## Appendix 5.3.3-4

## Calculation of Overall Heat Transfer Coefficient(U) and Fouling Factor(f) in Run 4

## OPERATION CONDITIONS FOR

## RUN 4

1.Operation Period 24t	h Sep. to 7th Oct.
2.Operation Time	320 h
3.Scale Control Method	PPN(M) Dosing
4.Operation Mode	Recirculation
5.Ball Cleaning	Only at start
6.Top Brine Temperature	112°C
7.Flow Rate	· · ·
-Make Up Seawater	3.75 m <sup>3</sup> /h
-Recirculation	6.5 m <sup>3</sup> /h
-Product Water	0.76 m <sup>3</sup> /h
-Blow Brine	2.99 m <sup>3</sup> ∕h
8. Chenical Consituents of Brine	
-pH at 25℃	8.52
-M-Alkalinity as CaCO <sub>3</sub>	143 mg/L
-Chloride ion	26,770 mg/L
-Concentration factor as $Cl^-$	1.15
9.Dosing Rate of Chemicals	
-Scale Inhibior = PPN(M)	2 mg/L
-Acid = 98% H <sub>2</sub> SO <sub>4</sub>	

	Date: September 23, 34	96		-	Time: 8:00				Total Operation Time: 18 hr.	ation Tim	- 10 DL :a	•
Variables	Brine Heater					Ev	Evaporator Stages	tages -				· · ·
			* 1		*3		<b>5</b> 7	· · · ·	*		6	40. 18
Flowrate (kg/h)	6500		6500		6500	· .	6500	с	6500		18500	18500
Specific Heat (kj/kg/Ю	3.989		3.969		3.956	- 	3.943		3,932		3.970	3.968
Inlet Temp. (deg. C)	5		78.6	۰.	65.5		52.6	i V C	40.8		36.1	34
outlet Temp. (deg. C)	112	. •	2		78.6		65.5	• .	52.6		40.5	36.1
Temp. Rise (deg. C)	5	:	12.4		13.1	• .	12.9		11.8		4.4	2.1
Flashing Temp. (deg. C)	119		26	•	83.2		70.6		58.3		43.7	38.7
Heat Transfer Rate (k)/S)	151.243		88.866		93.562	• • •	91.841		83.779		89.766	42.821
Heat Transfer Area (Sq.m)	4.6723		1.937		1.937		1.937	54 E F	1.937		4.9556	4.9556
LM.T.D. (deg. K)	15.148		6.281		9.722		10.229	- - 	10.519	· · · ·	5.087	3.547
U (kw/sg.m/Ю	2.137	·	7.304		4.969		4.635		4.112		3.561	2.436
Clean-U Value (kW/sq.m/K)	6 <b>.</b> 2		6.6		5.1	· .	5.1		5.1		5.1	5:1
f (sq.m K/kW)	0.212	۰.	-0.015		0.005		0.020	÷	0.047	1	0.085	0.214

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Exageneration Statement           Brine Menter         # # # # # # # # # # # # # # # # # # #	Run No. 4	Date: September 25, 94	_	Time: 12:00		Total Operation Time: 20 hr.	rime: 20 hr.	
#1         #2         #3         #4         #5         1         #5         1         #5 <th>Variables</th> <th>Brine Heater</th> <th></th> <th></th> <th>Evaporator Stages</th> <th></th> <th></th> <th></th>	Variables	Brine Heater			Evaporator Stages			
6500         6500         6500         6500         6500         6500         13500           3.399         3.969         3.969         3.956         3.943         3.973         3.970           91         7.35         6.57         5.23         4.12         3.66           112         91         7.8.5         6.57         5.29         40.5           21         12.5         12.8         12.8         11.7         3.6           119         93.7         83.7         7.11         5.87         4.3           151.245         89.582         91.421         91.134         83.076         79.569           151.245         89.582         91.427         91.134         83.076         79.569           151.248         7.234         10.308         10.535         1.3556           15.148         7.234         10.336         1.3555         5.522           2.137         6.39         4.579         4.466         4.048         5.7           3.9         6.6         5.1         5.1         5.1         5.1         5.1           3.1         0.232         0.023         0.023         0.021         0.048         0.48			#1	#2	€. *	*	in Th	
3.389         3.969         3.969         3.956         3.943         3.973         3.970           91         78.5         65.7         52.3         41.2         36.6           112         91         78.5         65.7         52.9         40.5           113         12.5         12.8         12.8         11.7         5.9         40.5           113         12.5         12.8         12.8         12.8         11.7         5.9         40.5           119         93.7         83.7         11.3         81.7         11.7         5.9         40.5           151.243         89.582         91.421         91.134         83.076         7.3.6         44.3           151.243         89.582         91.421         91.134         83.076         7.9569           151.248         7.234         10.303         1.937         1.937         4.356           15.148         7.234         10.303         1.937         1.937         5.308           3.9         6.6         5.1         5.1         5.1         5.1           3.9         6.6         5.1         5.1         5.1         5.1           3.9         6.6	Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	
91         78.5         65.7         52.9         41.2         36.6           112         91         78.5         65.7         52.9         40.5           21         12.5         12.8         65.7         52.9         40.5           11         33.7         83.7         71.1         58.7         44.3           11         33.7         83.7         71.1         58.7         44.3           151.245         89.552         91.421         91.134         83.076         73.569           151.245         89.552         91.421         91.134         83.076         73.569         73.569           151.245         89.552         91.421         91.134         83.076         73.569         73.569           151.248         7.224         10.330         1.937         1.937         1.937         4.3569           15.148         7.224         10.336         1.937         1.937         5.1         5.522           2.157         6.338         4.579         4.048         2.908         5.1           3.9         6.6         5.1         5.1         5.1         5.1           0.212         0.005         0.022         0.051<	Specific Heat (kj/kg/l0	3,989	3.969	3.956	3.943	3.933	3.970	· · · ·
112         91         78.5         65.7         52.9         40.5           21         12.5         12.8         12.8         11.7         3.9           119         93.7         83.7         71.1         58.7         44.3           119         93.7         83.7         71.1         58.7         44.3           151.245         89.582         91.421         91.134         83.076         79.569           151.245         1.937         1.937         1.937         1.937         4.355           15.148         7.234         10.308         10.535         10.595         5.522           15.148         7.234         10.308         10.535         10.595         5.522           2.137         6.393         4.579         4.466         4.048         2.968           3.9         6.6         5.1         5.1         5.1         5.1         5.1           3.9         6.6         5.1         5.1         5.1         5.1         5.1           0.212         0.005         0.022         0.028         0.051         0.148	Inlet Temp. (deg. C)	6	78.5	65.7	52.9	41.2	36.6	
21     125     128     128     117     3.9       119     38.7     83.7     83.7     71.1     58.7     4.4.3       151.243     89.582     91.421     91.134     83.076     79.569       151.243     89.582     91.421     91.134     83.076     79.569       157.23     1.337     1.937     1.937     1.937     4.9556       15.148     7.234     10.368     10.535     1.0555     5.522       2.137     6.393     4.579     4.466     4.048     2.908       3.9     6.6     5.1     5.1     5.1     5.1       3.1     0.212     0.005     0.022     0.028     0.051     0.148	Outlet Temp. (deg. C)	112	6	78.5	65.7	52.9	40.5	
119     93.7     83.7     71.1     58.7     44.3       151.245     89.582     91.421     91.134     83.076     79.569       151.245     89.582     91.421     91.134     83.076     79.569       4.6723     1.937     1.937     1.937     1.935     4.9556       15.148     7.234     10.308     10.555     1.937     4.9556       2.137     6.393     4.579     4.466     4.048     2.908       3.9     6.6     5.1     5.1     5.1       3.1     0.212     0.005     0.022     0.028     0.051     0.148	Temp. Rise (deg. C)	21	12.5	12.8	12.8	11.7	3.9	
151.243     83.582     91.421     91.134     83.076     73.569       4.6723     1.937     1.937     1.937     1.937     4.9556       15.148     7.234     10.308     10.555     1.937     4.9556       15.148     7.234     10.308     10.555     1.0555     5.522       2.137     6.393     4.579     4.466     4.048     2.908       3.9     6.6     5.1     5.1     5.1     5.1       3.1     0.212     0.005     0.022     0.028     0.051     0.148	Flashing Temp. (deg. C)	119	93.7	83.7	1.17	58.7	44.3	
4.6723       1.337       1.337       1.337       4.9556         15.148       7.234       10.308       10.535       10.595       5.522         2.137       6.393       4.579       4.466       4.048       2.908         3.9       6.6       5.1       5.1       5.1       5.1         3.9       6.6       5.1       5.1       5.1       5.1         3.9       6.6       5.1       5.1       5.1       5.1         3.9       6.6       0.022       0.028       0.051       0.148	Heat Transfer Rate (kJ/S)	151.243	89.582	91.421	91.134	83.076	79.569	LO.
15.148     7.234     10.508     10.535     10.595     5.522       2.137     6.393     4.579     4.466     4.048     2.908       3.9     6.6     5.1     5.1     5.1     5.1       3.9     6.6     0.022     0.028     0.051     0.148       0.212     0.005     0.022     0.028     0.051     0.148	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4
2.137       6.393       4.466       4.048       2.908         3.9       6.6       5.1       5.1       5.1       5.1         3.0       0.023       0.023       0.021       0.148       0.148	L.M.T.D. (deg. K)	15.148	7.234	10.308	10.535	10.595	5.522	
3.9     6.6     5.1     5.1     5.1       0.212     0.005     0.022     0.023     0.148	U (kW/sq.m/k)	2.137	6.393	4.579	4.466	4.048	2.908	
	Clean-U Value (kW/sq.m/K)	3.9	6.6	5.1	5.1	5.1	5.1	5
	f (sq.m K/kW)	0.212	0.005	0.022	0.028	0.051	0.148	-
		- -						
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		. 1						
		•		·	ч.			

Run No. 4	Date: September 25, 94		Time: 16:00		Total Operation Time: 24 hr.	1e: 24 hr.	
Variables	Brine Heater			Evaporator Stages			
		÷.	2#	(7) 78	**	10 **	<b>\$</b>
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.989	3.969	3.956	3.943	3.933	3.970	3.968
inlet Temp. (deg. C	2	78.6	65.6	52.9	41.1	36.6	φ£
outlet Temp. (deg. C)	112	6	78.6	65.6	52.9	40.5	36.6
Temp. Rise (deg. C)	3	12.4	13	12.7	11.8	9.0 2	2.6
Flashing Temp. (deg. C)	119	93.8	83.8	71.3	58.6	<b>44.3</b>	39.2
Heat Transfer Rate (K)/S)	151.243	88.866	92.849	90.421	83.785	79.569	53.019
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	15.148	7.330	10.377	10.837	10.519	5.522	3.751
u (kw/sq.m/Ю	2.137	6.259	4.619	4.307	4.112	2.908	2.852
Clean-U Value (kW/sq.m/K)	3.9	6.6	5.1	57		5	5.1
f (sq.m K/kw)	0.212	0.008	0.020	0.036	0.047	0.148	0.155

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Date: September 25, 94

Run No. 4

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Total Operation Time: 28 hr.

Variables	Brine Heater			Evaporator Stages			
		<b>F</b> #	#2	¥.3	*4	10 ]] ]】	90 #1
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.989	3.969	3.956	3.943	3.932	3.970	3.968
inlet Temp. (deg. C)	<b>.</b>	78.5	65.6	52.7	40.8	36.3	33
Outlet Temp. (deg. C)	112	હ્	78.5	65.6	52.7	4	36.3
Temp. Rise (deg. C)	<b>3</b> <b>3</b> <b>3</b>	12.5	12.9	12.9	11.9	4.7	3.3
Flashing Temp. (deg. C)	119.5	93.7	83.6	71.1	58.4	44	39
Heat Transfer Rate (K//S)	151.243	89.582	92.134	91.843	84,490	95.892	67.286
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	15.730	7.234	10.229	10.682	10.555	4.986	4.133
U (kw/sq.m/ko	2.058	6.393	4.650	4,439	4.133	3.881	3.285
Clean-U Value (kw/sq.m/K)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f isq.m K/kW)	0.230	0.005	0.019	0.029	0.046	0.062	0.108

Variation	Brine Heater			Evaporator Stages			
		<b>7</b>	#	*3	*4	5	<b>0</b> <b>*</b>
Flowrate (kg/h)	6500	6500.	6500	6500	6500	18500	18500
Specific Heat (ki/kg/k)	3.989	3.969	3.956	3.943	3.932	3.970	3.968
inlet Temp. (deg. C)	9	78.5	65.5	52.6	40.7	36.3	
outlet Temp. (deg. C)	112	6	78.5	65.5	52.6	40	36.3
Temp. Rise (deg. C)	24	12.5	13	12.9	11.9	3.7	
Flashing Temp. (deg. C)	120	92.9	83.3	70.6	58.3	43.9	38.9
Heat Transfer Rate (kj/S)	151.243	89,582	92.847	91.841	84.489	75.483	67.286
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	16.306	6.172	9.919	10.229	10.555	5.546	4.027
Ol/m.ps/Wol U	1.985	7.494	4.832	4.635	4 132	2.747	3.372
Clean-U Value (kW/sq.m/K)	3.9	6.6	5.1	<b>5.1</b>	5.10	5.1	<b>5.</b> 2
f (sq.m K/KW)	0.247	-0.018	0.011	0.020	0.046	0.168	0.101

18500 3.968 4.9556 3.949 3.230 5. 0.114 53 63.207 36.1 38.7 М 10 # 18500 3.970 36.1 43.5 79.562 4.9556 5.209 3.082 5.1 0.128 9 б М Total Operation Time: 36 hr. 10 # 52.5 6500 40.5 85,196 10.368 4.242 5.1 0.040 3.932 2 80 1.937 \* Evaporator Stages 52.5 70.8 6500 3.943 65.4 12.9 91.838 1.937 10.569 4.486 5 0.027 . # Time: 04:00 12.9 6500 3.955 65.4 78.3 92.129 9.885 4.811 2 0.012 83.1 1.937 ۲) # 6.989 6.192 0.010 6500 3.968 83.834 1.937 6.6 92.7 78.3 ട്ട 11.7 \*\* Date: September 26, 94 6500 119.5 158.420 4.6723 16.064 2.111 3.9 3.988 0.217 3 8 112 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/k0 Outlet Temp. (deg. C) inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) 0 (kw/sq.m/kg f (sq.m K/kW) Run No. 4 Variables

Run No. 4	Date: September 26, 94		Time: 08:00		Total operation	Total operation Time: 40 nr.	
Variabilas	Brine Heater			Evaporator Stages	<b>9</b>		
		#1	#3	<b>2</b> #	**	10 18	<b>9</b>
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/)0	3.988	3,969	3.955	3.943	3.932	3.970	3.968
Inlet Temp. (deg. C)	06	78.4	65.4	52.6	40.7	36.1	2
outlet Temp. (deg. C)	112	8	78.4	65.4	52.6	41	36.1
Temp. Rise (deg. C)	8	11.6	13	12.8	11.9	4.9	2.1
Flashing Temp. (deg. C)	120	92.8	83.3	70.6	58.1	43.8	38.7
Heat Transfer Rate (K)/S)	158.420	83.119	92.844	91.128	84.489	99.971	42.821
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	16.645	7.083	10.034	10.308	10.332	4.844	3.547
U (kw/sq.m/io	2.037	6.058	4.777	4.564	4.222	4.165	2.436
clean-U Value (KW/sq.m/K)	3.9	6.6	5.3	5.1	5.1	5.1	5.1
f (sq.m K/KW)	0.234	0.014	0.013	0.023	0.041	0.044	0.214

Run No. 4

Date: September 26, 94

Time: 12:00

Total Operation Time: 44 hr.

Variables	Brine Heater			Evaporator Stages			
		*	#2	#3	**	10 **	<b>6</b>
Flowrate (kg/h)	6500	6500	6500	6500	6500	19000	19000
Specific Heat (k)/kg/k0	3.988	3.968	3.955	3.943	3.932	3.970	3.968
Inlet Temp. (deg. C)	6	78.3	65.4	52.6	41.1	36.3	34
Outlet Temp. (deg. C)	112	06 06	78.3	65.4	52.6	41.3	36.3
Temp. Rise (deg. C)	22	11.7	12.9	12.8	11.5	LO	2.3
Flashing Temp. (deg. C)	119.5	93.7	83.3	71.2	58.4	44.6	38.8
Heat Transfer Rate (kj/S)	158.420	83.834	92.129	91.128	81.652	104.772	48.168
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	16.064	8.205	10.115	10.984	10.523	5.421	3.526
U (kw/sq.m/io	2.111	5.275	4.702	4.283	4.006	3.900	2.757
clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m k/kW)	0.217	0.038	0.017	0.037	0.054	0.060	0.167
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Variables         Brine Heater         Evaporator Stages           Variables         Brine Heater         Evaporator Stages           Variables         Brine Heater         Fine Heater         Fine Heater           Flowrate (kg/h)         6500         6500         6500         6500         18500         18500           Specific Heat (kg/kg/h)         3.398         3.3956         3.384         3.392         3.397         3.391           Specific Heat (kg/kg/h)         3.398         3.3956         3.384         3.392         3.397         3.391           Specific Heat (kg/kg/h)         3.398         3.3956         3.394         3.392         3.394         3.392         3.397         3.391           Specific Heat (kg/kg/h)         3.98         3.3956         3.384         3.392         3.394         3.392         3.397         3.391           Intel Temp. (deg. C)         112         91         17.7         11.9         13.7         11.9         4.5         4.43         3.55           Heat Transfer Area 6(JS)         1664         5.71         4.08         5.73         4.43         5.73         4.43         5.73         4.43         5.73         4.43         5.73         4.35         3.44	Run No. 4	Date: September 26, 94		Time: 16:00		Total Operation Time: 48 hr.	Time: 48 hr.	
#1         #2         #3         #4         #5         #5           6500         6500         6500         6500         6500         18500           3.988         3.966         5.366         5.344         3.970         1850           3.988         3.966         5.356         5.344         3.970         1850           90         783         66.4         5.27         41           112         90         783         66.4         5.27         41           113         113         113         113         137         41           1145         933         83.65         5.27         41           115         933         84.98         97.547         84.490         91.81           116.64         83.834         84.988         97.547         84.490         91.81           16.064         8.440         10.109         9.321         1.937         1.937         4.956           16.064         8.4400         10.366         5.21         4.030         5.42           2.111         5.128         4.340         9.921         1.956         5.21           2.111         5.128         4.341 <t< th=""><th>Variables</th><th>Brine Heater</th><th></th><th></th><th>Eveporator Stages</th><th></th><th></th><th></th></t<>	Variables	Brine Heater			Eveporator Stages			
6500         6500         6500         6500         6500         6500         6500         6500         6500         7855         7850         7850         7850         7850         7850         7850         7850         7850         7850         7850         7850         7850         7850         7850         7855         7813         7850         7850         7850         7850         7813         78143         7813         7813 <t< th=""><th>-</th><th></th><th>¥ 1</th><th>#2</th><th>£ #</th><th>*</th><th>10 12</th><th><b>9</b> <b>1</b></th></t<>	-		¥ 1	#2	£ #	*	10 12	<b>9</b> <b>1</b>
3.368         3.366         3.344         3.332         3.570           90         78.3         66.4         52.7         40.8         36.5           112         90         78.3         66.4         52.7         41           112         90         78.3         66.4         52.7         41           112         90         78.3         66.4         52.7         41           113         11.3         11.9         13.7         11.9         4.5           119.5         93.3         83.6         71         58.5         4.43           158.420         83.834         84.998         97.547         84.490         91.613           158.420         83.834         1.937         1.937         1.937         4.43           16.064         8.440         10.109         9.921         1.937         4.956           16.064         8.440         10.109         9.921         1.937         4.956           2.111         5.128         4.341         5.076         4.090         5.231           3.9         6.6         5.1         5.1         5.1         5.1           3.9         6.6         5.1         <	Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
90         78.3         66.4         52.7         40.8         36.5           112         90         78.3         66.4         52.7         41           22         11.7         11.9         66.4         52.7         41           22         11.7         11.9         13.7         11.9         45           119.5         93.3         83.6         71         58.5         41.3           119.5         93.3         84.999         97.547         84.490         91.813           158.420         83.8354         84.999         97.547         84.490         91.813           16.064         8.440         10.103         9.321         1.937         1.937         1.937           2.111         5.128         4.341         5.076         4.090         5.231           3.9         6.6         5.1         5.076         4.090         5.231           3.101         0.043         0.043         0.048         0.048         0.066	specific Heat (kj/kg/K)	3.988	3,968	3.956	3.944	3.932	3.970	3.968
112       90       78.3       66.4       52.7       41         22       11.7       11.9       13.7       11.9       4.5         22       11.7       11.9       13.7       11.9       4.5         119.5       93.9       83.6       7.1       58.5       4.4.3         158.420       83.834       84.998       97.547       84.490       91.813         158.420       83.834       84.998       97.547       84.490       91.813         16.064       8.440       10.109       9.921       1.937       1.937       4.9556         2.111       5.128       4.341       5.076       4.090       3.542       3.542         3.9       6.6       5.1       5.1       5.1       5.1       5.1       5.1         0.217       0.043       0.034       0.001       0.048       0.086       0.086	inlet Temp. (deg. C)	06	78.3	66.4	52.7	40.8	36.5	33.5
22       11.7       11.9       13.7       11.9       4.5         119.5       93.3       93.6       71       58.5       4.4.3         158.420       83.834       84.998       97.547       84.490       91.813         158.420       83.834       84.998       97.547       84.490       91.813         16.064       8.440       10.109       9.921       1.937       4.9556         2.111       5.128       4.341       5.076       4.090       3.542         3.9       6.6       5.1       5.1       5.1       5.1         0.043       0.034       0.034       0.034       0.034       0.036	outlet Temp. (deg. C)	112	06	78.3	66.4	52.7	4	36.5
119.5       93.9       83.6       71       58.5       44.3         158.420       83.834       84.998       97.547       84.490       91.813         4.6723       1.937       1.937       1.937       1.937       4.9556         16.064       8.440       10.109       9.921       10.666       5.231         2.111       5.128       4.341       5.076       4.090       3.542         3.9       6.6       5.1       5.1       5.1       5.1         3.9       0.043       0.034       0.048       0.048       0.086	Temp. Rise (deg. C)	52	11.7	11.9	13.7	11.9	4.5	<b>F</b> 3
158.420         83.834         84.998         97.547         84.490         91.813           4.6723         1.937         1.937         1.937         1.937         1.937         8.456           16.064         8.440         10.109         9.921         1.037         1.935         4.9556           2.111         5.128         4.341         5.076         4.090         3.542           3.9         6.6         5.1         5.1         5.1         5.1           0.043         0.034         0.004         0.048         0.086	Flashing Temp. (deg. C)	119.5	93.9	83.6	И.	58.5	44.3	38.8
4.6723       1.937       1.937       1.937       1.937       1.935         16.064       8.440       10.109       9.921       10.666       5.231         2.111       5.128       4.341       5.076       4.090       3.542         3.9       6.6       5.1       5.1       5.1       5.1         0.043       0.034       0.004       0.048       0.086	Heat Transfer Rate (kj/S)	158.420	83.834	84.998	97.547	84.490	91.813	61.173
16.064         8.440         10.109         9.921         10.666         5.231           2.111         5.128         4.341         5.076         4.090         3.542           3.9         6.6         5.1         5.1         5.1         5.1           0.043         0.034         0.048         0.048         0.086	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
2.111     5.128     4.341     5.076     4.090     3.542       3.9     6.6     5.1     5.1     5.1     5.1       0.043     0.034     0.034     0.048     0.086	L.M.T.D. (deg. K)	16.064	8.440	10.109	9.921	10.666	5.231	3.594
3.9         6.6         5.1         5.1         5.1         5.1         5.1         0.048         0.086	u (kw/sq.m/k)	2.111	5.128	4.341	5.076	4.090	3.542	3.435
0.217 0.043 0.034 0.001 0.048 0.086	Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1		Ч
	f (sq.m K/KW)	0.217	0.043	0.034	0.001	0.048	0.086	0.095

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18500 3.968 38.5 65.247 4.9556 3.670 3.587 5. 0.083 53 22 36.2 9# 97.931 4.915 5.5 18500 3.970 36.2 43.9 4.9556 4.020 0.053 4.8 Total Operation Time: 52 hr. 4 初業 40.5 5.7 52.4 84.485 4.047 0.051 6500 3.932 11.9 58.3 1.937 10.777 \*\* Evaporator Stages 5.056 0.002 3.943 52.4 13.9 10.105 5 6500 66.3 98.967 1.937 7 0 # Time: 20:00 66.3 78.2 5.7 0.039 6500 3.956 11.9 84.996 1.937 10.332 4.247 83.7 ₹ \* 3.968 78.2 11.8 5,299 0.037 6500 93.7 1.937 8.237 6.6 8 84.550 \*\* Date: September 26, 94 6500 3.988 119.5 158.420 4.6723 3.9 0.217 16.064 2.111 8 112 3 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/K) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/K0 Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k f (sq.m K/kW) Run No. 4 Variables

Run No. 4	Date: September 27, 94	·	Time: 00:00		Total Operation Time: 56 hr.	n Time: 56 hr.	
Variabios	Brine Heater			Evaporator Stages			
	ι	#1	*	₩	**	10 *	•
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.989	3.969	3.955	3.943	3.932	3.970	3.968
Inlet Temp. (deg. C)	δ	78	65.2	52.2	40.4	36	32.5
outlet Temp. (deg. C	112	91	78	65.2	52.2	40.5	36
Temp. Rise (deg. C)	21	13	12.8	13	11.8	4.5	3.5
Flashing Temp. (deg. C)	119	93.1	83.1	70.4	58.1	43.7	38.4
Heat Transfer Rate (KJ/S)	151.243	93.158	91.409	92.545	83.772	91.805	71.360
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	15.148	6.590	10.195	10.377	10.741	5.125	3.891
U (kw/sq.m/k)	2.137	7.298	4.629	4.604	4.027	3.615	3.701
Clean-U Value (kW/sq.m/k)	6, M	6.6	5.1	<u>5</u> ,	5.7	ŗ.	5.1
f (sq.m Kkw)	0.212	-0.014	0.020	0.021	0.052	0.081	0.074

CALCULATIONS OF OVERALL HEAT TRANSFER COEFFICIENT AND FOULING FACTOR Run No. 4 Date: September 27, 94 Time: 04:00

Run No. 4	Date: September 27, 94	ž	Time: 04:00		Total Operat	Total Operation Time: 60 hr.	
Variables	Brine Heater			Evaporator Stages	iges		
		*	<b>N</b> **		*	50 兼	5
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/Ю	3.989	3.969	3.955	3.943	3.932	3.970	3.967
lniet Temp. (deg. C	9	77.9	65	52	39.9	35.7	32
Outlet Temp. (deg. C)	112	9	77.9	65	52	40	35.7
Temp. Rise (deg. C)	Я	13.1	12.9	13	12.1	4.3	3.7
Flashing Temp. (deg. C)	120	32.9	83.1	70.4	57.8	43.4	8
Heat Transfer Rate (K)/S)	151.243	93.874	92.119	92.541	85.896	87.720	75.433
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	16.306	6.340	10.343	10.604	10.737	5.260	3.859
U (kw/sq.m/N	1.985	7.644	4.598	4.505	4.130	3.365	3.945
Clean-U Value (kW/sq.m/K)	3.9	6.6	5.1	5.1	5.1	5.1	5. 1
f tsq.m K/kW)	0.247	-0.021	0.021	0.026	0.046	0.101	0.057

<b>D_FOULING FACTOR</b>
RANSFER COEFFICIENT A
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Run No. 4	Date: September 27, 94		Time: 12:00		Total Opera	Total Operation Time: 68 hr.	Ŀ.	
Variables	Brine Heater	- - -		Evaporator Stages				
		**	#2	*3	**	10 14		9 #
Flowrate (kg/h)	6500	6500	6500	6500	6500	7	18500	18500
Specific Heat (k)/kg/k)	3.989	3.969	3.955	3.943	3.932		3.970	3.968
Inlet Temp. (deg. C)	9	78.5	65.3	52.4	40.5		35.7	33
Outlet Temp. (deg. C)	112	2	78.5	65.3	52.4		40.5	35.7
Temp. Rise (deg. C)	21	12.5	13.2	12.9	11.9		4.8	2.7
Flashing Temp. (deg. C)	122	94.1	83.6	70.8	58.2		43.7	38.5
Heat Transfer Rate (kj/S)	151.243	89.582	94.273	91.836	84.485	6	97.923	55.050
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.	4.9556	4.9556
L.M.T.D. (deg. K)	18.561	7.736	10.331	10.682	10.666	Д	5.239	3.999
u (kw/sq.m/io	1.744	5.978	4.711	4.438	4.089	N)	3.772	2.778
clean-U Value (kW/sq.m/k)	6.2	6.6	С. Г.	5.1	5.1		5.1	5.
f (sq.m k/k/M)	0.317	0.016	0.016	0.029	0.048	.0	0.069	0.164

18500 3.968 38.5 55.050 4.9556 2.778 5.1 0.164 35.7 3.999 6 3.970 35.7 **4**0.5 5.239 3.772 0.069 18500 97.923 л. 4.8 43.7 4.9556 Total Operation Time: 72 hr. 9 \* 0.048 58.2 4.089 5.1 6500 3.932 11.9 84.485 10.666 40.5 52.4 1.937 1 Evaporator Stages 70.8 0.029 6500 91.836 4.438 3.943 52.4 12.9 1.937 10.682 5.1 65.3 €# Time: 15:00 0.016 6500 3.955 65.3 78.5 13.2 83.6 10.331 4.711 5 94.273 1.937 #2 12.5 6.6 0.016 6500 78.5 94.1 89.582 7.736 5.978 3.969 1.937 2 \* ŀ Date: September 27, 94 1.744 9.8 8 6500 151.243 4.6723 18.561 0.317 3.989 52 112 δ 2 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/i0 Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. 10 Flowrate (kg/h) U (kw/sq.m/k Run No. 4 Variables

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f (sq.m K/kw)

Run No. 4	Date: September 27, 94		Time: 20:00		Total Operation Time: 76 hr.	ne: 76 hr.	
Variables	Brine Heater			Evaporator Stages			
		۲. ۴	#2	#3	<b>*</b>	lO ₩	*
Flowrate (kg/h)	6500	6500	<b>6500</b>	6500	6500	18500	18500
Specific Heat (k)/kg/K)	3.989	3.969	3.955	3.943	3.932	3.970	3.967
inlet Temp. (deg. C)	9	78.2	65.2	52.2	40.3	35.5	32
outlet Temp. (deg. C)	112	6	78.2	65.2	52.2	40	35.5
Temp. Rise (deg. C)	21	12.8	13	<b>1</b> 1	11.9	4.5	3.5
Flashing Temp. (deg. C)	122	93.8	83.5	70.7	28	43.4	38.3
Heat Transfer Rate (kj/S)	151.243	91.728	92.839	92.545	84.481	91.798	71.355
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	18.561	7.452	10.491	10.717	10.666	5.338	4.316
U (kw/sq.m/lo	1.744	6.355	4.569	4.458	4.089	3.471	3.336
clean-U Value (kW/sq.m/lo	3.9	6.6	5.1	ي 1	5.1	27	
f (sq.m k/kw)	0.317	0.006	0.023	0.028	0.048	0.092	0.104

Total Operation Time: 80 hr.

Time: 00:00

Date: September 28, 94

Run No. 4

38.3 71.740 0.102 18600 3.967 35.5 ы 10 4.9556 4.316 3.354 R ŝ 9 # 35.5 4.9556 5.125 3.634 0.079 18600 3.970 43.2 92.294 4.5 5.1 9 ю # 6500 3.932 39.9 57.6 85.896 1.937 10.514 4.218 5.1 0.041 12.1 ដ \* Evaporator Stages 70.5 3.943 4.525 0.025 6500 65.1 13.1 93.254 1.937 10.639 5 ដ ∾ # 3.955 4.690 5. 6500 65.1 78.2 13.1 83.3 93.552 1.937 10.297 0.017 × \* 6.115 7.744 6500 3.969 78.2 12.8 92.8 91.728 1.937 6.6 -0.022 2 \* \* 3.9 151.243 4.6723 17,442 1.856 0.282 6500 3.989 112 2 2 3 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/K) Heat Transfer Rate (Kj/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/lO Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k f (sq.m K/kw) Variables

Run No. 4	Date: September 28, 94		Time: 04:00		Total Operation Time: 84 hr.	Time: \$4 hr.	- - -
Variables	Brine Heater			Evaporator Stages			
		#1	#2	÷.	#4	<b>1</b>	9#
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
specific Heat (kj/kg/Ю	3.988	3.968	3.955	3.943	3.932	3.969	3.967
Inlet Temp. (deg. C)	68	78	65	52	39.9	35.3	32
Outlet Temp. (deg. C)	112	68	82	65	52	39.5	35.3
Temp. Rise (deg. C)	23	5	13	13	12.1	4.2	3.3
Flashing Temp. (deg. C)	119	<b>26</b>	83.3	70.5	57.8	43.2	38.2
Heat Transfer Rate (kj/S)	165.596	78.804	92.835	92.541	85.896	85.674	67.276
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	15.804	8.322	10.491	10.717	10.737	5.537	4.343
U (kW/sq.m/k)	2.243	4.889	4.569	4.458	4.130	3.122	3.126
clean-U Value (kw/sq.m/k)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m k/kw)	0.190	0.053	0.023	0.028	0.046	0.124	0.124

Run No. 4 Date: September 28, 94

Time: 08:00

Total Operation Time: 58 hr.

Variabies	Brine Heater			Evaporator Stages			
		**	*	₩ ₩		5	9#
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (k)/kg/Ю	3,989	3.969	3.955	3.943	3.932	3.970	3.968
Inlet Temp. (deg. C)	91.5	78.4	65.4	52.4	40.6	35.7	33.5
outlet Temp. (deg. C)	112	91.5	78.4	65.4	52.4	41	35.7
Temp. Rise (deg. C)	20.5	13.1	, Ю	13	11.8	5.3	2.2
Flashing Temp. (deg. C)	119	93.6	83.3	70.7	58.2	43.7	38.5
Heat Transfer Rate (kj/S)	147.653	93.887	92.844	92.549	83.776	108.128	44.857
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
LM.T.D. (deg. K)	14.982	6.618	10.034	10.491	10.630	4.879	3.794
U (kW/sq.m/Ю	2.109	7.324	4.777	4.554	4.069	4.472	2.386
Clean-U Value (KW/sq.m/K)	6.2	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m k/k/W)	0.218	-0.015	0.013	0.023	0.050	0.028	0.223

Run No. 4	Date: September 28, 94	-	Time: 16:00	R			Total Operation Time: 96 hr.	ation Tim	e: 96 hr.		
Variables	Brine Heater			μ	Evaporator Stages	5					
		#1	#2		₩.		*		10 10		0 0 1 1 1
Flowrate (kg/h)	6500	6500	6500		6500		6500		18500		18500
Specific Heat (kj/kg/K)	3.989	3.969	3.955		3.943		3.932		3.970		3.968
Inlet Temp. (deg. C)	6	78.2	65.3		52.5		40.7		35,9		8
outlet Temp. (deg. C)	112	9	78.2	•	65.3		52.5		41	•	35.9
Temp. Rise (deg. C)	21	12.8	12.9		12.8		11.8		5.1		2.9
Flashing Temp. (deg. C)	120	93.9	83.3		70.6		58.4		43.9		38.7
Heat Transfer Rate (K)/S)	151.243	91.728	92.126	. :	91.125		83.778		104.050	•	59.129
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	•••	1.937		1.937		4.9556		4.9556
L.M.T.D. (deg. 10	16.306	7.579	10.229	• .	10.422		10,741		5.026		4.080
U (KW/sq.m/K	1.985	6.249	4.650		4.514	•	4.027		4 178	•	2.925
Clean-U Value (kW/sq.m/l)	Q.F.	6.6	5.7		5.		ນ 7		δ		5. 7
f (sq.m K/KW)	0.247	0.009	0.019		0.025	• • • •	0.052		0.043		0.146
				- 							

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Total Operation Time: 100 hr. Evaporator Stages Time: 20:00 Date: September 28, 94 Brine Heater Run No. 4 Variables

	· · ·	***	*3	₩ ₩	*	10 *	9
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.989	3.969	3.955	3.943	3.932	3.970	3.967
inlet Temp. (deg. C)	90.5	78.1	65	52.2	40.1	35.7	32.5
Outlet Temp. (deg. C)	112	90.5	78.1	65	52.2	40	35.7
Temp. Rise (deg. C)	21.5	12.4	13.1	12.8	12.1	4.3	3.2
Flashing Temp. (deg. C)	119	93.9	83.6	70.9	28	43.6	38.6
Heat Transfer Rate (K)/S)	154.832	88.854	93.550	91.119	85.900	87.720	65.242
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	15.313	8.072	10.752	11.096	10.737	5.471	4.304
U (kw/sq.m/Ю	2.164	5.683	4.492	4.239	4.130	3.235	3.059
clean-U value (kw/sq.m/Ю	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m K/kw)	0.206	0.024	0.027	0.040	0.046	0.113	0.131

Run No. 4	Date: September 29, 94		Time: 12:00		Total Operatio	Total Operation Time: 116 hr.	
Variables	Brine Heater			Evaporator Stages			
	·	#1	*	£#	<b>2</b> .#	10 **	10
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.988	3.968	3.955	3.943	3.932	3.970	3.968
Inlet Temp. (deg. C)	6	78.2	65.1	52.5	40.8	35.8	33
outlet Temp. (deg. C)	112	06	78.2	65.1	52.5	9	35.8
Temp. Rise (deg. C)	22	11.8	13.1	12.6	11.7	4.2	2.8
Flashing Temp. (deg. C)	124	93.4	83.5	70.7	58.1	43.7	38.8
Heat Transfer Rate (kj/S)	158.420	84.550	93.552	83.699	83.069	85.680	57.089
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	21.124	7.880	10.525	10.690	10.373	5.537	4.247
U (kw/sq.m/k)	1.605	5.540	4.589	4.332	4.134	3.123	2.712
Clean-U Value (kW/sq.m/k)	9.E	6.6	5.1 1		2	5. <u>1</u>	22
f sq.m K/kW)	0.367	620.0	0.022	0.035	0.046	0.124	0.173

22

18500 3.968 8 55.050 4.9556 4.207 2.641 0.183 38.7 ŝ 35.7 5 9 # Total Operation Time: 120 hr. 18500 3.970 3.116 0.125 87.720 4.9556 5.681 <del>ر</del> 35.7 8 **4**3.8 10 # 6500 3.932 40.6 11.9 58.2 84.487 1.937 10.555 4.132 ņ, 0.046 52.5 \* Evaporator Stages 52.5 12.6 0.035 6500 3.943 65.1 70.7 89.699 1.937 10.690 4.332 5 € # Time: 16:00 0.018 6500 92.837 10.263 4.670 5 3.955 65.1 78.1 83.2 1.937 2 ¢ # **11.9** 93.3 6.6 0.025 6500 3.968 85.265 1.937 7.791 5.650 78.1 8 \* Date: September 29, 94 158.420 0.5 4.6723 18.914 1.793 0.301 6500 3.988 5 8 112 ส Brine Heater Clean-U Value (kW/sq.m/K) Heat Transfer Area (Sq.m) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/i0 Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. 10 Flowrate (kg/h) U (kW/sq.m/N f (sq.m K/KW) Run No. 4 Variables

Variabies					· ·		
	Brine Heater			Eveporator Stages			
	- - - - -	++	**	87 **	**	<b>#</b>	10 11
Flowrate (kg/h)	6500	6500	6500	6500	6500	13500	18500
Specific Heat (kj/kg/k)	3,989	3.969	3.955	3.943	3.932	3.970	3.967
inlet Temp. (deg. C)	9	78.2	65.1	52.1	40.2	35.3	32
outiet Temp. (deg. C)	112	9	78.2	65.1	52.1	40	35.3
Temp. Rise (deg. C)	3	12.8	13.1	13	11.9	4.7	Ю. Ю
Flashing Temp. (deg. C)	122	93.7	83.3	70.5	57.9	43.3	38.4
Heat Transfer Rate (kj/S)	151.243	91.728	93.552	92.543	84,480	95.877	67.276
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. 10	18.561	7.324	10.297	10.604	10.666	5.308	4.552
U (KW/sq.m/k)	1.744	6.465	4.690	4.506	4.089	3.645	2.982
clean-U Value (kW/sq.m/lo	3.9	6.6	5.1	5.	5.1	51	5.1
f (sq.m K/KW)	0.317	0.003	0.017	0.026	0.048	0.078	0.139

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18500 4.9556 4:512 2.917 5 0.147 3.967 32 35.2 38.3 65.237 3.2 9# 97.916 0.069 **Total Operation Time: 128 hr.** 18500 3.970 35.2 43.2 4.9556 5.239 3.772 5 珨 8. 10 6 # 57.9 5.7 0.044 6500 3.932 52.2 12.1 85.900 10.626 4.173 40.1 1.937 \*\* Evaporator Stages 70.6 0.023 6500 3.943 93.258 1.937 10.525 4.574 65.3 13.1 ŝ 52.2 ∾ ₩ Time: 00:00 6500 78.6 83.4 10.020 4.894 5 0.008 3.956 65.3 13.3 94.988 1.937 77 # -0.003 6500 3.969 78.6 88.866 6.816 6.6 93.4 1.937 6.731 12.4 2 \*\* Date: September 30, 94 6500 3.989 151:243 4.6723 1.744 9.9 3 0.317 12 18.561 112 3 δ Brine Heater clean-U Value (kW/sq.m/K Heat Transfer Area (Sq.m) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/k) Outlet Temp. (deg. C) inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kW/sq.m/k f (sq.m k/kw) Run No. 4 Variables

Run No. 4	Date: September 30, 94		Time: 04:00		Total Operation Time: 132 hr.	lme: 132 hr.	
Veriables	Brine Heater			Evaporator Stages			
	·	*1	# 5	~	**	5#	<b>6</b>
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.988	3.968	3.955	3.942	3.932	3.969	3.967
Inlet Temp. (deg. C)	6	78	64.9	51.8	39.7	34.9	32
outlet Temp. (deg. C)	112	06	78	67.9	51.8	90	34.9
Temp. Rise (deg. C)	22	12	13.1	13.1	12.1	5.1	2.9
Flashing Temp. (deg. C	121.5	92.3	82.6	63.9	57.5	42.8	37.9
Heat Transfer Rate (K)/S)	158.420	85.980	93.548	93.249	85.892	104.033	59.120
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	18.353	6.567	9.722	10.183	10.626	4.917	4.288
U (kw/sq.m/Ю	1.847	6.759	4.968	4.728	4.173	4.270	2.782
Clean-U Value (KW/sq.m/K)	6°£	6.6	5.1	5.1	5.1	5.1	5:1
f tsq.m K/kw	0.285	-0.004	0.005	0.015	0.044	0.038	0.163
		-			-		
		. 1	·. 	•			

18500 3.967 32.5 48.929 4.9556 2.418 0.217 34.9 37.9 4.083 꼰 2 9 \* Total Operation Time: 136 hr. 18500 3.969 34.9 39.5 0.093 93.830 5.482 3.454 5.7 4.6 4.9556 43 い来 39.9 6500 3.932 85.896 10.626 4.173 5.1 0.044 2 57.7 1.937 12.1 \*\* Evaporator Stages 3.943 0.020 6500 2 65.1 13.1 70.3 93.254 1.937 10.411 4.624 5 ۲ ۳ Time: 08:00 3.955 6500 65.1 78.2 13.1 93.552 10.068 5 0.012 83.1 1.937 4.797 21 #2 3.968 89.5 11.3 7.479 5.589 6500 78.2 92.7 80.961 1.937 0.027 6.6 #1 Date: September 30, 94 3.988 89.5 22.5 162.008 4.6723 <u>6</u>.5 6500 112 3 17.960 0.262 1.931 **Brine Heater** Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/K) outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U. (kw/sq.m/ko f (sq.m K/kw) Run No. 4 Variables

Variables         Brine Neetwr         Erveporetor Stages           Variables         Brine Neetwr         # 1         # 2         # 3         # 4         # 5           Flowrate (kg/h)         6500         6500         6500         6500         19500         19500           Specific Heat (k//kg/h)         3.388         3.345         3.343         3.355         3.343         3.366           Specific Heat (k//kg/h)         3.388         3.355         3.343         3.352         3.346         435           Inite Temp. (deg. C)         90         78.2         65.1         5.2.2         40.2         35.5           Temp. Rise (deg. C)         11.2         90         78.2         65.1         5.2.2         4.3           Heat Transfer Area Ku//s         11.3         13.3         83.4         70.7         58         43.4           Liw.T.D. (deg. D         17.78         7.779         84.550         1.337         435.6           Liw.T.D. (deg. L)         17.78         7.779         1.337         435.6           Liw.T.D. (deg. L)         1.337         1.337         1.337         435.6           Liw.T.D. (deg. L)         1.337         1.337         435.6         43.4	Run No. 4	Date: September 30, 94		Time: 12:00		Total Operation	Total Operation Time: 140 hr.	· · · ·
#1       #2       #3       #4         (kg/h)       6500       6500       6500       6500       6500       6500         leat (k/kg/h)       3.388       3.968       3.955       3.943       3.352         p. (deg. C)       90       78.2       65.1       52.2       40.2         mp. (deg. C)       112       90       78.2       65.1       52.2       40.2         mp. (deg. C)       112       90       78.2       65.1       52.2       40.2         mp. (deg. C)       112       90       78.2       65.1       52.2       40.2         mp. (deg. C)       123       11.3       13.1       12.9       52.2       40.2         mp. (deg. C)       123       93.3       83.4       70.7       58       5191         sfer kare (k/S)       158.420       84.550       93.552       91.832       85.191         sfer kare (k/S)       158.420       84.550       93.552       91.832       85.191         sfer kare (k/S)       1582       7.759       1.937       1.937       1.937       1.937         sfer kare (k/S)       1582       7.759       1.0.411       10.795       1.0.701 <tr< th=""><th>rishies</th><th>Brine Heater</th><th>7</th><th></th><th>Evaporator Stage</th><th></th><th></th><th></th></tr<>	rishies	Brine Heater	7		Evaporator Stage			
(Kg)()         6500         <			*1	#2	#3	**	9 #	*
Kg/k0         3.988         3.968         3.955         3.943         3.932           I. C1         90         78.2         65.1         52.2         40.2           eg. C1         112         90         78.2         65.1         52.2         40.2           eg. C1         112         90         78.2         65.1         52.2         40.2           eg. C1         12         93         33.4         13.1         12.9         12           .C1         22         11.8         13.1         12.9         12           .C1         93.3         83.4         70.7         58         12           ate (kJ5)         158.420         84.550         93.552         91.832         85.191           rea Sq.m)         4.6723         1.937         1.937         1.937         1.937           rea Sq.m)         4.6723         1.937         1.937         1.937         1.937           rea Sq.m)         1.5626         4.639         4.392         4.10         1.937           wsq.m/k0         3.9         6.6         5.1         1.0.701         1.937           wsq.m/k0         3.9         6.6         5.1         5.1	wrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
1. Cl       90       78.2       65.1       52.2       40.2         eg. Cl       112       90       78.2       65.1       52.2       40.2         eg. Cl       112       90       78.2       65.1       52.2       40.2         eg. Cl       122       11.8       13.1       12.9       12         .Cl       22       11.8       93.3       83.4       70.7       58         deg. Cl       121       93.552       91.832       85.191       12         ate (k/s)       158.420       84.550       93.552       91.832       85.191         rea Sq.m)       4.6723       1.937       1.937       1.937       1.337         rea Sq.m)       6.6       5.626       4.639       4.392       4.110         Msq.m/ko       3.9       6.6       5.1       5.1       5.1         0.268       0.079       0.079       0.032	ecific Heat (kj/kg/K)	3.988	3.968	3.955	3.943	3.932	3.969	3.967
eg. C) 112 90 782 65.1 522 CO 22 11.8 13.1 12.9 12 (deg. C) 121 93.3 83.4 70.7 58 ate (k/s) 158.420 84.550 93.552 91.832 85.191 rea (5.1) 1.937 1.937 1.937 1.937 1.937 1.906 5.626 4.639 4.592 4.110 1.906 5.626 4.639 4.592 4.110 0.268 0.026 0.019 0.032 0.047	et Temp. (deg. C)	8	78.2	65.1	52.2	40.2	35.2	32.5
Cl       22       11.8       13.1       12.9       12         Ideg. Cl       121       93.3       83.4       707       58         ite (kJS)       158.420       84.550       93.552       91.832       85.191         ite (kJS)       158.420       84.550       93.552       91.832       85.191         rea (Sq.m)       4.6723       1.937       1.937       1.937       1.937         rea (Sq.m)       4.6723       1.937       1.937       1.937       1.937         rea (Sq.m)       4.6723       1.937       1.937       1.937       1.937         M/g.m/lo       3.9       6.6       5.1       6.3       5.1       5.1       5.1         0.268       0.026       0.019       0.032       0.047       0.047	tlet Temp. (deg. C)	112	8	78.2	65.1	52.2	39.5	35.2
(deg. C)     121     93.3     83.4     70.7     58       ate (k/S)     158.420     84.550     93.552     91.832     85.191       rea (sq.m)     4.6723     1.937     1.937     1.937     1.937       rea (sq.m)     4.6723     1.937     1.937     1.937     1.937       rea (sq.m)     4.6723     1.937     1.937     1.937     1.937       rea (sq.m)     4.672     5.626     4.639     4.392     4.110       Wsq.m/ko     3.9     6.6     5.1     5.1     5.1       0.268     0.026     0.019     0.032     0.047	mp. Rise (deg. C)	22	11.8	13.1	12.9	12	4.3	2.7
ate (k/S)     158.420     84.550     93.552     91.832     85.191       rea (5q.m)     4.6723     1.937     1.937     1.937     1.937       17.788     7.759     10.411     10.795     10.701       17.906     5.626     4.639     4.392     4.110       M/sq.m/so     3.9     6.6     5.1     5.1     5.1       0.268     0.026     0.019     0.032     0.047	shing Temp. (deg. C)	121	93.3	83.4	70.7	28	43.4	38.1
rea (Sq.m) 4.6723 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.936 5.626 4.639 4.539 4.392 4.110 WSq.m/Vo 3.9 6.6 5.1 5.1 5.1 5.1 5.1 5.1 5.1 5.1	at Transfer Rate (KJ/S)	158.420	84.550	93.552	91.832	85.191	87.713	55.046
17.788         7.759         10.411         10.795         10.701           1.906         5.626         4.639         4.392         4.110           W/sq.m/ko         3.3         6.6         5.1         5.1         5.1           0.268         0.026         0.019         0.032         0.047	at Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
1.906         5.626         4.639         4.392         4.110           3.9         6.6         5.1         5.1         5.1         5.1           0.268         0.026         0.019         0.032         0.047	1.T.D. (deg. K)	17.788	7.759	10.411	10.795	10.701	5.786	4.103
3.9     6.6     5.1     5.1       0.268     0.026     0.019     0.032     0.047	kw/sq.m/ю	1.906	5.626	4.639	4.392	4.110	3.059	2.707
0.268 0.019 0.047	an-U Value (kW/sq.m/k)	S.	6.6	5.1	5.1	5.1	<b>5.</b> 2.	<b>5.1</b>
	q.m KKW	0.268	0.026	0.019	0.032	0.047	0.131	0.173

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Watelies         Enterior Stages         Enterior Stages           #1         #2         #3         #4         #5         #4           Flowrate (rg/h)         6500         6500         6500         6500         18500         1850           Flowrate (rg/h)         6500         6500         6500         6500         18500         1850         1850           Flowrate (rg/h)         6500         6500         6500         6500         6500         18500         1850         1850           Inter Temp. (deg. Cl         3388         3.355         3.343         3.382         3.366	Run No. 4	Date: September 30, 94	5	Time: 16:00		Total Operation Time: 144 hr.	Time: 144 hr.	
#1         #2         #3         #4         #500 <th>Variebies</th> <th>Brine Heater</th> <th></th> <th></th> <th>Eveporator Stag</th> <th>50 50 50</th> <th></th> <th></th>	Variebies	Brine Heater			Eveporator Stag	50 50 50		
6500         6500         6500         6500         6500         6500         6500         6500         18500           3.988         3.988         3.955         3.943         3.392         3.969           90         78.2         65         5.2.1         40.2         3.5           112         90         78.2         65         52.1         3.5           112         90         78.2         65         52.1         3.5           112         93.7         78.2         65         5.1         3.5           122         93.7         83.7         70.8         5.4         4.5           123         13.37         13.37         70.8         64.480         91.791           112         94.550         94.265         91.830         84.480         91.791           11337         11.37         70.8         91.891         7.955         4.355           118.914         8.237         10.776         1.937         4.9556           1793         5.299         4.512         4.302         4.047         5.1655           11.937         1.937         1.937         1.937         4.9556           11.793			**	#2	£#	7	10 **	<b>6</b> . <b>*</b>
3.968       3.956       3.943       3.932       3.969         90       78.2       65       52.1       40.2       35.5         112       90       78.2       65       52.1       35.5         112       90       78.2       65       52.1       35.5         122       11.8       13.2       12.9       11.9       4.5         122       93.7       83.7       70.8       5.2       4.5         122       94.550       94.265       91.830       84.480       91.791         158.420       84.550       94.265       91.830       84.480       91.791         158.420       84.550       94.265       91.830       84.480       91.791         18.914       8.237       1.937       1.937       1.937       4.9556         18.914       8.237       1.0776       1.937       4.9556         1703       5.299       4.512       4.307       5.655         1793       5.1       5.1       5.1       5.1         10       5.1       5.1       5.1       5.1         0       3.376       0.051       0.051       0.051       0.051 <td>Flowrate (kg/h)</td> <td>6500</td> <td>6500</td> <td>6500</td> <td>6500</td> <td>6500</td> <td>18500</td> <td>18500</td>	Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
90         78.2         65         52.1         40.2         35           112         90         78.2         65         52.1         35.         35.           122         11.8         13.2         13.2         12.9         11.9         4.5           122         33.7         83.7         70.8         5.2         5.1         35.5           122         33.7         83.7         70.8         5.8         4.5           122         34.550         94.265         91.830         84.480         91.791           138.914         8.237         1.937         1.937         1.937         5.655           18.914         8.237         10.786         11.019         10.777         5.655           138.91         5.299         4.512         4.302         4.047         5.655           10         5.1         5.1         5.1         5.1         5.1           0         3.3         0.035         0.035         0.035         0.1091	Specific Heat (kj/kg/K)	3.988	3,968	3.955	3.943	3.932	3.969	3.967
112       90       78.2       65       52.1       38.5         22       11.8       13.2       12.9       11.9       4.5         122       93.7       83.7       70.8       58       4.3         122       93.7       83.7       70.8       58       4.3         122       93.7       83.7       70.8       58       4.3         122       93.7       83.7       70.8       5.8       4.3         122       94.550       94.265       91.830       84.480       91.791         11       4.6723       1.937       1.937       1.937       1.937       4.9556         11       11.937       1.937       1.937       1.937       1.935       5.655         11.793       5.239       4.512       4.502       4.047       5.655         11.793       5.1       5.1       5.1       5.1       5.1         12       5.1       5.1       5.1       5.1       5.1         13       0.037       0.026       0.036       0.051       0.109	Inlet Temp. (deg. C)	06	78.2	65	52.1	40.2	35	32
22       11.8       13.2       12.9       11.9       4.5         122       93.7       83.7       70.8       58       45.2         123       94.550       94.265       91.830       91.791       45.2         11       158.420       84.550       94.265       91.830       91.791       45.2         11       158.420       84.550       94.265       91.830       84.480       91.791         11       158.420       84.550       94.265       91.830       84.480       91.791         11       18.914       8.237       1.937       1.937       1.937       1.937       5.655         11       18.914       8.237       10.776       1.937       1.937       5.655         11.793       5.299       4.512       4.302       4.047       5.756         10       3.3       6.6       5.1       5.1       5.1       5.1         10       0.301       0.037       0.026       0.036       0.051       0.0091       0.0091	Outlet Temp. (deg. C)	. 112	06	78.2	65	52.1	39.5	35
122     93.7     83.7     70.8     58     43.2       158.420     84.550     94.265     91.830     84.480     91.791       1     4.6723     1.937     1.937     1.937     1.937     4.9556       1     4.6723     1.937     1.937     1.937     1.957     4.9556       1     18.914     8.237     10.786     11.019     10.777     5.655       1     17.93     5.299     4.512     4.302     4.047     3.276       1     7.93     6.6     5.1     5.1     5.1     5.1       10     0.301     0.037     0.026     0.036     0.051     0.109	Temp, Rise (deg. C)	22	11.8	13.2	12.9	11.9	4.5	<b>N</b> 3
r Rate (k/5)         158.420         84.550         94.265         91.830         84.480         91.791           r Area Sq.m)         4.6723         1.937         1.937         1.937         4.9556           N         18.914         8.237         1.037         1.937         4.9556           N         18.914         8.237         10.776         1.937         4.9556           N         17.93         5.299         4.512         4.302         4.047         5.276           N         1.793         5.299         4.512         4.302         4.047         5.276           N(W/sq.m/k)         3.9         6.6         5.1         5.1         5.1         5.1           0.301         0.037         0.026         0.036         0.051         0.091         0.109	Flashing Temp. (deg. O	122	93.7	83.7	70.8	28	43.2	38.4
r Area Sq.m)         4.6723         1.937         1.937         1.937         1.937         4.9556           N         18.914         8.237         10.786         11.019         10.777         5.655           N         1.793         5.299         4.512         4.302         4.047         3.276           N         1.793         5.299         4.512         4.302         4.047         5.16           N         3.9         6.6         5.1         5.1         5.1         5.1           N         0.301         0.037         0.026         0.051         0.051         0.109	Heat Transfer Rate (k)/S)	158.420	84.550	94.265	91.830	84.480	91.791	61.159
(V)         18.914         8.237         10.786         11.019         10.777         5.655           1         1.793         5.299         4.512         4.302         4.047         3.276           1         1.793         5.299         4.512         4.302         4.047         3.276           1         8.39         6.6         5.1         5.1         5.1         5.1         5.1           1         0.301         0.037         0.026         0.036         0.051         0.109	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
1         1.793         5.299         4.512         4.302         4.047         3.276           (kW/sq.m/o         3.9         6.6         5.1         5.1         5.1         5.1         5.1           (kW/sq.m/o         3.9         6.6         5.1         5.1         5.1         5.1         5.1           0.301         0.037         0.026         0.036         0.051         0.109	L.M.T.D. (deg. K)	18.914	8.237	10.786	11.019	10.777	5.655	4.743
tkw/sq.m/k0 3.9 6.6 5.1 5.1 5.1 5.1 5.1 5.1 5.1 5.1 0.109 0.037 0.026 0.036 0.051 0.109	U (KW/sq.m/K)	1.793	5.299	4.512	4.302	4.047	3.276	2.602
0.301 0.037 0.026 0.036 0.051 0.109	Clean-U Value (kW/sq.m/to	3.9	6.6	5.1	5.1	5.1	5.1	5.1
	f (sq.m K/KW)	0.301	0.037	0.026	0.036	0.051	0.109	0.188

Brine H	# 6500 3.968 78.1	#2 6500 3.955	Evaporator Stages # 3				
ξ.		# 2 6500 3.955					
ίς Έ		6500 3.955		*	10) 18		10 #
	а. С	3.955	nnco	6500	18500		18500
	78.1 90		3.943	3.932	3.969		3.967
	8	6.4.9	52	39.9	34.6	•	32
		78.1	64.9	52	39.5	•	34.6
	11.9	13.2	12.9	12.1	4.9		2.6
	93.6	83.5	70.6	57.8	42.8		38.3
	85.265	94.263	91.828	85.896	99.947	· · . ·	53.003
Heat Transfer Area (sq.m) 4.6725	1.937	1.937	1.937	1.937	4.9556	• .	4.9556
L.M.T.D. (deg. K) 17.788	8.151	10.673	10.907	10.737	2:383	•	4.885
U (KW/sq.m/Ю	5.400	4.560	4.346	4.130	3.746	•	2.189
Clean-U Value (kw/sq.m/lo	6.6	51	5.1	5	57		ň
f (sq.m K/kw) 0.268	0.034	0.023	0.034	0.046	0.071		0.261

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CALCULATIONS OF OVERALL HEAT TRANSFER COEFFICIENT AND FOULING FACTOR Run No. 4 Date: October 01, 94 Time: 00:00

Run No. 4	Date: October 01, 34						
Variables	Brine Heater			Evaporator Stages			
· · · · · ·		*	#3	<b>*</b> 3	**	10 <b>m</b>	10 72
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.942	3.931	3.969	3.967
Iniet Temp. (deg. C)	6	77.8	64.6	51.5	39.9	34.6	32
outlet Temp. (deg. C)	112	6	77.8	64.6	51.5	39.4	34.6
Temp. Rise (deg. C)	52	12.2	13.2	13.1	11.6	4.8	2.6
Flashing Temp. (deg. C)			82.5	69.8	57.2	42.5	37.5
Heat Transfer Rate (K)/S)	158.420	87.411	94.256	93.243	82.342	97.906	53.003
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	16.645	8.368	9.871	10.411	10.448	5.131	4.062
U (kw/sq.m/k)	2.037	5.393	4.930	4.624	4.069	3.850	2.633
Clean-U Value (KW/sq.m/10	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sa.m k/kw)	0.234	0.034	0.007	0.020	0.050	0.064	0.184

Run No. 4	Date: October 01, 94		Time: 04:00		Total Opera	Total Operation Time: 156 hr.	Ľ	
Variables	Brine Heater			Eveporator Stages				
		#1	#2	£#	*	10 18		10 11 11
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	0	18500
Specific Heat (k)/kg/i0	3.988	3.968	3.955	3.942	3.931	3.969		3.967
Inlet Temp. (deg. C	6	77.8	64.6	51.5	39.3	34.5	Ō	32
Outlet Temp. (deg. C)	112	8	77.8	64.6	51.5	39.5	S	34.5
Temp. Rise (deg. C)	22	12.2	13.2	13.1	12.2		S	2.5
Flashing Temp. (deg. C)	120	92.9	82.8	70.1	57.3	42.5	. 10	37.4
Heat Transfer Rate (kj/S)	158.420	87.411	94.256	93.243	86.596	101.986		50.964
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	6	4.9556
LM.T.D. (deg. K)	16.645	7.394	10.217	10.752	10.772	5.098	8	4.021
U (kw/sq.m/k)	2.037	6.103	4.763	4.477	4.150	4.037	۲	2.557
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5	5		5.
f (sq.m.k/kw)	0.234	0.012	0.014	0.027	0.045	0.052	8	0.195

18500 37.5 0.128 59.120 4.9556 3.082 3.967 32 34.9 3.871 5 50 9 # Total Operation Time: 164 hr. 18500 43.5 39.5 93.830 6.003 4.9556 3.151 0.121 3.969 4.6 5 34.9 い 来 6500 51.8 57.8 3.932 39.7 85.892 1.937 10.959 4.046 0.051 ŝ 12.1 \* Evaporator Stages 6500 3.942 64.9 70.6 4.386 0.032 51.8 13.1 1.937 10.977 93.249 s. ? 来 Time: 12:00 6500 64.9 0.035 3.955 77.9 83.7 92.832 1.937 11.054 4.335 ň 5 57 # 6500 3,968 77.9 93.8 8.454 5.294 0.037 86,696 1.937 6.6 8 12.1 \* Date: October 01, 94 158.420 0.200 4.6723 15.478 2.191 ნ. ზ 6500 3.988 8 42 2 119 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/k) Outlet Temp. (deg. C) inlet Temp. (deg. O Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k f (sq.m K/kw) Run No. 4 Variables

Run No. 4	Date: October 01, 94		Time: 16:00		Total Operation Time: 168 hr.	lime: 168 hr.	
Variables	Brine Heater			Evaporator Stages			
		* *	÷.	77	*	6	<b>9</b> <b>#</b> 
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/l0	3.988	3,968	3.955	3.943	3.932	3.969	3.967
inlet Temp. (deg. C)	06	78.3	65	52	40	35.2	31.5
Outlet Temp. (deg. C)	112	06	78.3	65	23	39.5	35.2
Temp. Rise (deg. C)	22	11.7	13.3	13	12	4.3	3.7
Flashing Temp. (deg. C)	119.5	93.9	83.9	70.9	58.2	43.4	37.7
Heat Transfer Rate (k)/S)	158.420	83.834	94.981	92.541	85.187	87.713	75.428
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	16.064	8.440	10.934	11.166	11.143	5.786	4.074
U (kw/sq.m/i0	2.111	5.128	4.485	4.278	3.947	3.059	3.736
Clean-U Value (kW/sq.m/N	3.9	6.6	. <mark></mark>	5.1	5.1	5.1	5.1
f (sq.m K/KW)	0.217	0.043	0.027	0.038	0.057	0.131	0.072

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31.5 5.5 0.111 18500 37.9 71.349 4.9556 3.256 35 5 4.421 3.967 9 # Total Operation Time: 192 hr. 18500 81.589 4.9556 5.979 2.754 0.167 3.969 ŝ 43.2 ŝ 2 10 **#** 6500 39.9 3.986 5.5 0.055 3.932 51.9 85.185 1.937 11.033 2 ŝ \*\* Evaporator Stages 0.035 51.9 92.539 11.054 4.322 3.942 1.937 6500 64.9 5 70.7 က် 内兼 Time: 16:00 6500 11.166 5.1 3.955 64.9 4.292 0.037 83.8 92.832 1.937 77.9 1 ۲ \* 4.828 6.6 0.056 6500 3,968 86.696 9.270 77.9 94.5 1.937 8 12.1 ÷. Date: October 02, 94 3.9 0.234 6500 3.988 158.420 4.6723 16.645 2.037 120 8 112 3 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/l0 Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp, Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sg.m/k f (sq.m K/kW) Run No. 4 Variables

<b>L AND FOULING FACTOR</b>
ER COEFFICIEN
<b>SOF OVERALL HEAT TRANSF</b>
CALCULATIONS

Variabies	Brine Heater			Evaporator Stages			
		**	*2	5#		10 **	*
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
specific Heat (kj/kg/k)	3.989	3.969	3,955	3.942	3.931	3.969	3.967
inlet Temp. (deg. C)	90.5	78	64.7	51.7	39.5	34.7	3
Outlet Temp. (deg. C)	112	90.5	78	64.7	51.7	39	34.7
Temp. Rise (deg. C)	21.5	12.5	13.3	13	12.2	4.3	3.7
Flashing Temp. (deg. C)	119	94	83.5	70.5	57.6	42.9	37.7
Heat Transfer Rate (k)/S)	154.832	89.569	94.973	92.534	86.600	87.706	75.422
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	15.313	8.225	10.821	11.054	10.884	5.786	4.605
U (kw/sq.m/io	2.164	5.622	4.531	4.322	4.108	3.059	3.305
Clean-U Value (kW/sq.m/l0	6. M	6.6	5.1	5.1	5.1	5.	5
f (sq.m K/KW)	0.206	0.026	0.025	0.035	0.047	0.131	0.106

31.5 18200 34.6 37.6 62.168 4.9556 4.368 2.872 5 0.152 3.967 ų, 9 Total Operation Time: 200 hr. 0.039 18200 3.969 34.6 42.9 108.364 4.9556 5.135 4.258 5.4 ŝ \$ 10 # 51.9 12.2 57.8 6500 3.932 39.7 86.603 4.108 0.047 1.937 10.884 2 \*\* Evaporator Stages 51.9 70.8 6500 3,943 13.2 93.964 11.012 4.405 0.031 65.1 1.937 2 ۳¥ Time: 00:00 83.6 ru L 3.955 65.1 13.2 94.268 10.559 4.609 0.021 6500 78.3 1.937 . 71 # 0.020 6500 3.969 91.012 8.045 5.841 78.3 12.7 94.3 1.937 6.6 δ \* \* Date: October 03, 94 6500 3.989 119 151.243 15.148 9.5 0.212 4.6723 2.137 δ 112 ñ Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/l) Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kW/sq.m/io f (sq.m.K/kW) Run No. 4 Variables

37.6 4.9556 2.512 3.967 34.6 0.202 18100 20 2.6 51.857 4.166 ŝ 9# Total Operation Time: 204 hr. 3.969 34.6 39.5 0.082 18100 42.9 97.786 4.9556 5.490 3.594 9.9 5 9 # 51.9 0.045 3.932 12.2 57.7 4.150 6500 39.7 86.603 1.937 10.772 ų. \* Evaporator Stages 6500 3.943 51.9 70.3 0.023 1.937 10.525 4.574 33 13.1 93.251 5.2 四種 Time: 04:00 6500 3.955 78.1 13.1 83 93.550 1.937 10.068 0.012 65 4.797 5.1 #2 93.5 85.265 6500 3.968 11.9 1.937 8.032 5.481 6.6 0.031 8 78.1 #1 Date: October 03, 94 0.200 3.988 119 4.6723 6 M 6500 g 22 15.478 2.191 112 158.420 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/K) outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) LM.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k) f (sq.m K/kw) Run No. 4 Variables

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Run No. 4	Date: October 03, 94		Time: 08:00		Total Operation Time: 208 hr.	1 Time: 208 hr.	:
Variables	Brine Hester			Evaporator Stages			
		*	*	↔ ₩	*	10 11	40 78
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (k)/kg/N	3.988	3.969	3.956	3.943	3.932	3.969	3.967
Iniet Temp. (deg. C)	6	78.5	65.4	52.2	40.1	34.7	32
Outlet Temp. (deg. C)	112	06	78.5	65.4	52.2	04	34.7
Temp. Rise (deg. C)	3	11.5	13.1	13.2	12.1	5.3	2.7
Flashing Temp. (deg. C)	119	93.6	83.3	70.7	83	43.1	37.8
Heat Transfer Rate (k//S)	158.420	82.404	93.560	93.971	85.900	108.111	55.042
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4,9556
L.M.T.D. (deg. K)	15.478	8.021	9.953	10.559	10.737	5.317	4.310
U (kW/sq.m/k)	2.191	5.304	4.853	4.594	4.130	4.103	2.577
Clean-U Value (KW/sq.m/k)	3.9	6.6	5.1	. 5.1	5.1	5.1	5.1
f (sq.m K/KW)	0.200	0.037	0.010	0.022	0.046	0.048	0.192
				- - -			
		·				-	

Run No. 4	Date: October 03, 94		Time: 12:00		Tot	Total Operation Time: 212 hr.	Time:	212 hr.	· · .	
	Rrine Heater			Evaporator Stages	tages					
		*	*	<b>の</b> 兼		**		5		9 #
Flowrate (kg/h)	6500	6500	6500	6500		6500		18500		18500
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.943	•	3.932		3.969		3.967
Inlet Temp. (deg. C)	6	78.2	65	51.9	e Ante	39.6		35		32
Outlet Temp. (deg. C)	112	8	78.2	65		51.9		9	:	35
Temp. Rise (deg. C)	22	11.8	13.2	13.1	•	12.3		5		M
Flashing Temp. (deg. C)	119	63.9	83.6	70.7	. •	57.9		43.2		37.6
Heat Transfer Rate (K//S)	158.420	84.550	94.265	93.251	~	87.312	¥	101.994	••	61.159
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	•	1.937		4.9556	· ·	4.9556
L.M.T.D. (deg. K)	15.478	8.473	10.673	10.977		11.030		5.314	•	3.910
O//W/bs/www	2.191	5.152	4.560	4.386		4.087	· · · ·	3.873	:	3.156
Clean-U Value (kW/sq.m/k)	6.5	6.6	5.1	5.1	-	5.1		5 <b>.</b> 7		<del>د</del> . ۲.
f (sq.m K/kw)	0.200	0.043	0.023	0.032		0.049	· ·	0.062		0.121
		· · .						- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1		

18500 3.967 32 34.9 37.4 59.120 4.9556 3.766 3.168 5 0.120 2,0 9# Total Operation Time: 216 hr. 3.969 34.9 660.0 18500 39.5 43.1 93.830 4.9556 5.588 3.388 5.7 4.6 10 # 39.6 51.8 57.8 0.050 6500 3.931 12.2 10.994 4.067 86.601 1.937 5.7 \*\* Evaporator Stages 3.942 51.8 673 70.8 6500 13.1 93.249 4.298 0:037 1.937 11.201 S. **5**来 Time: 16:00 3.955 64.9 93.548 10.525 4.589 ۍ. ۲ 0.022 6500 83.3 1.937 28 13.1 × \* 0.036 5.346 6500 85.980 8.303 3.968 28 93.7 1.937 6,6 8 3 # 1 Date: October 03, 94 0.200 6500 3.988 119 158.420 4.6723 15.478 3.9 8 2.191 112 20 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/k) Outlet Temp. (deg. C) Iniet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k) f (sq.m K/kW) Run No. 4 Variables

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Run No. 4	Date: October 03, 94	·	Time: 20:00		Total Operat	Total Operation Time: 220 hr.		
Variables	Brine Heater			Evaporator Stages				
		#1	#2	9) *	**	9) *	<b>9</b> *	
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400	8
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.942	3.931	3.969	3.967	29
Inlet Temp. (deg. C)	06	77.8	64.7	51.5	39.6	34.6	31	31.8
outlet Temp. (deg. C)	112	06	77.8	64.7	51.5	39.2	34	34.6
Temp. Rise (deg. C)	22	12.2	13.1	13.2	11.9	4.6		2.8
Flashing Temp. (deg. C)	119	93.6	83.4	70.6	57.5	42.8	37.1	5
Heat Transfer Rate (Ki/S)	157.202	86.739	92.823	93.233	83.819	93.318	56.770	2
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.95	28
L.M.T.D. (deg. K)	15.478	8.248	10.865	11.237	10.887	5.588	3.726	56
U (kW/sq.m/i0	2.174	5.429	4.411	4.284	3.975	3.370	3.0	2
Clean-U Value (KW/sq.m/K)	<b>6</b> 3	6.6	<b>.</b> 	5.1	5.1	2	5	. 2
f (sa.m K/kw)	0.204	0.033	0.031	0.037	0.056	0.101	0.129	23
								1.

42

Run No. 4	Date: October 04, 94		Time: 00:00		Total Operation Time: 224 hr.	Time: 224 hr.	
Variables	Brine Heater			Evaporator Stages			
		<b>1</b>	#		**	10 11	*
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.942	3.931	3.969	3.967
inlet Temp. (deg. C)	89.5	77.8	64.7	51.4	39.1	34.3	2
Outlet Temp. (deg. C)	112	89.5	77.8	64.7	51.4	38.5	34.3
Temp. Rise (deg. C)	22.5	11.7	13.1	13.3	12.3	4.2	
Flashing Temp. (deg. C)	120	94	83.5	70.6	57.6	42.7	36.8
Heat Transfer Rate (k//S)	160.762	83.178	92.823	93.938	86.631	85.197	66.903
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. 10	16.813	9.134	10.977	11.272	11.251	6.059	3.921
u (kW/sq.m/N	2.047	4.701	4.366	4.303	3.975	2.837	3.443
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	ы. Г.	5.1	
f (sq.m K/KW)	0.232	0.061	0.033	0.036	0.055	0.156	0.094

Run No. 4	Date: October 04, 94		Time: 04:00		Total Op	Total Operation Time: 228 hr.	
Variables	Brine Heater			Evaporator Stages	3		
		#1	#2	€#	*		
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.942	3.931	3.969	3.966
Inlet Temp. (deg. C)	89.5	1.17	64.6	51.3	38.9	34.1	30.5
Outlet Temp. (deg. C)	112	89.5	<i>T.TT</i>	64.6	51.3	38	34.1
Temp. Rise (deg. C)	22.5	11.8	13.1	13.3	12.4	0. M	3.6
Flashing Temp. (deg. C	120	92.9	83.3	70.6	27.4	* .	36.7
Heat Transfer Rate (K)/S)	160.762	83.888	92.821	93.936	87.333	79.407	72.981
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937		4.9556
LM.T.D. (deg. K)	16.813	7.880	10.865	11.384	11.176		÷
U (KW/sq.m/Ю	2.047	5.496	4.411	4.260	4.034		
clean-U Value (kW/sq.m/K)	6 N	6.6	5.1	5.1	5.1		С. Г
f (sq.m K/KW)	0.232	0.030	0.031	0.039	0.052	0.189	0.085

18400 3.967 36.8 4.9556 3.650 2.354 0.229 42.577 32 34.1 2.1 5 9 # Total Operation Time: 232 hr. 18400 99.399 4.9556 5.703 0.088 3.969 42.6 3.517 34.1 50 0.4 5.7 90 # 6450 51.5 57.6 11.176 3.931 39.1 12.4 87.337 1.937 4.034 5.7 0.052 \*\* Evaporator Stages 6450 3.942 51.5 13.3 93.940 0.036 64.8 70.7 1.937 11.272 4.303 5.5 . 10 # Time: 08:00 64.8 6450 3.955 77.9 83.2 92.826 1.937 10.525 4.553 0.024 5.1 13.1 ۲ \* 6450 5.932 <u>6.6</u> 3.968 77.9 86.029 1.937 7.487 0.017 8 ₿ 12.1 1# Date: October 04, 94 6450. 3.988 119.5 157.202 4.6723 <u>б</u> 16.064 2.094 8 0.221 112 2 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/K) Heat Transfer Rate (K)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/k) Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k) f (sq.m K/kw) Run No. 4 Variables

Run No. 4	Date: October 04, 94		Time: 12:00		Total Operati	Total Operation Time: 236 hr.	Ľ.	
Variables	Brine Heater			Evaporator Stages				
		**	7	*	**	50 78		40 #1
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	0	18400
Specific Heat (k)/kg/Ю	3.988	3.968	3.955	3.942	3.931	3.969	6	3.967
Inlet Temp. (deg. C	6	9.77	64.7	51.5	39.2	34.4	<b>t</b>	32
Outlet Temp. (deg. C)	112	6	77.9	64.7	51.5	33	0	34.4
Temp. Rise (deg. C)	22	12.1	13.2	13.2	12.3	4.6	G	2.4
Flashing Temp. (deg. C)	119.5	93.5	83.3	70.6	57.5	42.6	G	36.9
Heat Transfer Rate (Kj/S)	157.202	86.029	93.533	93.233	86.633	93.315		48.660
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	6	4.9556
L.M.T.D. (deg. K)	16.064	8.096	10.673	11.237	11.030	5.588	 	3.566
u (kw/sq.m/o	2.094	5.486	4.524	4.284	4.055	3.370	0	2.753
Clean-U Value (kW/sq.m/K)	0. K)	6.6	5.	5.	2	5. 1.		<b>5.1</b>
f (sa.m K/kW)	0.221	0.031	0.025	0.037	0.051	0.10	<b>-</b>	0.167

36.6 3.299 0.107 18400 62.847 4.9556 3,844 3.967 34.1 5.7 б N 10 14 Total Operation Time: 240 hr. 42.4 99.399 4.9556 5.490 3.653 5.7 0.078 18400 3.969 4.9 50 34.1 10 # 57.5 4.015 6450 3.931 51.4 12.3 86.631 11.141 5.1 0.053 39.1 1.937 -Evaporator Stages 64.6 70.6 11.348 0,040 6450 3.942 51.4 13.2 93.231 1.937 4.241 ភ € # Time: 16:00 64.6 77.8 3.955 13.2 83.4 10.899 4.430 5 0.030 6450 1.937 93.531 **\*** 2 77.8 93.7 86.739 8.368 5.352 6.6 0.035 6450 3.968 12.2 1.937 8 \* Date: October 04, 94 6450 3.988 120.5 4.6723 17.219 1.954 3,9 0.255 157.202 8 112 33 Brine Heater Clean-U Value (kW/sq.m/K) Heat Transfer Area (Sq.m) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/K) Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Fiowrate (kg/h) U (kw/sq.m/k) f (sq.m K/kw) Run No. 4 Variables

Run No. 4	Date: October 04, 94		Time: 20:00	•	Total Operation Time: 244 hr.	lme: 244 hr.	
Variabies	Brine Heater			Evaporator Stages			
		#1	#2	<b>#</b> 3	##	1 <b>9</b>	*
Fiowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (kj/kg/N	3.988	3.968	3.955	3.942	3.931	3.969	3.966
inlet Temp. (deg. C)	6	77.8	64.8	51.4	36	34	31
Outlet Temp. (deg. C)	112	06	77.8	64.8	51.4	39	34
Temp. Rise (deg. C)	33	12.2	13	13.4	12.4	IJ	<b>M</b>
Flashing Temp. (deg. C)	120	93.7	83.3	70.6	57.5	42.5	36.7
Heat Transfer Rate (kj/S)	157.202	86.739	92.116	94.646	87.335	101.427	60.819
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	16.645	8.368	10.717	11,194	11.176	5.635	4.015
U (KW/sq.m/K)	2.021	5.352	4.437	4.365	4.034	3.632	3.057
Clean-U Value (KW/sq.m/K)	3.0	6.6	<u>5</u>	5.7	2	5.1	5
f (sq.m k/kw)	0.238	0.035	0.029	0.033	0.052	0.079	0.131

3.966 18400 4.9556 2.990 0.138 33.8 2.8 36.4 56.764 3.831 <u>5</u>.1 Б 9\* Total Operation Time: 248 hr. 18400 3.969 33.8 4.9556 6.059 2.837 0.156 85.191 88 42.2 5 42 9 # 6450 38.6 57.2 87.328 3.931 1.937 3.994 0.054 12.4 11.287 ۍ 5 \*\* Evaporator Stages 6450 11.116 0.030 3.942 64.5 70.2 95.344 13.5 4.428 1.937 ហំ 5 #3 Time: 00:00 6450 3.955 64.5 77.6 83 92.819 10.639 13.1 1.937 4.504 0.026 'n 2 # 6450 3.968 77.6 81.037 1.937 8.572 4.880 0.053 68 11.4 93.1 6.6 \*\* Date: October 05, 94 119.5 2.145 3.9 0.210 3.988 4.6723 16.396 6450 8 164.322 112 33 Brine Heater Clean-U Value (kW/sq.m/K) Heat Transfer Area (Sq.m) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/K) Outlet Temp. (deg. C) inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kW/sq.m/k f (sq.m K/kW) Run No. 4 Variables

Brine Heater         # 1         # 2         Evaporator Stages           n)         6.450         6.452         8.927         8.92         7.72         6.4.2         5.0.7         8.9         1.35.5         8.9         8.0         7.72         6.4.2         5.0.7         8.9         8.0.7         1.35.5         6.4.2         5.0.7         8.9         7.72         6.4.2         5.0.7         8.9         8.0.7         1.35.5         6.4.2         5.0.7         8.9         8         8.0.7         1.35.5         6.4.2         5.0.7         8.9         8         8         8.0.7         1.35.7         1.357         4.4.28         5.1         5.1 <t< th=""><th>Run No. 4 Date:</th><th>Date: October 05, 94</th><th></th><th>Time: 04:00</th><th></th><th>Total operation</th><th>Total operation Filme: 252 hr.</th><th></th></t<>	Run No. 4 Date:	Date: October 05, 94		Time: 04:00		Total operation	Total operation Filme: 252 hr.	
#1     #2     #3       6450     6450     6450     6450     6450       6450     6450     6450     6450     6450       3.988     3.967     3.954     3.942       89     77.2     64.2     5.07       112     89     77.2     64.2     5.07       112     89     77.2     64.2     5.07       112     89     77.2     64.2     5.07       112     89     77.2     64.2     5.07       112     89     77.2     64.2     5.07       119.5     92.7     82.5     66.9       16.322     83.876     92.102     95.338       16.356     8.257     1.937     1.937       16.396     8.257     1.937     1.937       16.395     5.257     4.552     4.428       3.9     5.1     5.1     5.1       3.9     5.1     5.1     5.1       3.9     0.030     0.030     0.030		rine Heater			Evaporator Stages			
6450     6450     6450     6450     6450       3.988     3.967     3.954     3.942       89     77.2     64.2     50.7       89     77.2     64.2     50.7       112     89     77.2     64.2       112     89     77.2     64.2       113     11.8     13     13.5       119.5     92.7     82.5     69.9       164.322     83.876     92.102     95.338       165.36     82.37     1.937     1.937       16.396     8.237     1.0.491     11.116       16.396     8.237     10.491     11.116       2.145     5.257     4.532     4.428       3.9     6.6     5.1     5.1       3.9     6.5     5.1     5.1			#1	#2	#3	**	ю *	*
3.388       3.967       3.954       3.942       3.942         89       77.2       6.4.2       5.0.7         112       89       77.2       6.4.2       5.0.7         112       89       77.2       6.4.2       5.0.7         123       11.8       13       13.5       64.2       69.9         119.5       92.7       82.5       69.9       87         119.5       92.7       82.5       69.9       87         164.322       83.876       92.102       95.338       87         164.323       1.937       1.937       1.937       1         164.323       8.237       1.937       1.937       1         16.5       5.257       4.532       4.428       3         2.145       5.257       4.532       4.428       3         3.9       6.6       5.1       5.1       5.1       5.1         0.210       0.039       0.030       0       0       0	Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
89       77.2       64.2       50.7         112       89       77.2       64.2       50.7         112       89       77.2       64.2       50.7         112       89       77.2       64.2       50.7         12       89       77.2       64.2       50.7         12       13.5       11.8       13.5       13.5         119.5       92.7       82.5       69.9       69.9         164.322       83.876       92.102       95.338       81         164.322       8.3876       92.102       95.338       81         16.55       1.937       1.937       1.937       1.937         16.56       8.237       10.491       11.116       11         16.55       5.257       4.532       4.428       3         3.9       6.6       5.1       5.1       5.1       5.1         0.210       0.039       0.030       0.330       0       0	Specific Heat (kj/kg/K)	3.988	3.967	3.954	3.942	3.930	3.968	3.966
112     89     77.2     64.2       23     11.8     13     13.5       119.5     92.7     82.5     69.9       119.5     92.7     82.5     69.9       119.5     92.7     82.5     69.9       164.322     83.876     92.102     95.338       164.322     1.937     1.937     1.937       16.366     8.237     10.491     11.116       16.396     8.237     10.491     11.116       2.145     5.257     4.532     4.428       3.9     6.6     5.1     5.1       3.9     6.6     5.1     5.1	Inlet Temp. (deg. C)	83	77.2	64.2	50.7	38.3	33.5	29.5
23       11.8       13       13.5         119.5       92.7       82.5       69.9         164.322       83.876       92.102       95.338       8         164.322       83.876       92.102       95.338       8         164.322       83.876       92.102       95.338       8         164.323       1.937       1.937       1.937       1         165.5       1.937       1.937       1.937       1         16.306       8.237       1.937       1.937       1         16.306       8.237       1.937       1.937       1         2.145       5.257       4.532       4.428       3         3.9       6.6       5.1       5.1       5.1       5.1         0.210       0.039       0.030       0       0	Outlet Temp. (deg. C)	112	68	2.77.2	64.2	50.7	37.5	33.5
119.5       92.7       82.5       69.9         164.322       83.876       92.102       95.338       87         164.322       83.876       92.102       95.338       87         4.6723       1.937       1.937       1.937       1.937       1.937         16.396       8.237       1.031       1.937       1.937       1.937       1.937         16.396       8.237       1.031       1.031       11.116       11         2.145       5.257       4.532       4.428       3         3.9       6.6       5.1       5.1       5.1         0.210       0.039       0.025       0.030       0	Temp. Rise (deg. C)	23	11.8	13	13.5	12.4	4	
164.322     83.876     92.102     95.338       1.637     1.937     1.937     1.937       16.396     8.237     1.0491     11.116       2.145     5.257     4.532     4.428       3.9     6.6     5.1     5.1       0.210     0.039     0.025     0.030	Flashing Temp. (deg. C)	119.5	92.7	82.5	6.69	56.9	41.8	36.1
4.6723       1.937       1.937       1.937         16.396       8.237       1.937       1.937         16.396       8.237       10.491       11.116         2.145       5.257       4.532       4.428         2.145       5.257       4.532       4.428         3.9       6.6       5.1       5.1         0.210       0.039       0.025       0.030	Heat Transfer Rate (kJ/S)	164.322	83.876	92.102	95.338	87.322	81.129	81.081
16.396         8.237         10.491         11.116           2.145         5.257         4.532         4.428           3.9         6.6         5.1         5.1           0.210         0.039         0.025         0.030	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
2.145     5.257     4.532     4.428       3.9     6.6     5.1     5.1       0.210     0.039     0.025     0.030	L.M.T.D. (deg. lo	16.396	8.237	10.491	11.116	11.287	6.082	4.294
3.9 6.6 5.1 5.1 5.1 0.030 0.030 0.030	U (KW/sq.m/y)	2.145	5.257	4.532	4.428	3.994	2.692	3.810
0.210 0.039 0.025 0.030	Clean-U Value (kW/sq.m/l0	3.9	6.6	а. 27	5.1	5.1	5 <b>.</b> 7	5.1
	f (sq.m k/k/w)	0.210	0.039	0.025	0.030	0.054	0.175	0.066

18400 3.966 32.5 4.9556 1.635 10.136 0.546 32 0.5 36 3.744 š 9 \* Total Operation Time: 256 hr. 18400 4.9556 3.728 0.072 3.968 111.548 6.038 32.5 41.7 器 ŝ S. <del>ان</del> \* 6450 87.324 0.054 3.931 38.4 50.8 12.4 5 1.937 11.287 3.994 5.7 \*\* Evaporator Stages 3.942 50.8 13.5 70.3 95.340 0.037 6450 64.3 1.937 11.454 4.297 ۍ. ۲ € # Time: 06:00 6450 64.3 3.954 13.1 82.9 92.814 1.937 10.752 4.457 5.1 0.028 7.4 . \* 6.6 6450 8.172 5.209 0.040 3.967 77.4 92.7 82.457 1.937 88 1.6 \*\* Date: October 05, 94 6450 3.988 164.322 4.6723 <del>3</del>.9 0.259 18.131 1.940 8 13 112 23 **Brine Heater** Heat Transfer Area (Sq.m) clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/K) outlet Temp. (deg. C) iniet Temp. (deg. C) Temp. Rise (deg. C) Flowrate (kg/h) L.M.T.D. (deg. K) U (kw/sq.m/k f (sq.m K/KW) Run No. 4 Variables

Run No. 4	Date: October 05, 94		Time: 12:00		Total Operation Time: 260 hr.	me: 250 hr.	
Verlables	Brine Heater			Evaporator Stages			
		# 1	#2	₩		10	*
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (kj/kg/K)	3.988	3.967	3.955	3.942	3.931	3.969	3.966
inlet Temp. (deg. C)	8	77.5	64.5	51.2	39	33.8	31
Outlet Temp. (deg. C)	112	83	77.5	64.5	51.2	38.5	33.8
Temp. Rise (deg. C)	23	11.5	13	13.3	12.2	4.7	2.8
Flashing Temp. (deg. C)	120.5	94.2	83.3	70.4	57.4	42.4	36.5
Heat Transfer Rate (KJ/S)	164.322	81.747	92.109	93.934	85.924	95.336	56.764
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	17.558	9.856	11.054	11.272	11.215	5.943	3.935
U (kw/sq.m/k)	2.003	4,282	4.302	4.302	3.955	3.237	2.911
Clean-U Value (kW/sq.m/k)	6. M	9	5.1	5.	5.1	5.1	5.1
f sq.m k/kw	0.243	0.082	0.036	0.036	0.057	0.113	0.147
						- - - - - - -	

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Run No. 4

Date: October 05, 94

Time: 16:00

Total Operation Time: 264 hr.

Variables	Brine Heater			Evaporator Stages	get		
	• .	· • •	#2	<b>約</b> 兼	*	lŋ th	9 #
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (k)/kg/iO	3.988	3.968	3.955	3.942	3.931	3.969	3.966
Inlet Temp. (deg. C)	8	77.5	64.4	51.1	38.9	33.7	3
Outlet Temp. (deg. C)	112	06	77.5	64.4	51.1	38.5	33.7
Temp. Rise (deg. C)	33	12.5	13.1	13.3	12.2	4.8	2.7
Flashing Temp. (deg. C)	121	94.4	83.7	70.5	57.4	42.2	36.4
Heat Transfer Rate (KJ/S)	157.202	88.868	92.816	93.932	85.923	97.364	54.736
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	17.788	9.289	11.536	11.495	11.325	5.771	3.895
U (kw/sq.m/Ю	1.891	4.939	4,154	4.218	3.917	3.404	2.836
Clean-U Value (kW/sq.m/Ю	O M	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m K/KW)	0.272	0.051	0.045	0.041	0.059	860.0	0.157

Run No. 4	Date: October 05, 94		Time: 20:00		Total Operation Time: 258 hr.	lme: 265 hr.	· · ·
Variables	Brine Heater			Evaporator Stages			
		#1	#2	0 <b>#</b>		<b>*</b>	<b>0</b> #
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (kj/kg/X)	3.988	3.968	3.955	3.942	3.931	3.968	3.966
Inlet Temp. (deg. C)	06	<i>L.T.</i>	64.4	2	38.5	33.6	р Я
Outlet Temp. (deg. C)	112	6	7.77	64.4	51	38	33.6
Temp. Rise (deg. C)	52	12.3	13.3	13.4	12.5	4.4	3.6
Flashing Temp. (deg. C)	120	94.4	83.5	70.5	57.3	42.2	36.2
Heat Transfer Rate (KJ/S)	157.202	87.448	94.236	94.637	88.031	89.246	72.976
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	16.645	9.222	11.159	11.531	11.433	6.139	4.143
U (kw/sq.m/Ю	2.021	4.896	4.360	4.237	3.975	2.933	3.555
Clean-U Value (kW/sq.m/K)	6.X	9.9	5.1	5.1	<b>5</b>	5.	5.1
f (sq.m k/kw)	0.238	0.053	0.033	0.040	0.055	0.145	0.085

	<b>AND FOULING FACTO!</b>	
	<b>TRANSFER COEFFICIENT ANI</b>	· .
	<b>CALCULATIONS OF OVERALL HEAT</b>	
•		

Date: October 06, 94

Run No. 4

Time: 00:00

Total Operation Time: 272 hr.

	-					-	
Variables	Brine Heater			Evaporator Stages			
		5#	*	₩ ₩	<b>*</b> #	10 H	<b>9</b>
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (k)/kg/lo	3.988	3.968	3.954	3.942	3.931	3.968	3,966
Inlet Temp. (deg. C)	89.5	77.5	64.3	50.8	38.3	33.4	29.5
Outlet Temp. (deg. C)	112	89.5	77.5	64.3	50.8	37.5	33.4
Temp. Rise (deg. C)	22.5	12	13.2	13.5	12.5	4.1	3.9
Flashing Temp. (deg. C)	120.5	63.9	82.9	70.2	57.1	41.9	36
Heat Transfer Rate (k)/S)	160.762	85.307	93.524	95.340	88.027	83.156	79.053
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	17.389	9.121	10.673	11.341	11.433	6.227	4.256
U (kW/sq.m/k)	1.979	4.829	4.524	4.340	3.975	2.695	3.748
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.7	5.1	5.1	5.1
f sq.m K/kW)	0.249	0.056	0.025	0.034	0.056	0.175	0.071

Run No. 4	Date: October 06, 94		Time: 04:00		Total Operation Time: 276 hr.	me: 276 hr.	
Variables	Brine Heater			Evaporator Stages			
		#1	#2	8	<b>*</b> #	10 1	<b>0</b> <b>1</b>
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (KJ/Kg/Ю	3.987	3.967	3.954	3.941	3.930	3.968	3.966
inlet Temp. (deg. C	88.5	77.2	5	50.4	37.8	33	39
Outlet Temp. (deg. C)	112	88.5	77.2	64	50.4	37.5	8
Temp. Rise (deg. C)	23.5	11.3	13.2	13.6	12.6	4.5	4
Flashing Temp. (deg. C)	120.5	93.6	82.7	69.9	56.6	41.5	35.6
Heat Transfer Rate (kj/S)	167.881	80.316	93.516	96.038	88.723	91.266	81.075
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	17.727	9.674	10.786	11.376	11.358	5.970	4.294
U (KW/sq.m/to	2.027	4.286	4.476	4.358	4.033	3.085	3.810
Clean-U Value (kW/sq.m/l0	3.9	6.6	<u>5</u>	5.	5.1	τ. Σ	5.
f (sa.m k/kW)	0.237	0.082	0.027	0.033	0.052	0.128	0.066

Run No. 4

Time: 08:00

Date: October 06, 94

Total Operation Time: 250 hr.

Variables	Brine Heater			Eveporator Stages			
		*	*	<b>8</b>	*	9	9
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (K)/Kg/K0	3.987	3.967	3.954	3.942	3.930	3.968	3.966
inlet Temp. (deg. C)	88.5	77.4	64.2	50.7	38.1	32.9	31.5
Outlet Temp. (deg. C)	112	88.5	77.4	64.2	50.7	38	32.9
Temp. Rise (deg. C	23.5	11.1	13.2	13.5	12.6	5.1	1.4
Flashing Temp. (deg. C)	121	93.7	82.8	20	56.9	41.6	35.7
Heat Transfer Rate (kj/S)	167.881	78.897	93.521	95.338	88.729	103.438	28.381
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	18.302	9.715	10.673	11.229	11.358	5.780	3.453
U (kW/sq.m/io	1.963	4.192	4.524	4.383	4.033	3.611	1.659
clean-U Value (kW/sq.m/K)	3.9	6.6	5.7	5.1	5.1	5.1	5.1
f (sq.m K/KW)	0.253	0.087	0.025	0.032	0.052	0.081	0.407
				:			

Run No. 4	Date: October 06, 94		Time: 12:00		Total Operation	Total Operation Time: 284 hr.	· · ·
Variables	Brine Heater			Evaporator Stages			
		#1	**	#3	*	10 #	<b>0</b>
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.942	3.931	3.968	3.967
iniet Temp. (deg. C)	6	77.6	64.4	51.2	38.8	33.6	31.5
outlet Temp. (deg. C)	112	8	77.6	64.4	51.2	38	33.6
Temp. Rise (deg. C)	22	12.4	13.2	13.2	12.4	4.4	2.1
Flashing Temp. (deg. C)	121	94.4	83.7	70.9	57.5	42.3	36.3
Heat Transfer Rate (KJ/S)	157.202	88.158	93.526	93.226	87.331	89.246	42.574
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	17.788	9.255	11.460	11.905	11.397	6.244	3.650
U (kW/sq.m/k)	1.891	4.917	4.213	4.043	3.956	2.884	2.354
Clean-U Value (kW/sq.m/K)	3.9	6.6	5	5.	5.1	2	5.1
f (sq.m k/kw)	0.272	0.052	0.041	0.051	0.057	0.151	0.229

18400 3,966 33.5 4.316 0.105 36.3 70.948 4.9556 R 5 3.317 5.7 9 \* Total Operation Time: 288 hr. 0.145 3.968 33.5 4.9556 18400 42.3 91.273 6.284 2.931 88 40 <u>ເ</u> 9 # 57.6 6450 51.1 12.4 87.329 11.617 5.1 0.062 3.931 38.7 1.937 3.881 \* Eveporator Stages 6450 3.942 51.1 64.4 13.3 70.6 0.043 93.932 1.937 11.607 4.178 5.3 ۍ بې Time: 16:00 83.5 92.816 0.040 6450 3.955 64.4 77.5 13,1 1.937 11.313 4.235 5.1 2 # 77.5 12.5 94.6 9.520 4.819 6.6 0.056 6450 3.968 8 88.868 1.937 \*\* Date: October 06, 94 3.988 122 4.6723 18.914 1.779 9.S 0.306 6450 8 112 22 157.202 Brine Heater Clean-U Value (kW/sq.m/K) Heat Transfer Area (Sq.m) Heat Transfer Rate (KJ/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/K) Outlet Temp. (deg. C) inlet Temp. (deg. C Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k f (sq.m K/kW) Variables Run No. 4

Run No. 4	Date: October 07, 94		Time: 00:00		Total Operation Time: 296 hr.	1 Time: 296 hr.	• • •
Variables	Brine Heater			Evaporator Stages			
		÷	#2	#3	4	40 **	40 11
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.942	3.931	3.968	3.966
inlet Temp. (deg. C	06	<i>L.</i> 17	64.4	2	38.5	33.4	29.8
Outlet Temp. (deg. C)	112	8	<i>C.11</i>	64.4	51	38	33.4
Temp. Rise (deg. C)	3	12.3	13.3	13.4	12.5	4.6	3.6
Flashing Temp. (deg. C)	121	94.5	83.4	70.5	57.3	42.1	36.1
Heat Transfer Rate (kj/S)	157.202	87.448	94.236	94.637	88.031	93.301	72.974
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	17.788	9.337	11.047	11.531	11.433	6.114	4.249
U (kw/sq.m/k)	1.891	4.835	4.404	4.237	3.975	3.079	3.466
Clean-U Value (kW/sq.m/K)	3.9	6.6	5.1	5.1	5.1	2.	5.1
f (sq.m k/k/w)	0.272	0.055	0.031	0.040	0.055	0.129	0.092

29.5 18400 35.8 72.970 4.9556 4.249 3.466 3.966 3.6 0.092 33.1 ц Ч 9 # Total Operation Time: 300 hr. 37.8 3.295 18400 3.968 33.1 41.6 4.9556 5.838 0.107 95.326 5 4 9 # 12.6 56.9 50.6 11.469 2 6450 3.930 38 88.727 1.937 3.994 0.054 \*\* Evaporator Stages 50.6 11.419 0.038 6450 94.628 4.278 3,941 2 1.937 3 13,4 5 L **竹**業 Time: 04:00 82.8 4.365 6450 3.954 92.807 1.937 0.033 13.1 10.977 ς. 2 77.7 #2 3.968 77.1 89.5 6.6 0.054 6450 12.4 4.856 88.146 1.937 9.371 2 \*\* Date: October 07, 94 6450 3.988 89.5 112 22.5 160.762 4.6723 17.960 1.916 0.266 121 3.9 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/K0 Outlet Temp. (deg. C) iniet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. l) Flowrate (kg/h) U (kW/sq.m/Ю f (sq.m K/KW) Run No. 4 Variables

Run No. 4	Date: October 07, 94		Time: 08:00		Total Operation Time: 304 hr.	ne: 304 hr.	
Variables	Brine Heater			Evaporator Stages			
		*1	#2	<b>9</b>	*	10	*
Flowrate (kg/h)	6450	6450:	6450	6450	6450	18400	18400
Specific Heat (kj/kg/K)	3.988	3.967	3.955	3.942	3.931	3.968	3.966
Inlet Temp. (deg. C)	88	77.5	64.4	2	38.5	33.3	3
Outlet Temp. (deg. C)	112	68	77.5	64.4	51	38	33.3
Temp. Rise (deg. C)	53	11.5	13.1	13.4	12.5	4.7	2.3
Flashing Temp. (deg. C)	122	94.2	83.5	70.6	57.4	42	36
Heat Transfer Rate (kj/S)	164.322	81.747	92.816	94.637	88.031	95.329	46.626
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	19.264	9.856	11.313	11.642	11.543	6.049	3.733
U (kw/sq.m/N	1.826	4.282	4.235	4.197	3.937	3.180	2.521
Clean-U Value (kW/sq.m/k)	Ð. M	6.6	5.3	5.1	5.	2	5. 7.
f tsq.m k/kW)	0.291	0.082	0.040	0.042	0.058	0.118	0.201

Total Operation Time: 308 hr.

Time: 12:00

Date: October 07, 94

Run No. 4

18400 3.967 4.9556 0.124 Ы 34.1 62.847 4.054 3.128 : 5 36.8 Ň . 9 # 0.145 18400 34.1 4.9556 2.934 3.969 38.5 42.7 6.139 4.4 89.253 5 . 9 # 6450 51.4 57.8 0.060 3.931 39.1 1.937 3.899 12.3 86.631 11.471 5.7 \*\* Evaporator Stages 6450 3.942 51.4 64.6 4.200 0.042 13.2 93.231 1.937 11.460 5 70.7 **の**来 64.6 6450 3.955 77.8 13.2 83.7 0.037 93.531 1.937 11.237 4.297 5 #2 77.8 94.8 6450 3.968 12.2 86.739 1.937 9.647 4.642 6.6 0.064 8 \*\* 6450 121.5 157.202 4.6723 3.9 0.289 3.988 18.353 1.833 8 112 2 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/K) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/l0 Outlet Temp. (deg. C) inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) 0//W:bs/MA) N f (sq.m K/kw) Variables

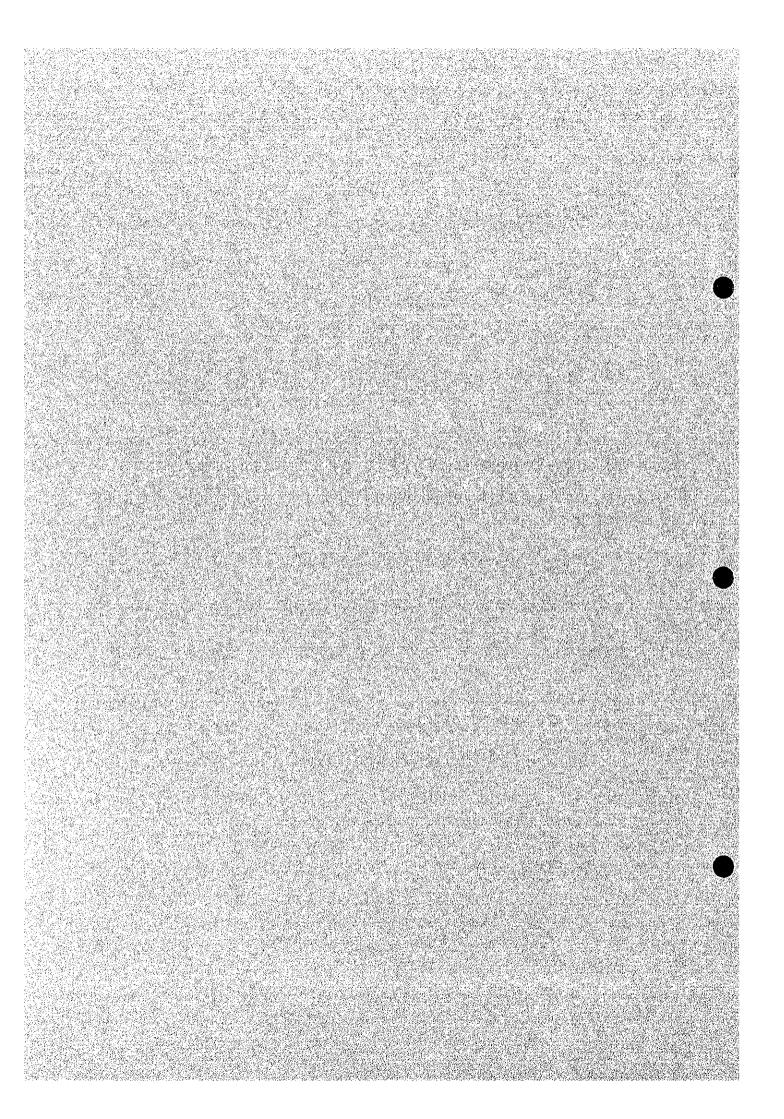
Run No. 4	Date: October 07, 94		Time: 20:00		Total Operation Time: 316 hr.	ime: 316 hr.	
Variables	Brine Heater			Evaporator Stages			
		* *	#2	£#	**	10 10	10
Flowrate (kg/h)	6450	6450	6450	6450	6450	18400	18400
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.942	3.931	3.969	3.966
Inlet Temp. (deg. C)	06	77.8	64.6	51.2	39	33.9	31
Outlet Temp. (deg. C)	112	06	77.8	64.6	51.2	38	33.9
Temp. Rise (deg. C)	22	12.2	13.2	13.4	12.2	4.1	2.9
Flashing Temp. (deg. C)	121	94.7	83.4	70.5	57.6	42.5	36.6
Heat Transfer Rate (k)/S)	157.202	86.739	93.531	94.641	85.924	83.163	58.792
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	17.788	9.533	10.899	11.307	11.435	6.330	3.975
U (kw/sq.m/Ю	1.891	4.697	4,430	4.321	3.879	2.651	2.984
Clean-U Value (kW/sq.m/k)	O. M	6.6	5.1	5.1	2	5.1	5.1
f (sq.m k/kW)	0.272	0.061	0:030	0.035	0.062	0.181	0.139

18400 0.110 3.966 30.5 36.5 3.266 33.8 66.898 4.9556 4.133 ы Г M M 10 14 Total Operation Time: 320 hr. 4.9556 2.789 0.162 18400 42.3 85.191 6.163 5.1 3.969 33.8 38 4.2 10 14 57.6 6450 51.1 87.329 1.937 11.617 3.881 5.7 0.062 3.931 38.7 12.4 \* Eveporator Stages 6450 3.942 51.1 64.5 13.4 70.8 94.639 1.937 11.754 0.044 4.157 ŗ. ₩3 Time: 00:00 64.5 4.340 13.2 83.5 11.124 5.1 0.034 6450 3.955 93.528 1.937 17.7 \*2 87.448 4.719 0.060 6450 3.968 7.77 12.3 94.7 1.937 9.567 6.6 ട് \*\* Date: October 08, 94 157.202 4.6723 18.914 1.779 9.9 0.306 6450 3.988 122 8 2 112 Brine Heater Clean-U Value (KW/sq.m/K) Heat Transfer Area (Sq.m) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/K) Outlet Temp. (deg. C) inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/N f (sq.m K/kW) Run No. 4 /ariables

.

## Appendix 5.3.3-5

## Calculation of Overall Heat Transfer Coefficient(U) and Fouling Factor(f) in Run 5-1



## OPERATION CONDITIONS

FOR

RUN 5-1

1. Operation Period		15th	Oct.	to 23 r	d Oct.	•
2. Operation Time					143 h	
3. Scale Control Method				H	ybrid	
4. Operation Mode			R	ecircul	ation	
5.Ball Cleaning			01	nly at	start	
6. Top Brine Temperature		т. "н		· · ·	112℃	·.
7. Flow Rate						
-Make Up Seawater				3.25	m <sup>3</sup> /h	
-Recirculation	· .	· _ :		6.5	m³∕h	
-Product Water	• •			0.79	m³/h	
-Blow Brine				2.46	m³/h	
8. Chenical Consituents of	Brine					
-pH at 25℃					8.01	
-M-Alkalinity as CaCO <sub>3</sub>				45 - 50	mg/L	
-Chloride ion	· ·			28,290	mg/L	
-Concentration factor as	C1 <sup>-</sup>				1.22	
9. Dosing Rate of Chemical	S					
-Scale Inhibior = PPN(M)	4.			. 1	mg/L	
$-Acid = 98\% H_2 SO_4$				72	mg/L	

Run No. 5-1	Date: October 16, 94		Time: 08:00	007		Total Operation Time: 12 hr.	n Time: 12 hr.		
Variables	Brine Heater			Ę,	Eveporator Stages				
-		*	*		5	<b>*</b> #	lD #	** ** **	
Flowrate (kg/h)	6500	6500	6500		6500	6500	18500	E .	18500
Specific Heat (k)/kg/k0	3.989	3.969	3.954		3.941	3.930	3.969	R7	3.966
inlet Temp. (deg. C)	6	77.5	63.7	-	50.3	38	33.9		31
Outlet Temp. (deg. C)	112	6	77.5		63.7	50.3	39	· ·	33.9
Temp. Rise (deg. C)	3	13.5	13.8		13.4	12.3	5.1		2.9
Flashing Temp. (deg. C)	116	93.2	82.2		69.1	56	41.8	•••	36.9
Heat Transfer Rate (k)/S)	151.243	96.735	98.525		95.355	87.283	104.017	ž	59.111
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937		1.937	1.937	4.9556	4	4.9556
L.M.T.D. (deg. K)	11.459	6.870	10.071		10.742	10.697	4.917	7	4.288
U (kw/sq.m/k)	2.825	7.270	5.050		4.583	4.213	4.269		2.782
clean-u Value (kW/sq.m/K)	3.9	6.6	5.1		5.1	5.1	5.1		5.1
f (sq.m K/kW)	0.0976	-0.0140	0.0019	- -	0.0221	0.0413	0.0382	Ö	0.1634
			***						

18500 3.969 Total Operation Time: 16 hr. 38.5 34.1 424 9.# 38.5 6500 3.931 56.3 50.7 12.2 \*\* Evaporator Stages 63.9 6500 3.941 50.7 13.2 69 **空** Time: 12:00 63.9 77.5 13.6 3.954 82.2 6500 \* 5 77.5 6500 3.969 13.5 93.5 2 \*\* Date: October 16, 94 3.989 114 6500 δ 112 2 Brine Heater Flashing Temp. (deg. C) Specific Heat (k)/kg/K Outlet Temp. (deg. C) iniet Temp. (deg. C) Temp. Rise (deg. C) Flowrate (kg/h) Run No. 5-1 Variables

18500

\*\*

3.967

31.5

52.999 4.9556 4.166

83.7.38

86.582

93.938 1.937 10.331 4.694 5.1

97.100

96.735 1.937 7.273 6.867

151.243

4.6723 8.598 3.765

Heat Transfer Area (Sq.m)

L.M.T.D. (deg. K)

3

U.(kW/sq.m/k)

Heat Transfer Rate (k)/S)

34.1 2.6 37.1

0.1934

0.0399

0.0170

6.6 -0.0059

3.9 0.0092

Clean-U Value (kW/sq.m/k)

f (sq.m K/kW)

2.567

5.510 3.286 5.1 0.1082

10.550

10.005 5.010 5.1 0.0035

1.937

4.237 5.1

4.9556

1.937

Variables				-			
	Brine Heater			Evaporator Stages			
		++	#	~~ *		10	*
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (KJ/Kg/K)	3.989	3.968	3.954	3.941	3.930	3.969	3.966
inlet Temp. (deg. C)	90.5	77.6	63.8	50.5	38.2	33.9	31
Outlet Temp. (deg. C)	112	90.5	77.6	63.8	50.5	38	33.9
Temp. Rise (deg. C)	21.5	12.9	13.8	13.3	12.3	4.1	2.9
Flashing Temp. (deg. C)	114	93.6	82.5	69.1	56.2	41.9	37
Heat Transfer Rate (kj/S)	154.832	92,430	98.527	94.647	87.287	83.615	59.111
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
LM.T.D. (deg. 10	8.726	7.860	10.304	10.594	10.697	5.707	4.392
U (KW/sq.m/io	3.798	6.071	4.937	4.612	4.213	2.957	2.716
Clean-U Value (kW/sq.m/K)	3,0	6.6	5.1	5.7	5.1	5.1	5.1
f sq.m k/kW	0.0069	0.0132	0.0065	0.0207	0.0413	0.1421	0.1721

4

18500 30.5 36.9 69.300 4.9556 3.116 0.1248 3.966 33.9 4.487 5.5 Ч. М 10 74 Total Operation Time: 24 hr. 18500 5.602 3.012 0.1359 83.615 4.9556 5.7 3.969 33.9 41.8 4 器 10 78 10.620 6500 3.930 12.4 87.994 1.937 4.278 0.0377 50.4 50 38 5 \*\* Evaporator Stages 6500 50.4 13.3 94.645 3.941 63.7 68.8 1.937 10.365 4.714 5 0.0161 € # Time: 20:00 77.5 13.8 98.525 9.955 5.110 . ج -0.0004 6500 63.7 82.1 1.937 3.954 × # 77.5 -0.0006 6500 3.968 90.5 1.937 7.255 6.628 6.6 93.1 ñ 93.145 ÷. Date: October 16, 94 21.5 114 6°£ 0.0069 6500 3.989 90.5 4.6723 8.726 3.798 154.832 112 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/i0 Outlet Temp. (deg. C) inlet Temp. (deg. C) Temp. Rise (deg. C) f (sq.m K/kw) L.M.T.D. (deg. K) Flowrate (kg/h) .) (kw/sq.m/ko Run No. 5-1 Variables

Variables         Bytine Haator         # 1         # 2         # 3         # 4         # 5         # 6           Flow rate (rg/m)         6 500         6 500         6 500         6 500         1 5 500         3 5 560         3 5 560         3 5 560         3 5 560         3 5 560         3 5 500	kun No. 5-1	Date: October 17, 94		Time: 00:00		Total Operation Time: 28 hr.	1e: 28 hr.	 
#1         #2         #3         #4         #5           KGNC         6500         6500         6500         6500         6500         6500         18500           1.0         91         77.5         63.7         5.941         3.956         3.966         3.966           8.0         13         3.953         3.954         3.941         3.936         3.966           91         77.5         63.7         50.2         37/7         33.7           8.1         77.5         63.7         50.2         33.7         33.7           8.1         77.5         63.7         50.2         38.7         3.5           1.1         32.7         81.9         68.7         50.2         38.7           1.66.1         1355         95.066         88.699         87.682         41.6           1.61.1         3.755         96.766         88.699         87.682         5.477           1.66.1         1.937         1.937         1.937         1.937         4.9556           et (US)         1.512         9.762         5.34         4.9556         5.471           8.56         6.16         5.33         4.806         4.296	Variables	Brine Heater			Evaporator Stages			
Kg/K         6500         6500         6500         6500         6500         6500         13500         13500           AG/K         3.983         3.963         3.954         3.941         3.950         3.968           J. O         91         77.5         63.7         50.2         37.7         33.7           BJ. O         112         91         77.5         63.7         50.2         37.7         33.7           BJ. O         113         17.5         63.7         50.2         37.7         33.7           BJ. O         21         13.5         13.8         13.5         43.5         43.5           Gleg. O         114         92.7         81.9         68.7         5.6.7         43.5           Gleg. O         151.243         96.735         98.525         96.066         88.699         87.692           Ree (K/S)         151.243         96.723         1.937         1.937         4.956           Ree (K/S)         151.243         96.735         98.525         96.066         88.699         87.692           Ree (K/S)         151.243         9.720         10.318         10.655         5.471           S.565         81.04 <th></th> <th></th> <th>**</th> <th>*</th> <th>€<b>?</b></th> <th></th> <th>50 #</th> <th></th>			**	*	€ <b>?</b>		50 #	
KgN0         3.963         3.963         3.954         3.941         3.930         3.968           1.0         91         77.5         63.7         50.2         37.7         33.7           89.0         112         91         77.5         63.7         50.2         38           89.0         21         13.5         13.5         13.5         50.2         38           .0         21         13.5         13.8         13.5         12.5         4.3           .0         21         13.5         13.6         68.7         50.2         38           .0         21         13.5         13.8         13.5         12.5         4.3           .0         14         92.7         81.9         68.7         55.8         41.6           .0         151.243         96.755         96.066         88.699         87.692         5.47           .0         4.5723         1.937         1.937         1.937         1.937         1.937         4.9566           .0         4.573         96.765         96.066         88.699         87.692         5.47           .0         8.593         6.106         5.33         4.806	Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
1.0       91       77.5       63.7       50.2       37.7       33.7         69.0       112       91       77.5       63.7       50.2       37.7       33.7         69.0       112       91       77.5       63.7       50.2       37.7       33.7         69.0       21       13.5       13.5       68.7       50.2       38.7       38.7         106.0       21       13.5       13.8       13.8       68.7       55.8       4.3         106.0       21       13.7       13.7       13.7       13.7       13.7       4.3         106.0       151.243       96.735       98.525       96.066       88.699       87.692       4.3         108.0       151.243       96.735       98.525       96.066       88.699       87.692       5.471         108.0       1.937       1.937       1.937       1.937       1.937       1.937       5.471         8.58       6.163       5.1       5.1       5.1       5.471       5.471         8.59       6.16       5.3       4.366       4.366       5.471       5.471         8.59       6.16       5.3       4.306       4.	specific Heat (kj/kg/K)	3.989	3.969	3.954	3.941	3.930	3.968	3.966
Bg. O         112         91         77,5         63.7         50.2         38           .O         21         13.5         13.8         13.5         13.6         13.5         4.3           .O         21         13.5         13.8         13.5         13.5         12.5         4.3           (deg. C         114         92.7         81.9         68.7         55.8         4.16           ite (k/5)         151.243         96.735         98.525         96.066         88.699         87.692           ite (k/5)         151.243         96.735         98.525         96.066         88.699         87.692           rea (5q.m)         4.6723         1.937         1.937         1.937         1.937         4.9556           rea (5q.m)         4.6723         1.937         1.937         1.937         1.937         4.9556           rea (5q.m)         4.553         6.104         5.233         4.806         4.298         5.471           s.765         8.104         5.233         4.806         4.298         3.234         5.471           N/5q.m/10         3.9         6.6         5.1         5.1         5.1         5.1           0.0092	nlet Temp. (deg. C)	6	77.5	63.7	50.2	37.7	33.7	30.5
Cl         21         13.5         13.5         13.5         12.5         4.3           ideg. Cl         114         92.7         81.9         68.7         55.8         41.6           ite (k/5)         151.243         96.735         98.525         96.066         88.699         87.692           ite (k/5)         151.243         96.735         98.525         96.066         88.699         87.692           rea (Sq.m)         4.6723         1.937         1.937         1.937         1.937         4.9556           rea (Sq.m)         4.6723         1.937         1.937         1.937         1.937         5.471           rea (Sq.m)         4.6723         1.937         1.937         1.937         1.937         5.471           rea (Sq.m)         8.598         6.163         9.720         10.318         10.655         5.471           % Sq.m/0         3.9         6.6         5.33         4.806         4.298         3.234           M/sq.m/0         3.9         6.6         5.1         5.1         5.1         5.1           0.0092         0.0281         0.0050         0.01201         0.01266         0.1131	Outlet Temp. (deg. C)	112	ይ	77.5	63.7	50.2	38	33.7
(deg. C)     114     92.7     81.9     68.7     55.8     41.6       ate (k/5)     151.243     96.735     98.525     96.066     88.699     87.692       rea (Sq.m)     4.6723     1.937     1.937     1.937     1.937     4.9556       rea (Sq.m)     4.6723     1.937     1.937     1.937     1.937     4.9556       rea (Sq.m)     4.6723     1.937     1.937     1.937     1.937     4.9556       rea (Sq.m)     3.765     8.104     5.233     4.806     4.298     3.234       M/sq.m/lo     3.9     6.6     5.1     5.1     5.1     5.1       0.0092     -0.0281     -0.020     0.0120     0.0366     0.1131	Temp. Rise (deg. C)	2	13.5	13.8	13.5	12.5	4.3	3.2
ate (k/5)     151.243     96.066     98.699     87.692       "ea (5q.m)     4.6723     1.937     1.937     1.937     4.9556       "ea (5q.m)     4.6723     1.937     1.937     1.937     4.9556       "ea (5q.m)     4.6723     1.937     1.937     1.937     4.9556       "ea (5q.m)     8.598     6.163     9.720     10.318     10.655     5.471       "a (5, 1)     5.133     9.720     10.318     10.655     5.471       "Nsq.m/K)     3.9     6.6     5.1     5.1     5.1     5.1       "Nsq.m/K)     3.9     6.6     5.1     5.1     5.1     5.1       "Nsq.m/K)     3.9     0.0281     -0.0281     0.0720     0.0366     0.1131	<sup>cl</sup> ashing Temp. (deg. C)	114	92.7	81.9	68.7	55.8	41.6	36.7
rea (Sq.m)       4.6723       1.937       1.937       1.937       1.937       1.937       4.9556         8.598       6.163       9.720       10.318       10.655       5.471         3.765       8.104       5.233       4.806       4.298       3.734         M/sq.m/l0       3.9       6.6       5.1       5.1       5.1       5.1         0.0092       -0.0281       -0.0050       0.01201       0.0366       0.1131	Heat Transfer Rate (kj/S)	151.243	96.735	98.525	96.066	88.699	87.692	65.23
8.598 6.163 9.720 10.318 10.655 5.471 3.765 8.104 5.233 4.806 4.298 3.234 Wsq.m/W 3.9 6.6 5.1 5.1 5.1 5.1 5.1 0.0092 -0.0281 -0.0050 0.0120 0.0366 0.1131	leat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
3.765         8.104         5.233         4.806         4.298         3.234           N/sq.m/k)         3.9         6.6         5.1         5.1         5.1         5.1         5.1           0.0092         -0.0281         -0.0050         0.01201         0.03566         0.1131	.M.T.D. (deg. lo	8.598	6,163	9.720	10.318	10.655	5.471	4.408
3.9         6.6         5.1 <td>) (KW/sq.m/Ю</td> <td>3.765</td> <td>8.104</td> <td>5.233</td> <td>4.806</td> <td>4.298</td> <td>3.234</td> <td>2.986</td>	) (KW/sq.m/Ю	3.765	8.104	5.233	4.806	4.298	3.234	2.986
0.0092 -0.0281 -0.0050 0.0120 0.0366 0.1131	Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
	· (sq.m k/kw)	0.0092	-0.0281	-0.0050	0.0120	0.0366	0.1131	0.1388

DK.	CALCULATIONS OF OVERALL HEAT TRANSFER Run No. 5-1 Date: October 17, 94	ALL HEAL LKANSHEK CC Date: October 17, 94	· ·	COEFFICIENT AND FOULING FACTOR Time: 04:00	CTOR	Total Operation Time: 32 hr.	me: 32 hr.	
n I. an A Airtín An gcluig		Brine Heater			Evaporator Stages			
			#1	#				*
1	Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
	Specific Heat (K)/kg/K)	3.989	3.968	3.954	3.941	3.930	3.968	3.966
	Inlet Temp. (deg. C)	90.5	4.77	63.5	05	37.6	33.6	30
	outlet Temp. (deg. C)	112	90.5	77.4	63.5	20	37.5	33.6
	Temp. Rise (deg. C)	21.5	13.1	13.9	13.5	12.4	3.9	3.6
	Flashing Temp. (deg. C)	114	93.1	82.3	68.7	55.7	41.5	36.5
.7	Heat Transfer Rate (K)/S)	154.832	93.861	99.235	96.061	87.986	79.531	73.372
-	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
	L.M.T.D. (deg. K)	8.726	7.285	10.337	10.548	10.732	5.731	4.460
÷	U (KW/sq.m/Ю	3.798	6.651	4.956	4.702	4.233	2.801	3.319
-	Ciean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	5.1	5.1

Run No. 5-1	Date: October 17, 94		Time: 08:00		Total Operation Time: 36 hr.	n Time: 36 hr.	
Variables	Brine Heater			Evaporator Stages			
		#	*	<b>*</b>	<b>*</b> #	10	10 11
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (k)/kg/k0	3.989	3.968	3.954	3.941	3.930	3.968	3.966
inlet Temp. (deg. C)	90.5	77.8	63.9	50.5	37.9	33.7	ŝ
Outlet Temp. (deg. C)	112	90.5	77.8	63.9	50.5	38	33.7
Temp. Rise (deg. C)	21.5	12.7	13.9	13.4	12.6	4.3	2.7
Flashing Temp, (deg. C)	114	93.7	82.7	69.4	56.1	41.7	36.8
Heat Transfer Rate (K)/S)	154.832	91.000	99.245	95.359	89.413	87.692	55.034
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	8.726	7.922	10.337	10.855	10.690	5.576	4.310
U (kw/sq.m/ko	3.798	5.930	4.956	4.535	4.318	3.173	2.577
Clean-U Value (kW/sq.m/l0	3.9	6.6	5.1	5.1	5 <b>.1</b>	27	5.1
f (sq.m K/kw)	0.0069	0.0171	0.0057	0.0244	0.0355	0.1191	0.1920

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18500 3.967 31.5 37.2 52.999 4.9556 4.269 2.505 0.2031 2.6 5.7 34.1 9 # 5.169 18500 3.969 3.902 0.0602 Total Operation Time: 40 hr. 99.939 4.9556 ŝ 34.1 8 43,1 ۱0 \* 87.292 6500 3,931 38.5 50.8 12.3 56.3 1.937 10.473 4.303 0.0363 5 1 Evaporator Stages 6500 3.942 50.8 4.613 64.1 13.3 94.653 1.937 10.594 5.7 0.0207 69.4 € ₩ Time: 12:00 13.8 3.955 77.9 82.4 98.535 6500 64.1 9.837 1.937 5.171 -0.0027 S. ۲ # 12.6 6500 3.969 77.9 90.5 90.284 1.937 7.136 6.532 0.0016 6.6 93.1 ÷# Date: October 17, 94 3.989 <del>90.5</del> 21.5 114 154.832 4.6723 8.726 3.798 6 ₩ 0.0069 6500 112 **Brine Heater** Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/K) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/N Outlet Temp. (deg. C) inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. lo Flowrate (kg/h) U (kW/sq.m/k f (sq.m K/KW) Run No. 5-1 Variables

Run No. 5-1	Date: October 17, 94		Time: 16:00		Total Opera	Total Operation Time: 44 hr.	₩ Jr.	• •
	Brine Heater			Evaporator Stages				
		*	#2	5	**		10 14	<b>10</b> **
Flowrate (kg/h)	6500	6500	6500	6500	6500		18500	18500
Specific Heat (ki/kg/k)	3.989	3.968	3.954	3.941	3.930		3.969	3.966
Inlet Temp. (deg. C)	90.5	77.4	63.6	50.4	38.1		34	31
Outlet Temp. (deg. C)	112	90.5	77.4	63.6	50.4		38.5	34
Temp. Rise (deg. C)	21.5	13.1	13.8	13.2	12.3	· ·	4.5	
Flashing Temp. (deg. C)	114.5	92.5	8	68.7	56		41,9	37
Heat Transfer Rate (kj/S)	154.832	93.861	98.522	93.932	87. <b>2</b> 85		91.777	61.150
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	<b>7</b>	4.9556	4.9556
L.M.T.D. (deg. K)	9.506	6.480	8.759	10.331	10.585	· · ·	5.338	4.328
U (KW/sq.m/k)	3.486	7.478	5.807	4.694	4.257		3.470	2.851
Clean-U Value (KW/sq.m/K)	3.9	6.6	5.1	5.1	5.1		5.1	5.1
f (sq.m K/KW)	0.0304	-0.0178	-0.0239	0.0170	0.0388	•	0.0921	0.1547

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30.5 36.9 18500 ŝ 71.339 4.9556 4.421 3.256 ŝ 0.1111 3.966 X 10 # 0.1418 18500 41.8 81.576 4.9556 5.562 2.959 ŝ Total Operation Time: 48 hr. 3.969 2 38 10 # 6500 3.930 37.9 50.3 87.992 1.937 10.732 4.233 0.0402 ŝ 12.4 50 \*\* Evaporator Stages 63.5 68.9 13.2 93.930 1.937 10.673 0.0240 50.3 4.543 6500 5.2 3.941 €# Time: 20:00 99.235 6500 3.954 63.5 77.4 13.9 81.1 1.937 8.913 5.748 5. -0.0221 #2 92.8 6.889 6500 3.968 77.4 90.5 93.861 1.937 7.033 -0.0093 13.1 6.6 #1 Date: October 17, 94 6500 3.989 90.5 21.5 114 154.832 4.6723 8.726 3.798 **σ**. Μ 0.0069 112 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/K) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) outlet Temp. (deg. C) Specific Heat (k)/kg/Ю Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k) f (sq.m. K/kW) Run No. 5-1 Variables

Kun No. 5-1				1.						
Variables	Brine Heater			Ē	Evaporator Stages					
		*1	*		6 #	*	-  -		*	
Flowrate (kg/h)	6500	6500	6500		6500	6500		18500		18500
Specific Heat (kj/kg/K)	3.989	3.968	3.954	•	3.941	3.930		3.969	M	3.966
inlet Temp. (deg. C)	90.5	77.3	63.4		50.1	37.7		33.9		. <b>R</b>
Outlet Temp. (deg. C	112	90.5	77.3		63.4	50.1		38		33.9
Temp. Rise (deg. C	21.5	13.2	13.9		13.3	12.4		4.1		6 M
Flashing Temp. (deg. C)	114.5	92.5	81.9		68.7	55.8	•	41.7		36.8
Heat Transfer Rate (Kj/S)	154.832	94.576	99.233		94.638	87,988		83.615	. 19	79.488
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937		1.937	1.937		4.9556	े <b>म</b>	4.9556
L.M.T.D. (deg. K)	9.506	6.508	9.988	•	10.594	10.732		5.498	4	4.576
U (KW/sq.m/K)	3.486	7.502	5.129	÷	4.612	4.233		3.069	M	3.505
Clean-U Value (kW/sq.m/K)	3.9	6.6	5.1		5.1	5.1		5.1		5.1
f tsq.m K/kW)	0.0304	-0.0182	-0.0011		0.0207	0.0402		0.1297	Ö	0.0892

18500 3.966 4.9556 4.382 30.5 36.8 69.300 3.191 5.1 33.9 3.4 0.1173 9 \* 18500 3.969 83.615 4.9556 5.602 3.012 0.1359 33.9 41.8 Total Operation Time: 56 hr. ۍ ۲ 38 2 9 # 37.8 50.2 87.990 6500 3.930 12.4 ŝ 1.937 10.843 4.189 0.0426 5.1 \*\* Evaporator Stages 6500 13.5 68.8 3.941 50.2 96.066 1.937 10.433 4.753 0.0143 63.7 Ľ, (1) 来 Time: 04:00 13.8 81.2 98.525 6500 3.954 77.5 1.937 8.881 5.727 5.5 0.0215 63.7 **\*** 2 6.860 6.6 6500 3.968 77.5 93.145 1.937 7.009 -0.0089 90.5 92.8 5 #1 Date: October 15, 94 3.989 90.5 0 21.5 6500 15 154,832 4.6723 10:238 3.237 0 2 0.0525 112 **Brine Heater** Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/K) Heat Transfer Rate (k//S) Flashing Temp. (deg. C) Specific Heat (k)/kg/K0 Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) f (sq.m k/kw) Flowrate (kg/h) U (kw/sq.m/N Run No. 5-1 Variables

Brine Heater         #1         #2         Evaporator Stages           6500         6500         6500         6500         6500           6500         6500         6500         6500         6500           77.6         63.8         3.941         3.930           90.5         77.6         63.8         50.5         38.2           112         90.5         77.6         63.8         50.5         38.2           21.5         112         90.5         77.6         63.8         50.5         38.2           21.5         112         90.5         77.6         63.8         50.5         38.2           0         115         93.4         81.7         69.1         56.3         12.3           0         115         93.4         81.7         69.1         56.3         12.3           0         115         93.4         11.33         11.33         12.3         12.3           0         154.83         1.357         94.647         87.2         4.169           0         10.238         7.609         9.363         10.354         10.360           10.238         5.1         5.42         5.1         5.	Run No. 5-1	Date: October 15, 94		Time: 08:00		Total Operation Time: 60 hr.	Time: 60 hr.	
#1       #2       #3       #4 <th< th=""><th>Veriation</th><th>Brine Heater</th><th></th><th></th><th>Evaporator Stages</th><th></th><th></th><th></th></th<>	Veriation	Brine Heater			Evaporator Stages			
6500         50.5         38.2         36.3         36.3         36.3         36.3         36.3         36.2         36.3         36.2 <th< th=""><th></th><th></th><th>**</th><th>#2</th><th>8#</th><th>*</th><th><b>1</b>0 <b>1</b>0 <b>1</b>0 <b>1</b>0 <b>1</b>0 <b>1</b>0 <b>1</b>0 <b>1</b>0</th><th>\$</th></th<>			**	#2	8#	*	<b>1</b> 0 <b>1</b> 0 <b>1</b> 0 <b>1</b> 0 <b>1</b> 0 <b>1</b> 0 <b>1</b> 0 <b>1</b> 0	\$
3.989       3.968       3.954       3.941       3.930         90.5       77.6       63.8       50.5       38.2         112       90.5       77.6       63.8       50.5       38.2         112       90.5       77.6       63.8       50.5       38.2         112       90.5       77.6       63.8       50.5       38.2         112       93.4       81.7       63.4       12.3       12.3         1154.832       92.430       98.527       94.647       87.287       9         154.832       92.430       98.527       94.647       87.287       9         4.6723       1.937       1.937       1.937       1.937       1.937       1.937       1.937         10.238       7.609       9.363       10.594       10.808       9       1.937       1.937       1.937         3.237       6.6       5.432       6.61       5.432       4.612       4.169       5.1       5.1         3.237       6.6       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1       5.1<	Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
90.5         77.6         63.8         50.5         38.2           112         90.5         77.6         63.8         50.5         38.2           21.5         12.9         13.8         13.3         12.3         12.3           21.5         12.9         13.8         13.3         13.3         12.3           115         93.4         81.7         69.1         56.3         56.3           154.832         92.430         98.527         94.647         87.287         9           154.832         92.430         98.527         94.647         87.287         9           16.723         1.937         1.937         1.937         1.937         1           3.237         6.271         5.432         1.937         1.937         1           3.237         6.271         5.432         4.612         4.169           3.237         6.6         5.1         5.1         5.1           3.237         6.6         5.1         5.1         5.1           3.237         0.0079         0.00207         0.00438         0	Specific Heat (kj/kg/K)	3.989	3.968	3.954	3.941	3.930	3.969	3.967
112       90.5       77.6       63.8       50.5         21.5       12.9       13.8       13.3       12.3         21.5       12.9       13.8       13.3       12.3         115       93.43       93.57       94.647       56.3       56.3         154.832       92.430       98.527       94.647       56.3       56.3         154.832       92.430       98.527       94.647       57.287       9         10.238       1.937       1.937       1.937       1.937       1.937         10.238       7.609       9.363       10.594       10.808       10.808         3.237       6.271       5.432       4.612       4.169       5.1         3.9       6.6       5.1       5.1       5.1       5.1         2.9       0.0079       0.00720       0.0438       1	iniet Temp. (deg. C)	90.5	77.6	63.8	50.5	38.2	34.1	31.5
21.5       12.9       13.8       13.3       12.3         115       93.4       81.7       69.1       56.3         154.832       92.430       98.527       94.647       87.287       9         154.832       92.430       98.527       94.647       87.287       9         154.832       92.430       98.527       94.647       87.287       9         154.832       92.430       98.527       94.647       87.287       9         10.238       7.609       9.363       10.594       10.808       10.237       4         3.237       6.274       5.432       4.612       4.169       5.1       5.1       5.1         3.9       6.6       5.1       5.1       5.1       5.1       5.1       5.1         0.0525       0.0079       0.00120       0.02077       0.0438       0	outlet Temp. (deg. C)	112	90.5	77.6	63.8	50.5	G M	34.1
115       93.4       81.7       69.1       56.3         154.832       92.430       98.527       94.647       87.287       9         154.832       92.430       98.527       94.647       87.287       9         4.6723       1.937       1.937       1.937       1.937       1         10.238       7.609       9.363       10.594       10.808         3.237       6.271       5.432       4.612       4.169         3.9       6.6       5.1       5.1       5.1         3.9       0.0079       0.0120       0.0207       0.0438       0	Temp. Rise (deg. C)	21.5	12.9	13.8	13.3	12.3	4.9	2.6
154.832       92.430       98.527       94.647       87.287       9         4.6723       1.937       1.937       1.937       1.937       1.937       4         10.238       7.609       9.365       10.594       10.808       10.808         3.237       6.271       5.432       4.612       4.169         3.237       6.271       5.432       4.612       4.169         3.237       0.0079       0.0120       0.0207       0.0438       0	Flashing Temp. (deg. C)	115	<b>33.4</b>	81.7	69.1	56.3	42.1	37
4.6723       1.937       1.937       1.937       1.937       1.937       1.937         10.238       7.609       9.363       10.594       10.808         3.237       6.271       5.432       4.612       4.169         3.9       6.6       5.1       5.1       5.1       5.1         0.0525       0.0079       -0.0120       0.0207       0.0438       0	Heat Transfer Rate (k)/S)	154.832	92.430	98.527	94.647	87.287	<b>93.939</b>	52.999
10.238         7.609         9.363         10.594         10.808           3.237         6.271         5.432         4.612         4.169           3.29         6.6         5.1         5.1         5.1         5.1           0.0525         0.0079         -0.0120         0.0207         0.0438         0	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
3.237     6.271     5.432     4.612     4.169       3.9     6.6     5.1     5.1     5.1       0.0525     0.0079     -0.0120     0.0207     0.0438	L.M.T.D. (deg. K)	10.238	7.609	9.363	10.594	10.808	5.169	4.062
3.9         6.6         5.1         5.1         5.1         5.1           0.0525         0.0079         -0.0120         0.0207         0.0438	U (kw/sg.m/ko	3.237	6.271	5.432	4.612	4.169	3.902	2.633
0.0525 0.0079 0.0120 0.0207 0.0438	Clean-U Value (kW/sq.m/k)	3.9	6.6	ŝ	5.1	5.1	5.1	5.1
	f (sq.m. K/KW)	0.0525	0.0079	-0.0120	0.0207	0.0438	0.0602	0.1838

18500 3.966 33.8 36.8 57.072 4.9556 4.247 2.712 ы Г 0.1727 Ы 2.8 10 12 Total Operation Time: 64 hr. 4.9556 5.432 3.182 5.5 18500 3.969 33.8 85.654 0.1182 41.6 38 4 10 # 55.6 6500 3.930 37.4 12.3 87.272 1.937 10.919 4.126 ŝ 0.0463 49.7 4 Evaporator Stages 62.8 68.3 10.752 4,475 0.0274 6500 3.941 93.204 5 1.937 49.7 13.1 **Р**# Time: 12:00 62.8 76.6 13.8 80.8 98.503 1.937 9.483 5.363 ŝ 0.0096 6500 3.953 2 # 3.968 92.5 95.993 7.243 6.842 6.6 6500 76.6 1:937 0.0054 8 13.4 \*\* Date: October 18, 94 3.988 115.5 158.420 4.6723 11.078 6.5 5 6500 3.061 0.0703 8 22 112 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/k) Outlet Temp. (deg. C) inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k f (sq.m k/kw) Run No. 5-1 Variables

Run No. 5-1	Date: October 18, 94		Time: 16:00		Total O	Total Operation Time: 68 hr.		•
Variables	Brine Heater			Evaporator Stages	seg:			
		*	*	₩ ₩	**	10		
Flowrate (kg/h)	6500	6500	6500	6500	6500	00 18500		18500
Specific Heat (kj/kg/K)	3.988	3.968	3.954	3.941	3.930	3.969		3.966
inlet Temp. (deg. C)	6	76.9	63.1	20	37.7	33.9		31
outlet Temp. (deg. C)	112	6	76.9	63.1	ý	50 38		33.9
Temp. Rise (deg. C)	22	13.1	13.8	13.1	12.3	.3		2.9
Flashing Temp. (deg. C)	116	92.9	<b>33</b>	68.7	5	56 41.9		36.8
Heat Transfer Rate (k)/S)	158.420	93.848	98.510	93.211	87.278	83.615		59.111
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	57 4.9556		4.9556
L.M.T.D. (deg. K)	11.753	7.670	9.363	10.865	11.030	5.707		4.184
U (kw/sq.m/to	2.885	6.317	5.431	4.429	4.085	35 2.957		2.851
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	.1 5.1	- 	5.
f (sq.m k/kw)	0.0902	0.0068	0.0120	0.0297	0.0487	37 0.1421		0.1547

CALCULATIONS OF OVERALL HEAT TRANSFER COEFFICIENT AND FOULING FACTOR Run No. 5-1 Date: October 18, 94 Time: 20:00

Total Operation Time: 72 hr.

Variables	Brine Heater			Evaporator Stages	20		
	· · · · · · · · · · · · · · · · · · ·	*	<b>7</b>	<b>6</b>	*	105 1148 -	*
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (k)/kg/k)	3.988	3.968	3.954	3.941	3.930	3.968	3.966
inlet Temp. (deg. C)	8	76.9	63	49.8	37.5	33.5	31
Outlet Temp. (deg. C)	112	06	76.9	63	49.8	38	33.5
Temp. Rise (deg. C)	22	13.1	13.9	13.2	12.3	4.5	2.5
Flashing Temp. (deg. C)	116	92.5	80.7	68.5	55.8	41.6	36.4
Heat Transfer Rate (kj/S)	158.420	93.848	99.223	93.919	87.274	91.770	50.956
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
LM.T.D. (deg. K)	11.753	7.155	9.034	10.786	11.030	5.549	4.021
U (kW/sq.m/Ю	2.885	6.772	5.670	4.495	4.085	3.337	2.557
Clean-U Value (KW/sq.m/K)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f tsq.m K/kW)	0.0902	-0.0038	-0.0197	0.0264	- 0.0487	0.1036	0.1950

Run No. 5-1	Date: October 19, 94	·	Time: 00:00	· · · · · · · · · · · · · · · · · · ·	Total Operat	Total Operation Time: 76 hr.	
Variables	Brine Heater			Evaporator Stages			
		*	#3	8	**	10 74	<b>19</b>
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.988	3.968	3.954	3.941	3.930	3.968	3.966
Inlet Temp. (deg. C)	06	77.2	63.4	S	37.4	33.5	30.5
outlet Temp. (deg. C)	112	6	77.2	63.4	8	37.5	33.5
Temp. Rise (deg. C)	22	12.8	13.8	13.4	12.6	4	M
Flashing Temp. (deg. C)	116	93.1	81.4	68.9	55.9	41.5	36.5
Heat Transfer Rate (k)/S)	158.420	91.702	98.517	95.348	89.404	81.570	61.145
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
LM.T.D. (deg. K)	11.753	7.829	9.483	10.855	11.025	5.771	4.328
U (KW/sq.m/K)	2.885	6.047	5.364	4.535	4.186	2.852	2.851
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sa.m K/kW)	0.0902	0.0139	-0.0096	0.0244	0.0428	0.1545	0.1547

18500 4.9556 0.1316 3.966 36.3 67.256 4.448 R 33.3 3 3.051 5 10 14 18500 33.3 37.5 41.4 Total Operation Time: 80 hr. 3.968 4.2 85.647 4.9556 5.746 3.008 ъ. 0.1364 9 \* 12.6 55.9 3.930 37.2 49.8 89.400 11.248 0.0476 6500 1.937 4.103 5.1 ¥ \* Evaporator Stages 6500 3.941 49.8 13.3 94.632 4.334 0.0346 8 1.937 11.272 5 63.1 0 # Time: 04:00 6500 63.1 81.3 97.795 9.804 5.150 5.7 -0.0019 3.954 76.8 1.937 13.7 ₩ \* 6500 3.968 76.8 92.4 6.923 6.6 94.563 7.052 -0.0071 13.2 1.937 8 1.4 Date: October 19, 94 116 2.885 3.9 6500 3.988 158,420 4.6723 11.753 0.0902 8 112 3 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (KW/sq.m/K) Heat Transfer Rate (KJ/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/K) Outlet Temp. (deg. C) Inlet Temp. (deg. O Temp. Rise (deg. C) LM.T.D. (deg. K) Flowrate (kg/h) f (sq.m K/kW) U (kw/sq.m/io Run No. 5-1 Variabies

Run No. 5-1	Date: October 19, 94		Time: 05:00		Total Operation Time: 84 hr.	rime: 84 hr.	•
Variables	Brine Heater			Evaporator Stages			
		#1	*2	<b>8</b>	*	5	*
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.988	3.968	3.954	3.941	3.930	3.968	3.966
inlet Temp. (deg. C)	8	77.1	63.3	50	37.5	33.2	30
Outlet Temp. (deg. C)	112	6	77.1	63.3	23	37.5	33.2
Temp, Rise (deg. C)	33	12.9	13.8	13.3	12.5	4.3	3.2
Flashing Temp. (deg. C)	116	9 <b>3.</b> 9	82.4	69.3	56.3	41.6	36.2
Heat Transfer Rate (k)/S)	158.420	92.417	98.515	94.636	88.695	87.685	65.218
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	11.753	8.833	10.765	11.384	11.433	5.995	4.408
U (kw/sq.m/io	2.885	5.401	4.725	4.292	4.005	2.951	2.986
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m tvkw)	0.0902	0.0336	0.0156	0.0369	0.0536	0.1427	0.1389

Run No. 5-1

Time: 12:00

Date: October 19, 94

Total Operation Time: 88 hr.

Variables	Brine Heater	· · · · · · · · · · · · · · · · · · ·		Evaporator Stages			
		-	*	<b>17</b>	*	10	10 11
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/l0	3.988	3.968	3.954	3.941	3.930	3.968	3.966
Inlet Temp. (deg. C	06	77.2	63.5	50.3	37.9	33.4	30.5
outlet Temp. (deg. C	112	8	77.2	63.5	50.3	38	33.4
Temp. Rise (deg. C)	22	12.8	13.7	13.2	12.4	4.6	2.9
Flashing Temp. (deg. C	117	94.1	82.5	9.69	26.6	41.8	36.5
Heat Transfer Rate (kj/S)	158.420	91.702	97.805	93.930	87.992	93.808	59.107
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
LM.T.D. (deg. K)	13.046	9.037	10.731	11.460	11.397	5.799	4.392
U (KW/sq.m/Ю	2.599	5.238	4.706	4.231	3.986	3.264	2.716
clean-U Value (kW/sq.m/N	3.9	6.6	5.1	5.1	5.1	5.1	5.7
f (sq.m k/kw)	0.1283	0.0394	0.0164	0.0403	0.0548	0.1103	0.1721

Run No. 5-1	Date: October 19, 94		Time: 16:00		Total operation Time: 92 nr.	n Time: 92 nr.	
Variables	Brine Heater			Evaporator Stages			
		7	*	<b>6</b>	4	10 ₩	*
Fiowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (k)/kg/k0	3.988	3.968	3.953	3.941	3,930	3.968	3.966
Inlet Temp. (deg. C	6	76.8	63	49.8	37.3	33.4	30.5
Outlet Temp. (deg. C)	112	5	76.8	63	49.8	37.5	33.4
Temp. Rise (deg. C)	3	13.2	13.8	13.2	12.5	41	2.9
Flashing Temp. (deg. C)	117	93.6	82	<b>69.2</b>	56.2	41.5	35.9
Heat Transfer Rate (KJ/S)	158.420	94.563	98.507	93.919	88.691	83.608	59.107
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	13.046	8.569	10.650	11.572	11.543	5.811	3.766
u (kw/sq.m/ko	2.599	5.697	4.775	4.190	3.967	2.903	3.167
Clean-U Value (KW/Sq.m/K)	3.9	6.6	5.1	5.1	5.1	5.1	5.3
f isq.m Kikw)	0.1283	0.0240	0.0133	0.0426	0.0560	0.1483	0.1196

Run No. 5-1 Date: October 19, 94

Total O

Time: 20:00

Total Operation Time: 96 hr.

Variables	Brine Heater			Evaporator Stages		-	1
		*	#	<b>竹</b> 葉	**	10 78	* *
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/K)	3.988	3.968	3.953	3.941	3.930	3.968	3.966
Inlet Temp. (deg. C)	8	76.8	63	49.7	37.1	33.3	29.5
outlet Temp. (deg. C)	112	06	76.8	63	49.7	37	33.3
Temp. Rise (deg. C)	2	13.2	13.8	13.3	12.6	3.7	3.8
Flashing Temp. (deg. C)	117.5	93.6	83	69.2	56.1	41.5	35.9
Heat Transfer Rate (k)/5)	158.420	94.563	98.507	94.629	89.398	75.448	77.444
Heat Transfer Area (Sq.m)	4.6723	1,937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	13.669	8.569	10.650	11.607	11.579	6.166	4.219
U (kw/sq.m/ko	2.480	5.697	4.775	4.209	3.986	2.469	3.705
Clean-U Value (kW/sq.m/k)	<b>6.5</b>	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m K/kW)	0.1467	0.0240	0.0133	0.0415	0.0548	0.2089	0.0739

Run No. 5-1	Date: October 20, 94		Time: 00:00		Total Operation Time: 100 hr.	rime: 100 hr.	
Variables	Brine Heater			Evaporator Stages			
· · · · · · · · · · · · · · · · · · ·		**	#2	Ср. Щ	*	l0 ★	*
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/k)	3.988	3.968	3.953	3.941	3.930	3.968	3.966
Inlet Temp. (deg. C)	6	76.6	63	49.6	37	33.2	8
Outlet Temp. (deg. C)	112	66	76.6	8	49.6	37	33.2
Temp. Rise (deg. C)	22	13.4	13.6	13.4	12.6	3.8	3.2
Flashing Temp. (deg. C)	117	93.3	82.1	69.3	55.9	41.3	35.8
Heat Transfer Rate (K)/5)	158.420	95,993	97.077	95.340	89.396	77.487	65.218
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	13.046	8.264	10.924	11.754	11.469	6.001	3.988
U (kw/sq.m/io	2.599	5.997	4.588	4.188	4.024	2.606	3:300
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m K/kW)	0.1283	0.0152	0.0219	0.0427	0.0524	0.1877	0.1070
		•					

Wartachtes         Einape Hanster         Einape Hanster           Wartachte         Brine Hanster         #1         #2         Einaporator Stages           Howmate (kg/h)         6500	Run No. 5-1	Date: October 20, 94	· · ·	Time: 04:00		Total Operation Time: 104 hr.	1 Time: 104 hr.	ана,
**1     *2     *3     *3       6500     6500     6500     6500     6500       3.388     3.968     3.953     3.940       3.388     3.968     3.953     3.940       90     76.6     62.9     43.5       112     90     76.6     62.9       112     90     76.6     62.9       112     90     76.6     62.9       112     90     76.6     62.9       112     90     76.6     62.9       112     93.5     92.1     13.4       113     13.7     13.4     13.7       113     13.6     97.790     95.338       113     95.935     97.790     95.338       113     1.937     1.937     1.937       113     1.937     1.937     1.937       113     1.937     1.937     1.937       113     1.937     1.937     1.937       113     1.937     1.937     1.937       113     1.937     1.937     1.937       113     1.937     1.937     1.937       113     1.937     1.937     1.937       113     1.937     1.937     1.937       11	Variabiles	Brine Hester			Evaporator Stage			
6500       6500       6500       6500       6500       6500         3.388       3.968       3.953       3.940       81         90       76.6       62.9       49.5         112       90       76.6       62.9       49.5         112       90       76.6       62.9       49.5         112       90       76.6       62.9       49.5         113       13.4       13.7       13.4       13.4         117       93.5       93.5       82.1       69.2       97.790       95.338       81         11       11       93.5       93.5       97.790       95.338       81         11       13.046       8.510       1.937       1.937       1.937         13.046       8.510       10.959       11.754       1       1.937         13.046       5.823       4.607       6.185       5.1       5.1         10       5.1       5.1       5.1       5.1       0.0427       0			*	#	<b>*</b>	*	10 *	10
3.388       3.968       3.953       3.940         90       76.6       6.2.9       49.5         112       90       76.6       62.9       49.5         112       90       76.6       62.9       49.5         112       93.5       13.7       13.4       13.4         113       93.5       82.1       69.2       62.9         117       93.5       82.1       13.7       13.4         113       95.993       97.790       95.338       1.957         113       158.420       95.993       97.790       95.338         113       13.64       1.957       1.957       1.957         113       13.046       8.510       1.959       1.1.957       1.957         113       2.599       5.823       4.607       4.188       1.1.754         10       3.9       6.6       5.1       5.1       5.1         10       3.9       0.0202       0.0210       0.0427       0.0427	Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
90     76.6     62.9     49.5       112     90     76.6     62.9       112     90     76.6     62.9       12     13.4     13.7     13.4       117     93.5     82.1     69.2       118.420     95.993     97.790     95.338       11.58.420     95.993     97.790     95.338       11.58.420     95.993     97.790     95.338       11.3.046     8.510     1.937     1.937       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       10.599     5.823     0.0210     0.0427	Specific Heat (kj/kg/iO	3.988	3.968	3.953	3.940	3.929	3.968	3.966
112     90     76.6     62.9       22     13.4     13.7     13.4       22     13.4     13.7     13.4       117     93.5     82.1     69.2       117     93.5     97.790     95.338       11     158.420     95.993     97.790     95.338       11     4.6723     1.957     1.957     1.957       13.046     8.510     10.959     11.754       13.046     5.823     4.607     4.188       10     3.9     6.6     5.1     5.1       10     3.9     0.0202     0.0210     0.0427	Inlet Temp. (deg. C)	06	76.6	62.9	49.5	37	33.1	30
22     13.4     13.7     13.4       117     93.5     13.1     13.4       117     93.5     13.1     69.2       117     93.5     97.790     95.338       118.420     95.993     97.790     95.338       11.58.420     95.993     1.937     1.937       11.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     9.66     5.1     5.1       10.1283     0.0202     0.0210     0.0427	Outlet Temp. (deg. C)	112	66	76.6	62.9	49.5	37.5	33.1
117     93.5     82.1     69.2       117     93.5     97.790     95.338       113.046     95.937     1.937     1.937       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     8.510     10.959     11.754       13.046     0.5823     4.607     4.188       10.1283     0.0202     0.0210     0.0427	Temp. Rise (deg. C)	33	13.4	13.7	13.4	12.5	4.4	3.1
158.420       95.933       97.790       95.338         4.6723       1.937       1.937       1.937         4.6723       1.937       1.937       1.937         13.046       8.510       10.959       11.754         2.599       5.823       4.607       4.188         3.9       6.6       5.1       5.1         0.1283       0.0202       0.0210       0.0427	Flashing Temp. (deg. C)	117	93.5	82.1	69.2	56	41.2	35.7
4.6723       1.937       1.937       1.937         13.046       8.510       10.959       11.754         2.599       5.823       4.607       4.188         3.9       6.6       5.1       5.1         0.1283       0.0202       0.0210       0.0427	Heat Transfer Rate (kj/S)	158.420	95.993	97.790	95.338	88.686	89.724	63.179
13.046         8.510         10.959         11.754           2.599         5.823         4.607         4.188           xW/sq.m/l0         3.9         6.6         5.1         5.1           0.1283         0.0202         0.0210         0.0427	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
2.599 5.823 4.607 4.188 (W/sq.m/k) 3.9 6.6 5.1 5.1 5.1 0.1283 0.0202 0.0210 0.0427 (	L.M.T.D. (deg. K)	13.046	8.510	10.959	11.754	11.654	5.616	3.949
W/sq.m/k) 3.9 6.6 5.1 5.1 5.1 0.1283 0.0202 0.0210 0.0427	U (kw/sq.m/ko	2.599	5.823	4.607	4.188	3.929	3.224	3.228
0.1283 0.0202 0.0210 0.0427	Clean-U Value (kW/sq.m/l0	3.9	6.6	5.1	5.1	5.1	5.1	5.1
	f (sq.m K/kw)	0.1283	0.0202	0.0210	0.0427	0.0584	0.1141	0.1137

Run No. 5-1	Date: October 20, 84		Time: 08:00		Total Operation Time: 108 hr.	ne: 108 hr.	
Variables	Brine Heater			Evaporator Stages			
		*	#5	(*) 17	*	10	10 12
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (K)/Kg/K	3.988	3.967	3.953	3.940	3.930	3.968	3.966
Inlet Temp. (deg. C)	89.5	76.4	62.7	49.6	37	33.1	30
Outlet Temp. (deg. C)	112	89.5	76.4	62.7	49.6	37	33.1
Temp. Rise (deg. C)	22.5	13.1	13.7	13.1	12.6	3.9	3.1
Flashing Temp. (deg. C)	118	93.7	82.2	69.4	56.3	41.5	35.8
Heat Transfer Rate (kj/S)	162.008	93.835	97.785	93.202	89.396	79.525	63.179
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	14.440	9.254	11.298	12.090	11.909	6.248	4.054
U (kw/sq.m/io	2.401	5.235	4.468	3.980	3.875	2.568	3.145
Clean-U Value (kW/sq.m/N	3.9	6.6	5.1	5.1	<b>5.1</b>	5.1	5.1
f (sq.m K/kw)	0.1600	0.0395	0.0277	0.0552	0.0620	0.1933	0.1219
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1.10000

18500 3.966 4.9556 4.054 0.1219 30,5 33.6 36.3 3,145 63.184 Š 3.1 6 \* Total Operation Time: 112 hr. 18500 37.5 4.9556 6:352 3.968 33.6 2.527 **6**.6 42.1 79.531 0.1997 ະ 1 10 14 56.8 0.0634 6500 3.930 37.9 12.3 87.281 1.937 11.691 3.854 2 50.2 \*\* Evaporator Stages 0.0506 93.215 11.869 4.055 69.8 5 6500 3.941 50.2 63.3 1.937 13.1 () ₩ Time: 12:00 10.969 0.0260 6500 3.954 63.3 13.4 82.3 95.655 4.502 ы. М 1.937 76.7 #2 0.0493 6500 89.5 12.8 1.937 9.505 4.980 99 2 3.967 91.689 76.7 1.4 Date: October 20, 94 89.5 112 22.5 118.5 162.008 15.045 2.305 6°£ ∵ 0.1775 3.988 4.6723 6500 Brine Heater Clean-U Value (kW/sq.m/k) Heat Transfer Area (Sq.m) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (kj/kg/k) Outlet Temp. (deg. C) iniet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) f (sq.m.k/kw) Flowrate (kg/h) U (kw/sq.m/io Run No. 5-1 Variables

Mariaktion         Envaluent Stepen           Mariaktion         Brink Heatert         #1         #2         #3         #4           Flowmate (kg/m)         6500         6501         712.5         76.7         66.2         50.1         77.5         50.1         77.5         50.1         77.5         50.1         77.5         50.1         77.5         50.1         77.5         50.1         77.5         50.1         77.5         50.1         77.5         50.1         77.5         50.1         77.5         50.1         76.7         66.2         50.1         77.5	Run No. 5-1	Date: October 20, 94		Time: 16:00		Total Operation Time: 116 hr.	i Time: 116 hr.	
#1     #2     #3       6500     6500     6500     6500       89.5     76.7     65.2     5.941       89.5     76.7     63.2     5.01       112     89.5     76.7     63.2     50.1       112     89.5     76.7     63.2     50.1       112     89.5     76.7     63.2     50.1       112     89.5     13.5     13.1       112     89.5     94.1     82.5     63.8       118.5     94.1     82.5     63.8       118.5     94.1     82.5     63.8       122.5     13.5     13.7     13.7       123.6     94.1     82.5     63.8       162.008     91.689     96.367     93.273       15.045     9.621     1.337     1.937       15.045     9.621     1.327     1.937       15.045     9.621     1.327     1.937       15.045     0.0577     0.0596     0.0529	Variables	Brine Heater			Evaporator Stag	8		
Ngg/k0         6500         76.7         83.2         50.1         50.1         50.1         65.2         50.1         65.2         50.1         65.0         65.0         65.0         65.0         65.0         65.0         65.0         65.1         15.1         16.2         06.2         51.1         17.37         1	•		<b>F</b> *	#2	2	**	9#	8
(Kg)()         3.988         3.967         3.954         3.941           J. Cl         89.5         76.7         63.2         50.1           eg. Cl         112         89.5         76.7         63.2         50.1           eg. Cl         112         89.5         76.7         63.2         50.1           eg. Cl         22.5         12.8         13.5         13.1         63.2           I. Cl         22.5         12.8         13.5         13.7         63.2           I. Cl         22.5         12.8         13.5         13.7         63.8           I. Cl         22.5         94.1         82.5         63.8         63.8           dee Cl         1.937         1.937         1.937         1.937         1.937           rea (Sq.m)         4.6723         1.937         1.937         1.937         1.937           rea (Sq.m)         4.6723         1.937         1.937         1.937         1.937           rea (Sq.m)         3.5         6.6         5.1         1.937         1.937           w// or	=lowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
a. Cl     89.5     76.7     63.2     50.1       eg. Cl     112     89.5     76.7     63.2     50.1       i. Cl     22.5     12.8     13.5     15.1     63.2       i. Cl     22.5     12.8     13.5     15.1       i. Cl     22.5     94.1     82.5     65.8       (deg. Cl     118.5     94.1     82.5     65.8       ate (kl/s)     162.008     91.689     96.367     93.213       ate (kl/s)     162.008     91.689     96.367     93.213       ate (kl/s)     15.045     9.521     1.937     1.937       fea (Sq.m)     4.6723     1.937     1.937     1.937       fea (Sq.m)     4.6723     1.937     1.937     1.937       fea (Sq.m)     4.6723     1.937     1.937     1.937       fea (Sq.m)     4.672     9.621     11.229     11.979       fisition     2.305     4.920     4.431     4.017       Wisq.m/O     3.9     6.6     5.1     5.1       0.1775     0.0517     0.0296     0.0529	specific Heat (kj/kg/k)	3.988	3.967	3.954	3.941	3.930	3.968	3.966
eg. C         112         89.5         76.7         63.2           I. C         22.5         12.8         13.5         13.1           I. C         22.5         12.8         13.5         13.1           (deg. C         118.5         94.1         82.5         69.8           ate (kJ/S)         162.008         91.689         96.367         93.213           frea (kJ/S)         162.008         91.689         96.367         93.213           frea (kJ/S)         162.008         91.689         96.367         93.213           frea (kJ/S)         1.5045         9.621         11.937         1.937           frea (kJ/S)         1.5045         9.621         11.1229         11.979           frea (kJ/S)         2.305         4.920         4.431         4.017           Wisq.m/lo         3.9         6.6         5.1         5.1           0.1775         0.0517         0.0296         0.0529         0.0529	niet Temp. (deg. C)	89.5	76.7	63.2	50.1	37.6	33.5	29.5
1.C     22.5     12.8     13.5     13.1       (deg. C     118.5     94.1     82.5     69.8       ate (kJ/s)     162.008     91.689     96.367     93.213       ate (kJ/s)     162.008     91.689     96.367     93.213       rea (Sq.m)     4.6723     1.937     1.937     1.937       rea (Sq.m)     2.305     4.920     4.431     4.017       Wisq.m/ko     3.9     6.6     5.1     5.1       0.1775     0.0517     0.0296     0.0529	Dutlet Temp. (deg. C)	112	89.5	76.7	63.2	50.1	37.5	33.5
(deg. C)     118.5     94.1     82.5     69.8       ate (tUS)     162.008     91.689     96.367     93.213       fea (Sq.m)     4.6723     1.937     1.937     1.937       fea (Sq.m)     4.6723     1.937     1.937     1.937       fea (Sq.m)     2.505     4.920     4.431     4.017       Wisq.m/lo     3.9     6.6     5.1     5.1       0.1775     0.0517     0.0296     0.0529	femp. Rise (deg. C)	22.5	12.8	13.5	13.1	12.5	4	4
ate (tUS) 162.008 91.689 96.367 93.213 rea (Sq.m) 4.6723 1.937 1.937 1.937 15.045 9.621 11.229 11.979 2.305 4.920 4.431 4.017 Wisq.m/lo 3.9 6.6 5.1 5.1 5.1 0.1775 0.0517 0.0296 0.0529	lashing Temp. (deg. C	118.5	94.1	82.5	69.8		42.2	36.3
rea (Sq.m) 4.6723 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.939 1.5.045 9.624 9.624 11.229 11.979 1.0296 1.0296 1.0259 0.00529 0.00550 0.00559 0.00550 0.00550 0.00559 0.00550 0.00550 0.00550 0.00550 0.00550 0.00550 0.00550 0.00550 0.00550 0.00550 0.005550 0.00550 0.00550 0.00550 0.00550 0.00550	Heat Transfer Rate (kJ/S)	162.008	91.689	96.367	93.213	88.697	81.570	81.521
15.045     9.621     11.229     11.979       2:305     4.920     4.431     4.017       Wisq.m/ro     3.9     6.6     5.1     5.1       0.1775     0.0517     0.0296     0.0529	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
2:305 4.920 4.431 4.017 W/sq.m/to 5.1 5.1 5.1 0.1775 0.0517 0.0296 0.0529	.M.T.D. (deg. K)	15.045	9.621	11.229	11.979	12.092	6.496	4.508
3.9     6.6     5.1     5.1       0.1775     0.0517     0.0296     0.0529	oi/m.ps/ww	2.305	4:920	4.431	4.017	3.787	2.534	3.649
0.0517 0.0296 0.0529	Clean-U Value (KW/sq.m/K)	6.5	6.6	<u>5</u> .1	5.1	5.1	27	5.1
	(sq.m Kikw)	0.1775	0.0517	0.0296	0.0529	0.0680	0.1986	0.0780

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Run No. 5-1	Date: October 20, 94		Time: 20:00		Total Operatio	Total Operation Time: 120 hr.	· · ·
Variables	Brine Heater			Evaporator Stages			
		<b>,</b>	2#	67 *#	4	10 12	9 *
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/l0	3.988	3.967	3.953	3.941	3.930	3.968	3.966
inlet Temp. (deg. C)	89.5	76.7	63.1	49.8	37.4	33.4	29.5
outlet Temp. (deg. C)	112	89.5	76.7	63.1	49.8	37.5	33.4
Temp. Rise (deg. C)	22.5	12.8	13.6	13.3	12.4	4.1	3.9
Flashing Temp. (deg. C)	118	93.6	82.8	69.5	56.5	41.9	36.1
Heat Transfer Rate (kj/S)	162.008	91.689	080.79	94.632	87.983	83.608	79.483
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	14.440	9.037	11.601	11.829	11.837	6.227	4.363
U (KW/sq.m/N	2.401	5.238	4.320	4.130	3.837	2.710	3.676
Clean-U Value (KW/sq.m/N	9;E	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m k/kw)	0.1600	0.0394	0.0354	0.0461	0.0645	0.1730	0.0760
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Run No. 5-1	Date: October 21, 94		Time: 00:00	•	Total Operal	Total Operation Time: 124 hr.	
Variables	Brine Heater			Évaporator Stages			
		#1	#2	#3	*	5	10
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (ki/kg/k)	3.988	3.967	3.953	3.941	3.930	3.968	3.966
Inlet Temp. (deg. C)	89.5	76.6	63	49.7	37.3	33.3	8
outlet Temp. (deg. C)	112	89.5	76.6	63	49.7	38	33.3
Temp. Rise (deg. C)	22.5	12.9	13.6	13.3	12.4	4.7	3.3
Flashing Temp. (deg. C)	117.5	93.6	82.7	69.6	56.5	41.9	36.1
Heat Transfer Rate (k)/S)	162.008	92.405	97.077	94.629	87.981	95.847	67.256
Heat Transfer Area (Sq.m)	4,6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. 10	13.825	9.070	11.601	12.051	11.946	5.943	4.238
U drwisq.m/N	2.508	5.259	4:320	4.054	3.802	3.254	3.202
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	<b>F.</b> 2	5.1
f tsq.m K/KW	0.1423	0.0386	0.0354	0.0506	0.0669	0.1112	0.1162
	· · · · · · · · · · · · · · · · · · ·						

18500 3.966 29.5 4.316 3.335 71.328 л. Г 0.1038 認 4.9556 35.8 10 12 Total Operation Time: 128 hr. 5.970 18500 91.762 4.9556 3.102 5 0.1263 3.968 37.5 41.5 45 R \$ # 6500 56.2 87.976 11.946 с С 0.0669 3.929 12.4 1.937 3.802 5 49.4 \*\* Evaporator Stages 6500 69.2 94.623 0.0483 3.940 5 49.4 62.7 13.3 1.937 4.091 11.940 6# Time: 04:00 6500 82.5 97.785 11.636 ŝ 0.0344 3.953 62.7 13.7 1.937 4.339 76.4 **7** 6500 93.5 76.4 89.5 93.835 1.937 9.017 5.372 6.6 0.0346 3.967 13.1 #1 Date: October 21, 94 o M 3.988 89.5 118 6500 22.5 162.008 4.6723 14.440 2.401 0.1600 112 Brine Heater Heat Transfer Area (Sq.m) Clean-U Value (kW/sq.m/K) Heat Transfer Rate (kj/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/k0 Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) f (sq.m K/KW) U (kw/sq.m/lo Run No. 5-1 Variables

FACTOR
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<b>VANSFER CO</b>
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<b>TIONS OF</b>
CALCULA

Variables							
	Brine Heater			Evaporator Stages			
		*	#5	8) #	2	10	
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (ki/kg/k)	3.988	3.967	3.953	3.941	3.930	3.968	3:966
inlet Temp. (deg. C)	89.5	76.5	62.9	49.6	37.1	33	30.5
outlet Temp. (deg. C)	112	89.5	76.5	62.9	49.6	37	8
Temp. Rise (deg. C)	22.5	13	13.6	13.3	12.5	4	
Flashing Temp. (deg. C)	117.5	<b>2</b> 6	81.9	69.4	56.4	41.5	35.7
Heat Transfer Rate (k//S)	162.008	93.120	97.075	94.627	88.683	81.564	50.953
Heat Transfer Area (5q.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	13.825	8.384	10.810	11.940	11.983	6.289	3.814
u (kw/sq.m/xo	2.508	5.734	4.636	4.091	3.821	2.617	6
Clean-U Value (kW/sq.m/lo	6. 2	9.9	5.1	5.1	5.1	5.1	5.1
f (sq.m K/kW)	0.1423	0.0229	0.0196	0.0483	0.0656	0.1861	0.1749

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Run No. 5-1 Date: October 21, 94

Time: 12:00

Total Operation Time: 136 hr.

					· · ·	ű	Evaporator Stages	ан 		· :	· · · · ·	
			· • • • •		#3		e #	<b>*</b>		50 14		<b>1</b>
Fiowrate (kg/h)	6500		6500	·	6500		6500		6500	Ŧ	18500	18500
Specific Heat (kj/kg/k)	3.988		3.967	•	3.953		3.941	κ,	3.930	10	3.968	3.966
inlet Temp. (deg. C)	89.5		76.6	•	63.2	•	50.1		37.6		33.4	30.5
Outlet Temp. (deg. C)	112		89.5		76.6	•	63.2		50.1		37.5	33.4
Temp. Rise (deg. C)	22.5		12.9		13.4		13.1	:	12.5	•	4,1	2.9
Flashing Temp. (deg. C)	18	•	76		82.9		70.1	· · ·	56.8		42	36.2
Heat Transfer Rate (ki/S)	162.008		92.405		95.652		93.213	ĕ	88.697	83	83.608	59.107
Heat Transfer Area (Sq.m)	4.6723		1.937		1.937		1.937	• ·	.937	4	4.9556	4.9556
LM.T.D. (deg. 10	14.440		9.539	• .	11.754		12.310	÷	11.873		6.330	4.080
U (kW/sq.m/ko	2.401		5.001		4.201		3.909		3.857	∾.	2.665	2.924
clean-U Value (kW/sq.m/K)	Ö, Ñ		6.6		5.1		5.1		5.1		5.1	5.1
f (sa.m K/kW)	0.1600		0.0484		0.0419		0.0597	0	0.0632	ò	0.1791	0.1460

Watables         Brine Heater         #1         #2         #3         #4         #5         #4         #5         #6           Membles         Brine Heater         #1         #2         #3         #4         #5         #6         #6           Flowrate (kg/h)         65:00         65:00         65:00         65:00         65:00         65:00         165:01         165:01         165:01	Run No. 5-1	Date: October 21, 94		Time: 15:00	· .	Total operatio	Total Operation Time: 140 hr.	•
#1         #2         #3         #4         #5<	Variables	Brine Heater			Evaporator Stages			
1)         6500         6500         6500         6500         6500         6500         6500         6500         18500           (k)(kg)(0         3.386         3.357         3.353         3.353         3.3567         3.3567         3.3567         3.3567         3.3567         3.3567         3.3567         3.3567         3.3567         3.3567         3.3566         18500         18500         18500         3.356         3.356         3.356         3.356         3.356         3.356         3.356         3.356         3.356         3.356         3.356         3.356         3.53         3.356         3.53         3.355         3.353         3.356         3.57         3.353         3.53         3.53         3.55         3.53         3.53         3.55         3.53         3.53         3.548         3.75         3.548         3.7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7         4.19         7			<b>1</b>	#2	<b>*</b>	*	10 14	•
(k)/kg/k0         3.988         3.967         3.953         3.941         3.950         3.968           leg. O         89.5         76.6         63         49.9         37.5         33.3           leg. O         89.5         76.6         63         49.9         37.5         33.3           leg. O         112         89.5         76.6         63         49.9         37.5         33.3           eg. O         22.5         12.9         13.6         13.1         12.4         3.7           eg. O         22.5         12.9         13.6         13.1         13.7         12.4         3.7           eg. O         21.08         92.405         97.077         93.208         87.995         75.448         7           Area (sq.m)         4.6723         1.937         1.937         1.937         1.937         41.9           Area (sq.m)         4.6723         1.937         1.937         1.937         4.9556         4           Area (sq.m)         4.6723         1.937         1.937         1.937         4.9556         4           Area (sq.m)         4.6723         1.937         1.937         1.937         4.9556         5         7	Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
leg. Cl         89.5         76.6         6.3         49.9         37.5         33.3           deg. Cl         112         89.5         76.6         6.3         49.9         37.5         33.3           eg. Cl         22.5         12.9         13.6         13.1         12.4         3.7           eg. Cl         22.5         12.9         13.6         13.1         12.4         3.7           eg. Cl         22.5         11.8         9.4         82.9         70         41.9         3.7           a. (deg. Cl         118         9.4         82.9         70         56.7         41.9         7           Area Sq.mi         4.6723         1.937         1.937         1.937         1.937         4.9556         4.1           Årea Sq.mi         4.6723         1.337         1.937         1.937         1.937         4.9556         4.1           Årea Sq.mi         4.6723         1.337         1.937         1.937         4.9556         4.1           År         3.602         5.001         4.238         3.875         3.802         2.315         3         3           År         3.9         5.1         5.1         5.1	specific Heat (k)/kg/io	3.988	3.967	3.953	3.941	3.930	3.968	3.966
(deg. C)         112         89.5         76.6         63         49.9         37           Bg. C)         22.5         12.9         13.6         13.1         12.4         3.7           Sg. C)         22.5         12.9         13.6         13.1         12.4         3.7           S. (deg. C)         118         94         82.9         70         56.7         41.9           Rate (kJ/s)         162.008         92.405         97.077         93.208         87.965         7.7           Area Sq.m)         4.6723         1.937         1.337         1.937         1.937         4.19           Area Sq.m)         4.6723         1.337         1.337         1.937         1.937         4.5           Area Sq.m)         4.6723         1.337         1.937         1.937         4.9556         4.1           K         2.401         5.001         4.238         3.875         3.802         2.315         3         3           K         2.401         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1         5.1	Inlet Temp. (deg. C)	89.5	76.6	63	49.9	37.5	33.3	29.5
Bg. Cl       22.5       12.9       13.6       13.1       12.4       3.7         5. (deg. Cl       118       94       82.9       70       56.7       41.9         Rate (k/5)       162.008       92.405       97.077       93.208       87.985       75.448       7         Area (sq.m)       4.6723       1.937       1.937       1.937       1.937       4.9556       4         Area (sq.m)       4.6723       1.937       1.937       1.937       1.937       1.937       4.9556       4         Area (sq.m)       4.6723       1.937       1.937       1.937       1.937       1.937       4.9556       4         Area (sq.m)       5.001       9.339       1.1824       1.937       1.937       4.9556       4         Kwisq.m/ko       3.9       6.6       5.1       5.	Outlet Temp. (deg. C)	112	89.5	76.6	63	49.9	37	33.3
0. (deg. C)       118       94       82.9       70       56.7       41.9         Rate (k/S)       162.008       92.405       97.077       93.208       87.985       75.448       7         Area (sq.m)       4.6723       1.937       1.937       1.937       1.937       1.937       4.956       4         Area (sq.m)       4.6723       1.937       1.937       1.937       1.937       4.9556       4         Area (sq.m)       4.6723       1.937       1.937       1.937       1.937       4.9556       4         Area (sq.m)       2.401       5.001       4.238       5.1       5.1       5.1       5.1         (kw/sq.m/k)       3.9       6.6       5.1       5.1       5.1       5.1       5.1         0.1600       0.0484       0.0599       0.0669       0.0669       0.2359       0	Temp. Rise (deg. C)	22.5	12.9	13.6	13.1	12.4	3.7	3.8
Rate (k/S)         162.008         92.405         97.077         93.208         87.985         75.448         7           Area (Sq.m)         4.67/23         1.937         1.937         1.937         1.937         4.9556         4           Area (Sq.m)         4.67/23         1.937         1.937         1.937         1.935         7.448           Area (Sq.m)         4.67/23         1.937         1.937         1.937         4.9556         4           A         2.401         5.001         9.539         11.824         12.419         11.946         6.577         4           A         2.401         5.001         4.238         3.875         3.802         2.315         2.315           (kw/sq.m/k)         3.9         6.6         5.1 </td <td>Flashing Temp. (deg. C</td> <td>118</td> <td><b>7</b>6</td> <td>82.9</td> <td>70</td> <td>56.7</td> <td>41.9</td> <td>36.2</td>	Flashing Temp. (deg. C	118	<b>7</b> 6	82.9	70	56.7	41.9	36.2
Area (Sq.m)       4.6723       1.937       1.937       1.937       1.937       4.9556       4         (c)       14.440       9.539       11.824       12.419       11.946       6.577       4.9556       4         (c)       2.401       5.001       9.539       11.824       12.419       11.946       6.577       4.955         (c)       2.401       5.001       4.238       3.875       3.802       2.315         (c)       5.1       5.1       5.1       5.1       5.1       5.1         (c)       0.0620       0.0669       0.0669       0.2359       0	Heat Transfer Rate (kj/S)	162.008	92.405	67.077	93.208	87.985	75.448	77.444
(c)         14.440         9.539         11.824         12.419         11.946         6.577           2.401         5.001         4.238         3.875         3.802         2.315           (kw/sq.m/lo         3.9         6.6         5.1         5.1         5.1         5.1           0.1600         0.0484         0.0399         0.0620         0.0669         0.2359         0	Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
2.401         5.001         4.238         3.875         3.802         2.315           (tw/sq.m/k)         3.9         6.6         5.1         5.1         5.1         5.1           0.1600         0.0484         0.0399         0.0620         0.0669         0.2359	LM.T.D. (deg. K)	14.440	9.539	11.824	12.419	11.946	6.577	4.538
(kW/sq.m/k) 3.9 6.6 5.1 5.1 5.1 5.1 5.1 5.1 5.1 0.2359 0.0620 0.0669 0.2359	U (kw/sq.m/Ю	2.401	5.001	4.238	3.875	3.802	2.315	3.444
0.1600 0.0484 0.0399 0.0620 0.0669 0.2359	clean-U Value (KW/sq.m/K	9. 9	6.6	5.1	5.1	2.1	5	5.1
	f (sq.m K/kw)	0.1600	0.0484	0.0399	0.0620	0.0669	0.2359	0.0943

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3 13,

Run No. 5-1 Date: October 21, 94

Time: 20:00

Total Operation Time: 144 hr.

6500       6500       6500       6500         3.988       3.967       3.953         3.988       3.967       3.953         89.5       76.3       3.953         112       89.5       76.3         112       89.5       76.3         112       89.5       76.3         112       89.5       76.3         113       13.2       13.2         113       93.8       82         162.008       94.550       97.070         162.008       94.550       97.070         162.008       94.550       97.070         162.008       94.550       97.070         162.008       94.550       97.070         162.008       94.550       1.937         14.440       9.404       11.151         2.401       5.190       4.49a         3.9       6.6       5.1		60 18 10 18 10 19
3.988       3.967       3.953         89.5       76.3       62.7         81.5       76.3       62.7         112       89.5       76.3         112       89.5       76.3         112       89.5       76.3         112       89.5       76.3         112       13.2       13.2         113       93.8       82         162.008       94.550       97.070         94.550       97.070       9         162.008       94.550       97.070         162.008       94.550       97.070         162.008       94.550       97.070         162.008       94.550       97.070         14.440       9.404       11.151         2.401       5.190       4.49a         3.9       6.6       5.1	6500 6500	18500 18500
89.5       76.3       62.7         112       89.5       76.3         22.5       13.2       13.6         22.5       13.2       13.6         162.008       94.550       97.070       93         162.008       94.550       97.070       93         14.440       9.404       1.937       1.937       1.937         2.401       5.190       4.494       6.6       5.1	3.940 3.929	3.968 3.966
112       89.5       76.3         22.5       13.2       13.6         218       93.8       82         118       93.8       82         162.008       94.550       97.070         162.008       94.550       97.070         14.440       9.404       1.937         2.401       5.190       4.494         3.9       6.6       5.1		33.1 29
22.5       13.2       13.6         118       93.8       82         162.008       94.550       97.070       93         162.008       94.550       97.070       93         162.008       94.550       97.070       93         14.440       9.404       1.937       1.937       1         2.401       5.190       4.494       1       1         3.9       6.6       5.1       5.1       1	62.7 49.5	37
118     93.8     82       162.008     94.550     97.070       4.6723     1.937     1.937       14.440     9.404     11.151       2.401     5.190     4.494       3.9     6.6     5.1	13.2 12.5	3.9 4.1
ite (k//5)     162.008     94.550     97.070       ea (5q.m)     4.6723     1.937     1.937       14.440     9.404     11.151       2.401     5.190     4.494       M/sq.m/k0     3.9     6.6     5.1	69.3	41.6 35.8
ea (Sq.m) 4.6723 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.937 1.94	93.913 88.686	79.525 83.554
14.440 9.404 11.151 2.401 5.190 4.494 N/sq.m/k0 3.9 6.6 5.1	1.937 1.937	4.9556 4.9556
2.401 5:190 4.494 (KW/sq.m/k) 3.9 6.6 5.1	12.015 12.092	6.352 4.439
3.9 6.6		2.526 3.798
	5.1	5.1 5.1
f tsg.m Kikwi 0.0264 0.0517 0.0517	0.0517 0.0680	0.1997 0.0672

Run No. 5-1	Date: October 22, 94		Time: 00:00		-	Total Operation Time: 148 hr.	rime: 148 hr.	
Variables	Brine Heater			Evap	Evaporator Stages			
		#1	*2		2.0	**	<b>4</b>	<b>9</b>
Flowrate (kg/h)	6500	6500	6500		6500	6500	18500	18500
Specific Heat (K)/Kg/K0	3.988	3.967	3.953	• * .	3.940	3.929	3.968	3.966
inlet Temp. (deg. C)	89.5	76.1	62.6		49.4	36.9	32.9	53
outlet Temp. (deg. C)	112	89.5	76.1	 	62.6	49.4	37	32.9
Temp. Rise (deg. C)	22.5	13.4	13.5		13.2	12.5	4.1	3.9
Flashing Temp. (deg. C)	119	93.8	81.9	, , ,	69.3	56.3	41.5	35.7
Heat Transfer Rate (k)/S)	162.008	95.979	96.353	<b>o</b>	93.910	88.684	83.602	79.477
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937		1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	15.642	9.470	11.229	~	12.126	12.092	6.330	4.470
u (kw/sq.m/io	2.217	5.232	4.430	•	3.998	3.786	2.665	3.588
clean-U Value (kW/sq.m/to	3.9	9.9	5.1		5.1	5.1	5.1	5.1
f (sq.m.K/KW)	0.1947	0.0396	0.0297	0	0.0540	0.0680	0.1792	0.0826
					1. 1. 1.		· · ·	

18500 4.9556 3.588 0.0826 3.966 32.9 4.470 8 3.0 5 35.7 79.477 10 # Total Operation Time: 152 hr. 18500 37.5 6.114 3.096 0.1269 3.968 32.9 41.6 4.9556 6.4 93.801 . 5 ¥ 0 6500 3.930 49.6 12.6 · 56.4 89.396 1.937 12.019 3.840 0.0643 ູ ທີ 5 1 Evaporator Stages 69.69 0.0495 49.6 6500 13.4 4.072 5 3.941 63 95.340 1.937 12.087 € ₩ Time: 04:00 6500 3.953 76.6 13.6 82.2 11.038 0.0242 97.077 1.937 4.541 63 5 ×. 76.6 89.5 6500 12.9 93.8 9.305 0.0435 3.967 1.937 5.127 6.6 92.405 \*\* Date: October 22, 94 6500 3.988 89.5 22.5 162.008 15.642 6.8 . 112 119 4.6723 2.217 0.1947 Brine Heater Heat Transfer Area (Sq.m) clean-U Value (kw/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (k)/kg/l0 Outlet Temp. (deg. C) iniet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kw/sq.m/k) f (sq.m K/KW) Run No. 5-1 Variables

Variables	Brine Heater			Evaporator Stages			
		*	#2	5	*	94	<b>\$</b>
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/)0	3.988	3.967	3.953	3.940	3.929	3.968	3.966
inlet Temp. (deg. C)	89.5	76.3	62.7	49.2	36.6	32.5	30
outiet Temp. (deg. C)	112	89.5	76.3	62.7	49.2	37	32.5
Temp. Rise (deg. C	22.5	13.2	13.6	13.5	12.6	4.5	2.5
Flashing Temp. (deg. C	119	92.9	80.9	6.89	56	41	35.3
Heat Transfer Rate (kj/S)	162.008	94.550	97.070	96.044	89.389	91.755	50.949
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. 10	15.642	8.325	9.888	11.678	12.019	5.970	3.918
U (kw/sq.m/k)	2.217	5.864	5.068	4.246	3.840	3:101	2.624
Clean-U Value (KW/sq.m/K)	0. M	6.6	5.1	r. L	5.1	5.1	ц,
f (sq.m k/kw)	0.1947	0.0190	0:0012	0.0394	0.0644	0.1264	0.1850

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Run No. 5-1	Date: October 22, 94	• • • •	Time: 16:00		Total Operation Time: 164 hr.	Time: 164 nr.	1.
Variables	Brine Heater			Evaporator Stages			
		<b>1</b>	#2	<b>6</b> <b>7</b>	**	10 18	÷
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (k)/kg/K)	3.988	3.968	3.954	3.942	3.931	3.968	3.965
Inlet Temp. (deg. C)	8	77.1	64.1	51.3	39.1	32.1	29.5
Outlet Temp. (deg. C)	112	8	77.1	64.1	51.3	37	32.1
Temp. Rise (deg. C)	3	12.9	13	12.8	12.2	4.9	2.6
Flashing Temp. (deg. C)	117.8	93.5	82.4	70.3	57.7	41.9	38.3
Heat Transfer Rate (k)/S)	158.420	92.417	92.813	91.100	86.592	806.66	52.983
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	14.038	8.352	10,491	11.430	11.435	7.069	7.424
U (KW/sq.m/k)	2.415	5.713	4.567	4.115	3.909	2.852	1.440
Clean-U Value (kW/sq.m/k)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sa.m k/kW)	0.1576	0.0235	0.0229	0.0469	0.0597	0.1546	0.4983

Run No. 5-1	Date: October 22, 94		Time: 20:00	. *	Total Operation Time: 168 hr.	n Time: 168 hr.	
Variables	Brine Heater			Evaporator Stages			
		· · · · · · · · · · · · · · · · · · ·	#2	69 1		10	*
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/k)	3.988	3.968	3.954	3.942	3.931	3.967	3.965
iniet Temp. (deg. C)	06	1.77	64.1	51.3	39.1	30.6	8
outlet Temp. (deg. C	112	6	1.77	64.1	51.3	36	30.6
Temp. Rise (deg. C)	22	12.9	13	12.8	12.2	5.4	1.6
Flashing Temp. (deg. C)	116	<b>1</b> 6	82.5	70.7	57.8	40.7	38.4
Heat Transfer Rate (kj/S)	158.420	92.417	92.813	91.100	86.592	110.083	32.601
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
LM.T.D. (deg. K)	11.753	8.952	10.604	11.872	11.545	7.059	8.575
U (kw/sq.m/Ю	2.885	5.330	4.519	3.962	3.872	3.147	0.767
Clean-U Value (KW/sq.m/K)	<b>5</b> .5	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m k/kw)	0.0902	0.0361	0.0252	0.0563	0.0622	0.1217	1.1074

40

18500 28.5 3.965 38.4 48.900 4.9556 8.645 1.141 0.6800 90 <del>2</del> Total Operation Time: 172 hr. 30.9 415 18500 35.5 93.773 4.9556 8.083 ŝ 0.2311 3.967 4.6 2.341 in 북 58.6 85.191 3.870 5 0.0623 6500 3.932 40.2 1.937 11.363 52.2 2 \* Evaporator Stages 12.019 12.6 6500 71.6 89.693 0.0635 3.943 52.2 64.8 1.937 3.853 5.5 **で**兼 Time: 00:00 64.8 83.8 92.830 11.278 4.249 77.8 1.937 0.0393 3.955 <del>ر</del>ې 6500 5 \* 6.6 6500 3.968 77.8 12.2 94.4 87.411 9.188 4.911 0.0521 8 1.937 \*\* Date: October 23, 94 9.639 3.518 6 £ 3.988 114.5 158.420 4.6723 0.0279 6500 8 112 2 **Brine Heater** Heat Transfer Area (Sq.m) clean-U Value (kW/sq.m/k) Heat Transfer Rate (k)/S) Flashing Temp. (deg. C) Specific Heat (ki/kg/K) Outlet Temp. (deg. C) Inlet Temp. (deg. C) Temp. Rise (deg. C) L.M.T.D. (deg. K) Flowrate (kg/h) U (kW/sq.m/Ю f (sq.m K/kW) Run No. 5-1 Variables

30.9

2.4

5

Run No. 5-1	Date: October 23, 94		Time: 04:00		Total Operation Time: 176 hr.	Time: 176 hr.	· ·
Verfables	Brine Heater			Evaporator Stages			
			#3	8	*	<b>10</b>	-
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (kj/kg/k)	3.988	3.968	3.955	3.943	3.932	3.967	3.965
Inlet Temp. (deg. C)	6	77.9	64.9	52.1	40.1	30.5	28.5
outlet Temp. (deg. C)	112	6	9.77	64.9	52.1	35.5	30.5
Temp. Rise (deg. C)	3	12.1	13	12.8	4	ŝ	8
Flashing Temp. (deg. C)	115	93.7	83	71.4	58.4	<b>41</b>	38
Heat Transfer Rate (kj/S)	158.420	86.696	92.832	91.117	85.189	101.924	40.749
Heat Transfer Area (Sq.m)	4.6723	1.937	1.937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	10.376	8.335	10.263	11.761	11.253	7.732	8.461
U (kw/sq.m/l0	3,268	5.370	4.670	4.000	3:908	2.660	0.972
Clean-U Value (kw/sq.m/ko	3.9	6.6	5.1	22	51	5.1	5.1
f (sq.m K/kW)	0.0496	0.0347	0.0181	0.0540	0.0598	0.1799	0.8328

Run No. 5-1 Time: October 23, 94

Total Operation Time: 180 hr.

			-				
Variables	Brine Heater			Evaporator Stagos			
		#1	*	£#	**	10 14	10
Flowrate (kg/h)	6500	6500	6500	6500	6500	18500	18500
Specific Heat (k)/kg/i0	3.988	3.968	3.955	3.943	3.932	3.967	3.965
Inlet Temp. (deg. C)	06	77.9	64.9	52.1	40.1	30.5	28.5
Outlet Temp. (deg. C)	112	6	6.17	64.9	52.1	35.5	30.5
Temp. Rise (deg. C)	3	12.1	13	12.8	12	ſ	6
Flashing Temp. (deg. C)	115	93.7	83	71.4	58.4	41	38
Heat Transfer Rate (Kj/S)	158.420	86.696	92.832	91,117	85.189	101.924	40.749
Heat Transfer Area (Sq.m)	4.6723	1.937	1:937	1.937	1.937	4.9556	4.9556
L.M.T.D. (deg. K)	10.376	8.335	10.263	11.761	11.253	7.732	8.461
U (kW/sq.m/k)	3.268	5.370	4.670	4.000	3.908	2.660	0.972
Clean-U Value (KW/sg.m/K)	3.9	6.6	5.1	5.1	5.1	5.1	5.1
f (sq.m K/KW)	0.0496	0.0347	0.0181	0.0540	0.0598	0.1799	0.8328