	UNIT HOUR METER READING	Hr	350	391	403	420
609	UNIT START COUNTER READING		98	109	112	115
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.7
700	TIME (HOURS)	HOURS	360	1	0	0
701	ENERGY BALANCE	%	-0.73	-0.65	-0.90	-0.92

Large Impellers - Metric

702	EVAP CAPACITY	KW	838.9	814.3	796.0	725.0
703	EVAP WATER FLOWRATE	L/S	30.41	30.29	30.76	31.67
704	COND WATER FLOWRATE	L/S	37.84	38.14	38.34	38.27
710	AVE ENT EVAP WATER TEMP	Deg C	13.26	13.08	12.87	12.13
711	AVE LVG EVAP WATER TEMP	Deg C	6.67	6.67	6.69	6.66
712	AVE ENT COND WATER TEMP	Deg C	29.43	29.43	29.56	29.43
713	AVE LVG COND WATER TEMP	Deg C	36.06	35.81	35.84	35.05
715	MOTOR VOLTAGE - AB	Volts	464	463	466	468
716	MOTOR VOLTAGE - AC	Volts	467	466	468	468
717	MOTOR VOLTAGE - CB	Volts	464	464	466	466
718	MOTOR CURRENT - A	Amps	269	261	271	228
719	MOTOR CURRENT - B	Amps	281	274	283	235
720	MOTOR CURRENT - C	Amps	267	262	265	219
721	UNIT POWER	KW	198	193	199	164
722	AVERAGE VOLTAGE	Volts	465	464	467	467
723	AVERAGE CURRENT	Amps	272	266	273	227
725	Coefficient of Performance		4.237	4.220	3.994	4.408
730	EVAP DELTA T	Deg C	6.59	6.42	6.18	5.47
731	COND DELTA T	Deg C	6.63	6.38	6.28	5.63
735	EVAP WATER FLOWRATE	Kg/Sec	30.39	30.28	30.75	31.66
736	COND WATER FLOWRATE	Kg/Sec	37.69	37.99	38.19	38.13
740	EVAP CAPACITY	KW	839.03	814.43	795.95	724.91
741	COND CAPACITY	KW	1043.11	1012.70	1002.38	896.02
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.32	1.94	1.82	1.54
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	41.23	40.98	41.49	39.78
750	RUNNING TIME	Hr	21	62	75	91
751	STARTS		3	14	17	20
752	EVAP APPROACH TEMP	Deg C	4.33	4.72	4.89	5.11
753	COND APPROACH TEMP	Deg C	5.17	5.17	5.67	4.72
800	EVAP AVG H2O TEMP	Deg C	9.96	9.88	9.78	9.39
801	EVAP WATER DENSITY	Kg/M3	1000.5	1000.5	1000.5	1000.5
802	EVAP H2O VISCOSITY	cp	1.301	1.304	1.308	1.321
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.190	4.190	4.191	4.191
804	EVAP H2O CON(K)	W/M C	0.587	0.587	0.587	0.586
810	COND AVG H2O TEMP	Deg C	32.74	32.62	32.71	32.24
811	COND WATER DENSITY	Kg/M3	995.5	995.5	995.5	995.7
812	COND H2O VISCOSITY	cp	0.753	0.754	0.753	0.760
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.177	4.177	4.177	4.177
814	COND H2O CON(K)	W/M C	0.622	0.622	0.622	0.621
815	ITD/DELTA T		1.66	1.74	1.79	1.94
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.006	0.006	0.028	0.017
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.006	0.006	0.011	0.017
852	RTD DIFFERENCE CHECK - EEWT	Deg C	-0.017	-0.022	-0.022	-0.028
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.006	0.006	0.011	0.011
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.011	-0.017	0.183	0.000

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		121	122	123	124	125
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	660.7	623.7	562.2	431.4	648.7
Power	KW	151.6	149.8	140.5	122.3	145.7
Coefficient of Performance (COP)		4.357	4.163	4.001	3.526	4.451
Evaporator Leaving Water Temperature	Deg C	6.68	6.68	6.69	6.68	6.67
Condenser Entering Water Temperature	Deg C	29.46	32.23	35.01	37.63	26.68
Energy Balance	%	-1.38	-1.15	-0.78	-0.71	-1.09
Evaporator Entering Water Temperature	Deg C	11.7	11.4	11.0	9.9	11.5
Evaporator Leaving Water Temperature	Deg C	6.68	6.68	6.69	6.68	6.67
Evaporator Water Flow Rate	L/s	31.4	31.4	31.3	31.6	31.7
Condenser Entering Water Temperature	Deg C	29.46	32.23	35.01	37.63	26.68
Condenser Leaving Water Temperature	Deg C	34.65	37.17	39.49	41.16	31.75
Condenser Water Flow Rate	L/s	38.0	38.0	38.1	38.1	38.0
Evap Sat Press	kPa	41.64	43.23	44.61	47.02	38.47
Sat Temp	Deg C	0.83	1.73	2.47	3.74	-1.01
Approach	Deg C	5.83	4.94	4.22	2.94	7.67
LMTD	Deg C	8.10	7.06	6.11	4.37	9.92
ITD/Delta T		2.17	2.04	1.98	1.90	2.57
Q/Ao	kW/m2	43.12	40.71	36.70	28.15	42.33
Uo	kW/m2 C	5.32	5.77	6.01	6.45	4.27
ho'	kW/m2 C	7.65	8.61	9.16	10.22	5.63
Cond Sat Press	kPa	167.75	179.54	190.23	195.05	150.44
Sat Temp	Deg C	38.93	41.11	42.98	43.80	35.52
Approach	Deg C	4.28	3.94	3.50	2.67	3.78
Refrigerant Leaving Temp	Deg C	38.21	40.09	42.29	42.80	35.35
LMTD	Deg C	6.54	6.08	5.42	4.16	5.95
Q/Ao	kW/m2	42.89	40.76	36.92	29.07	41.84
Uo	kW/m2 C	6.56	6.71	6.81	6.99	7.03
ho'	kW/m2 C	9.74	9.99	10.11	10.43	10.94
Cond Sat Temp	Deg C	38.93	41.11	42.98	43.80	35.52
Evap Sat Temp	Deg C	0.83	1.73	2.47	3.74	-1.01
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)		59.24	59.25	59.30	59.40	59.27
Compressor Suction Flow Rate (2)	m3/sec	1.462	1.337	1.175	0.859	1.534
Isentropic COP (2)		0.55	0.57	0.58	0.57	0.53
Adiabatic Efficiency (3)		0.68	0.67	0.66	0.57	0.67
Q/N - m3/rev (4)		0.87	0.80	0.70	0.51	0.91
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	118.59	118.31	118.04	120.11	120.73
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.72	11.43	10.98	9.95	11.56
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.69	11.41	10.96	9.91	11.53
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.68	6.70	6.68	6.67
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.67	6.68	6.67	6.66
15	COND WATER FLOWMETER DELTA P	kPa	172.64	172.85	172.85	172.78	172.58
17	ENT COND WATER TEMP LOC 1	Deg C	29.45	32.22	35.00	37.61	26.68
18	ENT COND WATER TEMP LOC 2	Deg C	29.46	32.24	35.02	37.65	26.67
19	LVG COND WATER TEMP LOC 1	Deg C	34.65	37.16	39.48	41.14	31.75
20	LVG COND WATER TEMP LOC 2	Deg C	34.65	37.18	39.49	41.17	31.75
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	3.88	4.42	5.04	6.08	2.02
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	2.63	3.33	3.84	5.06	0.73
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	2.77	3.46	4.20	5.58	1.04
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	41.64	43.23	44.61	47.02	38.47
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	69.57	72.88	75.91	77.77	63.57
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	69.91	73.22	76.26	78.67	63.98
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	66.47	70.19	73.84	76.46	60.40
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	108.66	115.14	120.93	124.31	98.80
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	111.76	118.31	124.31	127.97	101.28
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	107.01	114.04	120.73	125.07	96.39
431	COND SHELL STATIC PRESS - AVERAGE	kPa	167.75	179.54	190.23	195.05	150.44
440	REFRIGERANT LVG COND TEMP	Deg C	38.21	40.09	42.29	42.80	35.35
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	110.04	117.28	123.69	127.21	99.35
485	HIGH PRESS ECONOMIZER TEMP	Deg C	25.83	27.68	29.28	30.09	22.92
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	69.36	72.88	75.57	77.01	63.29
487	LOW PRESS ECONOMIZER TEMP	Deg C	13.22	14.54	15.52	16.01	10.83
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	54.26	55.85	56.67	57.50	49.50
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	13.18	14.42	15.38	15.72	10.75
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	69.50	72.67	75.22	76.19	63.50
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	7.02	7.70	8.11	8.37	4.95
534	ENT COND ORIFICE ASS'Y PRESS	kPa	167.47	179.33	189.12	193.95	150.31
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	38.62	40.76	42.47	43.25	35.32
536	LVG COND ORIFICE ASS'Y PRESS	kPa	126.66	133.55	139.07	139.27	114.80
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	30.17	31.73	32.96	33.04	27.25
560	ATMOSPHERIC PRESS	kPa	99.15	99.15	99.15	99.15	99.49
580	MOTOR VOLTAGE - AB	Volts	3.850	3.897	3.900	3.898	3.885
581	MOTOR VOLTAGE - AC	Volts	3.858	3.907	3.911	3.912	3.887
582	MOTOR VOLTAGE - CB	Volts	3.840	3.887	3.891	3.886	3.874
583	MOTOR CURRENT - A	Volts	2.115	2.074	1.957	1.723	2.033
584	MOTOR CURRENT - B	Volts	2.187	2.146	2.017	1.780	2.118
585	MOTOR CURRENT - C	Volts	2.067	2.019	1.923	1.702	1.955
586	MOTOR POWER - PHASE 1	Volts	0.941	0.924	0.843	0.716	0.913
587	MOTOR POWER - PHASE 3	Volts	1.586	1.573	1.499	1.323	1.516
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	34.66	37.18	39.49	41.20	31.74
601	MAXIMUM MOTOR TEMPERATURE	Deg C	54.72	53.06	50.72	43.50	48.61
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	68
608	UNIT HOUR METER READING	Hr	453	454	454	455	457
609	UNIT START COUNTER READING		124	124	124	124	125
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	0	0	1	1	19
701	ENERGY BALANCE	%	-1.38	-1.15	-0.78	-0.71	-1.09
702	EVAP CAPACITY	KW	660.7	623.7	562.2	431.4	648.7
703	EVAP WATER FLOWRATE	L/s	31.4	31.4	31.3	31.6	31.7
704	COND WATER FLOWRATE	L/s	38.0	38.0	38.1	38.1	38.0

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.70	11.42	10.97	9.93	11.54
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.68	6.69	6.68	6.67
712	AVE ENT COND WATER TEMP	Deg C	29.46	32.23	35.01	37.63	26.68
713	AVE LVG COND WATER TEMP	Deg C	34.65	37.17	39.49	41.16	31.75
715	MOTOR VOLTAGE - AB	Volts	462	468	468	468	466
716	MOTOR VOLTAGE - AC	Volts	463	469	469	469	466
717	MOTOR VOLTAGE - CB	Volts	461	466	467	466	465
718	MOTOR CURRENT - A	Amps	212	207	196	172	203
719	MOTOR CURRENT - B	Amps	219	215	202	178	212
720	MOTOR CURRENT - C	Amps	207	202	192	170	196
721	UNIT POWER	KW	152	150	141	122	146
722	AVERAGE VOLTAGE	Volts	462	468	468	468	466
723	AVERAGE CURRENT	Amps	212	208	197	174	204
725	Coefficient of Performance (COP)		4.357	4.163	4.001	3.526	4.451
730	EVAP DELTA T	Deg C	5.02	4.74	4.28	3.26	4.88
731	COND DELTA T	Deg C	5.19	4.94	4.48	3.53	5.07
735	EVAP WATER FLOWRATE	Kg/sec	31.41	31.37	31.34	31.61	31.69
736	COND WATER FLOWRATE	Kg/sec	37.85	37.86	37.84	37.82	37.85
740	EVAP CAPACITY	KW	660.7	623.8	562.3	431.4	648.5
741	COND CAPACITY	KW	821.4	780.8	707.2	556.8	801.3
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	0.83	1.73	2.47	3.74	-1.01
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	38.93	41.11	42.98	43.80	35.52
750	RUNNING TIME	Hr	125	125	125	126	128
751	STARTS		29	29	29	29	30
752	EVAP APPROACH TEMP	Deg C	5.83	4.94	4.22	2.94	7.67
753	COND APPROACH TEMP	Deg C	4.28	3.94	3.50	2.67	3.78
800	EVAP AVG H2O TEMP	Deg C	9.19	9.05	8.83	8.31	9.11
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.33	1.33	1.34	1.36	1.33
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.586	0.585	0.585	0.584	0.586
810	COND AVG H2O TEMP	Deg C	32.05	34.70	37.25	39.39	29.22
811	COND WATER DENSITY	Kg/M3	996	995	994	993	997
812	COND H2O VISCOSITY	cp	0.76	0.72	0.69	0.66	0.81
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.621	0.624	0.628	0.631	0.617
815	ITD/DELTA T		2.17	2.04	1.98	1.90	2.57
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.01	-0.03	-0.02	-0.04	0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.00	-0.02	-0.01	-0.02	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.03	0.02	0.04	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.01	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.01	-0.02	-0.01	-0.06	0.01

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		126	127	128	129	130
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	70	70	70
Capacity	KW	706.0	774.2	756.6	670.5	630.1
Power	KW	152.6	160.7	156.1	142.9	139.3
Coefficient of Performance (COP)		4.625	4.819	4.847	4.691	4.522
Evaporator Leaving Water Temperature	Deg C	6.69	6.65	6.68	6.67	6.68
Condenser Entering Water Temperature	Deg C	23.92	21.13	21.13	23.91	26.70
Energy Balance	%	-1.15	-1.44	-1.22	-1.57	-0.93
Evaporator Entering Water Temperature	Deg C	12.0	12.5	12.4	11.8	11.5
Evaporator Leaving Water Temperature	Deg C	6.69	6.65	6.68	6.67	6.68
Evaporator Water Flow Rate	L/s	31.6	31.6	31.6	31.5	31.5
Condenser Entering Water Temperature	Deg C	23.92	21.13	21.13	23.91	26.70
Condenser Leaving Water Temperature	Deg C	29.39	27.11	26.96	29.12	31.60
Condenser Water Flow Rate	L/s	38.0	37.9	37.9	37.9	38.0
Evap Sat Press	kPa	37.92	38.96	39.23	37.71	38.54
Sat Temp	Deg C	-1.34	-0.72	-0.56	-1.47	-0.97
Approach	Deg C	8.06	7.39	7.22	8.11	7.67
LMTD	Deg C	10.48	10.01	9.81	10.48	9.84
ITD/Delta T		2.51	2.26	2.27	2.60	2.60
Q/Ao	kW/m2	46.08	50.54	49.39	43.76	41.11
Uo	kW/m2 C	4.40	5.05	5.03	4.18	4.18
ho'	kW/m2 C	5.86	7.07	7.04	5.48	5.48
Cond Sat Press	kPa	141.20	132.93	131.69	138.38	149.20
Sat Temp	Deg C	33.58	31.74	31.47	32.96	35.27
Approach	Deg C	4.17	4.61	4.50	3.83	3.67
Refrigerant Leaving Temp	Deg C	33.32	31.53	31.29	32.77	35.06
LMTD	Deg C	6.55	7.22	7.02	6.08	5.77
Q/Ao	kW/m2	45.26	49.40	48.14	43.02	40.47
Uo	kW/m2 C	6.91	6.85	6.85	7.07	7.01
ho'	kW/m2 C	10.75	10.71	10.73	11.16	10.89
Cond Sat Temp	Deg C	33.58	31.74	31.47	32.96	35.27
Evap Sat Temp	Deg C	-1.34	-0.72	-0.56	-1.47	-0.97
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)		59.23	59.18	59.21	59.29	59.31
Compressor Suction Flow Rate (2)	m3/sec	1.687	1.800	1.745	1.608	1.486
Isentropic COP (2)		0.51	0.47	0.46	0.50	0.52
Adiabatic Efficiency (3)		0.66	0.64	0.63	0.66	0.67
Q/N - m3/rev (4)		1.01	1.07	1.04	0.96	0.88
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	119.76	120.11	120.11	119.35	119.21
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.04	12.51	12.40	11.76	11.47
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.02	12.49	12.38	11.73	11.44
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.70	6.66	6.68	6.67	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.64	6.67	6.67	6.68
15	COND WATER FLOWMETER DELTA P	kPa	173.20	172.30	172.30	172.51	172.64
17	ENT COND WATER TEMP LOC 1	Deg C	23.92	21.13	21.13	23.89	26.69
18	ENT COND WATER TEMP LOC 2	Deg C	23.92	21.12	21.12	23.91	26.71
19	LVG COND WATER TEMP LOC 1	Deg C	29.39	27.11	26.96	29.12	31.61
20	LVG COND WATER TEMP LOC 2	Deg C	29.38	27.11	26.95	29.11	31.60
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	1.88	2.01	2.17	1.56	1.98
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	0.68	0.72	0.94	0.19	0.58
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	0.74	1.12	1.30	1.04	1.35
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	37.92	38.96	39.23	37.71	38.54
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	61.98	62.19	61.85	60.81	63.02
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	62.60	62.47	62.05	61.02	63.43
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	58.33	57.43	57.36	57.23	60.05
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	94.53	91.70	91.91	93.15	98.46
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	97.08	94.60	94.94	96.18	101.35
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	91.22	87.56	88.11	90.53	96.53
431	COND SHELL STATIC PRESS - AVERAGE	kPa	141.20	132.93	131.69	138.38	149.20
440	REFRIGERANT LVG COND TEMP	Deg C	33.32	31.53	31.29	32.77	35.06
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	94.11	90.67	91.08	93.15	99.28
485	HIGH PRESS ECONOMIZER TEMP	Deg C	21.44	20.42	20.51	21.17	22.91
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	61.50	61.02	60.60	60.12	62.74
487	LOW PRESS ECONOMIZER TEMP	Deg C	10.17	9.99	9.83	9.62	10.64
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	50.06	50.88	51.02	48.26	49.44
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	10.17	10.01	9.91	9.59	10.57
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	61.85	61.57	61.29	60.47	62.74
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	5.18	5.81	5.69	4.38	4.76
534	ENT COND ORIFICE ASS'Y PRESS	kPa	141.48	133.55	132.31	138.72	148.65
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	33.42	31.73	31.42	32.82	34.97
536	LVG COND ORIFICE ASS'Y PRESS	kPa	109.76	106.73	105.77	107.21	113.83
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	25.96	25.18	25.00	25.42	27.03
560	ATMOSPHERIC PRESS	kPa	99.49	99.49	99.49	99.49	99.49
580	MOTOR VOLTAGE - AB	Volts	3.886	3.896	3.900	3.883	3.906
581	MOTOR VOLTAGE - AC	Volts	3.892	3.901	3.902	3.897	3.911
582	MOTOR VOLTAGE - CB	Volts	3.876	3.886	3.886	3.880	3.895
583	MOTOR CURRENT - A	Volts	2.113	2.219	2.156	1.990	1.940
584	MOTOR CURRENT - B	Volts	2.188	2.296	2.229	2.056	2.007
585	MOTOR CURRENT - C	Volts	2.050	2.154	2.096	1.946	1.892
586	MOTOR POWER - PHASE 1	Volts	0.945	1.003	0.971	0.868	0.845
587	MOTOR POWER - PHASE 3	Volts	1.599	1.674	1.631	1.514	1.477
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	29.35	27.05	26.93	29.06	31.59
601	MAXIMUM MOTOR TEMPERATURE	Deg C	53.06	67.50	66.94	49.17	46.94
605	1st STAGE VANE SETTING	Degrees	90	90	70	70	70
607	3rd STAGE VANE SETTING	Degrees	68	68	63	63	63
608	UNIT HOUR METER READING	Hr	457	457	458	458	459
609	UNIT START COUNTER READING		125	125	125	125	125
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	19	20	20	20	21
701	ENERGY BALANCE	%	-1.15	-1.44	-1.22	-1.57	-0.93
702	EVAP CAPACITY	KW	706.0	774.2	756.6	670.5	630.1
703	EVAP WATER FLOWRATE	L/s	31.6	31.6	31.6	31.5	31.5
704	COND WATER FLOWRATE	L/s	38.0	37.9	37.9	37.9	38.0

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	12.03	12.50	12.39	11.75	11.46
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.65	6.68	6.67	6.68
712	AVE ENT COND WATER TEMP	Deg C	23.92	21.13	21.13	23.91	26.70
713	AVE LVG COND WATER TEMP	Deg C	29.39	27.11	26.96	29.12	31.60
715	MOTOR VOLTAGE - AB	Volts	466	468	468	466	469
716	MOTOR VOLTAGE - AC	Volts	467	468	468	468	469
717	MOTOR VOLTAGE - CB	Volts	465	466	466	466	467
718	MOTOR CURRENT - A	Amps	211	222	216	199	194
719	MOTOR CURRENT - B	Amps	219	230	223	206	201
720	MOTOR CURRENT - C	Amps	205	215	210	195	189
721	UNIT POWER	KW	153	161	156	143	139
722	AVERAGE VOLTAGE	Volts	466	467	468	466	469
723	AVERAGE CURRENT	Amps	212	222	216	200	195
725	Coefficient of Performance (COP)		4.625	4.819	4.847	4.691	4.522
730	EVAP DELTA T	Deg C	5.33	5.85	5.71	5.08	4.77
731	COND DELTA T	Deg C	5.47	5.98	5.83	5.21	4.90
735	EVAP WATER FLOWRATE	Kg/sec	31.56	31.61	31.61	31.51	31.50
736	COND WATER FLOWRATE	Kg/sec	37.93	37.84	37.84	37.85	37.86
740	EVAP CAPACITY	KW	706.1	774.4	756.7	670.5	630.0
741	COND CAPACITY	KW	866.9	946.2	922.1	823.9	775.2
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	-1.34	-0.72	-0.56	-1.47	-0.97
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	33.58	31.74	31.47	32.96	35.27
750	RUNNING TIME	Hr	128	129	129	129	130
751	STARTS		30	30	30	30	30
752	EVAP APPROACH TEMP	Deg C	8.06	7.39	7.22	8.11	7.67
753	COND APPROACH TEMP	Deg C	4.17	4.61	4.50	3.83	3.67
800	EVAP AVG H2O TEMP	Deg C	9.36	9.58	9.53	9.21	9.07
801	EVAP WATER DENSITY	Kg/M3	1001	1000	1000	1001	1001
802	EVAP H2O VISCOSITY	cp	1.32	1.31	1.32	1.33	1.33
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.586	0.586	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	26.65	24.12	24.04	26.51	29.15
811	COND WATER DENSITY	Kg/M3	997	998	998	997	997
812	COND H2O VISCOSITY	cp	0.86	0.91	0.91	0.86	0.81
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.613	0.610	0.609	0.613	0.617
815	ITD/DELTA T		2.51	2.26	2.27	2.60	2.60
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.00	0.01	0.01	-0.01	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.00	0.01	0.01	0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.02	0.02	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.01	0.01
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.04	0.06	0.03	0.06	0.02

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		131	132	133	134	135
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	KW	632.2	599.1	539.3	414.9	369.2
Power	KW	145.3	141.7	135.2	118.0	111.0
Coefficient of Performance (COP)		4.352	4.229	3.990	3.515	3.326
Evaporator Leaving Water Temperature	Deg C	6.68	6.68	6.69	6.68	6.68
Condenser Entering Water Temperature	Deg C	29.44	32.23	35.02	37.80	38.34
Energy Balance	%	-1.08	-1.03	-1.12	-0.77	-0.87
Evaporator Entering Water Temperature	Deg C	11.4	11.2	10.7	9.8	9.5
Evaporator Leaving Water Temperature	Deg C	6.68	6.68	6.69	6.68	6.68
Evaporator Water Flow Rate	L/s	31.7	31.7	31.7	31.7	31.6
Condenser Entering Water Temperature	Deg C	29.44	32.23	35.02	37.80	38.34
Condenser Leaving Water Temperature	Deg C	34.41	36.96	39.33	41.19	41.41
Condenser Water Flow Rate	L/s	38.0	38.0	38.0	38.1	38.0
Evap Sat Press	kPa	41.09	42.82	44.68	47.16	47.64
Sat Temp	Deg C	0.53	1.49	2.51	3.80	4.06
Approach	Deg C	6.17	5.17	4.17	2.89	2.61
LMTD	Deg C	8.31	7.21	5.98	4.25	3.86
ITD/Delta T		2.29	2.15	2.03	1.92	1.94
Q/Ao	kW/m2	41.26	39.11	35.19	27.07	24.10
Uo	kW/m2 C	4.96	5.42	5.89	6.37	6.25
ho'	kW/m2 C	6.91	7.84	8.86	10.01	9.74
Cond Sat Press	kPa	163.34	175.95	187.12	193.40	192.98
Sat Temp	Deg C	38.09	40.46	42.44	43.52	43.45
Approach	Deg C	3.67	3.50	3.11	2.33	2.06
Refrigerant Leaving Temp	Deg C	37.57	39.69	41.76	42.68	42.58
LMTD	Deg C	5.82	5.53	4.96	3.78	3.35
Q/Ao	kW/m2	40.94	39.01	35.53	27.99	25.24
Uo	kW/m2 C	7.04	7.05	7.17	7.41	7.54
ho'	kW/m2 C	10.85	10.77	10.93	11.39	11.70
Cond Sat Temp	Deg C	38.09	40.46	42.44	43.52	43.45
Evap Sat Temp	Deg C	0.53	1.49	2.51	3.80	4.06
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.95	0.95
Estimated Motor Rev/sec (1)		59.27	59.29	59.33	59.42	59.46
Compressor Suction Flow Rate (2)	m3/sec	1.413	1.295	1.124	0.824	0.726
Isentropic COP (2)		0.54	0.56	0.57	0.56	0.56
Adiabatic Efficiency (3)		0.67	0.67	0.65	0.56	0.53
Q/N - m3/rev (4)		0.84	0.77	0.67	0.49	0.43
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	120.66	120.93	120.66	120.52	120.11
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.46	11.21	10.76	9.82	9.49
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.43	11.17	10.73	9.79	9.44
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69	6.69	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.67	6.68	6.67	6.67
15	COND WATER FLOWMETER DELTA P	kPa	172.51	172.71	172.64	173.26	172.44
17	ENT COND WATER TEMP LOC 1	Deg C	29.43	32.21	35.00	37.77	38.32
18	ENT COND WATER TEMP LOC 2	Deg C	29.44	32.24	35.04	37.83	38.36
19	LVG COND WATER TEMP LOC 1	Deg C	34.40	36.95	39.32	41.18	41.39
20	LVG COND WATER TEMP LOC 2	Deg C	34.41	36.96	39.34	41.20	41.41
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	3.11	4.20	4.81	6.02	6.52
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	1.91	2.89	3.80	5.11	5.48
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	2.64	3.41	4.32	5.53	5.91
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	41.09	42.82	44.68	47.16	47.64
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	67.84	71.57	75.01	77.50	77.91
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	68.19	71.91	75.43	78.46	79.22
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	65.02	69.15	73.15	76.19	76.74
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	106.94	113.76	120.18	123.76	123.35
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	109.97	117.21	123.48	127.21	127.41
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	105.21	112.59	119.14	123.69	124.31
431	COND SHELL STATIC PRESS - AVERAGE	kPa	163.34	175.95	187.12	193.40	192.98
440	REFRIGERANT LVG COND TEMP	Deg C	37.57	39.69	41.76	42.68	42.58
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	108.04	115.62	122.52	126.79	126.59
485	HIGH PRESS ECONOMIZER TEMP	Deg C	25.34	27.28	29.01	30.02	30.01
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	67.71	71.43	74.67	76.67	77.15
487	LOW PRESS ECONOMIZER TEMP	Deg C	12.64	14.03	15.20	15.88	16.08
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	52.88	54.47	56.12	57.30	57.57
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	12.59	13.92	15.03	15.61	15.69
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	67.78	71.22	74.26	75.91	76.12
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	6.39	7.08	7.78	8.27	8.44
534	ENT COND ORIFICE ASS'Y PRESS	kPa	162.99	175.40	186.16	192.09	192.85
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	37.77	40.06	42.00	43.05	42.99
536	LVG COND ORIFICE ASS'Y PRESS	kPa	121.28	129.00	135.48	137.62	137.14
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	29.56	31.28	32.63	32.92	32.71
560	ATMOSPHERIC PRESS	kPa	99.49	99.49	99.49	99.49	99.49
580	MOTOR VOLTAGE - AB	Volts	3.893	3.897	3.879	3.900	3.868
581	MOTOR VOLTAGE - AC	Volts	3.901	3.902	3.892	3.913	3.877
582	MOTOR VOLTAGE - CB	Volts	3.881	3.884	3.875	3.891	3.860
583	MOTOR CURRENT - A	Volts	2.023	1.982	1.890	1.658	1.572
584	MOTOR CURRENT - B	Volts	2.089	2.040	1.974	1.749	1.642
585	MOTOR CURRENT - C	Volts	1.962	1.923	1.847	1.655	1.559
586	MOTOR POWER - PHASE 1	Volts	0.894	0.866	0.825	0.686	0.629
587	MOTOR POWER - PHASE 3	Volts	1.527	1.495	1.428	1.281	1.221
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	34.43	36.96	39.34	41.21	41.42
601	MAXIMUM MOTOR TEMPERATURE	Deg C	49.17	49.17	47.50	42.89	40.83
605	1st STAGE VANE SETTING	Degrees	70	70	70	70	70
607	3rd STAGE VANE SETTING	Degrees	63	63	63	63	63
608	UNIT HOUR METER READING	Hr	459	459	460	460	460
609	UNIT START COUNTER READING		125	125	125	125	125
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	21	21	22	22	22
701	ENERGY BALANCE	%	-1.08	-1.03	-1.12	-0.77	-0.87
702	EVAP CAPACITY	KW	632.2	599.1	539.3	414.9	369.2
703	EVAP WATER FLOWRATE	L/s	31.7	31.7	31.7	31.7	31.6
704	COND WATER FLOWRATE	L/s	38.0	38.0	38.0	38.1	38.0

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.44	11.19	10.74	9.81	9.47
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.68	6.69	6.68	6.68
712	AVE ENT COND WATER TEMP	Deg C	29.44	32.23	35.02	37.80	38.34
713	AVE LVG COND WATER TEMP	Deg C	34.41	36.96	39.33	41.19	41.41
715	MOTOR VOLTAGE - AB	Volts	467	468	466	468	464
716	MOTOR VOLTAGE - AC	Volts	468	468	467	470	465
717	MOTOR VOLTAGE - CB	Volts	466	466	465	467	463
718	MOTOR CURRENT - A	Amps	202	198	189	166	157
719	MOTOR CURRENT - B	Amps	209	204	197	175	164
720	MOTOR CURRENT - C	Amps	196	192	185	166	156
721	UNIT POWER	KW	145	142	135	118	111
722	AVERAGE VOLTAGE	Volts	467	467	466	468	464
723	AVERAGE CURRENT	Amps	203	198	190	169	159
725	Coefficient of Performance (COP)		4.352	4.229	3.990	3.515	3.326
730	EVAP DELTA T	Deg C	4.76	4.51	4.06	3.13	2.79
731	COND DELTA T	Deg C	4.96	4.73	4.31	3.39	3.06
735	EVAP WATER FLOWRATE	Kg/sec	31.68	31.72	31.68	31.66	31.61
736	COND WATER FLOWRATE	Kg/sec	37.83	37.84	37.82	37.87	37.78
740	EVAP CAPACITY	KW	632.1	599.3	539.3	414.8	369.2
741	COND CAPACITY	KW	784.2	747.1	680.5	536.0	483.4
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	0.53	1.49	2.51	3.80	4.06
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	38.09	40.46	42.44	43.52	43.45
750	RUNNING TIME	Hr	130	130	131	131	131
751	STARTS		30	30	30	30	30
752	EVAP APPROACH TEMP	Deg C	6.17	5.17	4.17	2.89	2.61
753	COND APPROACH TEMP	Deg C	3.67	3.50	3.11	2.33	2.06
800	EVAP AVG H2O TEMP	Deg C	9.06	8.93	8.72	8.24	8.08
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.33	1.34	1.35	1.36	1.37
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.585	0.585	0.585	0.584	0.584
810	COND AVG H2O TEMP	Deg C	31.92	34.59	37.18	39.49	39.87
811	COND WATER DENSITY	Kg/M3	996	995	994	993	993
812	COND H2O VISCOSITY	cp	0.76	0.72	0.69	0.66	0.65
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.621	0.624	0.628	0.631	0.631
815	ITD/DELTA T		2.29	2.15	2.03	1.92	1.94
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.01	-0.03	-0.04	-0.06	-0.04
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.01	-0.01	-0.02	-0.02	-0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.03	0.03	0.03	0.05
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.01	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.03	-0.01	-0.02	-0.03	-0.02

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		136	137	138	139	140
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	40
Capacity	KW	541.8	477.5	306.6	568.5	588.6
Power	KW	129.1	120.0	98.3	129.0	129.4
Coefficient of Performance (COP)		4.198	3.979	3.118	4.407	4.550
Evaporator Leaving Water Temperature	Deg C	6.69	6.68	6.68	6.68	6.68
Condenser Entering Water Temperature	Deg C	32.23	35.00	38.23	29.39	26.63
Energy Balance	%	-1.40	-1.53	-1.13	-1.39	-1.61
Evaporator Entering Water Temperature	Deg C	10.8	10.3	9.0	11.0	11.1
Evaporator Leaving Water Temperature	Deg C	6.69	6.68	6.68	6.68	6.68
Evaporator Water Flow Rate	L/s	31.7	31.6	31.6	31.7	31.7
Condenser Entering Water Temperature	Deg C	32.23	35.00	38.23	29.39	26.63
Condenser Leaving Water Temperature	Deg C	36.52	38.84	40.81	33.86	31.22
Condenser Water Flow Rate	L/s	38.0	38.0	38.1	38.0	38.0
Evap Sat Press	kPa	44.06	45.71	48.47	41.92	40.06
Sat Temp	Deg C	2.17	3.06	4.47	0.99	-0.07
Approach	Deg C	4.50	3.61	2.22	5.67	6.72
LMTD	Deg C	6.34	5.22	3.22	7.63	8.78
ITD/Delta T		2.10	2.01	1.96	2.33	2.52
Q/Ao	kW/m2	35.36	31.16	20.01	37.10	38.41
Uo	kW/m2 C	5.57	5.97	6.21	4.86	4.38
ho'	kW/m2 C	8.17	9.06	9.65	6.72	5.83
Cond Sat Press	kPa	171.20	181.88	186.99	157.89	145.55
Sat Temp	Deg C	39.58	41.52	42.42	37.03	34.51
Approach	Deg C	3.06	2.67	1.61	3.17	3.28
Refrigerant Leaving Temp	Deg C	38.90	41.09	41.65	36.49	34.22
LMTD	Deg C	4.89	4.32	2.70	5.08	5.25
Q/Ao	kW/m2	35.42	31.57	21.33	36.83	37.98
Uo	kW/m2 C	7.24	7.30	7.90	7.25	7.23
ho'	kW/m2 C	11.22	11.27	12.60	11.37	11.45
Cond Sat Temp	Deg C	39.58	41.52	42.42	37.03	34.51
Evap Sat Temp	Deg C	2.17	3.06	4.47	0.99	-0.07
Estimated Motor Efficiency (1)		0.94	0.94	0.95	0.94	0.94
Estimated Motor Rev/sec (1)		59.36	59.41	59.52	59.36	59.36
Compressor Suction Flow Rate (2)	m3/sec	1.138	0.972	0.592	1.245	1.337
Isentropic COP (2)		0.53	0.55	0.53	0.51	0.49
Adiabatic Efficiency (3)		0.63	0.62	0.47	0.64	0.64
Q/N - m3/rev (4)		0.68	0.58	0.35	0.74	0.80
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	120.66	120.31	120.31	120.86	120.93
3	ENT EVAP WATER TEMP LOC 1	Deg C	10.78	10.30	9.00	10.98	11.12
4	ENT EVAP WATER TEMP LOC 2	Deg C	10.76	10.26	8.97	10.94	11.09
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.70	6.69	6.68	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.67	6.67	6.67	6.67
15	COND WATER FLOWMETER DELTA P	kPa	172.85	172.23	172.78	172.37	173.13
17	ENT COND WATER TEMP LOC 1	Deg C	32.21	34.98	38.21	29.38	26.63
18	ENT COND WATER TEMP LOC 2	Deg C	32.24	35.02	38.24	29.39	26.63
19	LVG COND WATER TEMP LOC 1	Deg C	36.52	38.82	40.81	33.85	31.23
20	LVG COND WATER TEMP LOC 2	Deg C	36.52	38.85	40.82	33.86	31.22
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.47	5.27	6.56	3.63	2.54
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.59	4.39	5.88	2.81	1.74
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.21	4.91	6.11	3.23	2.02
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	44.06	45.71	48.47	41.92	40.06
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	71.15	74.33	77.50	66.88	63.02
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	71.36	74.88	79.01	67.15	63.22
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	69.02	72.95	76.81	64.47	60.33
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	112.59	118.18	120.31	104.87	97.97
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	112.25	119.49	123.62	104.25	96.80
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	111.69	118.24	123.97	103.35	95.84
431	COND SHELL STATIC PRESS - AVERAGE	kPa	171.20	181.88	186.99	157.89	145.55
440	REFRIGERANT LVG COND TEMP	Deg C	38.90	41.09	41.65	36.49	34.22
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	115.76	121.97	126.24	107.83	100.32
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.35	28.87	29.86	25.28	23.24
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	70.67	73.98	76.81	66.60	62.60
487	LOW PRESS ECONOMIZER TEMP	Deg C	13.77	14.96	15.96	12.20	10.60
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	54.33	55.99	57.85	51.64	49.50
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	13.61	14.72	15.62	12.08	10.56
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	70.46	73.36	75.98	66.40	62.54
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	6.97	7.67	8.50	5.74	4.74
534	ENT COND ORIFICE ASS'Y PRESS	kPa	170.44	180.50	186.02	157.48	144.93
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	39.19	41.04	42.06	36.68	34.23
536	LVG COND ORIFICE ASS'Y PRESS	kPa	128.93	132.65	136.86	120.73	112.66
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	30.66	31.98	32.32	28.72	26.79
560	ATMOSPHERIC PRESS	kPa	99.49	99.42	99.35	99.35	99.35
580	MOTOR VOLTAGE - AB	Volts	3.881	3.896	3.896	3.895	3.906
581	MOTOR VOLTAGE - AC	Volts	3.895	3.903	3.906	3.909	3.915
582	MOTOR VOLTAGE - CB	Volts	3.872	3.879	3.885	3.885	3.895
583	MOTOR CURRENT - A	Volts	1.805	1.720	1.434	1.806	1.802
584	MOTOR CURRENT - B	Volts	1.881	1.757	1.503	1.870	1.885
585	MOTOR CURRENT - C	Volts	1.783	1.671	1.417	1.788	1.776
586	MOTOR POWER - PHASE 1	Volts	0.769	0.708	0.540	0.758	0.774
587	MOTOR POWER - PHASE 3	Volts	1.382	1.292	1.099	1.392	1.382
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	36.51	38.86	40.88	33.82	31.20
601	MAXIMUM MOTOR TEMPERATURE	Deg C	44.17	42.50	36.94	43.06	42.39
605	1st STAGE VANE SETTING	Degrees	40	40	40	40	40
607	3rd STAGE VANE SETTING	Degrees	50	50	50	50	50
608	UNIT HOUR METER READING	Hr	461	461	462	462	462
609	UNIT START COUNTER READING		125	125	125	125	125
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	23	23	24	24	25
701	ENERGY BALANCE	%	-1.40	-1.53	-1.13	-1.39	-1.61
702	EVAP CAPACITY	KW	541.8	477.5	306.6	568.5	588.6
703	EVAP WATER FLOWRATE	L/s	31.7	31.6	31.6	31.7	31.7
704	COND WATER FLOWRATE	L/s	38.0	38.0	38.1	38.0	38.0

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	10.77	10.28	8.98	10.96	11.11
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.68	6.68	6.68	6.68
712	AVE ENT COND WATER TEMP	Deg C	32.23	35.00	38.23	29.39	26.63
713	AVE LVG COND WATER TEMP	Deg C	36.52	38.84	40.81	33.86	31.22
715	MOTOR VOLTAGE - AB	Volts	466	468	468	467	469
716	MOTOR VOLTAGE - AC	Volts	467	468	469	469	470
717	MOTOR VOLTAGE - CB	Volts	465	466	466	466	467
718	MOTOR CURRENT - A	Amps	181	172	143	181	180
719	MOTOR CURRENT - B	Amps	188	176	150	187	189
720	MOTOR CURRENT - C	Amps	178	167	142	179	178
721	UNIT POWER	KW	129	120	98	129	129
722	AVERAGE VOLTAGE	Volts	466	467	468	468	469
723	AVERAGE CURRENT	Amps	182	172	145	182	182
725	Coefficient of Performance (COP)		4.198	3.979	3.118	4.407	4.550
730	EVAP DELTA T	Deg C	4.08	3.60	2.31	4.28	4.43
731	COND DELTA T	Deg C	4.29	3.83	2.59	4.47	4.59
735	EVAP WATER FLOWRATE	Kg/sec	31.68	31.64	31.64	31.71	31.72
736	COND WATER FLOWRATE	Kg/sec	37.86	37.78	37.82	37.82	37.91
740	EVAP CAPACITY	KW	541.8	477.4	306.7	568.5	588.6
741	COND CAPACITY	KW	678.5	604.7	408.5	705.4	727.4
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.17	3.06	4.47	0.99	-0.07
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	39.58	41.52	42.42	37.03	34.51
750	RUNNING TIME	Hr	132	132	133	133	134
751	STARTS		30	30	30	30	30
752	EVAP APPROACH TEMP	Deg C	4.50	3.61	2.22	5.67	6.72
753	COND APPROACH TEMP	Deg C	3.06	2.67	1.61	3.17	3.28
800	EVAP AVG H2O TEMP	Deg C	8.73	8.48	7.83	8.82	8.89
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.35	1.36	1.38	1.34	1.34
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.585	0.584	0.583	0.585	0.585
810	COND AVG H2O TEMP	Deg C	34.37	36.92	39.52	31.62	28.93
811	COND WATER DENSITY	Kg/M3	995	994	993	996	997
812	COND H2O VISCOSITY	cp	0.73	0.69	0.66	0.77	0.82
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.624	0.627	0.631	0.620	0.617
815	ITD/DELTA T		2.10	2.01	1.96	2.33	2.52
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.03	-0.04	-0.03	-0.01	0.00
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	-0.03	-0.01	-0.01	0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.04	0.03	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.01	-0.04	-0.08	0.03	0.03

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		141	142	143	144	145
Refrigerant		11	11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	10	10
Capacity	KW	585.8	611.4	399.8	287.3	287.3
Power	KW	124.7	125.3	110.9	68.5	71.6
Coefficient of Performance (COP)		4.698	4.878	3.605	4.193	4.013
Evaporator Leaving Water Temperature	Deg C	6.68	6.68	6.68	6.68	6.68
Condenser Entering Water Temperature	Deg C	23.84	21.08	36.63	21.16	23.92
Energy Balance	%	-1.47	-1.59	-1.63	-2.15	-1.80
Evaporator Entering Water Temperature	Deg C	11.1	11.3	9.7	8.9	8.9
Evaporator Leaving Water Temperature	Deg C	6.68	6.68	6.68	6.68	6.68
Evaporator Water Flow Rate	L/s	31.5	31.6	31.7	31.5	31.5
Condenser Entering Water Temperature	Deg C	23.84	21.08	36.63	21.16	23.92
Condenser Leaving Water Temperature	Deg C	28.38	25.79	39.89	23.44	26.22
Condenser Water Flow Rate	L/s	38.0	38.0	38.2	38.0	37.9
Evap Sat Press	kPa	37.78	37.16	47.09	44.47	46.40
Sat Temp	Deg C	-1.43	-1.81	3.77	2.40	3.42
Approach	Deg C	8.11	8.50	2.89	4.28	3.28
LMTD	Deg C	10.16	10.63	4.24	5.29	4.26
ITD/Delta T		2.83	2.84	1.96	2.96	2.50
Q/Ao	kW/m2	38.23	39.91	26.10	18.74	18.75
Uo	kW/m2 C	3.76	3.75	6.16	3.54	4.40
ho'	kW/m2 C	4.79	4.78	9.51	4.45	5.90
Cond Sat Press	kPa	132.31	121.83	185.26	106.66	115.56
Sat Temp	Deg C	31.61	29.15	42.12	25.28	27.59
Approach	Deg C	3.22	3.33	2.22	1.83	1.39
Refrigerant Leaving Temp	Deg C	31.53	29.14	41.28	24.79	27.44
LMTD	Deg C	5.16	5.37	3.61	2.83	2.34
Q/Ao	kW/m2	37.54	38.98	27.01	18.89	19.01
Uo	kW/m2 C	7.27	7.25	7.48	6.68	8.12
ho'	kW/m2 C	11.67	11.77	11.61	10.37	14.12
Cond Sat Temp	Deg C	31.61	29.15	42.12	25.28	27.59
Evap Sat Temp	Deg C	-1.43	-1.81	3.77	2.40	3.42
Estimated Motor Efficiency (1)		0.94	0.94	0.95	0.95	0.95
Estimated Motor Rev/sec (1)		59.39	59.38	59.46	59.67	59.66
Compressor Suction Flow Rate (2)	m3/sec	1.398	1.475	0.792	0.583	0.563
Isentropic COP (2)		0.47	0.44	0.54	0.32	0.34
Adiabatic Efficiency (3)		0.63	0.61	0.55	0.38	0.38
Q/N - m3/rev (4)		0.83	0.88	0.47	0.35	0.33
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	119.35	119.97	120.66	119.49	119.35
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.12	11.31	9.71	8.87	8.88
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.10	11.28	9.67	8.83	8.83
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.68	6.68	6.69	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67	6.67	6.67	6.67
15	COND WATER FLOWMETER DELTA P	kPa	172.99	172.99	173.95	172.71	172.51
17	ENT COND WATER TEMP LOC 1	Deg C	23.84	21.08	36.62	21.16	23.92
18	ENT COND WATER TEMP LOC 2	Deg C	23.84	21.07	36.64	21.16	23.92
19	LVG COND WATER TEMP LOC 1	Deg C	28.39	25.80	39.89	23.45	26.23
20	LVG COND WATER TEMP LOC 2	Deg C	28.38	25.78	39.90	23.44	26.22
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	1.07	0.81	5.31	4.03	4.88
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	0.44	0.02	5.24	4.12	5.06
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	0.83	0.44	5.43	4.43	5.17
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	37.78	37.16	47.09	44.47	46.40
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	58.54	56.26	75.70	47.57	51.64
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	58.74	56.40	76.81	48.61	52.74
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	55.78	53.02	74.53	46.88	50.88
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	90.73	85.84	119.90	64.33	71.50
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	89.01	83.63	122.80	68.19	74.67
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	87.84	82.05	118.59	71.50	78.46
431	COND SHELL STATIC PRESS - AVERAGE	kPa	132.31	121.83	185.26	106.66	115.56
440	REFRIGERANT LVG COND TEMP	Deg C	31.53	29.14	41.28	24.79	27.44
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	92.18	86.80	124.31	78.81	85.56
485	HIGH PRESS ECONOMIZER TEMP	Deg C	20.88	19.43	29.40	16.97	19.02
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	58.12	55.50	74.95	47.30	51.37
487	LOW PRESS ECONOMIZER TEMP	Deg C	8.70	7.58	15.30	3.71	5.66
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	46.54	45.51	56.61	46.26	48.68
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	8.68	7.57	14.99	3.69	5.64
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	58.40	55.99	74.12	47.71	51.57
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	3.32	2.90	7.97	3.13	4.35
534	ENT COND ORIFICE ASS'Y PRESS	kPa	131.83	121.97	184.37	104.04	114.87
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	31.38	29.06	41.68	24.49	27.28
536	LVG COND ORIFICE ASS'Y PRESS	kPa	104.18	98.46	134.17	84.46	91.77
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	24.43	22.78	32.13	18.64	20.90
560	ATMOSPHERIC PRESS	kPa	99.35	99.35	98.87	98.59	98.59
580	MOTOR VOLTAGE - AB	Volts	3.914	3.928	3.901	3.882	3.886
581	MOTOR VOLTAGE - AC	Volts	3.922	3.937	3.911	3.896	3.897
582	MOTOR VOLTAGE - CB	Volts	3.903	3.915	3.894	3.871	3.872
583	MOTOR CURRENT - A	Volts	1.741	1.757	1.582	1.085	1.127
584	MOTOR CURRENT - B	Volts	1.816	1.817	1.646	1.127	1.159
585	MOTOR CURRENT - C	Volts	1.733	1.742	1.566	1.106	1.127
586	MOTOR POWER - PHASE 1	Volts	0.731	0.728	0.627	0.304	0.333
587	MOTOR POWER - PHASE 3	Volts	1.347	1.361	1.221	0.838	0.860
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	28.38	25.74	39.93	23.39	26.19
601	MAXIMUM MOTOR TEMPERATURE	Deg C	40.83	47.50	40.28	28.06	26.39
605	1st STAGE VANE SETTING	Degrees	40	40	40	10	10
607	3rd STAGE VANE SETTING	Degrees	50	50	50	19	19
608	UNIT HOUR METER READING	Hr	463	463	465	466	467
609	UNIT START COUNTER READING		125	125	126	127	127
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	25	25	45	48	48
701	ENERGY BALANCE	%	-1.47	-1.59	-1.63	-2.15	-1.80
702	EVAP CAPACITY	KW	585.8	611.4	399.8	287.3	287.3
703	EVAP WATER FLOWRATE	L/s	31.5	31.6	31.7	31.5	31.5
704	COND WATER FLOWRATE	L/s	38.0	38.0	38.2	38.0	37.9

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.11	11.29	9.69	8.86	8.86
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.68	6.68	6.68	6.68
712	AVE ENT COND WATER TEMP	Deg C	23.84	21.08	36.63	21.16	23.92
713	AVE LVG COND WATER TEMP	Deg C	28.38	25.79	39.89	23.44	26.22
715	MOTOR VOLTAGE - AB	Volts	470	471	468	466	466
716	MOTOR VOLTAGE - AC	Volts	471	472	469	468	468
717	MOTOR VOLTAGE - CB	Volts	468	470	467	465	465
718	MOTOR CURRENT - A	Amps	174	176	158	109	113
719	MOTOR CURRENT - B	Amps	182	182	165	113	116
720	MOTOR CURRENT - C	Amps	173	174	157	111	113
721	UNIT POWER	KW	125	125	111	69	72
722	AVERAGE VOLTAGE	Volts	470	471	468	466	466
723	AVERAGE CURRENT	Amps	176	177	160	111	114
725	Coefficient of Performance (COP)		4.698	4.878	3.605	4.193	4.013
730	EVAP DELTA T	Deg C	4.43	4.62	3.01	2.17	2.17
731	COND DELTA T	Deg C	4.54	4.72	3.27	2.28	2.30
735	EVAP WATER FLOWRATE	Kg/sec	31.51	31.59	31.68	31.53	31.51
736	COND WATER FLOWRATE	Kg/sec	37.91	37.92	37.95	37.89	37.85
740	EVAP CAPACITY	KW	585.8	611.6	399.9	287.2	287.4
741	COND CAPACITY	KW	719.1	746.7	517.4	361.9	364.1
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	-1.43	-1.81	3.77	2.40	3.42
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	31.61	29.15	42.12	25.28	27.59
750	RUNNING TIME	Hr	134	134	136	137	138
751	STARTS		30	30	31	32	32
752	EVAP APPROACH TEMP	Deg C	8.11	8.50	2.89	4.28	3.28
753	COND APPROACH TEMP	Deg C	3.22	3.33	2.22	1.83	1.39
800	EVAP AVG H2O TEMP	Deg C	8.89	8.98	8.18	7.77	7.77
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.34	1.34	1.37	1.38	1.38
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.585	0.585	0.584	0.583	0.583
810	COND AVG H2O TEMP	Deg C	26.11	23.44	38.27	22.31	25.07
811	COND WATER DENSITY	Kg/M3	998	998	994	998	998
812	COND H2O VISCOSITY	cp	0.87	0.92	0.67	0.95	0.89
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.613	0.609	0.629	0.607	0.611
815	ITD/DELTA T		2.83	2.84	1.96	2.96	2.50
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.00	0.01	-0.03	0.01	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.02	-0.01	0.01	0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.03	0.04	0.04	0.04
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.01	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.01	0.06	-0.04	0.06	0.03

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm					
Run Number		146	147	148	149
Refrigerant		11	11	11	11
Oil		Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	10	10	10	10
Capacity	KW	276.7	261.6	238.7	211.7
Power	KW	72.9	73.6	73.0	72.4
Coefficient of Performance (COP)		3.796	3.553	3.270	2.923
Evaporator Leaving Water Temperature	Deg C	6.69	6.68	6.69	6.69
Condenser Entering Water Temperature	Deg C	26.69	29.44	32.25	34.29
Energy Balance	%	-1.80	-1.36	-1.64	-1.93
Evaporator Entering Water Temperature	Deg C	8.8	8.7	8.5	8.3
Evaporator Leaving Water Temperature	Deg C	6.69	6.68	6.69	6.69
Evaporator Water Flow Rate	L/s	31.5	31.5	31.5	31.5
Condenser Entering Water Temperature	Deg C	26.69	29.44	32.25	34.29
Condenser Leaving Water Temperature	Deg C	28.93	31.58	34.24	36.11
Condenser Water Flow Rate	L/s	38.0	38.0	38.1	38.2
Evap Sat Press	kPa	47.30	48.06	48.75	49.23
Sat Temp	Deg C	3.88	4.26	4.61	4.85
Approach	Deg C	2.83	2.44	2.11	1.83
LMTD	Deg C	3.76	3.32	2.90	2.56
ITD/Delta T		2.33	2.22	2.15	2.15
Q/Ao	kW/m2	18.06	17.06	15.59	13.82
Uo	kW/m2 C	4.80	5.14	5.38	5.40
ho'	kW/m2 C	6.64	7.31	7.81	7.84
Cond Sat Press	kPa	126.04	137.55	149.34	158.03
Sat Temp	Deg C	30.16	32.78	35.29	37.06
Approach	Deg C	1.22	1.22	1.06	0.94
Refrigerant Leaving Temp	Deg C	30.03	32.49	34.89	36.62
LMTD	Deg C	2.15	2.09	1.87	1.70
Q/Ao	kW/m2	18.52	17.68	16.48	15.05
Uo	kW/m2 C	8.60	8.46	8.80	8.88
ho'	kW/m2 C	15.39	14.73	15.54	15.62
Cond Sat Temp	Deg C	30.16	32.78	35.29	37.06
Evap Sat Temp	Deg C	3.88	4.26	4.61	4.85
Estimated Motor Efficiency (1)		0.95	0.95	0.95	0.95
Estimated Motor Rev/sec (1)		59.65	59.65	59.65	59.65
Compressor Suction Flow Rate (2)	m3/sec	0.535	0.501	0.453	0.399
Isentropic COP (2)		0.37	0.40	0.43	0.45
Adiabatic Efficiency (3)		0.39	0.40	0.40	0.37
Q/N - m3/rev (4)		0.32	0.30	0.27	0.24
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	119.07	119.14	119.21	119.35
3	ENT EVAP WATER TEMP LOC 1	Deg C	8.81	8.69	8.52	8.32
4	ENT EVAP WATER TEMP LOC 2	Deg C	8.76	8.64	8.49	8.27
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69	6.71	6.70
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.67	6.69	6.68
15	COND WATER FLOWMETER DELTA P	kPa	172.85	172.78	173.33	173.75
17	ENT COND WATER TEMP LOC 1	Deg C	26.68	29.43	32.24	34.27
18	ENT COND WATER TEMP LOC 2	Deg C	26.70	29.44	32.26	34.31
19	LVG COND WATER TEMP LOC 1	Deg C	28.93	31.58	34.24	36.10
20	LVG COND WATER TEMP LOC 2	Deg C	28.93	31.58	34.25	36.12
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	5.37	5.98	6.30	6.58
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	5.43	6.00	6.26	6.53
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	5.71	6.24	6.54	6.88
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	47.30	48.06	48.75	49.23
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	55.71	60.05	63.98	67.22
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	56.88	61.16	65.16	68.46
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	54.88	59.23	63.22	66.74
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	78.94	86.25	94.66	101.01
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	81.84	89.08	97.15	103.08
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	85.77	93.15	101.15	107.01
431	COND SHELL STATIC PRESS - AVERAGE	kPa	126.04	137.55	149.34	158.03
440	REFRIGERANT LVG COND TEMP	Deg C	30.03	32.49	34.89	36.62
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	92.25	99.22	106.52	111.42
485	HIGH PRESS ECONOMIZER TEMP	Deg C	20.90	22.91	24.90	26.22
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	55.30	59.57	63.57	67.02
487	LOW PRESS ECONOMIZER TEMP	Deg C	7.52	9.33	11.01	12.38
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	50.40	52.12	53.64	55.02
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	7.41	9.15	10.72	12.06
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	55.30	59.29	63.02	66.19
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	5.11	5.92	6.63	7.25
534	ENT COND ORIFICE ASS'Y PRESS	kPa	125.69	136.93	148.72	157.13
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	29.97	32.56	35.08	36.81
536	LVG COND ORIFICE ASS'Y PRESS	kPa	98.94	106.80	114.59	120.24
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	22.91	25.00	27.06	28.43
560	ATMOSPHERIC PRESS	kPa	98.59	98.53	98.53	98.53
580	MOTOR VOLTAGE - AB	Volts	3.881	3.874	3.897	3.909
581	MOTOR VOLTAGE - AC	Volts	3.896	3.891	3.912	3.926
582	MOTOR VOLTAGE - CB	Volts	3.873	3.864	3.887	3.900
583	MOTOR CURRENT - A	Volts	1.134	1.142	1.140	1.130
584	MOTOR CURRENT - B	Volts	1.179	1.181	1.184	1.184
585	MOTOR CURRENT - C	Volts	1.150	1.171	1.159	1.147
586	MOTOR POWER - PHASE 1	Volts	0.340	0.341	0.330	0.329
587	MOTOR POWER - PHASE 3	Volts	0.875	0.886	0.887	0.878
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	28.92	31.58	34.23	36.15
601	MAXIMUM MOTOR TEMPERATURE	Deg C	24.17	25.28	26.94	28.06
605	1st STAGE VANE SETTING	Degrees	10	10	10	10
607	3rd STAGE VANE SETTING	Degrees	19	19	19	19
608	UNIT HOUR METER READING	Hr	467	467	468	468
609	UNIT START COUNTER READING		127	127	127	127
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	49	49	49	50
701	ENERGY BALANCE	%	-1.80	-1.36	-1.64	-1.93
702	EVAP CAPACITY	KW	276.7	261.6	238.7	211.7
703	EVAP WATER FLOWRATE	L/s	31.5	31.5	31.5	31.5
704	COND WATER FLOWRATE	L/s	38.0	38.0	38.1	38.2

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	8.78	8.66	8.51	8.29
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.68	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	26.69	29.44	32.25	34.29
713	AVE LVG COND WATER TEMP	Deg C	28.93	31.58	34.24	36.11
715	MOTOR VOLTAGE - AB	Volts	466	465	468	469
716	MOTOR VOLTAGE - AC	Volts	468	467	469	471
717	MOTOR VOLTAGE - CB	Volts	465	464	466	468
718	MOTOR CURRENT - A	Amps	113	114	114	113
719	MOTOR CURRENT - B	Amps	118	118	118	118
720	MOTOR CURRENT - C	Amps	115	117	116	115
721	UNIT POWER	KW	73	74	73	72
722	AVERAGE VOLTAGE	Volts	466	465	468	469
723	AVERAGE CURRENT	Amps	115	116	116	115
725	Coefficient of Performance (COP)		3.796	3.553	3.270	2.923
730	EVAP DELTA T	Deg C	2.09	1.98	1.81	1.60
731	COND DELTA T	Deg C	2.24	2.14	1.99	1.82
735	EVAP WATER FLOWRATE	Kg/sec	31.47	31.48	31.49	31.51
736	COND WATER FLOWRATE	Kg/sec	37.88	37.86	37.91	37.94
740	EVAP CAPACITY	KW	276.8	261.5	238.8	211.8
741	COND CAPACITY	KW	354.7	338.6	315.7	288.3
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	3.88	4.26	4.61	4.85
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	30.16	32.78	35.29	37.06
750	RUNNING TIME	Hr	138	138	139	139
751	STARTS		32	32	32	32
752	EVAP APPROACH TEMP	Deg C	2.83	2.44	2.11	1.83
753	COND APPROACH TEMP	Deg C	1.22	1.22	1.06	0.94
800	EVAP AVG H2O TEMP	Deg C	7.73	7.67	7.60	7.49
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.39	1.39	1.39	1.39
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.583	0.583	0.583	0.583
810	COND AVG H2O TEMP	Deg C	27.81	30.51	33.24	35.20
811	COND WATER DENSITY	Kg/M3	997	996	995	995
812	COND H2O VISCOSITY	cp	0.84	0.79	0.74	0.72
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.615	0.619	0.623	0.625
815	ITD/DELTA T		2.33	2.22	2.15	2.15
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.02	-0.01	-0.02	-0.04
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.00	0.01	-0.01	-0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.04	0.05	0.03	0.04
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.01	0.01	0.01	-0.05

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		150	151	152	153	154
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	711.6	733.8	752.8	760.2	731.7
Power	KW	155.2	164.2	171.8	174.7	173.0
Coefficient of Performance (COP)		4.586	4.468	4.382	4.351	4.228
Evaporator Leaving Water Temperature	Deg C	6.69	6.70	6.69	6.69	6.69
Condenser Entering Water Temperature	Deg C	18.40	21.15	23.91	26.71	29.48
Energy Balance	%	-1.46	-1.39	-1.27	-1.10	-1.20
Evaporator Entering Water Temperature	Deg C	12.1	12.3	12.4	12.4	12.2
Evaporator Leaving Water Temperature	Deg C	6.69	6.70	6.69	6.69	6.69
Evaporator Water Flow Rate	L/s	31.5	31.5	31.3	31.8	31.8
Condenser Entering Water Temperature	Deg C	18.40	21.15	23.91	26.71	29.48
Condenser Leaving Water Temperature	Deg C	23.93	26.87	29.79	32.66	35.24
Condenser Water Flow Rate	L/s	38.0	38.0	38.0	38.1	38.1
Evap Sat Press	kPa	30.41	32.34	34.06	35.71	36.06
Sat Temp	Deg C	-1.71	-0.36	0.83	1.86	2.07
Approach	Deg C	8.39	7.06	5.83	4.83	4.61
LMTD	Deg C	10.87	9.57	8.40	7.33	7.02
ITD/Delta T		2.56	2.27	2.02	1.85	1.84
Q/Ao	kW/m2	46.44	47.89	49.13	49.61	47.75
Uo	kW/m2 C	4.27	5.00	5.85	6.77	6.81
ho'	kW/m2 C	5.64	6.99	8.77	10.96	11.06
Cond Sat Press	kPa	106.11	116.66	129.14	142.45	153.96
Sat Temp	Deg C	29.13	31.81	34.73	37.62	39.94
Approach	Deg C	5.22	4.94	4.94	4.94	4.72
Refrigerant Leaving Temp	Deg C	28.50	31.50	34.36	37.14	39.45
LMTD	Deg C	7.64	7.43	7.50	7.54	7.20
Q/Ao	kW/m2	45.79	47.42	48.77	49.24	47.69
Uo	kW/m2 C	6.00	6.38	6.50	6.53	6.62
ho'	kW/m2 C	8.85	9.61	9.78	9.74	9.86
Cond Sat Temp	Deg C	29.13	31.81	34.73	37.62	39.94
Evap Sat Temp	Deg C	-1.71	-0.36	0.83	1.86	2.07
Estimated Motor Efficiency (1)		0.94	0.93	0.93	0.93	0.93
Estimated Motor Rev/sec (1)		59.22	59.16	59.12	59.10	59.11
Compressor Suction Flow Rate (2)	m3/sec	2.002	1.960	1.924	1.873	1.795
Isentropic COP (2)		0.45	0.46	0.49	0.52	0.55
Adiabatic Efficiency (3)		0.58	0.59	0.61	0.64	0.66
Q/N - m3/rev (4)		1.19	1.17	1.15	1.12	1.07
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	119.62	118.87	118.04	121.42	121.28
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.09	12.28	12.44	12.42	12.21
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.07	12.26	12.42	12.39	12.18
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.71	6.71	6.70	6.71	6.71
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.69	6.69	6.69	6.69	6.69
15	COND WATER FLOWMETER DELTA P	kPa	172.92	173.20	173.47	173.54	173.75
17	ENT COND WATER TEMP LOC 1	Deg C	18.40	21.16	23.89	26.71	29.47
18	ENT COND WATER TEMP LOC 2	Deg C	18.39	21.14	23.91	26.71	29.50
19	LVG COND WATER TEMP LOC 1	Deg C	23.93	26.88	29.79	32.67	35.24
20	LVG COND WATER TEMP LOC 2	Deg C	23.93	26.87	29.79	32.66	35.25
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	-0.62	0.69	1.92	2.86	3.18
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	0.07	1.47	2.52	3.67	3.83
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	1.06	2.21	3.28	4.09	4.44
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	30.41	32.34	34.06	35.71	36.06
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	49.44	52.95	56.26	59.50	61.02
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	49.50	53.16	56.61	59.78	61.57
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	44.13	47.57	51.09	54.33	56.54
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	75.01	81.63	87.84	95.01	96.87
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	73.36	79.43	86.05	95.63	100.53
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	67.91	74.53	81.22	88.18	94.04
431	COND SHELL STATIC PRESS - AVERAGE	kPa	106.11	116.66	129.14	142.45	153.96
440	REFRIGERANT LVG COND TEMP	Deg C	28.50	31.50	34.36	37.14	39.45
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	72.67	79.98	86.94	92.94	98.73
485	HIGH PRESS ECONOMIZER TEMP	Deg C	18.82	21.29	23.51	25.28	26.91
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	48.40	52.33	56.12	59.57	61.50
487	LOW PRESS ECONOMIZER TEMP	Deg C	8.84	10.70	12.42	13.85	14.70
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	42.06	45.16	48.26	50.81	51.71
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	9.00	10.87	12.58	14.01	14.89
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	49.99	53.92	57.85	61.16	62.47
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	6.11	7.70	9.24	10.41	10.52
534	ENT COND ORIFICE ASS'Y PRESS	kPa	107.42	118.93	131.69	143.96	155.13
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	28.64	31.71	34.86	37.67	39.95
536	LVG COND ORIFICE ASS'Y PRESS	kPa	89.36	96.66	105.42	112.52	118.38
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	24.31	27.01	29.35	31.14	32.65
560	ATMOSPHERIC PRESS	kPa	100.04	99.97	99.97	99.97	99.97
580	MOTOR VOLTAGE - AB	Volts	3.899	3.877	3.871	3.877	3.880
581	MOTOR VOLTAGE - AC	Volts	3.902	3.882	3.877	3.883	3.884
582	MOTOR VOLTAGE - CB	Volts	3.890	3.871	3.864	3.871	3.874
583	MOTOR CURRENT - A	Volts	2.144	2.266	2.365	2.398	2.383
584	MOTOR CURRENT - B	Volts	2.238	2.369	2.470	2.504	2.482
585	MOTOR CURRENT - C	Volts	2.066	2.184	2.286	2.319	2.294
586	MOTOR POWER - PHASE 1	Volts	0.979	1.046	1.096	1.116	1.108
587	MOTOR POWER - PHASE 3	Volts	1.607	1.691	1.767	1.796	1.776
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	23.86	26.78	29.81	32.64	35.21
601	MAXIMUM MOTOR TEMPERATURE	Deg C	75.83	76.39	70.28	67.50	65.67
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	68
608	UNIT HOUR METER READING	Hr	469	469	469	470	470
609	UNIT START COUNTER READING		128	128	128	128	128
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	0	0	1	1	1
701	ENERGY BALANCE	%	-1.46	-1.39	-1.27	-1.10	-1.20
702	EVAP CAPACITY	KW	711.6	733.8	752.8	760.2	731.7
703	EVAP WATER FLOWRATE	L/s	31.5	31.5	31.3	31.8	31.8
704	COND WATER FLOWRATE	L/s	38.0	38.0	38.0	38.1	38.1

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	12.08	12.27	12.43	12.41	12.19
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.70	6.69	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	18.40	21.15	23.91	26.71	29.48
713	AVE LVG COND WATER TEMP	Deg C	23.93	26.87	29.79	32.66	35.24
715	MOTOR VOLTAGE - AB	Volts	468	465	465	465	466
716	MOTOR VOLTAGE - AC	Volts	468	466	465	466	466
717	MOTOR VOLTAGE - CB	Volts	467	465	464	465	465
718	MOTOR CURRENT - A	Amps	214	227	237	240	238
719	MOTOR CURRENT - B	Amps	224	237	247	250	248
720	MOTOR CURRENT - C	Amps	207	218	229	232	229
721	UNIT POWER	KW	155	164	172	175	173
722	AVERAGE VOLTAGE	Volts	468	465	465	465	466
723	AVERAGE CURRENT	Amps	215	227	237	241	239
725	Coefficient of Performance (COP)		4.586	4.468	4.382	4.351	4.228
730	EVAP DELTA T	Deg C	5.38	5.57	5.73	5.71	5.49
731	COND DELTA T	Deg C	5.54	5.73	5.89	5.95	5.76
735	EVAP WATER FLOWRATE	Kg/sec	31.54	31.44	31.33	31.78	31.76
736	COND WATER FLOWRATE	Kg/sec	37.91	37.94	37.96	37.96	37.97
740	EVAP CAPACITY	KW	711.6	733.8	752.7	760.1	731.6
741	COND CAPACITY	KW	877.1	908.2	934.1	943.2	913.4
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	-1.71	-0.36	0.83	1.86	2.07
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	29.13	31.81	34.73	37.62	39.94
750	RUNNING TIME	Hr	140	140	141	141	141
751	STARTS		33	33	33	33	33
752	EVAP APPROACH TEMP	Deg C	8.39	7.06	5.83	4.83	4.61
753	COND APPROACH TEMP	Deg C	5.22	4.94	4.94	4.94	4.72
800	EVAP AVG H2O TEMP	Deg C	9.39	9.49	9.56	9.55	9.44
801	EVAP WATER DENSITY	Kg/M3	1001	1000	1000	1000	1000
802	EVAP H2O VISCOSITY	cp	1.32	1.32	1.32	1.32	1.32
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.586	0.586	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	21.17	24.01	26.85	29.69	32.36
811	COND WATER DENSITY	Kg/M3	999	998	997	996	996
812	COND H2O VISCOSITY	cp	0.97	0.91	0.85	0.80	0.76
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.605	0.609	0.614	0.618	0.621
815	ITD/DELTA T		2.56	2.27	2.02	1.85	1.84
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.02	0.01	-0.01	0.00	-0.03
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.01	0.00	0.01	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.02	0.02	0.02	0.02
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.01	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.08	0.10	-0.02	0.03	0.03

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		155	156	157	158	159
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	70
Capacity	KW	692.6	641.0	580.1	502.8	556.6
Power	KW	168.9	162.4	154.4	142.3	147.6
Coefficient of Performance (COP)		4.101	3.948	3.758	3.535	3.771
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.69
Condenser Entering Water Temperature	Deg C	32.29	35.03	37.80	40.09	37.76
Energy Balance	%	-0.81	-1.13	-0.75	-1.07	-0.63
Evaporator Entering Water Temperature	Deg C	11.9	11.5	11.1	10.5	10.9
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.69
Evaporator Water Flow Rate	L/s	31.8	31.8	31.8	31.8	31.8
Condenser Entering Water Temperature	Deg C	32.29	35.03	37.80	40.09	37.76
Condenser Leaving Water Temperature	Deg C	37.76	40.15	42.47	44.21	42.23
Condenser Water Flow Rate	L/s	38.2	38.2	38.2	38.2	38.2
Evap Sat Press	kPa	36.40	36.89	37.37	38.06	37.58
Sat Temp	Deg C	2.29	2.59	2.88	3.29	3.01
Approach	Deg C	4.39	4.11	3.83	3.39	3.67
LMTD	Deg C	6.67	6.21	5.72	5.05	5.52
ITD/Delta T		1.85	1.85	1.88	1.90	1.88
Q/Ao	kW/m2	45.19	41.83	37.87	32.82	36.33
Uo	kW/m2 C	6.77	6.74	6.62	6.49	6.58
ho'	kW/m2 C	10.98	10.91	10.61	10.30	10.51
Cond Sat Press	kPa	166.03	177.47	188.09	195.33	186.02
Sat Temp	Deg C	42.25	44.31	46.14	47.33	45.79
Approach	Deg C	4.50	4.17	3.67	3.11	3.56
Refrigerant Leaving Temp	Deg C	41.82	43.40	45.74	46.83	45.42
LMTD	Deg C	6.86	6.38	5.69	4.90	5.50
Q/Ao	kW/m2	45.26	42.32	38.58	33.96	36.95
Uo	kW/m2 C	6.60	6.63	6.78	6.93	6.72
ho'	kW/m2 C	9.71	9.71	9.94	10.20	9.82
Cond Sat Temp	Deg C	42.25	44.31	46.14	47.33	45.79
Evap Sat Temp	Deg C	2.29	2.59	2.88	3.29	3.01
Estimated Motor Efficiency (1)		0.93	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)		59.13	59.17	59.22	59.29	59.26
Compressor Suction Flow Rate (2)	m3/sec	1.691	1.552	1.393	1.189	1.328
Isentropic COP (2)		0.58	0.61	0.63	0.64	0.62
Adiabatic Efficiency (3)		0.67	0.68	0.67	0.64	0.66
Q/N - m3/rev (4)		1.01	0.93	0.83	0.71	0.79
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	121.28	121.35	121.28	121.21	121.49
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.91	11.52	11.07	10.48	10.89
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.88	11.50	11.03	10.46	10.86
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.71	6.71	6.70	6.70	6.71
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.69	6.68	6.68	6.69
15	COND WATER FLOWMETER DELTA P	kPa	173.95	173.68	173.61	173.68	174.30
17	ENT COND WATER TEMP LOC 1	Deg C	32.29	35.02	37.78	40.08	37.76
18	ENT COND WATER TEMP LOC 2	Deg C	32.30	35.05	37.82	40.11	37.77
19	LVG COND WATER TEMP LOC 1	Deg C	37.76	40.14	42.46	44.19	42.22
20	LVG COND WATER TEMP LOC 2	Deg C	37.77	40.16	42.47	44.21	42.23
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	3.41	3.73	4.01	5.38	4.24
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.09	4.37	4.67	5.42	4.72
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.56	4.89	5.28	5.98	5.32
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	36.40	36.89	37.37	38.06	37.58
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	62.88	64.95	67.02	69.02	66.40
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	63.43	65.50	67.50	69.22	66.95
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	58.88	61.71	64.40	66.88	64.12
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	102.32	106.80	111.07	114.45	109.21
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	105.01	108.80	114.25	118.66	114.31
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	99.28	103.63	108.39	112.80	107.90
431	COND SHELL STATIC PRESS - AVERAGE	kPa	166.03	177.47	188.09	195.33	186.02
440	REFRIGERANT LVG COND TEMP	Deg C	41.82	43.40	45.74	46.83	45.42
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	104.39	110.73	116.31	121.28	115.90
485	HIGH PRESS ECONOMIZER TEMP	Deg C	28.49	30.12	31.57	32.72	31.43
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	63.98	66.19	68.40	69.50	67.57
487	LOW PRESS ECONOMIZER TEMP	Deg C	15.57	16.49	17.26	17.76	16.97
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	52.12	51.78	51.92	51.85	51.23
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	15.79	16.48	17.19	17.69	16.90
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	64.12	66.47	68.12	69.43	67.43
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	10.48	10.60	10.54	10.23	10.36
534	ENT COND ORIFICE ASS'Y PRESS	kPa	166.65	177.33	187.54	194.98	185.05
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	42.14	44.21	45.96	47.13	45.51
536	LVG COND ORIFICE ASS'Y PRESS	kPa	124.04	131.00	135.83	140.45	135.62
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	34.03	35.64	36.69	37.07	36.33
560	ATMOSPHERIC PRESS	kPa	99.97	99.90	99.90	99.90	99.84
580	MOTOR VOLTAGE - AB	Volts	3.902	3.881	3.881	3.911	3.885
581	MOTOR VOLTAGE - AC	Volts	3.906	3.887	3.884	3.916	3.889
582	MOTOR VOLTAGE - CB	Volts	3.895	3.872	3.871	3.904	3.878
583	MOTOR CURRENT - A	Volts	2.324	2.248	2.140	1.982	2.036
584	MOTOR CURRENT - B	Volts	2.428	2.342	2.235	2.075	2.134
585	MOTOR CURRENT - C	Volts	2.242	2.173	2.061	1.914	1.974
586	MOTOR POWER - PHASE 1	Volts	1.073	1.030	0.966	0.880	0.923
587	MOTOR POWER - PHASE 3	Volts	1.742	1.676	1.607	1.491	1.537
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	37.69	40.16	42.43	44.23	42.23
601	MAXIMUM MOTOR TEMPERATURE	Deg C	63.50	61.39	57.50	53.06	54.17
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	70
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	63
608	UNIT HOUR METER READING	Hr	470	471	471	472	472
609	UNIT START COUNTER READING		128	128	128	128	128
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	2	2	2	3	3
701	ENERGY BALANCE	%	-0.81	-1.13	-0.75	-1.07	-0.63
702	EVAP CAPACITY	KW	692.6	641.0	580.1	502.8	556.6
703	EVAP WATER FLOWRATE	L/s	31.8	31.8	31.8	31.8	31.8
704	COND WATER FLOWRATE	L/s	38.2	38.2	38.2	38.2	38.2

Medium Impellers - Metric

710	AVERAGE EVAP WATER TEMP	Deg C	11.90	11.51	11.05	10.47	10.88
711	AVERAGE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.69	6.69
712	AVERAGE COND WATER TEMP	Deg C	32.29	35.03	37.80	40.09	37.76
713	AVERAGE LVG COND WATER TEMP	Deg C	37.76	40.15	42.47	44.21	42.23
715	MOTOR VOLTAGE - AB	Volts	468	466	466	469	466
716	MOTOR VOLTAGE - AC	Volts	469	466	466	470	467
717	MOTOR VOLTAGE - CB	Volts	467	465	465	469	465
718	MOTOR CURRENT - A	Amps	232	225	214	198	204
719	MOTOR CURRENT - B	Amps	243	234	224	208	213
720	MOTOR CURRENT - C	Amps	224	217	206	191	197
721	UNIT POWER	KW	169	162	154	142	148
722	AVERAGE VOLTAGE	Volts	468	466	465	469	466
723	AVERAGE CURRENT	Amps	233	225	215	199	205
725	Coefficient of Performance (COP)		4.101	3.948	3.758	3.535	3.771
730	EVAP DELTA T	Deg C	5.21	4.81	4.36	3.78	4.18
731	COND DELTA T	Deg C	5.47	5.12	4.66	4.11	4.46
735	EVAP WATER FLOWRATE	Kg/sec	31.76	31.77	31.76	31.75	31.79
736	COND WATER FLOWRATE	Kg/sec	37.98	37.93	37.91	37.90	37.99
740	EVAP CAPACITY	KW	692.5	640.9	580.2	502.8	556.7
741	COND CAPACITY	KW	867.0	810.6	738.9	650.4	707.8
743	EVAP SATN TEMP (BASED ON ID #61)	Deg C	2.29	2.59	2.88	3.29	3.01
744	COND SATN TEMP (BASED ON ID #431)	Deg C	42.25	44.31	46.14	47.33	45.79
750	RUNNING TIME	Hr	142	142	142	143	143
751	STARTS		33	33	33	33	33
752	EVAP APPROACH TEMP	Deg C	4.39	4.11	3.83	3.39	3.67
753	COND APPROACH TEMP	Deg C	4.50	4.17	3.67	3.11	3.56
800	EVAP AVG H2O TEMP	Deg C	9.30	9.11	8.87	8.58	8.78
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.32	1.33	1.34	1.35	1.34
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.586	0.586	0.585	0.585	0.585
810	COND AVG H2O TEMP	Deg C	35.03	37.59	40.13	42.15	39.99
811	COND WATER DENSITY	Kg/M3	995	994	993	992	993
812	COND H2O VISCOSITY	cp	0.72	0.68	0.65	0.63	0.65
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.625	0.628	0.632	0.634	0.631
815	ITD/DELTA T		1.85	1.85	1.88	1.90	1.88
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.01	-0.03	-0.03	-0.02	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.01	-0.01	-0.01	-0.02	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.02	0.03	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.07	-0.01	0.03	-0.03	-0.01

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		160	161	162	163	164
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	KW	483.1	617.4	667.7	706.4	739.8
Power	KW	136.1	155.9	161.3	165.5	167.6
Coefficient of Performance (COP)		3.550	3.961	4.138	4.269	4.413
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.70
Condenser Entering Water Temperature	Deg C	39.98	34.98	32.19	29.44	26.67
Energy Balance	%	-0.97	-1.13	-1.20	-1.00	-1.10
Evaporator Entering Water Temperature	Deg C	10.3	11.3	11.7	12.0	12.3
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.70
Evaporator Water Flow Rate	L/s	31.8	31.8	31.8	31.5	31.6
Condenser Entering Water Temperature	Deg C	39.98	34.98	32.19	29.44	26.67
Condenser Leaving Water Temperature	Deg C	43.91	39.92	37.48	34.99	32.44
Condenser Water Flow Rate	L/s	38.2	38.1	38.1	38.1	38.1
Evap Sat Press	kPa	38.20	37.02	36.61	36.27	35.99
Sat Temp	Deg C	3.38	2.67	2.41	2.21	2.03
Approach	Deg C	3.33	4.00	4.28	4.50	4.67
LMTD	Deg C	4.90	6.05	6.47	6.81	7.10
ITD/Delta T		1.91	1.87	1.85	1.84	1.84
Q/Ao	kW/m2	31.53	40.30	43.57	46.09	48.28
Uo	kW/m2 C	6.43	6.66	6.74	6.76	6.80
ho'	kW/m2 C	10.15	10.71	10.89	10.99	11.07
Cond Sat Press	kPa	192.71	175.06	163.75	152.30	141.00
Sat Temp	Deg C	46.91	43.88	41.82	39.62	37.31
Approach	Deg C	3.00	3.94	4.33	4.61	4.89
Refrigerant Leaving Temp	Deg C	46.22	42.96	41.48	39.18	36.88
LMTD	Deg C	4.69	6.10	6.64	7.05	7.38
Q/Ao	kW/m2	32.57	40.74	43.69	45.88	47.80
Uo	kW/m2 C	6.95	6.67	6.58	6.51	6.47
ho'	kW/m2 C	10.23	9.81	9.69	9.63	9.63
Cond Sat Temp	Deg C	46.91	43.88	41.82	39.62	37.31
Evap Sat Temp	Deg C	3.38	2.67	2.41	2.21	2.03
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.93	0.93
Estimated Motor Rev/sec (1)		59.32	59.21	59.18	59.16	59.14
Compressor Suction Flow Rate (2)	m3/sec	1.137	1.488	1.621	1.722	1.808
Isentropic COP (2)		0.63	0.60	0.57	0.54	0.51
Adiabatic Efficiency (3)		0.63	0.67	0.67	0.66	0.64
Q/N - m3/rev (4)		0.68	0.89	0.97	1.03	1.08
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	121.35	121.28	121.49	119.55	120.31
3	ENT EVAP WATER TEMP LOC 1	Deg C	10.33	11.34	11.72	12.05	12.29
4	ENT EVAP WATER TEMP LOC 2	Deg C	10.29	11.32	11.69	12.02	12.27
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.70	6.70	6.70	6.71
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68	6.68	6.69
15	COND WATER FLOWMETER DELTA P	kPa	174.09	173.54	173.54	173.26	173.75
17	ENT COND WATER TEMP LOC 1	Deg C	39.97	34.97	32.18	29.44	26.67
18	ENT COND WATER TEMP LOC 2	Deg C	39.98	35.00	32.20	29.44	26.67
19	LVG COND WATER TEMP LOC 1	Deg C	43.91	39.90	37.47	34.99	32.44
20	LVG COND WATER TEMP LOC 2	Deg C	43.92	39.93	37.48	34.99	32.44
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.61	3.91	3.66	3.34	3.22
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	5.03	4.54	4.26	4.02	3.83
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	5.73	4.92	4.71	4.57	4.42
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	38.20	37.02	36.61	36.27	35.99
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	68.40	64.26	62.12	60.33	58.74
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	68.67	64.67	62.60	60.74	59.02
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	66.47	61.16	58.40	55.99	53.85
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	112.11	101.56	96.32	90.94	85.56
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	118.24	109.28	104.87	101.56	97.56
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	112.32	101.63	96.04	91.42	88.25
431	COND SHELL STATIC PRESS - AVERAGE	kPa	192.71	175.06	163.75	152.30	141.00
440	REFRIGERANT LVG COND TEMP	Deg C	46.22	42.96	41.48	39.18	36.88
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	120.31	109.97	103.97	98.18	92.73
485	HIGH PRESS ECONOMIZER TEMP	Deg C	32.51	29.99	28.42	26.84	25.29
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	68.95	65.50	63.29	61.23	59.23
487	LOW PRESS ECONOMIZER TEMP	Deg C	17.53	16.22	15.36	14.49	13.65
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	51.23	51.37	51.09	50.68	50.33
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	17.36	16.21	15.40	14.59	13.80
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	68.74	65.71	63.78	61.71	60.12
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	10.07	10.20	10.21	10.11	10.11
534	ENT COND ORIFICE ASS'Y PRESS	kPa	192.09	174.57	163.89	153.13	142.31
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	46.62	43.75	41.83	39.61	37.34
536	LVG COND ORIFICE ASS'Y PRESS	kPa	136.45	131.00	123.21	116.25	109.63
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	36.64	35.23	33.82	32.34	30.76
560	ATMOSPHERIC PRESS	kPa	99.77	99.77	99.77	99.70	99.70
580	MOTOR VOLTAGE - AB	Volts	3.862	3.872	3.874	3.874	3.881
581	MOTOR VOLTAGE - AC	Volts	3.870	3.877	3.879	3.881	3.890
582	MOTOR VOLTAGE - CB	Volts	3.859	3.866	3.865	3.867	3.876
583	MOTOR CURRENT - A	Volts	1.908	2.162	2.229	2.269	2.296
584	MOTOR CURRENT - B	Volts	2.007	2.263	2.326	2.384	2.409
585	MOTOR CURRENT - C	Volts	1.833	2.092	2.161	2.214	2.239
586	MOTOR POWER - PHASE 1	Volts	0.840	0.985	1.023	1.044	1.057
587	MOTOR POWER - PHASE 3	Volts	1.428	1.613	1.666	1.714	1.737
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	43.94	39.88	37.47	34.97	32.39
601	MAXIMUM MOTOR TEMPERATURE	Deg C	50.28	56.94	59.17	60.83	61.94
605	1st STAGE VANE SETTING	Degrees	70	70	70	70	70
607	3rd STAGE VANE SETTING	Degrees	63	63	63	63	63
608	UNIT HOUR METER READING	Hr	472	473	473	474	474
609	UNIT START COUNTER READING		128	128	128	128	128
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	4	4	4	5	5
701	ENERGY BALANCE	%	-0.97	-1.13	-1.20	-1.00	-1.10
702	EVAP CAPACITY	KW	483.1	617.4	667.7	706.4	739.8
703	EVAP WATER FLOWRATE	L/s	31.8	31.8	31.8	31.5	31.6
704	COND WATER FLOWRATE	L/s	38.2	38.1	38.1	38.1	38.1

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	10.31	11.33	11.70	12.03	12.28
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.69	6.70
712	AVE ENT COND WATER TEMP	Deg C	39.98	34.98	32.19	29.44	26.67
713	AVE LVG COND WATER TEMP	Deg C	43.91	39.92	37.48	34.99	32.44
715	MOTOR VOLTAGE - AB	Volts	463	465	465	465	466
716	MOTOR VOLTAGE - AC	Volts	464	465	466	466	467
717	MOTOR VOLTAGE - CB	Volts	463	464	464	464	465
718	MOTOR CURRENT - A	Amps	191	216	223	227	230
719	MOTOR CURRENT - B	Amps	201	226	233	238	241
720	MOTOR CURRENT - C	Amps	183	209	216	221	224
721	UNIT POWER	KW	136	156	161	165	168
722	AVERAGE VOLTAGE	Volts	464	465	465	465	466
723	AVERAGE CURRENT	Amps	192	217	224	229	231
725	Coefficient of Performance (COP)		3.550	3.961	4.138	4.269	4.413
730	EVAP DELTA T	Deg C	3.63	4.64	5.01	5.34	5.58
731	COND DELTA T	Deg C	3.94	4.93	5.28	5.55	5.77
735	EVAP WATER FLOWRATE	Kg/sec	31.77	31.76	31.79	31.53	31.63
736	COND WATER FLOWRATE	Kg/sec	37.95	37.92	37.93	37.92	37.98
740	EVAP CAPACITY	KW	483.2	617.5	667.6	706.2	739.7
741	COND CAPACITY	KW	623.9	780.3	836.9	878.7	915.5
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	3.38	2.67	2.41	2.21	2.03
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	46.91	43.88	41.82	39.62	37.31
750	RUNNING TIME	Hr	144	144	144	145	145
751	STARTS		33	33	33	33	33
752	EVAP APPROACH TEMP	Deg C	3.33	4.00	4.28	4.50	4.67
753	COND APPROACH TEMP	Deg C	3.00	3.94	4.33	4.61	4.89
800	EVAP AVG H2O TEMP	Deg C	8.50	9.02	9.20	9.37	9.49
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1000
802	EVAP H2O VISCOSITY	cp	1.36	1.34	1.33	1.32	1.32
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.584	0.585	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	41.94	37.45	34.84	32.22	29.56
811	COND WATER DENSITY	Kg/M3	992	994	995	996	997
812	COND H2O VISCOSITY	cp	0.63	0.68	0.72	0.76	0.81
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.634	0.628	0.625	0.621	0.617
815	ITD/DELTA T		1.91	1.87	1.85	1.84	1.84
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.02	-0.03	-0.02	-0.01	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.01	-0.03	-0.01	-0.01	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.04	0.03	0.03	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.01
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.03	0.02	0.01	0.02	0.05

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		165	166	167	168	169
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	40	40	40
Capacity	KW	753.8	740.1	684.6	666.3	643.1
Power	KW	166.1	161.5	145.6	145.6	145.4
Coefficient of Performance (COP)		4.537	4.584	4.701	4.577	4.423
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.69
Condenser Entering Water Temperature	Deg C	23.92	21.16	21.14	23.92	26.71
Energy Balance	%	-1.20	-1.17	-1.37	-1.34	-1.42
Evaporator Entering Water Temperature	Deg C	12.4	12.3	11.8	11.7	11.5
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.69
Evaporator Water Flow Rate	L/s	31.7	31.7	31.7	31.7	31.6
Condenser Entering Water Temperature	Deg C	23.92	21.16	21.14	23.92	26.71
Condenser Leaving Water Temperature	Deg C	29.77	26.90	26.43	29.10	31.74
Condenser Water Flow Rate	L/s	38.1	38.0	38.0	38.0	38.0
Evap Sat Press	kPa	35.23	33.58	36.27	36.40	36.61
Sat Temp	Deg C	1.55	0.48	2.21	2.29	2.41
Approach	Deg C	5.17	6.22	4.50	4.39	4.28
LMTD	Deg C	7.63	8.71	6.74	6.60	6.41
ITD/Delta T		1.91	2.11	1.87	1.88	1.88
Q/Ao	kW/m2	49.21	48.31	44.68	43.49	41.96
Uo	kW/m2 C	6.45	5.55	6.63	6.59	6.55
ho'	kW/m2 C	10.16	8.09	10.62	10.52	10.44
Cond Sat Press	kPa	129.35	116.66	111.90	122.38	133.48
Sat Temp	Deg C	34.78	31.81	30.62	33.18	35.70
Approach	Deg C	5.00	4.89	4.17	4.06	3.94
Refrigerant Leaving Temp	Deg C	34.39	31.57	30.59	32.97	35.56
LMTD	Deg C	7.56	7.41	6.48	6.32	6.13
Q/Ao	kW/m2	48.51	47.53	43.84	42.86	41.63
Uo	kW/m2 C	6.42	6.41	6.77	6.78	6.79
ho'	kW/m2 C	9.59	9.68	10.52	10.45	10.36
Cond Sat Temp	Deg C	34.78	31.81	30.62	33.18	35.70
Evap Sat Temp	Deg C	1.55	0.48	2.21	2.29	2.41
Estimated Motor Efficiency (1)		0.93	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)		59.15	59.18	59.27	59.27	59.27
Compressor Suction Flow Rate (2)	m3/sec	1.870	1.909	1.638	1.597	1.541
Isentropic COP (2)		0.48	0.45	0.40	0.44	0.47
Adiabatic Efficiency (3)		0.62	0.58	0.54	0.57	0.60
Q/N - m3/rev (4)		1.12	1.14	0.98	0.95	0.92
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	120.52	120.93	120.93	120.52	120.18
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.38	12.28	11.86	11.73	11.56
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.36	12.24	11.83	11.70	11.53
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.70	6.70	6.71	6.70
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.69	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	173.95	173.33	173.06	172.71	172.99
17	ENT COND WATER TEMP LOC 1	Deg C	23.92	21.17	21.14	23.92	26.69
18	ENT COND WATER TEMP LOC 2	Deg C	23.92	21.15	21.13	23.91	26.71
19	LVG COND WATER TEMP LOC 1	Deg C	29.77	26.91	26.43	29.11	31.74
20	LVG COND WATER TEMP LOC 2	Deg C	29.77	26.89	26.43	29.10	31.75
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	2.65	1.48	6.01	3.68	3.83
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.28	2.15	4.32	4.39	4.30
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	3.93	2.92	4.97	5.07	5.14
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	35.23	33.58	36.27	36.40	36.61
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	56.67	53.50	53.71	55.09	56.67
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	56.81	53.57	53.85	55.36	56.95
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	51.43	48.19	49.23	50.95	52.95
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	83.43	76.26	77.50	81.01	85.08
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	89.77	81.77	75.91	79.36	84.18
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	82.53	75.91	77.15	80.94	85.98
431	COND SHELL STATIC PRESS - AVERAGE	kPa	129.35	116.66	111.90	122.38	133.48
440	REFRIGERANT LVG COND TEMP	Deg C	34.39	31.57	30.59	32.97	35.56
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	87.22	80.88	84.46	88.67	93.35
485	HIGH PRESS ECONOMIZER TEMP	Deg C	23.59	21.61	22.89	24.03	25.42
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	56.54	52.95	53.57	55.16	57.09
487	LOW PRESS ECONOMIZER TEMP	Deg C	12.58	10.98	11.26	11.99	12.84
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	48.75	46.06	46.68	47.30	47.57
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	12.76	11.17	11.34	12.06	12.88
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	58.12	54.61	54.33	55.85	57.71
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.61	8.25	8.31	8.46	8.72
534	ENT COND ORIFICE ASS'Y PRESS	kPa	131.21	119.21	113.83	123.76	134.31
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	34.79	31.87	30.97	33.37	35.79
536	LVG COND ORIFICE ASS'Y PRESS	kPa	105.42	98.25	94.53	100.11	105.77
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	29.14	27.08	26.49	27.96	29.58
560	ATMOSPHERIC PRESS	kPa	99.63	99.63	98.66	98.66	98.73
580	MOTOR VOLTAGE - AB	Volts	3.914	3.965	3.859	3.858	3.862
581	MOTOR VOLTAGE - AC	Volts	3.924	3.976	3.862	3.860	3.866
582	MOTOR VOLTAGE - CB	Volts	3.907	3.953	3.853	3.850	3.857
583	MOTOR CURRENT - A	Volts	2.268	2.204	2.025	2.036	2.016
584	MOTOR CURRENT - B	Volts	2.373	2.287	2.130	2.124	2.117
585	MOTOR CURRENT - C	Volts	2.218	2.145	1.953	1.952	1.954
586	MOTOR POWER - PHASE 1	Volts	1.037	0.993	0.920	0.919	0.913
587	MOTOR POWER - PHASE 3	Volts	1.732	1.698	1.507	1.507	1.510
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	29.71	26.80	26.37	29.08	31.69
601	MAXIMUM MOTOR TEMPERATURE	Deg C	62.50	64.22	66.27	53.11	50.88
605	1st STAGE VANE SETTING	Degrees	70	70	40	40	40
607	3rd STAGE VANE SETTING	Degrees	63	63	50	50	50
608	UNIT HOUR METER READING	Hr	474	475	475	476	477
609	UNIT START COUNTER READING		128	128	129	129	129
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	5	6	119	119	120
701	ENERGY BALANCE	%	-1.20	-1.17	-1.37	-1.34	-1.42
702	EVAP CAPACITY	KW	753.8	740.1	684.6	666.3	643.1
703	EVAP WATER FLOWRATE	L/s	31.7	31.7	31.7	31.7	31.6
704	COND WATER FLOWRATE	L/s	38.1	38.0	38.0	38.0	38.0

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	12.37	12.26	11.84	11.72	11.54
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	23.92	21.16	21.14	23.92	26.71
713	AVE LVG COND WATER TEMP	Deg C	29.77	26.90	26.43	29.10	31.74
715	MOTOR VOLTAGE - AB	Volts	470	476	463	463	463
716	MOTOR VOLTAGE - AC	Volts	471	477	463	463	464
717	MOTOR VOLTAGE - CB	Volts	469	474	462	462	463
718	MOTOR CURRENT - A	Amps	227	220	203	204	202
719	MOTOR CURRENT - B	Amps	237	229	213	212	212
720	MOTOR CURRENT - C	Amps	222	215	195	195	195
721	UNIT POWER	KW	166	161	146	146	145
722	AVERAGE VOLTAGE	Volts	470	476	463	463	463
723	AVERAGE CURRENT	Amps	229	221	204	204	203
725	Coefficient of Performance (COP)		4.537	4.584	4.701	4.577	4.423
730	EVAP DELTA T	Deg C	5.68	5.57	5.15	5.02	4.84
731	COND DELTA T	Deg C	5.86	5.74	5.30	5.19	5.04
735	EVAP WATER FLOWRATE	Kg/sec	31.66	31.72	31.72	31.66	31.62
736	COND WATER FLOWRATE	Kg/sec	38.01	37.95	37.92	37.88	37.90
740	EVAP CAPACITY	KW	754.0	740.2	684.7	666.4	643.0
741	COND CAPACITY	KW	929.2	910.3	839.6	820.9	797.5
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.55	0.48	2.21	2.29	2.41
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	34.78	31.81	30.62	33.18	35.70
750	RUNNING TIME	Hr	145	146	147	147	148
751	STARTS		33	33	34	34	34
752	EVAP APPROACH TEMP	Deg C	5.17	6.22	4.50	4.39	4.28
753	COND APPROACH TEMP	Deg C	5.00	4.89	4.17	4.06	3.94
800	EVAP AVG H2O TEMP	Deg C	9.53	9.48	9.27	9.21	9.12
801	EVAP WATER DENSITY	Kg/M3	1000	1000	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.32	1.32	1.33	1.33	1.33
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.586	0.586	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	26.84	24.03	23.79	26.51	29.23
811	COND WATER DENSITY	Kg/M3	997	998	998	997	997
812	COND H2O VISCOSITY	cp	0.85	0.91	0.92	0.86	0.81
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.614	0.609	0.609	0.613	0.617
815	ITD/DELTA T		1.91	2.11	1.87	1.88	1.88
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.00	0.02	0.01	0.01	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.01	0.01	0.01	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.03	0.03	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.01	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.07	0.11	0.07	0.03	0.05

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		170	171	172	173	174
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	40
Capacity	KW	613.9	579.4	534.8	474.7	281.3
Power	KW	143.4	140.4	135.4	127.9	100.3
Coefficient of Performance (COP)		4.281	4.127	3.951	3.711	2.805
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.69
Condenser Entering Water Temperature	Deg C	29.46	32.23	35.02	37.81	40.51
Energy Balance	%	-1.28	-0.96	-0.92	-0.88	-0.50
Evaporator Entering Water Temperature	Deg C	11.3	11.0	10.7	10.3	8.8
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.69
Evaporator Water Flow Rate	L/s	31.5	31.8	31.8	31.8	31.7
Condenser Entering Water Temperature	Deg C	29.46	32.23	35.02	37.81	40.51
Condenser Leaving Water Temperature	Deg C	34.30	36.82	39.30	41.65	42.93
Condenser Water Flow Rate	L/s	38.0	38.0	38.0	38.1	38.1
Evap Sat Press	kPa	36.89	37.23	37.58	38.13	39.99
Sat Temp	Deg C	2.59	2.79	3.01	3.33	4.43
Approach	Deg C	4.11	3.89	3.67	3.33	2.28
LMTD	Deg C	6.13	5.81	5.44	4.92	3.20
ITD/Delta T		1.88	1.90	1.92	1.94	2.07
Q/Ao	kW/m2	40.06	37.81	34.90	30.97	18.36
Uo	kW/m2 C	6.54	6.51	6.41	6.29	5.73
ho'	kW/m2 C	10.42	10.33	10.08	9.80	8.54
Cond Sat Press	kPa	144.51	156.10	167.54	178.30	178.16
Sat Temp	Deg C	38.04	40.37	42.53	44.46	44.43
Approach	Deg C	3.72	3.56	3.22	2.78	1.50
Refrigerant Leaving Temp	Deg C	37.90	39.86	41.91	43.72	43.57
LMTD	Deg C	5.83	5.53	5.07	4.45	2.52
Q/Ao	kW/m2	39.94	37.87	35.24	31.67	20.00
Uo	kW/m2 C	6.85	6.85	6.95	7.11	7.93
ho'	kW/m2 C	10.40	10.30	10.44	10.70	12.57
Cond Sat Temp	Deg C	38.04	40.37	42.53	44.46	44.43
Evap Sat Temp	Deg C	2.59	2.79	3.01	3.33	4.43
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.95
Estimated Motor Rev/sec (1)		59.28	59.30	59.33	59.37	59.52
Compressor Suction Flow Rate (2)	m3/sec	1.467	1.379	1.267	1.113	0.631
Isentropic COP (2)		0.51	0.54	0.57	0.59	0.57
Adiabatic Efficiency (3)		0.62	0.63	0.63	0.62	0.46
Q/N - m3/rev (4)		0.87	0.82	0.75	0.66	0.37
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	119.55	121.49	121.42	121.49	121.07
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.35	11.06	10.72	10.27	8.82
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.31	11.03	10.68	10.23	8.78
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.71	6.69	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	172.78	172.78	172.51	173.20	172.85
17	ENT COND WATER TEMP LOC 1	Deg C	29.46	32.22	35.01	37.79	40.49
18	ENT COND WATER TEMP LOC 2	Deg C	29.46	32.23	35.03	37.83	40.53
19	LVG COND WATER TEMP LOC 1	Deg C	34.29	36.81	39.29	41.64	42.93
20	LVG COND WATER TEMP LOC 2	Deg C	34.30	36.82	39.31	41.66	42.94
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.06	4.19	4.47	4.77	5.83
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.57	4.53	4.84	5.03	6.09
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	5.26	5.30	5.67	5.94	6.86
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	36.89	37.23	37.58	38.13	39.99
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	58.54	60.60	62.88	65.29	66.67
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	58.74	60.95	63.29	65.71	68.19
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	55.16	57.78	60.67	63.57	66.33
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	89.98	91.77	97.56	102.52	102.39
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	89.63	95.84	102.39	107.08	109.97
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	91.49	96.46	100.94	107.01	111.07
431	COND SHELL STATIC PRESS - AVERAGE	kPa	144.51	156.10	167.54	178.30	178.16
440	REFRIGERANT LVG COND TEMP	Deg C	37.90	39.86	41.91	43.72	43.57
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	98.32	103.77	109.49	115.00	116.31
485	HIGH PRESS ECONOMIZER TEMP	Deg C	26.84	28.37	29.84	31.22	31.54
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	59.16	61.29	63.78	65.84	66.88
487	LOW PRESS ECONOMIZER TEMP	Deg C	13.66	14.63	15.54	16.34	16.72
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	48.33	48.95	49.30	49.64	49.44
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	13.71	14.61	15.51	16.19	16.38
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	59.57	61.85	63.91	65.57	65.98
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.96	9.16	9.31	9.35	9.26
534	ENT COND ORIFICE ASS'Y PRESS	kPa	145.00	155.82	167.47	177.95	176.99
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	38.14	40.36	42.44	44.28	44.18
536	LVG COND ORIFICE ASS'Y PRESS	kPa	112.18	118.04	123.69	128.72	127.55
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	31.19	32.70	34.08	35.11	34.24
560	ATMOSPHERIC PRESS	kPa	98.73	98.73	98.73	98.73	98.73
580	MOTOR VOLTAGE - AB	Volts	3.845	3.831	3.856	3.864	3.863
581	MOTOR VOLTAGE - AC	Volts	3.849	3.836	3.861	3.867	3.865
582	MOTOR VOLTAGE - CB	Volts	3.837	3.824	3.848	3.858	3.859
583	MOTOR CURRENT - A	Volts	2.003	1.962	1.899	1.793	1.451
584	MOTOR CURRENT - B	Volts	2.095	2.062	1.987	1.888	1.540
585	MOTOR CURRENT - C	Volts	1.934	1.902	1.836	1.735	1.417
586	MOTOR POWER - PHASE 1	Volts	0.903	0.885	0.842	0.785	0.591
587	MOTOR POWER - PHASE 3	Volts	1.487	1.455	1.414	1.347	1.080
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	34.28	36.84	39.29	41.63	42.96
601	MAXIMUM MOTOR TEMPERATURE	Deg C	50.28	49.17	48.61	46.39	39.17
605	1st STAGE VANE SETTING	Degrees	40	40	40	40	40
607	3rd STAGE VANE SETTING	Degrees	50	50	50	50	50
608	UNIT HOUR METER READING	Hr	477	477	478	478	478
609	UNIT START COUNTER READING		129	129	129	129	129
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	121	121	121	121	122
701	ENERGY BALANCE	%	-1.28	-0.96	-0.92	-0.88	-0.50
702	EVAP CAPACITY	KW	613.9	579.4	534.8	474.7	281.3
703	EVAP WATER FLOWRATE	L/s	31.5	31.8	31.8	31.8	31.7
704	COND WATER FLOWRATE	L/s	38.0	38.0	38.0	38.1	38.1

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.33	11.04	10.70	10.25	8.80
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	29.46	32.23	35.02	37.81	40.51
713	AVE LVG COND WATER TEMP	Deg C	34.30	36.82	39.30	41.65	42.93
715	MOTOR VOLTAGE - AB	Volts	461	460	463	464	464
716	MOTOR VOLTAGE - AC	Volts	462	460	463	464	464
717	MOTOR VOLTAGE - CB	Volts	460	459	462	463	463
718	MOTOR CURRENT - A	Amps	200	196	190	179	145
719	MOTOR CURRENT - B	Amps	210	206	199	189	154
720	MOTOR CURRENT - C	Amps	193	190	184	174	142
721	UNIT POWER	KW	143	140	135	128	100
722	AVERAGE VOLTAGE	Volts	461	460	463	464	464
723	AVERAGE CURRENT	Amps	201	198	191	181	147
725	Coefficient of Performance (COP)		4.281	4.127	3.951	3.711	2.805
730	EVAP DELTA T	Deg C	4.64	4.35	4.02	3.56	2.12
731	COND DELTA T	Deg C	4.84	4.59	4.28	3.84	2.42
735	EVAP WATER FLOWRATE	Kg/sec	31.53	31.80	31.78	31.79	31.74
736	COND WATER FLOWRATE	Kg/sec	37.86	37.85	37.81	37.87	37.81
740	EVAP CAPACITY	KW	613.8	579.4	534.7	474.5	281.3
741	COND CAPACITY	KW	765.1	725.3	674.9	606.7	383.0
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.59	2.79	3.01	3.33	4.43
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	38.04	40.37	42.53	44.46	44.43
750	RUNNING TIME	Hr	148	149	149	149	150
751	STARTS		34	34	34	34	34
752	EVAP APPROACH TEMP	Deg C	4.11	3.89	3.67	3.33	2.28
753	COND APPROACH TEMP	Deg C	3.72	3.56	3.22	2.78	1.50
800	EVAP AVG H2O TEMP	Deg C	9.01	8.87	8.69	8.47	7.74
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.34	1.34	1.35	1.36	1.39
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.585	0.585	0.585	0.584	0.583
810	COND AVG H2O TEMP	Deg C	31.88	34.52	37.16	39.73	41.72
811	COND WATER DENSITY	Kg/M3	996	995	994	993	992
812	COND H2O VISCOSITY	cp	0.77	0.73	0.69	0.65	0.63
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.621	0.624	0.628	0.631	0.633
815	ITD/DELTA T		1.88	1.90	1.92	1.94	2.07
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.01	-0.02	-0.02	-0.04	-0.04
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.01	-0.01	-0.02	-0.02	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.04	0.03	0.04	0.04	0.04
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.02	-0.03	0.00	0.01	-0.03

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		175	176	177	178	179
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	10	10	10	10
Capacity	KW	230.3	201.5	226.1	242.6	255.6
Power	KW	90.7	74.1	73.0	72.5	71.4
Coefficient of Performance (COP)		2.539	2.719	3.097	3.347	3.580
Evaporator Leaving Water Temperature	Deg C	6.68	6.69	6.69	6.69	6.69
Condenser Entering Water Temperature	Deg C	41.33	35.02	32.24	29.46	26.71
Energy Balance	%	-1.48	-3.24	-3.05	-2.67	-2.63
Evaporator Entering Water Temperature	Deg C	8.4	8.2	8.4	8.5	8.6
Evaporator Leaving Water Temperature	Deg C	6.68	6.69	6.69	6.69	6.69
Evaporator Water Flow Rate	L/s	31.7	31.7	31.7	31.7	31.7
Condenser Entering Water Temperature	Deg C	41.33	35.02	32.24	29.46	26.71
Condenser Leaving Water Temperature	Deg C	43.39	36.80	34.18	31.49	28.82
Condenser Water Flow Rate	L/s	38.1	38.1	38.0	38.0	38.0
Evap Sat Press	kPa	42.68	40.75	40.47	40.27	40.13
Sat Temp	Deg C	5.93	4.86	4.71	4.58	4.51
Approach	Deg C	0.72	1.83	2.00	2.11	2.17
LMTD	Deg C	1.44	2.51	2.74	2.92	3.05
ITD/Delta T		1.43	2.21	2.17	2.16	2.14
Q/Ao	kW/m2	15.03	13.14	14.75	15.84	16.69
Uo	kW/m2 C	10.43	5.23	5.38	5.42	5.47
ho'	kW/m2 C	26.04	7.47	7.78	7.87	7.98
Cond Sat Press	kPa	178.16	141.89	130.72	119.42	108.73
Sat Temp	Deg C	44.43	37.50	35.10	32.47	29.82
Approach	Deg C	1.06	0.72	0.94	1.00	1.00
Refrigerant Leaving Temp	Deg C	43.66	37.10	34.73	32.33	29.87
LMTD	Deg C	1.89	1.41	1.71	1.81	1.85
Q/Ao	kW/m2	16.94	14.72	15.97	16.79	17.43
Uo	kW/m2 C	8.99	10.45	9.33	9.29	9.40
ho'	kW/m2 C	15.37	21.17	17.29	17.46	18.16
Cond Sat Temp	Deg C	44.43	37.50	35.10	32.47	29.82
Evap Sat Temp	Deg C	5.93	4.86	4.71	4.58	4.51
Estimated Motor Efficiency (1)		0.95	0.95	0.95	0.95	0.95
Estimated Motor Rev/sec (1)		59.56	59.65	59.65	59.65	59.66
Compressor Suction Flow Rate (2)	m3/sec	0.486	0.438	0.492	0.528	0.555
Isentropic COP (2)		0.54	0.46	0.42	0.39	0.35
Adiabatic Efficiency (3)		0.39	0.35	0.37	0.37	0.36
Q/N - m3/rev (4)		0.29	0.26	0.29	0.31	0.33
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	120.73	120.86	120.86	120.93	120.93
3	ENT EVAP WATER TEMP LOC 1	Deg C	8.45	8.23	8.41	8.53	8.63
4	ENT EVAP WATER TEMP LOC 2	Deg C	8.38	8.18	8.37	8.49	8.60
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69	6.69	6.69	6.71
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.69	6.68	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	172.71	172.99	172.71	172.51	172.64
17	ENT COND WATER TEMP LOC 1	Deg C	41.32	34.99	32.23	29.46	26.70
18	ENT COND WATER TEMP LOC 2	Deg C	41.36	35.04	32.24	29.47	26.72
19	LVG COND WATER TEMP LOC 1	Deg C	43.38	36.78	34.17	31.49	28.82
20	LVG COND WATER TEMP LOC 2	Deg C	43.41	36.82	34.18	31.50	28.82
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	6.09	7.82	7.78	7.54	7.43
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	6.35	6.52	6.38	6.38	6.16
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	7.14	7.41	7.27	7.13	6.93
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	42.68	40.75	40.47	40.27	40.13
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	68.33	56.67	53.02	49.57	46.47
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	68.74	57.78	54.05	50.75	47.44
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	66.95	56.12	52.33	48.81	45.64
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	102.52	80.74	71.64	63.85	56.95
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	109.76	87.77	79.36	71.98	65.57
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	111.97	92.87	84.87	77.43	70.81
431	COND SHELL STATIC PRESS - AVERAGE	kPa	178.16	141.89	130.72	119.42	108.73
440	REFRIGERANT LVG COND TEMP	Deg C	43.66	37.10	34.73	32.33	29.87
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	116.66	100.32	93.91	87.63	82.05
485	HIGH PRESS ECONOMIZER TEMP	Deg C	31.62	27.42	25.56	23.74	22.14
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	67.64	56.67	53.02	49.50	46.40
487	LOW PRESS ECONOMIZER TEMP	Deg C	17.47	12.61	10.99	9.37	7.85
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	52.61	46.26	45.09	43.99	42.95
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	17.56	12.32	10.78	9.25	7.81
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	66.19	55.99	52.61	49.50	46.61
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.48	7.66	7.01	6.48	5.95
534	ENT COND ORIFICE ASS'Y PRESS	kPa	176.92	141.27	130.24	119.14	108.73
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	44.24	37.46	35.05	32.47	29.89
536	LVG COND ORIFICE ASS'Y PRESS	kPa	126.79	108.25	100.94	94.11	87.84
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	34.12	29.54	27.68	25.75	23.96
560	ATMOSPHERIC PRESS	kPa	98.73	98.73	98.73	98.73	98.73
580	MOTOR VOLTAGE - AB	Volts	3.863	3.889	3.864	3.865	3.862
581	MOTOR VOLTAGE - AC	Volts	3.865	3.892	3.868	3.868	3.867
582	MOTOR VOLTAGE - CB	Volts	3.858	3.881	3.859	3.857	3.859
583	MOTOR CURRENT - A	Volts	1.321	1.139	1.120	1.120	1.101
584	MOTOR CURRENT - B	Volts	1.433	1.227	1.216	1.207	1.198
585	MOTOR CURRENT - C	Volts	1.318	1.128	1.121	1.108	1.098
586	MOTOR POWER - PHASE 1	Volts	0.517	0.373	0.368	0.368	0.358
587	MOTOR POWER - PHASE 3	Volts	0.995	0.862	0.849	0.840	0.832
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	43.33	36.71	34.18	31.45	28.79
601	MAXIMUM MOTOR TEMPERATURE	Deg C	36.94	29.72	28.06	26.39	24.72
605	1st STAGE VANE SETTING	Degrees	40	10	10	10	10
607	3rd STAGE VANE SETTING	Degrees	50	19	19	19	19
608	UNIT HOUR METER READING	Hr	479	479	480	480	480
609	UNIT START COUNTER READING		129	129	129	129	129
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	122	123	123	123	124
701	ENERGY BALANCE	%	-1.48	-3.24	-3.05	-2.67	-2.63
702	EVAP CAPACITY	KW	230.3	201.5	226.1	242.6	255.6
703	EVAP WATER FLOWRATE	L/s	31.7	31.7	31.7	31.7	31.7
704	COND WATER FLOWRATE	L/s	38.1	38.1	38.0	38.0	38.0

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	8.41	8.21	8.38	8.51	8.62
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.69	6.69	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	41.33	35.02	32.24	29.46	26.71
713	AVE LVG COND WATER TEMP	Deg C	43.39	36.80	34.18	31.49	28.82
715	MOTOR VOLTAGE - AB	Volts	464	467	464	464	463
716	MOTOR VOLTAGE - AC	Volts	464	467	464	464	464
717	MOTOR VOLTAGE - CB	Volts	463	466	463	463	463
718	MOTOR CURRENT - A	Amps	132	114	112	112	110
719	MOTOR CURRENT - B	Amps	143	123	122	121	120
720	MOTOR CURRENT - C	Amps	132	113	112	111	110
721	UNIT POWER	KW	91	74	73	72	71
722	AVERAGE VOLTAGE	Volts	464	467	464	464	464
723	AVERAGE CURRENT	Amps	136	116	115	115	113
725	Coefficient of Performance (COP)		2.539	2.719	3.097	3.347	3.580
730	EVAP DELTA T	Deg C	1.73	1.52	1.70	1.82	1.92
731	COND DELTA T	Deg C	2.06	1.78	1.93	2.03	2.11
735	EVAP WATER FLOWRATE	Kg/sec	31.69	31.71	31.71	31.72	31.72
736	COND WATER FLOWRATE	Kg/sec	37.79	37.86	37.84	37.83	37.86
740	EVAP CAPACITY	KW	230.4	201.3	226.1	242.7	255.7
741	COND CAPACITY	KW	324.5	281.9	306.0	321.7	333.8
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	5.93	4.86	4.71	4.58	4.51
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	44.43	37.50	35.10	32.47	29.82
750	RUNNING TIME	Hr	150	150	151	151	152
751	STARTS		34	34	34	34	34
752	EVAP APPROACH TEMP	Deg C	0.72	1.83	2.00	2.11	2.17
753	COND APPROACH TEMP	Deg C	1.06	0.72	0.94	1.00	1.00
800	EVAP AVG H2O TEMP	Deg C	7.54	7.45	7.53	7.60	7.66
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.39	1.40	1.39	1.39	1.39
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.583	0.583	0.583	0.583	0.583
810	COND AVG H2O TEMP	Deg C	42.37	35.91	33.21	30.48	27.77
811	COND WATER DENSITY	Kg/M3	992	994	995	996	997
812	COND H2O VISCOSITY	cp	0.62	0.71	0.74	0.79	0.84
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.634	0.626	0.622	0.619	0.615
815	ITD/DELTA T		1.43	2.21	2.17	2.16	2.14
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.04	-0.06	-0.01	-0.01	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.03	-0.03	-0.01	-0.01	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.07	0.04	0.04	0.04	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	-0.01	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.04	0.08	-0.01	0.04	0.03

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm				
Run Number		180	181	
Refrigerant		123	123	
Oil		Solest 68	Solest 68	
1st Stage Guide Vane Setting	Degrees	10	10	
Capacity	KW	264.8	272.5	
Power	KW	69.8	68.5	
Coefficient of Performance (COP)		3.791	3.980	
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	
Condenser Entering Water Temperature	Deg C	23.91	21.13	
Energy Balance	%	-2.40	-2.04	
Evaporator Entering Water Temperature	Deg C	8.7	8.7	
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	
Evaporator Water Flow Rate	L/s	31.7	31.8	
Condenser Entering Water Temperature	Deg C	23.91	21.13	
Condenser Leaving Water Temperature	Deg C	26.07	23.32	
Condenser Water Flow Rate	L/s	37.9	37.8	
Evap Sat Press	kPa	40.06	39.78	
Sat Temp	Deg C	4.47	4.31	
Approach	Deg C	2.22	2.39	
LMTD	Deg C	3.12	3.30	
ITD/Delta T		2.11	2.17	
Q/Ao	kW/m2	17.28	17.78	
Uo	kW/m2 C	5.54	5.39	
ho'	kW/m2 C	8.13	7.79	
Cond Sat Press	kPa	98.39	91.36	
Sat Temp	Deg C	27.04	25.02	
Approach	Deg C	0.94	1.67	
Refrigerant Leaving Temp	Deg C	27.27	24.72	
LMTD	Deg C	1.84	2.64	
Q/Ao	kW/m2	17.80	18.08	
Uo	kW/m2 C	9.67	6.85	
ho'	kW/m2 C	19.60	10.79	
Cond Sat Temp	Deg C	27.04	25.02	
Evap Sat Temp	Deg C	4.47	4.31	
Estimated Motor Efficiency (1)		0.95	0.95	
Estimated Motor Rev/sec (1)		59.67	59.67	
Compressor Suction Flow Rate (2)	m3/sec	0.573	0.592	
Isentropic COP (2)		0.31	0.29	
Adiabatic Efficiency (3)		0.34	0.33	
Q/N - m3/rev (4)		0.34	0.35	
(1) From motor curves at measured power input				
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split				
(3) Ratio of isentropic and test KW/T				
(4) CFM from cycle calculation / estimated motor RPM				
(5) Heat transfer coefficient calculations use bulk fluid properties				

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	121.14	121.35
3	ENT EVAP WATER TEMP LOC 1	Deg C	8.70	8.75
4	ENT EVAP WATER TEMP LOC 2	Deg C	8.66	8.71
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.70	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	172.16	171.75
17	ENT COND WATER TEMP LOC 1	Deg C	23.91	21.13
18	ENT COND WATER TEMP LOC 2	Deg C	23.91	21.12
19	LVG COND WATER TEMP LOC 1	Deg C	26.07	23.33
20	LVG COND WATER TEMP LOC 2	Deg C	26.07	23.32
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	7.41	7.19
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	6.12	6.10
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	6.81	6.62
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	40.06	39.78
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	43.99	41.44
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	45.02	42.26
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	43.23	40.61
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	50.75	44.82
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	58.95	53.78
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	64.67	59.09
431	COND SHELL STATIC PRESS - AVERAGE	kPa	98.39	91.36
440	REFRIGERANT LVG COND TEMP	Deg C	27.27	24.72
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	77.01	72.33
485	HIGH PRESS ECONOMIZER TEMP	Deg C	20.69	19.27
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	44.06	41.58
487	LOW PRESS ECONOMIZER TEMP	Deg C	6.62	5.28
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	42.26	41.37
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	6.63	5.32
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	44.40	42.26
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	5.73	5.04
534	ENT COND ORIFICE ASS'Y PRESS	kPa	98.53	89.08
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	27.16	24.49
536	LVG COND ORIFICE ASS'Y PRESS	kPa	82.12	76.88
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	22.26	20.52
560	ATMOSPHERIC PRESS	kPa	98.73	98.66
580	MOTOR VOLTAGE - AB	Volts	3.866	3.872
581	MOTOR VOLTAGE - AC	Volts	3.869	3.875
582	MOTOR VOLTAGE - CB	Volts	3.862	3.868
583	MOTOR CURRENT - A	Volts	1.081	1.068
584	MOTOR CURRENT - B	Volts	1.187	1.166
585	MOTOR CURRENT - C	Volts	1.084	1.071
586	MOTOR POWER - PHASE 1	Volts	0.346	0.332
587	MOTOR POWER - PHASE 3	Volts	0.818	0.809
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	26.02	23.27
601	MAXIMUM MOTOR TEMPERATURE	Deg C	25.28	28.06
605	1st STAGE VANE SETTING	Degrees	10	10
607	3rd STAGE VANE SETTING	Degrees	19	19
608	UNIT HOUR METER READING	Hr	481	481
609	UNIT START COUNTER READING		129	129
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3
700	TIME (HOURS)	HOURS	124	125
701	ENERGY BALANCE	%	-2.40	-2.04
702	EVAP CAPACITY	KW	264.8	272.5
703	EVAP WATER FLOWRATE	L/s	31.7	31.8
704	COND WATER FLOWRATE	L/s	37.9	37.8

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	8.68	8.73
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	23.91	21.13
713	AVE LVG COND WATER TEMP	Deg C	26.07	23.32
715	MOTOR VOLTAGE - AB	Volts	464	465
716	MOTOR VOLTAGE - AC	Volts	464	465
717	MOTOR VOLTAGE - CB	Volts	463	464
718	MOTOR CURRENT - A	Amps	108	107
719	MOTOR CURRENT - B	Amps	119	117
720	MOTOR CURRENT - C	Amps	108	107
721	UNIT POWER	KW	70	68
722	AVERAGE VOLTAGE	Volts	464	465
723	AVERAGE CURRENT	Amps	112	110
725	Coefficient of Performance (COP)		3.791	3.980
730	EVAP DELTA T	Deg C	1.99	2.04
731	COND DELTA T	Deg C	2.16	2.19
735	EVAP WATER FLOWRATE	Kg/sec	31.74	31.77
736	COND WATER FLOWRATE	Kg/sec	37.82	37.78
740	EVAP CAPACITY	KW	264.7	272.4
741	COND CAPACITY	KW	340.9	346.4
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	4.47	4.31
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	27.04	25.02
750	RUNNING TIME	Hr	152	152
751	STARTS		34	34
752	EVAP APPROACH TEMP	Deg C	2.22	2.39
753	COND APPROACH TEMP	Deg C	0.94	1.67
800	EVAP AVG H2O TEMP	Deg C	7.69	7.71
801	EVAP WATER DENSITY	Kg/M3	1001	1001
802	EVAP H2O VISCOSITY	cp	1.39	1.39
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.583	0.583
810	COND AVG H2O TEMP	Deg C	24.99	22.22
811	COND WATER DENSITY	Kg/M3	998	998
812	COND H2O VISCOSITY	cp	0.89	0.95
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.611	0.607
815	ITD/DELTA T		2.11	2.17
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.00	0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.04	0.04
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.06	0.06

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		182	183	184	185	186
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	784.4	743.3	690.5	626.5	524.2
Power	KW	151.9	148.9	143.4	136.4	122.8
Coefficient of Performance (COP)		5.163	4.993	4.816	4.594	4.268
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.71	6.69	6.69
Condenser Entering Water Temperature	Deg C	21.15	23.92	26.74	29.47	32.26
Energy Balance	%	-1.13	-1.12	-1.42	-1.29	-1.51
Evaporator Entering Water Temperature	Deg C	12.8	12.5	12.0	11.5	10.7
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.71	6.69	6.69
Evaporator Water Flow Rate	L/s	30.5	30.4	30.9	30.9	30.8
Condenser Entering Water Temperature	Deg C	21.15	23.92	26.74	29.47	32.26
Condenser Leaving Water Temperature	Deg C	27.14	29.62	32.08	34.35	36.40
Condenser Water Flow Rate	L/s	37.8	37.9	38.0	38.0	38.0
Evap Sat Press	kPa	37.09	37.65	38.20	38.75	39.85
Sat Temp	Deg C	1.14	1.47	1.79	2.11	2.73
Approach	Deg C	5.56	5.22	4.94	4.61	3.94
LMTD	Deg C	8.25	7.79	7.26	6.72	5.75
ITD/Delta T		1.90	1.90	1.92	1.95	1.98
Q/Ao	kW/m2	51.20	48.52	45.06	40.88	34.20
Uo	kW/m2 C	6.21	6.23	6.20	6.08	5.95
ho'	kW/m2 C	9.70	9.78	9.66	9.38	9.08
Cond Sat Press	kPa	130.72	141.48	152.10	162.23	170.30
Sat Temp	Deg C	32.44	34.67	36.74	38.62	40.05
Approach	Deg C	5.28	5.06	4.67	4.28	3.67
Refrigerant Leaving Temp	Deg C	31.66	33.90	36.05	37.39	38.79
LMTD	Deg C	7.92	7.54	6.99	6.40	5.46
Q/Ao	kW/m2	49.35	47.02	44.04	40.25	34.19
Uo	kW/m2 C	6.23	6.23	6.30	6.28	6.26
ho'	kW/m2 C	9.28	9.20	9.26	9.15	9.03
Cond Sat Temp	Deg C	32.44	34.67	36.74	38.62	40.05
Evap Sat Temp	Deg C	1.14	1.47	1.79	2.11	2.73
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)		59.23	59.25	59.28	59.32	59.40
Compressor Suction Flow Rate (2)	m3/sec	1.813	1.702	1.566	1.407	1.149
Isentropic COP (2)		0.45	0.48	0.50	0.52	0.53
Adiabatic Efficiency (3)		0.66	0.68	0.68	0.68	0.65
Q/N - m3/rev (4)		1.08	1.01	0.93	0.84	0.68
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	111.76	111.01	114.73	114.59	114.04
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.84	12.54	12.06	11.55	10.76
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.82	12.53	12.03	11.52	10.73
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.70	6.71	6.72	6.71	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.69	6.69	6.70	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	171.61	172.44	172.44	172.44	172.64
17	ENT COND WATER TEMP LOC 1	Deg C	21.15	23.92	26.73	29.46	32.24
18	ENT COND WATER TEMP LOC 2	Deg C	21.15	23.92	26.75	29.48	32.27
19	LVG COND WATER TEMP LOC 1	Deg C	27.14	29.62	32.08	34.34	36.39
20	LVG COND WATER TEMP LOC 2	Deg C	27.14	29.61	32.08	34.36	36.41
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	2.47	2.73	3.09	3.47	5.87
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	2.26	2.57	2.92	3.29	4.48
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	2.36	2.67	2.99	3.38	5.22
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	37.09	37.65	38.20	38.75	39.85
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	59.29	61.02	63.02	65.02	67.15
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	59.71	61.50	63.50	65.50	67.57
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	55.23	57.43	59.98	62.67	65.50
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	83.43	87.29	90.67	94.73	99.56
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	92.04	96.73	101.63	106.80	111.14
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	85.63	91.08	96.53	102.11	105.56
431	COND SHELL STATIC PRESS - AVERAGE	kPa	130.72	141.48	152.10	162.23	170.30
440	REFRIGERANT LVG COND TEMP	Deg C	31.66	33.90	36.05	37.39	38.79
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	89.36	94.66	100.32	105.83	110.80
485	HIGH PRESS ECONOMIZER TEMP	Deg C	21.72	23.21	24.73	26.14	27.34
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	59.23	61.50	63.29	65.71	67.36
487	LOW PRESS ECONOMOMIZER TEMP	Deg C	11.79	12.61	13.46	14.29	14.85
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	49.92	50.19	50.81	51.37	51.16
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	11.87	12.66	13.46	14.25	14.74
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	60.26	61.85	63.78	65.84	67.15
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.13	8.32	8.45	8.57	8.43
534	ENT COND ORIFICE ASS'Y PRESS	kPa	131.83	141.82	152.24	162.16	169.68
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	32.00	34.12	36.17	37.93	39.24
536	LVG COND ORIFICE ASS'Y PRESS	kPa	105.63	111.63	116.87	122.24	125.69
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	26.42	27.82	29.08	30.27	30.88
560	ATMOSPHERIC PRESS	kPa	99.22	99.22	99.22	99.22	99.22
580	MOTOR VOLTAGE - AB	Volts	3.943	3.921	3.920	3.922	3.933
581	MOTOR VOLTAGE - AC	Volts	3.953	3.931	3.928	3.931	3.942
582	MOTOR VOLTAGE - CB	Volts	3.930	3.906	3.909	3.908	3.919
583	MOTOR CURRENT - A	Volts	2.093	2.063	1.990	1.899	1.767
584	MOTOR CURRENT - B	Volts	2.165	2.122	2.064	1.971	1.810
585	MOTOR CURRENT - C	Volts	2.035	2.007	1.932	1.854	1.695
586	MOTOR POWER - PHASE 1	Volts	0.931	0.913	0.876	0.824	0.726
587	MOTOR POWER - PHASE 3	Volts	1.601	1.568	1.514	1.449	1.321
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	27.09	29.58	32.02	34.31	36.39
601	MAXIMUM MOTOR TEMPERATURE	Deg C	49.17	48.06	45.28	44.17	40.83
605	1st STAGE VANE SETTING	Degrees	90	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68	68
608	UNIT HOUR METER READING	Hr	486	487	487	488	488
609	UNIT START COUNTER READING		131	131	131	131	131
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	0	0	1	1	2
701	ENERGY BALANCE	%	-1.13	-1.12	-1.42	-1.29	-1.51
702	EVAP CAPACITY	KW	784.4	743.3	690.5	626.5	524.2
703	EVAP WATER FLOWRATE	L/s	30.5	30.4	30.9	30.9	30.8
704	COND WATER FLOWRATE	L/s	37.8	37.9	38.0	38.0	38.0

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	12.83	12.53	12.04	11.54	10.74
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.71	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	21.15	23.92	26.74	29.47	32.26
713	AVE LVG COND WATER TEMP	Deg C	27.14	29.62	32.08	34.35	36.40
715	MOTOR VOLTAGE - AB	Volts	473	471	470	471	472
716	MOTOR VOLTAGE - AC	Volts	474	472	471	472	473
717	MOTOR VOLTAGE - CB	Volts	472	469	469	469	470
718	MOTOR CURRENT - A	Amps	209	206	199	190	177
719	MOTOR CURRENT - B	Amps	217	212	206	197	181
720	MOTOR CURRENT - C	Amps	204	201	193	185	170
721	UNIT POWER	KW	152	149	143	136	123
722	AVERAGE VOLTAGE	Volts	473	470	470	470	472
723	AVERAGE CURRENT	Amps	210	206	200	191	176
725	Coefficient of Performance (COP)		5.163	4.993	4.816	4.594	4.268
730	EVAP DELTA T	Deg C	6.14	5.84	5.33	4.84	4.06
731	COND DELTA T	Deg C	5.99	5.70	5.33	4.88	4.14
735	EVAP WATER FLOWRATE	Kg/sec	30.50	30.39	30.89	30.87	30.81
736	COND WATER FLOWRATE	Kg/sec	37.76	37.85	37.84	37.82	37.83
740	EVAP CAPACITY	KW	784.4	743.4	690.4	626.4	524.1
741	COND CAPACITY	KW	945.2	900.6	843.6	770.9	654.8
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.14	1.47	1.79	2.11	2.73
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	32.44	34.67	36.74	38.62	40.05
750	RUNNING TIME	Hr	158	158	158	159	159
751	STARTS		36	36	36	36	36
752	EVAP APPROACH TEMP	Deg C	5.56	5.22	4.94	4.61	3.94
753	COND APPROACH TEMP	Deg C	5.28	5.06	4.67	4.28	3.67
800	EVAP AVG H2O TEMP	Deg C	9.77	9.62	9.38	9.12	8.72
801	EVAP WATER DENSITY	Kg/M3	1000	1000	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.31	1.31	1.32	1.33	1.35
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.586	0.586	0.586	0.586	0.585
810	COND AVG H2O TEMP	Deg C	24.15	26.77	29.41	31.91	34.33
811	COND WATER DENSITY	Kg/M3	998	997	997	996	995
812	COND H2O VISCOSITY	cp	0.91	0.86	0.81	0.76	0.73
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.610	0.613	0.617	0.621	0.624
815	ITD/DELTA T		1.90	1.90	1.92	1.95	1.98
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.00	0.00	-0.02	-0.02	-0.03
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.01	0.01	-0.01	-0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.02	0.03	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.01	0.02	0.02	0.02	0.01
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.06	0.04	0.06	0.04	-0.01

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		187	188	189	190	191
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	70
Capacity	KW	503.5	603.3	668.4	722.2	769.3
Power	KW	118.0	131.0	138.6	143.4	147.1
Coefficient of Performance (COP)		4.268	4.605	4.822	5.036	5.229
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.68	6.69
Condenser Entering Water Temperature	Deg C	32.26	29.47	26.67	23.91	21.08
Energy Balance	%	-1.55	-1.34	-1.32	-1.23	-1.28
Evaporator Entering Water Temperature	Deg C	10.6	11.4	11.9	12.3	12.7
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.68	6.69
Evaporator Water Flow Rate	L/s	30.8	30.9	30.7	30.8	30.7
Condenser Entering Water Temperature	Deg C	32.26	29.47	26.67	23.91	21.08
Condenser Leaving Water Temperature	Deg C	36.24	34.17	31.83	29.44	26.95
Condenser Water Flow Rate	L/s	38.0	38.0	37.9	37.9	37.9
Evap Sat Press	kPa	40.13	38.96	38.33	37.78	37.30
Sat Temp	Deg C	2.88	2.22	1.87	1.54	1.26
Approach	Deg C	3.83	4.44	4.83	5.11	5.44
LMTD	Deg C	5.54	6.52	7.11	7.59	8.06
ITD/Delta T		1.98	1.96	1.93	1.92	1.91
Q/Ao	kW/m ²	32.87	39.37	43.61	47.13	50.21
Uo	kW/m ² C	5.94	6.04	6.13	6.21	6.23
ho'	kW/m ² C	9.06	9.28	9.52	9.68	9.74
Cond Sat Press	kPa	168.37	160.92	150.58	140.17	128.31
Sat Temp	Deg C	39.71	38.38	36.46	34.40	31.91
Approach	Deg C	3.44	4.22	4.61	4.94	4.94
Refrigerant Leaving Temp	Deg C	38.48	37.17	35.44	33.71	31.32
LMTD	Deg C	5.21	6.27	6.89	7.38	7.52
Q/Ao	kW/m ²	32.86	38.76	42.58	45.65	48.36
Uo	kW/m ² C	6.31	6.18	6.18	6.19	6.43
ho'	kW/m ² C	9.14	8.94	9.02	9.10	9.74
Cond Sat Temp	Deg C	39.71	38.38	36.46	34.40	31.91
Evap Sat Temp	Deg C	2.88	2.22	1.87	1.54	1.26
Estimated Motor Efficiency (1)		0.95	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)		59.42	59.35	59.31	59.28	59.26
Compressor Suction Flow Rate (2)	m ³ /sec	1.096	1.347	1.509	1.647	1.766
Isentropic COP (2)		0.52	0.52	0.49	0.47	0.44
Adiabatic Efficiency (3)		0.64	0.68	0.68	0.67	0.65
Q/N - m ³ /rev (4)		0.65	0.80	0.90	0.98	1.05
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	114.04	114.52	113.42	113.97	113.42
3	ENT EVAP WATER TEMP LOC 1	Deg C	10.61	11.36	11.89	12.29	12.68
4	ENT EVAP WATER TEMP LOC 2	Deg C	10.58	11.34	11.87	12.27	12.67
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.70	6.69	6.70	6.69	6.70
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68	6.67	6.69
15	COND WATER FLOWMETER DELTA P	kPa	172.44	172.23	172.30	172.51	171.89
17	ENT COND WATER TEMP LOC 1	Deg C	32.24	29.47	26.67	23.92	21.08
18	ENT COND WATER TEMP LOC 2	Deg C	32.27	29.47	26.67	23.91	21.08
19	LVG COND WATER TEMP LOC 1	Deg C	36.24	34.17	31.84	29.44	26.95
20	LVG COND WATER TEMP LOC 2	Deg C	36.24	34.18	31.83	29.44	26.95
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	6.01	5.48	5.13	4.91	4.53
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.57	4.07	3.64	3.47	3.04
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	5.30	4.63	4.37	4.11	3.57
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	40.13	38.96	38.33	37.78	37.30
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	66.88	64.74	62.40	60.54	58.74
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	67.29	65.16	62.88	60.95	59.02
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	65.29	62.47	59.57	57.16	54.68
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	98.66	95.08	89.91	89.08	83.77
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	110.87	106.94	102.11	97.63	92.11
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	105.28	101.01	96.11	91.08	84.67
431	COND SHELL STATIC PRESS - AVERAGE	kPa	168.37	160.92	150.58	140.17	128.31
440	REFRIGERANT LVG COND TEMP	Deg C	38.48	37.17	35.44	33.71	31.32
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	110.38	105.77	99.90	94.53	88.74
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.28	26.16	24.68	23.20	21.59
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	67.02	65.22	62.95	60.95	58.61
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.78	14.14	13.32	12.48	11.62
530	ENT EVAP ORIFICE ASSY PRESS	kPa	50.95	50.81	50.68	50.26	50.19
531	ENT EVAP ORIFICE ASSY TEMP	Deg C	14.59	14.08	13.28	12.52	11.74
532	LVG EVAP ORIFICE ASSY PRESS	kPa	66.67	65.29	63.16	61.29	58.95
533	LVG EVAP ORIFICE ASSY TEMP	Deg C	8.34	8.37	8.24	8.05	7.80
534	ENT COND ORIFICE ASSY PRESS	kPa	167.75	160.79	150.44	140.65	129.35
535	ENT COND ORIFICE ASSY TEMP	Deg C	38.88	37.73	35.89	33.89	31.62
536	LVG COND ORIFICE ASSY PRESS	kPa	124.11	120.93	116.59	110.80	104.11
537	LVG COND ORIFICE ASSY TEMP	Deg C	30.44	30.01	28.97	27.53	26.07
560	ATMOSPHERIC PRESS	kPa	99.22	99.22	99.22	99.22	99.90
580	MOTOR VOLTAGE - AB	Volts	3.937	3.943	3.955	3.948	3.894
581	MOTOR VOLTAGE - AC	Volts	3.945	3.953	3.963	3.956	3.911
582	MOTOR VOLTAGE - CB	Volts	3.921	3.930	3.941	3.931	3.889
583	MOTOR CURRENT - A	Volts	1.696	1.837	1.926	1.994	2.028
584	MOTOR CURRENT - B	Volts	1.739	1.901	1.992	2.051	2.115
585	MOTOR CURRENT - C	Volts	1.635	1.786	1.872	1.934	1.999
586	MOTOR POWER - PHASE 1	Volts	0.684	0.781	0.830	0.869	0.898
587	MOTOR POWER - PHASE 3	Volts	1.282	1.403	1.480	1.521	1.554
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	36.20	34.15	31.82	29.41	26.91
601	MAXIMUM MOTOR TEMPERATURE	Deg C	39.72	41.94	43.61	44.72	46.39
605	1st STAGE VANE SETTING	Degrees	70	70	70	70	70
607	3rd STAGE VANE SETTING	Degrees	63	63	63	63	63
608	UNIT HOUR METER READING	Hr	489	489	489	490	492
609	UNIT START COUNTER READING		131	131	131	131	132
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	2	3	3	3	21
701	ENERGY BALANCE	%	-1.55	-1.34	-1.32	-1.23	-1.28
702	EVAP CAPACITY	KW	503.5	603.3	668.4	722.2	769.3
703	EVAP WATER FLOWRATE	L/s	30.8	30.9	30.7	30.8	30.7
704	COND WATER FLOWRATE	L/s	38.0	38.0	37.9	37.9	37.9

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	10.59	11.35	11.88	12.28	12.67
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.68	6.69
712	AVE ENT COND WATER TEMP	Deg C	32.26	29.47	26.67	23.91	21.08
713	AVE LVG COND WATER TEMP	Deg C	36.24	34.17	31.83	29.44	26.95
715	MOTOR VOLTAGE - AB	Volts	472	473	475	474	467
716	MOTOR VOLTAGE - AC	Volts	473	474	476	475	469
717	MOTOR VOLTAGE - CB	Volts	471	472	473	472	467
718	MOTOR CURRENT - A	Amps	170	184	193	199	203
719	MOTOR CURRENT - B	Amps	174	190	199	205	212
720	MOTOR CURRENT - C	Amps	164	179	187	193	200
721	UNIT POWER	KW	118	131	139	143	147
722	AVERAGE VOLTAGE	Volts	472	473	474	473	468
723	AVERAGE CURRENT	Amps	169	184	193	199	205
725	Coefficient of Performance (COP)		4.268	4.605	4.822	5.036	5.229
730	EVAP DELTA T	Deg C	3.90	4.66	5.19	5.60	5.98
731	COND DELTA T	Deg C	3.99	4.70	5.17	5.53	5.87
735	EVAP WATER FLOWRATE	Kg/sec	30.81	30.86	30.71	30.79	30.71
736	COND WATER FLOWRATE	Kg/sec	37.81	37.80	37.82	37.85	37.79
740	EVAP CAPACITY	KW	503.6	603.3	668.2	722.1	769.3
741	COND CAPACITY	KW	629.4	742.4	815.6	874.4	926.2
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.88	2.22	1.87	1.54	1.26
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	39.71	38.38	36.46	34.40	31.91
750	RUNNING TIME	Hr	160	160	160	161	163
751	STARTS		36	36	36	36	37
752	EVAP APPROACH TEMP	Deg C	3.83	4.44	4.83	5.11	5.44
753	COND APPROACH TEMP	Deg C	3.44	4.22	4.61	4.94	4.94
800	EVAP AVG H2O TEMP	Deg C	8.64	9.02	9.29	9.48	9.68
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1000	1000
802	EVAP H2O VISCOSITY	cp	1.35	1.33	1.33	1.32	1.31
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.585	0.585	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	34.25	31.82	29.25	26.67	24.02
811	COND WATER DENSITY	Kg/M3	995	996	997	997	998
812	COND H2O VISCOSITY	cp	0.73	0.77	0.81	0.86	0.91
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.624	0.621	0.617	0.613	0.609
815	ITD/DELTA T		1.98	1.96	1.93	1.92	1.91
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.03	-0.01	-0.01	0.01	0.00
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.01	-0.01	0.01	0.01	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.02	0.02	0.02	0.01
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.01
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.04	0.02	0.02	0.03	0.04

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		192	193	194	195	196
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	40
Capacity	KW	688.8	652.9	607.2	546.7	438.8
Power	KW	130.7	128.4	124.9	118.4	105.5
Coefficient of Performance (COP)		5.271	5.085	4.863	4.616	4.158
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.69
Condenser Entering Water Temperature	Deg C	21.13	23.87	26.63	29.47	32.26
Energy Balance	%	-1.46	-1.23	-1.04	-1.26	-1.32
Evaporator Entering Water Temperature	Deg C	12.1	11.8	11.4	10.9	10.1
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.69	6.69
Evaporator Water Flow Rate	L/s	30.7	30.6	30.6	30.8	30.7
Condenser Entering Water Temperature	Deg C	21.13	23.87	26.63	29.47	32.26
Condenser Leaving Water Temperature	Deg C	26.37	28.87	31.32	33.73	35.74
Condenser Water Flow Rate	L/s	37.9	37.9	37.9	38.0	38.0
Evap Sat Press	kPa	38.13	38.47	38.96	39.58	40.82
Sat Temp	Deg C	1.74	1.94	2.22	2.57	3.27
Approach	Deg C	4.94	4.78	4.44	4.11	3.44
LMTD	Deg C	7.31	6.99	6.55	5.99	4.94
ITD/Delta T		1.92	1.93	1.94	1.97	2.01
Q/Ao	kW/m2	44.96	42.62	39.63	35.69	28.64
Uo	kW/m2 C	6.15	6.10	6.05	5.96	5.80
ho'	kW/m2 C	9.57	9.44	9.34	9.11	8.77
Cond Sat Press	kPa	122.66	133.34	144.03	154.79	162.03
Sat Temp	Deg C	30.66	32.99	35.18	37.25	38.58
Approach	Deg C	4.28	4.11	3.89	3.50	2.83
Refrigerant Leaving Temp	Deg C	30.19	32.48	34.38	36.33	37.75
LMTD	Deg C	6.57	6.29	5.90	5.37	4.36
Q/Ao	kW/m2	43.31	41.22	38.55	35.09	28.73
Uo	kW/m2 C	6.60	6.55	6.54	6.53	6.59
ho'	kW/m2 C	10.12	9.93	9.81	9.70	9.76
Cond Sat Temp	Deg C	30.66	32.99	35.18	37.25	38.58
Evap Sat Temp	Deg C	1.74	1.94	2.22	2.57	3.27
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.95	0.95
Estimated Motor Rev/sec (1)		59.35	59.37	59.39	59.42	59.49
Compressor Suction Flow Rate (2)	m3/sec	1.545	1.459	1.346	1.200	0.937
Isentropic COP (2)		0.41	0.44	0.47	0.49	0.50
Adiabatic Efficiency (3)		0.61	0.64	0.65	0.65	0.59
Q/N - m3/rev (4)		0.92	0.87	0.80	0.71	0.56
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	112.87	112.73	112.32	113.90	113.63
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.07	11.79	11.44	10.94	10.11
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.04	11.77	11.41	10.92	10.08
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.70	6.70	6.69	6.70	6.70
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	172.37	172.23	172.09	172.44	172.30
17	ENT COND WATER TEMP LOC 1	Deg C	21.13	23.88	26.63	29.47	32.24
18	ENT COND WATER TEMP LOC 2	Deg C	21.12	23.87	26.64	29.48	32.27
19	LVG COND WATER TEMP LOC 1	Deg C	26.38	28.88	31.32	33.73	35.73
20	LVG COND WATER TEMP LOC 2	Deg C	26.37	28.87	31.31	33.73	35.74
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.94	3.54	3.83	4.17	4.80
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.42	3.61	3.89	4.18	4.81
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	3.93	4.18	4.47	4.75	5.37
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	38.13	38.47	38.96	39.58	40.82
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	57.23	59.16	61.29	63.57	65.71
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	57.57	59.43	61.57	64.05	66.40
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	53.99	56.26	58.88	61.85	64.47
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	81.15	85.49	91.08	93.77	95.91
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	82.05	87.29	93.22	99.49	105.56
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	82.67	88.11	93.91	100.18	104.46
431	COND SHELL STATIC PRESS - AVERAGE	kPa	122.66	133.34	144.03	154.79	162.03
440	REFRIGERANT LVG COND TEMP	Deg C	30.19	32.48	34.38	36.33	37.75
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	89.01	94.11	99.28	104.80	108.87
485	HIGH PRESS ECONOMIZER TEMP	Deg C	21.71	23.07	24.49	25.90	26.92
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	57.36	59.29	61.71	63.91	65.50
487	LOW PRESS ECONOMOMIZER TEMP	Deg C	11.08	11.89	12.78	13.64	14.27
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	48.19	49.09	49.30	49.85	50.26
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	11.05	11.98	12.78	13.57	14.08
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	57.78	59.71	61.85	63.78	65.02
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	7.31	7.45	7.69	7.81	7.97
534	ENT COND ORIFICE ASS'Y PRESS	kPa	123.00	133.55	143.76	154.65	161.41
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	30.33	32.60	34.63	36.59	37.84
536	LVG COND ORIFICE ASS'Y PRESS	kPa	101.08	106.39	112.66	118.04	120.31
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	25.13	26.55	28.01	29.27	29.64
560	ATMOSPHERIC PRESS	kPa	99.97	99.97	99.97	99.97	99.97
580	MOTOR VOLTAGE - AB	Volts	3.893	3.881	3.894	3.888	3.891
581	MOTOR VOLTAGE - AC	Volts	3.908	3.895	3.907	3.901	3.906
582	MOTOR VOLTAGE - CB	Volts	3.887	3.874	3.886	3.880	3.882
583	MOTOR CURRENT - A	Volts	1.816	1.792	1.746	1.665	1.506
584	MOTOR CURRENT - B	Volts	1.907	1.877	1.828	1.746	1.579
585	MOTOR CURRENT - C	Volts	1.799	1.774	1.730	1.653	1.506
586	MOTOR POWER - PHASE 1	Volts	0.779	0.765	0.736	0.690	0.591
587	MOTOR POWER - PHASE 3	Volts	1.399	1.375	1.345	1.284	1.168
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	26.28	28.82	31.28	33.72	35.72
601	MAXIMUM MOTOR TEMPERATURE	Deg C	40.83	39.72	39.17	38.06	35.83
605	1st STAGE VANE SETTING	Degrees	40	40	40	40	40
607	3rd STAGE VANE SETTING	Degrees	50	50	50	50	50
608	UNIT HOUR METER READING	Hr	492	493	493	494	494
609	UNIT START COUNTER READING		132	132	132	132	132
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	21	22	22	23	23
701	ENERGY BALANCE	%	-1.46	-1.23	-1.04	-1.26	-1.32
702	EVAP CAPACITY	KW	688.8	652.9	607.2	546.7	438.8
703	EVAP WATER FLOWRATE	L/s	30.7	30.6	30.6	30.8	30.7
704	COND WATER FLOWRATE	L/s	37.9	37.9	37.9	38.0	38.0

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	12.06	11.78	11.42	10.93	10.10
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	21.13	23.87	26.63	29.47	32.26
713	AVE LVG COND WATER TEMP	Deg C	26.37	28.87	31.32	33.73	35.74
715	MOTOR VOLTAGE - AB	Volts	467	466	467	467	467
716	MOTOR VOLTAGE - AC	Volts	469	467	469	468	469
717	MOTOR VOLTAGE - CB	Volts	466	465	466	466	466
718	MOTOR CURRENT - A	Amps	182	179	175	167	151
719	MOTOR CURRENT - B	Amps	191	188	183	175	158
720	MOTOR CURRENT - C	Amps	180	177	173	165	151
721	UNIT POWER	KW	131	128	125	118	106
722	AVERAGE VOLTAGE	Volts	468	466	468	467	467
723	AVERAGE CURRENT	Amps	184	181	177	169	153
725	Coefficient of Performance (COP)		5.271	5.085	4.863	4.616	4.158
730	EVAP DELTA T	Deg C	5.37	5.09	4.74	4.24	3.41
731	COND DELTA T	Deg C	5.24	5.00	4.68	4.26	3.49
735	EVAP WATER FLOWRATE	Kg/sec	30.65	30.62	30.57	30.78	30.74
736	COND WATER FLOWRATE	Kg/sec	37.85	37.82	37.80	37.82	37.80
740	EVAP CAPACITY	KW	688.9	653.0	607.2	546.9	438.9
741	COND CAPACITY	KW	829.6	789.5	738.4	672.2	550.2
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	1.74	1.94	2.22	2.57	3.27
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	30.66	32.99	35.18	37.25	38.58
750	RUNNING TIME	Hr	164	164	164	165	165
751	STARTS		37	37	37	37	37
752	EVAP APPROACH TEMP	Deg C	4.94	4.78	4.44	4.11	3.44
753	COND APPROACH TEMP	Deg C	4.28	4.11	3.89	3.50	2.83
800	EVAP AVG H2O TEMP	Deg C	9.38	9.24	9.06	8.81	8.40
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.32	1.33	1.33	1.34	1.36
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.586	0.586	0.585	0.585	0.584
810	COND AVG H2O TEMP	Deg C	23.75	26.37	28.98	31.60	33.99
811	COND WATER DENSITY	Kg/M3	998	997	997	996	995
812	COND H2O VISCOSITY	cp	0.92	0.86	0.82	0.77	0.73
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.609	0.613	0.617	0.620	0.624
815	ITD/DELTA T		1.92	1.93	1.94	1.97	2.01
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.01	0.01	-0.01	-0.01	-0.03
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.01	0.01	0.00	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.02	0.03	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.10	0.06	0.04	0.01	0.01

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm						
Run Number		197	198	199	200	201
Refrigerant		245ca	245ca	245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	10	10	10	10
Capacity	KW	354.8	245.8	201.1	179.3	269.7
Power	KW	97.0	70.1	66.2	63.0	69.8
Coefficient of Performance (COP)		3.659	3.504	3.039	2.846	3.865
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.68	6.69
Condenser Entering Water Temperature	Deg C	33.67	29.42	32.19	33.33	26.63
Energy Balance	%	-1.00	-1.91	-1.24	-2.26	-2.42
Evaporator Entering Water Temperature	Deg C	9.4	8.6	8.3	8.1	8.8
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69	6.68	6.69
Evaporator Water Flow Rate	L/s	30.7	30.7	30.7	30.7	30.7
Condenser Entering Water Temperature	Deg C	33.67	29.42	32.19	33.33	26.63
Condenser Leaving Water Temperature	Deg C	36.54	31.45	33.90	34.89	28.82
Condenser Water Flow Rate	L/s	38.0	38.0	37.9	38.0	37.9
Evap Sat Press	kPa	41.71	42.89	43.30	43.64	42.61
Sat Temp	Deg C	3.75	4.38	4.59	4.77	4.23
Approach	Deg C	2.94	2.33	2.11	1.89	2.44
LMTD	Deg C	4.16	3.17	2.80	2.54	3.40
ITD/Delta T		2.07	2.22	2.33	2.36	2.17
Q/Ao	kW/m2	23.15	16.04	13.13	11.71	17.60
Uo	kW/m2 C	5.56	5.05	4.68	4.61	5.18
ho'	kW/m2 C	8.24	7.18	6.46	6.33	7.45
Cond Sat Press	kPa	163.47	132.86	143.96	148.51	120.93
Sat Temp	Deg C	38.84	32.89	35.16	36.06	30.28
Approach	Deg C	2.28	1.44	1.28	1.17	1.44
Refrigerant Leaving Temp	Deg C	37.82	32.22	34.34	35.14	29.83
LMTD	Deg C	3.55	2.31	2.00	1.84	2.39
Q/Ao	kW/m2	23.77	16.74	14.09	12.87	18.06
Uo	kW/m2 C	6.70	7.25	7.06	7.00	7.56
ho'	kW/m2 C	9.95	11.43	10.85	10.67	12.35
Cond Sat Temp	Deg C	38.84	32.89	35.16	36.06	30.28
Evap Sat Temp	Deg C	3.75	4.38	4.59	4.77	4.23
Estimated Motor Efficiency (1)		0.95	0.95	0.94	0.94	0.95
Estimated Motor Rev/sec (1)		59.53	59.67	59.69	59.70	59.67
Compressor Suction Flow Rate (2)	m3/sec	0.743	0.496	0.404	0.358	0.544
Isentropic COP (2)		0.49	0.40	0.43	0.44	0.36
Adiabatic Efficiency (3)		0.51	0.40	0.37	0.35	0.40
Q/N - m3/rev (4)		0.44	0.29	0.24	0.21	0.32
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	113.49	113.35	113.07	113.07	113.35
3	ENT EVAP WATER TEMP LOC 1	Deg C	9.46	8.61	8.27	8.09	8.80
4	ENT EVAP WATER TEMP LOC 2	Deg C	9.42	8.59	8.23	8.06	8.77
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.70	6.69	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68	6.67	6.68
15	COND WATER FLOWMETER DELTA P	kPa	172.78	172.23	171.95	172.37	172.09
17	ENT COND WATER TEMP LOC 1	Deg C	33.66	29.41	32.17	33.31	26.63
18	ENT COND WATER TEMP LOC 2	Deg C	33.68	29.43	32.20	33.34	26.63
19	LVG COND WATER TEMP LOC 1	Deg C	36.55	31.45	33.90	34.89	28.83
20	LVG COND WATER TEMP LOC 2	Deg C	36.54	31.44	33.89	34.89	28.82
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	6.66	7.02	7.46	7.37	6.97
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	5.39	5.90	6.17	6.17	5.78
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	5.89	6.33	6.66	6.67	6.18
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	41.71	42.89	43.30	43.64	42.61
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	66.60	58.88	61.57	62.74	55.09
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	67.57	60.05	62.74	63.98	56.12
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	65.71	58.40	61.23	62.60	54.40
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	100.04	76.95	84.67	87.91	68.88
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	107.01	84.18	91.77	95.08	76.12
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	107.01	89.70	96.60	99.15	81.70
431	COND SHELL STATIC PRESS - AVERAGE	kPa	163.47	132.86	143.96	148.51	120.93
440	REFRIGERANT LVG COND TEMP	Deg C	37.82	32.22	34.34	35.14	29.83
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	110.11	98.39	103.35	105.21	91.84
485	HIGH PRESS ECONOMIZER TEMP	Deg C	27.19	24.29	25.52	26.01	22.49
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	66.19	58.67	61.57	62.88	54.81
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.46	11.62	12.73	13.26	10.04
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	50.54	48.47	49.64	50.33	47.09
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	14.21	11.39	12.45	12.98	9.88
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	65.50	58.12	60.88	62.19	54.47
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.08	7.13	7.68	7.98	6.53
534	ENT COND ORIFICE ASS'Y PRESS	kPa	162.72	132.38	143.34	147.55	120.73
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	38.07	32.41	34.58	35.39	29.88
536	LVG COND ORIFICE ASS'Y PRESS	kPa	120.73	105.01	110.80	112.87	97.70
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	29.62	26.03	27.39	27.92	24.15
560	ATMOSPHERIC PRESS	kPa	99.90	99.90	99.97	99.90	99.90
580	MOTOR VOLTAGE - AB	Volts	3.936	3.888	3.885	3.892	3.906
581	MOTOR VOLTAGE - AC	Volts	3.946	3.899	3.895	3.904	3.919
582	MOTOR VOLTAGE - CB	Volts	3.927	3.871	3.874	3.882	3.897
583	MOTOR CURRENT - A	Volts	1.407	1.106	1.060	1.039	1.093
584	MOTOR CURRENT - B	Volts	1.465	1.155	1.116	1.091	1.157
585	MOTOR CURRENT - C	Volts	1.375	1.113	1.066	1.052	1.114
586	MOTOR POWER - PHASE 1	Volts	0.521	0.323	0.295	0.276	0.314
587	MOTOR POWER - PHASE 3	Volts	1.095	0.846	0.808	0.774	0.849
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	36.53	31.44	33.90	34.95	28.77
601	MAXIMUM MOTOR TEMPERATURE	Deg C	33.61	26.39	26.39	26.39	24.17
605	1st STAGE VANE SETTING	Degrees	40	10	10	10	10
607	3rd STAGE VANE SETTING	Degrees	50	19	19	19	19
608	UNIT HOUR METER READING	Hr	495	495	496	496	496
609	UNIT START COUNTER READING		132	132	132	132	132
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	24	24	25	25	26
701	ENERGY BALANCE	%	-1.00	-1.91	-1.24	-2.26	-2.42
702	EVAP CAPACITY	KW	354.8	245.8	201.1	179.3	269.7
703	EVAP WATER FLOWRATE	L/s	30.7	30.7	30.7	30.7	30.7
704	COND WATER FLOWRATE	L/s	38.0	38.0	37.9	38.0	37.9

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	9.44	8.60	8.25	8.07	8.78
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.68	6.69
712	AVE ENT COND WATER TEMP	Deg C	33.67	29.42	32.19	33.33	26.63
713	AVE LVG COND WATER TEMP	Deg C	36.54	31.45	33.90	34.89	28.82
715	MOTOR VOLTAGE - AB	Volts	472	467	466	467	469
716	MOTOR VOLTAGE - AC	Volts	474	468	467	469	470
717	MOTOR VOLTAGE - CB	Volts	471	465	465	466	468
718	MOTOR CURRENT - A	Amps	141	111	106	104	109
719	MOTOR CURRENT - B	Amps	147	116	112	109	116
720	MOTOR CURRENT - C	Amps	138	111	107	105	111
721	UNIT POWER	KW	97	70	66	63	70
722	AVERAGE VOLTAGE	Volts	472	466	466	467	469
723	AVERAGE CURRENT	Amps	142	112	108	106	112
725	Coefficient of Performance (COP)		3.659	3.504	3.039	2.846	3.865
730	EVAP DELTA T	Deg C	2.74	1.91	1.56	1.39	2.09
731	COND DELTA T	Deg C	2.88	2.03	1.71	1.56	2.19
735	EVAP WATER FLOWRATE	Kg/sec	30.73	30.71	30.67	30.67	30.71
736	COND WATER FLOWRATE	Kg/sec	37.84	37.80	37.76	37.80	37.80
740	EVAP CAPACITY	KW	354.7	245.7	201.1	179.4	269.7
741	COND CAPACITY	KW	455.2	320.6	269.8	246.4	346.0
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	3.75	4.38	4.59	4.77	4.23
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	38.84	32.89	35.16	36.06	30.28
750	RUNNING TIME	Hr	166	167	167	167	168
751	STARTS		37	37	37	37	37
752	EVAP APPROACH TEMP	Deg C	2.94	2.33	2.11	1.89	2.44
753	COND APPROACH TEMP	Deg C	2.28	1.44	1.28	1.17	1.44
800	EVAP AVG H2O TEMP	Deg C	8.07	7.65	7.47	7.38	7.73
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.37	1.39	1.40	1.40	1.39
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.584	0.583	0.583	0.583	0.583
810	COND AVG H2O TEMP	Deg C	35.11	30.43	33.04	34.11	27.73
811	COND WATER DENSITY	Kg/M3	995	996	995	995	997
812	COND H2O VISCOSITY	cp	0.72	0.79	0.75	0.73	0.84
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.625	0.618	0.622	0.624	0.615
815	ITD/DELTA T		2.07	2.22	2.33	2.36	2.17
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.02	-0.02	-0.03	-0.03	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.01	0.01	0.00	0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.02	0.03	0.04	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.01
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.02	0.01	0.00	-0.06	0.06

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm				
Run Number		202	203	204
Refrigerant		245ca	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	10	10	90
Capacity	KW	292.2	308.7	610.0
Power	KW	69.4	68.8	134.1
Coefficient of Performance (COP)		4.209	4.486	4.549
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69
Condenser Entering Water Temperature	Deg C	23.88	21.09	29.49
Energy Balance	%	-1.96	-2.03	-0.63
Evaporator Entering Water Temperature	Deg C	9.0	9.1	12.2
Evaporator Leaving Water Temperature	Deg C	6.69	6.69	6.69
Evaporator Water Flow Rate	L/s	30.7	30.7	26.6
Condenser Entering Water Temperature	Deg C	23.88	21.09	29.49
Condenser Leaving Water Temperature	Deg C	26.21	23.53	35.01
Condenser Water Flow Rate	L/s	37.9	37.9	32.6
Evap Sat Press	kPa	42.40	42.26	38.89
Sat Temp	Deg C	4.12	4.05	2.18
Approach	Deg C	2.56	2.67	4.50
LMTD	Deg C	3.59	3.71	6.89
ITD/Delta T		2.13	2.09	1.82
Q/Ao	kW/m2	19.06	20.14	39.80
Uo	kW/m2 C	5.31	5.42	5.78
ho'	kW/m2 C	7.70	7.95	9.17
Cond Sat Press	kPa	110.11	99.49	164.23
Sat Temp	Deg C	27.71	24.99	38.98
Approach	Deg C	1.50	1.44	3.94
Refrigerant Leaving Temp	Deg C	27.41	25.00	37.92
LMTD	Deg C	2.48	2.48	6.33
Q/Ao	kW/m2	19.17	20.03	39.04
Uo	kW/m2 C	7.72	8.07	6.17
ho'	kW/m2 C	12.96	14.18	9.40
Cond Sat Temp	Deg C	27.71	24.99	38.98
Evap Sat Temp	Deg C	4.12	4.05	2.18
Estimated Motor Efficiency (1)		0.95	0.95	0.94
Estimated Motor Rev/sec (1)		59.67	59.67	59.34
Compressor Suction Flow Rate (2)	m3/sec	0.589	0.621	1.366
Isentropic COP (2)		0.33	0.29	0.53
Adiabatic Efficiency (3)		0.39	0.37	0.68
Q/N - m3/rev (4)		0.35	0.37	0.81
(1) From motor curves at measured power input				
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split				
(3) Ratio of isentropic and test KW/T				
(4) CFM from cycle calculation / estimated motor RPM				
(5) Heat transfer coefficient calculations use bulk fluid properties				

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	113.49	113.63	84.87
3	ENT EVAP WATER TEMP LOC 1	Deg C	8.97	9.10	12.18
4	ENT EVAP WATER TEMP LOC 2	Deg C	8.94	9.07	12.16
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.70	6.70	6.70
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	171.75	171.82	126.86
17	ENT COND WATER TEMP LOC 1	Deg C	23.88	21.09	29.48
18	ENT COND WATER TEMP LOC 2	Deg C	23.88	21.09	29.49
19	LVG COND WATER TEMP LOC 1	Deg C	26.21	23.53	35.00
20	LVG COND WATER TEMP LOC 2	Deg C	26.20	23.52	35.02
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	6.77	6.60	5.43
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	5.90	5.65	3.90
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	6.07	6.01	4.63
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	42.40	42.26	38.89
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	51.99	48.95	65.50
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	52.88	49.78	65.91
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	51.16	48.26	63.22
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	61.43	54.68	95.91
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	69.09	62.47	107.90
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	74.60	68.05	103.77
431	COND SHELL STATIC PRESS - AVERAGE	kPa	110.11	99.49	164.23
440	REFRIGERANT LVG COND TEMP	Deg C	27.41	25.00	37.92
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	86.39	81.22	106.94
485	HIGH PRESS ECONOMIZER TEMP	Deg C	21.12	19.76	26.47
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	51.64	48.68	66.12
487	LOW PRESS ECONOMIZER TEMP	Deg C	8.66	7.39	14.42
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	46.06	45.09	51.30
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	8.58	7.36	14.39
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	51.64	48.88	66.12
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	6.01	5.57	8.58
534	ENT COND ORIFICE ASS'Y PRESS	kPa	109.90	99.49	164.03
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	27.38	24.81	38.30
536	LVG COND ORIFICE ASS'Y PRESS	kPa	91.70	85.84	123.00
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	22.58	20.96	30.48
560	ATMOSPHERIC PRESS	kPa	99.97	99.97	99.08
580	MOTOR VOLTAGE - AB	Volts	3.891	3.911	3.901
581	MOTOR VOLTAGE - AC	Volts	3.904	3.926	3.908
582	MOTOR VOLTAGE - CB	Volts	3.881	3.906	3.889
583	MOTOR CURRENT - A	Volts	1.090	1.086	1.873
584	MOTOR CURRENT - B	Volts	1.148	1.152	1.938
585	MOTOR CURRENT - C	Volts	1.109	1.104	1.833
586	MOTOR POWER - PHASE 1	Volts	0.315	0.306	0.808
587	MOTOR POWER - PHASE 3	Volts	0.842	0.841	1.427
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	26.13	23.44	34.98
601	MAXIMUM MOTOR TEMPERATURE	Deg C	25.28	28.06	43.33
605	1st STAGE VANE SETTING	Degrees	10	10	90
607	3rd STAGE VANE SETTING	Degrees	19	19	68
608	UNIT HOUR METER READING	Hr	497	497	501
609	UNIT START COUNTER READING		132	132	133
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	26	26	0
701	ENERGY BALANCE	%	-1.96	-2.03	-0.63
702	EVAP CAPACITY	KW	292.2	308.7	610.0
703	EVAP WATER FLOWRATE	L/s	30.7	30.7	26.6
704	COND WATER FLOWRATE	L/s	37.9	37.9	32.6

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	8.96	9.09	12.17
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	23.88	21.09	29.49
713	AVE LVG COND WATER TEMP	Deg C	26.21	23.53	35.01
715	MOTOR VOLTAGE - AB	Volts	467	469	468
716	MOTOR VOLTAGE - AC	Volts	469	471	469
717	MOTOR VOLTAGE - CB	Volts	466	469	467
718	MOTOR CURRENT - A	Amps	109	109	187
719	MOTOR CURRENT - B	Amps	115	115	194
720	MOTOR CURRENT - C	Amps	111	110	183
721	UNIT POWER	KW	69	69	134
722	AVERAGE VOLTAGE	Volts	467	470	468
723	AVERAGE CURRENT	Amps	112	111	188
725	Coefficient of Performance (COP)		4.209	4.486	4.549
730	EVAP DELTA T	Deg C	2.27	2.39	5.47
731	COND DELTA T	Deg C	2.33	2.43	5.52
735	EVAP WATER FLOWRATE	Kg/sec	30.73	30.74	26.57
736	COND WATER FLOWRATE	Kg/sec	37.77	37.79	32.44
740	EVAP CAPACITY	KW	292.1	308.7	609.9
741	COND CAPACITY	KW	367.3	383.7	747.8
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	4.12	4.05	2.18
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	27.71	24.99	38.98
750	RUNNING TIME	Hr	168	169	172
751	STARTS		37	37	38
752	EVAP APPROACH TEMP	Deg C	2.56	2.67	4.50
753	COND APPROACH TEMP	Deg C	1.50	1.44	3.94
800	EVAP AVG H2O TEMP	Deg C	7.83	7.89	9.43
801	EVAP WATER DENSITY	Kg/M3	1001	1001	1001
802	EVAP H2O VISCOSITY	cp	1.38	1.38	1.32
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.583	0.583	0.586
810	COND AVG H2O TEMP	Deg C	25.04	22.31	32.25
811	COND WATER DENSITY	Kg/M3	998	998	996
812	COND H2O VISCOSITY	cp	0.89	0.95	0.76
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.611	0.607	0.621
815	ITD/DELTA T		2.13	2.09	1.82
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.00	0.00	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.01	-0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.08	0.08	0.02

Medium Impellers - Metric

LTO 23127 Note: Impeller diameters are 635/635/622 mm					
Run Number		121	154	185	204
Refrigerant		11	123	245ca	245ca
Oil		Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90
Capacity	KW	660.7	731.7	626.5	610.0
Power	KW	151.6	173.0	136.4	134.1
Coefficient of Performance (COP)		4.357	4.228	4.594	4.549
Evaporator Leaving Water Temperature	Deg C	6.68	6.69	6.69	6.69
Condenser Entering Water Temperature	Deg C	29.46	29.48	29.47	29.49
Energy Balance	%	-1.38	-1.20	-1.29	-0.63
Evaporator Entering Water Temperature	Deg C	11.7	12.2	11.5	12.2
Evaporator Leaving Water Temperature	Deg C	6.68	6.69	6.69	6.69
Evaporator Water Flow Rate	L/s	31.4	31.8	30.9	26.6
Condenser Entering Water Temperature	Deg C	29.46	29.48	29.47	29.49
Condenser Leaving Water Temperature	Deg C	34.65	35.24	34.35	35.01
Condenser Water Flow Rate	L/s	38.0	38.1	38.0	32.6
Evap Sat Press	kPa	41.64	36.06	38.75	38.89
Sat Temp	Deg C	0.83	2.07	2.11	2.18
Approach	Deg C	5.83	4.61	4.61	4.50
LMTD	Deg C	8.10	7.02	6.72	6.89
ITD/Delta T		2.17	1.84	1.95	1.82
Q/Ao	kW/m2	43.12	47.75	40.88	39.80
Uo	kW/m2 C	5.32	6.81	6.08	5.78
ho'	kW/m2 C	7.65	11.06	9.38	9.17
Cond Sat Press	kPa	167.75	153.96	162.23	164.23
Sat Temp	Deg C	38.93	39.94	38.62	38.98
Approach	Deg C	4.28	4.72	4.28	3.94
Refrigerant Leaving Temp	Deg C	38.21	39.45	37.39	37.92
LMTD	Deg C	6.54	7.20	6.40	6.33
Q/Ao	kW/m2	42.89	47.69	40.25	39.04
Uo	kW/m2 C	6.56	6.62	6.28	6.17
ho'	kW/m2 C	9.74	9.86	9.15	9.40
Cond Sat Temp	Deg C	38.93	39.94	38.62	38.98
Evap Sat Temp	Deg C	0.83	2.07	2.11	2.18
Estimated Motor Efficiency (1)		0.94	0.93	0.94	0.94
Estimated Motor Rev/sec (1)		59.24	59.11	59.32	59.34
Compressor Suction Flow Rate (2)	m3/sec	1.462	1.795	1.407	1.366
Isentropic COP (2)		0.55	0.55	0.52	0.53
Adiabatic Efficiency (3)		0.68	0.66	0.68	0.68
Q/N - m3/rev (4)		0.87	1.07	0.84	0.81
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Medium Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	118.59	121.28	114.59	84.87
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.72	12.21	11.55	12.18
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.69	12.18	11.52	12.16
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.71	6.71	6.70
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.69	6.68	6.68
15	COND WATER FLOWMETER DELTA P	kPa	172.64	173.75	172.44	126.86
17	ENT COND WATER TEMP LOC 1	Deg C	29.45	29.47	29.46	29.48
18	ENT COND WATER TEMP LOC 2	Deg C	29.46	29.50	29.48	29.49
19	LVG COND WATER TEMP LOC 1	Deg C	34.65	35.24	34.34	35.00
20	LVG COND WATER TEMP LOC 2	Deg C	34.65	35.25	34.36	35.02
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	3.88	3.18	3.47	5.43
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	2.63	3.83	3.29	3.90
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	2.77	4.44	3.38	4.63
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	41.64	36.06	38.75	38.89
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	69.57	61.02	65.02	65.50
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	69.91	61.57	65.50	65.91
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	66.47	56.54	62.67	63.22
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	108.66	96.87	94.73	95.91
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	111.76	100.53	106.80	107.90
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	107.01	94.04	102.11	103.77
431	COND SHELL STATIC PRESS - AVERAGE	kPa	167.75	153.96	162.23	164.23
440	REFRIGERANT LVG COND TEMP	Deg C	38.21	39.45	37.39	37.92
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	110.04	98.73	105.83	106.94
485	HIGH PRESS ECONOMIZER TEMP	Deg C	25.83	26.91	26.14	26.47
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	69.36	61.50	65.71	66.12
487	LOW PRESS ECONOMIZER TEMP	Deg C	13.22	14.70	14.29	14.42
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	54.26	51.71	51.37	51.30
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	13.18	14.89	14.25	14.39
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	69.50	62.47	65.84	66.12
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	7.02	10.52	8.57	8.58
534	ENT COND ORIFICE ASS'Y PRESS	kPa	167.47	155.13	162.16	164.03
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	38.62	39.95	37.93	38.30
536	LVG COND ORIFICE ASS'Y PRESS	kPa	126.66	118.38	122.24	123.00
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	30.17	32.65	30.27	30.48
560	ATMOSPHERIC PRESS	kPa	99.15	99.97	99.22	99.08
580	MOTOR VOLTAGE - AB	Volts	3.850	3.880	3.922	3.901
581	MOTOR VOLTAGE - AC	Volts	3.858	3.884	3.931	3.908
582	MOTOR VOLTAGE - CB	Volts	3.840	3.874	3.908	3.889
583	MOTOR CURRENT - A	Volts	2.115	2.383	1.899	1.873
584	MOTOR CURRENT - B	Volts	2.187	2.482	1.971	1.938
585	MOTOR CURRENT - C	Volts	2.067	2.294	1.854	1.833
586	MOTOR POWER - PHASE 1	Volts	0.941	1.108	0.824	0.808
587	MOTOR POWER - PHASE 3	Volts	1.586	1.776	1.449	1.427
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	34.66	35.21	34.31	34.98
601	MAXIMUM MOTOR TEMPERATURE	Deg C	54.72	65.67	44.17	43.33
605	1st STAGE VANE SETTING	Degrees	90	90	90	90
607	3rd STAGE VANE SETTING	Degrees	68	68	68	68
608	UNIT HOUR METER READING	Hr	453	470	488	501
609	UNIT START COUNTER READING		124	128	131	133
610	CURRENT REFRIGERANT CHARGE	Kg	163.3	163.3	163.3	163.3
700	TIME (HOURS)	HOURS	0	1	1	0
701	ENERGY BALANCE	%	-1.38	-1.20	-1.29	-0.63
702	EVAP CAPACITY	KW	660.7	731.7	626.5	610.0
703	EVAP WATER FLOWRATE	L/s	31.4	31.8	30.9	26.6
704	COND WATER FLOWRATE	L/s	38.0	38.1	38.0	32.6

Medium Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.70	12.19	11.54	12.17
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.69	6.69	6.69
712	AVE ENT COND WATER TEMP	Deg C	29.46	29.48	29.47	29.49
713	AVE LVG COND WATER TEMP	Deg C	34.65	35.24	34.35	35.01
715	MOTOR VOLTAGE - AB	Volts	462	466	471	468
716	MOTOR VOLTAGE - AC	Volts	463	466	472	469
717	MOTOR VOLTAGE - CB	Volts	461	465	469	467
718	MOTOR CURRENT - A	Amps	212	238	190	187
719	MOTOR CURRENT - B	Amps	219	248	197	194
720	MOTOR CURRENT - C	Amps	207	229	185	183
721	UNIT POWER	KW	152	173	136	134
722	AVERAGE VOLTAGE	Volts	462	466	470	468
723	AVERAGE CURRENT	Amps	212	239	191	188
725	Coefficient of Performance (COP)		4.357	4.228	4.594	4.549
730	EVAP DELTA T	Deg C	5.02	5.49	4.84	5.47
731	COND DELTA T	Deg C	5.19	5.76	4.88	5.52
735	EVAP WATER FLOWRATE	Kg/sec	31.41	31.76	30.87	26.57
736	COND WATER FLOWRATE	Kg/sec	37.85	37.97	37.82	32.44
740	EVAP CAPACITY	KW	660.7	731.6	626.4	609.9
741	COND CAPACITY	KW	821.4	913.4	770.9	747.8
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	0.83	2.07	2.11	2.18
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	38.93	39.94	38.62	38.98
750	RUNNING TIME	Hr	125	141	159	172
751	STARTS		29	33	36	38
752	EVAP APPROACH TEMP	Deg C	5.83	4.61	4.61	4.50
753	COND APPROACH TEMP	Deg C	4.28	4.72	4.28	3.94
800	EVAP AVG H2O TEMP	Deg C	9.19	9.44	9.12	9.43
801	EVAP WATER DENSITY	Kg/M3	1001	1000	1001	1001
802	EVAP H2O VISCOSITY	cp	1.33	1.32	1.33	1.32
803	EVAP H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	W/M C	0.586	0.586	0.586	0.586
810	COND AVG H2O TEMP	Deg C	32.05	32.36	31.91	32.25
811	COND WATER DENSITY	Kg/M3	996	996	996	996
812	COND H2O VISCOSITY	cp	0.76	0.76	0.76	0.76
813	COND H2O SPECIFIC HEAT (Cp)	KJ/Kg C	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	W/M C	0.621	0.621	0.621	0.621
815	ITD/DELTA T		2.17	1.84	1.95	1.82
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.01	-0.03	-0.02	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.00	-0.01	-0.01	-0.02
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.02	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.01	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.01	0.03	0.04	0.02

Small Impellers - Metric

LTO 23127 Note: Impeller diameters are 610/610/610 mm						
Run Number		205	206	207	208	209
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	90	90	90
Capacity	KW	722.53	738.00	715.15	676.47	629.36
Power	KW	150.60	154.86	154.20	151.02	146.28
Coefficient of Performance (COP)		4.80	4.77	4.64	4.48	4.30
Evaporator Outlet Water Temperature	Deg C	6.69	6.69	6.69	6.68	6.68
Evaporator Inlet Water Temperature	Deg C	21.09	23.87	26.63	29.43	32.26
Energy Balance	%	-1.13	-1.20	-1.33	-1.25	-0.90
Evaporator Inlet Water Temperature	Deg C	12.27	12.41	12.23	11.91	11.54
Evaporator Outlet Water Temperature	Deg C	6.69	6.69	6.69	6.68	6.68
Evaporator Water Temperature Flowrate	L/s	30.88	30.80	30.78	30.92	30.88
Condenser Inlet Water Temperature	Deg C	21.09	23.87	26.63	29.43	32.26
Condenser Outlet Water Temperature	Deg C	26.62	29.54	32.15	34.69	37.17
Condenser Water Temperature Flowrate	L/s	38.22	38.15	38.22	38.22	38.21
Evaporator Saturation Pressure	kPa	33.85	35.78	36.34	36.68	37.09
Saturation Temperature	Deg C	0.66	1.89	2.24	2.46	2.71
Approach	Deg C	6.06	4.78	4.44	4.22	3.94
Log Mean Temperature Difference	Deg C	8.52	7.28	6.85	6.48	6.08
ITD/Delta T		2.08	1.84	1.80	1.81	1.82
Q/Ao	kW/m2	47.16	48.17	46.67	44.15	41.07
Uo	kW/m2 C	5.53	6.61	6.82	6.81	6.76
ho'	kW/m2 C	8.13	10.70	11.25	11.22	11.09
Cond Sat Press	kPa	114.04	126.86	138.03	149.20	160.03
Sat Temp	Deg C	31.16	34.22	36.68	39.00	41.12
Approach	Deg C	4.56	4.67	4.56	4.33	3.94
Refrigerant Leaving Temp	Deg C	31.12	34.06	36.46	38.81	40.72
LMTD	Deg C	6.95	7.14	6.93	6.59	6.08
Q/Ao	kW/m2	46.02	47.08	45.88	43.64	40.79
Uo	kW/m2 C	6.63	6.59	6.62	6.62	6.71
ho'	kW/m2 C	10.15	9.98	9.95	9.86	9.96
Cond Sat Temp	Deg C	31.16	34.22	36.68	39.00	41.12
Evap Sat Temp	Deg C	0.66	1.89	2.24	2.46	2.71
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)	Rev/sec	59.24	59.22	59.22	59.24	59.27
Compressor Suction Flow Rate (2)	m3/sec	1.936	1.802	1.729	1.628	1.506
Isentropic COP (2)		8.064	7.610	7.132	6.710	6.381
Adiabatic Efficiency (3)		0.595	0.626	0.650	0.668	0.674
Q/N - m3/rev (4)		0.0327	0.0304	0.0292	0.0275	0.0254
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	114.59	114.04	113.90	114.87	114.59
3	ENT EVAP WATER TEMP LOC 1	Deg C	12.28	12.42	12.24	11.91	11.56
4	ENT EVAP WATER TEMP LOC 2	Deg C	12.26	12.40	12.22	11.89	11.53
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.70	6.69	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68	6.67	6.67
15	COND WATER FLOWMETER DELTA P	kPa	175.13	174.44	174.92	174.64	174.44
17	ENT COND WATER TEMP LOC 1	Deg C	21.09	23.86	26.62	29.43	32.24
18	ENT COND WATER TEMP LOC 2	Deg C	21.09	23.87	26.63	29.44	32.26
19	LVG COND WATER TEMP LOC 1	Deg C	26.62	29.54	32.14	34.69	37.17
20	LVG COND WATER TEMP LOC 2	Deg C	26.62	29.54	32.16	34.69	37.17
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	2.91	3.98	4.49	4.56	4.78
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	2.13	3.28	3.80	3.94	4.21
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	2.34	3.46	4.07	4.27	4.54
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	33.85	35.78	36.34	36.68	37.09
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	53.78	57.23	58.95	60.47	62.33
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	54.12	57.50	59.29	61.02	62.74
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	49.02	52.40	54.54	56.81	59.16
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	72.46	80.46	85.22	89.15	93.22
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	78.12	86.18	92.73	96.87	101.08
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	73.43	80.32	86.12	91.42	96.73
431	COND SHELL STATIC PRESS - AVERAGE	kPa	114.04	126.86	138.03	149.20	160.03
440	REFRIGERANT LVG COND TEMP	Deg C	31.12	34.06	36.46	38.81	40.72
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	78.46	84.81	90.32	95.84	101.49
485	HIGH PRESS ECONOMIZER TEMP	Deg C	20.83	22.88	24.55	26.16	27.73
486	LOW PRESS ECONOMOMIZER STATIC PRESS	kPa	52.95	56.67	58.81	60.88	62.95
487	LOW PRESS ECONOMIZER TEMP	Deg C	11.06	12.70	13.59	14.45	15.26
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	45.92	48.81	49.71	50.26	50.47
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	11.20	12.84	13.73	14.52	15.28
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	54.26	58.12	59.85	61.57	63.29
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.09	9.44	9.83	9.86	9.90
534	ENT COND ORIFICE ASS'Y PRESS	kPa	116.45	128.52	139.55	150.17	159.61
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	31.49	34.47	36.89	39.08	41.10
536	LVG COND ORIFICE ASS'Y PRESS	kPa	93.84	101.90	106.18	113.28	119.21
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	26.31	28.48	29.98	31.51	32.99
560	ATMOSPHERIC PRESS	kPa	99.35	99.35	99.35	99.35	99.35
580	MOTOR VOLTAGE - AB	Volts	3.87	3.85	3.86	3.83	3.85
581	MOTOR VOLTAGE - AC	Volts	3.88	3.86	3.86	3.83	3.85
582	MOTOR VOLTAGE - CB	Volts	3.86	3.84	3.85	3.82	3.84
583	MOTOR CURRENT - A	Volts	2.09	2.15	2.14	2.11	2.03
584	MOTOR CURRENT - B	Volts	2.18	2.24	2.24	2.20	2.14
585	MOTOR CURRENT - C	Volts	2.03	2.10	2.07	2.04	1.97
586	MOTOR POWER - PHASE 1	Volts	0.94	0.97	0.98	0.96	0.92
587	MOTOR POWER - PHASE 3	Volts	1.57	1.61	1.60	1.56	1.52
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	26.59	29.52	32.15	34.70	37.16
601	MAXIMUM MOTOR TEMPERATURE	Deg C	60.83	58.06	56.39	55.28	53.06
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	90.00	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	68.00	68.00	68.00
608	UNIT HOUR METER READING	Hr	504.30	505.10	505.50	506.20	506.40
609	UNIT START COUNTER READING		134.00	134.00	134.00	134.00	134.00
610	CURRENT REFRIGERANT CHARGE	Kg	163.29	163.29	163.29	163.29	163.29
700	TIME (HOURS)	HOURS	382.42	383.03	383.74	384.16	384.55
701	ENERGY BALANCE	%	-1.13	-1.20	-1.33	-1.25	-0.90
702	EVAP CAPACITY	KW	722.53	738.00	715.15	676.47	629.36
703	EVAP WATER FLOWRATE	L/s	30.88	30.80	30.78	30.92	30.88
704	COND WATER FLOWRATE	L/s	38.22	38.15	38.22	38.22	38.21

Small Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	12.27	12.41	12.23	11.91	11.54
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.68	6.68
712	AVE ENT COND WATER TEMP	Deg C	21.09	23.87	26.63	29.43	32.26
713	AVE LVG COND WATER TEMP	Deg C	26.62	29.54	32.15	34.69	37.17
715	MOTOR VOLTAGE - AB	Volts	464.50	461.80	463.30	459.70	461.50
716	MOTOR VOLTAGE - AC	Volts	465.60	463.20	463.70	460.00	462.00
717	MOTOR VOLTAGE - CB	Volts	463.40	460.90	462.10	458.80	460.70
718	MOTOR CURRENT - A	Amps	208.90	215.00	213.80	210.90	203.00
719	MOTOR CURRENT - B	Amps	217.80	224.10	223.90	220.30	214.00
720	MOTOR CURRENT - C	Amps	203.30	209.50	207.10	204.00	197.10
721	UNIT POWER	KW	150.60	154.86	154.20	151.02	146.28
722	AVERAGE VOLTAGE	Volts	464.50	462.00	463.00	459.50	461.40
723	AVERAGE CURRENT	Amps	210.00	216.20	214.93	211.73	204.70
725	Coefficient of Performance (COP)		4.80	4.77	4.64	4.48	4.30
730	EVAP DELTA T	Deg C	5.59	5.72	5.54	5.22	4.87
731	COND DELTA T	Deg C	5.53	5.67	5.52	5.26	4.92
735	EVAP WATER FLOWRATE	Kg/sec	30.87	30.80	30.78	30.91	30.87
736	COND WATER FLOWRATE	Kg/sec	38.15	38.07	38.11	38.07	38.03
740	EVAP CAPACITY	Kw	722.65	738.10	715.10	676.43	629.32
741	COND CAPACITY	Kw	881.39	901.79	878.82	835.87	781.27
743	EVAP SATN TEMP (BASED ON ID #61)	Deg C	0.66	1.89	2.24	2.46	2.71
744	COND SATN TEMP (BASED ON ID #431)	Deg C	31.16	34.22	36.68	39.00	41.12
750	RUNNING TIME	Hr	175.40	176.20	176.60	177.30	177.50
751	STARTS		39.00	39.00	39.00	39.00	39.00
752	EVAP APPROACH TEMP	Deg C	6.06	4.78	4.44	4.22	3.94
753	COND APPROACH TEMP	Deg C	4.56	4.67	4.56	4.33	3.94
800	EVAP AVG H2O TEMP	Deg C	9.48	9.55	9.46	9.29	9.11
801	EVAP WATER DENSITY	Kg/m3	1000.50	1000.49	1000.50	1000.51	1000.52
802	EVAP H2O VISCOSITY	cp	1.32	1.32	1.32	1.33	1.33
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
810	COND AVG H2O TEMP	Deg C	23.86	26.70	29.39	32.07	34.71
811	COND WATER DENSITY	Kg/m3	998.10	997.36	996.58	995.75	994.87
812	COND H2O VISCOSITY	cp	0.91	0.86	0.81	0.76	0.72
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
815	ITD/DELTA T		2.08	1.84	1.80	1.81	1.82
850	RTD DIFFERENCE CHECK - ECWT	Deg C	0.00	-0.01	-0.02	-0.01	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.00	-0.01	0.00	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.02	0.02	0.02	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.03	0.02	-0.01	-0.01	0.01

Small Impellers - Metric

LTO 23127 Note: Impeller diameters are 610/610/610 mm						
Run Number		210	211	212	213	214
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90	70	70	70
Capacity	KW	571.70	496.10	724.64	725.70	694.76
Power	KW	138.84	128.58	147.66	150.60	148.67
Coefficient of Performance (COP)		4.12	3.86	4.91	4.82	4.67
Evaporator Outlet Water Temperature	Deg C	6.68	6.68	6.68	6.69	6.68
Evaporator Inlet Water Temperature	Deg C	35.00	37.79	21.13	23.92	26.67
Energy Balance	%	-1.23	-1.19	-1.30	-0.97	-1.36
Evaporator Inlet Water Temperature	Deg C	11.09	10.51	12.28	12.32	12.07
Evaporator Outlet Water Temperature	Deg C	6.68	6.68	6.68	6.69	6.68
Evaporator Water Temperature Flowrate	L/s	30.95	30.91	30.87	30.82	30.75
Condenser Inlet Water Temperature	Deg C	35.00	37.79	21.13	23.92	26.67
Condenser Outlet Water Temperature	Deg C	39.52	41.76	26.67	29.48	32.03
Condenser Water Temperature Flowrate	L/s	38.24	38.25	38.13	38.16	38.20
Evaporator Saturation Pressure	kPa	37.51	38.20	34.82	36.20	36.47
Saturation Temperature	Deg C	2.97	3.38	1.29	2.16	2.33
Approach	Deg C	3.72	3.28	5.39	4.56	4.33
Log Mean Temperature Difference	Deg C	5.63	4.97	7.86	6.97	6.68
ITD/Delta T		1.84	1.86	1.96	1.81	1.81
Q/Ao	kW/m2	37.32	32.37	47.29	47.37	45.33
Uo	kW/m2 C	6.63	6.51	6.02	6.80	6.78
ho'	kW/m2 C	10.74	10.46	9.21	11.18	11.17
Cond Sat Press	kPa	170.78	180.23	114.52	126.10	136.58
Sat Temp	Deg C	43.12	44.79	31.28	34.04	36.37
Approach	Deg C	3.61	3.06	4.61	4.56	4.33
Refrigerant Leaving Temp	Deg C	42.42	44.47	31.23	33.92	36.24
LMTD	Deg C	5.55	4.75	7.02	6.97	6.66
Q/Ao	kW/m2	37.47	32.91	46.03	46.12	44.52
Uo	kW/m2 C	6.75	6.94	6.56	6.61	6.68
ho'	kW/m2 C	9.97	10.29	10.00	10.03	10.09
Cond Sat Temp	Deg C	43.12	44.79	31.28	34.04	36.37
Evap Sat Temp	Deg C	2.97	3.38	1.29	2.16	2.33
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)	Rev/sec	59.31	59.37	59.26	59.24	59.25
Compressor Suction Flow Rate (2)	m3/sec	1.358	1.162	1.803	1.751	1.673
Isentropic COP (2)		6.104	5.929	8.234	7.744	7.235
Adiabatic Efficiency (3)		0.675	0.651	0.596	0.622	0.646
Q/N - m3/rev (4)		0.0229	0.0196	0.0304	0.0296	0.0282
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	115.14	114.87	114.52	114.04	113.63
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.10	10.52	12.29	12.33	12.08
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.08	10.49	12.27	12.31	12.06
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69	6.69	6.71	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67	6.67	6.68	6.67
15	COND WATER FLOWMETER DELTA P	kPa	174.51	174.44	174.37	174.51	174.71
17	ENT COND WATER TEMP LOC 1	Deg C	34.98	37.77	21.13	23.92	26.67
18	ENT COND WATER TEMP LOC 2	Deg C	35.02	37.81	21.12	23.93	26.67
19	LVG COND WATER TEMP LOC 1	Deg C	39.52	41.75	26.67	29.48	32.03
20	LVG COND WATER TEMP LOC 2	Deg C	39.53	41.77	26.67	29.48	32.03
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	5.12	5.50	3.54	4.23	4.48
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.49	4.91	2.80	3.65	3.81
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.88	5.23	3.08	4.01	4.11
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	37.51	38.20	34.82	36.20	36.47
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	64.26	66.47	54.33	57.02	58.40
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	64.67	66.95	54.40	57.16	58.67
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	61.78	64.74	49.44	52.33	54.19
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	96.53	102.52	73.84	79.91	84.25
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	105.01	108.87	80.81	88.87	93.01
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	100.87	107.08	74.60	80.81	85.91
431	COND SHELL STATIC PRESS - AVERAGE	kPa	170.78	180.23	114.52	126.10	136.58
440	REFRIGERANT LVG COND TEMP	Deg C	42.42	44.47	31.23	33.92	36.24
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	107.08	113.07	79.50	85.15	90.11
485	HIGH PRESS ECONOMIZER TEMP	Deg C	29.25	30.81	21.13	22.98	24.53
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	65.02	67.02	53.43	56.40	58.40
487	LOW PRESS ECONOMIZER TEMP	Deg C	16.08	16.86	11.26	12.60	13.44
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	50.61	50.61	46.54	48.75	49.30
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	16.05	16.76	11.41	12.73	13.50
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	65.16	66.95	54.74	57.71	59.09
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.90	9.83	8.43	9.44	9.46
534	ENT COND ORIFICE ASS'Y PRESS	kPa	170.44	179.68	117.07	127.55	138.03
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	42.98	44.63	31.56	34.28	36.56
536	LVG COND ORIFICE ASS'Y PRESS	kPa	123.55	128.86	94.11	101.15	107.28
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	34.18	35.11	26.42	28.28	29.84
560	ATMOSPHERIC PRESS	kPa	99.28	99.28	99.28	99.22	99.22
580	MOTOR VOLTAGE - AB	Volts	3.88	3.91	3.90	3.89	3.88
581	MOTOR VOLTAGE - AC	Volts	3.88	3.92	3.90	3.89	3.89
582	MOTOR VOLTAGE - CB	Volts	3.87	3.91	3.89	3.88	3.87
583	MOTOR CURRENT - A	Volts	1.93	1.80	2.04	2.09	2.06
584	MOTOR CURRENT - B	Volts	2.03	1.90	2.13	2.17	2.16
585	MOTOR CURRENT - C	Volts	1.88	1.77	1.99	2.03	2.01
586	MOTOR POWER - PHASE 1	Volts	0.86	0.77	0.92	0.94	0.93
587	MOTOR POWER - PHASE 3	Volts	1.45	1.37	1.55	1.57	1.55
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	39.55	41.79	26.61	29.44	32.03
601	MAXIMUM MOTOR TEMPERATURE	Deg C	50.83	48.06	56.94	55.28	53.06
605	1st STAGE VANE SETTING	Degrees	90.00	90.00	70.00	70.00	70.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00	63.00	63.00	63.00
608	UNIT HOUR METER READING	Hr	507.00	507.30	508.20	508.50	509.10
609	UNIT START COUNTER READING		134.00	134.00	134.00	134.00	134.00
610	CURRENT REFRIGERANT CHARGE	Kg	163.29	163.29	163.29	163.29	163.29
700	TIME (HOURS)	HOURS	384.96	385.46	386.21	386.70	387.11
701	ENERGY BALANCE	%	-1.23	-1.19	-1.30	-0.97	-1.36
702	EVAP CAPACITY	KW	571.70	496.10	724.64	725.70	694.76
703	EVAP WATER FLOWRATE	L/s	30.95	30.91	30.87	30.82	30.75
704	COND WATER FLOWRATE	L/s	38.24	38.25	38.13	38.16	38.20

Small Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.09	10.51	12.28	12.32	12.07
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.68	6.68	6.69	6.68
712	AVE ENT COND WATER TEMP	Deg C	35.00	37.79	21.13	23.92	26.67
713	AVE LVG COND WATER TEMP	Deg C	39.52	41.76	26.67	29.48	32.03
715	MOTOR VOLTAGE - AB	Volts	465.40	469.60	467.80	466.20	465.70
716	MOTOR VOLTAGE - AC	Volts	465.70	470.30	468.00	466.70	466.20
717	MOTOR VOLTAGE - CB	Volts	464.40	468.60	466.30	465.00	464.80
718	MOTOR CURRENT - A	Amps	193.40	180.10	203.80	208.50	206.40
719	MOTOR CURRENT - B	Amps	203.00	189.50	213.40	217.30	215.80
720	MOTOR CURRENT - C	Amps	188.10	176.90	198.50	202.80	200.60
721	UNIT POWER	KW	138.84	128.58	147.66	150.60	148.67
722	AVERAGE VOLTAGE	Volts	465.20	469.50	467.40	466.00	465.60
723	AVERAGE CURRENT	Amps	194.83	182.17	205.23	209.53	207.60
725	Coefficient of Performance (COP)		4.12	3.86	4.91	4.82	4.67
730	EVAP DELTA T	Deg C	4.41	3.83	5.61	5.62	5.39
731	COND DELTA T	Deg C	4.52	3.97	5.54	5.56	5.36
735	EVAP WATER FLOWRATE	Kg/sec	30.95	30.91	30.86	30.81	30.74
736	COND WATER FLOWRATE	Kg/sec	38.02	38.00	38.07	38.07	38.08
740	EVAP CAPACITY	Kw	571.80	495.96	724.59	725.78	694.58
741	COND CAPACITY	Kw	717.66	630.42	881.69	883.42	852.68
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.97	3.38	1.29	2.16	2.33
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	43.12	44.79	31.28	34.04	36.37
750	RUNNING TIME	Hr	178.10	178.40	179.30	179.60	180.20
751	STARTS		39.00	39.00	39.00	39.00	39.00
752	EVAP APPROACH TEMP	Deg C	3.72	3.28	5.39	4.56	4.33
753	COND APPROACH TEMP	Deg C	3.61	3.06	4.61	4.56	4.33
800	EVAP AVG H2O TEMP	Deg C	8.88	8.59	9.48	9.51	9.38
801	EVAP WATER DENSITY	Kg/m3	1000.54	1000.56	1000.50	1000.50	1000.50
802	EVAP H2O VISCOSITY	cp	1.34	1.35	1.32	1.32	1.32
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
810	COND AVG H2O TEMP	Deg C	37.26	39.78	23.89	26.70	29.36
811	COND WATER DENSITY	Kg/m3	993.96	993.02	998.09	997.36	996.59
812	COND H2O VISCOSITY	cp	0.69	0.65	0.91	0.86	0.81
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
815	ITD/DELTA T		1.84	1.86	1.96	1.81	1.81
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.04	-0.03	0.01	-0.01	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.01	-0.02	0.01	0.00	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.03	0.02	0.02	0.02
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.03	-0.04	0.07	0.03	0.00

Small Impellers - Metric

LTO 23127 Note: Impeller diameters are 610/610/610 mm						
Run Number		215	216	217	218	219
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	70	70	70	70	40
Capacity	KW	656.78	609.67	552.01	472.90	665.22
Power	KW	145.74	140.75	134.10	123.84	132.53
Coefficient of Performance (COP)		4.51	4.33	4.12	3.82	5.02
Evaporator Outlet Water Temperature	Deg C	6.68	6.68	6.68	6.68	6.69
Evaporator Inlet Water Temperature	Deg C	29.46	32.23	35.01	37.61	21.14
Energy Balance	%	-1.37	-1.22	-1.05	-1.79	-1.22
Evaporator Inlet Water Temperature	Deg C	11.78	11.38	10.94	10.33	11.80
Evaporator Outlet Water Temperature	Deg C	6.68	6.68	6.68	6.68	6.69
Evaporator Water Temperature Flowrate	L/s	30.71	30.95	30.94	30.91	31.06
Condenser Inlet Water Temperature	Deg C	29.46	32.23	35.01	37.61	21.14
Condenser Outlet Water Temperature	Deg C	34.56	36.99	39.37	41.42	26.19
Condenser Water Temperature Flowrate	L/s	38.24	38.27	38.25	38.30	38.27
Evaporator Saturation Pressure	kPa	36.82	37.23	37.71	38.40	36.61
Saturation Temperature	Deg C	2.54	2.79	3.09	3.50	2.41
Approach	Deg C	4.11	3.89	3.61	3.17	4.28
Log Mean Temperature Difference	Deg C	6.35	5.93	5.45	4.77	6.50
ITD/Delta T		1.81	1.83	1.84	1.87	1.84
Q/Ao	kW/m2	42.85	39.78	36.01	30.87	43.43
Uo	kW/m2 C	6.75	6.71	6.61	6.47	6.68
ho'	kW/m2 C	11.09	10.97	10.71	10.36	10.85
Cond Sat Press	kPa	147.75	158.51	169.06	177.26	109.83
Sat Temp	Deg C	38.71	40.83	42.81	44.28	30.10
Approach	Deg C	4.17	3.83	3.44	2.83	3.89
Refrigerant Leaving Temp	Deg C	38.56	40.29	42.19	43.89	30.22
LMTD	Deg C	6.36	5.90	5.32	4.50	6.09
Q/Ao	kW/m2	42.36	39.56	36.12	31.60	42.08
Uo	kW/m2 C	6.66	6.71	6.78	7.03	6.91
ho'	kW/m2 C	9.94	9.96	10.04	10.50	10.84
Cond Sat Temp	Deg C	38.71	40.83	42.81	44.28	30.10
Evap Sat Temp	Deg C	2.54	2.79	3.09	3.50	2.41
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)	Rev/sec	59.27	59.30	59.34	59.39	59.34
Compressor Suction Flow Rate (2)	m3/sec	1.574	1.452	1.304	1.101	1.575
Isentropic COP (2)		6.801	6.451	6.190	6.041	9.015
Adiabatic Efficiency (3)		0.663	0.671	0.665	0.632	0.557
Q/N - m3/rev (4)		0.0266	0.0245	0.0220	0.0185	0.0265
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	113.35	115.14	115.07	114.87	115.90
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.79	11.39	10.95	10.34	11.81
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.77	11.37	10.93	10.31	11.79
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69	6.69	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67	6.67	6.67	6.68
15	COND WATER FLOWMETER DELTA P	kPa	174.92	174.99	174.57	174.92	175.68
17	ENT COND WATER TEMP LOC 1	Deg C	29.45	32.21	34.99	37.61	21.14
18	ENT COND WATER TEMP LOC 2	Deg C	29.46	32.24	35.03	37.62	21.13
19	LVG COND WATER TEMP LOC 1	Deg C	34.56	36.98	39.36	41.42	26.19
20	LVG COND WATER TEMP LOC 2	Deg C	34.56	37.00	39.38	41.43	26.18
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.73	5.13	5.28	5.58	4.34
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	4.06	4.32	4.57	4.93	3.78
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.38	4.69	5.04	5.42	4.23
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	36.82	37.23	37.71	38.40	36.61
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	60.05	61.85	63.91	66.05	53.23
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	60.47	62.26	64.26	66.19	53.30
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	56.40	58.88	61.50	64.19	49.02
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	88.18	93.15	97.22	100.73	75.84
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	97.42	101.70	105.83	110.52	75.77
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	91.36	96.87	102.25	106.32	74.05
431	COND SHELL STATIC PRESS - AVERAGE	kPa	147.75	158.51	169.06	177.26	109.83
440	REFRIGERANT LVG COND TEMP	Deg C	38.56	40.29	42.19	43.89	30.22
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	95.77	101.28	106.94	112.04	80.53
485	HIGH PRESS ECONOMIZER TEMP	Deg C	26.11	27.68	29.20	30.52	21.49
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	60.47	62.47	64.60	66.33	52.61
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.24	15.08	15.91	16.52	10.87
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	49.30	49.78	50.12	49.78	46.13
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	14.31	15.07	15.86	16.41	10.96
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	60.95	62.74	64.67	65.84	53.43
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.66	9.62	9.69	9.54	8.06
534	ENT COND ORIFICE ASS'Y PRESS	kPa	148.17	158.37	169.20	176.57	111.56
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	38.76	40.85	42.78	44.08	30.55
536	LVG COND ORIFICE ASS'Y PRESS	kPa	109.97	117.49	122.93	128.04	91.29
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	31.19	32.80	33.89	34.46	25.56
560	ATMOSPHERIC PRESS	kPa	99.15	99.15	99.15	99.15	99.15
580	MOTOR VOLTAGE - AB	Volts	3.88	3.88	3.89	3.91	3.90
581	MOTOR VOLTAGE - AC	Volts	3.89	3.89	3.90	3.91	3.92
582	MOTOR VOLTAGE - CB	Volts	3.87	3.87	3.88	3.89	3.89
583	MOTOR CURRENT - A	Volts	2.02	1.96	1.88	1.74	1.84
584	MOTOR CURRENT - B	Volts	2.11	2.05	1.96	1.82	1.93
585	MOTOR CURRENT - C	Volts	1.98	1.91	1.82	1.70	1.82
586	MOTOR POWER - PHASE 1	Volts	0.90	0.87	0.82	0.74	0.79
587	MOTOR POWER - PHASE 3	Volts	1.53	1.48	1.41	1.32	1.42
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	34.53	37.03	39.38	41.44	26.19
601	MAXIMUM MOTOR TEMPERATURE	Deg C	51.94	50.83	49.17	45.78	59.17
605	1st STAGE VANE SETTING	Degrees	70.00	70.00	70.00	70.00	40.00
607	3rd STAGE VANE SETTING	Degrees	63.00	63.00	63.00	63.00	50.00
608	UNIT HOUR METER READING	Hr	510.30	510.60	511.20	511.40	512.20
609	UNIT START COUNTER READING		134.00	134.00	134.00	134.00	134.00
610	CURRENT REFRIGERANT CHARGE	Kg	163.29	163.29	163.29	163.29	163.29
700	TIME (HOURS)	HOURS	388.48	388.88	389.18	389.54	405.69
701	ENERGY BALANCE	%	-1.37	-1.22	-1.05	-1.79	-1.22
702	EVAP CAPACITY	KW	656.78	609.67	552.01	472.90	665.22
703	EVAP WATER FLOWRATE	L/s	30.71	30.95	30.94	30.91	31.06
704	COND WATER FLOWRATE	L/s	38.24	38.27	38.25	38.30	38.27

Small Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.78	11.38	10.94	10.33	11.80
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.68	6.68	6.68	6.69
712	AVE ENT COND WATER TEMP	Deg C	29.46	32.23	35.01	37.61	21.14
713	AVE LVG COND WATER TEMP	Deg C	34.56	36.99	39.37	41.42	26.19
715	MOTOR VOLTAGE - AB	Volts	465.20	465.80	467.30	468.80	468.00
716	MOTOR VOLTAGE - AC	Volts	466.20	466.70	467.80	469.30	469.80
717	MOTOR VOLTAGE - CB	Volts	464.20	464.80	465.80	467.30	467.00
718	MOTOR CURRENT - A	Amps	202.00	196.30	187.80	174.20	183.60
719	MOTOR CURRENT - B	Amps	210.90	204.70	195.60	182.20	192.60
720	MOTOR CURRENT - C	Amps	197.60	190.70	182.00	169.50	181.70
721	UNIT POWER	KW	145.74	140.75	134.10	123.84	132.53
722	AVERAGE VOLTAGE	Volts	465.20	465.80	467.00	468.50	468.30
723	AVERAGE CURRENT	Amps	203.50	197.23	188.47	175.30	185.97
725	Coefficient of Performance (COP)		4.51	4.33	4.12	3.82	5.02
730	EVAP DELTA T	Deg C	5.10	4.70	4.26	3.65	5.11
731	COND DELTA T	Deg C	5.10	4.77	4.36	3.81	5.05
735	EVAP WATER FLOWRATE	Kg/sec	30.71	30.95	30.94	30.91	31.05
736	COND WATER FLOWRATE	Kg/sec	38.10	38.09	38.03	38.05	38.21
740	EVAP CAPACITY	Kw	656.61	609.60	551.84	472.95	665.39
741	COND CAPACITY	Kw	811.35	757.77	691.76	605.26	806.08
743	EVAP SATN TEMP (BASED ON ID #61)	Deg C	2.54	2.79	3.09	3.50	2.41
744	COND SATN TEMP (BASED ON ID #431)	Deg C	38.71	40.83	42.81	44.28	30.10
750	RUNNING TIME	Hr	181.40	181.70	182.30	182.50	183.30
751	STARTS		39.00	39.00	39.00	39.00	39.00
752	EVAP APPROACH TEMP	Deg C	4.11	3.89	3.61	3.17	4.28
753	COND APPROACH TEMP	Deg C	4.17	3.83	3.44	2.83	3.89
800	EVAP AVG H2O TEMP	Deg C	9.23	9.03	8.81	8.51	9.24
801	EVAP WATER DENSITY	Kg/m3	1000.51	1000.53	1000.54	1000.56	1000.51
802	EVAP H2O VISCOSITY	cp	1.33	1.33	1.34	1.36	1.33
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
810	COND AVG H2O TEMP	Deg C	32.01	34.61	37.19	39.52	23.67
811	COND WATER DENSITY	Kg/m3	995.77	994.90	993.99	993.12	998.14
812	COND H2O VISCOSITY	cp	0.76	0.72	0.69	0.66	0.92
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
815	ITD/DELTA T		1.81	1.83	1.84	1.87	1.84
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.01	-0.03	-0.03	-0.02	0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.00	-0.02	-0.02	-0.01	0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.02	0.02	0.03	0.02
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.02	-0.04	-0.02	-0.03	0.01

Small Impellers - Metric

LTO 23127 Note: Impeller diameters are 610/610/610 mm						
Run Number		220	221	222	223	224
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	40	40	40	40
Capacity	KW	643.77	617.05	583.65	542.16	490.83
Power	KW	131.88	130.74	128.52	125.10	119.28
Coefficient of Performance (COP)		4.88	4.72	4.54	4.33	4.11
Evaporator Outlet Water Temperature	Deg C	6.68	6.68	6.68	6.68	6.69
Evaporator Inlet Water Temperature	Deg C	23.89	26.69	29.46	32.27	34.97
Energy Balance	%	-1.38	-0.95	-1.51	-1.02	-1.52
Evaporator Inlet Water Temperature	Deg C	11.64	11.44	11.16	10.84	10.45
Evaporator Outlet Water Temperature	Deg C	6.68	6.68	6.68	6.68	6.69
Evaporator Water Temperature Flowrate	L/s	30.98	30.94	31.12	31.11	31.08
Condenser Inlet Water Temperature	Deg C	23.89	26.69	29.46	32.27	34.97
Condenser Outlet Water Temperature	Deg C	28.82	31.43	33.99	36.50	38.85
Condenser Water Temperature Flowrate	L/s	38.25	38.27	38.27	38.29	38.32
Evaporator Saturation Pressure	kPa	36.82	37.02	37.37	37.71	38.20
Saturation Temperature	Deg C	2.54	2.67	2.88	3.09	3.38
Approach	Deg C	4.17	4.00	3.78	3.61	3.33
Log Mean Temperature Difference	Deg C	6.29	6.08	5.75	5.41	4.96
ITD/Delta T		1.84	1.84	1.85	1.86	1.88
Q/Ao	kW/m2	42.01	40.28	38.09	35.38	32.02
Uo	kW/m2 C	6.67	6.62	6.62	6.55	6.46
ho'	kW/m2 C	10.85	10.72	10.70	10.52	10.31
Cond Sat Press	kPa	120.04	130.72	141.55	152.58	162.78
Sat Temp	Deg C	32.62	35.10	37.43	39.67	41.64
Approach	Deg C	3.78	3.67	3.44	3.17	2.78
Refrigerant Leaving Temp	Deg C	32.63	35.08	37.30	39.27	41.23
LMTD	Deg C	5.93	5.72	5.39	4.99	4.46
Q/Ao	kW/m2	40.95	39.35	37.64	35.12	32.23
Uo	kW/m2 C	6.91	6.88	6.99	7.04	7.23
ho'	kW/m2 C	10.72	10.56	10.70	10.71	11.07
Cond Sat Temp	Deg C	32.62	35.10	37.43	39.67	41.64
Evap Sat Temp	Deg C	2.54	2.67	2.88	3.09	3.38
Estimated Motor Efficiency (1)		0.94	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)	Rev/sec	59.35	59.35	59.37	59.38	59.42
Compressor Suction Flow Rate (2)	m3/sec	1.524	1.460	1.376	1.272	1.142
Isentropic COP (2)		8.273	7.660	7.175	6.761	6.463
Adiabatic Efficiency (3)		0.590	0.616	0.633	0.641	0.637
Q/N - m3/rev (4)		0.0257	0.0246	0.0232	0.0214	0.0192
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	115.35	115.00	116.31	116.31	116.11
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.65	11.46	11.17	10.85	10.47
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.63	11.43	11.14	10.82	10.44
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69	6.69	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67	6.67	6.67	6.68
15	COND WATER FLOWMETER DELTA P	kPa	175.26	175.33	175.20	175.13	175.20
17	ENT COND WATER TEMP LOC 1	Deg C	23.89	26.69	29.47	32.26	34.96
18	ENT COND WATER TEMP LOC 2	Deg C	23.89	26.69	29.46	32.28	34.98
19	LVG COND WATER TEMP LOC 1	Deg C	28.82	31.43	33.99	36.50	38.85
20	LVG COND WATER TEMP LOC 2	Deg C	28.82	31.42	33.99	36.50	38.86
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.46	5.11	5.12	5.29	5.21
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.90	4.19	4.33	4.56	4.68
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.27	4.44	4.72	4.89	5.26
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	36.82	37.02	37.37	37.71	38.20
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	54.54	56.26	58.12	60.33	62.47
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	54.74	56.54	58.40	60.67	62.88
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	50.81	52.88	55.23	57.85	60.60
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	79.22	83.22	87.77	92.11	94.39
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	79.70	84.32	89.77	95.84	101.56
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	78.60	83.63	89.08	95.08	98.80
431	COND SHELL STATIC PRESS - AVERAGE	kPa	120.04	130.72	141.55	152.58	162.78
440	REFRIGERANT LVG COND TEMP	Deg C	32.63	35.08	37.30	39.27	41.23
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	84.81	89.63	94.87	100.53	105.77
485	HIGH PRESS ECONOMIZER TEMP	Deg C	22.88	24.33	25.87	27.47	28.88
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	54.33	56.54	58.61	60.88	62.88
487	LOW PRESS ECONOMIZER TEMP	Deg C	11.64	12.54	13.43	14.41	15.24
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	46.68	47.16	47.92	48.47	48.40
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	11.76	12.53	13.43	14.35	15.16
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	54.95	56.88	58.88	61.16	62.95
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	8.05	8.38	8.62	8.86	8.83
534	ENT COND ORIFICE ASS'Y PRESS	kPa	121.14	131.48	141.41	152.37	162.44
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	32.88	35.27	37.51	39.61	41.54
536	LVG COND ORIFICE ASS'Y PRESS	kPa	96.66	102.46	107.83	114.31	120.66
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	27.12	28.70	30.28	31.78	32.84
560	ATMOSPHERIC PRESS	kPa	99.15	99.08	99.08	99.08	99.01
580	MOTOR VOLTAGE - AB	Volts	3.84	3.85	3.86	3.86	3.86
581	MOTOR VOLTAGE - AC	Volts	3.85	3.86	3.86	3.87	3.87
582	MOTOR VOLTAGE - CB	Volts	3.84	3.84	3.85	3.86	3.86
583	MOTOR CURRENT - A	Volts	1.84	1.83	1.80	1.75	1.67
584	MOTOR CURRENT - B	Volts	1.95	1.93	1.90	1.85	1.78
585	MOTOR CURRENT - C	Volts	1.81	1.79	1.76	1.72	1.65
586	MOTOR POWER - PHASE 1	Volts	0.81	0.80	0.79	0.76	0.71
587	MOTOR POWER - PHASE 3	Volts	1.39	1.38	1.36	1.33	1.28
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	28.80	31.42	33.96	36.46	38.84
601	MAXIMUM MOTOR TEMPERATURE	Deg C	46.94	45.28	44.72	43.56	42.50
606	1st STAGE VANE SETTING	Degrees	40.00	40.00	40.00	40.00	40.00
607	3rd STAGE VANE SETTING	Degrees	50.00	50.00	50.00	50.00	50.00
608	UNIT HOUR METER READING	Hr	512.50	513.20	513.40	514.00	514.40
609	UNIT START COUNTER READING		135.00	135.00	135.00	135.00	135.00
610	CURRENT REFRIGERANT CHARGE	Kg	163.29	163.29	163.29	163.29	163.29
700	TIME (HOURS)	HOURS	406.18	406.66	407.08	407.40	408.02
701	ENERGY BALANCE	%	-1.38	-0.95	-1.51	-1.02	-1.52
702	EVAP CAPACITY	KW	643.77	617.05	583.65	542.16	490.83
703	EVAP WATER FLOWRATE	L/s	30.98	30.94	31.12	31.11	31.08
704	COND WATER FLOWRATE	L/s	38.25	38.27	38.27	38.29	38.32

Small Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.64	11.44	11.16	10.84	10.45
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.68	6.68	6.68	6.69
712	AVE ENT COND WATER TEMP	Deg C	23.89	26.69	29.46	32.27	34.97
713	AVE LVG COND WATER TEMP	Deg C	28.82	31.43	33.99	36.50	38.85
715	MOTOR VOLTAGE - AB	Volts	460.70	461.40	462.60	463.70	463.20
716	MOTOR VOLTAGE - AC	Volts	461.90	462.60	463.60	464.60	464.00
717	MOTOR VOLTAGE - CB	Volts	460.30	461.00	461.80	462.70	462.70
718	MOTOR CURRENT - A	Amps	184.10	182.60	180.40	175.40	166.70
719	MOTOR CURRENT - B	Amps	195.10	192.80	190.00	184.60	178.40
720	MOTOR CURRENT - C	Amps	180.70	179.30	176.10	172.40	165.00
721	UNIT POWER	KW	131.88	130.74	128.52	125.10	119.28
722	AVERAGE VOLTAGE	Volts	461.00	461.70	462.70	463.70	463.30
723	AVERAGE CURRENT	Amps	186.63	184.90	182.17	177.47	170.03
725	Coefficient of Performance (COP)		4.88	4.72	4.54	4.33	4.11
730	EVAP DELTA T	Deg C	4.96	4.76	4.47	4.16	3.77
731	COND DELTA T	Deg C	4.92	4.73	4.52	4.23	3.88
735	EVAP WATER FLOWRATE	Kg/sec	30.97	30.93	31.11	31.10	31.08
736	COND WATER FLOWRATE	Kg/sec	38.16	38.15	38.13	38.11	38.10
740	EVAP CAPACITY	Kw	643.63	617.14	583.56	542.14	490.69
741	COND CAPACITY	Kw	784.42	753.74	720.89	672.75	617.42
743	EVAP SATN TEMP (BASED ON ID #61)	Deg C	2.54	2.67	2.88	3.09	3.38
744	COND SATN TEMP (BASED ON ID #431)	Deg C	32.62	35.10	37.43	39.67	41.64
750	RUNNING TIME	Hr	183.60	184.30	184.50	185.10	185.50
751	STARTS		40.00	40.00	40.00	40.00	40.00
752	EVAP APPROACH TEMP	Deg C	4.17	4.00	3.78	3.61	3.33
753	COND APPROACH TEMP	Deg C	3.78	3.67	3.44	3.17	2.78
800	EVAP AVG H2O TEMP	Deg C	9.16	9.06	8.92	8.76	8.57
801	EVAP WATER DENSITY	Kg/m3	1000.52	1000.53	1000.54	1000.55	1000.56
802	EVAP H2O VISCOSITY	cp	1.33	1.33	1.34	1.35	1.35
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
810	COND AVG H2O TEMP	Deg C	26.36	29.06	31.73	34.39	36.91
811	COND WATER DENSITY	Kg/m3	997.45	996.68	995.86	994.98	994.09
812	COND H2O VISCOSITY	cp	0.86	0.81	0.77	0.73	0.69
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
815	ITD/DELTA T		1.84	1.84	1.85	1.86	1.88
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.01	0.00	0.01	-0.02	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.01	0.02	0.01	0.00	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.02	0.02	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	0.02	0.02	0.03	0.04	0.01

Small Impellers - Metric

LTO 23127 Note: impeller diameters are 610/610/610 mm						
Run Number		225	226	227	228	229
Refrigerant		123	123	123	123	123
Oil		Solest 68	Solest 68	Solest 68	Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	40	10	10	10	10
Capacity	KW	290.07	280.93	274.60	262.64	246.47
Power	KW	94.08	63.36	65.22	67.26	67.26
Coefficient of Performance (COP)		3.08	4.43	4.21	3.90	3.66
Evaporator Outlet Water Temperature	Deg C	6.69	6.69	6.69	6.68	6.69
Evaporator Inlet Water Temperature	Deg C	38.85	21.11	23.88	26.67	29.46
Energy Balance	%	-1.41	-2.77	-2.51	-2.54	-2.56
Evaporator Inlet Water Temperature	Deg C	8.92	8.84	8.79	8.70	8.58
Evaporator Outlet Water Temperature	Deg C	6.69	6.69	6.69	6.68	6.69
Evaporator Water Temperature Flowrate	L/s	31.01	31.08	31.07	31.05	31.06
Condenser Inlet Water Temperature	Deg C	38.85	21.11	23.88	26.67	29.46
Condenser Outlet Water Temperature	Deg C	41.29	23.32	26.06	28.79	31.46
Condenser Water Temperature Flowrate	L/s	38.39	38.13	38.16	38.24	38.30
Evaporator Saturation Pressure	kPa	39.99	39.78	40.06	40.27	40.40
Saturation Temperature	Deg C	4.43	4.31	4.47	4.58	4.66
Approach	Deg C	2.28	2.39	2.22	2.11	2.00
Log Mean Temperature Difference	Deg C	3.25	3.35	3.16	3.00	2.87
ITD/Delta T		2.01	2.10	2.06	2.04	2.07
Q/Ao	kW/m2	18.93	18.34	17.93	17.14	16.08
Uo	kW/m2 C	5.83	5.48	5.67	5.72	5.60
ho'	kW/m2 C	8.82	8.04	8.47	8.58	8.32
Cond Sat Press	kPa	168.78	91.70	99.15	108.80	119.21
Sat Temp	Deg C	42.76	25.12	27.25	29.83	32.42
Approach	Deg C	1.44	1.78	1.17	1.06	0.94
Refrigerant Leaving Temp	Deg C	42.23	24.77	27.38	29.92	32.46
LMTD	Deg C	2.49	2.76	2.09	1.91	1.78
Q/Ao	kW/m2	20.27	18.38	18.11	17.57	16.70
Uo	kW/m2 C	8.14	6.66	6.65	9.21	9.39
ho'	kW/m2 C	13.13	10.31	15.77	17.40	17.72
Cond Sat Temp	Deg C	42.76	25.12	27.25	29.83	32.42
Evap Sat Temp	Deg C	4.43	4.31	4.47	4.58	4.66
Estimated Motor Efficiency (1)		0.95	0.94	0.94	0.94	0.94
Estimated Motor Rev/sec (1)	Rev/sec	59.55	59.70	59.69	59.68	59.68
Compressor Suction Flow Rate (2)	m3/sec	0.648	0.610	0.594	0.569	0.535
Isentropic COP (2)		6.499	12.124	11.162	10.046	9.109
Adiabatic Efficiency (3)		0.474	0.366	0.377	0.389	0.402
Q/N - m3/rev (4)		0.0109	0.0102	0.0100	0.0095	0.0090
(1) From motor curves at measured power input						
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split						
(3) Ratio of isentropic and test KW/T						
(4) CFM from cycle calculation / estimated motor RPM						
(5) Heat transfer coefficient calculations use bulk fluid properties						

Small Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	115.62	116.18	116.04	115.90	115.97
3	ENT EVAP WATER TEMP LOC 1	Deg C	8.93	8.86	8.81	8.72	8.59
4	ENT EVAP WATER TEMP LOC 2	Deg C	8.90	8.83	8.78	8.68	8.56
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69	6.69	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.68	6.68	6.68	6.67	6.68
15	COND WATER FLOWMETER DELTA P	kPa	175.54	174.37	174.51	174.99	175.40
17	ENT COND WATER TEMP LOC 1	Deg C	38.82	21.11	23.88	26.67	29.44
18	ENT COND WATER TEMP LOC 2	Deg C	38.87	21.11	23.88	26.68	29.47
19	LVG COND WATER TEMP LOC 1	Deg C	41.28	23.33	26.07	28.79	31.46
20	LVG COND WATER TEMP LOC 2	Deg C	41.29	23.32	26.06	28.79	31.47
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	6.29	5.19	5.48	5.61	5.73
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	5.78	5.49	5.74	5.98	6.04
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	6.29	5.86	6.13	6.21	6.57
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	39.99	39.78	40.06	40.27	40.40
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	65.43	39.51	42.47	45.57	48.68
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	66.74	39.92	43.09	46.33	49.64
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	64.67	38.75	41.64	44.82	47.92
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	97.77	46.26	52.33	58.88	65.57
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	106.73	55.57	61.16	67.02	74.05
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	105.83	59.02	64.88	70.95	77.57
431	COND SHELL STATIC PRESS - AVERAGE	kPa	168.78	91.70	99.15	108.80	119.21
440	REFRIGERANT LVG COND TEMP	Deg C	42.23	24.77	27.38	29.92	32.46
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	110.52	66.74	72.05	77.63	83.50
485	HIGH PRESS ECONOMIZER TEMP	Deg C	30.13	16.97	18.62	20.52	22.49
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	65.02	39.51	42.40	45.30	48.47
487	LOW PRESS ECONOMIZER TEMP	Deg C	16.08	4.18	5.79	7.32	8.91
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	48.95	40.75	41.92	42.82	43.85
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	15.77	4.32	5.83	7.33	8.81
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	64.26	40.82	43.09	45.64	48.47
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.02	4.37	5.31	5.97	6.42
534	ENT COND ORIFICE ASS'Y PRESS	kPa	167.96	89.15	98.94	108.94	119.21
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	42.59	24.57	27.27	29.88	32.47
536	LVG COND ORIFICE ASS'Y PRESS	kPa	121.35	72.05	78.26	84.25	90.73
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	32.83	18.98	20.99	22.82	24.73
560	ATMOSPHERIC PRESS	kPa	99.01	98.94	98.94	98.87	98.80
580	MOTOR VOLTAGE - AB	Volts	3.85	3.88	3.88	3.89	3.89
581	MOTOR VOLTAGE - AC	Volts	3.86	3.89	3.89	3.89	3.89
582	MOTOR VOLTAGE - CB	Volts	3.84	3.87	3.87	3.88	3.88
583	MOTOR CURRENT - A	Volts	1.37	1.03	1.05	1.07	1.07
584	MOTOR CURRENT - B	Volts	1.46	1.09	1.11	1.14	1.14
585	MOTOR CURRENT - C	Volts	1.36	1.04	1.06	1.07	1.07
586	MOTOR POWER - PHASE 1	Volts	0.53	0.28	0.29	0.31	0.31
587	MOTOR POWER - PHASE 3	Volts	1.04	0.78	0.80	0.81	0.81
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	41.31	23.26	26.03	28.76	31.46
601	MAXIMUM MOTOR TEMPERATURE	Deg C	36.94	28.61	28.06	24.72	24.44
605	1st STAGE VANE SETTING	Degrees	40.00	10.00	10.00	10.00	10.00
607	3rd STAGE VANE SETTING	Degrees	50.00	19.00	19.00	19.00	19.00
608	UNIT HOUR METER READING	Hr	515.20	515.50	516.10	516.40	517.10
609	UNIT START COUNTER READING		135.00	135.00	135.00	135.00	135.00
610	CURRENT REFRIGERANT CHARGE	Kg	163.29	163.29	163.29	163.29	163.29
700	TIME (HOURS)	HOURS	408.66	409.21	409.58	410.08	410.62
701	ENERGY BALANCE	%	-1.41	-2.77	-2.51	-2.54	-2.56
702	EVAP CAPACITY	KW	290.07	280.93	274.60	262.64	246.47
703	EVAP WATER FLOWRATE	L/s	31.01	31.08	31.07	31.05	31.06
704	COND WATER FLOWRATE	L/s	38.39	38.13	38.16	38.24	38.30

Small Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	8.92	8.84	8.79	8.70	8.58
711	AVE LVG EVAP WATER TEMP	Deg C	6.69	6.69	6.69	6.68	6.69
712	AVE ENT COND WATER TEMP	Deg C	38.85	21.11	23.88	26.67	29.46
713	AVE LVG COND WATER TEMP	Deg C	41.29	23.32	26.06	28.79	31.46
715	MOTOR VOLTAGE - AB	Volts	461.90	465.40	465.50	466.40	466.80
716	MOTOR VOLTAGE - AC	Volts	462.60	466.20	466.20	467.20	467.20
717	MOTOR VOLTAGE - CB	Volts	461.00	464.40	464.50	465.20	465.80
718	MOTOR CURRENT - A	Amps	137.00	102.50	104.70	107.00	107.20
719	MOTOR CURRENT - B	Amps	145.70	108.90	110.60	114.20	114.00
720	MOTOR CURRENT - C	Amps	136.00	104.10	105.80	106.90	106.90
721	UNIT POWER	KW	94.08	63.36	65.22	67.26	67.26
722	AVERAGE VOLTAGE	Volts	461.80	465.30	465.40	466.30	466.60
723	AVERAGE CURRENT	Amps	139.57	105.17	107.03	109.37	109.37
725	Coefficient of Performance (COP)		3.08	4.43	4.21	3.90	3.66
730	EVAP DELTA T	Deg C	2.23	2.16	2.11	2.02	1.89
731	COND DELTA T	Deg C	2.44	2.21	2.18	2.11	2.01
735	EVAP WATER FLOWRATE	Kg/sec	31.01	31.09	31.07	31.05	31.06
736	COND WATER FLOWRATE	Kg/sec	38.12	38.07	38.07	38.12	38.15
740	EVAP CAPACITY	Kw	290.07	280.99	274.67	262.58	246.38
741	COND CAPACITY	Kw	388.24	352.11	346.78	336.50	319.95
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	4.43	4.31	4.47	4.58	4.66
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	42.76	25.12	27.25	29.83	32.42
750	RUNNING TIME	Hr	186.30	186.60	187.20	187.50	188.20
751	STARTS		40.00	40.00	40.00	40.00	40.00
752	EVAP APPROACH TEMP	Deg C	2.28	2.39	2.22	2.11	2.00
753	COND APPROACH TEMP	Deg C	1.44	1.78	1.17	1.06	0.94
800	EVAP AVG H2O TEMP	Deg C	7.81	7.77	7.74	7.69	7.63
801	EVAP WATER DENSITY	Kg/m3	1000.60	1000.61	1000.61	1000.61	1000.61
802	EVAP H2O VISCOSITY	cp	1.38	1.38	1.39	1.39	1.39
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.19	4.19	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
810	COND AVG H2O TEMP	Deg C	40.07	22.22	24.97	27.74	30.46
811	COND WATER DENSITY	Kg/m3	992.91	998.49	997.82	997.07	996.26
812	COND H2O VISCOSITY	cp	0.65	0.95	0.89	0.84	0.79
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.18	4.18	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006	0.0006	0.0006
815	ITD/DELTA T		2.01	2.10	2.06	2.04	2.07
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.05	0.01	-0.01	-0.01	-0.02
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.02	0.01	0.01	0.01	-0.01
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.03	0.03	0.03	0.03	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02	0.02	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.03	0.06	0.03	0.03	0.01

Small Impellers - Metric

LTO 23127 Note: Impeller diameters are 610/610/610 mm					
Run Number		230	231	232	
Refrigerant		123	123	123	
Oil		Solest 68	Solest 68	Solest 68	
1st Stage Guide Vane Setting	Degrees	10	10	90	
Capacity	KW	225.02	210.61	672.96	
Power	KW	68.16	68.51	151.08	
Coefficient of Performance (COP)		3.30	3.07	4.45	
Evaporator Outlet Water Temperature	Deg C	6.68	6.67	6.68	
Evaporator Inlet Water Temperature	Deg C	32.25	33.89	29.46	
Energy Balance	%	-2.22	-1.35	-1.21	
Evaporator Inlet Water Temperature	Deg C	8.41	8.29	12.26	
Evaporator Outlet Water Temperature	Deg C	6.68	6.67	6.68	
Evaporator Water Temperature Flowrate	L/s	31.01	31.03	28.79	
Condenser Inlet Water Temperature	Deg C	32.25	33.89	29.46	
Condenser Outlet Water Temperature	Deg C	34.12	35.67	35.06	
Condenser Water Temperature Flowrate	L/s	38.32	38.32	35.74	
Evaporator Saturation Pressure	kPa	40.68	40.82	36.54	
Saturation Temperature	Deg C	4.82	4.90	2.37	
Approach	Deg C	1.83	1.78	4.33	
Log Mean Temperature Difference	Deg C	2.63	2.49	6.71	
ITD/Delta T		2.07	2.09	1.77	
Q/Ao	kW/m2	14.69	13.75	43.91	
Uo	kW/m2 C	5.59	5.52	6.54	
ho'	kW/m2 C	8.30	8.13	10.83	
Cond Sat Press	kPa	130.10	137.41	149.96	
Sat Temp	Deg C	34.96	36.55	39.16	
Approach	Deg C	0.83	0.89	4.11	
Refrigerant Leaving Temp	Deg C	34.78	36.32	39.04	
LMTD	Deg C	1.60	1.61	6.50	
Q/Ao	kW/m2	15.57	14.73	43.44	
Uo	kW/m2 C	9.75	9.15	6.69	
ho'	kW/m2 C	18.72	16.46	10.26	
Cond Sat Temp	Deg C	34.96	36.55	39.16	
Evap Sat Temp	Deg C	4.82	4.90	2.37	
Estimated Motor Efficiency (1)		0.95	0.95	0.94	
Estimated Motor Rev/sec (1)	Rev/sec	59.68	59.67	59.24	
Compressor Suction Flow Rate (2)	m3/sec	0.488	0.456	1.626	
Isentropic COP (2)		8.351	7.937	6.659	
Adiabatic Efficiency (3)		0.395	0.387	0.669	
Q/N - m3/rev (4)		0.0082	0.0076	0.0275	
(1) From motor curves at measured power input					
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split					
(3) Ratio of isentropic and test KW/T					
(4) CFM from cycle calculation / estimated motor RPM					
(5) Heat transfer coefficient calculations use bulk fluid properties					

Small Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	115.62	115.76	99.63
3	ENT EVAP WATER TEMP LOC 1	Deg C	8.43	8.32	12.27
4	ENT EVAP WATER TEMP LOC 2	Deg C	8.39	8.26	12.24
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.68	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.66	6.67
15	COND WATER FLOWMETER DELTA P	kPa	175.47	175.33	152.72
17	ENT COND WATER TEMP LOC 1	Deg C	32.24	33.89	29.46
18	ENT COND WATER TEMP LOC 2	Deg C	32.26	33.90	29.47
19	LVG COND WATER TEMP LOC 1	Deg C	34.11	35.67	35.06
20	LVG COND WATER TEMP LOC 2	Deg C	34.13	35.67	35.06
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	5.88	5.97	3.54
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	6.07	6.18	3.89
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	6.59	6.72	4.48
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	40.68	40.82	36.54
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	52.06	54.40	60.33
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	53.16	55.50	60.74
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	51.50	53.92	56.61
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	72.74	77.57	88.11
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	80.74	86.12	97.35
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	84.39	89.42	91.22
431	COND SHELL STATIC PRESS - AVERAGE	kPa	130.10	137.41	149.96
440	REFRIGERANT LVG COND TEMP	Deg C	34.78	36.32	39.04
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	89.70	93.98	95.63
485	HIGH PRESS ECONOMIZER TEMP	Deg C	24.37	25.60	26.10
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	51.92	54.26	60.54
487	LOW PRESS ECONOMIZER TEMP	Deg C	10.57	11.62	14.34
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	44.95	45.71	50.40
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	10.37	11.41	14.41
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	51.78	53.99	61.43
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	7.02	7.38	9.82
534	ENT COND ORIFICE ASS'Y PRESS	kPa	129.83	136.65	150.86
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	34.98	36.46	39.31
536	LVG COND ORIFICE ASS'Y PRESS	kPa	97.77	102.11	114.59
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	26.81	28.00	31.71
560	ATMOSPHERIC PRESS	kPa	98.80	98.73	98.66
580	MOTOR VOLTAGE - AB	Volts	3.87	3.86	3.88
581	MOTOR VOLTAGE - AC	Volts	3.88	3.87	3.88
582	MOTOR VOLTAGE - CB	Volts	3.86	3.86	3.87
583	MOTOR CURRENT - A	Volts	1.08	1.08	2.10
584	MOTOR CURRENT - B	Volts	1.16	1.16	2.19
585	MOTOR CURRENT - C	Volts	1.07	1.08	2.03
586	MOTOR POWER - PHASE 1	Volts	0.33	0.33	0.94
587	MOTOR POWER - PHASE 3	Volts	0.81	0.81	1.58
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	34.12	35.72	35.06
601	MAXIMUM MOTOR TEMPERATURE	Deg C	25.83	26.94	54.72
605	1st STAGE VANE SETTING	Degrees	10.00	10.00	90.00
607	3rd STAGE VANE SETTING	Degrees	19.00	19.00	68.00
608	UNIT HOUR METER READING	Hr	517.40	518.10	519.00
609	UNIT START COUNTER READING		135.00	135.00	135.00
610	CURRENT REFRIGERANT CHARGE	Kg	163.29	163.29	163.29
700	TIME (HOURS)	HOURS	411.01	411.61	412.38
701	ENERGY BALANCE	%	-2.22	-1.35	-1.21
702	EVAP CAPACITY	KW	225.02	210.61	672.96
703	EVAP WATER FLOWRATE	L/s	31.01	31.03	28.79
704	COND WATER FLOWRATE	L/s	38.32	38.32	35.74

Small Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	8.41	8.29	12.26
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.67	6.68
712	AVE ENT COND WATER TEMP	Deg C	32.25	33.89	29.46
713	AVE LVG COND WATER TEMP	Deg C	34.12	35.67	35.06
715	MOTOR VOLTAGE - AB	Volts	464.60	463.30	465.50
716	MOTOR VOLTAGE - AC	Volts	465.00	464.30	465.80
717	MOTOR VOLTAGE - CB	Volts	463.40	462.80	464.40
718	MOTOR CURRENT - A	Amps	107.60	107.70	209.60
719	MOTOR CURRENT - B	Amps	115.80	115.80	218.80
720	MOTOR CURRENT - C	Amps	106.90	107.80	203.40
721	UNIT POWER	KW	68.16	68.51	151.08
722	AVERAGE VOLTAGE	Volts	464.30	463.50	465.20
723	AVERAGE CURRENT	Amps	110.10	110.43	210.60
725	Coefficient of Performance (COP)		3.30	3.07	4.45
730	EVAP DELTA T	Deg C	1.73	1.62	5.58
731	COND DELTA T	Deg C	1.87	1.77	5.60
735	EVAP WATER FLOWRATE	Kg/sec	31.01	31.03	28.79
736	COND WATER FLOWRATE	Kg/sec	38.14	38.12	35.60
740	EVAP CAPACITY	Kw	225.07	210.75	672.82
741	COND CAPACITY	Kw	298.21	282.11	832.01
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	4.82	4.90	2.37
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	34.96	36.55	39.16
750	RUNNING TIME	Hr	188.50	189.20	190.10
751	STARTS		40.00	40.00	40.00
752	EVAP APPROACH TEMP	Deg C	1.83	1.78	4.33
753	COND APPROACH TEMP	Deg C	0.83	0.89	4.11
800	EVAP AVG H2O TEMP	Deg C	7.54	7.48	9.47
801	EVAP WATER DENSITY	Kg/m3	1000.62	1000.62	1000.50
802	EVAP H2O VISCOSITY	cp	1.39	1.40	1.32
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.19	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006
810	COND AVG H2O TEMP	Deg C	33.18	34.78	32.26
811	COND WATER DENSITY	Kg/m3	995.38	994.84	995.69
812	COND H2O VISCOSITY	cp	0.74	0.72	0.76
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.18	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006	0.0006
815	ITD/DELTA T		-2.07	2.09	1.77
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.02	-0.01	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	-0.02	0.00	0.00
852	RTD DIFFERENCE CHECK - EEW	Deg C	0.04	0.06	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.03	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.01	-0.06	0.01

Small Impellers - Metric

LTO 23127 Note: Impeller diameters are 610/610/610 mm			
Run Number		208	232
Refrigerant		123	123
Oil		Solest 68	Solest 68
1st Stage Guide Vane Setting	Degrees	90	90
Capacity	KW	676.47	672.96
Power	KW	151.02	151.08
Coefficient of Performance (COP)		4.48	4.45
Evaporator Outlet Water Temperature	Deg C	6.68	6.68
Evaporator Inlet Water Temperature	Deg C	29.43	29.46
Energy Balance	%	-1.25	-1.21
Evaporator Inlet Water Temperature	Deg C	11.91	12.26
Evaporator Outlet Water Temperature	Deg C	6.68	6.68
Evaporator Water Temperature Flowrate	L/s	30.92	28.79
Condenser Inlet Water Temperature	Deg C	29.43	29.46
Condenser Outlet Water Temperature	Deg C	34.69	35.06
Condenser Water Temperature Flowrate	L/s	38.22	35.74
Evaporator Saturation Pressure	kPa	36.68	36.54
Saturation Temperature	Deg C	2.46	2.37
Approach	Deg C	4.22	4.33
Log Mean Temperature Difference	Deg C	6.48	6.71
ITD/Delta T		1.81	1.77
Q/Ao	kW/m2	44.15	43.91
Uo	kW/m2 C	6.81	6.54
ho'	kW/m2 C	11.22	10.83
Cond Sat Press	kPa	149.20	149.96
Sat Temp	Deg C	39.00	39.16
Approach	Deg C	4.33	4.11
Refrigerant Leaving Temp	Deg C	38.81	39.04
LMTD	Deg C	6.59	6.50
Q/Ao	kW/m2	43.64	43.44
Uo	kW/m2 C	6.62	6.69
ho'	kW/m2 C	9.86	10.26
Cond Sat Temp	Deg C	39.00	39.16
Evap Sat Temp	Deg C	2.46	2.37
Estimated Motor Efficiency (1)		0.94	0.94
Estimated Motor Rev/sec (1)	Rev/sec	59.24	59.24
Compressor Suction Flow Rate (2)	m3/sec	1.628	1.626
Isentropic COP (2)		6.710	6.659
Adiabatic Efficiency (3)		0.668	0.669
Q/N - m3/rev (4)		0.0275	0.0275
(1) From motor curves at measured power input			
(2) Cycle calculation using evap and cond sat, motor efficiency, and equal head split			
(3) Ratio of isentropic and test KW/T			
(4) CFM from cycle calculation / estimated motor RPM			
(5) Heat transfer coefficient calculations use bulk fluid properties			

Small Impellers - Metric

1	EVAP WATER FLOWMETER DELTA P	kPa	114.87	99.63
3	ENT EVAP WATER TEMP LOC 1	Deg C	11.91	12.27
4	ENT EVAP WATER TEMP LOC 2	Deg C	11.89	12.24
5	LVG EVAP WATER TEMP LOC 1	Deg C	6.69	6.69
6	LVG EVAP WATER TEMP LOC 2	Deg C	6.67	6.67
15	COND WATER FLOWMETER DELTA P	kPa	174.64	152.72
17	ENT COND WATER TEMP LOC 1	Deg C	29.43	29.46
18	ENT COND WATER TEMP LOC 2	Deg C	29.44	29.47
19	LVG COND WATER TEMP LOC 1	Deg C	34.69	35.06
20	LVG COND WATER TEMP LOC 2	Deg C	34.69	35.06
50	ABOVE EVAP DISTRIB TEMP - SUPPLY	Deg C	4.56	3.54
51	ABOVE EVAP DISTRIB TEMP - MIDDLE	Deg C	3.94	3.89
52	ABOVE EVAP DISTRIB TEMP - RETURN	Deg C	4.27	4.48
61	EVAP SHELL STATIC PRESS - AVERAGE	kPa	36.68	36.54
215	ENT 2nd IMPELLER TOTAL PRESS #1	kPa	60.47	60.33
216	ENT 2nd IMPELLER TOTAL PRESS #2	kPa	61.02	60.74
218	ENT 2nd IMP SHROUD STATIC PRESS #1	kPa	56.81	56.61
315	ENT 3rd IMPELLER TOTAL PRESS #1	kPa	89.15	88.11
316	ENT 3rd IMPELLER TOTAL PRESS #2	kPa	96.87	97.35
318	ENT 3rd IMP SHROUD STATIC PRESS #1	kPa	91.42	91.22
431	COND SHELL STATIC PRESS - AVERAGE	kPa	149.20	149.96
440	REFRIGERANT LVG COND TEMP	Deg C	38.81	39.04
484	HIGH PRESS ECONOMIZER STATIC PRESS	kPa	95.84	95.63
485	HIGH PRESS ECONOMIZER TEMP	Deg C	26.16	26.10
486	LOW PRESS ECONOMIZER STATIC PRESS	kPa	60.88	60.54
487	LOW PRESS ECONOMIZER TEMP	Deg C	14.45	14.34
530	ENT EVAP ORIFICE ASS'Y PRESS	kPa	50.26	50.40
531	ENT EVAP ORIFICE ASS'Y TEMP	Deg C	14.52	14.41
532	LVG EVAP ORIFICE ASS'Y PRESS	kPa	61.57	61.43
533	LVG EVAP ORIFICE ASS'Y TEMP	Deg C	9.86	9.82
534	ENT COND ORIFICE ASS'Y PRESS	kPa	150.17	150.86
535	ENT COND ORIFICE ASS'Y TEMP	Deg C	39.08	39.31
536	LVG COND ORIFICE ASS'Y PRESS	kPa	113.28	114.59
537	LVG COND ORIFICE ASS'Y TEMP	Deg C	31.51	31.71
560	ATMOSPHERIC PRESS	kPa	99.35	98.66
580	MOTOR VOLTAGE - AB	Volts	3.83	3.88
581	MOTOR VOLTAGE - AC	Volts	3.83	3.88
582	MOTOR VOLTAGE - CB	Volts	3.82	3.87
583	MOTOR CURRENT - A	Volts	2.11	2.10
584	MOTOR CURRENT - B	Volts	2.20	2.19
585	MOTOR CURRENT - C	Volts	2.04	2.03
586	MOTOR POWER - PHASE 1	Volts	0.96	0.94
587	MOTOR POWER - PHASE 3	Volts	1.56	1.58
595	TC CARD #1 CHECK (LVG COND TEMP)	Deg C	34.70	35.06
601	MAXIMUM MOTOR TEMPERATURE	Deg C	55.28	54.72
605	1st STAGE VANE SETTING	Degrees	90.00	90.00
607	3rd STAGE VANE SETTING	Degrees	68.00	68.00
608	UNIT HOUR METER READING	Hr	506.20	519.00
609	UNIT START COUNTER READING		134.00	135.00
610	CURRENT REFRIGERANT CHARGE	Kg	163.29	163.29
700	TIME (HOURS)	HOURS	384.16	412.38
701	ENERGY BALANCE	%	-1.25	-1.21
702	EVAP CAPACITY	KW	676.47	672.96
703	EVAP WATER FLOWRATE	L/s	30.92	28.79
704	COND WATER FLOWRATE	L/s	38.22	35.74

Small Impellers - Metric

710	AVE ENT EVAP WATER TEMP	Deg C	11.91	12.26
711	AVE LVG EVAP WATER TEMP	Deg C	6.68	6.68
712	AVE ENT COND WATER TEMP	Deg C	29.43	29.46
713	AVE LVG COND WATER TEMP	Deg C	34.69	35.06
715	MOTOR VOLTAGE - AB	Volts	459.70	465.50
716	MOTOR VOLTAGE - AC	Volts	460.00	465.80
717	MOTOR VOLTAGE - CB	Volts	458.80	464.40
718	MOTOR CURRENT - A	Amps	210.90	209.60
719	MOTOR CURRENT - B	Amps	220.30	218.80
720	MOTOR CURRENT - C	Amps	204.00	203.40
721	UNIT POWER	KW	151.02	151.08
722	AVERAGE VOLTAGE	Volts	459.50	465.20
723	AVERAGE CURRENT	Amps	211.73	210.60
725	Coefficient of Performance (COP)		4.48	4.45
730	EVAP DELTA T	Deg C	5.22	5.58
731	COND DELTA T	Deg C	5.26	5.60
735	EVAP WATER FLOWRATE	Kg/sec	30.91	28.79
736	COND WATER FLOWRATE	Kg/sec	38.07	35.60
740	EVAP CAPACITY	Kw	676.43	672.82
741	COND CAPACITY	Kw	835.87	832.01
743	EVAP SAT'N TEMP (BASED ON ID #61)	Deg C	2.46	2.37
744	COND SAT'N TEMP (BASED ON ID #431)	Deg C	39.00	39.16
750	RUNNING TIME	Hr	177.30	190.10
751	STARTS		39.00	40.00
752	EVAP APPROACH TEMP	Deg C	4.22	4.33
753	COND APPROACH TEMP	Deg C	4.33	4.11
800	EVAP AVG H2O TEMP	Deg C	9.29	9.47
801	EVAP WATER DENSITY	Kg/m3	1000.51	1000.50
802	EVAP H2O VISCOSITY	cp	1.33	1.32
803	EVAP H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.19	4.19
804	EVAP H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006
810	COND AVG H2O TEMP	Deg C	32.07	32.26
811	COND WATER DENSITY	Kg/m3	995.75	995.69
812	COND H2O VISCOSITY	cp	0.76	0.76
813	COND H2O SPECIFIC HEAT (Cp)	Kj/Kg C	4.18	4.18
814	COND H2O THERMAL CONDUCTIVITY	KW/M C	0.0006	0.0006
815	ITD/DELTA T		1.81	1.77
850	RTD DIFFERENCE CHECK - ECWT	Deg C	-0.01	-0.01
851	RTD DIFFERENCE CHECK - LCWT	Deg C	0.00	0.00
852	RTD DIFFERENCE CHECK - EEWT	Deg C	0.02	0.03
853	RTD DIFFERENCE CHECK - LEWT	Deg C	0.02	0.02
870	TC/RTD CARD #1 CHECK (#19-#595)	Deg C	-0.01	0.01