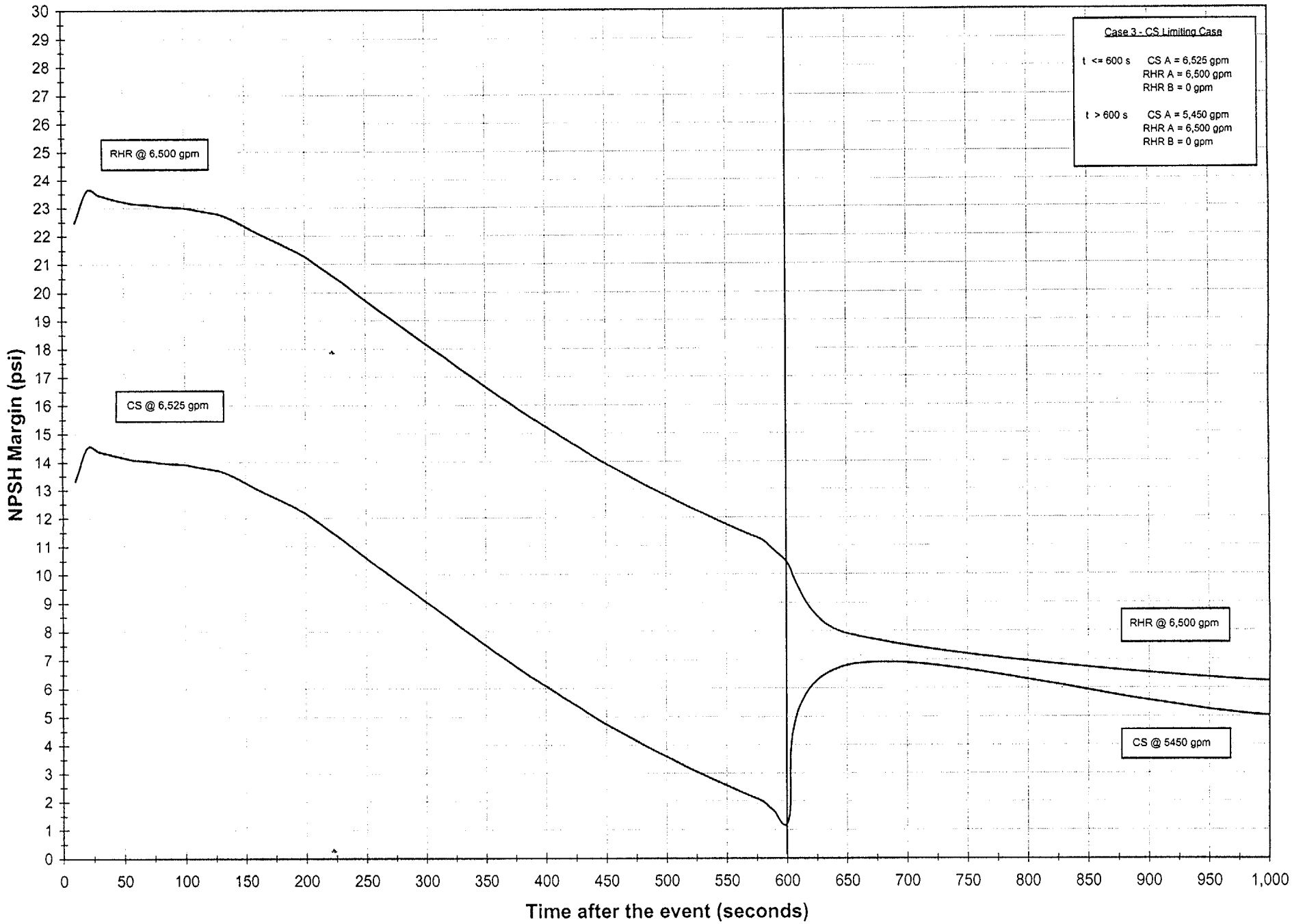
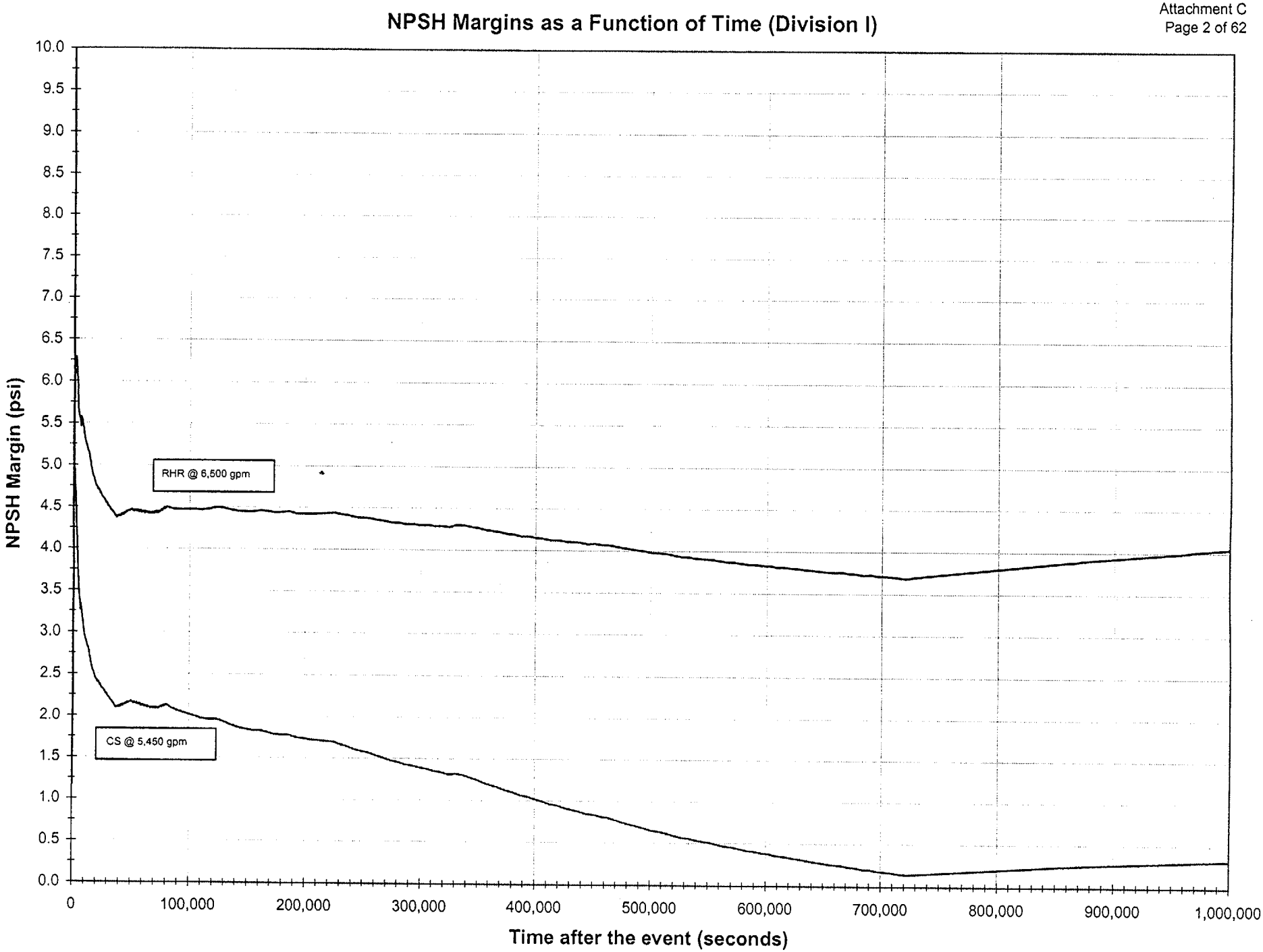
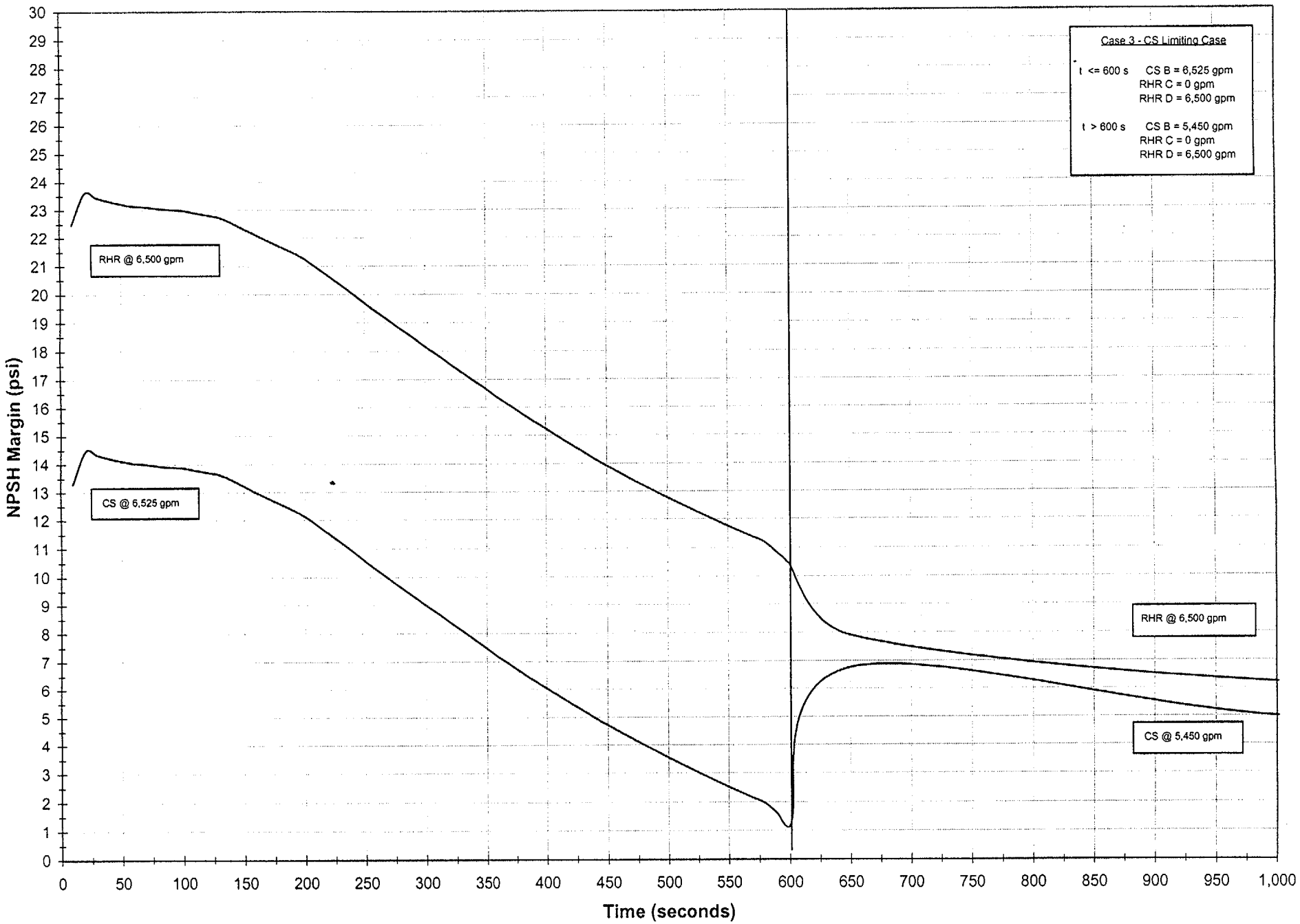
NPSH Margins as a Function of Time (Division I)



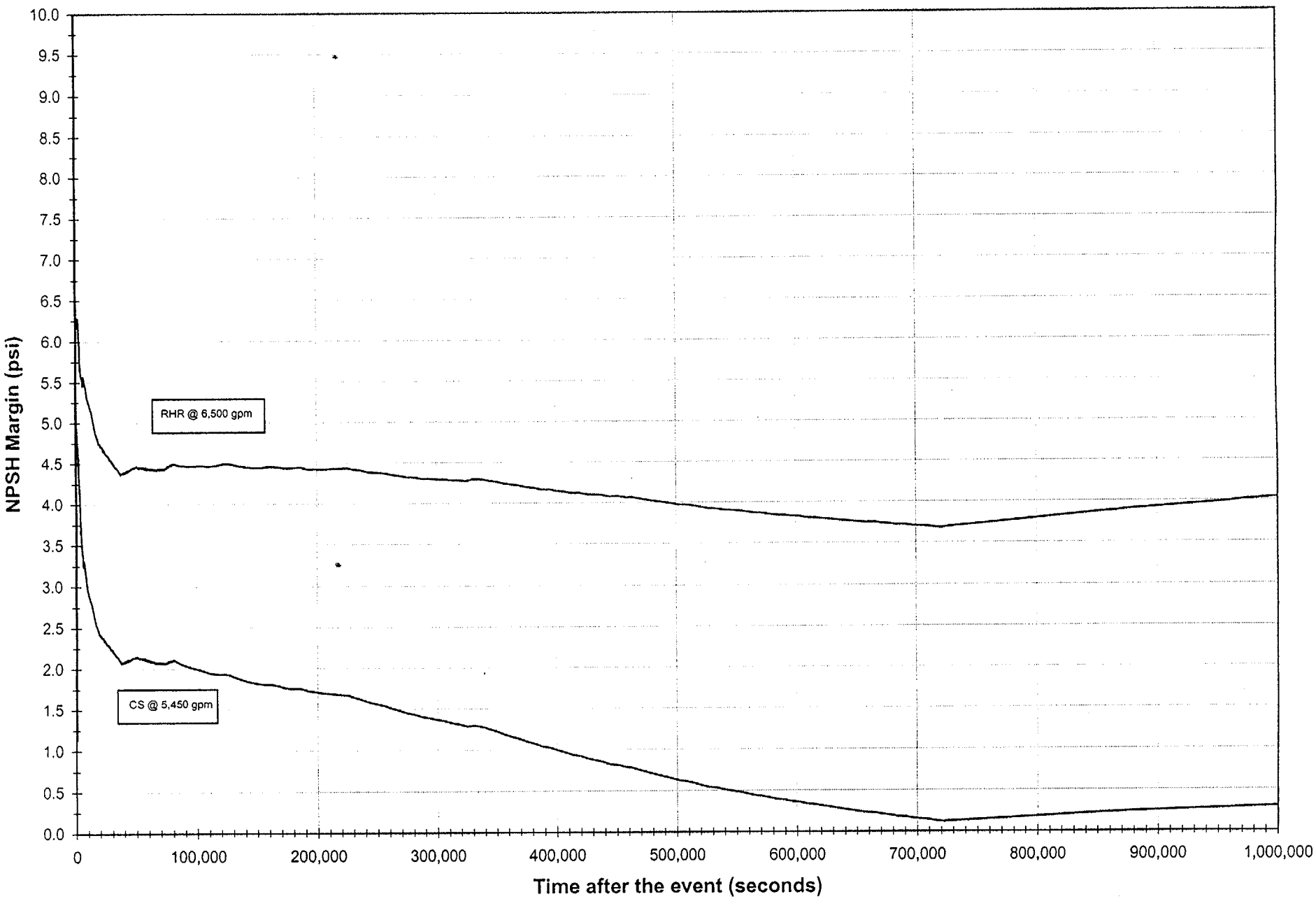
All pages of Attachment C checked
JW 6/15/01


NPSH Margins as a Function of Time (Division I)
NPSH Margin (psi)
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
RHR @ 6,500 gpm
CS @ 5,450 gpm
0
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000
900,000
1,000,000
Time after the event (seconds)

NPSH Margins as a Function of Time (Division II)



NPSH Margins as a Function of Time (Division II)



Case ->	***3***							
			Run profiles Used					
		T<=	*T>*					
Division I		600	600	*Terminating at ->*		1,000,000	*Seconds*	
CS pump A ->		6,525	5,450	*Gpm*				
RHR pump A ->		6,500	6,500	*Gpm*				
RHR pump B ->		0	0	*Gpm*				
					Amount of Fibrous Material			
Division II						75.3	*Lbm*	
CS pump B ->		6,525	5,450	*Gpm*				
RHR pump C ->		0	0	*Gpm*				
RHR pump D ->		6,500	6,500	*Gpm*				
Interpolation routine using Suppression Pool temperature/pressure data in 97044G.xls								
time (sec) ->			999,900					
Pool Temp (°F) ->			147.5					
Chamber Pressure (psia) ->			14.2	*(Constant La =0.635%/day assumed)*				
				Base pressure used ->			14.2	*psia*
Calculated Margins as a Function of Time (psi)								
Division I					**Division II**			
	CS	**RHR**				**CS**	**RHR**	
Time (sec)	**Pump A**	**Pump A**	**Pump B**		**Time (sec)**	**Pump B**	**Pump C**	**Pump D**
10	13.32	22.47			***10***	13.29		22.46
20	14.50	23.60			***20***	14.47		23.60
30	14.36	23.44			***30***	14.32		23.44
40	14.24	23.32			***40***	14.21		23.32
50	14.15	23.22			***50***	14.12		23.22
60	14.07	23.14			***60***	14.04		23.14
70	14.04	23.11			***70***	14.00		23.11
80	13.98	23.06			***80***	13.94		23.05
90	13.94	23.02			***90***	13.90		23.01
100	13.91	23.00			***100***	13.88		22.99
110	13.83	22.91			***110***	13.79		22.91
120	13.74	22.83			***120***	13.71		22.82
130	13.66	22.75			***130***	13.62		22.74
140	13.48	22.57			***140***	13.44		22.56
150	13.25	22.34			***150***	13.22		22.34
160	13.02	22.12			***160***	12.99		22.11
170	12.81	21.91			***170***	12.77		21.90
180	12.61	21.71			***180***	12.57		21.70
190	12.40	21.51			***190***	12.37		21.50
200	12.16	21.27			***200***	12.13		21.26
210	11.86	20.97			***210***	11.83		20.97
220	11.56	20.67			***220***	11.53		20.67
230	11.25	20.37			***230***	11.22		20.36
240	10.93	20.04			***240***	10.89		20.04
250	10.60	19.72			***250***	10.57		19.71

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
260	10.28	19.40			***260***	10.24		19.39
270	9.96	19.09			***270***	9.93		19.08
280	9.65	18.78			***280***	9.62		18.77
290	9.34	18.47			***290***	9.30		18.47
300	9.03	18.17			***300***	9.00		18.16
310	8.73	17.87			***310***	8.69		17.86
320	8.42	17.56			***320***	8.39		17.56
330	8.12	17.26			***330***	8.09		17.26
340	7.82	16.96			***340***	7.78		16.96
350	7.51	16.66			***350***	7.48		16.65
360	7.22	16.37			***360***	7.18		16.36
370	6.92	16.08			***370***	6.89		16.07
380	6.63	15.79			***380***	6.60		15.78
390	6.35	15.51			***390***	6.32		15.51
400	6.08	15.24			***400***	6.04		15.24
410	5.81	14.97			***410***	5.77		14.97
420	5.54	14.70			***420***	5.50		14.70
430	5.27	14.44			***430***	5.23		14.43
440	5.00	14.17			***440***	4.96		14.16
450	4.74	13.91			***450***	4.70		13.91
460	4.50	13.68			***460***	4.46		13.67
470	4.26	13.44			***470***	4.23		13.44
480	4.02	13.21			***480***	3.99		13.21
490	3.80	12.99			***490***	3.77		12.99
500	3.58	12.77			***500***	3.55		12.77
510	3.36	12.56			***510***	3.33		12.55
520	3.15	12.35			***520***	3.12		12.35
530	2.95	12.15			***530***	2.92		12.15
540	2.75	11.95			***540***	2.71		11.94
550	2.55	11.75			***550***	2.51		11.75
560	2.36	11.57			***560***	2.32		11.57
570	2.17	11.39			***570***	2.14		11.38
580	1.98	11.20			***580***	1.94		11.19
590	1.60	10.82			***590***	1.57		10.82
600	1.21	10.43			***600***	1.17		10.43
650	6.79	7.91			***650***	6.77		7.90
1,000	5.01	6.23			***1,000***	4.99		6.23
1,350	4.94	6.27			***1,350***	4.92		6.26
1,700	4.80	6.23			***1,700***	4.78		6.22
2,050	4.71	6.23			***2,050***	4.68		6.22
2,400	4.67	6.28			***2,400***	4.65		6.28
2,750	4.43	6.13			***2,750***	4.41		6.12
3,100	4.25	6.02			***3,100***	4.23		6.01
3,450	4.10	5.94			***3,450***	4.08		5.93
3,800	3.91	5.81			***3,800***	3.89		5.81
4,150	3.73	5.68			***4,150***	3.70		5.68
4,500	3.62	5.63			***4,500***	3.59		5.62
4,850	3.54	5.60			***4,850***	3.52		5.59
5,200	3.47	5.57			***5,200***	3.44		5.56
5,550	3.42	5.55			***5,550***	3.39		5.55
5,900	3.36	5.53			***5,900***	3.34		5.52

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
6,250	3.26	5.46			6,250	3.24		5.45
6,600	3.33	5.56			6,600	3.31		5.55
6,950	3.33	5.57			6,950	3.30		5.56
7,300	3.29	5.55			7,300	3.27		5.54
7,650	3.25	5.53			7,650	3.23		5.52
8,000	3.19	5.48			8,000	3.17		5.48
8,350	3.16	5.46			8,350	3.13		5.45
8,700	3.12	5.44			8,700	3.10		5.43
9,050	3.07	5.39			9,050	3.05		5.39
9,400	3.03	5.35			9,400	3.00		5.34
9,750	3.00	5.33			9,750	2.98		5.33
10,100	2.97	5.31			10,100	2.95		5.30
10,450	2.95	5.28			10,450	2.92		5.28
10,800	2.93	5.26			10,800	2.90		5.26
11,150	2.90	5.24			11,150	2.88		5.23
11,500	2.90	5.24			11,500	2.87		5.23
11,850	2.86	5.20			11,850	2.84		5.20
12,200	2.85	5.19			12,200	2.83		5.19
12,550	2.84	5.17			12,550	2.81		5.17
12,900	2.83	5.16			12,900	2.80		5.16
13,250	2.81	5.15			13,250	2.79		5.14
13,600	2.79	5.13			13,600	2.77		5.12
13,950	2.77	5.10			13,950	2.75		5.10
14,300	2.73	5.06			14,300	2.70		5.05
14,650	2.71	5.04			14,650	2.69		5.03
15,000	2.68	5.01			15,000	2.65		5.00
15,350	2.65	4.97			15,350	2.62		4.97
15,700	2.63	4.96			15,700	2.61		4.95
16,050	2.61	4.94			16,050	2.59		4.93
16,400	2.58	4.91			16,400	2.56		4.90
16,750	2.55	4.88			16,750	2.53		4.87
17,100	2.54	4.87			17,100	2.52		4.86
17,450	2.53	4.85			17,450	2.51		4.85
17,800	2.52	4.84			17,800	2.50		4.84
18,150	2.50	4.81			18,150	2.47		4.81
18,500	2.49	4.81			18,500	2.47		4.80
18,850	2.48	4.80			18,850	2.46		4.79
19,200	2.46	4.77			19,200	2.43		4.77
19,550	2.44	4.75			19,550	2.41		4.74
19,900	2.44	4.75			19,900	2.42		4.75
20,250	2.43	4.74			20,250	2.41		4.73
20,600	2.43	4.74			20,600	2.41		4.73
20,950	2.40	4.71			20,950	2.38		4.70
21,300	2.40	4.71			21,300	2.38		4.70
21,650	2.41	4.72			21,650	2.39		4.71
22,000	2.41	4.71			22,000	2.38		4.70
22,350	2.40	4.70			22,350	2.37		4.69
22,700	2.40	4.70			22,700	2.38		4.70
23,050	2.37	4.66			23,050	2.34		4.66
23,400	2.36	4.66			23,400	2.34		4.65
23,750	2.37	4.67			23,750	2.35		4.66

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
24,100	2.36	4.66			24,100	2.34		4.65
24,450	2.35	4.65			24,450	2.33		4.64
24,800	2.34	4.63			24,800	2.31		4.62
25,150	2.33	4.62			25,150	2.31		4.62
25,500	2.33	4.62			25,500	2.31		4.61
25,850	2.32	4.61			25,850	2.30		4.61
26,200	2.31	4.60			26,200	2.29		4.60
26,550	2.32	4.60			26,550	2.29		4.60
26,900	2.31	4.60			26,900	2.29		4.59
27,250	2.30	4.58			27,250	2.27		4.58
27,600	2.30	4.58			27,600	2.27		4.58
27,950	2.29	4.58			27,950	2.27		4.57
28,300	2.27	4.55			28,300	2.24		4.54
28,650	2.27	4.55			28,650	2.24		4.54
29,000	2.27	4.55			29,000	2.24		4.54
29,350	2.26	4.54			29,350	2.24		4.54
29,700	2.24	4.52			29,700	2.22		4.52
30,050	2.25	4.54			30,050	2.23		4.53
30,400	2.23	4.51			30,400	2.20		4.50
30,750	2.23	4.51			30,750	2.20		4.50
31,100	2.23	4.51			31,100	2.20		4.50
31,450	2.21	4.49			31,450	2.19		4.48
31,800	2.21	4.49			31,800	2.18		4.48
32,150	2.20	4.48			32,150	2.18		4.48
32,500	2.18	4.46			32,500	2.16		4.45
32,850	2.18	4.46			32,850	2.16		4.46
33,200	2.18	4.46			33,200	2.16		4.45
33,550	2.18	4.45			33,550	2.15		4.45
33,900	2.17	4.44			33,900	2.14		4.44
34,250	2.16	4.44			34,250	2.14		4.44
34,600	2.16	4.44			34,600	2.14		4.44
34,950	2.14	4.42			34,950	2.12		4.42
35,300	2.14	4.42			35,300	2.12		4.42
35,650	2.14	4.41			35,650	2.11		4.41
36,000	2.12	4.40			36,000	2.10		4.40
36,350	2.12	4.40			36,350	2.09		4.39
36,700	2.10	4.38			36,700	2.08		4.38
37,050	2.11	4.39			37,050	2.09		4.38
37,400	2.10	4.37			37,400	2.07		4.37
37,750	2.09	4.37			37,750	2.07		4.36
38,100	2.10	4.38			38,100	2.08		4.37
38,450	2.11	4.39			38,450	2.08		4.38
38,800	2.10	4.38			38,800	2.08		4.38
39,150	2.10	4.38			39,150	2.08		4.38
39,500	2.11	4.39			39,500	2.09		4.39
39,850	2.10	4.38			39,850	2.08		4.38
40,200	2.12	4.40			40,200	2.09		4.39
40,550	2.10	4.39			40,550	2.08		4.38
40,900	2.12	4.40			40,900	2.09		4.39
41,250	2.12	4.40			41,250	2.09		4.39
41,600	2.11	4.39			41,600	2.08		4.38

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
41,950	2.13	4.41			41,950	2.10		4.41
42,300	2.11	4.40			42,300	2.09		4.39
42,650	2.13	4.42			42,650	2.11		4.41
43,000	2.13	4.42			43,000	2.11		4.41
43,350	2.13	4.42			43,350	2.11		4.41
43,700	2.12	4.40			43,700	2.09		4.40
44,050	2.13	4.41			44,050	2.10		4.41
44,400	2.13	4.42			44,400	2.11		4.42
44,750	2.13	4.42			44,750	2.11		4.41
45,100	2.14	4.43			45,100	2.12		4.42
45,450	2.14	4.43			45,450	2.11		4.42
45,800	2.15	4.44			45,800	2.13		4.43
46,150	2.14	4.43			46,150	2.12		4.42
46,500	2.15	4.44			46,500	2.13		4.44
46,850	2.15	4.44			46,850	2.12		4.43
47,200	2.15	4.45			47,200	2.13		4.44
47,550	2.16	4.45			47,550	2.13		4.44
47,900	2.15	4.45			47,900	2.13		4.44
48,250	2.16	4.45			48,250	2.13		4.45
48,600	2.16	4.45			48,600	2.14		4.45
48,950	2.16	4.45			48,950	2.13		4.45
49,300	2.16	4.46			49,300	2.14		4.45
49,650	2.16	4.46			49,650	2.14		4.46
50,000	2.16	4.46			50,000	2.14		4.45
50,350	2.17	4.47			50,350	2.15		4.46
50,700	2.17	4.46			50,700	2.14		4.46
51,050	2.16	4.46			51,050	2.14		4.45
51,400	2.16	4.45			51,400	2.13		4.45
51,750	2.16	4.46			51,750	2.13		4.45
52,100	2.15	4.45			52,100	2.13		4.45
52,450	2.14	4.44			52,450	2.12		4.44
52,800	2.15	4.45			52,800	2.13		4.45
53,150	2.16	4.46			53,150	2.13		4.45
53,500	2.15	4.46			53,500	2.13		4.45
53,850	2.15	4.45			53,850	2.13		4.45
54,200	2.15	4.45			54,200	2.13		4.45
54,550	2.15	4.45			54,550	2.12		4.45
54,900	2.14	4.44			54,900	2.11		4.44
55,250	2.16	4.46			55,250	2.13		4.46
55,600	2.14	4.45			55,600	2.12		4.44
55,950	2.14	4.45			55,950	2.12		4.44
56,300	2.14	4.44			56,300	2.11		4.44
56,650	2.15	4.45			56,650	2.12		4.45
57,000	2.13	4.44			57,000	2.10		4.43
57,350	2.14	4.44			57,350	2.11		4.44
57,700	2.14	4.45			57,700	2.12		4.45
58,050	2.13	4.44			58,050	2.11		4.44
58,400	2.14	4.45			58,400	2.12		4.45
58,750	2.12	4.43			58,750	2.09		4.42
59,100	2.13	4.44			59,100	2.10		4.43
59,450	2.13	4.45			59,450	2.11		4.44

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
59,800	2.12	4.43			59,800	2.09		4.43
60,150	2.13	4.44			60,150	2.11		4.44
60,500	2.12	4.43			60,500	2.10		4.43
60,850	2.12	4.44			60,850	2.10		4.43
61,200	2.13	4.44			61,200	2.10		4.44
61,550	2.11	4.43			61,550	2.09		4.42
61,900	2.12	4.43			61,900	2.09		4.43
62,250	2.12	4.44			62,250	2.10		4.44
62,600	2.11	4.43			62,600	2.09		4.42
62,950	2.11	4.43			62,950	2.09		4.43
63,300	2.11	4.44			63,300	2.09		4.43
63,650	2.11	4.43			63,650	2.09		4.43
64,000	2.10	4.42			64,000	2.08		4.42
64,350	2.11	4.43			64,350	2.09		4.43
64,700	2.11	4.44			64,700	2.09		4.43
65,050	2.10	4.42			65,050	2.07		4.42
65,400	2.11	4.43			65,400	2.08		4.43
65,750	2.10	4.43			65,750	2.08		4.42
66,100	2.10	4.42			66,100	2.07		4.42
66,450	2.10	4.42			66,450	2.07		4.42
66,800	2.10	4.43			66,800	2.08		4.42
67,150	2.09	4.42			67,150	2.07		4.42
67,500	2.09	4.42			67,500	2.07		4.41
67,850	2.10	4.43			67,850	2.07		4.42
68,200	2.10	4.43			68,200	2.08		4.43
68,550	2.10	4.44			68,550	2.08		4.43
68,900	2.09	4.43			68,900	2.07		4.42
69,250	2.09	4.42			69,250	2.07		4.42
69,600	2.10	4.43			69,600	2.07		4.43
69,950	2.08	4.42			69,950	2.06		4.42
70,300	2.10	4.44			70,300	2.08		4.44
70,650	2.09	4.43			70,650	2.07		4.43
71,000	2.09	4.43			71,000	2.07		4.42
71,350	2.10	4.44			71,350	2.07		4.43
71,700	2.08	4.42			71,700	2.06		4.42
72,050	2.10	4.44			72,050	2.08		4.44
72,400	2.09	4.43			72,400	2.06		4.42
72,750	2.09	4.44			72,750	2.07		4.43
73,100	2.09	4.44			73,100	2.07		4.43
73,450	2.08	4.43			73,450	2.06		4.42
73,800	2.09	4.44			73,800	2.07		4.44
74,150	2.09	4.44			74,150	2.06		4.43
74,500	2.09	4.44			74,500	2.07		4.44
74,850	2.09	4.44			74,850	2.07		4.44
75,200	2.10	4.46			75,200	2.08		4.45
75,550	2.10	4.45			75,550	2.07		4.44
75,900	2.11	4.47			75,900	2.09		4.46
76,250	2.10	4.46			76,250	2.08		4.45
76,600	2.10	4.45			76,600	2.08		4.45
76,950	2.11	4.47			76,950	2.09		4.46
77,300	2.11	4.47			77,300	2.09		4.46

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
77,650	2.12	4.48			77,650	2.09		4.47
78,000	2.12	4.48			78,000	2.10		4.47
78,350	2.13	4.49			78,350	2.10		4.48
78,700	2.11	4.47			78,700	2.09		4.47
79,050	2.12	4.48			79,050	2.10		4.48
79,400	2.12	4.48			79,400	2.09		4.47
79,750	2.12	4.48			79,750	2.10		4.48
80,100	2.13	4.50			80,100	2.11		4.49
80,450	2.13	4.50			80,450	2.11		4.49
80,800	2.13	4.50			80,800	2.11		4.49
81,150	2.13	4.50			81,150	2.10		4.49
81,500	2.12	4.50			81,500	2.10		4.49
81,850	2.12	4.49			81,850	2.10		4.49
82,200	2.12	4.49			82,200	2.09		4.49
82,550	2.11	4.49			82,550	2.09		4.48
82,900	2.11	4.49			82,900	2.09		4.48
83,250	2.11	4.49			83,250	2.08		4.48
83,600	2.10	4.48			83,600	2.08		4.48
83,950	2.10	4.48			83,950	2.08		4.48
84,300	2.10	4.48			84,300	2.07		4.48
84,650	2.09	4.48			84,650	2.07		4.47
85,000	2.09	4.48			85,000	2.07		4.47
85,350	2.09	4.48			85,350	2.06		4.47
85,700	2.09	4.48			85,700	2.06		4.47
86,050	2.08	4.48			86,050	2.06		4.47
86,400	2.08	4.48			86,400	2.06		4.47
86,750	2.08	4.48			86,750	2.06		4.47
87,100	2.08	4.48			87,100	2.05		4.47
87,450	2.08	4.47			87,450	2.05		4.47
87,800	2.07	4.47			87,800	2.05		4.47
88,150	2.07	4.47			88,150	2.05		4.47
88,500	2.07	4.47			88,500	2.05		4.47
88,850	2.07	4.47			88,850	2.05		4.47
89,200	2.07	4.47			89,200	2.04		4.47
89,550	2.06	4.47			89,550	2.04		4.47
89,900	2.06	4.47			89,900	2.04		4.47
90,250	2.06	4.47			90,250	2.04		4.47
90,600	2.06	4.47			90,600	2.04		4.47
90,950	2.06	4.47			90,950	2.03		4.47
91,300	2.06	4.47			91,300	2.03		4.46
91,650	2.05	4.47			91,650	2.03		4.46
92,000	2.05	4.47			92,000	2.03		4.46
92,350	2.05	4.47			92,350	2.03		4.46
92,700	2.05	4.47			92,700	2.03		4.46
93,050	2.05	4.47			93,050	2.02		4.47
93,400	2.05	4.47			93,400	2.02		4.47
93,750	2.04	4.47			93,750	2.02		4.47
94,100	2.04	4.47			94,100	2.02		4.47
94,450	2.04	4.47			94,450	2.02		4.47
94,800	2.04	4.47			94,800	2.02		4.47
95,150	2.04	4.47			95,150	2.01		4.47

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
95,500	2.04	4.47			95,500	2.01		4.47
95,850	2.03	4.47			95,850	2.01		4.47
96,200	2.03	4.47			96,200	2.01		4.47
96,550	2.03	4.47			96,550	2.01		4.47
96,900	2.03	4.47			96,900	2.01		4.47
97,250	2.03	4.47			97,250	2.00		4.47
97,600	2.03	4.47			97,600	2.00		4.47
97,950	2.03	4.47			97,950	2.00		4.47
98,300	2.02	4.47			98,300	2.00		4.47
98,650	2.02	4.47			98,650	2.00		4.47
99,000	2.02	4.47			99,000	2.00		4.47
99,350	2.02	4.47			99,350	2.00		4.47
99,700	2.02	4.47			99,700	1.99		4.47
100,050	2.02	4.47			100,050	1.99		4.47
100,400	2.02	4.47			100,400	1.99		4.47
100,750	2.01	4.47			100,750	1.99		4.47
101,100	2.01	4.47			101,100	1.99		4.47
101,450	2.01	4.47			101,450	1.99		4.47
101,800	2.01	4.47			101,800	1.99		4.47
102,150	2.01	4.47			102,150	1.99		4.47
102,500	2.01	4.47			102,500	1.98		4.47
102,850	2.01	4.47			102,850	1.98		4.47
103,200	2.00	4.47			103,200	1.98		4.47
103,550	2.00	4.47			103,550	1.98		4.47
103,900	2.00	4.47			103,900	1.98		4.47
104,250	2.00	4.47			104,250	1.98		4.47
104,600	2.00	4.47			104,600	1.97		4.47
104,950	2.00	4.47			104,950	1.97		4.47
105,300	2.00	4.47			105,300	1.97		4.47
105,650	1.99	4.47			105,650	1.97		4.47
106,000	1.99	4.47			106,000	1.97		4.47
106,350	1.99	4.47			106,350	1.97		4.47
106,700	1.99	4.47			106,700	1.96		4.46
107,050	1.99	4.47			107,050	1.96		4.46
107,400	1.98	4.47			107,400	1.96		4.46
107,750	1.98	4.47			107,750	1.96		4.46
108,100	1.98	4.47			108,100	1.96		4.46
108,450	1.98	4.47			108,450	1.96		4.46
108,800	1.98	4.47			108,800	1.95		4.46
109,150	1.98	4.47			109,150	1.95		4.46
109,500	1.97	4.47			109,500	1.95		4.46
109,850	1.97	4.47			109,850	1.95		4.46
110,200	1.97	4.47			110,200	1.95		4.46
110,550	1.97	4.47			110,550	1.95		4.46
110,900	1.97	4.47			110,900	1.95		4.46
111,250	1.97	4.47			111,250	1.95		4.46
111,600	1.97	4.47			111,600	1.94		4.46
111,950	1.97	4.47			111,950	1.94		4.46
112,300	1.97	4.47			112,300	1.94		4.46
112,650	1.97	4.47			112,650	1.94		4.47
113,000	1.97	4.47			113,000	1.94		4.47

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
113,350	1.96	4.47			113,350	1.94		4.47
113,700	1.96	4.47			113,700	1.94		4.47
114,050	1.96	4.47			114,050	1.94		4.47
114,400	1.96	4.47			114,400	1.94		4.47
114,750	1.96	4.47			114,750	1.94		4.47
115,100	1.96	4.47			115,100	1.94		4.47
115,450	1.96	4.47			115,450	1.94		4.47
115,800	1.96	4.48			115,800	1.94		4.47
116,150	1.96	4.48			116,150	1.94		4.47
116,500	1.96	4.48			116,500	1.94		4.47
116,850	1.96	4.48			116,850	1.93		4.47
117,200	1.96	4.48			117,200	1.94		4.47
117,550	1.96	4.48			117,550	1.94		4.47
117,900	1.96	4.48			117,900	1.94		4.48
118,250	1.96	4.48			118,250	1.94		4.48
118,600	1.96	4.48			118,600	1.94		4.48
118,950	1.96	4.48			118,950	1.94		4.48
119,300	1.96	4.49			119,300	1.94		4.48
119,650	1.96	4.49			119,650	1.94		4.48
120,000	1.96	4.49			120,000	1.94		4.48
120,350	1.96	4.49			120,350	1.94		4.48
120,700	1.96	4.49			120,700	1.94		4.49
121,050	1.96	4.49			121,050	1.94		4.49
121,400	1.96	4.49			121,400	1.94		4.49
121,750	1.96	4.49			121,750	1.94		4.49
122,100	1.96	4.50			122,100	1.94		4.49
122,450	1.96	4.50			122,450	1.94		4.49
122,800	1.96	4.50			122,800	1.94		4.49
123,150	1.96	4.50			123,150	1.94		4.49
123,500	1.96	4.50			123,500	1.93		4.49
123,850	1.96	4.50			123,850	1.93		4.49
124,200	1.96	4.50			124,200	1.93		4.49
124,550	1.95	4.50			124,550	1.93		4.49
124,900	1.95	4.50			124,900	1.93		4.49
125,250	1.95	4.50			125,250	1.93		4.49
125,600	1.95	4.50			125,600	1.93		4.49
125,950	1.95	4.50			125,950	1.93		4.49
126,300	1.95	4.50			126,300	1.93		4.49
126,650	1.95	4.50			126,650	1.92		4.49
127,000	1.95	4.50			127,000	1.92		4.49
127,350	1.95	4.50			127,350	1.92		4.49
127,700	1.94	4.50			127,700	1.92		4.49
128,050	1.94	4.49			128,050	1.92		4.49
128,400	1.94	4.49			128,400	1.92		4.49
128,750	1.94	4.49			128,750	1.91		4.49
129,100	1.93	4.49			129,100	1.91		4.48
129,450	1.93	4.49			129,450	1.91		4.48
129,800	1.93	4.49			129,800	1.91		4.48
130,150	1.93	4.49			130,150	1.90		4.48
130,500	1.93	4.48			130,500	1.90		4.48
130,850	1.92	4.48			130,850	1.90		4.48

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
131,200	1.92	4.48			131,200	1.90		4.48
131,550	1.92	4.48			131,550	1.90		4.48
131,900	1.92	4.48			131,900	1.89		4.47
132,250	1.92	4.48			132,250	1.89		4.47
132,600	1.91	4.48			132,600	1.89		4.47
132,950	1.91	4.48			132,950	1.89		4.47
133,300	1.91	4.48			133,300	1.89		4.47
133,650	1.91	4.47			133,650	1.88		4.47
134,000	1.91	4.47			134,000	1.88		4.47
134,350	1.90	4.47			134,350	1.88		4.47
134,700	1.90	4.47			134,700	1.88		4.47
135,050	1.90	4.47			135,050	1.88		4.47
135,400	1.90	4.47			135,400	1.87		4.46
135,750	1.90	4.47			135,750	1.87		4.46
136,100	1.89	4.47			136,100	1.87		4.46
136,450	1.89	4.47			136,450	1.87		4.46
136,800	1.89	4.47			136,800	1.87		4.46
137,150	1.89	4.47			137,150	1.87		4.46
137,500	1.89	4.46			137,500	1.86		4.46
137,850	1.89	4.46			137,850	1.86		4.46
138,200	1.88	4.46			138,200	1.86		4.46
138,550	1.88	4.46			138,550	1.86		4.46
138,900	1.88	4.46			138,900	1.86		4.46
139,250	1.88	4.46			139,250	1.86		4.45
139,600	1.88	4.46			139,600	1.85		4.45
139,950	1.88	4.46			139,950	1.85		4.45
140,300	1.87	4.46			140,300	1.85		4.45
140,650	1.87	4.46			140,650	1.85		4.45
141,000	1.87	4.46			141,000	1.85		4.45
141,350	1.87	4.46			141,350	1.85		4.45
141,700	1.87	4.45			141,700	1.84		4.45
142,050	1.87	4.45			142,050	1.84		4.45
142,400	1.86	4.45			142,400	1.84		4.45
142,750	1.86	4.45			142,750	1.84		4.45
143,100	1.86	4.45			143,100	1.84		4.45
143,450	1.86	4.45			143,450	1.84		4.45
143,800	1.86	4.45			143,800	1.84		4.45
144,150	1.86	4.45			144,150	1.84		4.45
144,500	1.86	4.45			144,500	1.83		4.45
144,850	1.86	4.45			144,850	1.83		4.45
145,200	1.86	4.45			145,200	1.83		4.45
145,550	1.85	4.45			145,550	1.83		4.45
145,900	1.85	4.45			145,900	1.83		4.45
146,250	1.85	4.45			146,250	1.83		4.44
146,600	1.85	4.45			146,600	1.83		4.44
146,950	1.85	4.45			146,950	1.83		4.44
147,300	1.85	4.45			147,300	1.83		4.44
147,650	1.85	4.45			147,650	1.82		4.44
148,000	1.85	4.45			148,000	1.82		4.44
148,350	1.85	4.45			148,350	1.82		4.44
148,700	1.84	4.45			148,700	1.82		4.44

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
149,050	1.84	4.45			149,050	1.82		4.44
149,400	1.84	4.45			149,400	1.82		4.44
149,750	1.84	4.45			149,750	1.82		4.44
150,100	1.84	4.45			150,100	1.82		4.44
150,450	1.84	4.45			150,450	1.82		4.44
150,800	1.84	4.45			150,800	1.82		4.44
151,150	1.84	4.45			151,150	1.82		4.44
151,500	1.84	4.45			151,500	1.81		4.44
151,850	1.84	4.45			151,850	1.81		4.44
152,200	1.84	4.45			152,200	1.81		4.44
152,550	1.84	4.45			152,550	1.81		4.44
152,900	1.84	4.45			152,900	1.81		4.44
153,250	1.83	4.45			153,250	1.81		4.44
153,600	1.83	4.45			153,600	1.81		4.44
153,950	1.83	4.45			153,950	1.81		4.44
154,300	1.83	4.45			154,300	1.81		4.44
154,650	1.83	4.45			154,650	1.81		4.44
155,000	1.83	4.45			155,000	1.81		4.45
155,350	1.83	4.45			155,350	1.81		4.45
155,700	1.83	4.45			155,700	1.81		4.45
156,050	1.83	4.45			156,050	1.81		4.45
156,400	1.83	4.45			156,400	1.81		4.45
156,750	1.83	4.45			156,750	1.81		4.45
157,100	1.83	4.45			157,100	1.81		4.45
157,450	1.83	4.46			157,450	1.81		4.45
157,800	1.83	4.46			157,800	1.81		4.45
158,150	1.83	4.46			158,150	1.81		4.45
158,500	1.83	4.46			158,500	1.81		4.45
158,850	1.83	4.46			158,850	1.81		4.45
159,200	1.83	4.46			159,200	1.81		4.45
159,550	1.83	4.46			159,550	1.81		4.45
159,900	1.83	4.46			159,900	1.81		4.45
160,250	1.83	4.46			160,250	1.81		4.46
160,600	1.83	4.46			160,600	1.81		4.46
160,950	1.83	4.46			160,950	1.81		4.46
161,300	1.83	4.46			161,300	1.81		4.46
161,650	1.83	4.46			161,650	1.80		4.46
162,000	1.83	4.46			162,000	1.80		4.46
162,350	1.83	4.46			162,350	1.80		4.45
162,700	1.83	4.46			162,700	1.80		4.45
163,050	1.82	4.46			163,050	1.80		4.45
163,400	1.82	4.46			163,400	1.80		4.45
163,750	1.82	4.46			163,750	1.80		4.45
164,100	1.82	4.46			164,100	1.80		4.45
164,450	1.82	4.46			164,450	1.80		4.45
164,800	1.82	4.46			164,800	1.80		4.45
165,150	1.82	4.46			165,150	1.79		4.45
165,500	1.82	4.46			165,500	1.79		4.45
165,850	1.82	4.46			165,850	1.79		4.45
166,200	1.82	4.46			166,200	1.79		4.45
166,550	1.81	4.46			166,550	1.79		4.45

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
166,900	1.81	4.46			166,900	1.79		4.45
167,250	1.81	4.45			167,250	1.79		4.45
167,600	1.81	4.45			167,600	1.79		4.45
167,950	1.81	4.45			167,950	1.79		4.45
168,300	1.81	4.45			168,300	1.78		4.45
168,650	1.81	4.45			168,650	1.78		4.45
169,000	1.80	4.45			169,000	1.78		4.45
169,350	1.80	4.45			169,350	1.78		4.44
169,700	1.80	4.45			169,700	1.78		4.44
170,050	1.80	4.45			170,050	1.78		4.44
170,400	1.80	4.45			170,400	1.77		4.44
170,750	1.80	4.45			170,750	1.77		4.44
171,100	1.80	4.45			171,100	1.77		4.44
171,450	1.79	4.44			171,450	1.77		4.44
171,800	1.79	4.44			171,800	1.77		4.44
172,150	1.79	4.44			172,150	1.77		4.44
172,500	1.79	4.44			172,500	1.77		4.44
172,850	1.79	4.44			172,850	1.76		4.44
173,200	1.79	4.44			173,200	1.76		4.43
173,550	1.79	4.44			173,550	1.76		4.43
173,900	1.78	4.44			173,900	1.76		4.43
174,250	1.78	4.44			174,250	1.76		4.43
174,600	1.78	4.44			174,600	1.76		4.43
174,950	1.78	4.44			174,950	1.76		4.44
175,300	1.78	4.44			175,300	1.76		4.44
175,650	1.78	4.44			175,650	1.76		4.44
176,000	1.78	4.44			176,000	1.76		4.44
176,350	1.78	4.44			176,350	1.76		4.44
176,700	1.78	4.44			176,700	1.76		4.44
177,050	1.78	4.44			177,050	1.76		4.44
177,400	1.78	4.44			177,400	1.76		4.44
177,750	1.78	4.44			177,750	1.76		4.44
178,100	1.78	4.44			178,100	1.76		4.44
178,450	1.78	4.44			178,450	1.76		4.44
178,800	1.78	4.44			178,800	1.75		4.44
179,150	1.78	4.44			179,150	1.75		4.44
179,500	1.78	4.44			179,500	1.75		4.44
179,850	1.78	4.44			179,850	1.75		4.44
180,200	1.78	4.44			180,200	1.75		4.44
180,550	1.78	4.44			180,550	1.75		4.44
180,900	1.78	4.45			180,900	1.75		4.44
181,250	1.78	4.45			181,250	1.75		4.44
181,600	1.78	4.45			181,600	1.75		4.44
181,950	1.78	4.45			181,950	1.75		4.44
182,300	1.78	4.45			182,300	1.75		4.44
182,650	1.78	4.45			182,650	1.75		4.44
183,000	1.78	4.45			183,000	1.75		4.44
183,350	1.78	4.45			183,350	1.75		4.44
183,700	1.78	4.45			183,700	1.75		4.44
184,050	1.78	4.45			184,050	1.76		4.44
184,400	1.78	4.45			184,400	1.76		4.44

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
184,750	1.78	4.45			*184,750*	1.76		4.45
185,100	1.78	4.45			*185,100*	1.76		4.45
185,450	1.78	4.45			*185,450*	1.76		4.45
185,800	1.78	4.45			*185,800*	1.76		4.45
186,150	1.78	4.45			*186,150*	1.75		4.45
186,500	1.78	4.45			*186,500*	1.75		4.44
186,850	1.78	4.45			*186,850*	1.75		4.44
187,200	1.77	4.45			*187,200*	1.75		4.44
187,550	1.77	4.45			*187,550*	1.75		4.44
187,900	1.77	4.44			*187,900*	1.75		4.44
188,250	1.77	4.44			*188,250*	1.74		4.44
188,600	1.77	4.44			*188,600*	1.74		4.44
188,950	1.77	4.44			*188,950*	1.74		4.43
189,300	1.76	4.44			*189,300*	1.74		4.43
189,650	1.76	4.44			*189,650*	1.74		4.43
190,000	1.76	4.44			*190,000*	1.74		4.43
190,350	1.76	4.43			*190,350*	1.73		4.43
190,700	1.76	4.43			*190,700*	1.73		4.43
191,050	1.76	4.43			*191,050*	1.73		4.43
191,400	1.75	4.43			*191,400*	1.73		4.42
191,750	1.75	4.43			*191,750*	1.73		4.42
192,100	1.75	4.43			*192,100*	1.73		4.42
192,450	1.75	4.43			*192,450*	1.73		4.42
192,800	1.75	4.43			*192,800*	1.72		4.42
193,150	1.75	4.43			*193,150*	1.72		4.42
193,500	1.75	4.43			*193,500*	1.72		4.42
193,850	1.75	4.43			*193,850*	1.72		4.42
194,200	1.75	4.43			*194,200*	1.72		4.42
194,550	1.75	4.43			*194,550*	1.72		4.42
194,900	1.74	4.43			*194,900*	1.72		4.42
195,250	1.74	4.43			*195,250*	1.72		4.42
195,600	1.74	4.43			*195,600*	1.72		4.42
195,950	1.74	4.43			*195,950*	1.72		4.42
196,300	1.74	4.43			*196,300*	1.72		4.42
196,650	1.74	4.43			*196,650*	1.72		4.42
197,000	1.74	4.43			*197,000*	1.72		4.42
197,350	1.74	4.43			*197,350*	1.72		4.42
197,700	1.74	4.43			*197,700*	1.72		4.42
198,050	1.74	4.43			*198,050*	1.71		4.42
198,400	1.74	4.43			*198,400*	1.71		4.42
198,750	1.74	4.43			*198,750*	1.71		4.42
199,100	1.74	4.43			*199,100*	1.71		4.42
199,450	1.74	4.43			*199,450*	1.71		4.42
199,800	1.73	4.43			*199,800*	1.71		4.42
200,150	1.73	4.43			*200,150*	1.71		4.42
200,500	1.73	4.43			*200,500*	1.71		4.42
200,850	1.73	4.43			*200,850*	1.71		4.42
201,200	1.73	4.43			*201,200*	1.71		4.42
201,550	1.73	4.43			*201,550*	1.71		4.42
201,900	1.73	4.43			*201,900*	1.71		4.42
202,250	1.73	4.43			*202,250*	1.70		4.42

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
202,600	1.73	4.43			202,600	1.70		4.42
202,950	1.73	4.42			202,950	1.70		4.42
203,300	1.73	4.42			203,300	1.70		4.42
203,650	1.72	4.42			203,650	1.70		4.42
204,000	1.72	4.42			204,000	1.70		4.42
204,350	1.72	4.42			204,350	1.70		4.42
204,700	1.72	4.42			204,700	1.70		4.42
205,050	1.72	4.42			205,050	1.70		4.42
205,400	1.72	4.42			205,400	1.70		4.42
205,750	1.72	4.42			205,750	1.70		4.42
206,100	1.72	4.42			206,100	1.70		4.42
206,450	1.72	4.43			206,450	1.70		4.42
206,800	1.72	4.43			206,800	1.70		4.42
207,150	1.72	4.43			207,150	1.70		4.42
207,500	1.72	4.43			207,500	1.69		4.42
207,850	1.72	4.43			207,850	1.69		4.42
208,200	1.72	4.43			208,200	1.69		4.42
208,550	1.72	4.43			208,550	1.69		4.42
208,900	1.72	4.43			208,900	1.69		4.42
209,250	1.72	4.43			209,250	1.69		4.42
209,600	1.72	4.43			209,600	1.69		4.42
209,950	1.72	4.43			209,950	1.69		4.42
210,300	1.72	4.43			210,300	1.69		4.42
210,650	1.72	4.43			210,650	1.69		4.42
211,000	1.71	4.43			211,000	1.69		4.42
211,350	1.71	4.43			211,350	1.69		4.42
211,700	1.71	4.43			211,700	1.69		4.42
212,050	1.71	4.43			212,050	1.69		4.43
212,400	1.71	4.43			212,400	1.69		4.43
212,750	1.71	4.43			212,750	1.69		4.43
213,100	1.71	4.43			213,100	1.69		4.43
213,450	1.71	4.43			213,450	1.69		4.43
213,800	1.71	4.43			213,800	1.69		4.43
214,150	1.71	4.43			214,150	1.69		4.43
214,500	1.71	4.43			214,500	1.69		4.43
214,850	1.71	4.43			214,850	1.69		4.43
215,200	1.71	4.43			215,200	1.68		4.43
215,550	1.71	4.43			215,550	1.68		4.43
215,900	1.71	4.43			215,900	1.68		4.43
216,250	1.71	4.43			216,250	1.68		4.43
216,600	1.71	4.43			216,600	1.68		4.43
216,950	1.71	4.43			216,950	1.68		4.43
217,300	1.71	4.43			217,300	1.68		4.43
217,650	1.71	4.43			217,650	1.68		4.43
218,000	1.70	4.43			218,000	1.68		4.43
218,350	1.70	4.43			218,350	1.68		4.43
218,700	1.70	4.43			218,700	1.68		4.43
219,050	1.70	4.43			219,050	1.68		4.43
219,400	1.70	4.43			219,400	1.68		4.43
219,750	1.70	4.43			219,750	1.68		4.43
220,100	1.70	4.43			220,100	1.68		4.43

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
220,450	1.70	4.44			220,450	1.68		4.43
220,800	1.70	4.44			220,800	1.68		4.43
221,150	1.70	4.44			221,150	1.68		4.43
221,500	1.70	4.44			221,500	1.68		4.43
221,850	1.70	4.44			221,850	1.68		4.43
222,200	1.70	4.44			222,200	1.68		4.43
222,550	1.70	4.44			222,550	1.68		4.43
222,900	1.70	4.44			222,900	1.68		4.43
223,250	1.70	4.44			223,250	1.68		4.43
223,600	1.70	4.44			223,600	1.67		4.43
223,950	1.70	4.44			223,950	1.67		4.43
224,300	1.70	4.44			224,300	1.67		4.43
224,650	1.70	4.44			224,650	1.67		4.43
225,000	1.70	4.44			225,000	1.67		4.43
225,350	1.70	4.44			225,350	1.67		4.43
225,700	1.69	4.44			225,700	1.67		4.43
226,050	1.69	4.44			226,050	1.67		4.43
226,400	1.69	4.44			226,400	1.67		4.43
226,750	1.69	4.43			226,750	1.67		4.43
227,100	1.69	4.43			227,100	1.66		4.43
227,450	1.69	4.43			227,450	1.66		4.43
227,800	1.68	4.43			227,800	1.66		4.43
228,150	1.68	4.43			228,150	1.66		4.42
228,500	1.68	4.43			228,500	1.66		4.42
228,850	1.68	4.43			228,850	1.65		4.42
229,200	1.68	4.43			229,200	1.65		4.42
229,550	1.67	4.43			229,550	1.65		4.42
229,900	1.67	4.42			229,900	1.65		4.42
230,250	1.67	4.42			230,250	1.65		4.42
230,600	1.67	4.42			230,600	1.64		4.42
230,950	1.67	4.42			230,950	1.64		4.42
231,300	1.67	4.42			231,300	1.64		4.42
231,650	1.66	4.42			231,650	1.64		4.42
232,000	1.66	4.42			232,000	1.64		4.41
232,350	1.66	4.42			232,350	1.64		4.41
232,700	1.66	4.42			232,700	1.64		4.41
233,050	1.66	4.42			233,050	1.63		4.41
233,400	1.66	4.42			233,400	1.63		4.41
233,750	1.66	4.42			233,750	1.63		4.41
234,100	1.65	4.42			234,100	1.63		4.41
234,450	1.65	4.42			234,450	1.63		4.41
234,800	1.65	4.42			234,800	1.63		4.41
235,150	1.65	4.41			235,150	1.63		4.41
235,500	1.65	4.41			235,500	1.62		4.41
235,850	1.65	4.41			235,850	1.62		4.41
236,200	1.65	4.41			236,200	1.62		4.41
236,550	1.64	4.41			236,550	1.62		4.41
236,900	1.64	4.41			236,900	1.62		4.40
237,250	1.64	4.41			237,250	1.62		4.40
237,600	1.64	4.41			237,600	1.61		4.40
237,950	1.64	4.41			237,950	1.61		4.40

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
238,300	1.63	4.41			238,300	1.61		4.40
238,650	1.63	4.40			238,650	1.61		4.40
239,000	1.63	4.40			239,000	1.61		4.40
239,350	1.63	4.40			239,350	1.60		4.40
239,700	1.63	4.40			239,700	1.60		4.39
240,050	1.62	4.40			240,050	1.60		4.39
240,400	1.62	4.40			240,400	1.60		4.39
240,750	1.62	4.40			240,750	1.60		4.39
241,100	1.62	4.40			241,100	1.59		4.39
241,450	1.62	4.39			241,450	1.59		4.39
241,800	1.61	4.39			241,800	1.59		4.39
242,150	1.61	4.39			242,150	1.59		4.39
242,500	1.61	4.39			242,500	1.59		4.38
242,850	1.61	4.39			242,850	1.58		4.38
243,200	1.61	4.39			243,200	1.58		4.38
243,550	1.61	4.39			243,550	1.58		4.38
243,900	1.60	4.39			243,900	1.58		4.38
244,250	1.60	4.39			244,250	1.58		4.38
244,600	1.60	4.39			244,600	1.58		4.38
244,950	1.60	4.39			244,950	1.58		4.38
245,300	1.60	4.39			245,300	1.58		4.38
245,650	1.60	4.39			245,650	1.57		4.38
246,000	1.60	4.39			246,000	1.57		4.38
246,350	1.60	4.39			246,350	1.57		4.38
246,700	1.59	4.38			246,700	1.57		4.38
247,050	1.59	4.38			247,050	1.57		4.38
247,400	1.59	4.38			247,400	1.57		4.38
247,750	1.59	4.38			247,750	1.57		4.38
248,100	1.59	4.38			248,100	1.57		4.38
248,450	1.59	4.38			248,450	1.56		4.38
248,800	1.59	4.38			248,800	1.56		4.38
249,150	1.59	4.38			249,150	1.56		4.38
249,500	1.59	4.38			249,500	1.56		4.38
249,850	1.58	4.38			249,850	1.56		4.38
250,200	1.58	4.38			250,200	1.56		4.38
250,550	1.58	4.38			250,550	1.56		4.38
250,900	1.58	4.38			250,900	1.56		4.38
251,250	1.58	4.38			251,250	1.56		4.37
251,600	1.58	4.38			251,600	1.55		4.37
251,950	1.58	4.38			251,950	1.55		4.37
252,300	1.58	4.38			252,300	1.55		4.37
252,650	1.58	4.38			252,650	1.55		4.37
253,000	1.57	4.38			253,000	1.55		4.37
253,350	1.57	4.38			253,350	1.55		4.37
253,700	1.57	4.38			253,700	1.55		4.37
254,050	1.57	4.38			254,050	1.55		4.37
254,400	1.57	4.38			254,400	1.55		4.37
254,750	1.57	4.38			254,750	1.54		4.37
255,100	1.57	4.38			255,100	1.54		4.37
255,450	1.57	4.38			255,450	1.54		4.37
255,800	1.56	4.38			255,800	1.54		4.37

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
256,150	1.56	4.37			256,150	1.54		4.37
256,500	1.56	4.37			256,500	1.54		4.37
256,850	1.56	4.37			256,850	1.53		4.37
257,200	1.56	4.37			257,200	1.53		4.37
257,550	1.56	4.37			257,550	1.53		4.36
257,900	1.55	4.37			257,900	1.53		4.36
258,250	1.55	4.37			258,250	1.53		4.36
258,600	1.55	4.37			258,600	1.53		4.36
258,950	1.55	4.37			258,950	1.52		4.36
259,300	1.55	4.36			259,300	1.52		4.36
259,650	1.54	4.36			259,650	1.52		4.36
260,000	1.54	4.36			260,000	1.52		4.36
260,350	1.54	4.36			260,350	1.52		4.36
260,700	1.54	4.36			260,700	1.52		4.36
261,050	1.54	4.36			261,050	1.51		4.35
261,400	1.54	4.36			261,400	1.51		4.35
261,750	1.53	4.36			261,750	1.51		4.35
262,100	1.53	4.36			262,100	1.51		4.35
262,450	1.53	4.36			262,450	1.51		4.35
262,800	1.53	4.36			262,800	1.51		4.35
263,150	1.53	4.35			263,150	1.50		4.35
263,500	1.53	4.35			263,500	1.50		4.35
263,850	1.53	4.35			263,850	1.50		4.35
264,200	1.52	4.35			264,200	1.50		4.35
264,550	1.52	4.35			264,550	1.50		4.35
264,900	1.52	4.35			264,900	1.50		4.35
265,250	1.52	4.35			265,250	1.49		4.35
265,600	1.52	4.35			265,600	1.49		4.34
265,950	1.52	4.35			265,950	1.49		4.34
266,300	1.51	4.35			266,300	1.49		4.34
266,650	1.51	4.35			266,650	1.49		4.34
267,000	1.51	4.35			267,000	1.49		4.34
267,350	1.51	4.35			267,350	1.49		4.34
267,700	1.51	4.35			267,700	1.48		4.34
268,050	1.51	4.35			268,050	1.48		4.34
268,400	1.50	4.34			268,400	1.48		4.34
268,750	1.50	4.34			268,750	1.48		4.34
269,100	1.50	4.34			269,100	1.48		4.34
269,450	1.50	4.34			269,450	1.48		4.34
269,800	1.50	4.34			269,800	1.47		4.33
270,150	1.50	4.34			270,150	1.47		4.33
270,500	1.49	4.34			270,500	1.47		4.33
270,850	1.49	4.34			270,850	1.47		4.33
271,200	1.49	4.34			271,200	1.47		4.33
271,550	1.49	4.34			271,550	1.47		4.33
271,900	1.49	4.33			271,900	1.46		4.33
272,250	1.49	4.33			272,250	1.46		4.33
272,600	1.49	4.33			272,600	1.46		4.33
272,950	1.48	4.33			272,950	1.46		4.33
273,300	1.48	4.33			273,300	1.46		4.33
273,650	1.48	4.33			273,650	1.46		4.32

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
274,000	1.48	4.33			274,000	1.45		4.32
274,350	1.48	4.33			274,350	1.45		4.32
274,700	1.48	4.33			274,700	1.45		4.32
275,050	1.47	4.33			275,050	1.45		4.32
275,400	1.47	4.33			275,400	1.45		4.32
275,750	1.47	4.33			275,750	1.45		4.32
276,100	1.47	4.33			276,100	1.45		4.32
276,450	1.47	4.33			276,450	1.45		4.32
276,800	1.47	4.33			276,800	1.45		4.32
277,150	1.47	4.33			277,150	1.44		4.32
277,500	1.47	4.33			277,500	1.44		4.32
277,850	1.47	4.33			277,850	1.44		4.32
278,200	1.47	4.33			278,200	1.44		4.32
278,550	1.46	4.33			278,550	1.44		4.32
278,900	1.46	4.33			278,900	1.44		4.32
279,250	1.46	4.33			279,250	1.44		4.32
279,600	1.46	4.32			279,600	1.44		4.32
279,950	1.46	4.32			279,950	1.44		4.32
280,300	1.46	4.32			280,300	1.43		4.32
280,650	1.46	4.32			280,650	1.43		4.32
281,000	1.46	4.32			281,000	1.43		4.32
281,350	1.45	4.32			281,350	1.43		4.32
281,700	1.45	4.32			281,700	1.43		4.32
282,050	1.45	4.32			282,050	1.43		4.31
282,400	1.45	4.32			282,400	1.43		4.31
282,750	1.45	4.32			282,750	1.42		4.31
283,100	1.45	4.32			283,100	1.42		4.31
283,450	1.44	4.32			283,450	1.42		4.31
283,800	1.44	4.32			283,800	1.42		4.31
284,150	1.44	4.31			284,150	1.42		4.31
284,500	1.44	4.31			284,500	1.42		4.31
284,850	1.44	4.31			284,850	1.41		4.31
285,200	1.44	4.31			285,200	1.41		4.31
285,550	1.44	4.31			285,550	1.41		4.31
285,900	1.43	4.31			285,900	1.41		4.30
286,250	1.43	4.31			286,250	1.41		4.30
286,600	1.43	4.31			286,600	1.41		4.30
286,950	1.43	4.31			286,950	1.41		4.30
287,300	1.43	4.31			287,300	1.40		4.30
287,650	1.43	4.31			287,650	1.40		4.30
288,000	1.43	4.31			288,000	1.40		4.30
288,350	1.43	4.31			288,350	1.40		4.30
288,700	1.42	4.31			288,700	1.40		4.30
289,050	1.42	4.31			289,050	1.40		4.30
289,400	1.42	4.31			289,400	1.40		4.30
289,750	1.42	4.31			289,750	1.40		4.30
290,100	1.42	4.31			290,100	1.40		4.30
290,450	1.42	4.31			290,450	1.40		4.30
290,800	1.42	4.31			290,800	1.40		4.30
291,150	1.42	4.31			291,150	1.39		4.30
291,500	1.42	4.31			291,500	1.39		4.30

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
291,850	1.42	4.31			291,850	1.39		4.30
292,200	1.42	4.31			292,200	1.39		4.30
292,550	1.41	4.31			292,550	1.39		4.30
292,900	1.41	4.31			292,900	1.39		4.30
293,250	1.41	4.31			293,250	1.39		4.30
293,600	1.41	4.31			293,600	1.39		4.30
293,950	1.41	4.31			293,950	1.39		4.30
294,300	1.41	4.31			294,300	1.39		4.30
294,650	1.41	4.31			294,650	1.38		4.30
295,000	1.41	4.31			295,000	1.38		4.30
295,350	1.41	4.30			295,350	1.38		4.30
295,700	1.40	4.30			295,700	1.38		4.30
296,050	1.40	4.30			296,050	1.38		4.30
296,400	1.40	4.30			296,400	1.38		4.30
296,750	1.40	4.30			296,750	1.38		4.30
297,100	1.40	4.30			297,100	1.38		4.30
297,450	1.40	4.30			297,450	1.38		4.30
297,800	1.40	4.30			297,800	1.37		4.30
298,150	1.40	4.30			298,150	1.37		4.30
298,500	1.40	4.30			298,500	1.37		4.30
298,850	1.40	4.30			298,850	1.37		4.30
299,200	1.39	4.30			299,200	1.37		4.30
299,550	1.39	4.30			299,550	1.37		4.29
299,900	1.39	4.30			299,900	1.37		4.29
300,250	1.39	4.30			300,250	1.37		4.29
300,600	1.39	4.30			300,600	1.37		4.29
300,950	1.39	4.30			300,950	1.37		4.29
301,300	1.39	4.30			301,300	1.36		4.29
301,650	1.39	4.30			301,650	1.36		4.29
302,000	1.39	4.30			302,000	1.36		4.29
302,350	1.39	4.30			302,350	1.36		4.29
302,700	1.39	4.30			302,700	1.36		4.29
303,050	1.38	4.30			303,050	1.36		4.29
303,400	1.38	4.30			303,400	1.36		4.29
303,750	1.38	4.30			303,750	1.36		4.29
304,100	1.38	4.30			304,100	1.36		4.29
304,450	1.38	4.30			304,450	1.36		4.29
304,800	1.38	4.30			304,800	1.36		4.29
305,150	1.38	4.30			305,150	1.36		4.29
305,500	1.38	4.30			305,500	1.35		4.29
305,850	1.38	4.30			305,850	1.35		4.29
306,200	1.38	4.30			306,200	1.35		4.29
306,550	1.37	4.30			306,550	1.35		4.29
306,900	1.37	4.30			306,900	1.35		4.29
307,250	1.37	4.30			307,250	1.35		4.29
307,600	1.37	4.30			307,600	1.35		4.29
307,950	1.37	4.30			307,950	1.34		4.29
308,300	1.37	4.29			308,300	1.34		4.29
308,650	1.37	4.29			308,650	1.34		4.29
309,000	1.36	4.29			309,000	1.34		4.29
309,350	1.36	4.29			309,350	1.34		4.29

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
309,700	1.36	4.29			309,700	1.34		4.29
310,050	1.36	4.29			310,050	1.34		4.29
310,400	1.36	4.29			310,400	1.33		4.29
310,750	1.36	4.29			310,750	1.33		4.28
311,100	1.36	4.29			311,100	1.33		4.28
311,450	1.35	4.29			311,450	1.33		4.28
311,800	1.35	4.29			311,800	1.33		4.28
312,150	1.35	4.29			312,150	1.33		4.28
312,500	1.35	4.29			312,500	1.33		4.28
312,850	1.35	4.29			312,850	1.33		4.28
313,200	1.35	4.29			313,200	1.33		4.28
313,550	1.35	4.29			313,550	1.32		4.28
313,900	1.35	4.29			313,900	1.32		4.28
314,250	1.35	4.29			314,250	1.32		4.28
314,600	1.35	4.29			314,600	1.32		4.28
314,950	1.35	4.29			314,950	1.32		4.28
315,300	1.34	4.29			315,300	1.32		4.28
315,650	1.34	4.29			315,650	1.32		4.28
316,000	1.34	4.29			316,000	1.32		4.28
316,350	1.34	4.29			316,350	1.32		4.28
316,700	1.34	4.29			316,700	1.32		4.28
317,050	1.34	4.29			317,050	1.32		4.28
317,400	1.34	4.29			317,400	1.32		4.28
317,750	1.34	4.29			317,750	1.31		4.28
318,100	1.34	4.29			318,100	1.31		4.28
318,450	1.34	4.29			318,450	1.31		4.28
318,800	1.34	4.29			318,800	1.31		4.28
319,150	1.33	4.29			319,150	1.31		4.28
319,500	1.33	4.29			319,500	1.31		4.28
319,850	1.33	4.29			319,850	1.31		4.28
320,200	1.33	4.28			320,200	1.31		4.28
320,550	1.33	4.28			320,550	1.30		4.28
320,900	1.33	4.28			320,900	1.30		4.28
321,250	1.33	4.28			321,250	1.30		4.28
321,600	1.32	4.28			321,600	1.30		4.28
321,950	1.32	4.28			321,950	1.30		4.28
322,300	1.32	4.28			322,300	1.30		4.28
322,650	1.32	4.28			322,650	1.30		4.27
323,000	1.32	4.28			323,000	1.29		4.27
323,350	1.32	4.28			323,350	1.29		4.27
323,700	1.32	4.28			323,700	1.29		4.27
324,050	1.31	4.28			324,050	1.29		4.27
324,400	1.31	4.28			324,400	1.29		4.27
324,750	1.31	4.28			324,750	1.29		4.27
325,100	1.31	4.28			325,100	1.29		4.27
325,450	1.31	4.28			325,450	1.29		4.27
325,800	1.31	4.28			325,800	1.29		4.28
326,150	1.31	4.28			326,150	1.29		4.28
326,500	1.31	4.28			326,500	1.29		4.28
326,850	1.32	4.28			326,850	1.29		4.28
327,200	1.32	4.29			327,200	1.29		4.28

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
327,550	1.32	4.29			327,550	1.29		4.28
327,900	1.32	4.29			327,900	1.29		4.28
328,250	1.32	4.29			328,250	1.29		4.28
328,600	1.32	4.29			328,600	1.29		4.29
328,950	1.32	4.29			328,950	1.29		4.29
329,300	1.32	4.29			329,300	1.29		4.29
329,650	1.32	4.30			329,650	1.30		4.29
330,000	1.32	4.30			330,000	1.30		4.29
330,350	1.32	4.30			330,350	1.30		4.29
330,700	1.32	4.30			330,700	1.30		4.29
331,050	1.32	4.30			331,050	1.30		4.29
331,400	1.32	4.30			331,400	1.30		4.29
331,750	1.32	4.30			331,750	1.29		4.29
332,100	1.32	4.30			332,100	1.29		4.29
332,450	1.32	4.30			332,450	1.29		4.29
332,800	1.32	4.30			332,800	1.29		4.29
333,150	1.32	4.30			333,150	1.29		4.29
333,500	1.31	4.30			333,500	1.29		4.29
333,850	1.31	4.30			333,850	1.29		4.29
334,200	1.31	4.30			334,200	1.29		4.29
334,550	1.31	4.30			334,550	1.29		4.29
334,900	1.31	4.30			334,900	1.29		4.29
335,250	1.31	4.30			335,250	1.29		4.29
335,600	1.31	4.30			335,600	1.29		4.29
335,950	1.31	4.30			335,950	1.28		4.29
336,300	1.31	4.30			336,300	1.28		4.29
336,650	1.31	4.30			336,650	1.28		4.29
337,000	1.31	4.30			337,000	1.28		4.29
337,350	1.30	4.30			337,350	1.28		4.29
337,700	1.30	4.30			337,700	1.28		4.29
338,050	1.30	4.30			338,050	1.28		4.29
338,400	1.30	4.30			338,400	1.28		4.29
338,750	1.30	4.29			338,750	1.28		4.29
339,100	1.30	4.29			339,100	1.27		4.29
339,450	1.30	4.29			339,450	1.27		4.29
339,800	1.30	4.29			339,800	1.27		4.29
340,150	1.29	4.29			340,150	1.27		4.29
340,500	1.29	4.29			340,500	1.27		4.29
340,850	1.29	4.29			340,850	1.27		4.28
341,200	1.29	4.29			341,200	1.26		4.28
341,550	1.29	4.29			341,550	1.26		4.28
341,900	1.28	4.29			341,900	1.26		4.28
342,250	1.28	4.28			342,250	1.26		4.28
342,600	1.28	4.28			342,600	1.26		4.28
342,950	1.28	4.28			342,950	1.25		4.28
343,300	1.28	4.28			343,300	1.25		4.27
343,650	1.27	4.28			343,650	1.25		4.27
344,000	1.27	4.28			344,000	1.25		4.27
344,350	1.27	4.28			344,350	1.25		4.27
344,700	1.27	4.28			344,700	1.24		4.27
345,050	1.27	4.28			345,050	1.24		4.27

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
345,400	1.27	4.28			345,400	1.24		4.27
345,750	1.26	4.28			345,750	1.24		4.27
346,100	1.26	4.27			346,100	1.24		4.27
346,450	1.26	4.27			346,450	1.24		4.27
346,800	1.26	4.27			346,800	1.24		4.27
347,150	1.26	4.27			347,150	1.23		4.27
347,500	1.26	4.27			347,500	1.23		4.27
347,850	1.26	4.27			347,850	1.23		4.27
348,200	1.25	4.27			348,200	1.23		4.27
348,550	1.25	4.27			348,550	1.23		4.27
348,900	1.25	4.27			348,900	1.23		4.26
349,250	1.25	4.27			349,250	1.23		4.26
349,600	1.25	4.27			349,600	1.22		4.26
349,950	1.25	4.27			349,950	1.22		4.26
350,300	1.24	4.27			350,300	1.22		4.26
350,650	1.24	4.27			350,650	1.22		4.26
351,000	1.24	4.26			351,000	1.22		4.26
351,350	1.24	4.26			351,350	1.21		4.26
351,700	1.24	4.26			351,700	1.21		4.26
352,050	1.23	4.26			352,050	1.21		4.25
352,400	1.23	4.26			352,400	1.21		4.25
352,750	1.23	4.26			352,750	1.21		4.25
353,100	1.23	4.26			353,100	1.20		4.25
353,450	1.23	4.25			353,450	1.20		4.25
353,800	1.22	4.25			353,800	1.20		4.25
354,150	1.22	4.25			354,150	1.20		4.25
354,500	1.22	4.25			354,500	1.20		4.25
354,850	1.22	4.25			354,850	1.19		4.24
355,200	1.22	4.25			355,200	1.19		4.24
355,550	1.21	4.25			355,550	1.19		4.24
355,900	1.21	4.25			355,900	1.19		4.24
356,250	1.21	4.24			356,250	1.19		4.24
356,600	1.21	4.24			356,600	1.18		4.24
356,950	1.21	4.24			356,950	1.18		4.24
357,300	1.21	4.24			357,300	1.18		4.24
357,650	1.20	4.24			357,650	1.18		4.24
358,000	1.20	4.24			358,000	1.18		4.24
358,350	1.20	4.24			358,350	1.18		4.24
358,700	1.20	4.24			358,700	1.18		4.23
359,050	1.20	4.24			359,050	1.17		4.23
359,400	1.20	4.24			359,400	1.17		4.23
359,750	1.19	4.24			359,750	1.17		4.23
360,100	1.19	4.24			360,100	1.17		4.23
360,450	1.19	4.24			360,450	1.17		4.23
360,800	1.19	4.24			360,800	1.17		4.23
361,150	1.19	4.24			361,150	1.16		4.23
361,500	1.19	4.23			361,500	1.16		4.23
361,850	1.19	4.23			361,850	1.16		4.23
362,200	1.18	4.23			362,200	1.16		4.23
362,550	1.18	4.23			362,550	1.16		4.23
362,900	1.18	4.23			362,900	1.16		4.23

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
363,250	1.18	4.23			363,250	1.16		4.23
363,600	1.18	4.23			363,600	1.15		4.23
363,950	1.18	4.23			363,950	1.15		4.22
364,300	1.18	4.23			364,300	1.15		4.22
364,650	1.17	4.23			364,650	1.15		4.22
365,000	1.17	4.23			365,000	1.15		4.22
365,350	1.17	4.23			365,350	1.15		4.22
365,700	1.17	4.23			365,700	1.15		4.22
366,050	1.17	4.23			366,050	1.14		4.22
366,400	1.17	4.23			366,400	1.14		4.22
366,750	1.17	4.22			366,750	1.14		4.22
367,100	1.16	4.22			367,100	1.14		4.22
367,450	1.16	4.22			367,450	1.14		4.22
367,800	1.16	4.22			367,800	1.14		4.22
368,150	1.16	4.22			368,150	1.14		4.22
368,500	1.16	4.22			368,500	1.13		4.22
368,850	1.16	4.22			368,850	1.13		4.22
369,200	1.16	4.22			369,200	1.13		4.21
369,550	1.15	4.22			369,550	1.13		4.21
369,900	1.15	4.22			369,900	1.13		4.21
370,250	1.15	4.22			370,250	1.13		4.21
370,600	1.15	4.21			370,600	1.12		4.21
370,950	1.15	4.21			370,950	1.12		4.21
371,300	1.14	4.21			371,300	1.12		4.21
371,650	1.14	4.21			371,650	1.12		4.21
372,000	1.14	4.21			372,000	1.12		4.20
372,350	1.14	4.21			372,350	1.11		4.20
372,700	1.14	4.21			372,700	1.11		4.20
373,050	1.13	4.21			373,050	1.11		4.20
373,400	1.13	4.21			373,400	1.11		4.20
373,750	1.13	4.20			373,750	1.11		4.20
374,100	1.13	4.20			374,100	1.10		4.20
374,450	1.13	4.20			374,450	1.10		4.20
374,800	1.12	4.20			374,800	1.10		4.19
375,150	1.12	4.20			375,150	1.10		4.19
375,500	1.12	4.20			375,500	1.10		4.19
375,850	1.12	4.20			375,850	1.10		4.19
376,200	1.12	4.20			376,200	1.09		4.19
376,550	1.12	4.20			376,550	1.09		4.19
376,900	1.12	4.20			376,900	1.09		4.19
377,250	1.11	4.20			377,250	1.09		4.19
377,600	1.11	4.20			377,600	1.09		4.19
377,950	1.11	4.20			377,950	1.09		4.19
378,300	1.11	4.19			378,300	1.09		4.19
378,650	1.11	4.19			378,650	1.08		4.19
379,000	1.11	4.19			379,000	1.08		4.19
379,350	1.11	4.19			379,350	1.08		4.19
379,700	1.10	4.19			379,700	1.08		4.19
380,050	1.10	4.19			380,050	1.08		4.19
380,400	1.10	4.19			380,400	1.08		4.19
380,750	1.10	4.19			380,750	1.08		4.19

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
381,100	1.10	4.19			381,100	1.07		4.19
381,450	1.10	4.19			381,450	1.07		4.18
381,800	1.10	4.19			381,800	1.07		4.18
382,150	1.09	4.19			382,150	1.07		4.18
382,500	1.09	4.19			382,500	1.07		4.18
382,850	1.09	4.19			382,850	1.07		4.18
383,200	1.09	4.18			383,200	1.06		4.18
383,550	1.09	4.18			383,550	1.06		4.18
383,900	1.08	4.18			383,900	1.06		4.18
384,250	1.08	4.18			384,250	1.06		4.18
384,600	1.08	4.18			384,600	1.06		4.17
384,950	1.08	4.18			384,950	1.05		4.17
385,300	1.08	4.18			385,300	1.05		4.17
385,650	1.07	4.18			385,650	1.05		4.17
386,000	1.07	4.17			386,000	1.05		4.17
386,350	1.07	4.17			386,350	1.05		4.17
386,700	1.07	4.17			386,700	1.04		4.17
387,050	1.07	4.17			387,050	1.04		4.17
387,400	1.06	4.17			387,400	1.04		4.16
387,750	1.06	4.17			387,750	1.04		4.16
388,100	1.06	4.17			388,100	1.04		4.16
388,450	1.06	4.17			388,450	1.04		4.16
388,800	1.06	4.17			388,800	1.04		4.16
389,150	1.06	4.17			389,150	1.04		4.16
389,500	1.06	4.17			389,500	1.03		4.16
389,850	1.06	4.17			389,850	1.03		4.16
390,200	1.06	4.17			390,200	1.03		4.16
390,550	1.06	4.17			390,550	1.03		4.16
390,900	1.06	4.17			390,900	1.03		4.16
391,250	1.05	4.17			391,250	1.03		4.16
391,600	1.05	4.17			391,600	1.03		4.16
391,950	1.05	4.17			391,950	1.03		4.16
392,300	1.05	4.17			392,300	1.03		4.16
392,650	1.05	4.17			392,650	1.03		4.16
393,000	1.05	4.17			393,000	1.03		4.16
393,350	1.05	4.17			393,350	1.03		4.16
393,700	1.05	4.17			393,700	1.03		4.17
394,050	1.05	4.17			394,050	1.02		4.16
394,400	1.05	4.17			394,400	1.02		4.16
394,750	1.04	4.17			394,750	1.02		4.16
395,100	1.04	4.17			395,100	1.02		4.16
395,450	1.04	4.17			395,450	1.02		4.16
395,800	1.04	4.16			395,800	1.01		4.16
396,150	1.04	4.16			396,150	1.01		4.16
396,500	1.04	4.16			396,500	1.01		4.16
396,850	1.03	4.16			396,850	1.01		4.16
397,200	1.03	4.16			397,200	1.01		4.16
397,550	1.03	4.16			397,550	1.01		4.15
397,900	1.03	4.16			397,900	1.00		4.15
398,250	1.03	4.16			398,250	1.00		4.15
398,600	1.02	4.16			398,600	1.00		4.15

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
398,950	1.02	4.16			*398,950*	1.00		4.15
399,300	1.02	4.15			*399,300*	1.00		4.15
399,650	1.02	4.15			*399,650*	0.99		4.15
400,000	1.02	4.15			*400,000*	0.99		4.15
400,350	1.02	4.15			*400,350*	0.99		4.15
400,700	1.01	4.15			*400,700*	0.99		4.15
401,050	1.01	4.15			*401,050*	0.99		4.14
401,400	1.01	4.15			*401,400*	0.99		4.14
401,750	1.01	4.15			*401,750*	0.99		4.14
402,100	1.01	4.15			*402,100*	0.98		4.14
402,450	1.01	4.15			*402,450*	0.98		4.14
402,800	1.01	4.15			*402,800*	0.98		4.14
403,150	1.00	4.15			*403,150*	0.98		4.14
403,500	1.00	4.15			*403,500*	0.98		4.14
403,850	1.00	4.15			*403,850*	0.98		4.14
404,200	1.00	4.15			*404,200*	0.98		4.14
404,550	1.00	4.15			*404,550*	0.98		4.14
404,900	1.00	4.15			*404,900*	0.97		4.14
405,250	1.00	4.14			*405,250*	0.97		4.14
405,600	1.00	4.14			*405,600*	0.97		4.14
405,950	0.99	4.14			*405,950*	0.97		4.14
406,300	0.99	4.14			*406,300*	0.97		4.14
406,650	0.99	4.14			*406,650*	0.97		4.14
407,000	0.99	4.14			*407,000*	0.97		4.14
407,350	0.99	4.14			*407,350*	0.96		4.14
407,700	0.99	4.14			*407,700*	0.96		4.13
408,050	0.98	4.14			*408,050*	0.96		4.13
408,400	0.98	4.14			*408,400*	0.96		4.13
408,750	0.98	4.14			*408,750*	0.96		4.13
409,100	0.98	4.14			*409,100*	0.95		4.13
409,450	0.98	4.13			*409,450*	0.95		4.13
409,800	0.98	4.13			*409,800*	0.95		4.13
410,150	0.97	4.13			*410,150*	0.95		4.13
410,500	0.97	4.13			*410,500*	0.95		4.13
410,850	0.97	4.13			*410,850*	0.95		4.13
411,200	0.97	4.13			*411,200*	0.94		4.12
411,550	0.97	4.13			*411,550*	0.94		4.12
411,900	0.96	4.13			*411,900*	0.94		4.12
412,250	0.96	4.13			*412,250*	0.94		4.12
412,600	0.96	4.13			*412,600*	0.94		4.12
412,950	0.96	4.12			*412,950*	0.94		4.12
413,300	0.96	4.13			*413,300*	0.93		4.12
413,650	0.96	4.13			*413,650*	0.93		4.12
414,000	0.96	4.13			*414,000*	0.93		4.12
414,350	0.96	4.13			*414,350*	0.93		4.12
414,700	0.96	4.13			*414,700*	0.93		4.12
415,050	0.96	4.13			*415,050*	0.93		4.12
415,400	0.95	4.13			*415,400*	0.93		4.12
415,750	0.95	4.13			*415,750*	0.93		4.12
416,100	0.95	4.13			*416,100*	0.93		4.12
416,450	0.95	4.13			*416,450*	0.93		4.12

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
416,800	0.95	4.13			*416,800*	0.93		4.12
417,150	0.95	4.13			*417,150*	0.93		4.12
417,500	0.95	4.13			*417,500*	0.93		4.12
417,850	0.95	4.13			*417,850*	0.92		4.12
418,200	0.95	4.13			*418,200*	0.92		4.12
418,550	0.95	4.13			*418,550*	0.92		4.12
418,900	0.95	4.13			*418,900*	0.92		4.12
419,250	0.95	4.13			*419,250*	0.92		4.12
419,600	0.94	4.13			*419,600*	0.92		4.12
419,950	0.94	4.13			*419,950*	0.92		4.12
420,300	0.94	4.12			*420,300*	0.92		4.12
420,650	0.94	4.12			*420,650*	0.91		4.12
421,000	0.94	4.12			*421,000*	0.91		4.12
421,350	0.94	4.12			*421,350*	0.91		4.12
421,700	0.93	4.12			*421,700*	0.91		4.11
422,050	0.93	4.12			*422,050*	0.91		4.11
422,400	0.93	4.12			*422,400*	0.91		4.11
422,750	0.93	4.12			*422,750*	0.90		4.11
423,100	0.93	4.12			*423,100*	0.90		4.11
423,450	0.93	4.12			*423,450*	0.90		4.11
423,800	0.92	4.11			*423,800*	0.90		4.11
424,150	0.92	4.11			*424,150*	0.90		4.11
424,500	0.92	4.11			*424,500*	0.90		4.11
424,850	0.92	4.11			*424,850*	0.89		4.11
425,200	0.92	4.11			*425,200*	0.89		4.11
425,550	0.91	4.11			*425,550*	0.89		4.10
425,900	0.91	4.11			*425,900*	0.89		4.10
426,250	0.91	4.11			*426,250*	0.89		4.10
426,600	0.91	4.11			*426,600*	0.89		4.10
426,950	0.91	4.11			*426,950*	0.89		4.10
427,300	0.91	4.11			*427,300*	0.88		4.10
427,650	0.91	4.11			*427,650*	0.88		4.10
428,000	0.91	4.11			*428,000*	0.88		4.10
428,350	0.91	4.11			*428,350*	0.88		4.10
428,700	0.90	4.11			*428,700*	0.88		4.10
429,050	0.90	4.11			*429,050*	0.88		4.10
429,400	0.90	4.11			*429,400*	0.88		4.10
429,750	0.90	4.11			*429,750*	0.88		4.10
430,100	0.90	4.11			*430,100*	0.88		4.10
430,450	0.90	4.11			*430,450*	0.87		4.10
430,800	0.90	4.11			*430,800*	0.87		4.10
431,150	0.90	4.11			*431,150*	0.87		4.10
431,500	0.89	4.11			*431,500*	0.87		4.10
431,850	0.89	4.10			*431,850*	0.87		4.10
432,200	0.89	4.10			*432,200*	0.87		4.10
432,550	0.89	4.10			*432,550*	0.87		4.10
432,900	0.89	4.10			*432,900*	0.87		4.10
433,250	0.89	4.10			*433,250*	0.87		4.10
433,600	0.89	4.10			*433,600*	0.86		4.10
433,950	0.89	4.10			*433,950*	0.86		4.10
434,300	0.89	4.10			*434,300*	0.86		4.10

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
434,650	0.88	4.10			***434,650***	0.86		4.10
435,000	0.88	4.10			***435,000***	0.86		4.10
435,350	0.88	4.10			***435,350***	0.86		4.10
435,700	0.88	4.10			***435,700***	0.86		4.10
436,050	0.88	4.10			***436,050***	0.86		4.10
436,400	0.88	4.10			***436,400***	0.86		4.10
436,750	0.88	4.10			***436,750***	0.85		4.09
437,100	0.88	4.10			***437,100***	0.85		4.09
437,450	0.88	4.10			***437,450***	0.85		4.09
437,800	0.88	4.10			***437,800***	0.85		4.09
438,150	0.87	4.10			***438,150***	0.85		4.09
438,500	0.87	4.10			***438,500***	0.85		4.09
438,850	0.87	4.10			***438,850***	0.85		4.09
439,200	0.87	4.10			***439,200***	0.84		4.09
439,550	0.87	4.09			***439,550***	0.84		4.09
439,900	0.87	4.09			***439,900***	0.84		4.09
440,250	0.86	4.09			***440,250***	0.84		4.09
440,600	0.86	4.09			***440,600***	0.84		4.09
440,950	0.86	4.09			***440,950***	0.84		4.08
441,300	0.86	4.09			***441,300***	0.83		4.08
441,650	0.86	4.09			***441,650***	0.83		4.08
442,000	0.86	4.09			***442,000***	0.83		4.08
442,350	0.85	4.09			***442,350***	0.83		4.08
442,700	0.85	4.09			***442,700***	0.83		4.08
443,050	0.85	4.08			***443,050***	0.83		4.08
443,400	0.85	4.08			***443,400***	0.83		4.08
443,750	0.85	4.08			***443,750***	0.82		4.08
444,100	0.85	4.08			***444,100***	0.82		4.08
444,450	0.84	4.08			***444,450***	0.82		4.07
444,800	0.84	4.08			***444,800***	0.82		4.08
445,150	0.84	4.08			***445,150***	0.82		4.08
445,500	0.84	4.08			***445,500***	0.82		4.08
445,850	0.84	4.08			***445,850***	0.82		4.08
446,200	0.84	4.08			***446,200***	0.82		4.08
446,550	0.84	4.08			***446,550***	0.82		4.08
446,900	0.84	4.08			***446,900***	0.82		4.08
447,250	0.84	4.08			***447,250***	0.82		4.08
447,600	0.84	4.08			***447,600***	0.82		4.08
447,950	0.84	4.08			***447,950***	0.82		4.08
448,300	0.84	4.08			***448,300***	0.82		4.08
448,650	0.84	4.08			***448,650***	0.82		4.08
449,000	0.84	4.08			***449,000***	0.81		4.08
449,350	0.84	4.08			***449,350***	0.81		4.08
449,700	0.84	4.09			***449,700***	0.81		4.08
450,050	0.84	4.09			***450,050***	0.81		4.08
450,400	0.84	4.09			***450,400***	0.81		4.08
450,750	0.84	4.09			***450,750***	0.81		4.08
451,100	0.84	4.09			***451,100***	0.81		4.08
451,450	0.83	4.08			***451,450***	0.81		4.08
451,800	0.83	4.08			***451,800***	0.81		4.08
452,150	0.83	4.08			***452,150***	0.81		4.08

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
452,500	0.83	4.08			***452,500***	0.81		4.08
452,850	0.83	4.08			***452,850***	0.80		4.08
453,200	0.83	4.08			***453,200***	0.80		4.07
453,550	0.83	4.08			***453,550***	0.80		4.07
453,900	0.82	4.08			***453,900***	0.80		4.07
454,250	0.82	4.08			***454,250***	0.80		4.07
454,600	0.82	4.08			***454,600***	0.80		4.07
454,950	0.82	4.08			***454,950***	0.80		4.07
455,300	0.82	4.07			***455,300***	0.80		4.07
455,650	0.82	4.07			***455,650***	0.79		4.07
456,000	0.82	4.07			***456,000***	0.79		4.07
456,350	0.82	4.07			***456,350***	0.79		4.07
456,700	0.81	4.07			***456,700***	0.79		4.07
457,050	0.81	4.07			***457,050***	0.79		4.07
457,400	0.81	4.07			***457,400***	0.79		4.07
457,750	0.81	4.07			***457,750***	0.79		4.07
458,100	0.81	4.07			***458,100***	0.79		4.07
458,450	0.81	4.07			***458,450***	0.79		4.07
458,800	0.81	4.07			***458,800***	0.79		4.07
459,150	0.81	4.07			***459,150***	0.79		4.07
459,500	0.81	4.07			***459,500***	0.78		4.07
459,850	0.81	4.07			***459,850***	0.78		4.07
460,200	0.81	4.07			***460,200***	0.78		4.07
460,550	0.81	4.07			***460,550***	0.78		4.07
460,900	0.81	4.07			***460,900***	0.78		4.07
461,250	0.81	4.07			***461,250***	0.78		4.07
461,600	0.81	4.07			***461,600***	0.78		4.07
461,950	0.80	4.07			***461,950***	0.78		4.07
462,300	0.80	4.07			***462,300***	0.78		4.06
462,650	0.80	4.07			***462,650***	0.78		4.06
463,000	0.80	4.07			***463,000***	0.78		4.06
463,350	0.80	4.07			***463,350***	0.78		4.06
463,700	0.80	4.07			***463,700***	0.77		4.06
464,050	0.80	4.07			***464,050***	0.77		4.06
464,400	0.79	4.07			***464,400***	0.77		4.06
464,750	0.79	4.07			***464,750***	0.77		4.06
465,100	0.79	4.06			***465,100***	0.77		4.06
465,450	0.79	4.06			***465,450***	0.77		4.06
465,800	0.79	4.06			***465,800***	0.76		4.06
466,150	0.79	4.06			***466,150***	0.76		4.06
466,500	0.79	4.06			***466,500***	0.76		4.06
466,850	0.78	4.06			***466,850***	0.76		4.05
467,200	0.78	4.06			***467,200***	0.76		4.05
467,550	0.78	4.06			***467,550***	0.76		4.05
467,900	0.78	4.06			***467,900***	0.76		4.05
468,250	0.78	4.06			***468,250***	0.75		4.05
468,600	0.78	4.06			***468,600***	0.75		4.05
468,950	0.78	4.05			***468,950***	0.75		4.05
469,300	0.77	4.05			***469,300***	0.75		4.05
469,650	0.77	4.05			***469,650***	0.75		4.05
470,000	0.77	4.05			***470,000***	0.75		4.05

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
470,350	0.77	4.05			***470,350***	0.75		4.05
470,700	0.77	4.05			***470,700***	0.74		4.04
471,050	0.77	4.05			***471,050***	0.74		4.04
471,400	0.76	4.05			***471,400***	0.74		4.04
471,750	0.76	4.05			***471,750***	0.74		4.04
472,100	0.76	4.05			***472,100***	0.74		4.04
472,450	0.76	4.05			***472,450***	0.74		4.04
472,800	0.76	4.04			***472,800***	0.73		4.04
473,150	0.76	4.04			***473,150***	0.73		4.04
473,500	0.76	4.04			***473,500***	0.73		4.04
473,850	0.75	4.04			***473,850***	0.73		4.04
474,200	0.75	4.04			***474,200***	0.73		4.04
474,550	0.75	4.04			***474,550***	0.73		4.03
474,900	0.75	4.04			***474,900***	0.73		4.03
475,250	0.75	4.04			***475,250***	0.72		4.03
475,600	0.75	4.04			***475,600***	0.72		4.03
475,950	0.75	4.04			***475,950***	0.72		4.03
476,300	0.74	4.04			***476,300***	0.72		4.03
476,650	0.74	4.03			***476,650***	0.72		4.03
477,000	0.74	4.03			***477,000***	0.72		4.03
477,350	0.74	4.03			***477,350***	0.72		4.03
477,700	0.74	4.03			***477,700***	0.71		4.03
478,050	0.74	4.03			***478,050***	0.71		4.03
478,400	0.74	4.03			***478,400***	0.71		4.03
478,750	0.73	4.03			***478,750***	0.71		4.02
479,100	0.73	4.03			***479,100***	0.71		4.02
479,450	0.73	4.03			***479,450***	0.71		4.02
479,800	0.73	4.03			***479,800***	0.71		4.02
480,150	0.73	4.03			***480,150***	0.71		4.02
480,500	0.73	4.03			***480,500***	0.70		4.02
480,850	0.73	4.03			***480,850***	0.70		4.02
481,200	0.73	4.03			***481,200***	0.70		4.02
481,550	0.72	4.02			***481,550***	0.70		4.02
481,900	0.72	4.02			***481,900***	0.70		4.02
482,250	0.72	4.02			***482,250***	0.70		4.02
482,600	0.72	4.02			***482,600***	0.70		4.02
482,950	0.72	4.02			***482,950***	0.69		4.02
483,300	0.72	4.02			***483,300***	0.69		4.02
483,650	0.72	4.02			***483,650***	0.69		4.01
484,000	0.72	4.02			***484,000***	0.69		4.01
484,350	0.71	4.02			***484,350***	0.69		4.01
484,700	0.71	4.02			***484,700***	0.69		4.01
485,050	0.71	4.02			***485,050***	0.69		4.01
485,400	0.71	4.02			***485,400***	0.69		4.01
485,750	0.71	4.02			***485,750***	0.68		4.01
486,100	0.71	4.02			***486,100***	0.68		4.01
486,450	0.71	4.01			***486,450***	0.68		4.01
486,800	0.70	4.01			***486,800***	0.68		4.01
487,150	0.70	4.01			***487,150***	0.68		4.01
487,500	0.70	4.01			***487,500***	0.68		4.01
487,850	0.70	4.01			***487,850***	0.68		4.01

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
488,200	0.70	4.01			***488,200***	0.68		4.01
488,550	0.70	4.01			***488,550***	0.67		4.00
488,900	0.70	4.01			***488,900***	0.67		4.00
489,250	0.70	4.01			***489,250***	0.67		4.00
489,600	0.69	4.01			***489,600***	0.67		4.00
489,950	0.69	4.01			***489,950***	0.67		4.00
490,300	0.69	4.01			***490,300***	0.67		4.00
490,650	0.69	4.01			***490,650***	0.67		4.00
491,000	0.69	4.01			***491,000***	0.67		4.00
491,350	0.69	4.01			***491,350***	0.66		4.00
491,700	0.69	4.00			***491,700***	0.66		4.00
492,050	0.69	4.00			***492,050***	0.66		4.00
492,400	0.68	4.00			***492,400***	0.66		4.00
492,750	0.68	4.00			***492,750***	0.66		4.00
493,100	0.68	4.00			***493,100***	0.66		4.00
493,450	0.68	4.00			***493,450***	0.66		4.00
493,800	0.68	4.00			***493,800***	0.66		3.99
494,150	0.68	4.00			***494,150***	0.65		3.99
494,500	0.68	4.00			***494,500***	0.65		3.99
494,850	0.68	4.00			***494,850***	0.65		3.99
495,200	0.67	4.00			***495,200***	0.65		3.99
495,550	0.67	4.00			***495,550***	0.65		3.99
495,900	0.67	4.00			***495,900***	0.65		3.99
496,250	0.67	3.99			***496,250***	0.65		3.99
496,600	0.67	3.99			***496,600***	0.64		3.99
496,950	0.67	3.99			***496,950***	0.64		3.99
497,300	0.67	3.99			***497,300***	0.64		3.99
497,650	0.66	3.99			***497,650***	0.64		3.98
498,000	0.66	3.99			***498,000***	0.64		3.98
498,350	0.66	3.99			***498,350***	0.64		3.98
498,700	0.66	3.99			***498,700***	0.64		3.98
499,050	0.66	3.99			***499,050***	0.63		3.98
499,400	0.66	3.98			***499,400***	0.63		3.98
499,750	0.66	3.98			***499,750***	0.63		3.98
500,100	0.65	3.98			***500,100***	0.63		3.98
500,450	0.65	3.98			***500,450***	0.63		3.98
500,800	0.65	3.98			***500,800***	0.63		3.97
501,150	0.65	3.98			***501,150***	0.63		3.97
501,500	0.65	3.98			***501,500***	0.62		3.97
501,850	0.65	3.98			***501,850***	0.62		3.97
502,200	0.65	3.98			***502,200***	0.62		3.97
502,550	0.65	3.98			***502,550***	0.62		3.97
502,900	0.65	3.98			***502,900***	0.62		3.97
503,250	0.65	3.98			***503,250***	0.62		3.97
503,600	0.64	3.98			***503,600***	0.62		3.97
503,950	0.64	3.98			***503,950***	0.62		3.97
504,300	0.64	3.98			***504,300***	0.62		3.97
504,650	0.64	3.98			***504,650***	0.62		3.97
505,000	0.64	3.98			***505,000***	0.62		3.97
505,350	0.64	3.98			***505,350***	0.62		3.97
505,700	0.64	3.98			***505,700***	0.62		3.97

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
506,050	0.64	3.98			506,050	0.62		3.97
506,400	0.64	3.98			506,400	0.62		3.97
506,750	0.64	3.98			506,750	0.61		3.97
507,100	0.64	3.98			507,100	0.61		3.97
507,450	0.64	3.98			507,450	0.61		3.97
507,800	0.64	3.98			507,800	0.61		3.97
508,150	0.64	3.98			508,150	0.61		3.97
508,500	0.63	3.98			508,500	0.61		3.97
508,850	0.63	3.98			508,850	0.61		3.97
509,200	0.63	3.98			509,200	0.61		3.97
509,550	0.63	3.97			509,550	0.61		3.97
509,900	0.63	3.97			509,900	0.61		3.97
510,250	0.63	3.97			510,250	0.60		3.97
510,600	0.63	3.97			510,600	0.60		3.97
510,950	0.63	3.97			510,950	0.60		3.97
511,300	0.62	3.97			511,300	0.60		3.97
511,650	0.62	3.97			511,650	0.60		3.97
512,000	0.62	3.97			512,000	0.60		3.97
512,350	0.62	3.97			512,350	0.60		3.96
512,700	0.62	3.97			512,700	0.60		3.96
513,050	0.62	3.97			513,050	0.59		3.96
513,400	0.62	3.97			513,400	0.59		3.96
513,750	0.62	3.97			513,750	0.59		3.96
514,100	0.62	3.97			514,100	0.59		3.96
514,450	0.61	3.97			514,450	0.59		3.96
514,800	0.61	3.96			514,800	0.59		3.96
515,150	0.61	3.96			515,150	0.59		3.96
515,500	0.61	3.96			515,500	0.59		3.96
515,850	0.61	3.96			515,850	0.58		3.96
516,200	0.61	3.96			516,200	0.58		3.96
516,550	0.61	3.96			516,550	0.58		3.95
516,900	0.60	3.96			516,900	0.58		3.95
517,250	0.60	3.96			517,250	0.58		3.95
517,600	0.60	3.96			517,600	0.58		3.95
517,950	0.60	3.96			517,950	0.58		3.95
518,300	0.60	3.95			518,300	0.57		3.95
518,650	0.60	3.95			518,650	0.57		3.95
519,000	0.60	3.95			519,000	0.57		3.95
519,350	0.59	3.95			519,350	0.57		3.95
519,700	0.59	3.95			519,700	0.57		3.95
520,050	0.59	3.95			520,050	0.57		3.94
520,400	0.59	3.95			520,400	0.57		3.94
520,750	0.59	3.95			520,750	0.56		3.94
521,100	0.59	3.95			521,100	0.56		3.94
521,450	0.59	3.95			521,450	0.56		3.94
521,800	0.58	3.95			521,800	0.56		3.94
522,150	0.58	3.94			522,150	0.56		3.94
522,500	0.58	3.94			522,500	0.56		3.94
522,850	0.58	3.94			522,850	0.56		3.94
523,200	0.58	3.94			523,200	0.56		3.94
523,550	0.58	3.94			523,550	0.55		3.93

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
523,900	0.58	3.94			523,900	0.55		3.93
524,250	0.58	3.94			524,250	0.55		3.93
524,600	0.57	3.94			524,600	0.55		3.93
524,950	0.57	3.94			524,950	0.55		3.93
525,300	0.57	3.94			525,300	0.55		3.93
525,650	0.57	3.93			525,650	0.55		3.93
526,000	0.57	3.93			526,000	0.54		3.93
526,350	0.57	3.93			526,350	0.54		3.93
526,700	0.57	3.93			526,700	0.54		3.93
527,050	0.57	3.93			527,050	0.54		3.93
527,400	0.57	3.93			527,400	0.54		3.93
527,750	0.57	3.93			527,750	0.54		3.93
528,100	0.57	3.93			528,100	0.54		3.93
528,450	0.56	3.93			528,450	0.54		3.93
528,800	0.56	3.93			528,800	0.54		3.93
529,150	0.56	3.93			529,150	0.54		3.93
529,500	0.56	3.93			529,500	0.54		3.93
529,850	0.56	3.93			529,850	0.54		3.93
530,200	0.56	3.93			530,200	0.54		3.93
530,550	0.56	3.93			530,550	0.54		3.92
530,900	0.56	3.93			530,900	0.54		3.92
531,250	0.56	3.93			531,250	0.54		3.92
531,600	0.56	3.93			531,600	0.54		3.92
531,950	0.56	3.93			531,950	0.54		3.92
532,300	0.56	3.93			532,300	0.54		3.92
532,650	0.56	3.93			532,650	0.54		3.92
533,000	0.56	3.93			533,000	0.53		3.92
533,350	0.56	3.93			533,350	0.53		3.92
533,700	0.56	3.93			533,700	0.53		3.92
534,050	0.56	3.93			534,050	0.53		3.92
534,400	0.55	3.93			534,400	0.53		3.92
534,750	0.55	3.92			534,750	0.53		3.92
535,100	0.55	3.92			535,100	0.53		3.92
535,450	0.55	3.92			535,450	0.53		3.92
535,800	0.55	3.92			535,800	0.52		3.92
536,150	0.55	3.92			536,150	0.52		3.92
536,500	0.55	3.92			536,500	0.52		3.91
536,850	0.55	3.92			536,850	0.52		3.91
537,200	0.54	3.92			537,200	0.52		3.91
537,550	0.54	3.92			537,550	0.52		3.91
537,900	0.54	3.92			537,900	0.52		3.91
538,250	0.54	3.92			538,250	0.52		3.91
538,600	0.54	3.92			538,600	0.52		3.91
538,950	0.54	3.91			538,950	0.51		3.91
539,300	0.54	3.91			539,300	0.51		3.91
539,650	0.54	3.91			539,650	0.51		3.91
540,000	0.54	3.91			540,000	0.51		3.91
540,350	0.53	3.91			540,350	0.51		3.91
540,700	0.53	3.91			540,700	0.51		3.91
541,050	0.53	3.91			541,050	0.51		3.91
541,400	0.53	3.91			541,400	0.51		3.91

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
541,750	0.53	3.91			541,750	0.51		3.91
542,100	0.53	3.91			542,100	0.51		3.91
542,450	0.53	3.91			542,450	0.50		3.91
542,800	0.53	3.91			542,800	0.50		3.90
543,150	0.53	3.91			543,150	0.50		3.90
543,500	0.53	3.91			543,500	0.50		3.90
543,850	0.52	3.91			543,850	0.50		3.90
544,200	0.52	3.91			544,200	0.50		3.90
544,550	0.52	3.91			544,550	0.50		3.90
544,900	0.52	3.91			544,900	0.50		3.90
545,250	0.52	3.91			545,250	0.50		3.90
545,600	0.52	3.91			545,600	0.50		3.90
545,950	0.52	3.91			545,950	0.50		3.90
546,300	0.52	3.91			546,300	0.49		3.90
546,650	0.52	3.91			546,650	0.49		3.90
547,000	0.52	3.91			547,000	0.49		3.90
547,350	0.52	3.91			547,350	0.49		3.90
547,700	0.52	3.91			547,700	0.49		3.90
548,050	0.52	3.91			548,050	0.49		3.90
548,400	0.51	3.91			548,400	0.49		3.90
548,750	0.51	3.91			548,750	0.49		3.90
549,100	0.51	3.91			549,100	0.49		3.90
549,450	0.51	3.90			549,450	0.49		3.90
549,800	0.51	3.90			549,800	0.49		3.90
550,150	0.51	3.90			550,150	0.49		3.90
550,500	0.51	3.90			550,500	0.49		3.90
550,850	0.51	3.90			550,850	0.49		3.90
551,200	0.51	3.90			551,200	0.49		3.90
551,550	0.51	3.90			551,550	0.48		3.90
551,900	0.51	3.90			551,900	0.48		3.90
552,250	0.51	3.90			552,250	0.48		3.90
552,600	0.51	3.90			552,600	0.48		3.90
552,950	0.50	3.90			552,950	0.48		3.89
553,300	0.50	3.90			553,300	0.48		3.89
553,650	0.50	3.90			553,650	0.48		3.89
554,000	0.50	3.90			554,000	0.48		3.89
554,350	0.50	3.90			554,350	0.48		3.89
554,700	0.50	3.90			554,700	0.47		3.89
555,050	0.50	3.90			555,050	0.47		3.89
555,400	0.50	3.89			555,400	0.47		3.89
555,750	0.49	3.89			555,750	0.47		3.89
556,100	0.49	3.89			556,100	0.47		3.89
556,450	0.49	3.89			556,450	0.47		3.89
556,800	0.49	3.89			556,800	0.47		3.89
557,150	0.49	3.89			557,150	0.47		3.89
557,500	0.49	3.89			557,500	0.46		3.88
557,850	0.49	3.89			557,850	0.46		3.88
558,200	0.49	3.89			558,200	0.46		3.88
558,550	0.49	3.89			558,550	0.46		3.88
558,900	0.48	3.89			558,900	0.46		3.88
559,250	0.48	3.89			559,250	0.46		3.88

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
559,600	0.48	3.89			559,600	0.46		3.88
559,950	0.48	3.88			559,950	0.46		3.88
560,300	0.48	3.88			560,300	0.46		3.88
560,650	0.48	3.88			560,650	0.45		3.88
561,000	0.48	3.88			561,000	0.45		3.88
561,350	0.48	3.88			561,350	0.45		3.88
561,700	0.48	3.88			561,700	0.45		3.88
562,050	0.47	3.88			562,050	0.45		3.88
562,400	0.47	3.88			562,400	0.45		3.87
562,750	0.47	3.88			562,750	0.45		3.87
563,100	0.47	3.88			563,100	0.45		3.87
563,450	0.47	3.88			563,450	0.45		3.87
563,800	0.47	3.88			563,800	0.44		3.87
564,150	0.47	3.88			564,150	0.44		3.87
564,500	0.47	3.88			564,500	0.44		3.87
564,850	0.47	3.88			564,850	0.44		3.87
565,200	0.47	3.88			565,200	0.44		3.87
565,550	0.47	3.88			565,550	0.44		3.87
565,900	0.46	3.88			565,900	0.44		3.87
566,250	0.46	3.87			566,250	0.44		3.87
566,600	0.46	3.87			566,600	0.44		3.87
566,950	0.46	3.87			566,950	0.44		3.87
567,300	0.46	3.87			567,300	0.44		3.87
567,650	0.46	3.87			567,650	0.44		3.87
568,000	0.46	3.87			568,000	0.44		3.87
568,350	0.46	3.87			568,350	0.44		3.87
568,700	0.46	3.87			568,700	0.44		3.87
569,050	0.46	3.87			569,050	0.43		3.87
569,400	0.46	3.87			569,400	0.43		3.87
569,750	0.46	3.87			569,750	0.43		3.87
570,100	0.46	3.87			570,100	0.43		3.87
570,450	0.46	3.87			570,450	0.43		3.87
570,800	0.46	3.87			570,800	0.43		3.87
571,150	0.45	3.87			571,150	0.43		3.87
571,500	0.45	3.87			571,500	0.43		3.86
571,850	0.45	3.87			571,850	0.43		3.86
572,200	0.45	3.87			572,200	0.43		3.86
572,550	0.45	3.87			572,550	0.43		3.86
572,900	0.45	3.87			572,900	0.42		3.86
573,250	0.45	3.87			573,250	0.42		3.86
573,600	0.45	3.87			573,600	0.42		3.86
573,950	0.45	3.87			573,950	0.42		3.86
574,300	0.44	3.86			574,300	0.42		3.86
574,650	0.44	3.86			574,650	0.42		3.86
575,000	0.44	3.86			575,000	0.42		3.86
575,350	0.44	3.86			575,350	0.42		3.86
575,700	0.44	3.86			575,700	0.42		3.86
576,050	0.44	3.86			576,050	0.41		3.86
576,400	0.44	3.86			576,400	0.41		3.85
576,750	0.44	3.86			576,750	0.41		3.85
577,100	0.44	3.86			577,100	0.41		3.85

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
577,450	0.43	3.86			577,450	0.41		3.85
577,800	0.43	3.86			577,800	0.41		3.85
578,150	0.43	3.86			578,150	0.41		3.85
578,500	0.43	3.86			578,500	0.41		3.85
578,850	0.43	3.86			578,850	0.41		3.85
579,200	0.43	3.85			579,200	0.40		3.85
579,550	0.43	3.85			579,550	0.40		3.85
579,900	0.43	3.85			579,900	0.40		3.85
580,250	0.43	3.85			580,250	0.40		3.85
580,600	0.42	3.85			580,600	0.40		3.85
580,950	0.42	3.85			580,950	0.40		3.85
581,300	0.42	3.85			581,300	0.40		3.85
581,650	0.42	3.85			581,650	0.40		3.84
582,000	0.42	3.85			582,000	0.40		3.84
582,350	0.42	3.85			582,350	0.40		3.84
582,700	0.42	3.85			582,700	0.39		3.84
583,050	0.42	3.85			583,050	0.39		3.84
583,400	0.42	3.85			583,400	0.39		3.84
583,750	0.42	3.85			583,750	0.39		3.84
584,100	0.42	3.85			584,100	0.39		3.84
584,450	0.42	3.85			584,450	0.39		3.84
584,800	0.41	3.85			584,800	0.39		3.84
585,150	0.41	3.85			585,150	0.39		3.84
585,500	0.41	3.85			585,500	0.39		3.84
585,850	0.41	3.85			585,850	0.39		3.84
586,200	0.41	3.85			586,200	0.39		3.84
586,550	0.41	3.85			586,550	0.39		3.84
586,900	0.41	3.85			586,900	0.39		3.84
587,250	0.41	3.85			587,250	0.39		3.84
587,600	0.41	3.85			587,600	0.39		3.84
587,950	0.41	3.85			587,950	0.39		3.84
588,300	0.41	3.85			588,300	0.39		3.84
588,650	0.41	3.85			588,650	0.38		3.84
589,000	0.41	3.85			589,000	0.38		3.84
589,350	0.41	3.85			589,350	0.38		3.84
589,700	0.41	3.85			589,700	0.38		3.84
590,050	0.41	3.84			590,050	0.38		3.84
590,400	0.41	3.84			590,400	0.38		3.84
590,750	0.40	3.84			590,750	0.38		3.84
591,100	0.40	3.84			591,100	0.38		3.84
591,450	0.40	3.84			591,450	0.38		3.84
591,800	0.40	3.84			591,800	0.38		3.84
592,150	0.40	3.84			592,150	0.38		3.84
592,500	0.40	3.84			592,500	0.37		3.83
592,850	0.40	3.84			592,850	0.37		3.83
593,200	0.40	3.84			593,200	0.37		3.83
593,550	0.40	3.84			593,550	0.37		3.83
593,900	0.39	3.84			593,900	0.37		3.83
594,250	0.39	3.84			594,250	0.37		3.83
594,600	0.39	3.84			594,600	0.37		3.83
594,950	0.39	3.84			594,950	0.37		3.83

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
595,300	0.39	3.84			595,300	0.37		3.83
595,650	0.39	3.83			595,650	0.37		3.83
596,000	0.39	3.83			596,000	0.37		3.83
596,350	0.39	3.83			596,350	0.36		3.83
596,700	0.39	3.83			596,700	0.36		3.83
597,050	0.39	3.83			597,050	0.36		3.83
597,400	0.39	3.83			597,400	0.36		3.83
597,750	0.39	3.83			597,750	0.36		3.83
598,100	0.39	3.83			598,100	0.36		3.83
598,450	0.39	3.83			598,450	0.36		3.83
598,800	0.39	3.83			598,800	0.36		3.83
599,150	0.38	3.83			599,150	0.36		3.83
599,500	0.38	3.83			599,500	0.36		3.83
599,850	0.38	3.83			599,850	0.36		3.83
600,200	0.38	3.83			600,200	0.36		3.83
600,550	0.38	3.83			600,550	0.36		3.83
600,900	0.38	3.83			600,900	0.36		3.83
601,250	0.38	3.83			601,250	0.36		3.83
601,600	0.38	3.83			601,600	0.36		3.83
601,950	0.38	3.83			601,950	0.36		3.83
602,300	0.38	3.83			602,300	0.36		3.83
602,650	0.38	3.83			602,650	0.35		3.83
603,000	0.38	3.83			603,000	0.35		3.82
603,350	0.38	3.83			603,350	0.35		3.82
603,700	0.37	3.83			603,700	0.35		3.82
604,050	0.37	3.83			604,050	0.35		3.82
604,400	0.37	3.83			604,400	0.35		3.82
604,750	0.37	3.82			604,750	0.35		3.82
605,100	0.37	3.82			605,100	0.35		3.82
605,450	0.37	3.82			605,450	0.34		3.82
605,800	0.37	3.82			605,800	0.34		3.82
606,150	0.37	3.82			606,150	0.34		3.82
606,500	0.36	3.82			606,500	0.34		3.81
606,850	0.36	3.82			606,850	0.34		3.81
607,200	0.36	3.82			607,200	0.34		3.81
607,550	0.36	3.82			607,550	0.34		3.81
607,900	0.36	3.82			607,900	0.34		3.81
608,250	0.36	3.81			608,250	0.33		3.81
608,600	0.36	3.81			608,600	0.33		3.81
608,950	0.36	3.81			608,950	0.33		3.81
609,300	0.36	3.81			609,300	0.33		3.81
609,650	0.36	3.81			609,650	0.33		3.81
610,000	0.36	3.81			610,000	0.33		3.81
610,350	0.36	3.81			610,350	0.33		3.81
610,700	0.36	3.81			610,700	0.33		3.81
611,050	0.35	3.81			611,050	0.33		3.81
611,400	0.35	3.81			611,400	0.33		3.81
611,750	0.35	3.81			611,750	0.33		3.81
612,100	0.35	3.81			612,100	0.33		3.81
612,450	0.35	3.81			612,450	0.33		3.81
612,800	0.35	3.81			612,800	0.33		3.81

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
613,150	0.35	3.81			613,150	0.33		3.81
613,500	0.35	3.81			613,500	0.33		3.81
613,850	0.35	3.81			613,850	0.33		3.81
614,200	0.35	3.81			614,200	0.33		3.81
614,550	0.35	3.81			614,550	0.33		3.81
614,900	0.35	3.81			614,900	0.33		3.81
615,250	0.35	3.81			615,250	0.32		3.81
615,600	0.35	3.81			615,600	0.32		3.81
615,950	0.35	3.81			615,950	0.32		3.81
616,300	0.35	3.81			616,300	0.32		3.81
616,650	0.35	3.81			616,650	0.32		3.80
617,000	0.34	3.81			617,000	0.32		3.80
617,350	0.34	3.81			617,350	0.32		3.80
617,700	0.34	3.81			617,700	0.32		3.80
618,050	0.34	3.81			618,050	0.32		3.80
618,400	0.34	3.81			618,400	0.32		3.80
618,750	0.34	3.81			618,750	0.32		3.80
619,100	0.34	3.81			619,100	0.31		3.80
619,450	0.34	3.81			619,450	0.31		3.80
619,800	0.34	3.81			619,800	0.31		3.80
620,150	0.34	3.81			620,150	0.31		3.80
620,500	0.34	3.81			620,500	0.31		3.80
620,850	0.33	3.80			620,850	0.31		3.80
621,200	0.33	3.80			621,200	0.31		3.80
621,550	0.33	3.80			621,550	0.31		3.80
621,900	0.33	3.80			621,900	0.31		3.80
622,250	0.33	3.80			622,250	0.31		3.80
622,600	0.33	3.80			622,600	0.31		3.80
622,950	0.33	3.80			622,950	0.31		3.80
623,300	0.33	3.80			623,300	0.31		3.80
623,650	0.33	3.80			623,650	0.30		3.80
624,000	0.33	3.80			624,000	0.30		3.79
624,350	0.33	3.80			624,350	0.30		3.79
624,700	0.33	3.80			624,700	0.30		3.79
625,050	0.33	3.80			625,050	0.30		3.79
625,400	0.33	3.80			625,400	0.30		3.79
625,750	0.32	3.80			625,750	0.30		3.79
626,100	0.32	3.80			626,100	0.30		3.79
626,450	0.32	3.80			626,450	0.30		3.79
626,800	0.32	3.80			626,800	0.30		3.79
627,150	0.32	3.80			627,150	0.30		3.79
627,500	0.32	3.80			627,500	0.30		3.79
627,850	0.32	3.80			627,850	0.30		3.79
628,200	0.32	3.79			628,200	0.30		3.79
628,550	0.32	3.79			628,550	0.29		3.79
628,900	0.32	3.79			628,900	0.29		3.79
629,250	0.32	3.79			629,250	0.29		3.79
629,600	0.32	3.79			629,600	0.29		3.79
629,950	0.31	3.79			629,950	0.29		3.79
630,300	0.31	3.79			630,300	0.29		3.79
630,650	0.31	3.79			630,650	0.29		3.79

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
631,000	0.31	3.79			631,000	0.29		3.78
631,350	0.31	3.79			631,350	0.29		3.78
631,700	0.31	3.79			631,700	0.29		3.78
632,050	0.31	3.79			632,050	0.29		3.78
632,400	0.31	3.79			632,400	0.28		3.78
632,750	0.31	3.79			632,750	0.28		3.78
633,100	0.31	3.79			633,100	0.28		3.78
633,450	0.31	3.79			633,450	0.28		3.78
633,800	0.30	3.79			633,800	0.28		3.78
634,150	0.30	3.79			634,150	0.28		3.78
634,500	0.30	3.79			634,500	0.28		3.78
634,850	0.30	3.79			634,850	0.28		3.78
635,200	0.30	3.78			635,200	0.28		3.78
635,550	0.30	3.78			635,550	0.28		3.78
635,900	0.30	3.78			635,900	0.28		3.78
636,250	0.30	3.78			636,250	0.27		3.78
636,600	0.30	3.78			636,600	0.27		3.78
636,950	0.30	3.78			636,950	0.27		3.78
637,300	0.30	3.78			637,300	0.27		3.78
637,650	0.29	3.78			637,650	0.27		3.78
638,000	0.29	3.78			638,000	0.27		3.78
638,350	0.29	3.78			638,350	0.27		3.77
638,700	0.29	3.78			638,700	0.27		3.77
639,050	0.29	3.78			639,050	0.27		3.77
639,400	0.29	3.78			639,400	0.27		3.77
639,750	0.29	3.78			639,750	0.27		3.77
640,100	0.29	3.78			640,100	0.26		3.77
640,450	0.29	3.78			640,450	0.26		3.77
640,800	0.29	3.78			640,800	0.26		3.77
641,150	0.29	3.78			641,150	0.26		3.77
641,500	0.29	3.78			641,500	0.26		3.77
641,850	0.29	3.78			641,850	0.26		3.77
642,200	0.28	3.77			642,200	0.26		3.77
642,550	0.28	3.77			642,550	0.26		3.77
642,900	0.28	3.77			642,900	0.26		3.77
643,250	0.28	3.77			643,250	0.26		3.77
643,600	0.28	3.77			643,600	0.26		3.77
643,950	0.28	3.77			643,950	0.26		3.77
644,300	0.28	3.77			644,300	0.26		3.77
644,650	0.28	3.77			644,650	0.26		3.77
645,000	0.28	3.77			645,000	0.25		3.77
645,350	0.28	3.77			645,350	0.25		3.76
645,700	0.28	3.77			645,700	0.25		3.76
646,050	0.28	3.77			646,050	0.25		3.76
646,400	0.28	3.77			646,400	0.25		3.76
646,750	0.28	3.77			646,750	0.25		3.76
647,100	0.27	3.77			647,100	0.25		3.76
647,450	0.27	3.77			647,450	0.25		3.76
647,800	0.27	3.77			647,800	0.25		3.76
648,150	0.27	3.77			648,150	0.25		3.76
648,500	0.27	3.77			648,500	0.25		3.76

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
648,850	0.27	3.77			648,850	0.25		3.76
649,200	0.27	3.77			649,200	0.25		3.76
649,550	0.27	3.77			649,550	0.24		3.76
649,900	0.27	3.76			649,900	0.24		3.76
650,250	0.27	3.76			650,250	0.24		3.76
650,600	0.27	3.76			650,600	0.24		3.76
650,950	0.27	3.76			650,950	0.24		3.76
651,300	0.26	3.76			651,300	0.24		3.76
651,650	0.26	3.76			651,650	0.24		3.76
652,000	0.26	3.76			652,000	0.24		3.76
652,350	0.26	3.76			652,350	0.24		3.76
652,700	0.26	3.76			652,700	0.24		3.76
653,050	0.26	3.76			653,050	0.24		3.76
653,400	0.26	3.76			653,400	0.24		3.75
653,750	0.26	3.76			653,750	0.24		3.75
654,100	0.26	3.76			654,100	0.23		3.75
654,450	0.26	3.76			654,450	0.23		3.75
654,800	0.26	3.76			654,800	0.23		3.75
655,150	0.26	3.76			655,150	0.23		3.75
655,500	0.26	3.76			655,500	0.23		3.75
655,850	0.26	3.76			655,850	0.23		3.75
656,200	0.26	3.76			656,200	0.23		3.75
656,550	0.26	3.76			656,550	0.23		3.75
656,900	0.25	3.76			656,900	0.23		3.75
657,250	0.25	3.76			657,250	0.23		3.75
657,600	0.25	3.76			657,600	0.23		3.75
657,950	0.25	3.76			657,950	0.23		3.75
658,300	0.25	3.76			658,300	0.23		3.75
658,650	0.25	3.76			658,650	0.23		3.75
659,000	0.25	3.76			659,000	0.23		3.75
659,350	0.25	3.76			659,350	0.23		3.75
659,700	0.25	3.76			659,700	0.23		3.75
660,050	0.25	3.76			660,050	0.23		3.75
660,400	0.25	3.76			660,400	0.23		3.75
660,750	0.25	3.76			660,750	0.23		3.75
661,100	0.25	3.76			661,100	0.23		3.75
661,450	0.25	3.76			661,450	0.23		3.75
661,800	0.25	3.76			661,800	0.23		3.75
662,150	0.25	3.76			662,150	0.23		3.75
662,500	0.25	3.76			662,500	0.22		3.75
662,850	0.25	3.76			662,850	0.22		3.75
663,200	0.25	3.76			663,200	0.22		3.75
663,550	0.25	3.76			663,550	0.22		3.75
663,900	0.25	3.76			663,900	0.22		3.75
664,250	0.25	3.76			664,250	0.22		3.75
664,600	0.25	3.76			664,600	0.22		3.75
664,950	0.25	3.76			664,950	0.22		3.75
665,300	0.25	3.76			665,300	0.22		3.75
665,650	0.25	3.76			665,650	0.22		3.75
666,000	0.24	3.76			666,000	0.22		3.75
666,350	0.24	3.76			666,350	0.22		3.75

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
666,700	0.24	3.75			666,700	0.22		3.75
667,050	0.24	3.75			667,050	0.22		3.75
667,400	0.24	3.75			667,400	0.22		3.75
667,750	0.24	3.75			667,750	0.22		3.75
668,100	0.24	3.75			668,100	0.21		3.75
668,450	0.24	3.75			668,450	0.21		3.74
668,800	0.24	3.75			668,800	0.21		3.74
669,150	0.24	3.75			669,150	0.21		3.74
669,500	0.23	3.75			669,500	0.21		3.74
669,850	0.23	3.75			669,850	0.21		3.74
670,200	0.23	3.75			670,200	0.21		3.74
670,550	0.23	3.75			670,550	0.21		3.74
670,900	0.23	3.74			670,900	0.21		3.74
671,250	0.23	3.74			671,250	0.21		3.74
671,600	0.23	3.74			671,600	0.20		3.74
671,950	0.23	3.74			671,950	0.20		3.74
672,300	0.23	3.74			672,300	0.20		3.74
672,650	0.23	3.74			672,650	0.20		3.74
673,000	0.23	3.74			673,000	0.20		3.74
673,350	0.23	3.74			673,350	0.20		3.74
673,700	0.23	3.74			673,700	0.20		3.74
674,050	0.23	3.74			674,050	0.20		3.74
674,400	0.22	3.74			674,400	0.20		3.74
674,750	0.22	3.74			674,750	0.20		3.74
675,100	0.22	3.74			675,100	0.20		3.73
675,450	0.22	3.74			675,450	0.20		3.73
675,800	0.22	3.74			675,800	0.20		3.73
676,150	0.22	3.74			676,150	0.20		3.73
676,500	0.22	3.74			676,500	0.20		3.73
676,850	0.22	3.74			676,850	0.20		3.73
677,200	0.22	3.74			677,200	0.20		3.73
677,550	0.22	3.74			677,550	0.20		3.73
677,900	0.22	3.74			677,900	0.20		3.73
678,250	0.22	3.74			678,250	0.19		3.73
678,600	0.22	3.74			678,600	0.19		3.73
678,950	0.22	3.74			678,950	0.19		3.73
679,300	0.22	3.73			679,300	0.19		3.73
679,650	0.21	3.73			679,650	0.19		3.73
680,000	0.21	3.73			680,000	0.19		3.73
680,350	0.21	3.73			680,350	0.19		3.73
680,700	0.21	3.73			680,700	0.19		3.73
681,050	0.21	3.73			681,050	0.19		3.72
681,400	0.21	3.73			681,400	0.18		3.72
681,750	0.21	3.73			681,750	0.18		3.72
682,100	0.21	3.73			682,100	0.18		3.72
682,450	0.21	3.73			682,450	0.18		3.72
682,800	0.21	3.73			682,800	0.18		3.72
683,150	0.20	3.73			683,150	0.18		3.72
683,500	0.20	3.72			683,500	0.18		3.72
683,850	0.20	3.72			683,850	0.18		3.72
684,200	0.20	3.72			684,200	0.18		3.72

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
684,550	0.20	3.72			684,550	0.18		3.72
684,900	0.20	3.72			684,900	0.18		3.72
685,250	0.20	3.72			685,250	0.18		3.72
685,600	0.20	3.72			685,600	0.18		3.72
685,950	0.20	3.72			685,950	0.18		3.72
686,300	0.20	3.72			686,300	0.18		3.72
686,650	0.20	3.73			686,650	0.18		3.72
687,000	0.20	3.73			687,000	0.18		3.72
687,350	0.20	3.73			687,350	0.18		3.72
687,700	0.20	3.73			687,700	0.18		3.72
688,050	0.20	3.73			688,050	0.18		3.72
688,400	0.20	3.73			688,400	0.18		3.72
688,750	0.20	3.73			688,750	0.17		3.72
689,100	0.20	3.73			689,100	0.17		3.72
689,450	0.20	3.73			689,450	0.17		3.72
689,800	0.20	3.73			689,800	0.17		3.72
690,150	0.20	3.73			690,150	0.17		3.72
690,500	0.20	3.73			690,500	0.17		3.72
690,850	0.20	3.73			690,850	0.17		3.72
691,200	0.20	3.73			691,200	0.17		3.72
691,550	0.19	3.72			691,550	0.17		3.72
691,900	0.19	3.72			691,900	0.17		3.72
692,250	0.19	3.72			692,250	0.17		3.72
692,600	0.19	3.72			692,600	0.17		3.72
692,950	0.19	3.72			692,950	0.17		3.72
693,300	0.19	3.72			693,300	0.17		3.72
693,650	0.19	3.72			693,650	0.16		3.71
694,000	0.19	3.72			694,000	0.16		3.71
694,350	0.19	3.72			694,350	0.16		3.71
694,700	0.19	3.72			694,700	0.16		3.71
695,050	0.19	3.72			695,050	0.16		3.71
695,400	0.18	3.72			695,400	0.16		3.71
695,750	0.18	3.72			695,750	0.16		3.71
696,100	0.18	3.72			696,100	0.16		3.71
696,450	0.18	3.71			696,450	0.16		3.71
696,800	0.18	3.71			696,800	0.16		3.71
697,150	0.18	3.71			697,150	0.16		3.71
697,500	0.18	3.71			697,500	0.16		3.71
697,850	0.18	3.71			697,850	0.16		3.71
698,200	0.18	3.71			698,200	0.15		3.71
698,550	0.18	3.71			698,550	0.15		3.71
698,900	0.18	3.71			698,900	0.15		3.71
699,250	0.18	3.71			699,250	0.15		3.71
699,600	0.18	3.71			699,600	0.15		3.71
699,950	0.18	3.71			699,950	0.15		3.71
700,300	0.18	3.71			700,300	0.15		3.71
700,650	0.18	3.71			700,650	0.15		3.71
701,000	0.18	3.71			701,000	0.15		3.71
701,350	0.17	3.71			701,350	0.15		3.71
701,700	0.17	3.71			701,700	0.15		3.70
702,050	0.17	3.71			702,050	0.15		3.70

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
702,400	0.17	3.71			702,400	0.15		3.70
702,750	0.17	3.71			702,750	0.15		3.70
703,100	0.17	3.71			703,100	0.15		3.70
703,450	0.17	3.71			703,450	0.15		3.70
703,800	0.17	3.71			703,800	0.15		3.70
704,150	0.17	3.71			704,150	0.15		3.70
704,500	0.17	3.71			704,500	0.15		3.70
704,850	0.17	3.71			704,850	0.15		3.70
705,200	0.17	3.71			705,200	0.15		3.70
705,550	0.17	3.71			705,550	0.15		3.70
705,900	0.17	3.71			705,900	0.14		3.70
706,250	0.17	3.71			706,250	0.14		3.70
706,600	0.17	3.71			706,600	0.14		3.70
706,950	0.17	3.71			706,950	0.14		3.70
707,300	0.17	3.71			707,300	0.14		3.70
707,650	0.17	3.71			707,650	0.14		3.70
708,000	0.17	3.71			708,000	0.14		3.70
708,350	0.17	3.71			708,350	0.14		3.70
708,700	0.17	3.71			708,700	0.14		3.70
709,050	0.16	3.71			709,050	0.14		3.70
709,400	0.16	3.70			709,400	0.14		3.70
709,750	0.16	3.70			709,750	0.14		3.70
710,100	0.16	3.70			710,100	0.14		3.70
710,450	0.16	3.70			710,450	0.14		3.70
710,800	0.16	3.70			710,800	0.14		3.70
711,150	0.16	3.70			711,150	0.14		3.70
711,500	0.16	3.70			711,500	0.13		3.69
711,850	0.16	3.70			711,850	0.13		3.69
712,200	0.16	3.70			712,200	0.13		3.69
712,550	0.16	3.70			712,550	0.13		3.69
712,900	0.16	3.70			712,900	0.13		3.69
713,250	0.15	3.70			713,250	0.13		3.69
713,600	0.15	3.70			713,600	0.13		3.69
713,950	0.15	3.70			713,950	0.13		3.69
714,300	0.15	3.69			714,300	0.13		3.69
714,650	0.15	3.69			714,650	0.13		3.69
715,000	0.15	3.69			715,000	0.13		3.69
715,350	0.15	3.69			715,350	0.12		3.69
715,700	0.15	3.69			715,700	0.12		3.69
716,050	0.15	3.69			716,050	0.12		3.69
716,400	0.15	3.69			716,400	0.12		3.69
716,750	0.15	3.69			716,750	0.12		3.69
717,100	0.15	3.69			717,100	0.12		3.69
717,450	0.15	3.69			717,450	0.12		3.69
717,800	0.15	3.69			717,800	0.12		3.69
718,150	0.14	3.69			718,150	0.12		3.68
718,500	0.14	3.69			718,500	0.12		3.68
718,850	0.14	3.69			718,850	0.12		3.68
719,200	0.14	3.69			719,200	0.12		3.68
719,550	0.14	3.69			719,550	0.12		3.68
719,900	0.14	3.69			719,900	0.12		3.68

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
720,250	0.14	3.69			720,250	0.12		3.68
720,600	0.14	3.69			720,600	0.12		3.68
720,950	0.14	3.69			720,950	0.12		3.68
721,300	0.14	3.69			721,300	0.12		3.68
721,650	0.14	3.69			721,650	0.12		3.68
722,000	0.14	3.69			722,000	0.12		3.68
722,350	0.14	3.69			722,350	0.12		3.68
722,700	0.14	3.69			722,700	0.12		3.68
723,050	0.14	3.69			723,050	0.12		3.68
723,400	0.14	3.69			723,400	0.12		3.69
723,750	0.14	3.69			723,750	0.12		3.69
724,100	0.14	3.69			724,100	0.12		3.69
724,450	0.14	3.69			724,450	0.12		3.69
724,800	0.14	3.69			724,800	0.12		3.69
725,150	0.14	3.69			725,150	0.12		3.69
725,500	0.14	3.70			725,500	0.12		3.69
725,850	0.14	3.70			725,850	0.12		3.69
726,200	0.14	3.70			726,200	0.12		3.69
726,550	0.14	3.70			726,550	0.12		3.69
726,900	0.14	3.70			726,900	0.12		3.69
727,250	0.15	3.70			727,250	0.12		3.69
727,600	0.15	3.70			727,600	0.12		3.69
727,950	0.15	3.70			727,950	0.12		3.70
728,300	0.15	3.70			728,300	0.12		3.70
728,650	0.15	3.70			728,650	0.12		3.70
729,000	0.15	3.70			729,000	0.12		3.70
729,350	0.15	3.70			729,350	0.12		3.70
729,700	0.15	3.70			729,700	0.12		3.70
730,050	0.15	3.70			730,050	0.12		3.70
730,400	0.15	3.70			730,400	0.12		3.70
730,750	0.15	3.70			730,750	0.12		3.70
731,100	0.15	3.71			731,100	0.12		3.70
731,450	0.15	3.71			731,450	0.12		3.70
731,800	0.15	3.71			731,800	0.12		3.70
732,150	0.15	3.71			732,150	0.12		3.70
732,500	0.15	3.71			732,500	0.13		3.70
732,850	0.15	3.71			732,850	0.13		3.70
733,200	0.15	3.71			733,200	0.13		3.70
733,550	0.15	3.71			733,550	0.13		3.70
733,900	0.15	3.71			733,900	0.13		3.70
734,250	0.15	3.71			734,250	0.13		3.70
734,600	0.15	3.71			734,600	0.13		3.70
734,950	0.15	3.71			734,950	0.13		3.71
735,300	0.15	3.71			735,300	0.13		3.71
735,650	0.15	3.71			735,650	0.13		3.71
736,000	0.15	3.71			736,000	0.13		3.71
736,350	0.15	3.71			736,350	0.13		3.71
736,700	0.15	3.71			736,700	0.13		3.71
737,050	0.15	3.71			737,050	0.13		3.71
737,400	0.15	3.71			737,400	0.13		3.71
737,750	0.15	3.71			737,750	0.13		3.71

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
738,100	0.15	3.71			738,100	0.13		3.71
738,450	0.15	3.72			738,450	0.13		3.71
738,800	0.15	3.72			738,800	0.13		3.71
739,150	0.15	3.72			739,150	0.13		3.71
739,500	0.16	3.72			739,500	0.13		3.71
739,850	0.16	3.72			739,850	0.13		3.71
740,200	0.16	3.72			740,200	0.13		3.71
740,550	0.16	3.72			740,550	0.13		3.71
740,900	0.16	3.72			740,900	0.13		3.71
741,250	0.16	3.72			741,250	0.13		3.71
741,600	0.16	3.72			741,600	0.13		3.71
741,950	0.16	3.72			741,950	0.13		3.71
742,300	0.16	3.72			742,300	0.13		3.72
742,650	0.16	3.72			742,650	0.13		3.72
743,000	0.16	3.72			743,000	0.13		3.72
743,350	0.16	3.72			743,350	0.13		3.72
743,700	0.16	3.72			743,700	0.13		3.72
744,050	0.16	3.72			744,050	0.13		3.72
744,400	0.16	3.72			744,400	0.13		3.72
744,750	0.16	3.72			744,750	0.13		3.72
745,100	0.16	3.72			745,100	0.14		3.72
745,450	0.16	3.73			745,450	0.14		3.72
745,800	0.16	3.73			745,800	0.14		3.72
746,150	0.16	3.73			746,150	0.14		3.72
746,500	0.16	3.73			746,500	0.14		3.72
746,850	0.16	3.73			746,850	0.14		3.72
747,200	0.16	3.73			747,200	0.14		3.72
747,550	0.16	3.73			747,550	0.14		3.72
747,900	0.16	3.73			747,900	0.14		3.72
748,250	0.16	3.73			748,250	0.14		3.72
748,600	0.16	3.73			748,600	0.14		3.72
748,950	0.16	3.73			748,950	0.14		3.72
749,300	0.16	3.73			749,300	0.14		3.72
749,650	0.16	3.73			749,650	0.14		3.73
750,000	0.16	3.73			750,000	0.14		3.73
750,350	0.16	3.73			750,350	0.14		3.73
750,700	0.16	3.73			750,700	0.14		3.73
751,050	0.16	3.73			751,050	0.14		3.73
751,400	0.16	3.73			751,400	0.14		3.73
751,750	0.16	3.73			751,750	0.14		3.73
752,100	0.17	3.73			752,100	0.14		3.73
752,450	0.17	3.73			752,450	0.14		3.73
752,800	0.17	3.74			752,800	0.14		3.73
753,150	0.17	3.74			753,150	0.14		3.73
753,500	0.17	3.74			753,500	0.14		3.73
753,850	0.17	3.74			753,850	0.14		3.73
754,200	0.17	3.74			754,200	0.14		3.73
754,550	0.17	3.74			754,550	0.14		3.73
754,900	0.17	3.74			754,900	0.14		3.73
755,250	0.17	3.74			755,250	0.14		3.73
755,600	0.17	3.74			755,600	0.14		3.73

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
755,950	0.17	3.74			755,950	0.14		3.73
756,300	0.17	3.74			756,300	0.14		3.73
756,650	0.17	3.74			756,650	0.14		3.74
757,000	0.17	3.74			757,000	0.14		3.74
757,350	0.17	3.74			757,350	0.14		3.74
757,700	0.17	3.74			757,700	0.15		3.74
758,050	0.17	3.74			758,050	0.15		3.74
758,400	0.17	3.74			758,400	0.15		3.74
758,750	0.17	3.74			758,750	0.15		3.74
759,100	0.17	3.74			759,100	0.15		3.74
759,450	0.17	3.74			759,450	0.15		3.74
759,800	0.17	3.74			759,800	0.15		3.74
760,150	0.17	3.75			760,150	0.15		3.74
760,500	0.17	3.75			760,500	0.15		3.74
760,850	0.17	3.75			760,850	0.15		3.74
761,200	0.17	3.75			761,200	0.15		3.74
761,550	0.17	3.75			761,550	0.15		3.74
761,900	0.17	3.75			761,900	0.15		3.74
762,250	0.17	3.75			762,250	0.15		3.74
762,600	0.17	3.75			762,600	0.15		3.74
762,950	0.17	3.75			762,950	0.15		3.74
763,300	0.17	3.75			763,300	0.15		3.74
763,650	0.17	3.75			763,650	0.15		3.74
764,000	0.17	3.75			764,000	0.15		3.75
764,350	0.17	3.75			764,350	0.15		3.75
764,700	0.18	3.75			764,700	0.15		3.75
765,050	0.18	3.75			765,050	0.15		3.75
765,400	0.18	3.75			765,400	0.15		3.75
765,750	0.18	3.75			765,750	0.15		3.75
766,100	0.18	3.75			766,100	0.15		3.75
766,450	0.18	3.75			766,450	0.15		3.75
766,800	0.18	3.75			766,800	0.15		3.75
767,150	0.18	3.76			767,150	0.15		3.75
767,500	0.18	3.76			767,500	0.15		3.75
767,850	0.18	3.76			767,850	0.15		3.75
768,200	0.18	3.76			768,200	0.15		3.75
768,550	0.18	3.76			768,550	0.15		3.75
768,900	0.18	3.76			768,900	0.15		3.75
769,250	0.18	3.76			769,250	0.15		3.75
769,600	0.18	3.76			769,600	0.15		3.75
769,950	0.18	3.76			769,950	0.15		3.75
770,300	0.18	3.76			770,300	0.16		3.75
770,650	0.18	3.76			770,650	0.16		3.75
771,000	0.18	3.76			771,000	0.16		3.75
771,350	0.18	3.76			771,350	0.16		3.76
771,700	0.18	3.76			771,700	0.16		3.76
772,050	0.18	3.76			772,050	0.16		3.76
772,400	0.18	3.76			772,400	0.16		3.76
772,750	0.18	3.76			772,750	0.16		3.76
773,100	0.18	3.76			773,100	0.16		3.76
773,450	0.18	3.76			773,450	0.16		3.76

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
773,800	0.18	3.76			773,800	0.16		3.76
774,150	0.18	3.76			774,150	0.16		3.76
774,500	0.18	3.77			774,500	0.16		3.76
774,850	0.18	3.77			774,850	0.16		3.76
775,200	0.18	3.77			775,200	0.16		3.76
775,550	0.18	3.77			775,550	0.16		3.76
775,900	0.18	3.77			775,900	0.16		3.76
776,250	0.18	3.77			776,250	0.16		3.76
776,600	0.18	3.77			776,600	0.16		3.76
776,950	0.18	3.77			776,950	0.16		3.76
777,300	0.19	3.77			777,300	0.16		3.76
777,650	0.19	3.77			777,650	0.16		3.76
778,000	0.19	3.77			778,000	0.16		3.76
778,350	0.19	3.77			778,350	0.16		3.77
778,700	0.19	3.77			778,700	0.16		3.77
779,050	0.19	3.77			779,050	0.16		3.77
779,400	0.19	3.77			779,400	0.16		3.77
779,750	0.19	3.77			779,750	0.16		3.77
780,100	0.19	3.77			780,100	0.16		3.77
780,450	0.19	3.77			780,450	0.16		3.77
780,800	0.19	3.77			780,800	0.16		3.77
781,150	0.19	3.77			781,150	0.16		3.77
781,500	0.19	3.77			781,500	0.16		3.77
781,850	0.19	3.78			781,850	0.16		3.77
782,200	0.19	3.78			782,200	0.16		3.77
782,550	0.19	3.78			782,550	0.16		3.77
782,900	0.19	3.78			782,900	0.17		3.77
783,250	0.19	3.78			783,250	0.17		3.77
783,600	0.19	3.78			783,600	0.17		3.77
783,950	0.19	3.78			783,950	0.17		3.77
784,300	0.19	3.78			784,300	0.17		3.77
784,650	0.19	3.78			784,650	0.17		3.77
785,000	0.19	3.78			785,000	0.17		3.77
785,350	0.19	3.78			785,350	0.17		3.77
785,700	0.19	3.78			785,700	0.17		3.78
786,050	0.19	3.78			786,050	0.17		3.78
786,400	0.19	3.78			786,400	0.17		3.78
786,750	0.19	3.78			786,750	0.17		3.78
787,100	0.19	3.78			787,100	0.17		3.78
787,450	0.19	3.78			787,450	0.17		3.78
787,800	0.19	3.78			787,800	0.17		3.78
788,150	0.19	3.78			788,150	0.17		3.78
788,500	0.19	3.78			788,500	0.17		3.78
788,850	0.19	3.79			788,850	0.17		3.78
789,200	0.19	3.79			789,200	0.17		3.78
789,550	0.19	3.79			789,550	0.17		3.78
789,900	0.20	3.79			789,900	0.17		3.78
790,250	0.20	3.79			790,250	0.17		3.78
790,600	0.20	3.79			790,600	0.17		3.78
790,950	0.20	3.79			790,950	0.17		3.78
791,300	0.20	3.79			791,300	0.17		3.78

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
791,650	0.20	3.79			***791,650***	0.17		3.78
792,000	0.20	3.79			***792,000***	0.17		3.78
792,350	0.20	3.79			***792,350***	0.17		3.78
792,700	0.20	3.79			***792,700***	0.17		3.78
793,050	0.20	3.79			***793,050***	0.17		3.79
793,400	0.20	3.79			***793,400***	0.17		3.79
793,750	0.20	3.79			***793,750***	0.17		3.79
794,100	0.20	3.79			***794,100***	0.17		3.79
794,450	0.20	3.79			***794,450***	0.17		3.79
794,800	0.20	3.79			***794,800***	0.17		3.79
795,150	0.20	3.79			***795,150***	0.17		3.79
795,500	0.20	3.79			***795,500***	0.18		3.79
795,850	0.20	3.79			***795,850***	0.18		3.79
796,200	0.20	3.80			***796,200***	0.18		3.79
796,550	0.20	3.80			***796,550***	0.18		3.79
796,900	0.20	3.80			***796,900***	0.18		3.79
797,250	0.20	3.80			***797,250***	0.18		3.79
797,600	0.20	3.80			***797,600***	0.18		3.79
797,950	0.20	3.80			***797,950***	0.18		3.79
798,300	0.20	3.80			***798,300***	0.18		3.79
798,650	0.20	3.80			***798,650***	0.18		3.79
799,000	0.20	3.80			***799,000***	0.18		3.79
799,350	0.20	3.80			***799,350***	0.18		3.79
799,700	0.20	3.80			***799,700***	0.18		3.79
800,050	0.20	3.80			***800,050***	0.18		3.79
800,400	0.20	3.80			***800,400***	0.18		3.80
800,750	0.20	3.80			***800,750***	0.18		3.80
801,100	0.20	3.80			***801,100***	0.18		3.80
801,450	0.20	3.80			***801,450***	0.18		3.80
801,800	0.20	3.80			***801,800***	0.18		3.80
802,150	0.20	3.80			***802,150***	0.18		3.80
802,500	0.20	3.80			***802,500***	0.18		3.80
802,850	0.21	3.80			***802,850***	0.18		3.80
803,200	0.21	3.80			***803,200***	0.18		3.80
803,550	0.21	3.81			***803,550***	0.18		3.80
803,900	0.21	3.81			***803,900***	0.18		3.80
804,250	0.21	3.81			***804,250***	0.18		3.80
804,600	0.21	3.81			***804,600***	0.18		3.80
804,950	0.21	3.81			***804,950***	0.18		3.80
805,300	0.21	3.81			***805,300***	0.18		3.80
805,650	0.21	3.81			***805,650***	0.18		3.80
806,000	0.21	3.81			***806,000***	0.18		3.80
806,350	0.21	3.81			***806,350***	0.18		3.80
806,700	0.21	3.81			***806,700***	0.18		3.80
807,050	0.21	3.81			***807,050***	0.18		3.80
807,400	0.21	3.81			***807,400***	0.18		3.81
807,750	0.21	3.81			***807,750***	0.18		3.81
808,100	0.21	3.81			***808,100***	0.19		3.81
808,450	0.21	3.81			***808,450***	0.19		3.81
808,800	0.21	3.81			***808,800***	0.19		3.81
809,150	0.21	3.81			***809,150***	0.19		3.81

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
809,500	0.21	3.81			809,500	0.19		3.81
809,850	0.21	3.81			809,850	0.19		3.81
810,200	0.21	3.81			810,200	0.19		3.81
810,550	0.21	3.82			810,550	0.19		3.81
810,900	0.21	3.82			810,900	0.19		3.81
811,250	0.21	3.82			811,250	0.19		3.81
811,600	0.21	3.82			811,600	0.19		3.81
811,950	0.21	3.82			811,950	0.19		3.81
812,300	0.21	3.82			812,300	0.19		3.81
812,650	0.21	3.82			812,650	0.19		3.81
813,000	0.21	3.82			813,000	0.19		3.81
813,350	0.21	3.82			813,350	0.19		3.81
813,700	0.21	3.82			813,700	0.19		3.81
814,050	0.21	3.82			814,050	0.19		3.81
814,400	0.21	3.82			814,400	0.19		3.81
814,750	0.21	3.82			814,750	0.19		3.82
815,100	0.21	3.82			815,100	0.19		3.82
815,450	0.22	3.82			815,450	0.19		3.82
815,800	0.22	3.82			815,800	0.19		3.82
816,150	0.22	3.82			816,150	0.19		3.82
816,500	0.22	3.82			816,500	0.19		3.82
816,850	0.22	3.82			816,850	0.19		3.82
817,200	0.22	3.82			817,200	0.19		3.82
817,550	0.22	3.82			817,550	0.19		3.82
817,900	0.22	3.83			817,900	0.19		3.82
818,250	0.22	3.83			818,250	0.19		3.82
818,600	0.22	3.83			818,600	0.19		3.82
818,950	0.22	3.83			818,950	0.19		3.82
819,300	0.22	3.83			819,300	0.19		3.82
819,650	0.22	3.83			819,650	0.19		3.82
820,000	0.22	3.83			820,000	0.19		3.82
820,350	0.22	3.83			820,350	0.19		3.82
820,700	0.22	3.83			820,700	0.19		3.82
821,050	0.22	3.83			821,050	0.20		3.82
821,400	0.22	3.83			821,400	0.20		3.82
821,750	0.22	3.83			821,750	0.20		3.82
822,100	0.22	3.83			822,100	0.20		3.83
822,450	0.22	3.83			822,450	0.20		3.83
822,800	0.22	3.83			822,800	0.20		3.83
823,150	0.22	3.83			823,150	0.20		3.83
823,500	0.22	3.83			823,500	0.20		3.83
823,850	0.22	3.83			823,850	0.20		3.83
824,200	0.22	3.83			824,200	0.20		3.83
824,550	0.22	3.83			824,550	0.20		3.83
824,900	0.22	3.83			824,900	0.20		3.83
825,250	0.22	3.84			825,250	0.20		3.83
825,600	0.22	3.84			825,600	0.20		3.83
825,950	0.22	3.84			825,950	0.20		3.83
826,300	0.22	3.84			826,300	0.20		3.83
826,650	0.22	3.84			826,650	0.20		3.83
827,000	0.22	3.84			827,000	0.20		3.83

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
827,350	0.22	3.84			827,350	0.20		3.83
827,700	0.22	3.84			827,700	0.20		3.83
828,050	0.23	3.84			828,050	0.20		3.83
828,400	0.23	3.84			828,400	0.20		3.83
828,750	0.23	3.84			828,750	0.20		3.83
829,100	0.23	3.84			829,100	0.20		3.84
829,450	0.23	3.84			829,450	0.20		3.84
829,800	0.23	3.84			829,800	0.20		3.84
830,150	0.23	3.84			830,150	0.20		3.84
830,500	0.23	3.84			830,500	0.20		3.84
830,850	0.23	3.84			830,850	0.20		3.84
831,200	0.23	3.84			831,200	0.20		3.84
831,550	0.23	3.84			831,550	0.20		3.84
831,900	0.23	3.84			831,900	0.20		3.84
832,250	0.23	3.85			832,250	0.20		3.84
832,600	0.23	3.85			832,600	0.20		3.84
832,950	0.23	3.85			832,950	0.20		3.84
833,300	0.23	3.85			833,300	0.20		3.84
833,650	0.23	3.85			833,650	0.21		3.84
834,000	0.23	3.85			834,000	0.21		3.84
834,350	0.23	3.85			834,350	0.21		3.84
834,700	0.23	3.85			834,700	0.21		3.84
835,050	0.23	3.85			835,050	0.21		3.84
835,400	0.23	3.85			835,400	0.21		3.84
835,750	0.23	3.85			835,750	0.21		3.84
836,100	0.23	3.85			836,100	0.21		3.84
836,450	0.23	3.85			836,450	0.21		3.85
836,800	0.23	3.85			836,800	0.21		3.85
837,150	0.23	3.85			837,150	0.21		3.85
837,500	0.23	3.85			837,500	0.21		3.85
837,850	0.23	3.85			837,850	0.21		3.85
838,200	0.23	3.85			838,200	0.21		3.85
838,550	0.23	3.85			838,550	0.21		3.85
838,900	0.23	3.85			838,900	0.21		3.85
839,250	0.23	3.85			839,250	0.21		3.85
839,600	0.23	3.86			839,600	0.21		3.85
839,950	0.23	3.86			839,950	0.21		3.85
840,300	0.23	3.86			840,300	0.21		3.85
840,650	0.23	3.86			840,650	0.21		3.85
841,000	0.24	3.86			841,000	0.21		3.85
841,350	0.24	3.86			841,350	0.21		3.85
841,700	0.24	3.86			841,700	0.21		3.85
842,050	0.24	3.86			842,050	0.21		3.85
842,400	0.24	3.86			842,400	0.21		3.85
842,750	0.24	3.86			842,750	0.21		3.85
843,100	0.24	3.86			843,100	0.21		3.85
843,450	0.24	3.86			843,450	0.21		3.85
843,800	0.24	3.86			843,800	0.21		3.86
844,150	0.24	3.86			844,150	0.21		3.86
844,500	0.24	3.86			844,500	0.21		3.86
844,850	0.24	3.86			844,850	0.21		3.86

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
845,200	0.24	3.86			***845,200***	0.21		3.86
845,550	0.24	3.86			***845,550***	0.21		3.86
845,900	0.24	3.86			***845,900***	0.21		3.86
846,250	0.24	3.86			***846,250***	0.22		3.86
846,600	0.24	3.86			***846,600***	0.22		3.86
846,950	0.24	3.87			***846,950***	0.22		3.86
847,300	0.24	3.87			***847,300***	0.22		3.86
847,650	0.24	3.87			***847,650***	0.22		3.86
848,000	0.24	3.87			***848,000***	0.22		3.86
848,350	0.24	3.87			***848,350***	0.22		3.86
848,700	0.24	3.87			***848,700***	0.22		3.86
849,050	0.24	3.87			***849,050***	0.22		3.86
849,400	0.24	3.87			***849,400***	0.22		3.86
849,750	0.24	3.87			***849,750***	0.22		3.86
850,100	0.24	3.87			***850,100***	0.22		3.86
850,450	0.24	3.87			***850,450***	0.22		3.86
850,800	0.24	3.87			***850,800***	0.22		3.87
851,150	0.24	3.87			***851,150***	0.22		3.87
851,500	0.24	3.87			***851,500***	0.22		3.87
851,850	0.24	3.87			***851,850***	0.22		3.87
852,200	0.24	3.87			***852,200***	0.22		3.87
852,550	0.24	3.87			***852,550***	0.22		3.87
852,900	0.24	3.87			***852,900***	0.22		3.87
853,250	0.24	3.87			***853,250***	0.22		3.87
853,600	0.25	3.87			***853,600***	0.22		3.87
853,950	0.25	3.87			***853,950***	0.22		3.87
854,300	0.25	3.88			***854,300***	0.22		3.87
854,650	0.25	3.88			***854,650***	0.22		3.87
855,000	0.25	3.88			***855,000***	0.22		3.87
855,350	0.25	3.88			***855,350***	0.22		3.87
855,700	0.25	3.88			***855,700***	0.22		3.87
856,050	0.25	3.88			***856,050***	0.22		3.87
856,400	0.25	3.88			***856,400***	0.22		3.87
856,750	0.25	3.88			***856,750***	0.22		3.87
857,100	0.25	3.88			***857,100***	0.22		3.87
857,450	0.25	3.88			***857,450***	0.22		3.87
857,800	0.25	3.88			***857,800***	0.22		3.87
858,150	0.25	3.88			***858,150***	0.22		3.87
858,500	0.25	3.88			***858,500***	0.22		3.87
858,850	0.25	3.88			***858,850***	0.22		3.87
859,200	0.25	3.88			***859,200***	0.22		3.88
859,550	0.25	3.88			***859,550***	0.22		3.88
859,900	0.25	3.88			***859,900***	0.22		3.88
860,250	0.25	3.88			***860,250***	0.22		3.88
860,600	0.25	3.88			***860,600***	0.22		3.88
860,950	0.25	3.88			***860,950***	0.22		3.88
861,300	0.25	3.88			***861,300***	0.22		3.88
861,650	0.25	3.88			***861,650***	0.22		3.88
862,000	0.25	3.88			***862,000***	0.23		3.88
862,350	0.25	3.88			***862,350***	0.23		3.88
862,700	0.25	3.88			***862,700***	0.23		3.88

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
863,050	0.25	3.88			863,050	0.23		3.88
863,400	0.25	3.89			863,400	0.23		3.88
863,750	0.25	3.89			863,750	0.23		3.88
864,100	0.25	3.89			864,100	0.23		3.88
864,450	0.25	3.89			864,450	0.23		3.88
864,800	0.25	3.89			864,800	0.23		3.88
865,150	0.25	3.89			865,150	0.23		3.88
865,500	0.25	3.89			865,500	0.23		3.88
865,850	0.25	3.89			865,850	0.23		3.88
866,200	0.25	3.89			866,200	0.23		3.88
866,550	0.25	3.89			866,550	0.23		3.88
866,900	0.25	3.89			866,900	0.23		3.88
867,250	0.25	3.89			867,250	0.23		3.88
867,600	0.25	3.89			867,600	0.23		3.88
867,950	0.25	3.89			867,950	0.23		3.89
868,300	0.25	3.89			868,300	0.23		3.89
868,650	0.25	3.89			868,650	0.23		3.89
869,000	0.25	3.89			869,000	0.23		3.89
869,350	0.25	3.89			869,350	0.23		3.89
869,700	0.25	3.90			869,700	0.23		3.89
870,050	0.25	3.90			870,050	0.23		3.89
870,400	0.26	3.90			870,400	0.23		3.89
870,750	0.26	3.90			870,750	0.23		3.89
871,100	0.26	3.90			871,100	0.23		3.89
871,450	0.26	3.90			871,450	0.23		3.89
871,800	0.26	3.90			871,800	0.23		3.89
872,150	0.26	3.90			872,150	0.23		3.89
872,500	0.26	3.90			872,500	0.23		3.90
872,850	0.26	3.90			872,850	0.23		3.90
873,200	0.26	3.90			873,200	0.23		3.90
873,550	0.26	3.90			873,550	0.23		3.90
873,900	0.26	3.90			873,900	0.23		3.90
874,250	0.26	3.90			874,250	0.23		3.90
874,600	0.26	3.90			874,600	0.23		3.90
874,950	0.26	3.90			874,950	0.23		3.90
875,300	0.26	3.90			875,300	0.23		3.90
875,650	0.26	3.91			875,650	0.23		3.90
876,000	0.26	3.91			876,000	0.23		3.90
876,350	0.26	3.91			876,350	0.23		3.90
876,700	0.26	3.91			876,700	0.24		3.90
877,050	0.26	3.91			877,050	0.24		3.90
877,400	0.26	3.91			877,400	0.24		3.90
877,750	0.26	3.91			877,750	0.24		3.90
878,100	0.26	3.91			878,100	0.24		3.90
878,450	0.26	3.91			878,450	0.24		3.90
878,800	0.26	3.91			878,800	0.24		3.90
879,150	0.26	3.91			879,150	0.24		3.90
879,500	0.26	3.91			879,500	0.24		3.90
879,850	0.26	3.91			879,850	0.24		3.90
880,200	0.26	3.91			880,200	0.24		3.90
880,550	0.26	3.91			880,550	0.24		3.90

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
880,900	0.26	3.91			880,900	0.24		3.91
881,250	0.26	3.91			881,250	0.24		3.91
881,600	0.26	3.91			881,600	0.24		3.91
881,950	0.26	3.91			881,950	0.24		3.91
882,300	0.26	3.91			882,300	0.24		3.91
882,650	0.26	3.91			882,650	0.24		3.91
883,000	0.26	3.91			883,000	0.24		3.91
883,350	0.26	3.91			883,350	0.24		3.91
883,700	0.26	3.91			883,700	0.24		3.91
884,050	0.26	3.91			884,050	0.24		3.91
884,400	0.26	3.91			884,400	0.24		3.91
884,750	0.26	3.91			884,750	0.24		3.91
885,100	0.26	3.92			885,100	0.24		3.91
885,450	0.26	3.92			885,450	0.24		3.91
885,800	0.26	3.92			885,800	0.24		3.91
886,150	0.26	3.92			886,150	0.24		3.91
886,500	0.26	3.92			886,500	0.24		3.91
886,850	0.26	3.92			886,850	0.24		3.91
887,200	0.26	3.92			887,200	0.24		3.91
887,550	0.26	3.92			887,550	0.24		3.91
887,900	0.26	3.92			887,900	0.24		3.91
888,250	0.26	3.92			888,250	0.24		3.91
888,600	0.27	3.92			888,600	0.24		3.91
888,950	0.27	3.92			888,950	0.24		3.91
889,300	0.27	3.92			889,300	0.24		3.91
889,650	0.27	3.92			889,650	0.24		3.91
890,000	0.27	3.92			890,000	0.24		3.91
890,350	0.27	3.92			890,350	0.24		3.92
890,700	0.27	3.92			890,700	0.24		3.92
891,050	0.27	3.92			891,050	0.24		3.92
891,400	0.27	3.92			891,400	0.24		3.92
891,750	0.27	3.92			891,750	0.24		3.92
892,100	0.27	3.92			892,100	0.24		3.92
892,450	0.27	3.92			892,450	0.24		3.92
892,800	0.27	3.92			892,800	0.24		3.92
893,150	0.27	3.92			893,150	0.24		3.92
893,500	0.27	3.92			893,500	0.24		3.92
893,850	0.27	3.92			893,850	0.24		3.92
894,200	0.27	3.93			894,200	0.24		3.92
894,550	0.27	3.93			894,550	0.24		3.92
894,900	0.27	3.93			894,900	0.24		3.92
895,250	0.27	3.93			895,250	0.24		3.92
895,600	0.27	3.93			895,600	0.24		3.92
895,950	0.27	3.93			895,950	0.24		3.92
896,300	0.27	3.93			896,300	0.24		3.92
896,650	0.27	3.93			896,650	0.24		3.92
897,000	0.27	3.93			897,000	0.24		3.92
897,350	0.27	3.93			897,350	0.24		3.92
897,700	0.27	3.93			897,700	0.25		3.92
898,050	0.27	3.93			898,050	0.25		3.92
898,400	0.27	3.93			898,400	0.25		3.92

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
898,750	0.27	3.93			898,750	0.25		3.92
899,100	0.27	3.93			899,100	0.25		3.92
899,450	0.27	3.93			899,450	0.25		3.93
899,800	0.27	3.93			899,800	0.25		3.93
900,150	0.27	3.93			900,150	0.25		3.93
900,500	0.27	3.93			900,500	0.25		3.93
900,850	0.27	3.93			900,850	0.25		3.93
901,200	0.27	3.93			901,200	0.25		3.93
901,550	0.27	3.93			901,550	0.25		3.93
901,900	0.27	3.93			901,900	0.25		3.93
902,250	0.27	3.93			902,250	0.25		3.93
902,600	0.27	3.93			902,600	0.25		3.93
902,950	0.27	3.93			902,950	0.25		3.93
903,300	0.27	3.93			903,300	0.25		3.93
903,650	0.27	3.94			903,650	0.25		3.93
904,000	0.27	3.94			904,000	0.25		3.93
904,350	0.27	3.94			904,350	0.25		3.93
904,700	0.27	3.94			904,700	0.25		3.93
905,050	0.27	3.94			905,050	0.25		3.93
905,400	0.27	3.94			905,400	0.25		3.93
905,750	0.27	3.94			905,750	0.25		3.93
906,100	0.27	3.94			906,100	0.25		3.93
906,450	0.27	3.94			906,450	0.25		3.93
906,800	0.27	3.94			906,800	0.25		3.93
907,150	0.27	3.94			907,150	0.25		3.93
907,500	0.27	3.94			907,500	0.25		3.93
907,850	0.27	3.94			907,850	0.25		3.93
908,200	0.27	3.94			908,200	0.25		3.93
908,550	0.27	3.94			908,550	0.25		3.93
908,900	0.27	3.94			908,900	0.25		3.94
909,250	0.27	3.94			909,250	0.25		3.94
909,600	0.28	3.94			909,600	0.25		3.94
909,950	0.28	3.94			909,950	0.25		3.94
910,300	0.28	3.94			910,300	0.25		3.94
910,650	0.28	3.94			910,650	0.25		3.94
911,000	0.28	3.94			911,000	0.25		3.94
911,350	0.28	3.94			911,350	0.25		3.94
911,700	0.28	3.94			911,700	0.25		3.94
912,050	0.28	3.94			912,050	0.25		3.94
912,400	0.28	3.94			912,400	0.25		3.94
912,750	0.28	3.94			912,750	0.25		3.94
913,100	0.28	3.95			913,100	0.25		3.94
913,450	0.28	3.95			913,450	0.25		3.94
913,800	0.28	3.95			913,800	0.25		3.94
914,150	0.28	3.95			914,150	0.25		3.94
914,500	0.28	3.95			914,500	0.25		3.94
914,850	0.28	3.95			914,850	0.25		3.94
915,200	0.28	3.95			915,200	0.25		3.94
915,550	0.28	3.95			915,550	0.25		3.94
915,900	0.28	3.95			915,900	0.25		3.94
916,250	0.28	3.95			916,250	0.25		3.94

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
916,600	0.28	3.95			916,600	0.25		3.94
916,950	0.28	3.95			916,950	0.25		3.94
917,300	0.28	3.95			917,300	0.25		3.94
917,650	0.28	3.95			917,650	0.25		3.94
918,000	0.28	3.95			918,000	0.25		3.94
918,350	0.28	3.95			918,350	0.25		3.95
918,700	0.28	3.95			918,700	0.26		3.95
919,050	0.28	3.95			919,050	0.26		3.95
919,400	0.28	3.95			919,400	0.26		3.95
919,750	0.28	3.95			919,750	0.26		3.95
920,100	0.28	3.95			920,100	0.26		3.95
920,450	0.28	3.95			920,450	0.26		3.95
920,800	0.28	3.95			920,800	0.26		3.95
921,150	0.28	3.95			921,150	0.26		3.95
921,500	0.28	3.95			921,500	0.26		3.95
921,850	0.28	3.95			921,850	0.26		3.95
922,200	0.28	3.96			922,200	0.26		3.95
922,550	0.28	3.96			922,550	0.26		3.95
922,900	0.28	3.96			922,900	0.26		3.95
923,250	0.28	3.96			923,250	0.26		3.95
923,600	0.28	3.96			923,600	0.26		3.95
923,950	0.28	3.96			923,950	0.26		3.95
924,300	0.28	3.96			924,300	0.26		3.95
924,650	0.28	3.96			924,650	0.26		3.95
925,000	0.28	3.96			925,000	0.26		3.95
925,350	0.28	3.96			925,350	0.26		3.95
925,700	0.28	3.96			925,700	0.26		3.95
926,050	0.28	3.96			926,050	0.26		3.95
926,400	0.28	3.96			926,400	0.26		3.95
926,750	0.28	3.96			926,750	0.26		3.95
927,100	0.28	3.96			927,100	0.26		3.95
927,450	0.28	3.96			927,450	0.26		3.96
927,800	0.28	3.96			927,800	0.26		3.96
928,150	0.28	3.96			928,150	0.26		3.96
928,500	0.28	3.96			928,500	0.26		3.96
928,850	0.28	3.96			928,850	0.26		3.96
929,200	0.28	3.96			929,200	0.26		3.96
929,550	0.28	3.96			929,550	0.26		3.96
929,900	0.28	3.96			929,900	0.26		3.96
930,250	0.28	3.96			930,250	0.26		3.96
930,600	0.29	3.96			930,600	0.26		3.96
930,950	0.29	3.96			930,950	0.26		3.96
931,300	0.29	3.96			931,300	0.26		3.96
931,650	0.29	3.97			931,650	0.26		3.96
932,000	0.29	3.97			932,000	0.26		3.96
932,350	0.29	3.97			932,350	0.26		3.96
932,700	0.29	3.97			932,700	0.26		3.96
933,050	0.29	3.97			933,050	0.26		3.96
933,400	0.29	3.97			933,400	0.26		3.96
933,750	0.29	3.97			933,750	0.26		3.96
934,100	0.29	3.97			934,100	0.26		3.96

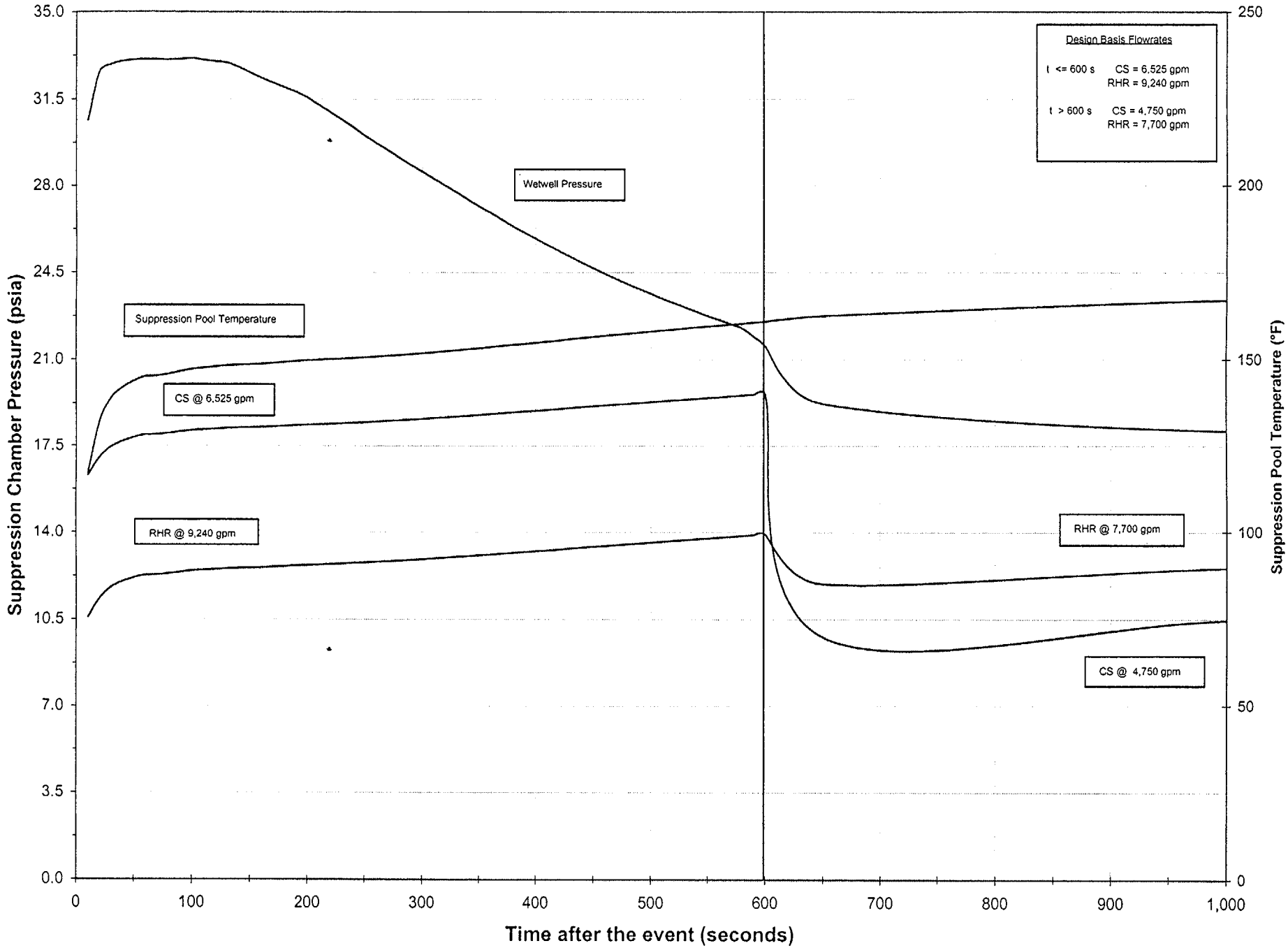
Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
934,450	0.29	3.97			934,450	0.26		3.96
934,800	0.29	3.97			934,800	0.26		3.96
935,150	0.29	3.97			935,150	0.26		3.96
935,500	0.29	3.97			935,500	0.26		3.96
935,850	0.29	3.97			935,850	0.26		3.96
936,200	0.29	3.97			936,200	0.26		3.96
936,550	0.29	3.97			936,550	0.26		3.96
936,900	0.29	3.97			936,900	0.26		3.97
937,250	0.29	3.97			937,250	0.26		3.97
937,600	0.29	3.97			937,600	0.26		3.97
937,950	0.29	3.97			937,950	0.26		3.97
938,300	0.29	3.97			938,300	0.26		3.97
938,650	0.29	3.97			938,650	0.26		3.97
939,000	0.29	3.97			939,000	0.26		3.97
939,350	0.29	3.97			939,350	0.26		3.97
939,700	0.29	3.97			939,700	0.26		3.97
940,050	0.29	3.97			940,050	0.27		3.97
940,400	0.29	3.97			940,400	0.27		3.97
940,750	0.29	3.97			940,750	0.27		3.97
941,100	0.29	3.98			941,100	0.27		3.97
941,450	0.29	3.98			941,450	0.27		3.97
941,800	0.29	3.98			941,800	0.27		3.97
942,150	0.29	3.98			942,150	0.27		3.97
942,500	0.29	3.98			942,500	0.27		3.97
942,850	0.29	3.98			942,850	0.27		3.97
943,200	0.29	3.98			943,200	0.27		3.97
943,550	0.29	3.98			943,550	0.27		3.97
943,900	0.29	3.98			943,900	0.27		3.97
944,250	0.29	3.98			944,250	0.27		3.97
944,600	0.29	3.98			944,600	0.27		3.97
944,950	0.29	3.98			944,950	0.27		3.97
945,300	0.29	3.98			945,300	0.27		3.97
945,650	0.29	3.98			945,650	0.27		3.97
946,000	0.29	3.98			946,000	0.27		3.98
946,350	0.29	3.98			946,350	0.27		3.98
946,700	0.29	3.98			946,700	0.27		3.98
947,050	0.29	3.98			947,050	0.27		3.98
947,400	0.29	3.98			947,400	0.27		3.98
947,750	0.29	3.98			947,750	0.27		3.98
948,100	0.29	3.98			948,100	0.27		3.98
948,450	0.29	3.98			948,450	0.27		3.98
948,800	0.29	3.98			948,800	0.27		3.98
949,150	0.29	3.98			949,150	0.27		3.98
949,500	0.29	3.98			949,500	0.27		3.98
949,850	0.29	3.98			949,850	0.27		3.98
950,200	0.29	3.99			950,200	0.27		3.98
950,550	0.29	3.99			950,550	0.27		3.98
950,900	0.29	3.99			950,900	0.27		3.98
951,250	0.29	3.99			951,250	0.27		3.98
951,600	0.29	3.99			951,600	0.27		3.98
951,950	0.30	3.99			951,950	0.27		3.98

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
952,300	0.30	3.99			952,300	0.27		3.98
952,650	0.30	3.99			952,650	0.27		3.98
953,000	0.30	3.99			953,000	0.27		3.98
953,350	0.30	3.99			953,350	0.27		3.98
953,700	0.30	3.99			953,700	0.27		3.98
954,050	0.30	3.99			954,050	0.27		3.98
954,400	0.30	3.99			954,400	0.27		3.98
954,750	0.30	3.99			954,750	0.27		3.98
955,100	0.30	3.99			955,100	0.27		3.98
955,450	0.30	3.99			955,450	0.27		3.99
955,800	0.30	3.99			955,800	0.27		3.99
956,150	0.30	3.99			956,150	0.27		3.99
956,500	0.30	3.99			956,500	0.27		3.99
956,850	0.30	3.99			956,850	0.27		3.99
957,200	0.30	3.99			957,200	0.27		3.99
957,550	0.30	3.99			957,550	0.27		3.99
957,900	0.30	3.99			957,900	0.27		3.99
958,250	0.30	3.99			958,250	0.27		3.99
958,600	0.30	3.99			958,600	0.27		3.99
958,950	0.30	3.99			958,950	0.27		3.99
959,300	0.30	3.99			959,300	0.27		3.99
959,650	0.30	4.00			959,650	0.27		3.99
960,000	0.30	4.00			960,000	0.27		3.99
960,350	0.30	4.00			960,350	0.27		3.99
960,700	0.30	4.00			960,700	0.27		3.99
961,050	0.30	4.00			961,050	0.28		3.99
961,400	0.30	4.00			961,400	0.28		3.99
961,750	0.30	4.00			961,750	0.28		3.99
962,100	0.30	4.00			962,100	0.28		3.99
962,450	0.30	4.00			962,450	0.28		3.99
962,800	0.30	4.00			962,800	0.28		3.99
963,150	0.30	4.00			963,150	0.28		4.00
963,500	0.30	4.00			963,500	0.28		4.00
963,850	0.30	4.00			963,850	0.28		4.00
964,200	0.30	4.00			964,200	0.28		4.00
964,550	0.30	4.00			964,550	0.28		4.00
964,900	0.30	4.00			964,900	0.28		4.00
965,250	0.30	4.01			965,250	0.28		4.00
965,600	0.30	4.01			965,600	0.28		4.00
965,950	0.30	4.01			965,950	0.28		4.00
966,300	0.30	4.01			966,300	0.28		4.00
966,650	0.30	4.01			966,650	0.28		4.00
967,000	0.30	4.01			967,000	0.28		4.00
967,350	0.31	4.01			967,350	0.28		4.00
967,700	0.31	4.01			967,700	0.28		4.00
968,050	0.31	4.01			968,050	0.28		4.01
968,400	0.31	4.01			968,400	0.28		4.01
968,750	0.31	4.01			968,750	0.28		4.01
969,100	0.31	4.01			969,100	0.28		4.01
969,450	0.31	4.01			969,450	0.28		4.01
969,800	0.31	4.01			969,800	0.28		4.01

Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
970,150	0.31	4.01			970,150	0.28		4.01
970,500	0.31	4.01			970,500	0.28		4.01
970,850	0.31	4.01			970,850	0.28		4.01
971,200	0.31	4.01			971,200	0.28		4.01
971,550	0.31	4.01			971,550	0.28		4.01
971,900	0.31	4.02			971,900	0.28		4.01
972,250	0.31	4.02			972,250	0.28		4.01
972,600	0.31	4.02			972,600	0.28		4.01
972,950	0.31	4.02			972,950	0.28		4.01
973,300	0.31	4.02			973,300	0.28		4.01
973,650	0.31	4.02			973,650	0.28		4.01
974,000	0.31	4.02			974,000	0.28		4.01
974,350	0.31	4.02			974,350	0.28		4.01
974,700	0.31	4.02			974,700	0.28		4.01
975,050	0.31	4.02			975,050	0.28		4.01
975,400	0.31	4.02			975,400	0.28		4.01
975,750	0.31	4.02			975,750	0.28		4.01
976,100	0.31	4.02			976,100	0.29		4.01
976,450	0.31	4.02			976,450	0.29		4.01
976,800	0.31	4.02			976,800	0.29		4.01
977,150	0.31	4.02			977,150	0.29		4.02
977,500	0.31	4.02			977,500	0.29		4.02
977,850	0.31	4.02			977,850	0.29		4.02
978,200	0.31	4.02			978,200	0.29		4.02
978,550	0.31	4.02			978,550	0.29		4.02
978,900	0.31	4.02			978,900	0.29		4.02
979,250	0.31	4.02			979,250	0.29		4.02
979,600	0.31	4.02			979,600	0.29		4.02
979,950	0.31	4.02			979,950	0.29		4.02
980,300	0.31	4.02			980,300	0.29		4.02
980,650	0.31	4.02			980,650	0.29		4.02
981,000	0.31	4.02			981,000	0.29		4.02
981,350	0.31	4.03			981,350	0.29		4.02
981,700	0.31	4.03			981,700	0.29		4.02
982,050	0.31	4.03			982,050	0.29		4.02
982,400	0.31	4.03			982,400	0.29		4.02
982,750	0.31	4.03			982,750	0.29		4.02
983,100	0.31	4.03			983,100	0.29		4.02
983,450	0.31	4.03			983,450	0.29		4.02
983,800	0.31	4.03			983,800	0.29		4.02
984,150	0.31	4.03			984,150	0.29		4.02
984,500	0.31	4.03			984,500	0.29		4.02
984,850	0.31	4.03			984,850	0.29		4.02
985,200	0.31	4.03			985,200	0.29		4.02
985,550	0.31	4.03			985,550	0.29		4.02
985,900	0.31	4.03			985,900	0.29		4.02
986,250	0.31	4.03			986,250	0.29		4.02
986,600	0.31	4.03			986,600	0.29		4.03
986,950	0.31	4.03			986,950	0.29		4.03
987,300	0.31	4.03			987,300	0.29		4.03
987,650	0.31	4.03			987,650	0.29		4.03

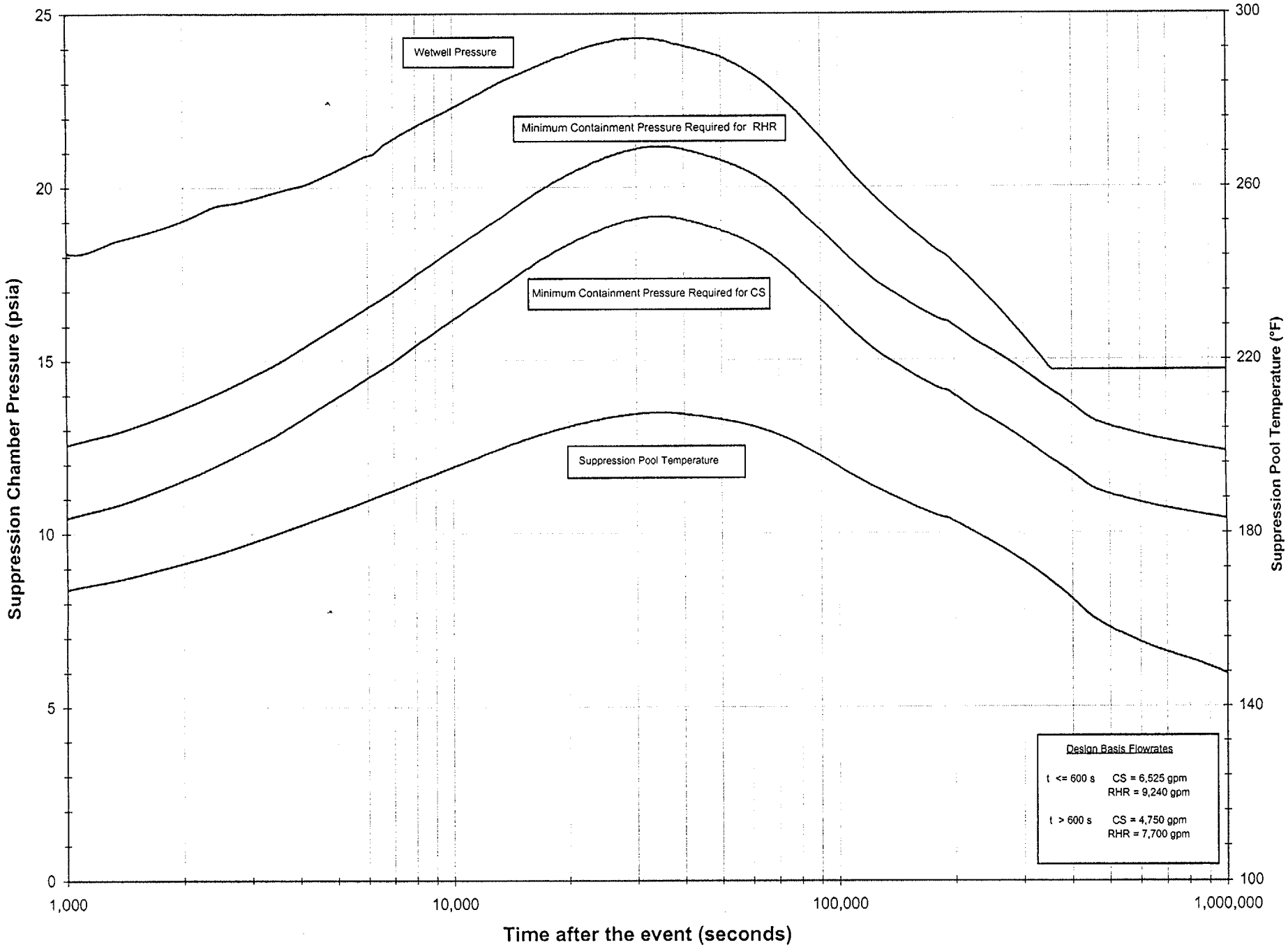
Time (sec)	Pump A	Pump A	Pump B		Time (sec)	Pump B	Pump C	Pump D
988,000	0.32	4.03			***988,000***	0.29		4.03
988,350	0.32	4.03			***988,350***	0.29		4.03
988,700	0.32	4.03			***988,700***	0.29		4.03
989,050	0.32	4.03			***989,050***	0.29		4.03
989,400	0.32	4.03			***989,400***	0.29		4.03
989,750	0.32	4.03			***989,750***	0.29		4.03
990,100	0.32	4.03			***990,100***	0.29		4.03
990,450	0.32	4.03			***990,450***	0.29		4.03
990,800	0.32	4.04			***990,800***	0.29		4.03
991,150	0.32	4.04			***991,150***	0.29		4.03
991,500	0.32	4.04			***991,500***	0.29		4.03
991,850	0.32	4.04			***991,850***	0.29		4.03
992,200	0.32	4.04			***992,200***	0.29		4.03
992,550	0.32	4.04			***992,550***	0.29		4.03
992,900	0.32	4.04			***992,900***	0.29		4.03
993,250	0.32	4.04			***993,250***	0.29		4.03
993,600	0.32	4.04			***993,600***	0.29		4.03
993,950	0.32	4.04			***993,950***	0.29		4.03
994,300	0.32	4.04			***994,300***	0.29		4.03
994,650	0.32	4.04			***994,650***	0.29		4.03
995,000	0.32	4.04			***995,000***	0.29		4.03
995,350	0.32	4.04			***995,350***	0.29		4.03
995,700	0.32	4.04			***995,700***	0.29		4.04
996,050	0.32	4.04			***996,050***	0.29		4.04
996,400	0.32	4.04			***996,400***	0.29		4.04
996,750	0.32	4.04			***996,750***	0.29		4.04
997,100	0.32	4.04			***997,100***	0.29		4.04
997,450	0.32	4.04			***997,450***	0.30		4.04
997,800	0.32	4.04			***997,800***	0.30		4.04
998,150	0.32	4.04			***998,150***	0.30		4.04
998,500	0.32	4.04			***998,500***	0.30		4.04
998,850	0.32	4.04			***998,850***	0.30		4.04
999,200	0.32	4.04			***999,200***	0.30		4.04
999,550	0.32	4.04			***999,550***	0.30		4.04
999,900	0.32	4.04			***999,900***	0.30		4.04
Min ->	0.14	3.69			***Min ->***	0.12		3.68

Minimum Containment Pressure Required for ECCS Pump Operation

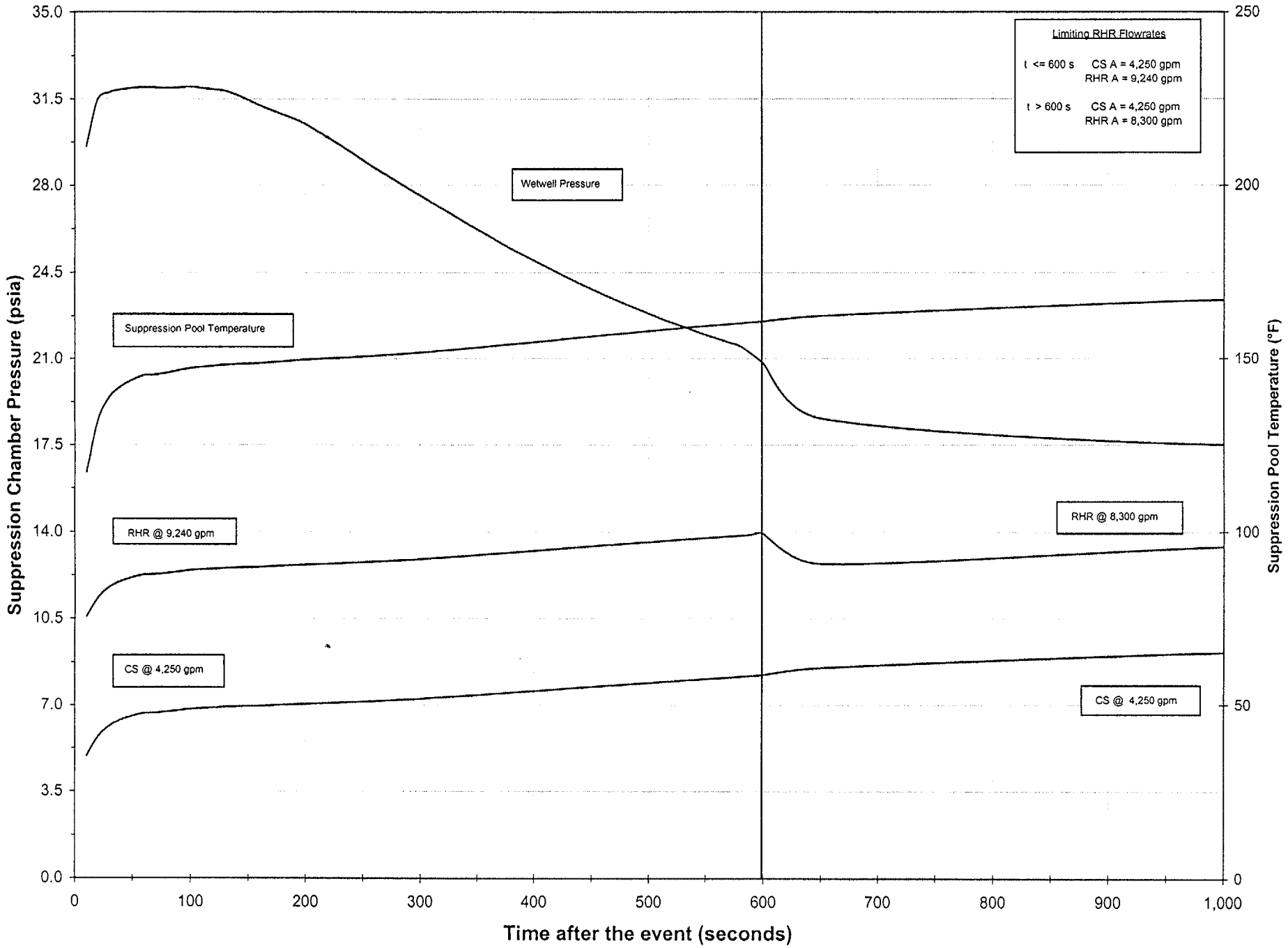


All pages of Attachment D Checked
GW 6/15/01

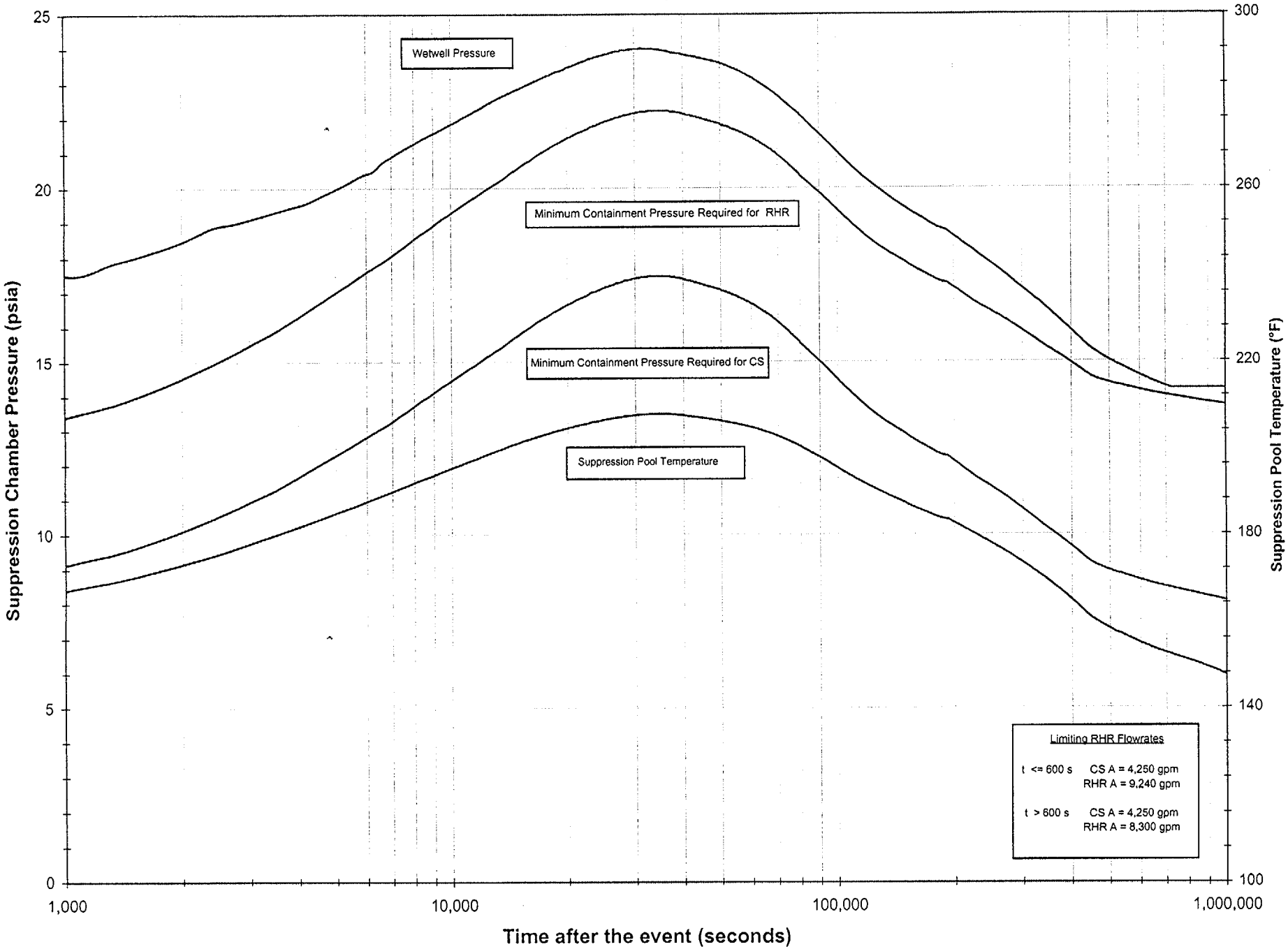
Minimum Containment Pressure Required for ECCS Pump Operation



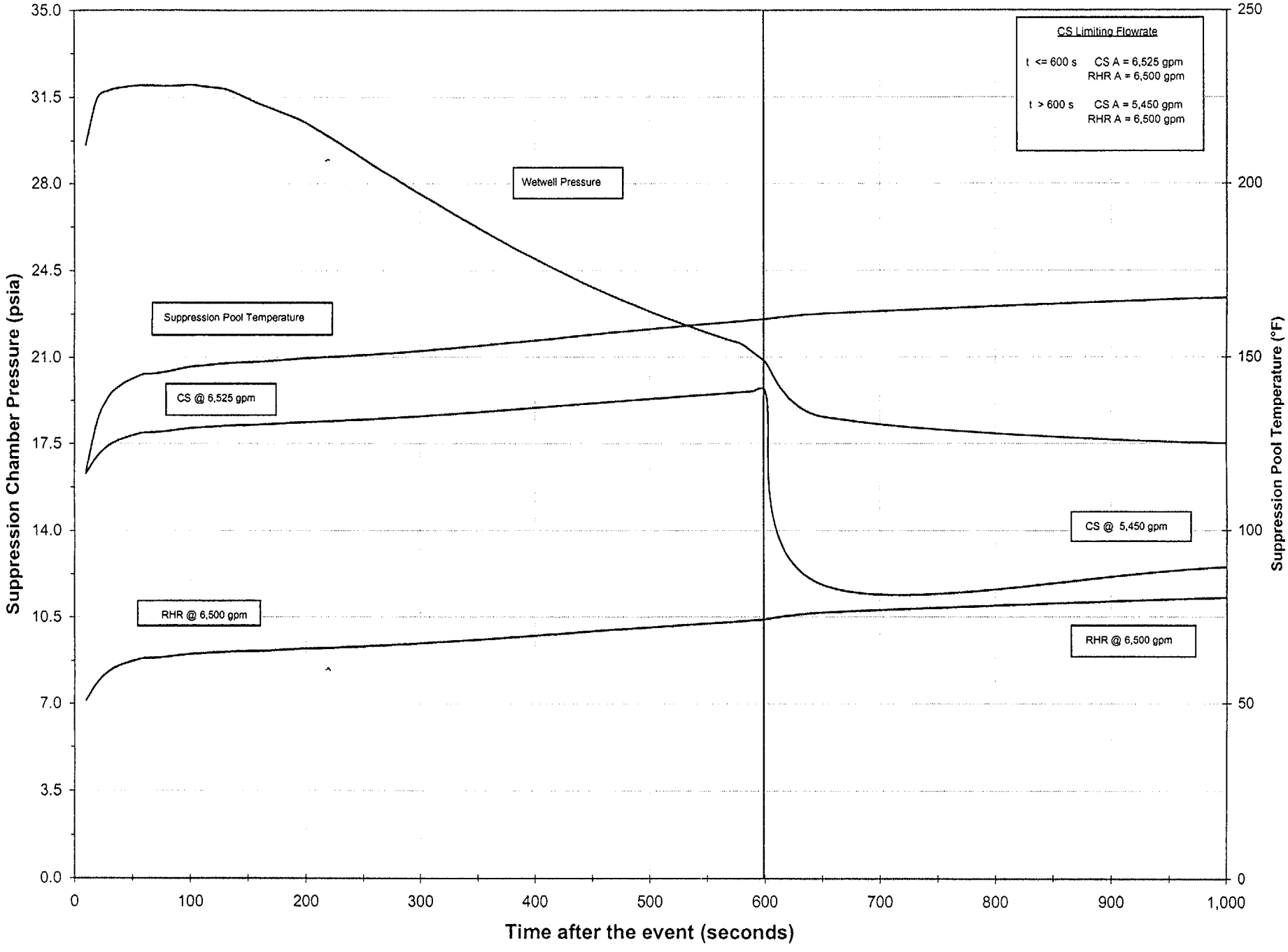
Minimum Containment Pressure Required for ECCS Pump Operation



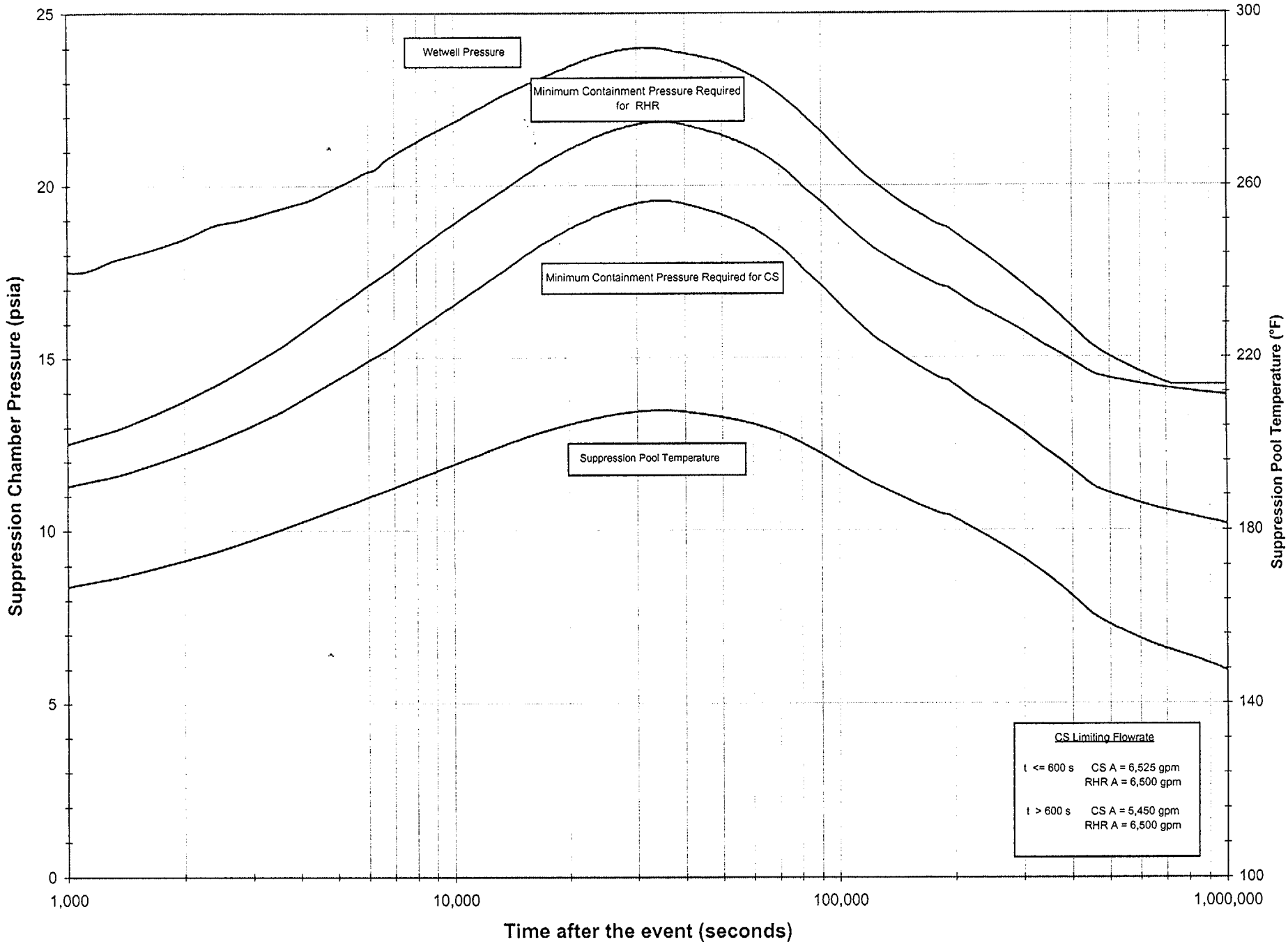
Minimum Containment Pressure Required for ECCS Pump Operation



Minimum Containment Pressure Required for ECCS Pump Operation



Minimum Containment Pressure Required for ECCS Pump Operation



Case ->	**4**	**A (Overpressure Calculations Using Case 1's flowrates)**						
			Run profiles Used					
		T<=	*T>*					
Division I		600	600	*Terminating at ->*		1,000,000	*Seconds*	
CS pump A ->		6,525	4,750	*Gpm*				
RHR pump A ->		9,240	7,700	*Gpm*				
RHR pump B ->		0	0	*Gpm*				
					Amount of Fibrous Material			
Division II						75.3	*Lbm*	
CS pump B ->		6,525	4,750	*Gpm*				
RHR pump C ->		0	0	*Gpm*				
RHR pump D ->		9,240	7,700	*Gpm*				
Interpolation routine using Suppression Pool temperature/pressure data in 97044G.xls								
time (sec) ->			999,900					
Pool Temp (°F) ->			147.5					
Chamber Pressure (psia) ->			14.7	*(Constant La =5%/day assumed)*				
				Base pressure used ->			14.7	*psia*

Max ->	33.14	207.80		4.91	6.46			4.94		6.47
			CS	*RHR*						
Minimum Overpressure Required			4.94	6.47	psig					

Case ->	**4**	**B (Overpressure Calculations Using Case 2's flowrates)**						
			Run profiles Used					
		T<=	*T>*					
Division I		600	600	*Terminating at ->*		1,000,000	*Seconds*	
CS pump A ->		4,250	4,250	*Gpm*				
RHR pump A ->		9,240	8,300	*Gpm*				
RHR pump B ->		0	0	*Gpm*				
					Amount of Fibrous Material			
Division II						75.3	*Lbm*	
CS pump B ->		4,250	4,250	*Gpm*				
RHR pump C ->		0	0	*Gpm*				
RHR pump D ->		9,240	8,300	*Gpm*				
Interpolation routine using Suppression Pool temperature/pressure data in 97044G.xls								
time (sec) ->			999,900					
Pool Temp (°F) ->			147.5					
Chamber Pressure (psia) ->			14.2	*(Constant La =0.635%/day assumed)*				
				Base pressure used ->			14.2	*psia*

Time (sec)	Pressure	Temp		Pump A	Pump A	Pump B		Pump B	Pump C	Pump D
Max ->	32.00	207.80		3.26	8.03			3.27		8.04
			CS	*RHR*						
Minimum Overpressure Required			3.27	8.04	psig					

Case ->	**4**	**C**	***(Overpressure Calculations Using Case 3's flowrates)***					
			Run profiles Used					
		T<=	*T>*					
Division I		600	600	*Terminating at ->*		1,000,000	*Seconds*	
CS pump A ->		6,525	5,450	*Gpm*				
RHR pump A ->		6,500	6,500	*Gpm*				
RHR pump B ->		0	0	*Gpm*				
					Amount of Fibrous Material			
Division II						75.3	*Lbm*	
CS pump B ->		6,525	5,450	*Gpm*				
RHR pump C ->		0	0	*Gpm*				
RHR pump D ->		6,500	6,500	*Gpm*				
Interpolation routine using Suppression Pool temperature/pressure data in 97044G.xls								
time (sec) ->			999,900					
Pool Temp (°F) ->			147.5					
Chamber Pressure (psia) ->			14.2	*(Constant La =0.635%/day assumed)*				
				Base pressure used ->			14.2	*psia*

Time (sec)	Pressure	Temp		Pump A	Pump A	Pump B		Pump B	Pump C	Pump D
Max ->	32.00	207.80		7.63	5.35			7.65		5.36
			CS	*RHR*						
Minimum Overpressure Required			7.65	5.36	psig					

Preparer: E. Kenk

Date: 5/10/2001

Reviewer: [illegible]

Date: 6/15/2001

Assumptions;

1. The median inside filter disk diameter for CS strainer is approximately equal to the values given in NEDC-32721P, Appendix D, Page D-9, for the RHR strainer starting from the lifting lug end. This assumption is based upon an inspection of the strainer's cut-away details, Drawings 105E2199 & 105E2200.
2. The thickness of each CS filter disk is approximately the same as the RHR strainer's starting from the lifting lug end. This assumption is again based upon an inspection of the strainer's basic design, plus rough scaling off drawings 105E2199 & 105E2200.
3. The distance between the base of the strainer assembly is approximately 5" and its inside diameter is equal to the flange's ID at one end and the filter disk's ID at the other. This assumption is based upon the lift hole size given on drawings 105E2199 & 105E2200, which is 3", plus an half-inch on each side, as a typical minimum edge distance for a hole in thin material. Rough scaling off the strainer's drawing also suggests that this is a good approximation.
4. The outside of the ring of each filter disk isn't perforated. This assumption is based upon a picture of the strainer in Reference 2 and NEDC-32721P.
5. A correction factor of 0.95 will be applied against the filter disk's surface are to account for any flow shading effects due to internal support rings. This factor is based upon dimensions provided in NEDC-32721P for the RHR strainer, and applied to the CS strainer because of their design similarities.

0. The diameter of the strainer's lifting lug is 9.5 inches. See Attachment I, description for Cells D85, F85, & H85 for justification.

Calculation

Estimate of the CS Strainer's Surface and Flow Area;

Data :=

	0	1
0	1.421	5.021
1	1.096	6.137
2	0.935	7.067
3	0.835	7.811
4	0.766	8.555
5	0.715	9.299
6	0.675	9.857
7	0.640	10.043
8	0.640	10.973
9	0.640	11.530
10	0.640	12.088
11	0.640	12.646
12	0.640	13.018
13	0.640	13.390
14	0.640	13.762
15	0.640	14.134
16	0.640	14.506
17	0.640	14.870
18	0.640	15.250

From strainer drawing 105E2199,

$Disks := 19$ (Number of Filter Disks.)

$Do := 36 \cdot in$ (Strainer OD.)

$Di := 15.25 \cdot in$ (Stack's Average Inlet Diameter.)

$Base_ht := 5 \cdot in$ (Strainer's Base Height.)

$L := 44.69 \cdot in$ (Strainer's Stack Assembly Height.)

$Dlug := 9.5 \cdot in$ (Lifting Lug Diameter - Assumption 6.)

(Column 0 obtained from NEDC-32721P, Column 1 is data scaled off drawing.)

Preparer: E. Kuck

Date: 5/10/2001

Reviewer: [illegible]

Date: 6/15/01

$$Disk_Area := \frac{\pi}{4} \cdot \left[\left(\left(Do^2 - Dlug^2 \right) \right) + \left[Do^2 - \left(Data_{0,1} \cdot in \right)^2 \right] + 2 \cdot \left[\sum_{i=1}^{18} \left[Do^2 - \left(Data_{i,1} \cdot in \right)^2 \right] \right] \right] \cdot 0.95$$

$Disk_Area = 229.0049\ ft^2$

As the spacers between the filter disks are preforated, their combined surface area can be approximated by;

$$Length := \frac{L - \left(\sum_{i=0}^{18} Data_{i,0} \right) \cdot in}{18}$$ (19 disks with 18 hubs.)

$Length = 1.6982 \cdot in$

$$Hub_Area := \sum_{i=0}^{17} \pi \cdot Length \cdot Data_{i,1} \cdot in$$

$Hub_Area = 7.2136\ ft^2$

Finally, as the strainer's base hub is also perforated, and based upon an inspection of drawing 105E2199, approximately equal to a cylinder strainer's ID. Therefore;

$Base_Area := \pi \cdot Base_ht \cdot Di$

$Base_Area = 1.6635\ ft^2$

Giving a total surface area of;

$Surface_Area := Disk_Area + Hub_Area + Base_Area$

$Surface_Area = 237.882\ ft^2$

Flow area is approximately 40% of the surface area (i.e., the perforation occupy about 40% of the area);

$Flow_Area := 0.4 \cdot Surface_Area$

Preparer: E. Kwak

Date: 5/10/2001

Reviewer: [illegible]

Date: 6/15/2001

Flow_Area = 95.1528 ft^2

Use 93 Square feet

Estimate of the RHR Strainer's Surface and Flow Area;

Data :=

i	0	1
0	1.421	6.270
1	1.096	8.080
2	0.935	9.530
3	0.835	10.770
4	0.766	11.870
5	0.715	12.870
6	0.675	13.780
7	0.640	14.630
8	0.640	15.420
9	0.640	16.160
10	0.640	16.860
11	0.640	17.530
12	0.640	18.160
13	0.640	18.760
14	0.640	19.340
15	0.640	19.900
16	0.640	20.430
17	0.640	20.940
18	0.640	21.430
19	0.640	21.910
20	0.640	22.370
21	0.640	22.820
22	0.640	23.250

From strainer drawing 105E2200,

Disks := 23	(Number of Filter Disks.)
Do := 44·in	(Strainer OD.)
Di := 19.25·in	(Stack's Average Inlet Diameter.)
Base_ht := 5·in	(Strainer's Base Height.)
L := 55.99·in	(Strainer's Stack Assembly Height.)
Dlug := 9.5·in	(Lifting Lug Diameter - Assumption 6.)

(Tabular Data obtained from NEDC-32721P.)

$$Disk_Area := \frac{\pi}{4}\cdot\left[\left(\left(Do^2 - Dlug^2\right)\right) + \left[Do^2 - \left(Data_{0,1}\cdot in\right)^2\right] + 2\cdot\left[\sum_{i=1}^{22}\left[Do^2 - \left(Data_{i,1}\cdot in\right)^2\right]\right]\right]\cdot 0.95$$

Disk_Area = 389.4532 ft^2

Preparer: E. Kral

Date: 5/10/2001

Reviewer: [illegible]

Date: 6/15/01

As the spacers between the filter disks are preforated, their combined surface area can be approximated by;

$$Length := \frac{L - \left(\sum_{i=0}^{22} Data_{i,0} \right) \cdot in}{22}$$

(23 disks with 22 hubs.)

$$Length = 1.7867 \cdot in$$

$$Hub_Area := \sum_{i=0}^{18} \pi \cdot Length \cdot Data_{i,1} \cdot in$$

$$Hub_Area = 11.4104\ ft^2$$

Finally, as the strainer's base hub is also perforated, and based upon an inspection of drawing 105E2199, approximately equal to a right circular cone with one end equal to the strainer's inlet diameter and the other equal to the last filter disk's ID. Therefore;

$$Base_Area := \frac{\pi}{2} \cdot \left(Data_{22,1} \cdot in + Di \right) \cdot \sqrt{\left[\frac{\left(Data_{22,1} \cdot in - Di \right)}{2} \right]^2 + Base_ht^2}$$

$$Base_Area = 2.4966\ ft^2$$

Giving a total surface area of;

$$Surface_Area := Disk_Area + Hub_Area + Base_Area$$

$$Surface_Area = 403.3602\ ft^2$$

Flow area is approximately 40% of the surface area;

$$Flow_Area := 0.4 \cdot Surface_Area$$

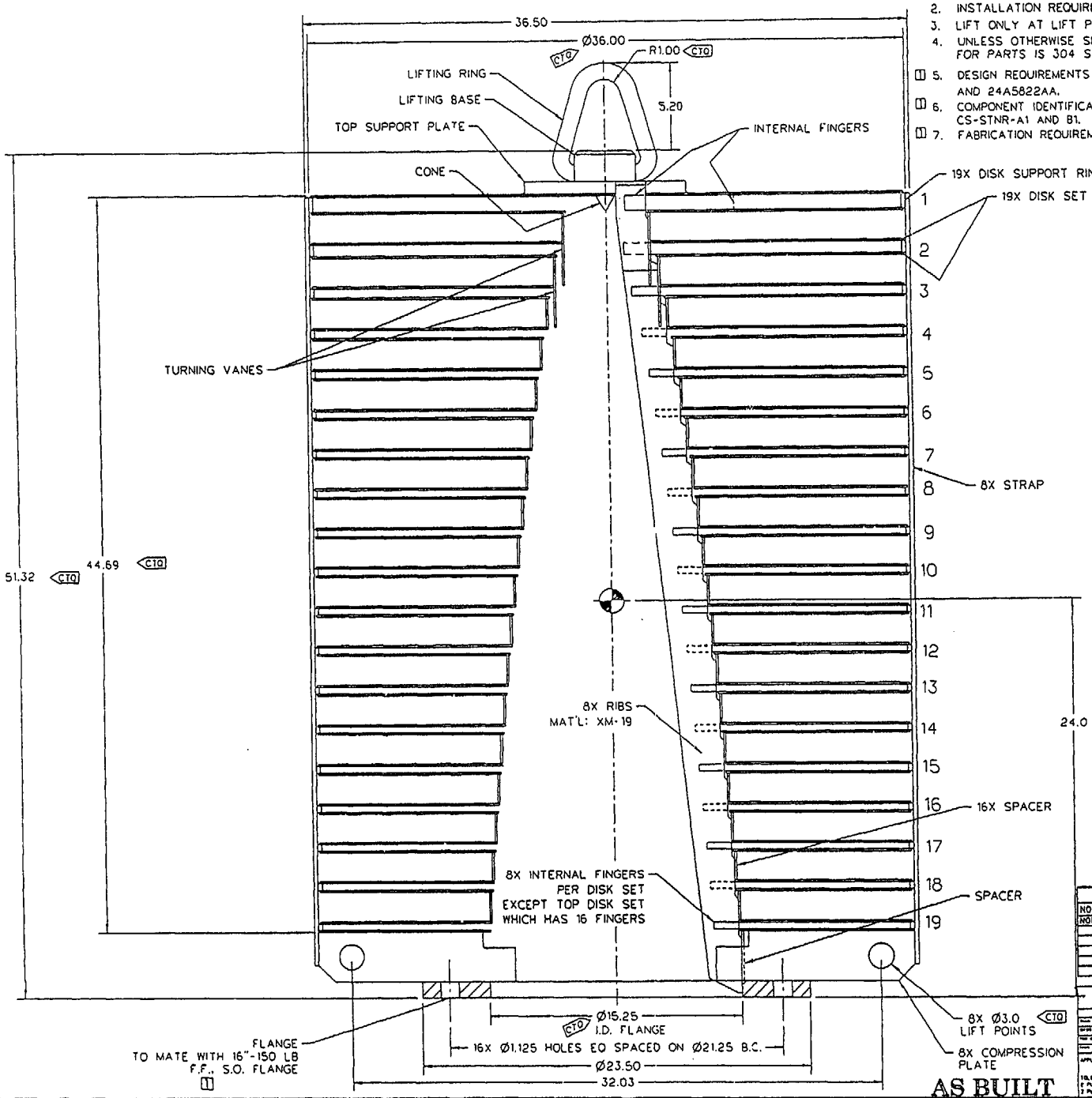
$$Flow_Area = 161.3441\ ft^2$$

Use 160 Square Feet

NOTES:

1. APPROXIMATE TARE WEIGHT IS #1200.
2. INSTALLATION REQUIREMENTS PER 24A5894.
3. LIFT ONLY AT LIFT POINTS.
4. UNLESS OTHERWISE SPECIFIED, MATERIAL FOR PARTS IS 304 SST.
5. [1] DESIGN REQUIREMENTS PER. 24A5822 AND 24A5822AA.
6. [1] COMPONENT IDENTIFICATION CODE CS-STNR-A1 AND B1.
7. [1] FABRICATION REQUIREMENTS PER. 24A5849.

NEDC 970444
ATT. N
pg 6 of 6



452243254

AS BUILT

REVISIONS BY N.P.P.D.

NO.	REVISIONS	DFT	CKD	APP	DATE
N01	MP 96-132 (DCN 97-0255)	PAM	D.J.F.	WJD	7-10-97

CN05157
CHK BY: NA

Nuclear Energy

CORE SPRAY
SUCTION STRAINER

105E2199

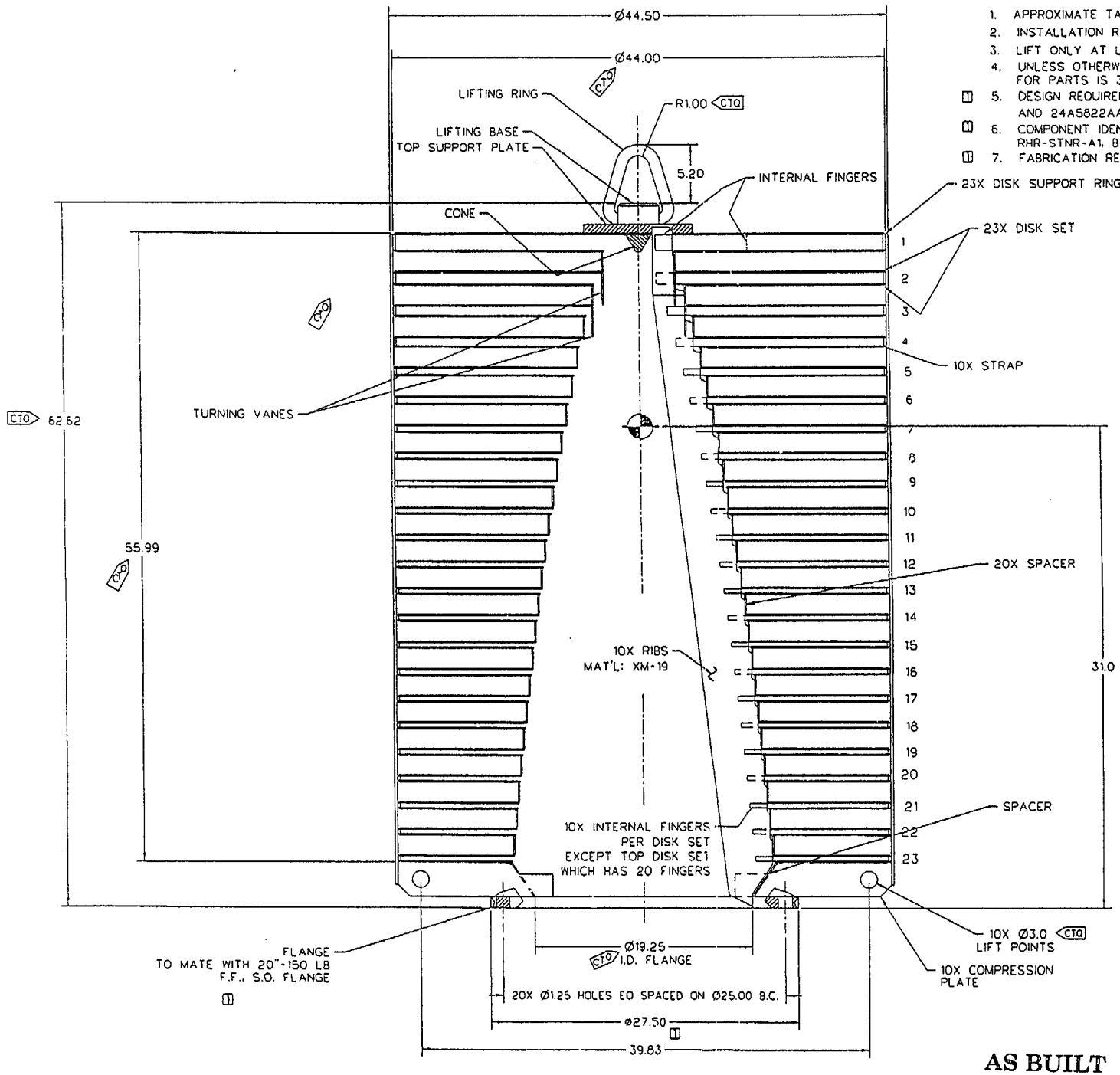
N01

WC-B685001

NOTES:

1. APPROXIMATE TARE WEIGHT IS 2100 LBS.
2. INSTALLATION REQUIREMENTS PER 24A5894.
3. LIFT ONLY AT LIFT POINTS.
4. UNLESS OTHERWISE SPECIFIED, MATERIAL FOR PARTS IS 304 SST.
5. DESIGN REQUIREMENTS PER. 24A5822 AND 24A5822AA. [1]
6. COMPONENT IDENTIFICATION CODE RHR-STNR-A1, B1, C1 AND D1. [1]
7. FABRICATION REQUIREMENTS PER. 24A5849. [1]

NEDC 97-044A
ATT. N
pg 6 of 6



452243255

AS BUILT

REVISIONS BY N.P.P.D.

NO.	REVISIONS	DFT	CKD	APP	DATE
N01	MP96-132 (DCN 97-0254)	PAM	DJF	WD	7-10-97

Nuclear Energy

RHR SUCTION STRAINER

105E2200 N01

MC-9685101

SN 6/15/01

Properties of Water

Temperature	Viscosity (lb-s/ft^2)	Density (slugs/ft^3)		Temperature	Viscosity (Centipoise)	Density (lb/ft^3)	Vap. Pres (psia)
60	2.36E-05	1.938		60	1.120	62.371	0.25611
68	2.11E-05	1.937		70	0.980	62.305	0.36292
80	1.80E-05	1.934		80	0.850	62.220	0.50683
90	1.60E-05	1.931		90	0.760	62.116	0.69813
100	1.42E-05	1.927		100	0.680	61.996	0.95024
120	1.17E-05	1.918		110	0.610	61.862	1.2750
140	9.81E-06	1.908		120	0.670	61.713	1.6927
160	8.38E-06	1.896		130	0.510	61.550	2.2230
180	7.26E-06	1.883		140	0.470	61.376	2.8892
200	6.37E-06	1.868		150	0.440	61.188	3.7184
220	5.79E-06	1.853		160	0.410	60.994	4.7414
				170	0.380	60.787	5.9926
				180	0.360	60.569	7.5110
				190	0.330	60.343	9.340
				200	0.300	60.107	11.526
				210	0.286	59.862	14.123
				220	0.277	59.623	17.188

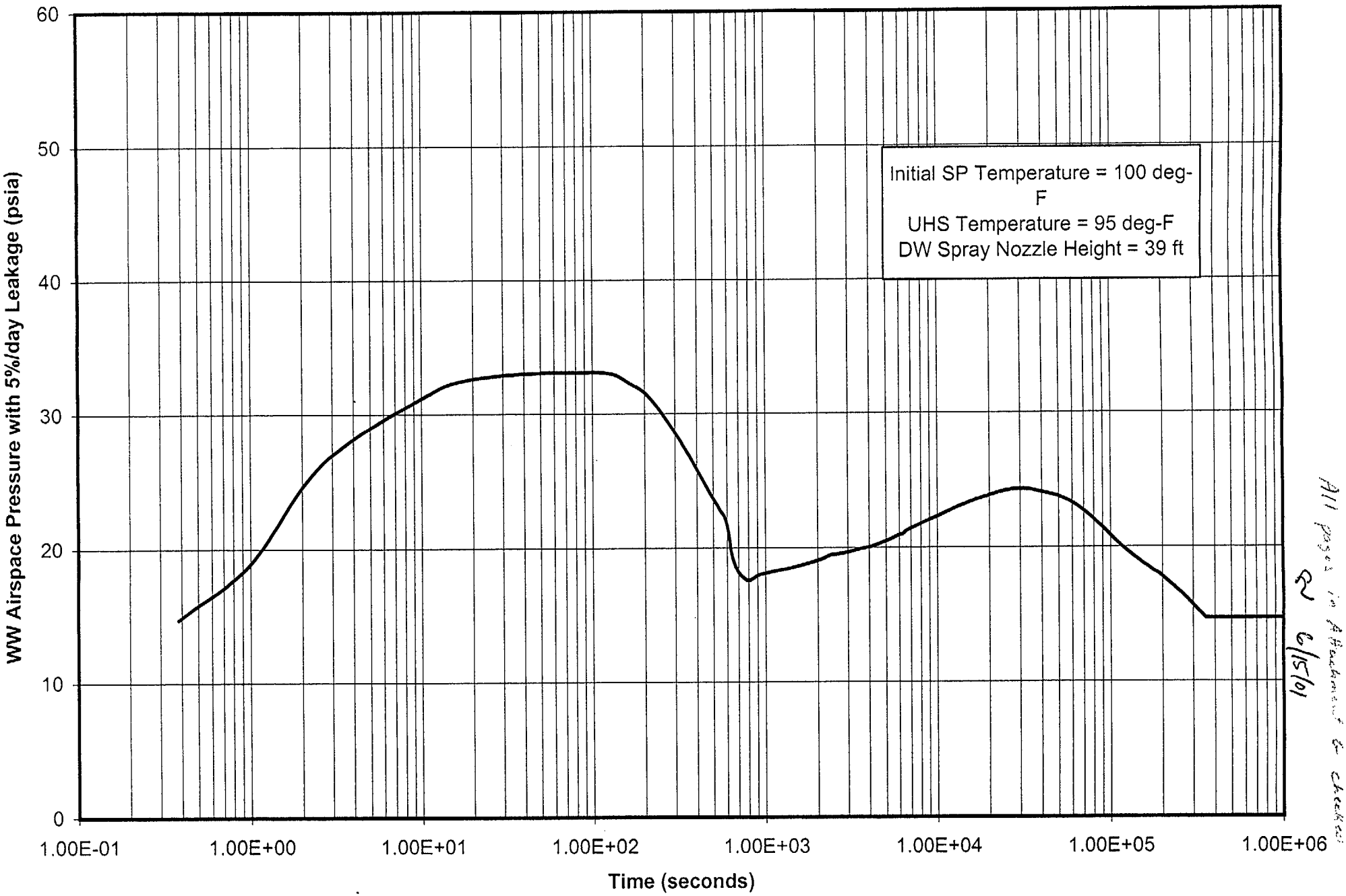
Pump NPSHr Data

RHR	Pump A	Pump B	Pump C	Pump D
0	22.60	22.60	24.00	22.60
6,000	22.60	22.60	24.00	22.60
7,000	23.50	23.50	24.50	23.50
8,000	25.00	25.00	26.60	25.00
9,000	27.50	27.50	30.33	27.50
10,000	32.00	32.00	36.00	32.00
10,500	35.00	35.00	39.50	35.00

All Data on this line was extrapolated

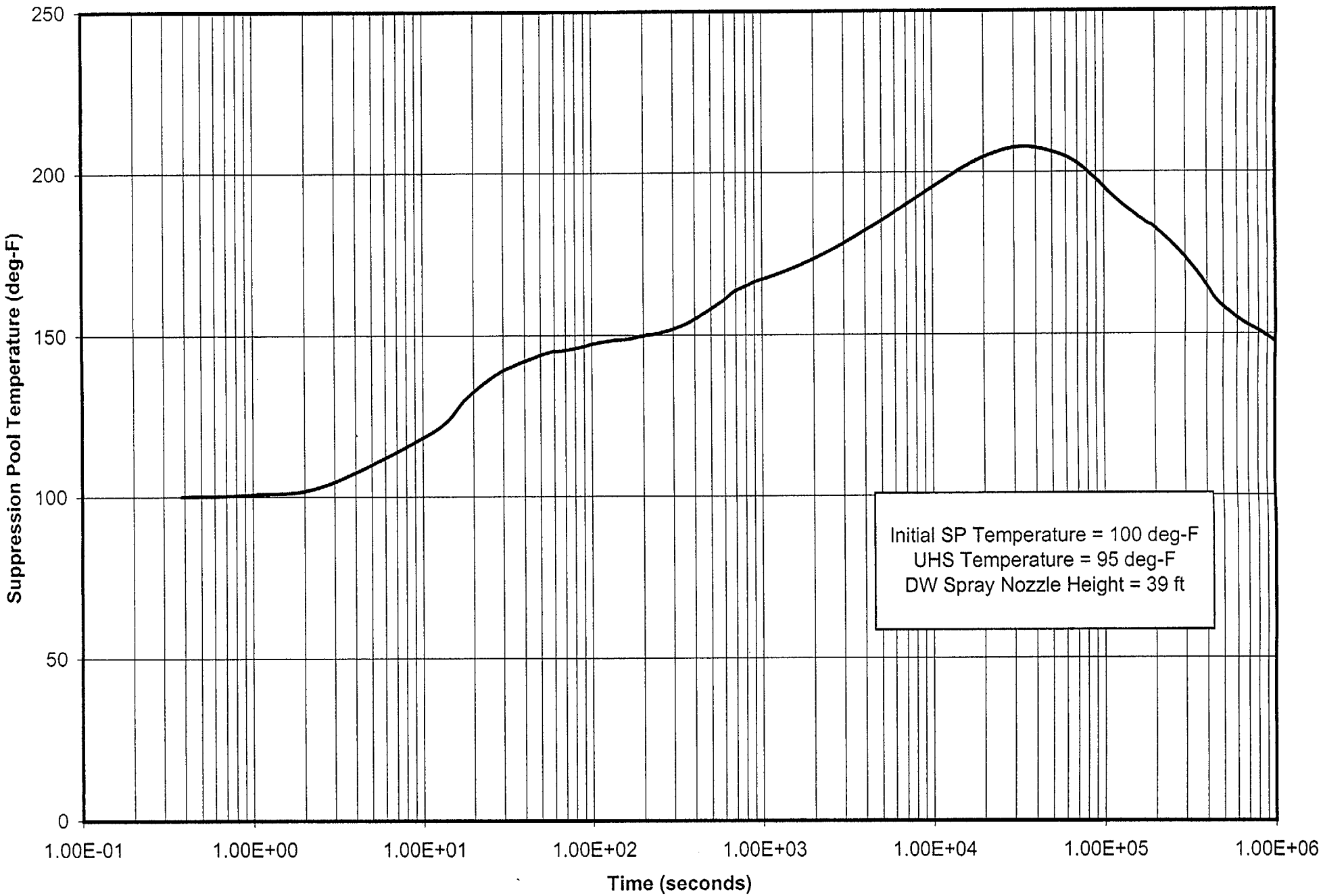
CS	Pump A	Pump B
0	15.00	15.00
4,000	15.00	15.00
4,500	16.10	16.10
5,000	17.60	17.60
5,500	19.60	19.60
6,000	22.50	22.50
6,500	34.00	34.00
6,600	40.00	40.00

Cooper Nuclear Station Containment Heatup Analysis

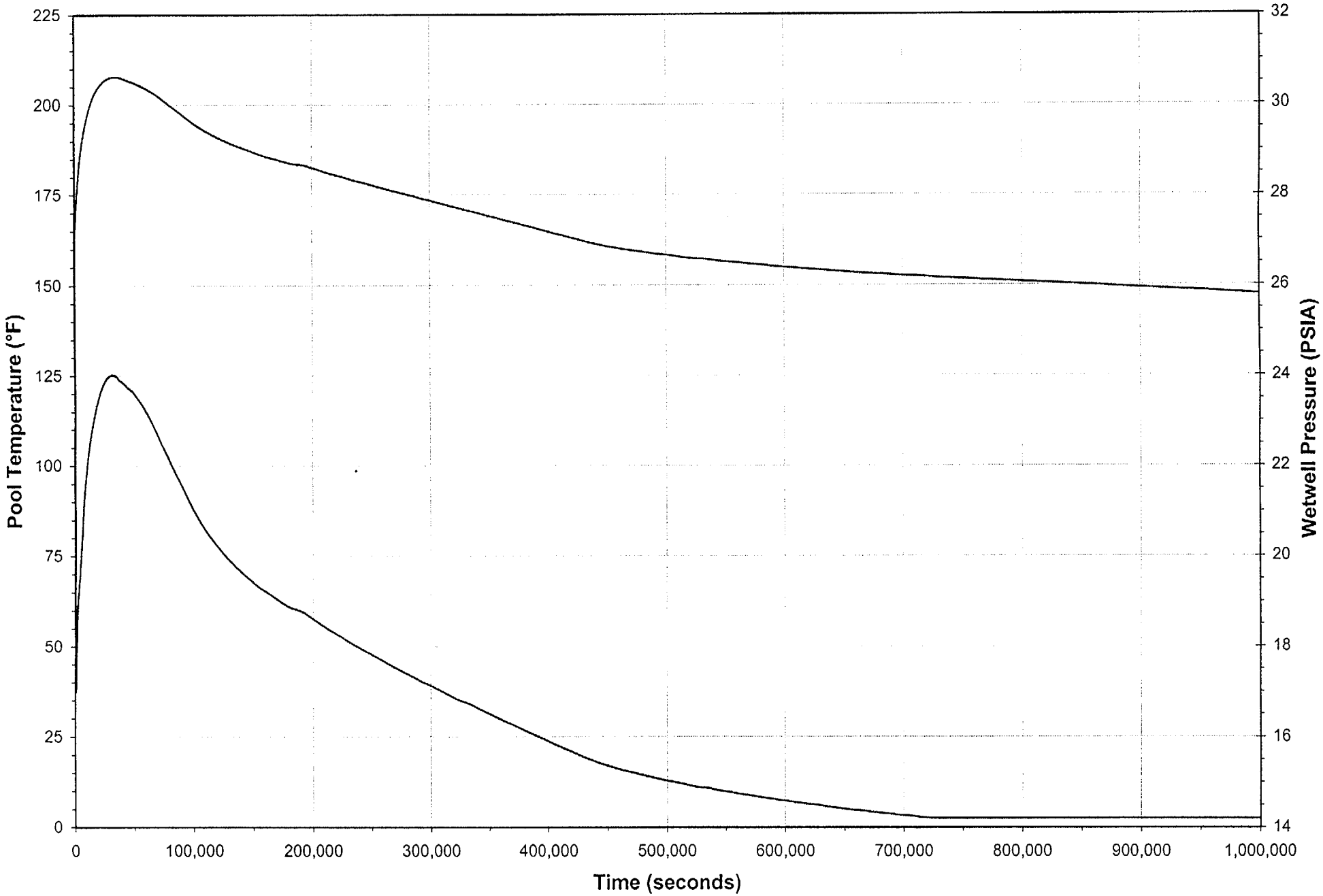


All pages in Attachment G checked
6/15/01

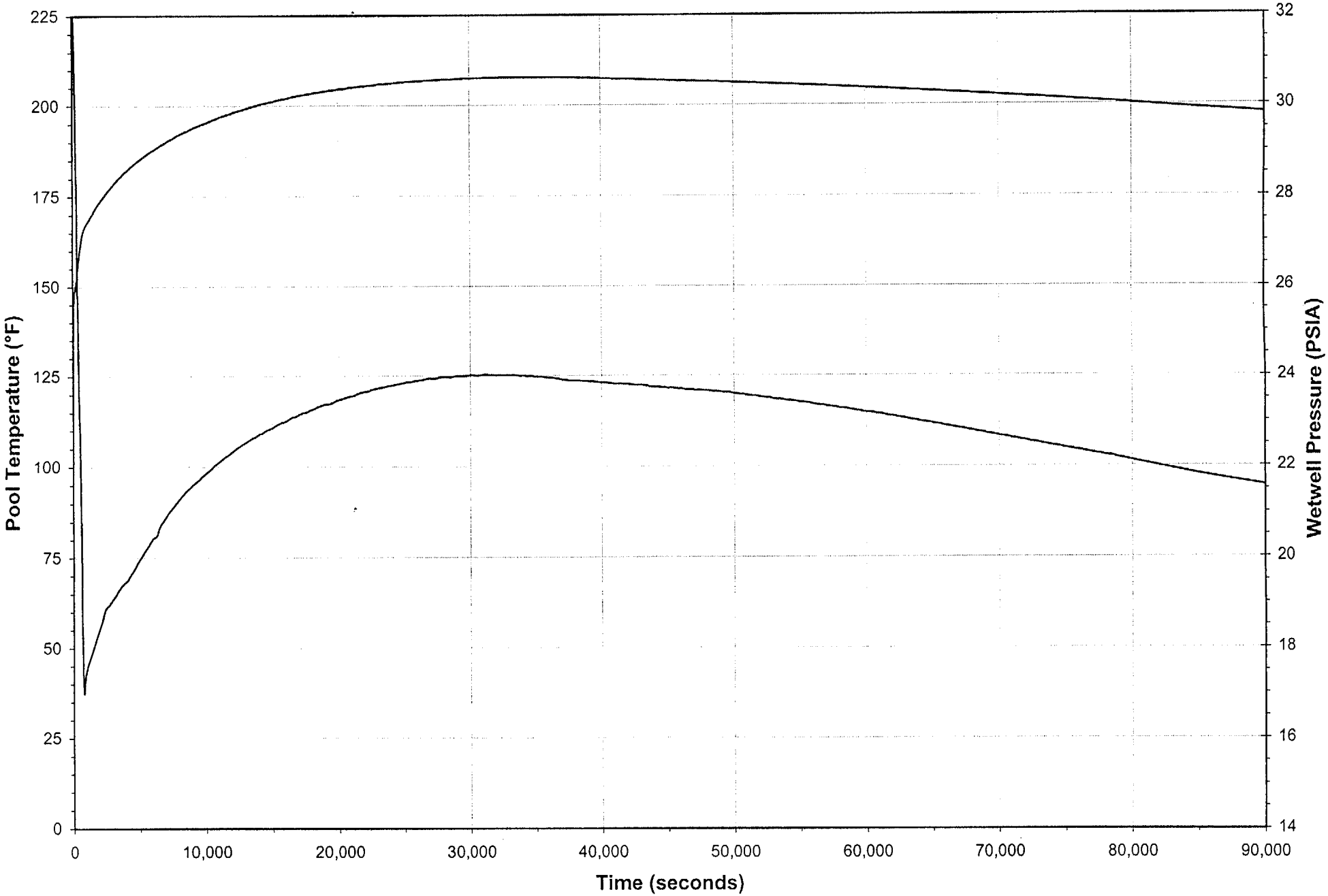
Cooper Nuclear Station Containment Heatup Analysis



Suppression Pool Temperature/Wetwell Pressure Profiles (DBA LOCA)



Suppression Pool Temperature/Wetwell Pressure Profiles (DBA LOCA)



GE Company Proprietary Information									*These columns contain*		
SHEX-04V Results			**FINAL**		PID: 001BE	37,015.00			*Non-GE data.*		
									La =	0.635	%/Day
Initial SP temperature (deg-F)			100.00						***Atms =***	14.2	psia
UHS temperature (deg-F)			95.00								
Drywell spray nozzle height (ft)			39.00								
TIME	*DW PRESS*	*DW TEMP*	*WW PRESS*	*WW TEMP*	*SP TEMP*	*P STM WW*	*P AIR WW*	*WW PRESS*	*WW PRESS*	*WW PRESS*	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
0.0	14.70	160.00	14.70	100.00	100.00	0.95	13.75	14.70	14.20	14.20	
0.4	26.65	215.90	14.71	100.00	100.00	0.95	13.76	14.71	14.21	14.21	
1.0	33.48	240.70	18.85	137.50	100.70	1.20	17.65	18.85	18.21	18.21	
2.6	38.05	259.50	26.38	181.60	103.50	1.56	24.82	26.38	25.48	25.48	
11.9	42.05	270.30	31.73	205.90	120.60	1.79	29.95	31.74	30.65	30.65	
17.5	41.33	269.20	32.50	210.30	129.80	1.82	30.69	32.50	31.39	31.39	
26.9	37.07	321.30	32.86	212.20	137.60	1.81	31.04	32.85	31.72	31.72	
35.6	36.75	321.80	32.98	212.70	140.90	1.80	31.18	32.98	31.85	31.85	
40.6	36.28	315.20	33.03	212.90	142.10	1.80	31.23	33.03	31.89	31.89	
44.6	36.13	310.60	33.05	212.90	142.90	1.79	31.26	33.05	31.91	31.91	
49.0	36.32	307.20	33.08	213.00	143.70	1.79	31.29	33.07	31.94	31.94	
54.0	36.16	301.60	33.10	213.10	144.40	1.78	31.32	33.10	31.96	31.96	
57.9	36.20	298.30	33.12	213.10	144.90	1.77	31.34	33.11	31.97	31.97	
59.8	36.18	293.00	33.11	213.00	145.20	1.77	31.34	33.11	31.97	31.97	
60.7	35.50	260.10	33.11	213.00	145.10	1.77	31.34	33.11	31.97	31.97	
62.7	36.16	261.20	33.11	213.00	145.10	1.77	31.34	33.10	31.97	31.97	
63.7	36.14	261.20	33.11	213.00	145.10	1.77	31.34	33.10	31.97	31.97	
64.6	36.12	261.10	33.11	212.90	145.20	1.76	31.34	33.10	31.96	31.96	
65.6	36.12	261.10	33.11	212.90	145.20	1.76	31.34	33.10	31.96	31.96	
66.5	36.11	261.10	33.10	212.80	145.20	1.76	31.34	33.10	31.96	31.96	
67.4	36.15	261.20	33.10	212.70	145.30	1.76	31.34	33.10	31.96	31.96	
68.4	36.15	261.20	33.10	212.70	145.30	1.76	31.34	33.10	31.96	31.96	
69.3	36.14	261.20	33.10	212.60	145.40	1.76	31.34	33.10	31.96	31.96	
70.2	36.13	261.20	33.10	212.50	145.40	1.76	31.34	33.10	31.96	31.96	
71.2	36.14	261.20	33.10	212.50	145.50	1.76	31.34	33.10	31.96	31.96	
72.1	36.14	261.20	33.09	212.40	145.50	1.76	31.34	33.09	31.96	31.96	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
73.1	36.13	261.20	33.09	212.40	145.60	1.76	31.34	33.09	31.96	31.96	
74.0	36.13	261.20	33.09	212.30	145.60	1.75	31.34	33.09	31.95	31.95	
75.0	36.12	261.10	33.09	212.20	145.70	1.75	31.34	33.09	31.95	31.95	
75.9	36.11	261.10	33.09	212.20	145.70	1.75	31.34	33.09	31.95	31.95	
76.8	36.11	261.10	33.09	212.10	145.80	1.75	31.34	33.09	31.95	31.95	
77.8	36.13	261.20	33.09	212.10	145.80	1.75	31.34	33.09	31.95	31.95	
78.7	36.12	261.10	33.09	212.00	145.90	1.75	31.34	33.09	31.95	31.95	
79.7	36.14	261.20	33.09	212.00	145.90	1.75	31.34	33.09	31.95	31.95	
80.7	36.11	261.10	33.09	212.00	146.00	1.75	31.34	33.09	31.95	31.95	
81.8	36.11	261.10	33.09	211.90	146.10	1.75	31.34	33.09	31.95	31.95	
82.9	36.12	261.10	33.09	211.90	146.10	1.75	31.35	33.09	31.96	31.96	
84.0	36.12	261.10	33.09	211.90	146.20	1.75	31.35	33.09	31.95	31.95	
85.1	36.12	261.10	33.10	211.80	146.30	1.74	31.35	33.09	31.95	31.95	
86.1	36.12	261.10	33.10	211.80	146.40	1.74	31.35	33.09	31.95	31.95	
87.2	36.13	261.20	33.10	211.80	146.40	1.74	31.36	33.10	31.96	31.96	
88.2	36.13	261.20	33.10	211.80	146.50	1.74	31.36	33.10	31.96	31.96	
89.3	36.13	261.20	33.10	211.70	146.60	1.74	31.36	33.10	31.96	31.96	
90.4	36.14	261.20	33.11	211.70	146.60	1.74	31.37	33.11	31.97	31.97	
91.5	36.13	261.20	33.11	211.70	146.70	1.74	31.37	33.11	31.97	31.97	
92.5	36.14	261.20	33.11	211.60	146.80	1.74	31.37	33.11	31.97	31.97	
93.6	36.14	261.20	33.11	211.60	146.80	1.74	31.38	33.12	31.98	31.98	
94.8	36.16	261.20	33.12	211.60	146.90	1.74	31.38	33.11	31.97	31.97	
96.0	36.15	261.20	33.12	211.60	147.00	1.74	31.39	33.12	31.98	31.98	
97.2	36.16	261.20	33.13	211.60	147.10	1.73	31.39	33.12	31.98	31.98	
98.6	36.16	261.20	33.13	211.60	147.20	1.73	31.40	33.13	31.99	31.99	
100.0	36.17	261.20	33.14	211.60	147.30	1.73	31.41	33.14	32.00	32.00	
133.3	34.57	258.60	32.96	210.00	148.40	1.69	31.26	32.95	31.81	31.82	
164.0	32.59	255.10	32.28	205.30	148.80	1.64	30.63	32.27	31.16	31.16	
196.3	31.22	252.10	31.69	201.30	149.70	1.60	30.08	31.68	30.59	30.59	
227.6	30.27	250.00	30.77	195.30	150.20	1.56	29.21	30.76	29.70	29.70	
258.8	29.35	247.50	29.79	188.80	150.80	1.51	28.27	29.78	28.75	28.75	
290.1	28.40	244.70	28.86	182.50	151.50	1.48	27.38	28.85	27.86	27.86	
321.3	27.49	241.90	27.98	176.80	152.40	1.45	26.53	27.97	27.01	27.01	
352.6	26.62	238.90	27.10	170.20	153.30	1.43	25.67	27.09	26.16	26.16	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
383.8	25.78	235.80	26.26	164.40	154.30	1.41	24.86	26.26	25.36	25.36	
415.1	25.02	232.80	25.50	159.30	155.30	1.39	24.11	25.49	24.62	24.62	
446.3	24.30	229.80	24.76	153.60	156.40	1.38	23.37	24.75	23.90	23.90	
479.1	23.58	226.70	24.06	148.10	157.40	1.38	22.68	24.05	23.23	23.23	
511.2	22.96	223.80	23.44	143.30	158.40	1.38	22.06	23.43	22.64	22.64	
547.2	22.31	220.60	22.81	138.60	159.50	1.39	21.42	22.80	22.03	22.03	
581.1	21.79	217.80	22.26	134.70	160.40	1.39	20.87	22.25	21.50	21.50	
609.2	20.71	211.50	21.22	129.30	161.20	1.36	19.86	21.21	20.50	20.50	
636.6	19.13	199.80	19.61	125.70	162.10	1.31	18.30	19.60	18.94	18.94	
666.9	18.31	191.70	18.76	129.40	163.00	1.31	17.44	18.75	18.12	18.12	
702.5	17.71	184.80	18.16	134.20	163.70	1.35	16.81	18.15	17.55	17.55	
742.4	17.31	179.70	17.82	139.00	164.30	1.41	16.41	17.81	17.22	17.22	
792.5	17.14	176.10	17.57	142.40	165.00	1.48	16.09	17.57	16.99	16.99	
843.1	17.24	175.70	17.71	145.90	165.60	1.58	16.13	17.70	17.12	17.12	
905.6	18.07	180.60	17.96	147.50	166.40	1.69	16.27	17.95	17.36	17.36	
968.1	18.50	183.00	18.06	147.90	166.90	1.77	16.30	18.06	17.47	17.47	
1,121.8	19.03	185.70	18.25	148.80	167.90	1.92	16.33	18.24	17.65	17.66	
1,371.8	19.22	186.70	18.49	150.50	169.50	2.11	16.38	18.47	17.89	17.89	
1,622.4	19.16	186.30	18.71	151.90	171.10	2.28	16.43	18.69	18.11	18.11	
1,872.7	19.08	185.80	18.94	153.50	172.50	2.46	16.48	18.92	18.33	18.34	
2,132.9	18.98	185.30	19.18	154.50	173.90	2.67	16.52	19.17	18.58	18.59	
2,398.4	18.97	185.20	19.46	155.80	175.20	2.90	16.56	19.44	18.86	18.86	
2,668.4	19.08	185.00	19.55	157.30	176.50	3.12	16.43	19.52	18.95	18.95	
2,954.9	19.20	184.90	19.67	158.90	177.80	3.37	16.30	19.64	19.07	19.08	
3,230.8	19.31	184.70	19.79	159.90	179.00	3.64	16.15	19.76	19.20	19.20	
3,510.9	19.43	184.50	19.91	161.70	180.10	3.90	16.01	19.88	19.32	19.33	
3,789.9	19.53	184.30	20.00	162.90	181.10	4.13	15.88	19.97	19.42	19.43	
4,065.5	19.61	184.00	20.08	163.80	182.10	4.34	15.74	20.04	19.50	19.51	
4,344.4	19.73	184.10	20.22	164.70	183.00	4.57	15.65	20.18	19.64	19.65	
4,623.4	19.86	184.30	20.34	165.60	183.90	4.79	15.55	20.30	19.77	19.77	
4,901.4	20.00	184.50	20.48	166.80	184.70	5.02	15.47	20.44	19.92	19.92	
5,183.4	20.13	184.70	20.62	167.80	185.50	5.24	15.37	20.57	20.05	20.05	
5,458.4	20.25	184.80	20.74	168.80	186.20	5.46	15.28	20.69	20.18	20.18	
5,740.4	20.38	184.90	20.86	169.70	187.00	5.69	15.18	20.82	20.31	20.31	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
6,019.8	20.57	185.50	20.99	169.40	187.70	5.91	15.08	20.94	20.44	20.44	
6,274.8	20.70	185.50	21.03	170.70	188.30	6.09	14.94	20.98	20.48	20.49	
6,541.6	20.76	185.40	21.25	172.50	188.90	6.34	14.91	21.19	20.70	20.70	
6,813.3	20.88	185.60	21.37	173.80	189.50	6.54	14.83	21.31	20.82	20.83	
7,084.5	21.01	185.80	21.49	175.10	190.10	6.74	14.76	21.43	20.95	20.96	
7,355.2	21.12	186.00	21.60	176.20	190.70	6.90	14.70	21.54	21.06	21.06	
7,629.9	21.22	186.20	21.70	177.20	191.20	7.05	14.65	21.63	21.16	21.16	
7,902.9	21.31	186.40	21.79	177.90	191.80	7.17	14.62	21.73	21.25	21.26	
8,177.9	21.39	186.70	21.88	178.60	192.30	7.28	14.60	21.81	21.34	21.35	
8,451.6	21.48	187.00	21.97	179.20	192.80	7.39	14.59	21.91	21.44	21.44	
8,727.5	21.56	187.30	22.05	179.80	193.20	7.48	14.57	21.98	21.51	21.52	
9,006.9	21.64	187.50	22.12	180.30	193.70	7.57	14.56	22.05	21.59	21.59	
9,282.9	21.72	187.80	22.20	180.90	194.20	7.66	14.54	22.12	21.66	21.66	
9,549.2	21.79	188.00	22.27	181.30	194.60	7.74	14.53	22.18	21.73	21.73	
9,824.0	21.85	188.30	22.34	181.80	195.00	7.81	14.53	22.26	21.80	21.81	
10,098.8	21.93	188.60	22.41	182.20	195.40	7.89	14.52	22.32	21.87	21.88	
10,379.2	22.00	188.80	22.48	182.60	195.80	7.96	14.51	22.39	21.94	21.94	
10,653.3	22.06	189.10	22.56	183.10	196.20	8.04	14.52	22.47	22.02	22.03	
10,925.7	22.13	189.40	22.61	183.40	196.60	8.11	14.51	22.52	22.08	22.08	
11,210.3	22.20	189.60	22.69	183.90	197.00	8.18	14.51	22.59	22.15	22.16	
11,483.1	22.27	189.90	22.76	184.20	197.30	8.25	14.51	22.66	22.22	22.22	
11,755.4	22.33	190.10	22.80	184.50	197.70	8.30	14.50	22.70	22.26	22.27	
12,036.0	22.40	190.40	22.88	185.00	198.00	8.38	14.50	22.78	22.34	22.35	
12,315.0	22.45	190.60	22.94	185.30	198.40	8.44	14.50	22.84	22.40	22.41	
12,593.3	22.52	190.90	23.00	185.60	198.70	8.50	14.50	22.89	22.45	22.46	
12,871.9	22.56	191.00	23.05	185.90	199.00	8.55	14.50	22.94	22.51	22.52	
13,154.1	22.62	191.30	23.11	186.20	199.30	8.61	14.50	22.99	22.56	22.57	
13,432.0	22.67	191.50	23.16	186.50	199.60	8.66	14.50	23.05	22.62	22.63	
13,707.1	22.72	191.60	23.20	186.70	199.90	8.71	14.49	23.08	22.66	22.66	
13,987.9	22.76	191.80	23.25	187.00	200.20	8.76	14.49	23.13	22.71	22.72	
14,262.7	22.81	191.90	23.29	187.20	200.50	8.81	14.48	23.17	22.75	22.75	
14,539.3	22.85	192.10	23.34	187.50	200.70	8.86	14.48	23.22	22.80	22.81	
14,814.2	22.89	192.20	23.38	187.70	201.00	8.90	14.47	23.25	22.83	22.84	
15,087.9	22.93	192.30	23.42	188.00	201.20	8.96	14.46	23.29	22.87	22.88	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
15,362.5	22.97	192.50	23.46	188.30	201.50	9.00	14.46	23.33	22.92	22.93	
15,635.4	23.02	192.60	23.51	188.50	201.70	9.05	14.46	23.37	22.96	22.97	
15,916.8	23.06	192.80	23.53	188.70	201.90	9.08	14.45	23.40	22.99	23.00	
16,192.1	23.10	192.90	23.57	188.90	202.10	9.12	14.45	23.44	23.03	23.04	
16,468.2	23.13	193.10	23.63	189.10	202.40	9.17	14.45	23.48	23.08	23.09	
16,746.8	23.17	193.20	23.65	189.30	202.60	9.21	14.44	23.51	23.10	23.11	
17,022.3	23.20	193.30	23.69	189.50	202.80	9.25	14.44	23.55	23.15	23.16	
17,295.5	23.24	193.40	23.73	189.70	203.00	9.29	14.44	23.59	23.19	23.20	
17,570.2	23.27	193.50	23.75	189.80	203.10	9.32	14.43	23.60	23.20	23.21	
17,846.8	23.30	193.60	23.79	190.10	203.30	9.36	14.43	23.64	23.25	23.26	
18,122.0	23.34	193.70	23.81	190.20	203.50	9.39	14.42	23.66	23.27	23.28	
18,402.0	23.36	193.80	23.86	190.50	203.70	9.44	14.42	23.71	23.32	23.33	
18,677.5	23.39	193.90	23.89	190.70	203.80	9.48	14.41	23.73	23.35	23.36	
18,953.9	23.42	194.00	23.91	190.80	204.00	9.52	14.40	23.76	23.37	23.38	
19,230.7	23.45	194.00	23.92	191.00	204.10	9.54	14.38	23.76	23.38	23.39	
19,504.5	23.48	194.10	23.95	191.10	204.30	9.58	14.37	23.79	23.41	23.42	
19,782.2	23.50	194.10	23.99	191.40	204.40	9.62	14.37	23.83	23.45	23.46	
20,055.5	23.53	194.20	24.02	191.50	204.60	9.66	14.36	23.85	23.48	23.49	
20,329.2	23.55	194.30	24.04	191.70	204.70	9.70	14.35	23.88	23.50	23.51	
20,604.4	23.58	194.40	24.07	191.90	204.80	9.73	14.34	23.90	23.53	23.54	
20,881.3	23.61	194.50	24.09	192.00	205.00	9.76	14.33	23.92	23.55	23.56	
21,154.5	23.64	194.50	24.11	192.10	205.10	9.79	14.32	23.93	23.57	23.58	
21,427.3	23.66	194.60	24.14	192.30	205.20	9.83	14.32	23.97	23.60	23.62	
21,700.9	23.68	194.70	24.17	192.50	205.30	9.86	14.32	24.00	23.63	23.65	
21,971.5	23.70	194.70	24.20	192.60	205.40	9.89	14.31	24.01	23.65	23.67	
22,244.8	23.73	194.80	24.21	192.70	205.50	9.90	14.30	24.02	23.66	23.67	
22,519.7	23.75	194.90	24.24	192.90	205.60	9.94	14.30	24.05	23.70	23.71	
22,792.6	23.77	194.90	24.26	193.00	205.70	9.96	14.30	24.07	23.72	23.73	
23,068.8	23.79	195.00	24.28	193.10	205.90	9.98	14.29	24.08	23.73	23.74	
23,343.6	23.81	195.10	24.30	193.20	206.00	10.00	14.29	24.10	23.75	23.76	
23,614.4	23.83	195.10	24.31	193.30	206.00	10.02	14.29	24.11	23.77	23.78	
23,889.6	23.85	195.20	24.33	193.40	206.10	10.05	14.28	24.13	23.79	23.80	
24,162.8	23.87	195.20	24.35	193.50	206.20	10.06	14.28	24.14	23.80	23.81	
24,436.3	23.88	195.30	24.36	193.50	206.30	10.08	14.28	24.16	23.82	23.83	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
24,713.8	23.90	195.30	24.38	193.60	206.40	10.10	14.27	24.17	23.83	23.84	
24,990.4	23.91	195.40	24.39	193.70	206.50	10.12	14.27	24.18	23.85	23.86	
25,261.4	23.92	195.40	24.40	193.80	206.60	10.14	14.27	24.20	23.87	23.88	
25,532.4	23.94	195.50	24.42	193.90	206.60	10.15	14.26	24.20	23.87	23.88	
25,801.3	23.95	195.50	24.42	193.90	206.70	10.17	14.26	24.22	23.89	23.90	
26,075.4	23.96	195.50	24.44	194.00	206.80	10.18	14.26	24.22	23.90	23.91	
26,352.0	23.97	195.50	24.46	194.10	206.80	10.20	14.25	24.23	23.91	23.92	
26,621.8	23.98	195.60	24.47	194.20	206.90	10.22	14.25	24.25	23.92	23.94	
26,899.1	23.99	195.60	24.49	194.30	207.00	10.24	14.25	24.27	23.94	23.96	
27,170.1	24.00	195.60	24.48	194.30	207.00	10.24	14.24	24.26	23.93	23.95	
27,439.6	24.01	195.60	24.49	194.30	207.10	10.26	14.23	24.26	23.94	23.96	
27,713.3	24.02	195.70	24.51	194.40	207.10	10.28	14.23	24.28	23.96	23.98	
27,983.9	24.02	195.60	24.52	194.50	207.20	10.29	14.23	24.29	23.97	23.99	
28,254.0	24.03	195.70	24.52	194.50	207.30	10.30	14.22	24.29	23.97	23.99	
28,524.2	24.05	195.70	24.52	194.50	207.30	10.30	14.21	24.28	23.96	23.98	
28,799.3	24.04	195.70	24.53	194.60	207.30	10.32	14.21	24.29	23.98	24.00	
29,070.7	24.05	195.70	24.54	194.70	207.40	10.33	14.21	24.30	23.99	24.01	
29,339.9	24.05	195.70	24.55	194.70	207.40	10.34	14.20	24.30	23.99	24.01	
29,609.5	24.06	195.70	24.54	194.70	207.50	10.35	14.19	24.30	23.99	24.01	
29,876.7	24.07	195.70	24.55	194.80	207.50	10.36	14.19	24.30	24.00	24.02	
30,146.5	24.06	195.70	24.56	194.80	207.50	10.37	14.19	24.31	24.01	24.03	
30,414.3	24.07	195.70	24.54	194.80	207.60	10.37	14.18	24.30	24.00	24.02	
30,685.2	24.07	195.60	24.56	194.90	207.60	10.38	14.17	24.30	24.00	24.02	
30,953.8	24.07	195.60	24.56	194.90	207.60	10.39	14.17	24.31	24.01	24.03	
31,220.5	24.07	195.60	24.56	195.00	207.70	10.40	14.17	24.31	24.02	24.04	
31,487.1	24.07	195.60	24.56	195.00	207.70	10.40	14.16	24.30	24.01	24.03	
31,755.6	24.07	195.60	24.56	195.00	207.70	10.41	14.15	24.30	24.01	24.03	
32,023.3	24.07	195.50	24.55	195.00	207.70	10.41	14.14	24.29	24.00	24.02	
32,285.0	24.07	195.50	24.56	195.10	207.70	10.42	14.14	24.30	24.01	24.03	
32,550.4	24.07	195.50	24.55	195.10	207.80	10.42	14.13	24.28	24.00	24.02	
32,813.4	24.07	195.50	24.56	195.10	207.80	10.43	14.13	24.29	24.01	24.03	
33,077.8	24.06	195.40	24.55	195.10	207.80	10.43	14.12	24.28	24.00	24.02	
33,338.1	24.06	195.40	24.55	195.10	207.80	10.44	14.12	24.29	24.01	24.03	
33,599.0	24.06	195.40	24.55	195.20	207.80	10.44	14.11	24.28	24.00	24.02	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
33,857.6	24.05	195.30	24.54	195.10	207.80	10.44	14.10	24.26	23.99	24.01	
34,118.8	24.05	195.30	24.54	195.20	207.80	10.45	14.10	24.27	24.00	24.02	
34,382.0	24.05	195.30	24.53	195.20	207.80	10.44	14.09	24.25	23.98	24.00	
34,640.2	24.04	195.20	24.54	195.20	207.80	10.45	14.09	24.26	23.99	24.01	
34,898.0	24.04	195.20	24.52	195.20	207.80	10.44	14.08	24.24	23.97	23.99	
35,159.5	24.03	195.10	24.53	195.20	207.80	10.45	14.07	24.23	23.97	23.99	
35,415.6	24.03	195.10	24.51	195.20	207.80	10.45	14.07	24.23	23.97	23.99	
35,672.4	24.02	195.10	24.51	195.20	207.80	10.45	14.06	24.22	23.96	23.98	
35,931.3	24.01	195.00	24.50	195.20	207.80	10.45	14.05	24.21	23.95	23.97	
36,187.9	24.00	195.00	24.50	195.20	207.80	10.45	14.05	24.21	23.95	23.97	
36,444.8	24.00	194.90	24.49	195.20	207.80	10.45	14.04	24.19	23.94	23.96	
36,703.6	23.99	194.90	24.48	195.20	207.80	10.45	14.03	24.18	23.93	23.95	
36,960.9	23.98	194.80	24.46	195.10	207.70	10.44	14.02	24.16	23.91	23.94	
37,222.1	23.97	194.80	24.46	195.20	207.70	10.45	14.01	24.16	23.91	23.94	
37,480.6	23.94	194.60	24.43	195.10	207.70	10.44	14.00	24.14	23.89	23.92	
37,739.3	23.96	194.70	24.44	195.20	207.70	10.45	13.99	24.13	23.89	23.92	
37,997.7	23.96	194.70	24.44	195.20	207.70	10.45	13.99	24.13	23.89	23.92	
38,259.7	23.95	194.60	24.43	195.20	207.60	10.45	13.99	24.13	23.89	23.92	
38,518.2	23.94	194.60	24.43	195.20	207.60	10.45	13.98	24.12	23.88	23.91	
38,773.9	23.93	194.60	24.43	195.20	207.60	10.45	13.98	24.12	23.88	23.91	
39,033.9	23.93	194.60	24.42	195.20	207.60	10.45	13.97	24.10	23.87	23.90	
39,295.7	23.92	194.50	24.41	195.10	207.50	10.45	13.97	24.10	23.87	23.90	
39,554.9	23.92	194.50	24.40	195.10	207.50	10.45	13.96	24.09	23.86	23.89	
39,815.4	23.91	194.50	24.40	195.10	207.50	10.45	13.95	24.08	23.85	23.88	
40,075.6	23.90	194.40	24.39	195.10	207.40	10.45	13.95	24.08	23.85	23.88	
40,334.6	23.90	194.40	24.39	195.10	207.40	10.45	13.94	24.06	23.84	23.87	
40,592.6	23.89	194.40	24.38	195.10	207.40	10.44	13.94	24.05	23.83	23.86	
40,854.3	23.88	194.40	24.38	195.10	207.30	10.44	13.93	24.04	23.82	23.85	
41,114.6	23.88	194.30	24.37	195.10	207.30	10.44	13.93	24.04	23.82	23.85	
41,372.1	23.87	194.30	24.37	195.10	207.30	10.44	13.93	24.04	23.82	23.85	
41,631.3	23.87	194.30	24.36	195.10	207.30	10.44	13.92	24.02	23.81	23.84	
41,886.7	23.86	194.20	24.36	195.10	207.20	10.44	13.92	24.02	23.81	23.84	
42,146.7	23.85	194.20	24.35	195.10	207.20	10.44	13.91	24.01	23.80	23.83	
42,404.3	23.85	194.20	24.34	195.10	207.20	10.44	13.90	24.00	23.79	23.82	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
42,659.2	23.84	194.20	24.34	195.10	207.10	10.44	13.90	24.00	23.79	23.82	
42,919.1	23.84	194.10	24.33	195.10	207.10	10.44	13.90	23.99	23.79	23.82	
43,177.9	23.83	194.10	24.32	195.10	207.10	10.44	13.89	23.98	23.78	23.81	
43,437.2	23.82	194.10	24.32	195.10	207.00	10.44	13.88	23.97	23.77	23.80	
43,693.1	23.82	194.10	24.30	195.00	207.00	10.42	13.88	23.95	23.75	23.78	
43,951.8	23.81	194.00	24.31	195.10	207.00	10.43	13.87	23.95	23.75	23.78	
44,210.3	23.81	194.00	24.30	195.10	206.90	10.43	13.87	23.95	23.75	23.78	
44,468.8	23.80	194.00	24.29	195.00	206.90	10.43	13.86	23.93	23.74	23.77	
44,729.2	23.79	193.90	24.29	195.10	206.90	10.43	13.86	23.93	23.74	23.77	
44,989.9	23.79	193.90	24.27	195.00	206.80	10.42	13.85	23.91	23.72	23.75	
45,247.7	23.78	193.90	24.28	195.00	206.80	10.43	13.85	23.92	23.73	23.76	
45,504.2	23.77	193.80	24.27	195.00	206.80	10.43	13.84	23.91	23.72	23.75	
45,759.3	23.77	193.80	24.26	195.00	206.70	10.42	13.84	23.89	23.71	23.74	
46,014.6	23.76	193.80	24.26	195.00	206.70	10.43	13.83	23.89	23.71	23.74	
46,271.1	23.76	193.70	24.24	195.00	206.70	10.42	13.82	23.87	23.69	23.72	
46,527.2	23.76	193.70	24.25	195.00	206.60	10.42	13.82	23.87	23.69	23.72	
46,786.8	23.75	193.70	24.24	195.00	206.60	10.42	13.82	23.87	23.69	23.72	
47,042.3	23.75	193.70	24.22	194.90	206.60	10.41	13.81	23.84	23.67	23.70	
47,299.4	23.74	193.70	24.23	195.00	206.50	10.42	13.81	23.85	23.68	23.71	
47,553.9	23.74	193.60	24.22	194.90	206.50	10.41	13.81	23.84	23.67	23.70	
47,810.1	23.73	193.60	24.22	195.00	206.50	10.41	13.81	23.84	23.67	23.70	
48,064.8	23.72	193.60	24.22	195.00	206.50	10.41	13.80	23.83	23.66	23.69	
48,320.7	23.72	193.50	24.20	194.90	206.40	10.40	13.80	23.81	23.65	23.68	
48,574.3	23.71	193.50	24.20	194.90	206.40	10.40	13.80	23.81	23.65	23.68	
48,831.6	23.71	193.50	24.19	194.90	206.40	10.40	13.79	23.80	23.64	23.67	
49,089.4	23.70	193.40	24.18	194.90	206.30	10.39	13.79	23.79	23.63	23.66	
49,345.6	23.69	193.40	24.18	194.80	206.30	10.39	13.79	23.79	23.63	23.66	
49,601.1	23.68	193.40	24.17	194.80	206.30	10.39	13.79	23.78	23.63	23.66	
49,856.3	23.67	193.30	24.16	194.80	206.20	10.38	13.78	23.76	23.61	23.64	
50,111.1	23.67	193.30	24.15	194.70	206.20	10.37	13.78	23.75	23.60	23.63	
50,365.1	23.66	193.30	24.14	194.70	206.10	10.36	13.78	23.74	23.59	23.62	
50,619.8	23.65	193.20	24.13	194.70	206.10	10.36	13.78	23.74	23.59	23.62	
50,875.2	23.64	193.20	24.12	194.60	206.10	10.35	13.77	23.71	23.57	23.60	
51,129.7	23.63	193.20	24.11	194.60	206.00	10.34	13.77	23.70	23.56	23.59	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
51,385.1	23.63	193.20	24.10	194.60	206.00	10.33	13.77	23.69	23.55	23.58	
51,638.9	23.62	193.10	24.09	194.50	206.00	10.33	13.77	23.69	23.55	23.58	
51,894.7	23.61	193.10	24.08	194.50	205.90	10.32	13.76	23.67	23.53	23.56	
52,148.2	23.60	193.10	24.07	194.50	205.90	10.31	13.76	23.65	23.52	23.55	
52,403.9	23.60	193.00	24.06	194.40	205.90	10.30	13.76	23.64	23.51	23.54	
52,660.9	23.59	193.00	24.05	194.40	205.80	10.30	13.76	23.64	23.51	23.54	
52,917.3	23.58	193.00	24.04	194.40	205.80	10.29	13.75	23.62	23.49	23.52	
53,171.3	23.57	192.90	24.04	194.30	205.70	10.28	13.75	23.61	23.48	23.51	
53,425.2	23.56	192.90	24.03	194.30	205.70	10.28	13.75	23.60	23.48	23.51	
53,677.9	23.55	192.80	24.02	194.30	205.70	10.27	13.75	23.59	23.47	23.50	
53,931.7	23.55	192.80	24.01	194.20	205.60	10.26	13.74	23.57	23.45	23.48	
54,184.7	23.54	192.80	24.00	194.20	205.60	10.26	13.74	23.57	23.45	23.48	
54,438.9	23.53	192.70	23.99	194.20	205.60	10.25	13.74	23.56	23.44	23.47	
54,692.8	23.52	192.70	23.98	194.10	205.50	10.24	13.74	23.55	23.43	23.46	
54,947.4	23.52	192.70	23.97	194.10	205.50	10.23	13.73	23.52	23.41	23.44	
55,201.6	23.51	192.60	23.96	194.00	205.40	10.23	13.73	23.52	23.41	23.44	
55,454.7	23.50	192.60	23.95	194.00	205.40	10.22	13.73	23.51	23.40	23.43	
55,706.9	23.49	192.60	23.94	194.00	205.40	10.21	13.73	23.50	23.39	23.42	
55,960.4	23.48	192.50	23.93	193.90	205.30	10.20	13.72	23.48	23.37	23.40	
56,212.6	23.47	192.50	23.91	193.90	205.30	10.19	13.72	23.46	23.36	23.39	
56,467.2	23.47	192.50	23.90	193.80	205.20	10.18	13.72	23.45	23.35	23.38	
56,721.6	23.46	192.40	23.89	193.80	205.20	10.18	13.72	23.45	23.35	23.38	
56,973.1	23.45	192.40	23.88	193.80	205.20	10.17	13.71	23.43	23.33	23.36	
57,225.3	23.44	192.40	23.87	193.70	205.10	10.16	13.71	23.42	23.32	23.35	
57,480.3	23.43	192.30	23.86	193.70	205.10	10.15	13.71	23.40	23.31	23.34	
57,732.6	23.42	192.30	23.85	193.60	205.00	10.14	13.71	23.39	23.30	23.33	
57,985.6	23.41	192.20	23.84	193.60	205.00	10.13	13.70	23.37	23.28	23.31	
58,237.4	23.41	192.20	23.83	193.60	204.90	10.13	13.70	23.37	23.28	23.31	
58,491.3	23.40	192.20	23.81	193.50	204.90	10.12	13.70	23.36	23.27	23.30	
58,744.1	23.39	192.10	23.80	193.50	204.90	10.11	13.69	23.33	23.25	23.28	
58,996.8	23.38	192.10	23.79	193.40	204.80	10.10	13.69	23.32	23.23	23.27	
59,249.2	23.37	192.10	23.78	193.40	204.80	10.09	13.69	23.31	23.22	23.26	
59,501.7	23.36	192.00	23.77	193.40	204.70	10.08	13.69	23.30	23.21	23.25	
59,754.4	23.35	192.00	23.76	193.30	204.70	10.07	13.68	23.28	23.19	23.23	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
60,007.3	23.34	191.90	23.75	193.30	204.60	10.06	13.68	23.26	23.18	23.22	
60,258.9	23.33	191.90	23.73	193.20	204.60	10.06	13.68	23.26	23.18	23.22	
60,510.4	23.32	191.80	23.72	193.20	204.60	10.05	13.68	23.25	23.17	23.21	
60,762.2	23.31	191.80	23.71	193.10	204.50	10.04	13.67	23.23	23.15	23.19	
61,016.7	23.30	191.80	23.71	193.10	204.50	10.04	13.67	23.23	23.15	23.19	
61,269.2	23.29	191.70	23.69	193.10	204.40	10.02	13.67	23.21	23.13	23.17	
61,521.4	23.28	191.70	23.67	193.00	204.40	10.01	13.66	23.18	23.11	23.15	
61,773.6	23.27	191.60	23.66	193.00	204.30	10.00	13.66	23.17	23.10	23.14	
62,027.2	23.26	191.60	23.65	192.90	204.30	9.99	13.66	23.16	23.09	23.13	
62,279.6	23.25	191.50	23.64	192.90	204.20	9.98	13.66	23.15	23.08	23.12	
62,531.4	23.24	191.50	23.62	192.80	204.20	9.97	13.65	23.13	23.06	23.10	
62,783.4	23.23	191.50	23.61	192.80	204.10	9.96	13.65	23.12	23.05	23.09	
63,035.4	23.22	191.40	23.60	192.70	204.10	9.95	13.65	23.10	23.04	23.08	
63,286.6	23.21	191.40	23.59	192.70	204.00	9.94	13.64	23.08	23.02	23.06	
63,539.1	23.20	191.30	23.57	192.60	204.00	9.93	13.64	23.07	23.01	23.05	
63,791.6	23.19	191.30	23.56	192.60	203.90	9.92	13.64	23.06	23.00	23.04	
64,042.7	23.18	191.20	23.55	192.50	203.90	9.91	13.63	23.04	22.98	23.02	
64,294.3	23.17	191.20	23.53	192.50	203.80	9.90	13.63	23.02	22.97	23.01	
64,546.3	23.16	191.10	23.52	192.40	203.80	9.89	13.63	23.01	22.96	23.00	
64,799.1	23.15	191.10	23.51	192.40	203.70	9.88	13.63	23.00	22.95	22.99	
65,051.1	23.14	191.10	23.49	192.30	203.70	9.87	13.62	22.98	22.93	22.97	
65,304.6	23.13	191.00	23.48	192.30	203.60	9.86	13.62	22.97	22.92	22.96	
65,557.2	23.12	191.00	23.47	192.20	203.60	9.85	13.62	22.96	22.91	22.95	
65,808.9	23.11	190.90	23.45	192.20	203.50	9.84	13.61	22.93	22.89	22.93	
66,060.7	23.10	190.90	23.44	192.10	203.50	9.83	13.61	22.92	22.88	22.92	
66,313.6	23.09	190.80	23.43	192.10	203.40	9.82	13.61	22.91	22.87	22.91	
66,567.2	23.07	190.80	23.41	192.00	203.40	9.81	13.60	22.89	22.85	22.89	
66,819.9	23.06	190.70	23.40	192.00	203.30	9.80	13.60	22.87	22.84	22.88	
67,071.1	23.05	190.70	23.39	191.90	203.30	9.79	13.60	22.86	22.83	22.87	
67,323.7	23.04	190.60	23.37	191.90	203.20	9.78	13.60	22.85	22.82	22.86	
67,574.9	23.03	190.60	23.36	191.80	203.20	9.77	13.59	22.83	22.80	22.84	
67,827.1	23.02	190.50	23.35	191.80	203.10	9.76	13.59	22.81	22.79	22.83	
68,079.2	23.01	190.50	23.33	191.70	203.00	9.75	13.59	22.80	22.78	22.82	
68,331.9	23.00	190.40	23.32	191.70	203.00	9.74	13.58	22.78	22.76	22.80	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
68,585.2	22.99	190.40	23.31	191.60	202.90	9.73	13.58	22.77	22.75	22.79	
68,836.6	22.98	190.30	23.29	191.60	202.90	9.72	13.58	22.76	22.74	22.78	
69,087.9	22.97	190.30	23.28	191.50	202.80	9.71	13.57	22.73	22.72	22.76	
69,339.8	22.95	190.20	23.27	191.50	202.80	9.70	13.57	22.72	22.70	22.75	
69,592.8	22.94	190.20	23.25	191.40	202.70	9.68	13.57	22.71	22.69	22.73	
69,844.2	22.93	190.10	23.24	191.30	202.70	9.67	13.56	22.69	22.67	22.72	
70,095.4	22.92	190.10	23.22	191.30	202.60	9.66	13.56	22.67	22.66	22.70	
70,346.7	22.91	190.00	23.21	191.20	202.50	9.65	13.56	22.66	22.65	22.69	
70,599.6	22.90	190.00	23.20	191.20	202.50	9.64	13.56	22.65	22.64	22.68	
70,852.3	22.89	189.90	23.18	191.10	202.40	9.63	13.55	22.62	22.62	22.66	
71,105.2	22.88	189.90	23.17	191.10	202.40	9.62	13.55	22.61	22.61	22.65	
71,356.4	22.86	189.80	23.15	191.00	202.30	9.61	13.55	22.60	22.60	22.64	
71,607.9	22.85	189.80	23.14	191.00	202.30	9.60	13.54	22.58	22.58	22.62	
71,859.4	22.84	189.70	23.13	190.90	202.20	9.59	13.54	22.56	22.57	22.61	
72,112.7	22.83	189.70	23.11	190.90	202.10	9.58	13.54	22.55	22.55	22.60	
72,364.6	22.82	189.60	23.10	190.80	202.10	9.57	13.53	22.53	22.53	22.58	
72,616.8	22.81	189.60	23.08	190.70	202.00	9.56	13.53	22.52	22.52	22.57	
72,869.4	22.79	189.50	23.07	190.70	202.00	9.54	13.53	22.50	22.51	22.56	
73,122.4	22.78	189.50	23.06	190.60	201.90	9.53	13.52	22.48	22.49	22.54	
73,375.4	22.77	189.40	23.04	190.60	201.90	9.52	13.52	22.47	22.48	22.52	
73,627.1	22.76	189.40	23.03	190.50	201.80	9.51	13.52	22.46	22.47	22.51	
73,879.9	22.75	189.30	23.02	190.50	201.70	9.50	13.51	22.43	22.45	22.49	
74,132.6	22.74	189.30	23.00	190.40	201.70	9.49	13.51	22.42	22.44	22.48	
74,384.3	22.73	189.20	22.99	190.40	201.60	9.48	13.51	22.41	22.43	22.47	
74,636.8	22.71	189.20	22.98	190.30	201.60	9.47	13.51	22.40	22.42	22.46	
74,888.7	22.70	189.10	22.96	190.30	201.50	9.46	13.50	22.37	22.40	22.44	
75,140.3	22.69	189.10	22.95	190.20	201.40	9.45	13.50	22.36	22.39	22.43	
75,392.7	22.68	189.00	22.94	190.20	201.40	9.44	13.50	22.35	22.38	22.42	
75,645.7	22.67	188.90	22.92	190.10	201.30	9.43	13.49	22.33	22.36	22.40	
75,896.4	22.65	188.90	22.91	190.10	201.20	9.42	13.49	22.32	22.35	22.39	
76,149.7	22.64	188.80	22.90	190.00	201.20	9.41	13.49	22.30	22.34	22.38	
76,401.4	22.63	188.80	22.88	190.00	201.10	9.40	13.48	22.28	22.32	22.36	
76,654.7	22.62	188.70	22.87	189.90	201.10	9.39	13.48	22.27	22.31	22.35	
76,908.2	22.61	188.70	22.86	189.80	201.00	9.38	13.48	22.26	22.30	22.34	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
77,160.7	22.59	188.60	22.84	189.80	200.90	9.37	13.47	22.24	22.28	22.32	
77,413.6	22.58	188.60	22.83	189.70	200.90	9.36	13.47	22.23	22.27	22.31	
77,666.4	22.57	188.50	22.82	189.70	200.80	9.35	13.47	22.21	22.26	22.30	
77,917.8	22.56	188.40	22.80	189.60	200.70	9.34	13.46	22.19	22.24	22.28	
78,169.7	22.54	188.40	22.79	189.60	200.70	9.33	13.46	22.18	22.22	22.27	
78,421.8	22.53	188.30	22.78	189.60	200.60	9.32	13.46	22.17	22.22	22.27	
78,674.9	22.52	188.30	22.76	189.50	200.60	9.31	13.46	22.15	22.20	22.25	
78,926.9	22.51	188.20	22.74	189.40	200.50	9.29	13.45	22.13	22.18	22.23	
79,178.7	22.50	188.20	22.73	189.30	200.40	9.28	13.45	22.11	22.17	22.21	
79,430.7	22.48	188.10	22.71	189.30	200.40	9.27	13.45	22.10	22.15	22.20	
79,683.3	22.47	188.10	22.70	189.20	200.30	9.26	13.44	22.08	22.13	22.18	
79,935.1	22.46	188.00	22.68	189.20	200.20	9.25	13.44	22.06	22.12	22.17	
85,030.2	22.22	186.90	22.39	187.90	198.90	9.01	13.38	21.73	21.82	21.87	
91,340.1	21.93	185.50	22.07	186.60	197.40	8.76	13.31	21.37	21.50	21.56	
97,641.9	21.66	184.20	21.74	185.20	195.80	8.50	13.24	20.99	21.16	21.22	
103,949.7	21.40	182.90	21.42	183.70	194.30	8.25	13.18	20.64	20.85	20.92	
110,254.2	21.18	181.80	21.15	182.50	193.00	8.03	13.12	20.32	20.57	20.64	
116,558.1	20.98	180.80	20.92	181.40	191.80	7.85	13.07	20.03	20.33	20.40	
122,868.4	20.81	179.90	20.71	180.40	190.70	7.68	13.03	19.78	20.12	20.20	
129,179.1	20.65	179.10	20.52	179.50	189.80	7.53	12.99	19.55	19.93	20.01	
135,487.4	20.51	178.30	20.36	178.60	188.90	7.40	12.95	19.34	19.76	19.84	
141,789.1	20.38	177.60	20.20	177.90	188.10	7.28	12.92	19.14	19.60	19.69	
148,090.9	20.26	176.90	20.06	177.10	187.30	7.17	12.89	18.96	19.46	19.55	
154,401.3	20.15	176.30	19.93	176.50	186.50	7.07	12.86	18.78	19.32	19.42	
160,708.4	20.04	175.70	19.83	176.00	185.80	6.99	12.83	18.63	19.21	19.31	
167,019.1	19.94	175.10	19.71	175.40	185.20	6.91	12.81	18.48	19.10	19.21	
173,322.4	19.85	174.60	19.60	174.80	184.60	6.82	12.78	18.32	18.98	19.09	
179,629.3	19.77	174.10	19.51	174.30	184.00	6.74	12.76	18.18	18.88	18.99	
185,930.8	19.72	173.80	19.45	173.90	183.60	6.70	12.75	18.08	18.82	18.94	
192,232.6	19.67	173.50	19.40	173.70	183.40	6.66	12.73	17.98	18.76	18.88	
198,537.2	19.57	172.90	19.28	173.10	182.70	6.58	12.70	17.82	18.64	18.77	
204,840.2	19.48	172.40	19.17	172.50	182.10	6.49	12.68	17.67	18.53	18.66	
211,143.9	19.38	171.80	19.07	171.90	181.40	6.41	12.65	17.52	18.41	18.55	
217,447.9	19.29	171.30	18.96	171.30	180.80	6.34	12.63	17.38	18.31	18.45	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
223,758.8	19.21	170.80	18.87	170.80	180.20	6.26	12.61	17.24	18.21	18.36	
230,059.6	19.13	170.20	18.77	170.30	179.60	6.19	12.58	17.09	18.11	18.26	
236,369.3	19.04	169.70	18.68	169.70	179.00	6.12	12.56	16.96	18.01	18.17	
242,674.3	18.96	169.20	18.59	169.20	178.50	6.05	12.54	16.83	17.92	18.08	
248,980.8	18.88	168.70	18.50	168.70	177.90	5.98	12.52	16.70	17.83	17.99	
255,286.1	18.81	168.20	18.41	168.20	177.30	5.92	12.50	16.57	17.74	17.91	
261,588.6	18.73	167.70	18.33	167.70	176.80	5.85	12.48	16.44	17.65	17.82	
267,892.4	18.66	167.30	18.24	167.20	176.20	5.79	12.45	16.31	17.55	17.73	
274,195.6	18.58	166.80	18.16	166.70	175.70	5.73	12.43	16.18	17.46	17.65	
280,498.9	18.50	166.30	18.08	166.10	175.10	5.66	12.41	16.06	17.37	17.56	
286,802.9	18.43	165.80	17.99	165.60	174.60	5.60	12.39	15.93	17.29	17.48	
293,099.4	18.36	165.30	17.91	165.10	174.00	5.54	12.37	15.81	17.20	17.40	
299,408.8	18.29	164.80	17.83	164.60	173.50	5.48	12.36	15.70	17.13	17.33	
305,708.8	18.22	164.30	17.75	164.10	172.90	5.42	12.34	15.57	17.04	17.25	
312,010.0	18.15	163.80	17.67	163.60	172.40	5.36	12.32	15.45	16.96	17.17	
318,313.8	18.08	163.40	17.60	163.10	171.80	5.30	12.30	15.33	16.87	17.09	
324,616.9	18.01	162.90	17.52	162.60	171.30	5.24	12.28	15.21	16.79	17.01	
330,921.0	17.94	162.40	17.47	162.30	170.70	5.21	12.26	15.12	16.73	16.96	
337,224.4	17.88	161.90	17.39	161.80	170.20	5.15	12.25	15.01	16.66	16.89	
343,529.5	17.81	161.50	17.32	161.30	169.70	5.09	12.23	14.89	16.58	16.81	
349,826.4	17.75	161.00	17.25	160.80	169.10	5.04	12.21	14.77	16.50	16.74	
356,134.1	17.68	160.50	17.17	160.30	168.60	4.98	12.19	14.70	16.42	16.66	
362,444.5	17.62	160.00	17.10	159.80	168.00	4.92	12.17	14.70	16.34	16.59	
368,741.3	17.55	159.60	17.03	159.30	167.50	4.87	12.16	14.70	16.27	16.52	
375,042.5	17.49	159.10	16.96	158.80	167.00	4.82	12.14	14.70	16.19	16.45	
381,347.8	17.43	158.60	16.88	158.30	166.40	4.76	12.12	14.70	16.11	16.38	
387,655.4	17.36	158.10	16.81	157.80	165.90	4.71	12.10	14.70	16.04	16.31	
393,960.4	17.30	157.60	16.74	157.30	165.30	4.66	12.09	14.70	15.97	16.24	
400,264.9	17.24	157.10	16.67	156.80	164.80	4.61	12.07	14.70	15.89	16.17	
406,571.8	17.18	156.70	16.60	156.30	164.20	4.55	12.05	14.70	15.82	16.10	
412,886.3	17.11	156.20	16.54	155.80	163.70	4.50	12.03	14.70	15.74	16.03	
419,197.3	17.05	155.70	16.47	155.30	163.10	4.45	12.02	14.70	15.68	15.97	
425,498.3	16.99	155.20	16.40	154.80	162.60	4.40	12.00	14.70	15.60	15.90	
431,800.0	16.93	154.70	16.34	154.30	162.00	4.35	11.98	14.70	15.53	15.83	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
438,114.9	16.87	154.30	16.27	153.80	161.50	4.30	11.97	14.70	15.47	15.78	
444,414.2	16.83	153.90	16.22	153.40	161.10	4.26	11.95	14.70	15.40	15.72	
450,723.4	16.78	153.50	16.17	153.00	160.60	4.23	11.94	14.70	15.35	15.67	
457,040.3	16.74	153.20	16.12	152.70	160.30	4.19	11.93	14.70	15.30	15.63	
463,336.8	16.71	152.90	16.08	152.30	159.90	4.16	11.92	14.70	15.26	15.59	
469,645.0	16.67	152.60	16.05	152.00	159.60	4.14	11.91	14.70	15.22	15.55	
475,956.4	16.64	152.30	16.01	151.70	159.30	4.11	11.90	14.70	15.17	15.51	
482,258.4	16.61	152.10	15.97	151.50	159.00	4.08	11.89	14.70	15.13	15.48	
488,561.9	16.58	151.80	15.94	151.20	158.70	4.06	11.88	14.70	15.09	15.45	
494,866.5	16.55	151.60	15.91	150.90	158.40	4.03	11.87	14.70	15.06	15.41	
501,162.3	16.53	151.30	15.88	150.70	158.20	4.01	11.86	14.70	15.02	15.38	
507,468.3	16.50	151.10	15.85	150.40	157.90	3.99	11.86	14.70	14.99	15.36	
513,769.5	16.47	150.90	15.82	150.20	157.60	3.97	11.85	14.70	14.96	15.33	
520,071.4	16.45	150.70	15.79	149.90	157.40	3.95	11.84	14.70	14.92	15.30	
526,372.8	16.42	150.50	15.76	149.70	157.20	3.93	11.83	14.70	14.89	15.27	
532,675.5	16.42	150.40	15.75	149.60	157.10	3.92	11.83	14.70	14.87	15.26	
538,983.5	16.40	150.20	15.72	149.40	156.90	3.90	11.82	14.70	14.84	15.23	
545,285.0	16.37	150.00	15.70	149.20	156.60	3.88	11.81	14.70	14.81	15.20	
551,593.6	16.35	149.80	15.67	149.00	156.40	3.87	11.81	14.70	14.79	15.19	
557,899.0	16.33	149.60	15.65	148.80	156.20	3.85	11.80	14.70	14.75	15.16	
564,202.4	16.30	149.40	15.63	148.60	156.00	3.83	11.79	14.70	14.72	15.14	
570,504.0	16.28	149.20	15.61	148.40	155.80	3.82	11.79	14.70	14.70	15.12	
576,812.4	16.26	149.10	15.58	148.20	155.60	3.80	11.78	14.70	14.67	15.09	
583,127.6	16.25	148.90	15.56	148.00	155.40	3.79	11.77	14.70	14.64	15.07	
589,435.8	16.23	148.70	15.54	147.90	155.20	3.77	11.77	14.70	14.62	15.06	
595,744.5	16.21	148.60	15.52	147.70	155.00	3.76	11.76	14.70	14.60	15.03	
602,049.1	16.19	148.40	15.50	147.50	154.80	3.75	11.76	14.70	14.58	15.02	
608,352.0	16.18	148.30	15.48	147.30	154.70	3.73	11.75	14.70	14.55	15.00	
614,660.5	16.16	148.10	15.47	147.20	154.50	3.72	11.75	14.70	14.53	14.98	
620,965.3	16.14	148.00	15.45	147.00	154.30	3.71	11.74	14.70	14.50	14.96	
627,268.1	16.13	147.80	15.43	146.90	154.20	3.70	11.74	14.70	14.49	14.95	
633,580.0	16.11	147.70	15.41	146.70	154.00	3.68	11.73	14.70	14.46	14.93	
639,888.9	16.09	147.50	15.40	146.60	153.80	3.67	11.72	14.70	14.43	14.91	
646,193.5	16.08	147.40	15.38	146.40	153.70	3.66	11.72	14.70	14.42	14.89	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
652,498.5	16.07	147.20	15.36	146.30	153.50	3.65	11.71	14.70	14.39	14.87	
658,806.8	16.05	147.10	15.35	146.10	153.40	3.64	11.71	14.70	14.38	14.86	
665,107.5	16.04	147.00	15.33	146.00	153.20	3.63	11.71	14.70	14.36	14.85	
671,404.3	16.03	146.90	15.32	145.90	153.10	3.62	11.70	14.70	14.34	14.84	
677,708.4	16.01	146.80	15.31	145.80	153.00	3.61	11.70	14.70	14.32	14.83	
684,015.8	16.00	146.70	15.29	145.60	152.90	3.60	11.69	14.70	14.30	14.81	
690,321.4	15.99	146.60	15.28	145.50	152.70	3.59	11.69	14.70	14.29	14.80	
696,621.4	15.98	146.50	15.27	145.40	152.60	3.59	11.68	14.70	14.27	14.78	
702,935.3	15.97	146.30	15.26	145.30	152.50	3.58	11.68	14.70	14.25	14.78	
709,242.1	15.96	146.20	15.25	145.20	152.40	3.57	11.68	14.70	14.24	14.77	
715,548.3	15.95	146.10	15.24	145.10	152.30	3.56	11.67	14.70	14.22	14.75	
721,849.3	15.94	146.00	15.22	145.00	152.20	3.56	11.67	14.70	14.20	14.74	
728,154.1	15.92	145.90	15.21	144.90	152.00	3.55	11.67	14.70	14.20	14.74	
734,466.5	15.91	145.80	15.20	144.80	151.90	3.54	11.66	14.70	14.20	14.72	
740,770.5	15.90	145.70	15.19	144.70	151.80	3.53	11.66	14.70	14.20	14.71	
747,083.5	15.89	145.60	15.18	144.60	151.70	3.53	11.65	14.70	14.20	14.70	
753,389.8	15.88	145.50	15.17	144.50	151.60	3.52	11.65	14.70	14.20	14.69	
759,686.4	15.87	145.50	15.16	144.40	151.50	3.51	11.65	14.70	14.20	14.68	
765,991.0	15.86	145.40	15.16	144.40	151.40	3.51	11.65	14.70	14.20	14.68	
772,289.9	15.86	145.30	15.15	144.40	151.30	3.51	11.64	14.70	14.20	14.67	
778,594.9	15.85	145.20	15.15	144.30	151.20	3.51	11.64	14.70	14.20	14.67	
784,904.5	15.84	145.10	15.14	144.20	151.10	3.50	11.64	14.70	14.20	14.66	
791,211.1	15.83	145.00	15.13	144.10	151.00	3.49	11.64	14.70	14.20	14.65	
797,521.6	15.82	144.90	15.12	144.00	150.90	3.49	11.63	14.70	14.20	14.64	
803,818.5	15.81	144.80	15.11	144.00	150.80	3.48	11.63	14.70	14.20	14.63	
810,125.8	15.80	144.70	15.10	143.90	150.70	3.47	11.63	14.70	14.20	14.62	
816,431.4	15.79	144.60	15.08	143.80	150.60	3.46	11.62	14.70	14.20	14.60	
822,734.3	15.78	144.60	15.07	143.70	150.50	3.46	11.62	14.70	14.20	14.60	
829,035.5	15.77	144.50	15.06	143.60	150.40	3.45	11.62	14.70	14.20	14.59	
835,341.0	15.76	144.40	15.05	143.50	150.30	3.44	11.61	14.70	14.20	14.57	
841,645.4	15.75	144.30	15.04	143.40	150.20	3.43	11.61	14.70	14.20	14.56	
847,941.4	15.74	144.20	15.03	143.30	150.10	3.43	11.61	14.70	14.20	14.56	
854,250.4	15.73	144.10	15.02	143.20	150.00	3.42	11.60	14.70	14.20	14.54	
860,553.1	15.72	144.00	15.01	143.10	149.90	3.41	11.60	14.70	14.20	14.53	

TIME	DW PRESS	DW TEMP	WW PRESS	WW TEMP	SP TEMP	P STM WW	P AIR WW	WW PRESS	WW PRESS	WW PRESS	
			w/o leakage					w/ air leakage	W/La = Constant Tech Spec	W/La = Adjusted Tech Spec	
sec.	psia	deg-F *	psia	deg-F	deg-F	psia	psia	psia	psia	psia	
								5% per day			
866,857.8	15.71	143.90	15.00	143.00	149.80	3.40	11.60	14.70	14.20	14.53	
873,163.9	15.70	143.80	14.99	142.90	149.60	3.39	11.59	14.70	14.20	14.51	
879,469.6	15.69	143.70	14.98	142.80	149.50	3.39	11.59	14.70	14.20	14.50	
885,779.1	15.69	143.60	14.97	142.70	149.40	3.38	11.59	14.70	14.20	14.50	
892,085.0	15.68	143.50	14.96	142.60	149.30	3.37	11.58	14.70	14.20	14.48	
898,397.3	15.67	143.40	14.95	142.60	149.20	3.36	11.58	14.70	14.20	14.47	
904,697.0	15.66	143.30	14.93	142.50	149.10	3.36	11.58	14.70	14.20	14.47	
910,997.3	15.65	143.30	14.92	142.40	149.00	3.35	11.57	14.70	14.20	14.45	
917,300.5	15.64	143.20	14.91	142.30	148.90	3.34	11.57	14.70	14.20	14.44	
923,607.6	15.63	143.10	14.90	142.20	148.80	3.33	11.57	14.70	14.20	14.44	
929,910.8	15.62	143.00	14.89	142.10	148.70	3.33	11.57	14.70	14.20	14.43	
936,214.5	15.61	142.90	14.88	142.00	148.60	3.32	11.56	14.70	14.20	14.41	
942,521.3	15.60	142.80	14.87	141.90	148.50	3.31	11.56	14.70	14.20	14.41	
948,825.9	15.59	142.70	14.86	141.80	148.40	3.30	11.56	14.70	14.20	14.40	
955,130.6	15.58	142.60	14.85	141.70	148.30	3.30	11.55	14.70	14.20	14.38	
961,438.5	15.57	142.50	14.84	141.60	148.20	3.29	11.55	14.70	14.20	14.38	
967,738.8	15.56	142.40	14.83	141.50	148.00	3.28	11.55	14.70	14.20	14.37	
974,047.8	15.55	142.30	14.82	141.40	147.90	3.28	11.54	14.70	14.20	14.35	
980,353.1	15.54	142.20	14.81	141.30	147.80	3.27	11.54	14.70	14.20	14.35	
986,655.6	15.53	142.10	14.80	141.20	147.70	3.26	11.54	14.70	14.20	14.34	
992,956.1	15.53	142.00*	14.79	141.10	147.60	3.25	11.53	14.70	14.20	14.33	
999,266.8	15.52	141.90	14.78	141.00	147.50	3.25	11.53	14.70	14.20	14.32	
1,000,000.0	15.51	141.90	14.78	141.00	147.50	3.25	11.53	14.70	14.20	14.32	
				Max	207.80			*Max*	32.00		

All pages in Attachment H checked
6/15/01

This calculation uses the Visual Basic macro shown below, and in conjunction with the calculation capability of the spreadsheet itself, work together to provide an efficient and accurate means of modeling NPSH pump margins without resorting to the traditional means of generating computer code in a native language such as FORTRAN or C. The accuracy of these calculations, as well as their applicability, have been checked line by line by the originator, and were randomly checked by an independent checker.

```
Sub NPSH()
'
' Macro written by E. Kirchman (DED) on 5/4/2001
'
' Keyboard Shortcut: Ctrl+r
'
'  Declare variables

   Dim i As Long                    'Housekeeping variable
   Dim t As Long                    'Time keeping variable
   Dim Nre As Double                'Reynolds Number (dimensionless)
   Dim f As Double                  'friction factor based upon pipe's Reynolds Number (dimensionless)
   Dim Head_csa As Double           'CS loop A's piping headloss (feet)
   Dim Head_csb As Double           'CS loop B's piping headloss (feet)
   Dim Head_rhra As Double          'RHR loop A's piping headloss (feet)
   Dim Head_rhrb As Double          'RHR loop B's piping headloss (feet)
   Dim Head_rhrc As Double          'RHR loop C's piping headloss (feet)
   Dim Head_rhrd As Double          'RHR loop D's piping headloss (feet)
   Dim Req_pres_csa As Double       'Pressure required for adequate NPSH, CS loop A (feet)
   Dim Req_pres_csb As Double       'Pressure required for adequate NPSH, CS loop B (feet)
   Dim Req_pres_rhra As Double      'Pressure required for adequate NPSH, RHR loop A (feet)
   Dim Req_pres_rhrb As Double      'Pressure required for adequate NPSH, RHR loop B (feet)
   Dim Req_pres_rhrc As Double      'Pressure required for adequate NPSH, RHR loop C (feet)
   Dim Req_pres_rhrd As Double      'Pressure required for adequate NPSH, RHR loop D (feet)
   Dim Margin As Double             'Housekeeping varible
   Dim Expo As Double               'Housekeeping variable (non-dimensional)
   Dim f1 As Double                 'Housekeeping variable (non-dimensional)
   Dim Fiber As Double              'Interim mass of fibrous material (Lbs)
   Dim Sludge As Double             'Interim mass of sludge (Lbs)
   Dim Dirt As Double               'Interim mass of dirt/dust (Lbs)
   Dim Paint As Double              'Interim mass of paint chips (Lbs)
   Dim Rust As Double               'Interim mass of rust (Lbs)
   Dim Cal_sil As Double            'Interim mass of Calcium silicate (Lbs)
   Dim Loading(5, 2) As Double      'Housekeeping variable array
   Dim Debris(5) As Double          'Housekeeping variable array
   Dim Cs_A_1 As Double             'CS Loop A's flowrate for the first half (gpm)
   Dim Cs_A_2 As Double             'CS Loop A's flowrate after that (gpm)
   Dim Cs_B_1 As Double             'CS Loop B's flowrate for the first half (gpm)
   Dim Cs_B_2 As Double             'CS Loop B's flowrate after half (gpm)
   Dim Rhr_A_1 As Double            'RHR Loop A' flowrate for the first half (gpm)
   Dim Rhr_A_2 As Double            'RHR Loop A' flowrate after that (gpm)
   Dim Rhr_B_1 As Double            'RHR Loop B's flowrate for the first half (gpm)
   Dim Rhr_B_2 As Double            'RHR Loop B's flowrate after that (gpm)
   Dim Rhr_C_1 As Double            'RHR Loop C's flowrate for the first half (gpm)
   Dim Rhr_C_2 As Double            'RHR Loop C's flowrate after that (gpm)
   Dim Rhr_D_1 As Double            'RHR Loop D's flowrate for the first half (gpm)
   Dim Rhr_D_2 As Double            'RHR Loop D's flowrate after that (gpm)
   Dim Delta_T_1 As Integer         'Time increment for the first half (seconds)
   Dim Delta_T_2 As Integer         'Time increment after that (seconds)
   Dim Tmin As Integer              'First half time range (seconds)
   Dim Tmax As Long                 'Second half time range (seconds)

 ' Get the initial and final flowrates for CS & RHR off the respected sheet

 '  Set Divsion I flowrates (Divison II power failure)

   'For the first part

   Cs_A_1 = Range("C7").Value       'Sets CS flow for the first part (gpm)
   Rhr_A_1 = Range("C8").Value      'Sets RHR Loop A for the first part (gpm)
```

```
    Rhr_B_1 = Range("C9").Value          'Sets RHR Loop B  for the first part (gpm)

    'For the remaining duration of the event

    Cs_A_2 = Range("D7").Value           'Sets CS flow for the remaining duration (gpm)
    Rhr_A_2 = Range("D8").Value          'Sets RHR Loop A for the remaining duration (gpm)
    Rhr_B_2 = Range("D9").Value          'Sets RHR Loop B for the remaining duration (gpm)

  ' Set Division II flowrates (Division I power failure)

    'For the first part

    Cs_B_1 = Range("C12").Value          'Sets CS flow for the first part (gpm)
    Rhr_C_1 = Range("C13").Value         'Sets RHR Loop C for the first part (gpm)
    Rhr_D_1 = Range("C14").Value         'Sets RHR Loop D for the first part (gpm)

    'For the remaining duration of the event

    Cs_B_2 = Range("D12").Value          'Sets CS flow for the remaining duration (gpm)
    Rhr_C_2 = Range("D13").Value         'Sets RHR Loop C for the remaining duration (gpm)
    Rhr_D_2 = Range("D14").Value         'Sets RHR Loop D for the remaining duration (gpm)

' Set time increments for both the first half and the time thereafter

    Delta_T_1 = 10                       'Increment by 10 second intervals for the first half
    Delta_T_2 = 350                      'Increment by 300 second intervals thereafter
    Tmin = Range("C6").Value             'Time range of first half (seconds)
    Tmax = Range("G6").Value             'Time range of second half (seconds) - Must not exceed data range of attachment G!

' Check to see if termination time (Tmax) is less than pump switchover time (Tmin).  If so, make switchover time equal to termination
' time (Tmin=Tmax)

    If Tmax < Tmin Then Tmin = Tmax

' Bump-up factor for piping frictional losses

  bump = 1.2        'Applying a 20% bump-up factor

' And lets start with a clean output area

  Range("A28:K10000").ClearContents

' And lets put in some reporting functions at the end of the spreadsheet

  ' But first we have to estimate where the spreadsheet ends;

    t = 28 + Int(((Tmin / Delta_T_1) + Int((Tmax - Tmin) / Delta_T_2)))

  ' Get the pool's projected temperature at T=0 seconds to obtain the base pressure

      Range("D18").Value = 0
      Range("H21").Value = Range("D20").Value
      f1 = Range("D20").Value

  ' And then write the functions to their respective output sheet alittle below that point

    If Range("B1") = 4 Then

        Range("A" + CStr(t + 3)).Formula = "Max ->"
        Range("B" + CStr(t + 3)).Formula = "=MAX(B28:" + "B" + CStr(t) + ")"
        Range("C" + CStr(t + 3)).Formula = "=MAX(C28:" + "C" + CStr(t) + ")"
        Range("E" + CStr(t + 3)).Formula = "=IF(MAX(E28:" + "E" + CStr(t) + ")-" + CStr(f1) + "<=0," + Chr(34) + Chr(34) + ",MAX(E28:" + "E" + CStr(t) + ")-" + CStr(f1) + ")"
        Range("F" + CStr(t + 3)).Formula = "=IF(MAX(F28:" + "F" + CStr(t) + ")-" + CStr(f1) + "<=0," + Chr(34) + Chr(34) + ",MAX(F28:" + "F" + CStr(t) + ")-" + CStr(f1) + ")"
        Range("G" + CStr(t + 3)).Formula = "=IF(MAX(G28:" + "G" + CStr(t) + ")-" + CStr(f1) + "<=0," + Chr(34) + Chr(34) + ",MAX(G28:" + "G" + CStr(t) + ")-" + CStr(f1) + ")"
        Range("I" + CStr(t + 3)).Formula = "=IF(MAX(I28:" + "I" + CStr(t) + ")-" + CStr(f1) + "<=0," + Chr(34) + Chr(34) + ",MAX(I28:" + "I" + CStr(t) + ")-" + CStr(f1) + ")"
        Range("J" + CStr(t + 3)).Formula = "=IF(MAX(J28:" + "J" + CStr(t) + ")-" + CStr(f1) + "<=0," + Chr(34) + Chr(34) + ",MAX(J28:" + "J" + CStr(t) + ")-" + CStr(f1) + ")"
        Range("K" + CStr(t + 3)).Formula = "=IF(MAX(K28:" + "K" + CStr(t) + ")-" + CStr(f1) + "<=0," + Chr(34) + Chr(34) + ",MAX(K28:" + "K" + CStr(t) + ")-" + CStr(f1) + ")"

        Range("D" + CStr(t + 5)).Formula = "CS"
```

```
        Range("E" + CStr(t + 5)).Formula = "RHR"
        Range("A" + CStr(t + 6)).Formula = "Minimum Overpressure Required"
        Range("D" + CStr(t + 6)).Formula = "=MAX(E" + CStr(t + 3) + ",I" + CStr(t + 3) + ")"
        Range("E" + CStr(t + 6)).Formula = "=MAX(F" + CStr(t + 3) + ",G" + CStr(t + 3) + ",J" + CStr(t + 3) + ",K" + CStr(t + 3) + ")"
        Range("F" + CStr(t + 6)).Formula = "psig"

    Else

        Range("A" + CStr(t + 3)).Formula = "Min ->"
        Range("B" + CStr(t + 3)).Formula = "=IF(MIN(B28:" + "B" + CStr(t) + ")=0," + Chr(34) + Chr(34) + ",MIN(B28:" + "B" + CStr(t) + "))"
        Range("C" + CStr(t + 3)).Formula = "=IF(MIN(C28:" + "C" + CStr(t) + ")=0," + Chr(34) + Chr(34) + ",MIN(C28:" + "C" + CStr(t) + "))"
        Range("D" + CStr(t + 3)).Formula = "=IF(MIN(D28:" + "D" + CStr(t) + ")=0," + Chr(34) + Chr(34) + ",MIN(D28:" + "D" + CStr(t) + "))"

        Range("F" + CStr(t + 3)).Formula = "Min ->"
        Range("G" + CStr(t + 3)).Formula = "=IF(MIN(G28:" + "G" + CStr(t) + ")=0," + Chr(34) + Chr(34) + ",MIN(G28:" + "G" + CStr(t) + "))"
        Range("H" + CStr(t + 3)).Formula = "=IF(MIN(H28:" + "H" + CStr(t) + ")=0," + Chr(34) + Chr(34) + ",MIN(H28:" + "H" + CStr(t) + "))"
        Range("I" + CStr(t + 3)).Formula = "=IF(MIN(I28:" + "I" + CStr(t) + ")=0," + Chr(34) + Chr(34) + ",MIN(I28:" + "I" + CStr(t) + "))"

    End If

' And transfer the related fibrous mass loading to the calculation sheet from the input sheet

    Range("Calc!E22").Value = Range("G11").Value

' Calculation routine

  ' Starting for t = 0 to Tmin seconds

    Range("Calc!D7").Value = Cs_A_1    'Set the initial CS flowrate
    Range("Calc!F7").Value = Rhr_A_1  'Set the initial RHR loop A flowrate
    Range("Calc!H7").Value = Rhr_B_1  'Set the initial RHR loop B flowrate

  ' Temporaily freeze the spreadsheet while writing data to it to speed-up processing

    With Application
        .Calculation = xlManual
        .MaxChange = 0.0001
    End With

  ' Perform the time specific calculations

    For t = Delta_T_1 To Int(Tmin / Delta_T_1) * Delta_T_1 Step Delta_T_1

        Expo = ((t / 60#) * (Range("Calc!D7").Value + Range("Calc!F7").Value + Range("Calc!H7").Value)) / Range("Calc!D40").Value

        For i = 0 To 5

            If Range("Calc!D47").Value > 0 Then

                Range("Calc!D" + CStr(49 + i)).Value = Range("Calc!D" + CStr(34 + i)).Value * Range("Calc!D47").Value * (1 - Exp(-Expo))

                Else: Range("Calc!D" + CStr(49 + i)).Value = 0

            End If

            If Range("Calc!F47").Value > 0 Then

                Range("Calc!F" + CStr(49 + i)).Value = Range("Calc!D" + CStr(34 + i)).Value * Range("Calc!F47").Value * (1 - Exp(-Expo))

                Else: Range("Calc!F" + CStr(49 + i)).Value = 0

            End If

            If Range("Calc!H47").Value > 0 Then

                Range("Calc!H" + CStr(49 + i)).Value = Range("Calc!D" + CStr(34 + i)).Value * Range("Calc!H47").Value * (1 - Exp(-Expo))

                Else: Range("Calc!H" + CStr(49 + i)).Value = 0
```

```
        End If

      Next i

' Unfreeze the spreadsheet

  With Application
      .Calculation = xlAutomatic
      .MaxChange = 0.0001
  End With

' Get the pool's projected temperature at this time slice

  Range("D18").Value = t
  Range("Calc!D9").Value = Range("D19").Value

  If t <= 10 Then

      Range("Calc!G37").Value = Range("Calc!D60").Value    'Store initial CS approach velocity
      Range("Calc!H37").Value = Range("Calc!F60").Value    'Store initial RHR approach velocity
      Range("Calc!I37").Value = Range("Calc!H60").Value    'Store initial RHR approach velocity

  End If

' CS Loop A;

  ' Skip if flowrate = 0

    If Range("Calc!D7").Value > 0# Then

  ' Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!D7").Value) / (Range("Calc!G10").Value * Range("Calc!D6").Value)

  ' Friction factor

    f = 0.01        'Initial guess for friction factor interation

   Do While Abs(f1 - f) > 0.000001

        f1 = f
        f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!D6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

    Loop

  ' Headloss (in feet)

    Head_csa = (0.00259 * (2.202 + (52.67 * f)) * Range("Calc!D7").Value ^ 2) / Range("Calc!D6").Value ^ 4
    Head_csa = Head_csa * bump

    End If

' RHR Loop A;

  ' Skip if flowrate = 0

    If Range("Calc!F7").Value > 0# Then

  ' Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!F7").Value) / (Range("Calc!G10").Value * Range("Calc!F6").Value)

  ' Friction factor

    f = 0.01        'Initial guess for friction factor interation

    Do While Abs(f1 - f) > 0.000001

        f1 = f
```

```
    f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!F6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

  Loop

' Headloss (in feet)

  Head_rhra = (0.00259 * (1.207 + (32.199 * f)) * Range("Calc!F7").Value ^ 2) / Range("Calc!F6").Value ^ 4
  Head_rhra = Head_rhra * bump

  End If

' RHR Loop B;

' Skip if flowrate = 0

  If Range("Calc!H7").Value > 0# Then

' Reynolds Number

  Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!H7").Value) / (Range("Calc!G10").Value * Range("Calc!H6").Value)

' Friction factor

  f = 0.01        'Initial guess for friction factor interation

  Do While Abs(f1 - f) > 0.000001

    f1 = f
    f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!H6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

  Loop

' Headloss (in feet)

  Head_rhrb = (0.00259 * (1.417 + (29.537 * f)) * Range("Calc!H7").Value ^ 2) / Range("Calc!H6").Value ^ 4
  Head_rhrb = Head_rhrb * bump

  End If

' Ready to do the final calculations, but since Case 5 calculates the minimum overpressure required for adequate NPSH,
' slightly different routines are needed

  If Range("B1").Value = 4 Then

' If Case 5, calculate the absolute pressure required for adequate NPSH h(abs) = - (h(static) - h(vapor pres) - h(fric) - h(NPSHr) - h(strainer))

    ' Calculate  h(static) - h(vapor pres) as it is common to all

    Margin = Range("Calc!D109").Value - (((Range("Calc!G12").Value) * 144#) / Range("Calc!G11").Value)

    ' Write time increment and  suppression pool temperature and pressure at that increment on spreadsheet

    Range("A" + CStr(27 + (t / Delta_T_1))).Value = t
    Range("B" + CStr(27 + (t / Delta_T_1))).Value = Range("D20").Value
    Range("C" + CStr(27 + (t / Delta_T_1))).Value = Range("D19").Value

    ' Begin calculating the absolute pressure required and write each result to the spreadsheet

    ' For CS loop A;

    If Range("Calc!D7").Value > 0# Then

      Margin_csa = Margin - Head_csa - Range("Calc!B107").Value - Range("Calc!D101").Value
      Range("E" + CStr(27 + (t / Delta_T_1))).Value = -(Margin_csa * Range("Calc!G11").Value) / 144#

    End If

    ' For RHR loop A;
```

```
        If Range("Calc!F7").Value > 0# Then

            Margin_rhra = Margin - Head_rhra - Range("Calc!D107").Value - Range("Calc!F101").Value
            Range("F" + CStr(27 + (t / Delta_T_1))).Value = -(Margin_rhra * Range("Calc!G11").Value) / 144#

        End If

      ' For RHR loop B;

        If Range("Calc!H7").Value > 0# Then

            Margin_rhrb = Margin - Head_rhrb - Range("Calc!E107").Value - Range("Calc!H101").Value
            Range("G" + CStr(27 + (t / Delta_T_1))).Value = -(Margin_rhrb * Range("Calc!G11").Value) / 144#

        End If

    Else

    ' If not Case 5, then calculate the NPSH margins (h(abs) + h(static) - h(vapor pres) - h(fric) - h(NPSHr) - h(strainer))

      ' Calculate  h(static) + h(abs) - h(vapor pres) as it is common to all

        Margin = Range("Calc!D109").Value + (((Range("D20").Value - Range("Calc!G12").Value) * 144#) / Range("Calc!G11").Value)

      ' Calculate the margins and write each result to the spreadsheet;

      ' First, write the time step

        Range("A" + CStr(27 + (t / Delta_T_1))).Value = t

      ' Then the margins

      ' For CS loop A;

        If Range("Calc!D7").Value > 0# Then

            Margin_csa = Margin - Head_csa - Range("Calc!B107").Value - Range("Calc!D101").Value
            Range("B" + CStr(27 + (t / Delta_T_1))).Value = (Margin_csa * Range("Calc!G11").Value) / 144#

        End If

      ' For RHR loop A;

        If Range("Calc!F7").Value > 0# Then

            Margin_rhra = Margin - Head_rhra - Range("Calc!D107").Value - Range("Calc!F101").Value
            Range("C" + CStr(27 + (t / Delta_T_1))).Value = (Margin_rhra * Range("Calc!G11").Value) / 144#

        End If

      ' For RHR loop B;

        If Range("Calc!H7").Value > 0# Then

            Margin_rhrb = Margin - Head_rhrb - Range("Calc!E107").Value - Range("Calc!H101").Value
            Range("D" + CStr(27 + (t / Delta_T_1))).Value = (Margin_rhrb * Range("Calc!G11").Value) / 144#

        End If

    End If

  Next t

  ' Skip if done (i.e., if termination time equals pump switch time (Tmax=Tmin))

  If Tmax = Tmin Then GoTo ii

  ' Finishing out
```

```
    Range("Calc!D7").Value = Cs_A_2          'Set the new CS flowrate
    Range("Calc!F7").Value = Rhr_A_2         'Set the new flowrate for RHR Loop A
    Range("Calc!H7").Value = Rhr_B_2         'Set the new flowrate for RHR Loop B

  ' Again temporaily freeze the spreadsheet while writing data to it to speed-up processing

    With Application
      .Calculation = xlManual
      .MaxChange = 0.0001
    End With

  ' Save the debris loadings that were previously calculated

    For i = 0 To 5

      Loading(i, 0) = Range("Calc!D" + CStr(49 + i)).Value
      Loading(i, 1) = Range("Calc!F" + CStr(49 + i)).Value
      Loading(i, 2) = Range("Calc!H" + CStr(49 + i)).Value

    Next i

  ' Calculate the amount of debris remaining available for strainer deposition

    For i = 0 To 5

    Debris(i) = Range("Calc!D" + CStr(34 + i)).Value - Range("Calc!D" + CStr(49 + i)).Value - Range("Calc!F" + CStr(49 + i)).Value
    Debris(i) = Debris(i) - Range("Calc!H" + CStr(49 + i)).Value

    Next i

  ' Perform the time specific calculations

    For t = Int(Tmin / Delta_T_1) * Delta_T_1 + 50 To Int(Tmax - 1) Step Delta_T_2

      Expo = (t / 60# * (Range("Calc!D7").Value + Range("Calc!F7").Value + Range("Calc!H7").Value)) / Range("Calc!D40").Value

      For i = 0 To 5

        If Range("Calc!D47").Value > 0 Then

          Range("Calc!D" + CStr(49 + i)).Value = (Debris(i) * Range("Calc!D47").Value * (1 - Exp(-Expo))) + Loading(i, 0)

        End If

        If Range("Calc!F47").Value > 0 Then

          Range("Calc!F" + CStr(49 + i)).Value = (Debris(i) * Range("Calc!F47").Value * (1 - Exp(-Expo))) + Loading(i, 1)

        End If

        If Range("Calc!H47").Value > 0 Then

          Range("Calc!H" + CStr(49 + i)).Value = (Debris(i) * Range("Calc!H47").Value * (1 - Exp(-Expo))) + Loading(i, 2)

        End If

      Next i

  ' Unfreeze the spreadsheet

    With Application
      .Calculation = xlAutomatic
      .MaxChange = 0.0001
    End With

  ' Get the pool's projected temperature at this time slice

    Range("D18").Value = t
    Range("Calc!D9").Value = Range("D19").Value
```

```
' CS Loop A;

  ' Skip if flowrate = 0

    If Range("Calc!D7").Value > 0# Then

  ' Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!D7").Value) / (Range("Calc!G10").Value * Range("Calc!D6").Value)

  ' Fiction factor

    f = 0.01          'Initial guess for friction factor interation

    Do While Abs(f1 - f) > 0.000001

      f1 = f
      f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!D6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

    Loop

  ' Hadloss (in feet)

    Head_csa = (0.00259 * (2.202 + (52.67 * f)) * Range("Calc!D7").Value ^ 2) / Range("Calc!D6").Value ^ 4
    Head_csa = Head_csa * bump

    End If

' RHR Loop A

  ' Skip if flow = 0

    If Range("Calc!F7") > 0# Then

  ' Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!F7").Value) / (Range("Calc!G10").Value * Range("Calc!F6").Value)

  ' Fiction factor

    f = 0.01          'Initial guess for friction factor interation

    Do While Abs(f1 - f) > 0.000001

      f1 = f
      f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!F6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

    Loop

  ' Headloss (in feet)

    Head_rhra = (0.00259 * (1.207 + (32.199 * f)) * Range("Calc!F7").Value ^ 2) / Range("Calc!F6").Value ^ 4
    Head_rhra = Head_rhra * bump

    End If

' RHR Loop B

  ' Skip if flow = 0

    If Range("Calc!H7") > 0# Then

  ' Reynolds Number for RHR

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!H7").Value) / (Range("Calc!G10").Value * Range("Calc!H6").Value)

  ' Friction factor
```

```
f = 0.01        'Initial guess for friction factor interation

Do While Abs(f1 - f) > 0.000001

  f1 = f
  f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!H6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

Loop

' Headloss (in feet)

Head_rhrb = (0.00259 * (1.417 + (29.537 * f)) * Range("Calc!H7").Value ^ 2) / Range("Calc!H6").Value ^ 4
Head_rhrb = Head_rhrb * bump

End If

' Ready again to do the final calculations, but since Case 5 calculates the minimum overpressure required for adequate NPSH,
' slightly different routines are needed

If Range("B1").Value = 4 Then

' If Case 5, calculate the absolute pressure required for adequate NPSH h(abs) = - (h(static) - h(vapor pres) - h(fric) - h(NPSHr) - h(strainer))

  ' Calculate  h(static) - h(vapor pres) as it is common to all

   Margin = Range("Calc!D109").Value - (((Range("Calc!G12").Value) * 144#) / Range("Calc!G11").Value)

  ' Write time increment and  suppression pool temperature and pressure at that increment on spreadsheet

   Range("A" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = t
   Range("B" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = Range("D20").Value
   Range("C" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = Range("D19").Value

  ' Begin calculating the absolute pressure required and write each result to the spreadsheet

  ' For CS loop A;

   If Range("Calc!D7").Value > 0# Then

     Margin_csa = Margin - Head_csa - Range("Calc!B107").Value - Range("Calc!D101").Value
     Range("E" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = -(Margin_csa * Range("Calc!G11").Value) / 144#

   End If

  ' For RHR loop A;

   If Range("Calc!F7").Value > 0# Then

     Margin_rhra = Margin - Head_rhra - Range("Calc!D107").Value - Range("Calc!F101").Value
     Range("F" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = -(Margin_rhra * Range("Calc!G11").Value) / 144#

   End If

  ' For RHR loop B;

   If Range("Calc!H7").Value > 0# Then

     Margin_rhrb = Margin - Head_rhrb - Range("Calc!E107").Value - Range("Calc!H101").Value
     Range("G" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = -(Margin_rhrb * Range("Calc!G11").Value) / 144#

   End If

 Else

' If not Case 5, then calculate the NPSH margins (h(abs) + h(static) - h(vapor pres) - h(fric) - h(NPSHr) - h(strainer))

  ' Calculate  h(static) + h(abs) - h(vapor pres) as it is common to all

   Margin = Range("Calc!D109").Value + (((Range("D20").Value - Range("Calc!G12").Value) * 144#) / Range("Calc!G11").Value)
```

```
        ' Calculate the margins and write each result to the spreadsheet

        ' First, write the time step

          Range("A" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = t

        ' Then the margins

        ' For CS loop A;

          If Range("Calc!D7") > 0# Then

            Margin_csa = Margin - Head_csa - Range("Calc!B107").Value - Range("Calc!D101").Value
            Range("B" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = (Margin_csa * Range("Calc!G11").Value) / 144#

          End If

        ' For RHR loop A;

          If Range("Calc!F7") > 0# Then

            Margin_rhra = Margin - Head_rhra - Range("Calc!D107").Value - Range("Calc!F101").Value
            Range("C" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = (Margin_rhra * Range("Calc!G11").Value) / 144#

          End If

        ' For RHR loop B;

          If Range("Calc!H7") > 0# Then

            Margin_rhrb = Margin - Head_rhrb - Range("Calc!E107").Value - Range("Calc!H101").Value
            Range("D" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = (Margin_rhrb * Range("Calc!G11").Value) / 144#

          End If

      End If

    Next t

ii:
' ************************************ Division II ********************************

  ' Starting for t = 0 to 600 seconds

    Range("Calc!D7").Value = Cs_B_1    'Set the initial CS flowrate
    Range("Calc!F7").Value = Rhr_C_1  'Set the initial RHR loop C flowrate
    Range("Calc!H7").Value = Rhr_D_1  'Set the initial RHR loop D flowrate

  ' Temporaily freeze the spreadsheet while writing data to it to speed-up processing

    With Application
        .Calculation = xlManual
        .MaxChange = 0.0001
    End With

  ' Perform the time specific calculations

    For t = Delta_T_1 To Int(Tmin / Delta_T_1) * Delta_T_1 Step Delta_T_1

        Expo = ((t / 60#) * (Range("Calc!D7").Value + Range("Calc!F7").Value + Range("Calc!H7").Value)) / Range("Calc!D40").Value

        For i = 0 To 5

          If Range("Calc!D47").Value > 0 Then

            Range("Calc!D" + CStr(49 + i)).Value = Range("Calc!D" + CStr(34 + i)).Value * Range("Calc!D47").Value * (1 - Exp(-Expo))

            Else: Range("Calc!D" + CStr(49 + i)).Value = 0
```

```
        End If

        If Range("Calc!F47").Value > 0 Then

          Range("Calc!F" + CStr(49 + i)).Value = Range("Calc!D" + CStr(34 + i)).Value * Range("Calc!F47").Value * (1 - Exp(-Expo))

          Else: Range("Calc!F" + CStr(49 + i)).Value = 0

        End If

        If Range("Calc!H47").Value > 0 Then

          Range("Calc!H" + CStr(49 + i)).Value = Range("Calc!D" + CStr(34 + i)).Value * Range("Calc!H47").Value * (1 - Exp(-Expo))

          Else: Range("Calc!H" + CStr(49 + i)).Value = 0

        End If

      Next i

' Unfreeze the spreadsheet

  With Application
      .Calculation = xlAutomatic
      .MaxChange = 0.0001
  End With

' Get the pool's projected temperature at this time slice

  Range("D18").Value = t
  Range("Calc!D9").Value = Range("D19").Value

  If t <= 10 Then

      Range("Calc!G37").Value = Range("Calc!D60").Value   'Store initial CS approach velocity
      Range("Calc!H37").Value = Range("Calc!F60").Value   'Store initial RHR approach velocity
      Range("Calc!I37").Value = Range("Calc!H60").Value   'Store initial RHR approach velocity

  End If

' CS Loop B;

  ' Skip if flowrate = 0

    If Range("Calc!D7").Value > 0# Then

  ' Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!D7").Value) / (Range("Calc!G10").Value * Range("Calc!D6").Value)

  ' Friction factor

  ' f = 0.01        'Initial guess for friction factor interation

    Do While Abs(f1 - f) > 0.000001

      f1 = f
      f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!D6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

    Loop

  ' Headloss (in feet)

    Head_csb = (0.00259 * (2.202 + (55.145 * f)) * Range("Calc!D7").Value ^ 2) / Range("Calc!D6").Value ^ 4
    Head_csb = Head_csb * bump

    End If
```

```
' RHR Loop C;

  ' Skip if flowrate = 0

    If Range("Calc!F7").Value > 0# Then

  ' Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!F7").Value) / (Range("Calc!G10").Value * Range("Calc!F6").Value)

  ' Friction factor

    f = 0.01          'Initial guess for friction factor interation

    Do While Abs(f1 - f) > 0.000001

      f1 = f
      f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!F6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

    Loop

  ' Headloss (in feet)

    Head_rhrc = (0.00259 * (1.417 + (29.615 * f)) * Range("Calc!F7").Value ^ 2) / Range("Calc!F6").Value ^ 4
    Head_rhrc = Head_rhrc * bump

    End If

' RHR Loop D;

  ' Skip if flowrate = 0

    If Range("Calc!H7").Value > 0# Then

  ' Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!H7").Value) / (Range("Calc!G10").Value * Range("Calc!H6").Value)

  ' Friction factor

    f = 0.01          'Initial guess for friction factor interation

    Do While Abs(f1 - f) > 0.000001

      f1 = f
      f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!H6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

    Loop

  ' Headloss (in feet)

    Head_rhrd = (0.00259 * (1.207 + (33.288 * f)) * Range("Calc!H7").Value ^ 2) / Range("Calc!H6").Value ^ 4
    Head_rhrd = Head_rhrd * bump

    End If

  ' Ready to do the final calculations, but since Case 5 calculates the minimum overpressure required for adequate NPSH,
  ' slightly different routines are needed

    If Range("B1").Value = 4 Then

  ' If Case 5, calculate the absolute pressure required for adequate NPSH h(abs) = - (h(static) - h(vapor pres) - h(fric) - h(NPSHr) - h(strainer))

      ' Calculate   h(static) - h(vapor pres) as it is common to all

        Margin = Range("Calc!D109").Value - (((Range("Calc!G12").Value) * 144#) / Range("Calc!G11").Value)

      ' Begin calculating the absolute pressure required and write each result to the spreadsheet
```

```
    ' For CS loop B;

      If Range("Calc!D7").Value > 0# Then

        Margin_csb = Margin - Head_csb - Range("Calc!B107").Value - Range("Calc!D101").Value
        Range("I" + CStr(27 + (t / Delta_T_1))).Value = -(Margin_csb * Range("Calc!G11").Value) / 144#

      End If

    ' For RHR loop C;

      If Range("Calc!F7").Value > 0# Then

        Margin_rhrc = Margin - Head_rhrc - Range("Calc!D107").Value - Range("Calc!F101").Value
        Range("J" + CStr(27 + (t / Delta_T_1))).Value = -(Margin_rhrc * Range("Calc!G11").Value) / 144#

      End If

    ' For RHR loop D;

      If Range("Calc!H7").Value > 0# Then

        Margin_rhrd = Margin - Head_rhrd - Range("Calc!E107").Value - Range("Calc!H101").Value
        Range("K" + CStr(27 + (t / Delta_T_1))).Value = -(Margin_rhrd * Range("Calc!G11").Value) / 144#

      End If

  Else

' If not Case 5, then calculate the NPSH margins (h(abs) + h(static) - h(vapor pres) - h(fric) - h(NPSHr) - h(strainer))

    ' Calculate  h(abs) + h(static) - h(vapor pres) as it is common to all

      Margin = Range("Calc!D109").Value + (((Range("D20").Value - Range("Calc!G12").Value) * 144#) / Range("Calc!G11").Value)

    ' Write time step to spreadsheet

      Range("F" + CStr(27 + (t / Delta_T_1))).Value = t

    ' Begin calculating the margins and write each result to the spreadsheet

  'For CS loop B;

      If Range("Calc!D7") > 0# Then

        Margin_csb = Margin - Head_csb - Range("Calc!C107").Value - Range("Calc!D101").Value
        Range("G" + CStr(27 + (t / Delta_T_1))).Value = (Margin_csb * Range("Calc!G11").Value) / 144#

      End If

  'For RHR loop C;

      If Range("Calc!F7") > 0# Then

        Margin_rhrc = Margin - Head_rhrc - Range("Calc!F107").Value - Range("Calc!F101").Value
        Range("H" + CStr(27 + (t / Delta_T_1))).Value = (Margin_rhrc * Range("Calc!G11").Value) / 144#

      End If

  'For RHR loop D;

      If Range("Calc!H7") > 0# Then

        Margin_rhrd = Margin - Head_rhrd - Range("Calc!G107").Value - Range("Calc!H101").Value
        Range("I" + CStr(27 + (t / Delta_T_1))).Value = (Margin_rhrd * Range("Calc!G11").Value) / 144#

      End If

  End If
```

```
  Next t

'  Test for illogical Tmax

  If Tmax <= Tmin Then End

'  Finishing out

  Range("Calc!D7").Value = Cs_B_2          'Set the new CS flowrate
  Range("Calc!F7").Value = Rhr_C_2         'Set the new flowrate for RHR Loop C
  Range("Calc!H7").Value = Rhr_D_2         'Set the new flowrate for RHR Loop D

'  Again temporaily freeze the spreadsheet while writing data to it to speed-up processing

  With Application
    .Calculation = xlManual
    .MaxChange = 0.0001
  End With

'  Save the debris loadings that were previously calculated

  For i = 0 To 5

    Loading(i, 0) = Range("Calc!D" + CStr(49 + i)).Value
    Loading(i, 1) = Range("Calc!F" + CStr(49 + i)).Value
    Loading(i, 2) = Range("Calc!H" + CStr(49 + i)).Value

  Next i

'  Calculate the amount of debris remaining available for strainer deposition

  For i = 0 To 5

  Debris(i) = Range("Calc!D" + CStr(34 + i)).Value - Range("Calc!D" + CStr(49 + i)).Value - Range("Calc!F" + CStr(49 + i)).Value
  Debris(i) = Debris(i) - Range("Calc!H" + CStr(49 + i)).Value

  Next i

'  Perform the time specific calculations

  For t = Int(Tmin / Delta_T_1) * Delta_T_1 + 50 To Int(Tmax - 1) Step Delta_T_2

    Expo = ((t / 60#) * (Range("Calc!D7").Value + Range("Calc!F7").Value + Range("Calc!H7").Value)) / Range("Calc!D40").Value

    For i = 0 To 5

      If Range("Calc!D47").Value > 0 Then

        Range("Calc!D" + CStr(49 + i)).Value = (Debris(i) * Range("Calc!D47").Value * (1 - Exp(-Expo))) + Loading(i, 0)

      End If

      If Range("Calc!F47").Value > 0 Then

        Range("Calc!F" + CStr(49 + i)).Value = (Debris(i) * Range("Calc!F47").Value * (1 - Exp(-Expo))) + Loading(i, 1)

      End If

      If Range("Calc!H47").Value > 0 Then

        Range("Calc!H" + CStr(49 + i)).Value = (Debris(i) * Range("Calc!H47").Value * (1 - Exp(-Expo))) + Loading(i, 2)

      End If

    Next i

'  Unfreeze the spreadsheet

  With Application
```

```
    .Calculation = xlAutomatic
    .MaxChange = 0.0001
  End With

'  Get the pool's projected temperature at this time slice

  Range("D18").Value = t
  Range("Calc!D9").Value = Range("D19").Value

'  CS Loop B;

  '  Skip if flowrate = 0

    If Range("Calc!D7").Value > 0# Then

  '  Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!D7").Value) / (Range("Calc!G10").Value * Range("Calc!D6").Value)

  '  Fiction factor

    f = 0.01        'Initial guess for friction factor interation

    Do While Abs(f1 - f) > 0.000001

      f1 = f
      f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!D6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

    Loop

  '  Hadloss (in feet)

    Head_csb = (0.00259 * (2.202 + (55.145 * f)) * Range("Calc!D7").Value ^ 2) / Range("Calc!D6").Value ^ 4
    Head_csb = Head_csb * bump

    End If

'  RHR Loop C

  '  Skip if flow = 0

    If Range("Calc!F7") > 0# Then

  '  Reynolds Number

    Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!F7").Value) / (Range("Calc!G10").Value * Range("Calc!F6").Value)

  '  Fiction factor

    f = 0.01        'Initial guess for friction factor interation

    Do While Abs(f1 - f) > 0.000001

      f1 = f
      f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!F6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

    Loop

  '  Headloss (in feet)

    Head_rhrc = (0.00259 * (1.417 + (29.615 * f)) * Range("Calc!F7").Value ^ 2) / Range("Calc!F6").Value ^ 4
    Head_rhrc = Head_rhrc * bump

    End If

'  RHR Loop D

  '  Skip if flow = 0
```

```
If Range("Calc!H7") > 0# Then

' Reynolds Number for RHR

Nre = (50.6 * Range("Calc!G11").Value * Range("Calc!H7").Value) / (Range("Calc!G10").Value * Range("Calc!H6").Value)

' Friction factor

f = 0.01        'Initial guess for friction factor interation

Do While Abs(f1 - f) > 0.000001

  f1 = f
  f = (Log(10) / (-2# * Log(((0.00015 * 12#) / (3.7 * Range("Calc!H6").Value)) + (2.51 / (Nre * f ^ 0.5))))) ^ 2

Loop

' Headloss (in feet)

Head_rhrd = (0.00259 * (1.207 + (33.288 * f)) * Range("Calc!H7").Value ^ 2) / Range("Calc!H6").Value ^ 4
Head_rhrd = Head_rhrd * bump

End If

' Ready again to do the final calculations, but since Case 5 calculates the minimum overpressure required for adequate NPSH,
' slightly different routines are needed

If Range("B1").Value = 4 Then

' If Case 5, calculate the absolute pressure required for adequate NPSH h(abs) = - (h(static) - h(vapor pres) - h(fric) - h(NPSHr) - h(strainer))

    ' Calculate  h(static) - h(vapor pres) as it is common to all

    Margin = Range("Calc!D109").Value - (((Range("Calc!G12").Value) * 144#) / Range("Calc!G11").Value)

    ' Begin calculating the absolute pressure required and write each result to the spreadsheet

    ' For CS loop B;

    If Range("Calc!D7").Value > 0# Then

      Margin_csb = Margin - Head_csb - Range("Calc!B107").Value - Range("Calc!D101").Value
      Range("I" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = -(Margin_csb * Range("Calc!G11").Value) / 144#

    End If

    ' For RHR loop C;

    If Range("Calc!F7").Value > 0# Then

      Margin_rhrc = Margin - Head_rhrc - Range("Calc!D107").Value - Range("Calc!F101").Value
      Range("J" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = -(Margin_rhrc * Range("Calc!G11").Value) / 144#

    End If

    ' For RHR loop D;

    If Range("Calc!H7").Value > 0# Then

      Margin_rhrd = Margin - Head_rhrd - Range("Calc!E107").Value - Range("Calc!H101").Value
      Range("K" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = -(Margin_rhrd * Range("Calc!G11").Value) / 144#

    End If

  Else

' If not Case 5, then calculate the NPSH margins (h(abs) + h(static) - h(vapor pres) - h(fric) - h(NPSHr) - h(strainer))

    ' Calculate  h(static) + h(abs) - h(vapor pres) as it is common to all
```

```
        Margin = Range("Calc!D109").Value + (((Range("D20").Value - Range("Calc!G12").Value) * 144#) / Range("Calc!G11").Value)

    ' Begin calculating the margins and write each result to the spreadsheet

        Range("F" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = t

    ' For CS loop B;

        If Range("Calc!D7") > 0# Then

            Margin_csb = Margin - Head_csb - Range("Calc!C107").Value - Range("Calc!D101").Value
            Range("G" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = (Margin_csb * Range("Calc!G11").Value) / 144#

        End If

    ' RHR Loop C;

        If Range("Calc!F7") > 0# Then

            Margin_rhrc = Margin - Head_rhrc - Range("Calc!F107").Value - Range("Calc!F101").Value
            Range("H" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = (Margin_rhrc * Range("Calc!G11").Value) / 144#

        End If

    ' RHR Loop D

        If Range("Calc!H7") > 0# Then

            Margin_rhrd = Margin - Head_rhrd - Range("Calc!G107").Value - Range("Calc!H101").Value
            Range("I" + CStr(28 + Int(Tmin / Delta_T_1) + ((t - Tmin - 50) / Delta_T_2))).Value = (Margin_rhrd * Range("Calc!G11").Value) / 144#

        End If

    End If

Next t

End Sub
```

All pages in Attachment I checked gr 6/15/01

Equation used in the Headloss Worksheet (refer to attached copy for cell references)

Starting with;

Cells D4, D5, D6, F4, F5, F6, H4, H5, & H6

Constants derived from the applicable strainer fabrication drawings; 105E2199 & 105E2200.

Cells D7, F7, & H7

Assumed flowrate. These values are inserted automatically by the macro to match the flow profile being analyzed.

Cell D9

Pool temperature obtained from the "Suppression Pool Temperature and Pressure Data as a Function of Time, " data. The spreadsheet determines the pool temperature at time = t by linear interpolation.

$$T = ((t - t1) * (T2 - T1))/(t2 - t1) + T1$$

where;

T	=	temperature @ time = t
t1	=	time period just less than time t shown on data sheet
t2	=	time period just greater than time t shown on data sheet
T1	=	Pool temperature shown on data sheet @ time = t1
T2	=	Pool temperature shown on data sheet @ time = t2

Cells D10 & G10

Viscosity of water obtained from the "Properties of Water," data. The spreadsheet again determines this value by linear interpolation.

$$\mu = ((T - T1) * (\mu 2 - \mu 1))/(T2 - T1) + \mu 1$$

where;

T	=	temperature @ time = t
$\mu 1$	=	Viscosity at a temperature just less than T shown on data sheet
$\mu 2$	=	Viscosity at a temperature just greater than T shown on data sheet
T1	=	Water temperature just less than T shown on data sheet
T2	=	Water temperature just greater than T shown on data sheet

Cells D11 & G11

Density of water obtained from the "Properties of Water," data. The spreadsheet again determines this value by linear interpolation.

$$\rho = ((T - T1) * (\rho 2 - \rho 1))/(T2 - T1) + \rho 1$$

where;

T	=	temperature @ time = t
$\rho 1$	=	Density at a temperature just less than T shown on data sheet
$\rho 2$	=	Density at a temperature just greater than T shown on data sheet
T1	=	Water temperature just less than T shown on data sheet
T2	=	Water temperature just greater than T shown on data sheet

Cell G12

Vapor pressure of water obtained from the "Properties of Water," data. The spreadsheet again determines this value by linear interpolation.

$$\lambda = ((T - T1) * (\lambda 2 - \lambda 1))/(T2 - T1) + \lambda 1$$

where;

T	=	temperature @ time = t
$\lambda 1$	=	Vapor pressure at a temperature just less than T shown on data sheet
$\lambda 2$	=	Vapor pressure at a temperature just greater than T shown on data sheet
T1	=	Water temperature just less than T shown on data sheet
T2	=	Water temperature just greater than T shown on data sheet

Cells D14, D15, D16, & D17

Constants obtained from URG Guide, Volume 2, Appendix E, for Nukon insulation.

Cell E19

Estimated amount of fibers in the suppression pool prior to the accident. All fibers are conservatively assumed to be available for deposition.

Cell E20

For conservatism, the amount of fibers entered in Cell E19 is increased by the margin entered in Cell C20

Cell E21

The equivalent mass of the fiber count in Cell E20 is estimated as follows;

Assuming that the mean fiber length is approximately 6 mm (0.23622 inches), reference NLS 950218, page 2, last paragraph (Copy Attached), the equivalent mass is conservatively based upon a fiber length of 0.5". Thus, the equivalent mass is found via;

Mass Equivalent = (Volume of One Fiber) * (Number of Fibers) * (Fiber Density)

Cell E22

The amount of Fibrous material available for strainer deposition (See Methodology for amount derivation) from Cell G11 of the respective input sheet. This transfer is done automatically by the macro.

Cell E24

Sum of Cells E21 & E22

Cells D28 & D29

Assumed strainer's surface area blockage in square inches. Note; this is based upon the strains actual surface area, not its flow area, which is approximately equal to 40% of its actual surface area.

Cells H28 & H29

Strainer's estimated flow area (ft^2).

Cells D31 & D32

Percent flow blockage based upon area blockage enter in Cells D28 & D29. The relationship used is;

Percent Blockage =((Area Blockage * 0.4) / Strainers Flow Area) * 100

Cells H31 & H32

Circumferential Correction factor based upon area blockage. This factor linearly prorates the strainer's circumferential area once the area blockage reduces the strainers flow area to the strainer's circumferential area or less. Blockages that does not reduce the strainer's flow area to that or less than its circumferential area is assumed to have a negligible effect upon the strainer's headloss.

If (Blockage Area * 0.4) > (Strainer's Flow Area - Strainer's Circumferential Area) then;

Correction Factor = 1 - ((((Blockage Area * 0.4) - (Strainer's Flow Area - Strainer's Circumferential area)) / Strainer's Circumferential Area)

Else

Correction Factor = 1

Cells D34 through D39

Constants obtained from NEDC 97-042.

Cells G37, H37, & I37

Initial strainer approach velocity. This value is written by the macro after the first pass, with the

spreadsheet using this value to calculate the factor, f2 for all subsequent calculations. This conservatively accounts for a fibrous bed's hysteresis, which is generally observed whenever flow is subsequently reduced after a fibrous bed has been allowed to form.

Cell D40

Constant equal to the suppression pool's volume at low water level ~~(Ref. NEDC 98-042).~~ Note; this constant little effect upon the overall NPSH margin.

Cells D45, F45, & H45

The circumscribed, not actual, filter area.

$A_c = \pi * D * L$ (Ref. URG, Volume 2, page A-2)

Where;

π = 3.1416
D = Strainer outside diameter (feet)
L = Strainers length (feet)

Cells D46, F46 & H46

The resultant of the values in Cells D45, F45, & H45 being multiplied by the applicable correction factor given in Cell H31 or H32.

Cell D47, F47, & H47

Strainer's loading factor which is simply the portion of the total ECCS flow passing through it.

$LF = Q/Q_{total}$

Where;

Q = Flowrate though subject strainer (gpm) @ time = t
Q_{total} = Total ECCS flowrate (gpm) @ time = t

Cells D49, F49, & H49

Amount of fibrous material trapped on a strainer as a function of time as calculated by the macro.

$Fraction = 1 - e^{-\sigma t}$ (Equation 1 of this calculation)

And multiplying the fraction by the amount of fibrous material that could be trapped on the strainer;

$M_f' = M_f * LF * Fraction$

$= M_f * LF * (1 - e^{((-t * Qtot)/655,668)})$

Where;

$\varnothing$ = Filtering time constant (minutes^{-1})
= Total flowrate (gpm) / Volume of suppression pool (gallons)
(Suppression pool's water volume at minimum level is approximately 655,668 gallons - Ref. NEDC 98-042)
t = Time (minutes)
Qtot = Total ECCS flowrate (gpm) @ time = t
LF = Strainer's loading factor
M_f = Total mass of fibrous material in suppression pool (Lbm)

Cells D50, F50, & H50

Amount of sludge trapped in the strainer's growing fibrous bed as a function of time as calculated by the macro. Again using;

Fraction = $1 - e^{-\varnothing t}$ (Equation 1 of this calculation)

And multiplying the fraction by the amount of sludge that could be trapped on the strainer;

$M_s' = M_s * LF * \text{Fraction}$

$= M_s * LF * (1 - e^{((-t * Qtot)/655,668)})$

Where;

$\varnothing$ = Filtering time constant (minutes^{-1})
= Total flowrate (gpm) / Volume of suppression pool (gallons)
(Suppression pool's water volume at minimum level is approximately 655,668 gallons - Ref. NEDC 98-042))
t = Time (minutes)
Qtot = Total ECCS flowrate (gpm) @ time = t
LF = Strainer's loading factor
M_s = Total mass of sludge in suppression pool (Lbm)

Cells D51, F51, & H51

Amount of dirt/dust trapped in the strainer's growing fibrous bed as a function of time as calculated by the macro. Again using;

Fraction = $1 - e^{-\varnothing t}$ (Equation 1 of this calculation)

And multiplying the fraction by the amount of dirt/dust that could be trapped on the strainer;

$M_d' = M_d * LF * \text{Fraction}$

$= M_d * LF * (1 - e^{((-t * Qtot)/655,668)})$

Where;

$\varnothing$ = Filtering time constant (minutes^{-1})
= Total flowrate (gpm) / Volume of suppression pool (gallons)
(Suppression pool's water volume at minimum level is approximately 655,668 gallons - Ref. NEDC 98-042))

t = Time (minutes)
Qtot = Total ECCS flowrate (gpm) @ time = t
LF = Strainer's loading factor
M_d = Total mass of dirt/dust in suppression pool (Lbm)

Cells D52, F52, & H52

Amount of paint chips trapped in the strainer's growing fibrous bed as a function of time as calculated by the macro. Again using;

Fraction = $1 - e^{-\varnothing t}$ (Equation 1 of this calculation)

And multiplying the fraction by the amount of paint chips that could be trapped on the strainer;

$M_p' = M_p * LF * \text{Fraction}$

$= M_p * LF * (1 - e^{((-t * Qtot)/655,668)})$

Where;

$\varnothing$ = Filtering time constant (minutes^{-1})
= Total flowrate (gpm) / Volume of suppression pool (gallons)
(Suppression pool's water volume at minimum level is approximately 655,668 gallons - Ref. NEDC 98-042))
t = Time (minutes)
Qtot = Total ECCS flowrate (gpm) @ time = t
LF = Strainer's loading factor
M_p = Total mass of paint chips in suppression pool (Lbm)

Cells D53, F53, & H53

Amount of rust trapped in the strainer's growing fibrous bed as a function of time as calculated by the macro. Again using;

Fraction = $1 - e^{-\varnothing t}$ (Equation 1 of this calculation)

And multiplying the fraction by the amount of rust that could be trapped on the strainer;

$M_r' = M_r * LF * \text{Fraction}$

$= M_r * LF * (1 - e^{((-t * Qtot)/655,668)})$

Where;

$\varnothing$ = Filtering time constant (minutes^{-1})
= Total flowrate (gpm) / Volume of suppression pool (gallons)
(Suppression pool's water volume at minimum level is approximately 655,668 gallons - Ref. NEDC 98-042))
t = Time (minutes)
Qtot = Total ECCS flowrate (gpm) @ time = t
LF = Strainer's loading factor
M_r = Total mass of rust in suppression pool (Lbm)

Cells D54, F54, & H54

Amount of calcium silicate trapped in the strainer's growing fibrous bed as a function of time as calculated by the macro. Therefore, again using;

Fraction = $1 - e^{-\varnothing t}$ (Equation 1 of this calculation)

And multiplying the fraction by the amount of calcium silicate that could be trapped on the strainer;

$M_{cs}' = M_{cs} * LF * \text{Fraction}$

$= M_{cs} * LF * (1 - e^{((-t * Qtot)/655,668)})$

Where;

$\varnothing$ = Filtering time constant (minutes^{-1})
= Total flowrate (gpm) / Volume of suppression pool (gallons)
(Suppression pool's water volume at minimum level is approximately 655,668 gallons - Ref. NEDC 98-042))
t = Time (minutes)
Qtot = Total ECCS flowrate (gpm) @ time = t
LF = Strainer's loading factor
M_{cs} = Total mass of calcium silicate in suppression pool (Lbm)

Cells D56, F56, & H56

Total mass of the corrosion products. Per URG, corrosion products forms the sludge typically found in the suppression pool.

$M_c' = M_s'$

Where;

M_s' = Mass of sludge trapped on strainer @ time = t

Cells D58, F58, & H58

Ratio of the mass of corrosion to fibrous products trapped on a strainer @ time = t.

$\phi = M_c'/M_f'$ (Reference URG, Volume 2, page A-3)

Where;

M_c' = Mass of corrosion products trapped on strainer @ time = t
M_f' = Mass of fiber trapped on strainer @ time = t

Cells D60, F60, & H60

Strainer's approach velocity.

$V = Q / A_c$ (Reference URG, Volume 2, page A-2)

$= Q / (448.83125 * A_c (ft^2))$ (Note; URG rounded off the conversion factor to 450)

Where;

Q = Flowrate through strainer @ time = t (gpm)
A_c = Strainer's circumscribed area (ft^2)

Cells D62, F62, & H62

Reynolds Number based upon the strainer's inter-fiber spacing.

$Nre = (\rho * V * d) / \mu$ (Reference URG, Volume 2, page A-3)

Where;

ρ = Density of Water ($Slugs/ft^3$) @ time = t
V = Strainer approach velocity (ft/sec) @ time = t
d = Strainer's inter-fiber spacing (ft)
μ = Viscosity of water ($lb\text{-}sec/ft^2$) @ time = t

Cells D64, F64, & H64

Fiber bed thickness on strainer at time = t.

$thk = V_f / A_c$ (Reference URG, Volume 2, page A-4)

$= M_f' / (\xi * A_c)$

Where;

V_f = Volume of fiber (ft^3) on strainer @ time = t
M_f' = Mass of fiber (Lbm) on strainer
ξ = Density of fiber (Lbm/ft^3)

Cells C71, E71, G71, C72, E72, G72, C73, E73, G73, C74, E74, & G74

These cells only echo the data in cells D52, F52, H52, D53, F53, H53, D51, F51, H51, D54, F54, & H54, respectively.

Cells C74, E74, G74, C75, E75, & G75

These cells have been zeroed out because no sand or Zinc filler has ever been discovered in CNS suppression pool.

Cells D71 through D76, F71 through F76, & H71 through H76

Calculate the ratio of paint chips, rust flakes, cement dust, sand, zinc filler, and calcium silicate to the strainer's fibrous loading at time = t.

ϕ_x = M_x'/M_f' (Reference URG, Volume 2, page A-4)

Where;

M_x' = Mass of a given product trapped on strainer @ time = t
M_f' = Mass of fiber trapped on strainer @ time = t

And let;

ϕ_{pc} = Mass ratio of paint chips to fiber @ time = t
ϕ_{rf} = Mass ratio of rust flakes to fiber @ time = t
ϕ_{cd} = Mass ratio of cement dust to fiber @ time = t
ϕ_{sand} = Mass ratio of sand to fiber @ time = t
ϕ_{zinc} = Mass ratio of zinc filler to fiber @ time = t
ϕ_{cs} = Mass ratio of calcium silicate to fiber @ time = t

Cells D79, F79, & H79

Bump factor (non-dimensional). Note; spreadsheet automatically limits M_c'/M_f' ratio to 4 in accordance with URG recommendations.

$$K_{bu} = ((16.5 * (1 + (0.41*\phi) + (0.30*\phi_{pc}) + (0.19*\phi_{rf}) + (0.13*\phi_{sand}) + (0.31*\phi_{cd}) + (0.20*\phi_{zinc}) + (6.12*\phi_{cs}))) + (V * (18.6 * (1 + (0.39*\phi) + (0.77*\phi_{pc}) + (0.27*\phi_{rf}) + (0.15*\phi_{sand}) + (1.20*\phi_{cd}) + (0.33*\phi_{zinc}) + (13.96*\phi_{cs}))))) / ((16.5 * (1 + (0.41*\phi))) + (V*18.6 * (1 + (0.39*\phi)))))$$

(Ref. URG, Vol. 2, page A-4)

Where;

ϕ = Mass ratio of corrosion products to fiber @ time = t
ϕ_{pc} = Mass ratio of paint chips to fiber @ time = t
ϕ_{rf} = Mass ratio of rust flakes to fiber @ time = t
ϕ_{sand} = Mass ratio of sand to fiber @ time = t
ϕ_{cd} = Mass ratio of cement dust to fiber @ time = t
ϕ_{zinc} = Mass ratio of zinc filler to fiber @ time = t
ϕ_{cs} = Mass ratio of calcium silicate to fiber @ time = t
V = Strainer approach velocity (ft/sec) @ time = t

Cells D84, F84, & H84

Fibrous bed thickness to strainer's diameter ratio.

α = Thk / D (Ref. NEDC-32721P, Rev. 1, Section 3)

Where;

Thk = Thickness of strainer's fibrous bed (ft) @ time = t
D = Strainer's circumscribed outside dia (ft)

Cells D85, F85, & H85

Reynold's number based upon an approach velocity that considers the cylindrical area plus the front and back perforated areas and fiber diameter.

$Nre' = (\rho * V' * d') / \mu$

as $V' = Q / ((\pi * D * L) + ((\pi *((2*D^2) - D_O^2 - D_L^2)) / 4))$ (NEDC-32721P, Rev. 1, page 3-6)

$Nre' = (\rho * Q * d') / (9.79198 * \mu * ((D * L) + (((2*D^2) - D_O^2 - D_L^2) / 4)))$

Where;

- Q = The strainer's flowrate (gpm)
- ρ = Suppression pool water density @ time = t (Lbm/ft^3)
- d = Mean fiber diameter (ft)
- D = The strainer's cylindrical outside diameter (in).
- L = The strainer's active length (in).
- D_L = Diameter of the suction side boss (in)
- D_o = Diameter of the non-perforated area of the strainer's top (in)

The constant 9.79198 is a units conversion factor that also contains the constant PI (π).

Unfortunately, the variables D_o & D_L cannot be obtained from any drawings for either the CS or RHR strainers. Nevertheless, they can be estimated with reasonable accuracy by scaling off the drawings. Therefore, using the RHR strainer drawing, 105E2200, the diameter of the lifting lug's support plate is approximately 9", and the suction side boss is about 20", giving;

$D_o \approx 9.5"$
$D_L \approx 19.25" \approx$ Inlet Diameter (D_{in})

Reducing the equation to;

$$Nre' = (\rho * Q * d') / (9.79198 * \mu * ((D * L) + (((2*D^2) - 9.5^2 - D_{in}^2) / 4)))$$

The parameters result in a Reynolds Number equal to that previously calculated by General Electric in NEDC 97-044, Rev. O. Therefore, they have been validated.

Similarly, using the CS strainer drawing, 105E2199, the diameter of the lifting lug's support plate is approximately 9", and the suction side boss is about 20", giving;

$D_o \approx 9.5"$
$D_L \approx 15.25" \approx$ Inlet Diameter (D_{in})

Reducing the equation to the same as for RHR.

Cells D86, F86, & H86

Reynolds number factor.

$f_1 = 1 + (0.07 * Nre')$ (Ref. NEDC-32721P, Rev. 1, page 3-6)

Where;

Nre' = Reynolds number based upon an approach velocity that considers the cylindrical area plus the front and back perforated areas and inter-fiber spacing.

Cells D87, F87, & H87

Fiber bed compression factor based upon the strainer's initial approach velocity as recorded in Cells G18, H18, & I18. The initial approach velocity was used even though the actual velocity drops later as the result of manually induced flow reductions to conservatively account for a fibrous bed's hysteresis effect.

$f_2 = 0.2197 + ((0.23 * \mu * V) / (\rho * 32.174 * d^2))$ (Ref. NEDC-32721P, Rev. 1, page 3-10)

Where;

V = Strainer approach velocity (ft/sec) @ time = 10 sec (held artificially constant to this value)
d = Strainer's inter-fiber spacing (ft)
μ = Viscosity of water (lb-sec/ft^2) @ time = t
ρ = Density of Water (Slugs/ft^3) @ time = t

Note; f_2 cannot exceed 1.0 per NEDC-32721P, Rev. 1, page 3-10. Therefore, a limit has also been inserted in the spreadsheet to meet this requirement.

Cells D88, F88, & H88

Loading factor.

$f_3 = 1 + (0.15 * M_c'/M_f')$ (Ref. NEDC-32721P, Rev. 1, page 3-15)

Where;

M_c' = Mass of corrosion products trapped on strainer @ time = t
M_f' = Mass of fiber trapped on strainer @ time = t

Cells D89, F89, & H89

Shape factor.

$f_4 = 0.1558 + (6.525 *(Thk / D))$ $Thk/D < 0.27$

$f_4 = 2.0157 - (6.525 *(Thk / D))$ $0.27 < Thk/D < 1.8$

(Ref. NEDC-32721P, Rev. 1, page 3-14)

Where;

Thk = Thickness of strainer's fibrous bed (ft) @ time = t
D = Strainer's circumscribed outside dia (ft)

Cells D91, F91, & H91

Non-dimensional strainer headloss factor.

$K_h' = f_1 * f_2 * f_3 * f_4 * CF$ (Ref. NEDC-32721P, Rev. 1, page 3-4)

Where;

f_1 = Reynold's number factor.
f_2 = Fiber bed compression factor.
f_3 = Loading factor.
f_4 = Shape factor.
CF = Correction factor. GE recommends 0.8. For conservatism, this evaluation assumes CF = 1

Cells D93, F93, & H93

Fibrous headloss.

$\Delta h' = K_h' * ((\mu * V * Thk) / (\rho * 32.174 * d^2))$ (Ref. NEDC-32721P, Rev. 1, page 3-10)

Where;

V = Strainer approach velocity (ft/sec) @ time = t
Thk = Thickness of strainer's fibrous bed (ft)
d = Strainer's inter-fiber spacing (ft)
μ = Viscosity of water (lb-sec/ft^2) @ time = t
ρ = Density of Water (Slugs/ft^3) @ time = t
K_h' = Non-dimensional strainer headloss factor.

Cells D95, F95, & H95

Corrected fibrous headloss.

$\Delta h_{tot}' = K_{bu} * \Delta h'$

Where;

$\Delta h'$ = Strainer's fibrous headloss (ft) @ time = t
K_{bu} = Bump-up factor @ time = t

Cells D99, F99, & H99

Clean strainer headloss.

$\Delta h_{tot}' = 2.2403 * (V_{suc}^2 / (2 * 32.174)$ (Ref. NEDC-32721P, Rev. 1, page 3-21)

Where;

$\Delta h_{clean}'$ = Clean Strainer's (ft) @ time = t
V_{suc} = Suction line fluid velocity @ time = t

Suction line velocity is based upon a 24" strainer for RHR, and a 16" ID strainer for CS. As this doesn't exactly match the strainer ID's used, the transitional flange losses must be added in. Accordingly, per Crane Technical Paper #401, the head loss for a sudden contraction based upon the small diameter is

$$\Delta h_{cont} = (0.00259 * (0.5 * (1-(D_{flange}/D_{std})^2)) * Q^2) / (D_{flange})^4$$

And recognizing that V_{suc} is equal to;

$$V_{suc} = (Q * 4 * 144) / (\pi * (D_{std})^2 * 60 * 7.48052)$$

Gives a final clean strainer headloss statement of;

$$\Delta h_{tot}' = (2.2403 * (((Q * 4 * 144) / (\pi * (D_{std})^2 * 60 * 7.48052))^2 / (2 * 32.174)) + ((0.00259 * (0.5 * (1-(D_{flange}/D_{std})^2)) * Q^2) / (D_{flange})^4)$$

Where;

D_{flange} = Flange's ID (inches)
D_{std} = Standard ID assumed by GE (24" for RHR, 16" for CS)
Q = Flowrate (gal/min)

Finally, to account for strainer area blockage, the clean strainer headloss will be corrected by the inverse square of the percent remaining flow area. This relationship is based upon the generic flow relationship that states headloss is proportional to the square of the flow velocity. Since flow velocity is proportional to flow area for a constant flowrate, the headloss will be proportional to the square of the flow area. Thus, the clean headloss statement will be corrected as follows;

$$\Delta h_{tot}' = (2.2403 * (((Q * 4 * 144) / (\pi * (D_{std})^2 * 60 * 7.48052))^2 / (2 * 32.174)) * (1 / (1 - (\%\ \text{Flow Area Blockage} / 100)))^2 + ((0.00259 * (0.5 * (1-(D_{flange}/D_{std})^2)) * Q^2) / (D_{flange})^4)$$

Note, the correct is only applied to the losses associated with the strainer, and not those associated with the sudden contraction.

Cells D101, F101, & H101

Total headloss

$\Delta h(GE) = \Delta h(\text{fibrous}) + \Delta h(\text{clean strainer})$

Cells D107, D108, & B114 through G114

Interpolation routines similar to those used earlier but to calculate either the pool temperature, the suppression chamber's absolute pressure, or the NPSH required by a pump using the data collected from the manufacturers' certified pump curves.

Cell D109

The suppression pool low water level assumed in this evaluation (LWL = 12.5833' Ref. NEDC 98-042).

Input Sheets (common to all) - Case 1 used as an example.

Cell B1

Macro uses this cell to determine which case is being considered.

Cells C6, C7, C8, C9, C12, C13, C14, D7, D8, D9, D12, D13, D14, & G6

Inputs provided by user. Note number in Cell G6 must not exceed the data range for the case being calculated or the macro will terminate and return an error message.

Cell D6

Echos contents of Cell C6.

Cell D18

The macro writes the current time step here and Cells D19 and D20 perform an interpolation for this temperture using the data on Attachment G to get the pool temperature and Wetwell pressure at this time slice. This information is then picked up by the macro and used in its various calculations. Note; these interpolations are all keyed into the data range associated with the case being considered, so they are Case specific.

Cell G11

The amount of fibrous material to be used in the calculations.

Cell H21

The macro records the wetwell pressure here @ T = 0, and later uses this information to calculate the overpressure curves.

	A	B	C	D	E	F	G	H	I
1	**Case ->**	**1**							
2									
3				***Run profiles Used***					
4									
5			*T<=*	*T>*					
6	***Division I***		600	600	*Terminating at ->*		1,000,000	*Seconds*	
7	*CS pump A ->*		6,525	4,750	*Gpm*				
8	*RHR pump A ->*		9,240	7,700	*Gpm*				
9	*RHR pump B ->*		0	0	*Gpm*				
10						*Amount of Fibrous Material*			
11	***Division II***						75.3	*Lbm*	
12	*CS pump B ->*		6,525	4,750	*Gpm*				
13	*RHR pump C ->*		0	0	*Gpm*				
14	*RHR pump D ->*		9,240	7,700	*Gpm*				
15									
16	***Interpolation routine using Suppression Pool temperature/pressure data in 97044G.xls***								
17									
18	*time (sec) ->*			999,900					
19	*Pool Temp (°F) ->*			147.5					
20	*Chamber Pressure (psia) ->*			14.7	*(Constant La =5%/day assumed)*				
21					*Base pressure used ->*			14.7	*psia*
22									

	A	B	C	D	E	F	G	H	I
1				***HEAD LOSS WORKSHEET***					
2	***INPUTS***								
3				***CS Pump***		***RHR Pump A/C***		***RHR Pump B/D***	
4	*Strainer Diameter ->*			36	*in*	44	*in*	44	*in*
5	*Strainer Active Length ->*			44.7	*in*	56	*in*	56	*in*
6	*Strainer Outlet Dia ->*			15.25	*in*	19.25	*in*	19.25	*in*
7	*Flowrate ->*			4,750	*gpm*	0	*gpm*	7,700	*gpm*
8									
9	*Water Temperature ->*			147.500	*°F*				
10			*mu ->*	9.27E-06	*lb-s/ft^2*	or	0.4475	*Centipoise*	
11			*Rho ->*	1.9035	*slugs/ft^3*	or	61.2352	*lb/ft^3*	
12					*Vapor Pressure ->*		3.5111	*psia*	
13									
14	*Inter-fiber spacing (Nukon) ->*			1.56E-04	*ft*	*(URG Guide, Volume 1)*			
15	*Fiber Diameter (Nukon) ->*			2.33E-05	*ft*				
16	*Insulation density (Nukon) ->*			2.4	*Lbm/ft^3*				
17	*Fiber Density (Nukon) ->*			180	*Lbm/ft^3*				
18									
19	*Est. Number of Fibers in Pool @ t = 0 ->*				1.2E+07	*Fibers*	*(Ref. NLS 950218)*		
20	*Increased by ->*		*100*	*%*	2.4E+07	*Fibers*			
21	*Equivalent Mass of these fibers ->*				0.077	*Lbs*			
22	*Mass of Fibrous Material in Pool ->*				75.3	*Lbm*	*(See Methodology for derivation)*		
23									
24				Total	75.4	*Lbs*			
25									
26				***Strainer Area Blockage Prior to Accident***					
27									
28			*CS ->*	1,674	*in^2*		*CS ->*	93	*ft^2*
29			*RHR ->*	1,674	*in^2*		*RHR ->*	160	*ft^2*
30	*Percent Flow Blockage @ t = 0*								
31			*CS ->*	5.00	*%*	*Correction Factor ->*		1.000	
32			*RHR ->*	2.91	*%*			1.000	
33									
34	*Mass of Fibrous Material ->*			75.4	*Lbs*				
35	*Mass of Sludge ->*			1200	*Lbs*				
36	*Mass of Dirt/Dust ->*			150	*Lbs*	*Strainer Approach Velocity @ t = 0*			
37	*Mass of Paint Chips ->*			500	*Lbs*		*0.4141*	*0.0000*	*0.3830*
38	*Mass of Rust ->*			50	*Lbs*				
39	*Mass of Calcium Silicated ->*			20	*Lbs*				
40	*Suppression Pool Volume ->*			655,668	*gallons*				
41									
42				***CALCULATED VALUES***					
43									
44				*CS Pump*		*RHR Pump A/C*		*RHR Pump B/D*	
45	*Circumscribed Filter Area ->*			35.11	*ft^2*	53.76	*ft^2*	53.76	*ft^2*
46	*Area Corrected for Blockage ->*			35.11	*ft^2*	53.76	*ft^2*	53.76	*ft^2*
47	*Load Factor ->*			0.38		0.00		0.62	
48									
49	*Fibrous Material Trapped ->*			29.28	*Lbs*	0.00	*Lbs*	46.10	*Lbs*
50	*Sludge Trapped ->*			466.13	*Lbs*	0.00	*Lbs*	733.87	*Lbs*
51	*Dirt/Dust Trapped ->*			58.27	*Lbs*	0.00	*Lbs*	91.73	*Lbs*
52	*Paint Chips Trapped ->*			194.22	*Lbs*	0.00	*Lbs*	305.78	*Lbs*
53	*Rust Trapped ->*			19.42	*Lbs*	0.00	*Lbs*	30.58	*Lbs*
54	*Calcium Silicate Trapped ->*			7.77	*Lbs*	0.00	*Lbs*	12.23	*Lbs*

	A	B	C	D	E	F	G	H	I
55									
56	*Total Corrosion Products ->*			466.13	*Lbs*	0.00	*Lbs*	733.87	*Lbs*
57									
58	*Corrosion/fiber prod ratio (Mc/Mf)*			15.92		0.00		15.92	
59									
60	*Strainer Approach Velocity ->*			0.30	*ft/s*	0.00	*ft/s*	0.32	*ft/s*
61									
62	*Reynolds Number ->*			9.65		0.00		10.22	
63									
64	*Fibrous Mat'l Bed Thickness ->*			0.35	*ft*	0.00	*ft*	0.36	*ft*
65									
66	***Bump Factor Determination***								
67									
68	*Component Ratio Determination*								
69									
70	*item*		*Mass (Mx)*	*(Mx/Mf)*	*Mass (Mx)*	*(Mx/Mf)*	*Mass (Mx)*	*(Mx/Mf)*	
71	*Paint Chips ->*		194.22	6.63	0.00	0.00	305.78	6.63	
72	*Rust Flakes ->*		19.42	0.66	0.00	0.00	30.58	0.66	
73	*Sand ->*		0.00	0.00	0.00	0.00	0.00	0.00	
74	*Dirt/Dust ->*		58.27	1.99	0.00	0.00	91.73	1.99	
75	*Zinc Filler ->*		0.00	0.00	0.00	0.00	0.00	0.00	
76	*Calcium Silicate ->*		7.77	0.27	0.00	0.00	12.23	0.27	
77									
78				*CS Pump*		*RHR Pump A/C*		*RHR Pump B/D*	
79	*Bump up factor ->*			3.34		1.00		3.37	
80									
81	***Head Loss Determination***								
82									
83				*CS Pump*		*RHR Pump A/C*		*RHR Pump B/D*	
84	*t/D ->*			0.116		0.000		0.097	
85	*Reynolds Number (df) ->*			1.066		0.000		1.134	
86	*f1 ->*			1.075		1.000		1.079	
87	*f2 ->*			0.812		0.220		0.768	
88	*f3 ->*			3.388		1.000		3.388	
89	*f4 ->*			0.912		0.156		0.792	
90									
91	*K(h) = f1*f2*f3*f4 ->*			2.696		0.034		2.223	
92									
93	*fibrous headloss ->*			1.76	*ft*	0.00	*ft*	1.58	*ft*
94									
95	*Corrected fibrous headloss ->*			5.87	*ft*	0.00	*ft*	5.32	*ft*
96									
97	***Summary***								
98									
99	*Clean Headloss ->*			2.27	*ft*	0.00	*ft*	1.30	*ft*
100									
101	*Total Headloss ->*			8.14	*ft*	0.00	*ft*	6.62	*ft*
102									
103	***Interpolation routine using Pump NPSHr data on 97044F.xls based upon flowrate***								
104									
105		*Core Spray*		*RHR*					
106		*Pump A*	*Pump B*	*Pump A*	*Pump B*	*Pump C*	*Pump D*		
107	*NPSHr ->*	16.85	16.85	22.60	24.55	24.00	24.55		
108									

	A	B	C	D	E	F	G	H	I
109	*Assumed Static head ->*			12.58	*feet (applicable to both RHR & CS)*				
110									
111									
112									

Arw 4/6/99

Iso: 2603-1

CS LOOP A

#	Description	Dia.	Lg.	Elev.	Eqn.	Kcorr.	K_{fit}	K_{pipe}
1	STRAINER (4.04' @ 6135 GPM)	15.25"						
2	STD TO S/80 SUD. CONT	15.25 / 14.312			1	1	0.07685	
3	1.5' OF S/80 PIPE	14.312	1.5000'		2	1.28907		1.62125
4	S/80 TO STD SUD EXP	14.312 / 15.25			3	"	0.01833	
5	1.9975' OF STD PIPE		1.9975'		2	1		1.5718
6	90° DW ELBOW				4		0.182	
7	4' OF STD PIPE		4.0000'		2			3.14754
8	90° DW ELBOW				4		0.182	
9	4.5417' OF STD PIPE		4.5417'		2			3.5738
10	90° DW ELBOW				4		0.182	
11	22.5833' OF STD PIPE		22.5833'		2			17.77047
12	90° DW ELBOW				4		0.182	
13	18.7083' OF STD PIPE		18.7083'		2			14.72129
14	16"x14" RED ELBOW	15.25 / 13.25			5		0.32849	
15	1.8958' OF STD PIPE	13.250	1.8958'		2	1.75475		3.01282
16	VALVE (Cv = 12,925)				6		0.28847	
17	1.4583' OF STD PIPE		1.4583'		2			2.31754
18	VALVE (Cv = 12,925)				6		0.28847	
19	2.1458' OF STD PIPE		2.1458'		2			3.41013

AHW
4/6/99

Iso: 2603-1

#	Description	Dia.	Lg.	Elev.	Eqn.	Kcorr.	K_{fit}	K_{pipe}
20	TEE (RUN FLOW)	↓			7	↓	0.45624	
21	0.9583' OF STD PIPE	↓	0.9583'		2	↓		1.52294
22	STD TO S/40 SWD CONT	13.124"			8	↓	0.01725	
							2.202 +	52.67(f)

AMW 4/6/99

Iso: 2603-2

CS LOOP D

#	Description	Dia.	Lg.	Elev.	Eqn.	Kcorr.	K_{fit}	K_{pipe}
1	STRAINER (4.04' @ 6135 GPM)	15.25"						
2	STD TO S/80 SUD CONT	15.25 / 14.312			1		0.07685	
3	1.5' OF S/80 PIPE	14.312	1.5000'		2	1.28907		1.62125
4	S/80 TO STD SUD EXP	14.312 / 15.25			3	"	0.01833	
5	1.9975' OF STD PIPE	15.25"	1.9975'		2	1		1.5718
6	90° BW ELBOW				4		0.182	
7	4' OF STD PIPE		4.0000'		2			3.14754
8	90° BW ELBOW				4		0.182	
9	4.5417' OF STD PIPE		4.5417'		2			3.5738
10	90° BW ELBOW				4		0.182	
11	25.6042' OF STD PIPE		25.6042'		2			20.14757
12	90° BW ELBOW				4		0.182	
13	18.875' OF STD PIPE		18.875'		2			14.85246
14	16"x14" RED ELBOW	15.25 / 13.25			5		0.32849	
15	2' OF STD PIPE	13.25	2.0000'		2	1.75475		3.17842
16	VALVE (Cv=12,925)				6		0.28847	
17	1.5' OF STD PIPE		1.5000'		2			2.38381
18	VALVE (Cv=12,925)				6		0.28847	
19	2.0208' OF STD PIPE		2.0208'		2			3.21148

AMW 4/6/99

Iso: 2603-2

#	Description	Dia.	Lg.	Elev.	Eqn.	Kcorr.	K_{fit}	K_{pipe}
20	TEE (RUN FLOW)	↓			7	↓	0.45624	
21	0.9167' OF STD PIPE	↓	0.9167'		2	↓		1.45683
22	STD TO S/40 SWD CONT	13.124			8	↓	0.01725	
							2.202 +	55.145(f)

ARW 4/6/99

Iso: 2626-1 & 2625-2

RHR LOOP A

#	Description	Dia.	Lg.	Elev.	Eqn.	Kcorr.	K_{fit}	K_{pipe}
1	STRAINER (1.83' @ 9349 GPM)	19.25"						
2	STD TO S/30 SUD CONT	19.25 / 19.00			9		0.0136	
3	1.5' OF S/30 PIPE	19.00"	1.5000'		2	1.05368		0.99822
4	S/30 TO STD SUD EXP	19.00 / 19.25			10	"	0.0007	
5	1.9975' OF STD PIPE	19.25	1.9975'		2	1		1.24519
6	90° SR BW ELL				11		0.24	
7	22.5' OF STD PIPE		22.5000'		2			14.02597
8	90° BW ELL				4		0.168	
9	14.9635' OF STD PIPE		14.9635'		2			9.3279
10	45° BW ELL				12		0.11893	
11	1.0386' OF STD PIPE		1.0386'		2			0.64744
12	VALVE (Cv = 28,225)				6		0.15358	
13	3.3177' OF STD PIPE		3.3177'		2			2.06818
14	VALVE (Cv = 28,225)				6		0.15358	
15	1.0417' OF STD PIPE		1.0417'		2			0.64937
16	45° BW ELL				12		0.11893	
17	2.4479' OF STD PIPE		2.4479'		2			1.52596
18	TEE (RUN FLOW)				13		0.24	
19	2.7448' OF STD PIPE		2.7448'		2			1.71104

1.207 + 32.199 (f)

ARW 4/6/99

Iso: 2626-2 & 2625-4

RHR LOOP O

#	Description	Dia.	Lg.	Elev.	Eqn.	Kcorr.	K_{fit}	K_{pipe}
1	STRAINER (1.83'@9346 GPM)	19.25						
2	STD TO S/30 SUD CONT	19.25 / 19.00			9		0.0136	
3	1.5' OF S/30 PIPE	19.00'	1.5000'		2	1.05368		0.99822
4	S/30 TO STD SUD EXP	19.00 / 19.25			10	"	0.0007	
5	2.0524' OF STD PIPE	19.25	2.0524'		2	1		1.27942
6	60° CUT ELBOW				12		0.13529	
7	6.4167' OF STD PIPE		6.4167'		2			4.00002
8	90° SR. BW ELL				11		0.24	
9	24.1458' OF STD PIPE		24.1458'		2			15.05193
10	90° SR BW ELL				11		0.24	
11	5.1667' OF STD PIPE		5.1667'		2			3.2208
12	VALVE (Cv = 28,225)				6		0.15358	
13	1.6667' OF STD PIPE		1.6667'		2			1.03898
14	90° SR. BW ELL				11		0.24	
15	1.6667' OF STD PIPE		1.6667'		2			1.03898
16	VALVE (Cv = 28,225)				6		0.15358	
17	2.1667' OF STD PIPE		2.1667'		2			1.35067
18	TEE (RUN FLOW)				13		0.24	
19	2.5' OF STD PIPE		2.5000'		2			1.55844

1.417 + 29.537(A)

AMW 4/6/99

Iso: 2626-1 & 2625-1

RHR LOOP C

#	Description	Dia.	Lg.	Elev.	Eqn.	Kcorr.	K_{fit}	K_{pipe}
1	STRAINER (1.83' @ 9349 GPM)	19.25						
2	STD TO S/30 SUD CONT	19.25 / 19.00			9		0.0136	
3	1.5' OF S/30 PIPE	19.00	1.5000'		2	1.05368		0.99822
4	S/30 TO STD SUD EXP	19.00 / 19.25			10	"	0.0007	
5	2.0718' OF STD PIPE	19.25	2.0718'		2	1		1.29151
6	60° CUT BW ELL				12		0.13529	
7	6.4167' OF STD PIPE		6.4167'		2			4.00002
8	90° SR BW ELL				11		0.24	
9	24.25' OF STD PIPE		24.2500'		2			15.11688
10	90° SR BW ELL				11		0.24	
11	5.1667' OF STD PIPE		5.1667'		2			3.2208
12	VALVE (Cv = 28,225)				6		0.15358	
13	1.6667' OF STD PIPE		1.6667'		2			1.03898
14	90° SR BW ELL				11		0.24	
15	1.6667' OF STD PIPE		1.6667'		2			1.03898
16	VALVE (Cv = 28,225)				6		0.15358	
17	2.1667' OF STD PIPE		2.1667'		2			1.35067
18	TEE (RUN FLOW)				13		0.24	
19	2.5' OF STD PIPE		2.5000'		2			1.55844

1.417 + 29.615(f)

AW 4/6/99

Iso: 2626-2 & 2625-2

RHR LOOP D

#	Description	Dia.	Lg.	Elev.	Eqn.	Kcorr.	K_{fit}	K_{pipe}
1	STRAINER (1.83' @ 9349 GPM)	19.25"						
2	STD TO S/30 SVD CONT	19.25" / 19.00"			9		0.0136	
3	1.5' OF S/30 PIPE	19.00"	1.5000'		2	1.05368		0.99822
4	S/30 TO STD SVD EXP	19.00" / 19.25			10	"	0.0007	
5	1.9975' OF STD PIPE	19.25'	1.9975'		2	1		1.24519
6	90° SR BW ELL				11		0.24	
7	24.25' OF STD PIPE		24.2500'		2			15.11688
8	90° BW ELL				4		0.168	
9	14.9561' OF STD PIPE		14.9561'		2			9.32328
10	45° BW ELL				12		0.11893	
11	1.0417' OF STD PIPE		1.0417'		2			0.64937
12	VALVE (Cv = 28,225)				6		0.15358	
13	3.3177' OF STD PIPE		3.3177'		2			2.06818
14	VALVE (Cv = 28,225)				6		0.15358	
15	1.0417' OF STD PIPE		1.0417'		2			0.64937
16	45° BW ELL				12		0.11893	
17	2.4479' OF STD PIPE		2.4479'		2			1.52596
18	TEE (RUN FLOW)				13		0.24	
19	2.7448' OF STD PIPE		2.7448'		2			1.71104

1.207 + 33.288(f)

N132-0994

Nebraska Public Power District

DESIGN CALCULATION SHEET

ATT. J

Sheet 9 of 16

No. 97-044A

Prepared By: E. Kuck

Date Nov 12 19 98

Checked/Reviewed By: [illegible]

Date 4-6 19 99

EQN 1

MINOR SUDDEN CONTRACTION (STD TO S/80)

$D_1 = 15.25''$ (16" STD PIPE)

$D_2 = 14.312''$ (16" S/80 PIPE)

$$\beta = \frac{14.312}{15.25} \cong 0.938492$$

$$K \cong \frac{0.5(1-\beta^2)}{\beta^4}$$ (REF CRANE TECH PAPER # 410, pg 4-26)

$$\cong \frac{0.5(1-(0.938492)^2)}{(0.938492)^4}$$

$$\cong 0.07685$$

$$K_{CORR} = \left(\frac{1}{\beta}\right)^4 = \left(\frac{1}{0.938492}\right)^4$$ (CORRECTION FACTOR FOR COMPONENTS DOWNSTREAM OF THIS MINOR SUDDEN CONTRACTION)

$$\boxed{\cong 1.289075}$$

16" STD → S/80 CONTRACTION

EQN 2

STRAIGHT PIPE

$$K \cong f\frac{L}{D}$$ (REF CRANE TECHNICAL PAPER # 410 pg 3-4)

EQN 3

MINOR SUDDEN EXPANSION (S/80 → STD)

$D_1 = 14.312$

$D_2 = 15.25$

$$\beta = \frac{14.312}{15.25} \cong 0.938492$$

N132-0994

Nebraska Public Power District

DESIGN CALCULATION SHEET

ATT. 5

Sheet 10 of 16

No. 97-044A

Prepared By: E. Kerr

Date NOV 12 19 98

Checked/Reviewed By: [illegible]

Date 4-6 19 99

$K \cong (1-\beta^2)^2$ (REF. CRANE TECHNICAL PAPER # 410, PG A-26)

$K \cong (1-(0.938492)^2)^2$

$\cong 0.014216$

$K' = K_{CONT}(K_{CORR})$

$\cong 0.014216(1.289075)$

$\boxed{\cong 0.018326}$ S/80 → STD EXPANSION

$K_{CORR} = 1$ (CORRECTION FACTOR FOR COMPONENTS DOWNSTREAM OF THIS MINOR SUDDEN EXPANSION)

EQN 4

90° ELBOW

$K \cong 14f(t)$ (REF CRANE TECHNICAL PAPER # 410, PG A 29)

16" PIPE $f(t) \cong 0.013$

20" PIPE $f(t) \cong 0.012$

(REF CRANE TECHNICAL PAPER # 410, PG A-26)

$K_{16''} = 14(0.013) \cong \boxed{0.182}$ 16" 90° ELL

$K_{20''} = 14(0.012) \cong \boxed{0.168}$ 20" 90° ELL

N132-0994

Nebraska Public Power District

DESIGN CALCULATION SHEET

ATT. 5

Sheet 11 of 16

No. 97-044A Prepared By: E. Kuck Checked/Reviewed By: [illegible]

Date NOV 12 19 98 Date 4-6 19 99

EQN 5

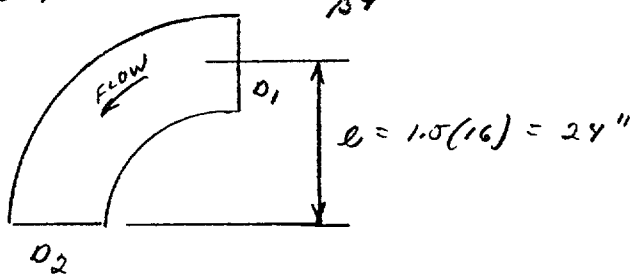
16 x 14 REDUCING ELBOW

$$K \cong K_{\substack{GRAD\\CONT}} + {}^{*}K_{ELBOW}$$

* REFERRED TO THE SMALLER DIA.

$$K_{\substack{GRAD\\CONT}} \cong \frac{0.8\left(\sin\frac{\theta}{2}\right)(1-\beta^2)}{\beta^4}$$

(REF CRANE TECHNICAL PAPER # 410, Pg A26)

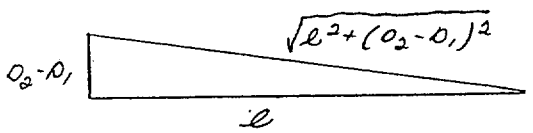


$D_1 = 15.25''$

$D_2 = 13.25''$

$C = 2\pi\ell = 2\pi(24) \cong 150.796''$

$\ell = C/4 = \frac{150.796}{4} = 37.6991$



$$\sin(\theta) = \frac{D_2-D_1}{\sqrt{\ell^2+(D_2-D_1)^2}}$$

$$\sin\frac{\theta}{2} = \frac{D_2-D_1}{2\sqrt{\ell^2+\left(\frac{D_2-D_1}{2}\right)^2}}$$

$$= \frac{15.25-13.25}{2\sqrt{(37.6991)^2+\left(\frac{15.25-13.25}{2}\right)^2}}$$

$$\cong 0.02652$$

N132-0994

Nebraska Public Power District

DESIGN CALCULATION SHEET

ATT. 5

Sheet 12 of 16

:. No. 97-044A Prepared By: E. Kurek Checked/Reviewed By: [illegible]

Date NOV 12 19 98 Date 4-6 19 99

$$K_{GRAD} = \frac{0.8(0.02652)\left(1-\left(\frac{13.25}{15.25}\right)^2\right)}{\left(\frac{13.25}{15.25}\right)^4}$$

$$\cong 0.00912$$

$K_{ELBOW} \cong 14 f_f$ (REF CRANE TECHNICAL PAPER # 410, pg A-28)

$f_f \cong 0.013$ (REF CRANE TECHNICAL PAPER # 410, pg A-26)

$K \cong 14(0.013) \cong 0.182$

REFERRING BACK TO THE 16"ϕ PIPE

$$K_{ELL} \cong \frac{0.182}{(\beta)^4} \cong \frac{0.182}{\left(\frac{13.25}{15.25}\right)^4} \cong 0.31936$$

$$K_{14X16} \cong 0.00912 + 0.31936$$

$$\boxed{\cong 0.32849}$$ 14X16 RED ELL

$$K_{CORR} \cong \left(\frac{15.25}{13.25}\right)^4 \cong 1.75475$$

EQN 6

VALVES

$K \cong \frac{891 d^4}{C_v^2}$ (REF CRANE TECHNICAL PAPER # 410, pg 3-4

GS

$$K \cong \frac{891(13.25)^4}{(12,925)^2} \cong 0.16439$$

N132-0994

Nebraska Public Power District

DESIGN CALCULATION SHEET

ATT. 5

Sheet 13 of 16

No. 97-044A

Prepared By: E. Kurek

Date Nov 12 19 98

Checked/Reviewed By: [illegible]

Date 4-6 19 99

CORRECTING BACK TO @ 15.25" ID

$$K' = \frac{K}{\left(\frac{13.25}{15.25}\right)^4} \cong \frac{0.16439}{\left(\frac{13.25}{15.25}\right)^4} \cong \boxed{0.28847}_{CS}$$

RHR

$$K \cong \frac{891(19.25)^4}{(28,225)^2}$$

$$K \cong \boxed{0.15358}_{RHR}$$

(NO CORRECTION FOR RHR VALVES)

EQN 7

TEE - RUN FLOW

$K \cong 20 f_t$ (REF CRANE TECHNICAL PAPER # 410, PG A-29)

$f_t \cong 0.013$ (REF CRANE TECHNICAL PAPER # 410, PG A-26)

$K \cong 0.013(20) \cong 0.2600$

CORRECTING BACK TO @ 15.25" ID

$$K' = \frac{0.2600}{\left(\frac{13.25}{15.25}\right)^4} \cong \boxed{0.45624}_{16"\ TEE\ (RUN\ FLOW)}$$

N132-0994

Nebraska Public Power District

ATT. 5

DESIGN CALCULATION SHEET

Sheet 14 of 16

No. 97-044A

Prepared By: E. Kuna

Date NOV 12 19 98

Checked/Reviewed By: [illegible]

Date 4-6 19 99

EQN 8

STD TO S/40 SUDDEN CONTRACTION (MINOR)

$D_1 = 13.25$
$D_2 = 13.124''$

$$\beta = \frac{13.124}{13.25} \cong 0.99049$$

$$K \cong \frac{0.5(1-\beta^2)}{\beta^4}$$ (REF CRANE TECHNICAL PAPER # 410, PG A-26)

$$\cong \frac{0.5(1-(0.99049)^2)}{(0.99049)^4} \cong 0.00983$$

CORRECTING TO A 15.25" ID PIPE

$$K' = \frac{0.00983}{\left(\frac{13.25}{15.25}\right)^4} \cong \boxed{0.01725}$$ 16" STD → S/40 CONT.

EQN 9

STD TO S/30 SUDDEN CONTRACTION (MINOR)

$D_1 = 19.25''$ (20" STD PIPE)
$D_2 = 19.00''$ (20" S/30 PIPE)

$$\beta = \frac{19.00}{19.25} \cong 0.98701$$

$$K \cong \frac{0.5(1-\beta^2)}{\beta^4} \cong \frac{0.5(1-(0.98701)^2)}{(0.98701)^4}$$ (REF CRANE TECHNICAL PAPER # 410, PG A-26)

$$\boxed{\cong 0.0136}$$ 20" STD → S/30 CONT

N132-0994

Nebraska Public Power District

DESIGN CALCULATION SHEET

ATT. J

Sheet 15 of 16

No. 97-044A Prepared By: E. Kuck Checked/Reviewed By: [illegible]

Date Nov 12 19 98 Date 4-6 19 99

EQN 10

S/30 TO STD MINOR SUDDEN EXPANSION

$D_1 = 19.00$ (20" S/30 PIPE)
$D_2 = 19.25$ (20" STD PIPE)

$\beta = \frac{19.00}{19.25} \cong 0.98701$

$K \cong (1-\beta^2)^2$ (REF CRANE TECHNICAL PAPER # 410, PG A-26)

$\cong (1-(0.98701)^2)^2$

$\cong 0.00067$

CORRECTING BACK TO 19.25" ID

$K \cong \frac{0.00067}{\left(\frac{19.00}{19.25}\right)^4} \cong \boxed{0.00070}$ 20" S/30 → STD EXP.

EQN 11

90° SR BW ELL

$K \cong 20 f_f$ (REF CRANE TECHNICAL PAPER # 410, PG A-27)

$f_f \cong 0.012$ (REF CRANE TECHNICAL PAPER # 410, PG A-26)

$K \cong 0.012(20) \cong \boxed{0.2400}$ 20" SR ELL

EQN 12

45° BW ELL

$K \cong (n-1)\left(\left(0.25\pi f_f \frac{r}{D}\right) + 0.5(K)\right) + K$ REF CRANE TECHNICAL PAPER # 410, PG A 29

N132-0994

Nebraska Public Power District

ATT. J

DESIGN CALCULATION SHEET

Sheet 16 of 16

No. 97-044A Prepared By: E. Kerr Checked/Reviewed By: [illegible]

Date Nov 12 19 98 Date 4-6 19 99

$n = 45/90 \cong 0.5$

$f_f = 0.012$ (REF CRANE TECHNICAL PAPER # 410, Pg A-29)

$r/d = 1.5$ (LONG RADIUS ELL)

$K = 14 f_f = 14(0.012) \cong 0.1680$

$K_{45^\circ} \cong (-0.5)(0.25\pi(0.012)(1.5) + 0.5(0.1680)) + 0.1680$

$\boxed{0.11893 \text{ (45° ELL)}}$

FOR A 60° CUT ELL

$n = 60/90 = 0.6667$

$K_{60^\circ} \cong (0.6667-1)(0.25\pi(0.012)(1.5) + 0.5(0.168)) + 0.168$

$\boxed{\cong 0.13529 \text{ (60° ELL)}}$

EQN 13

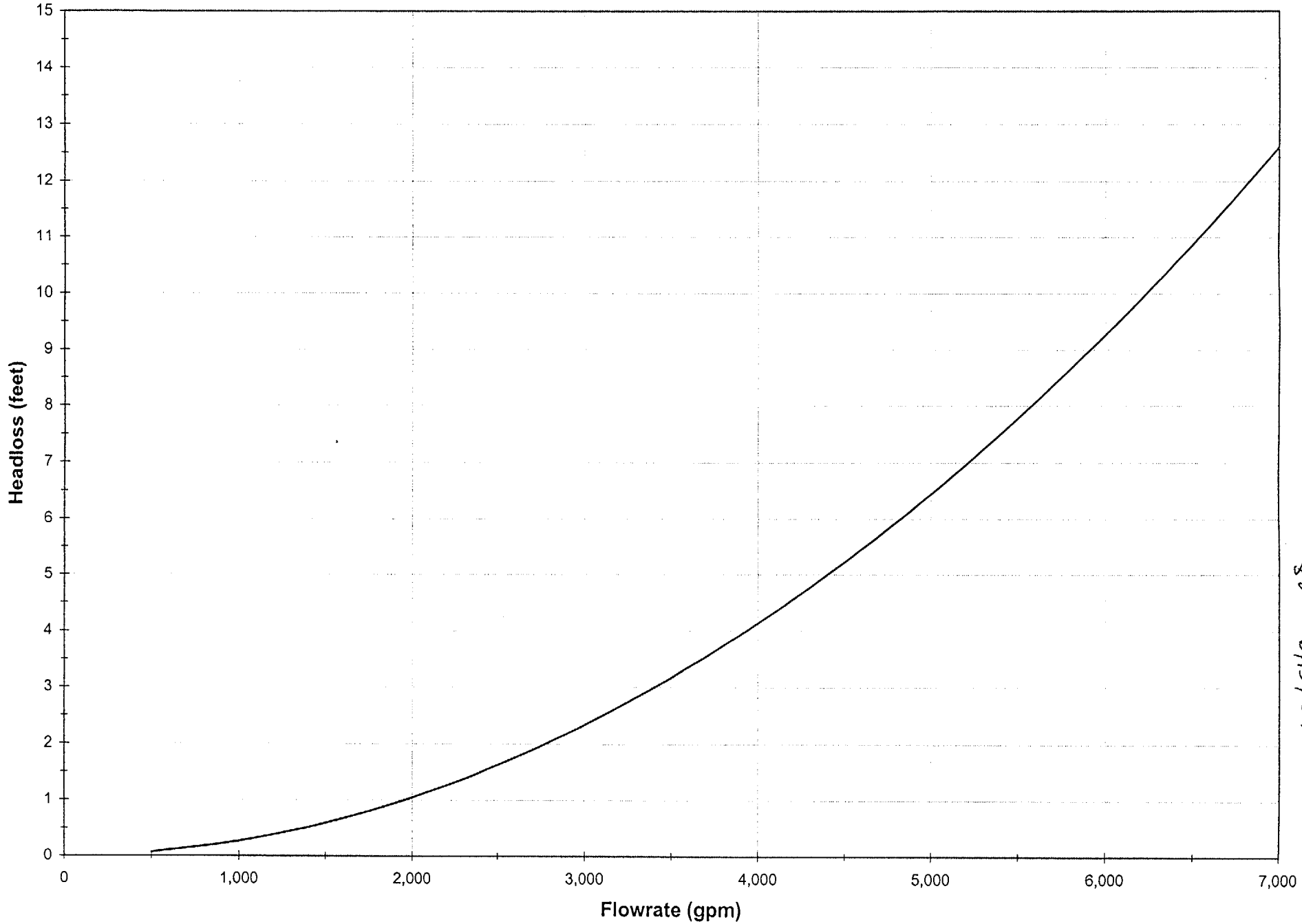
TEE (RUN FLOW)

$K \cong 20 f_f$ (REF CRANE TECHNICAL PAPER # 410, Pg A-29)

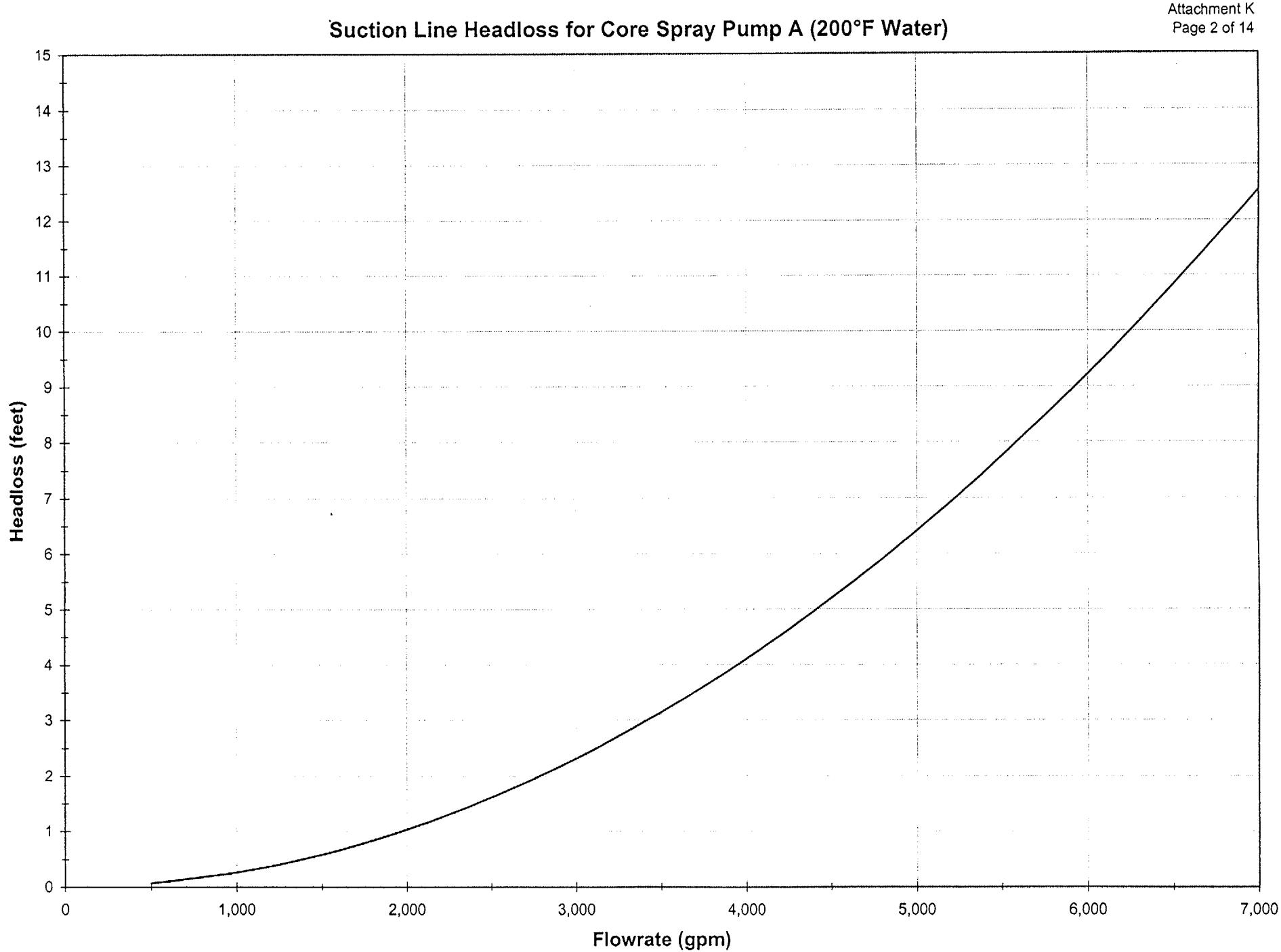
$f_f = 0.012$ (REF CRANE TECHNICAL PAPER # 410, Pg A-26)

$K \cong 0.012(20) \cong \boxed{0.2400}$ 20" TEE (RUN FLOW)

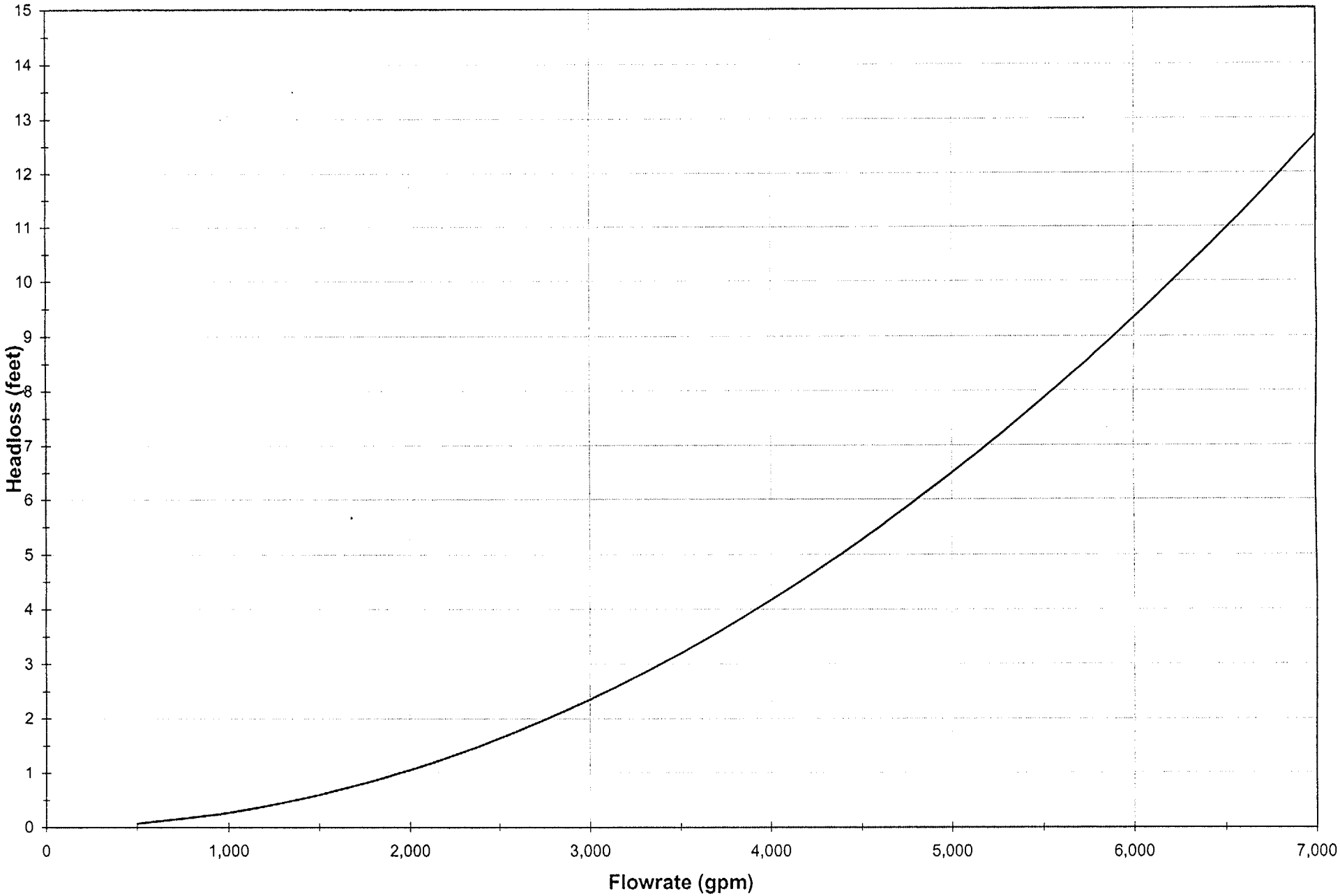
Suction Line Headloss for Core Spray Pump A (95°F Water)



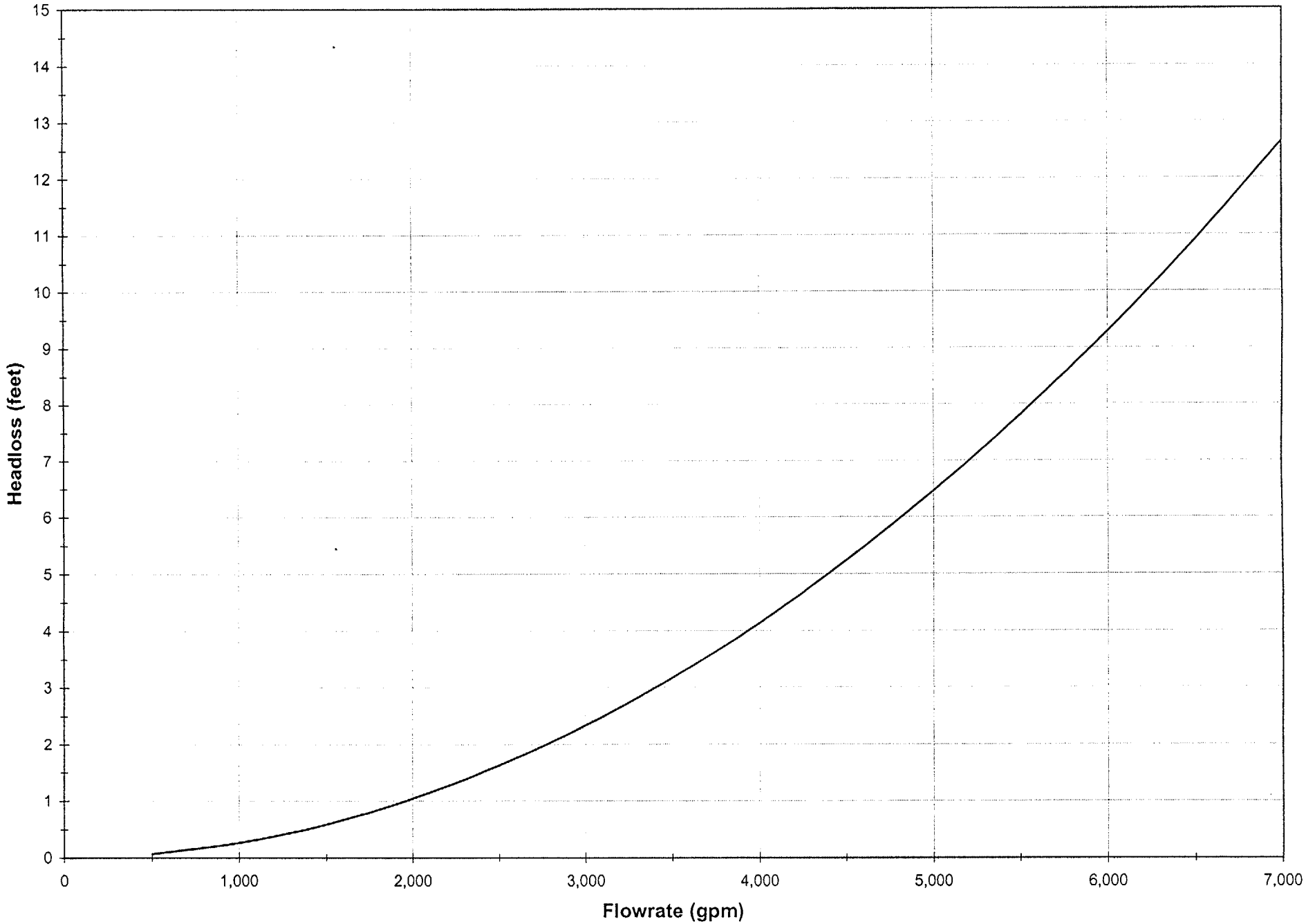
All pages in Attachment K checked
SR 6/15/01

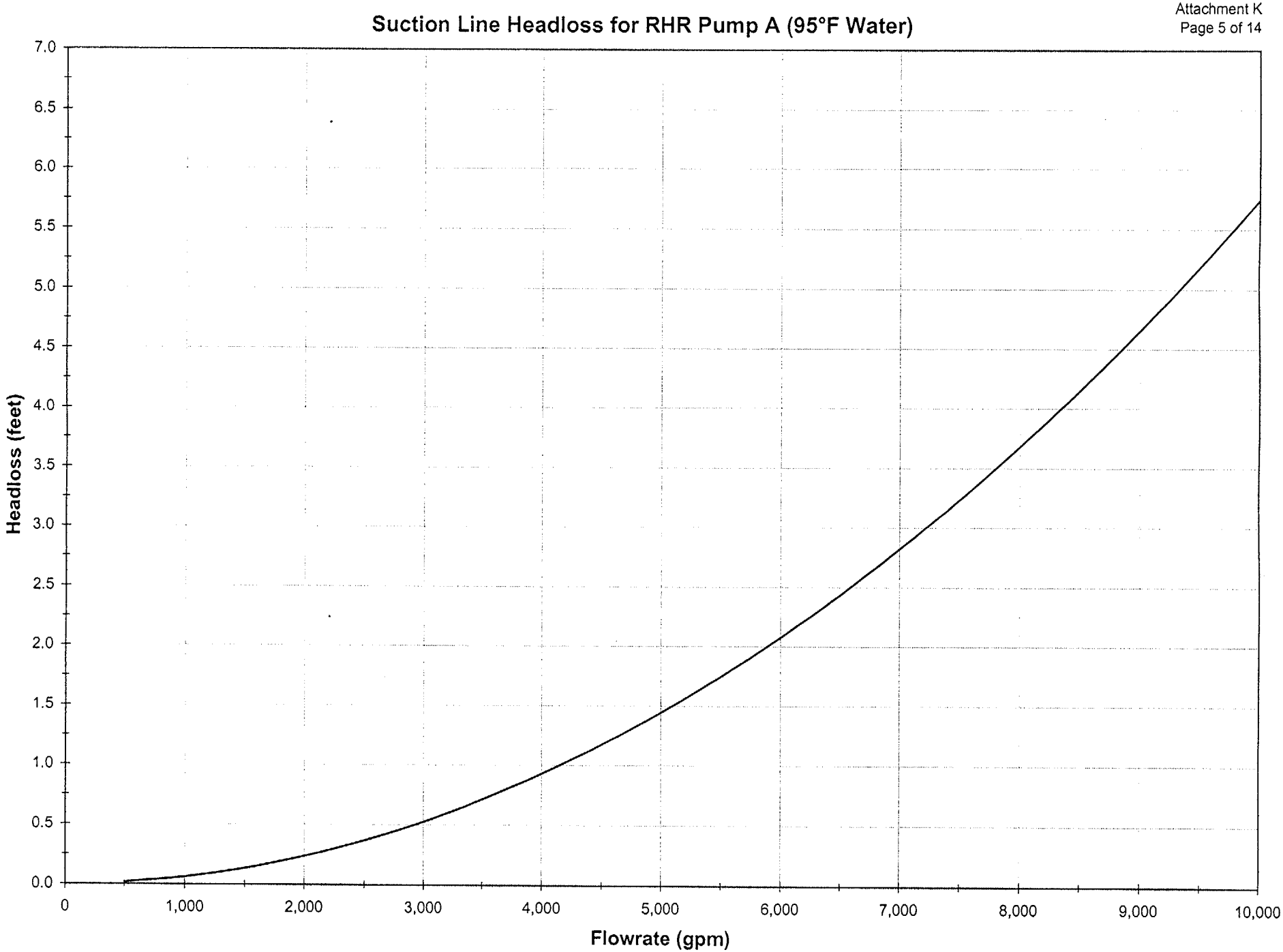

Suction Line Headloss for Core Spray Pump A (200°F Water)
Headloss (feet)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Flowrate (gpm)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000

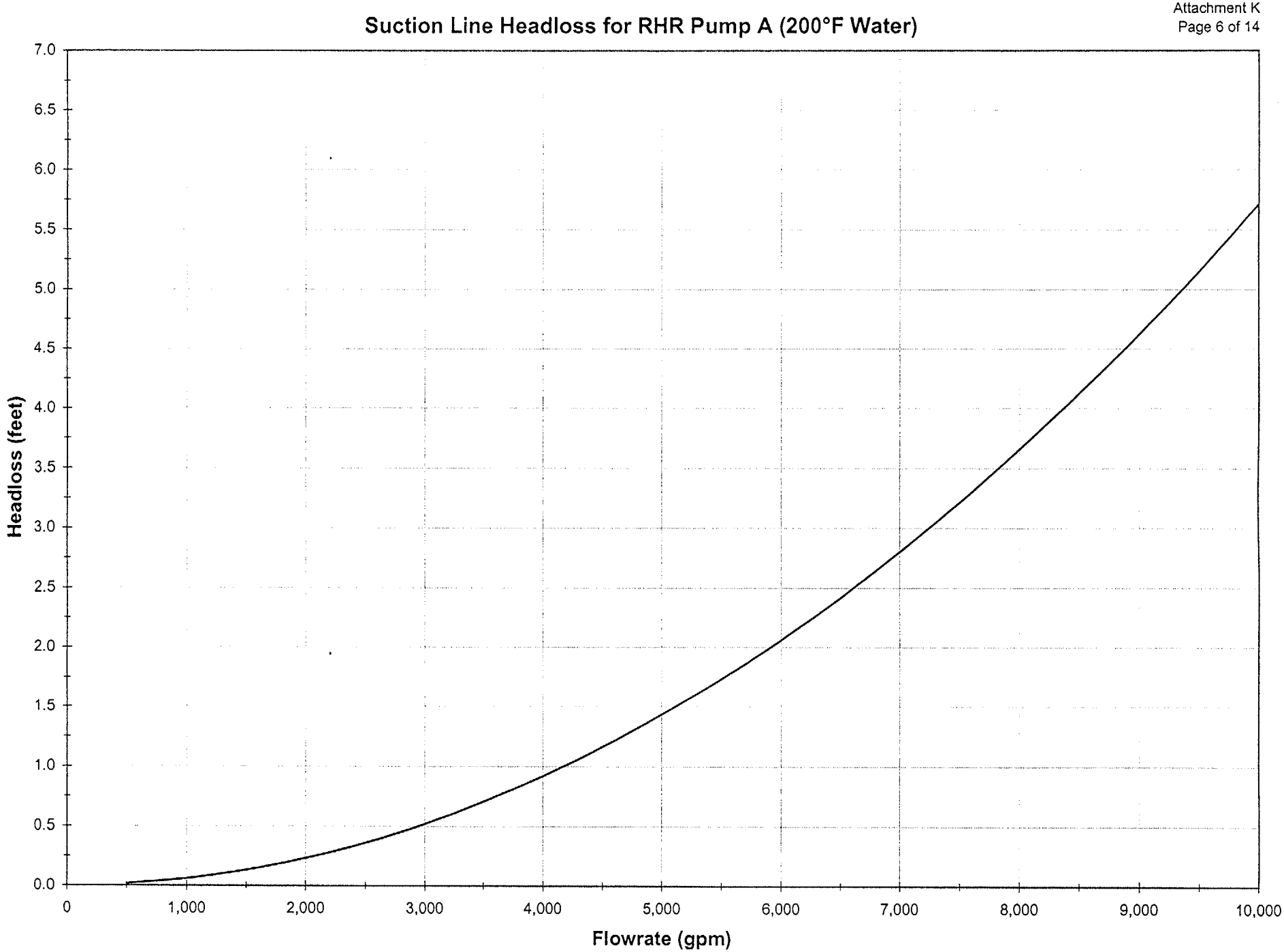
Suction Line Headloss for Core Spray Pump B (95°F Water)

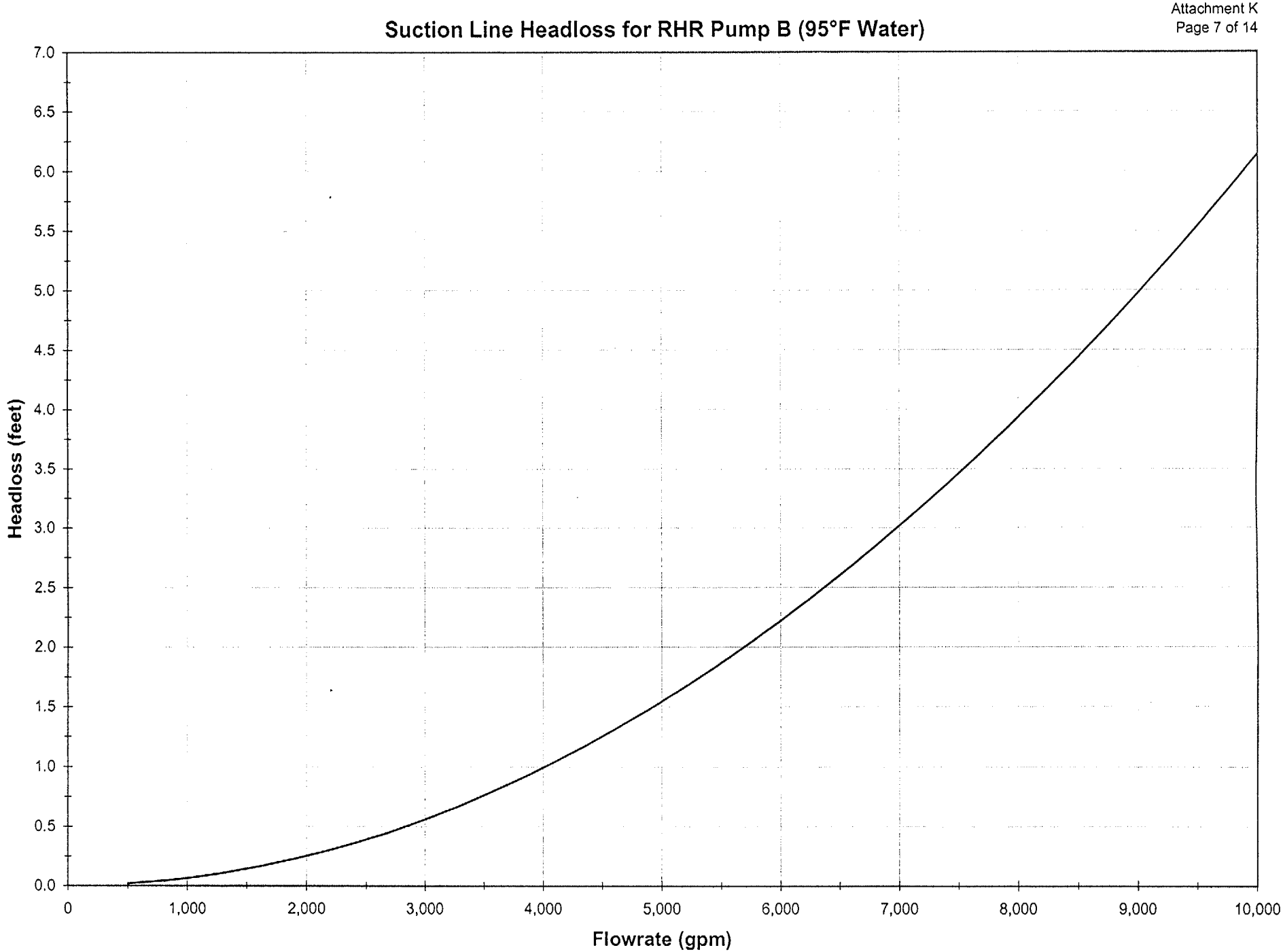


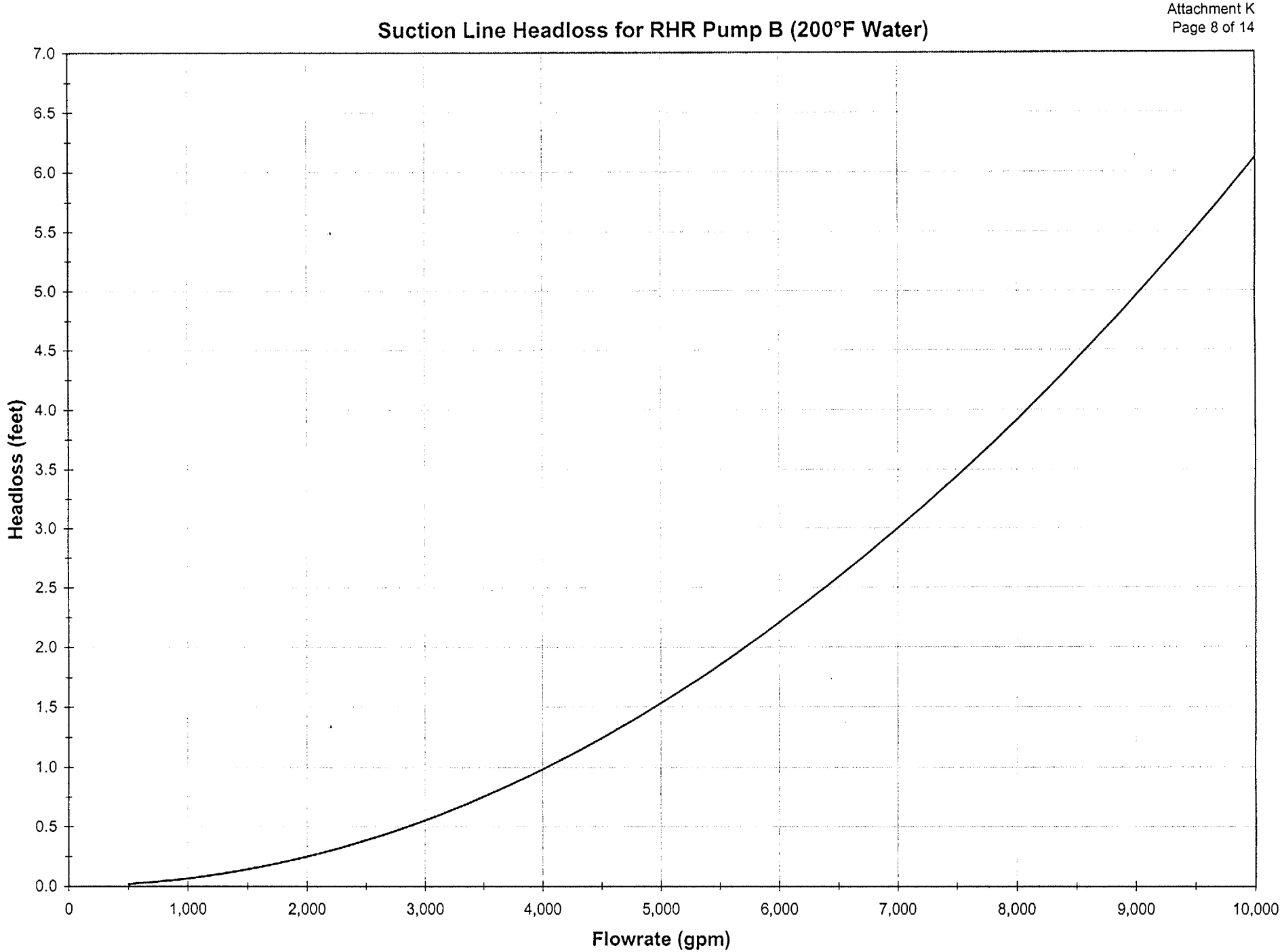
Suction Line Headloss for Core Spray Pump B (200°F Water)

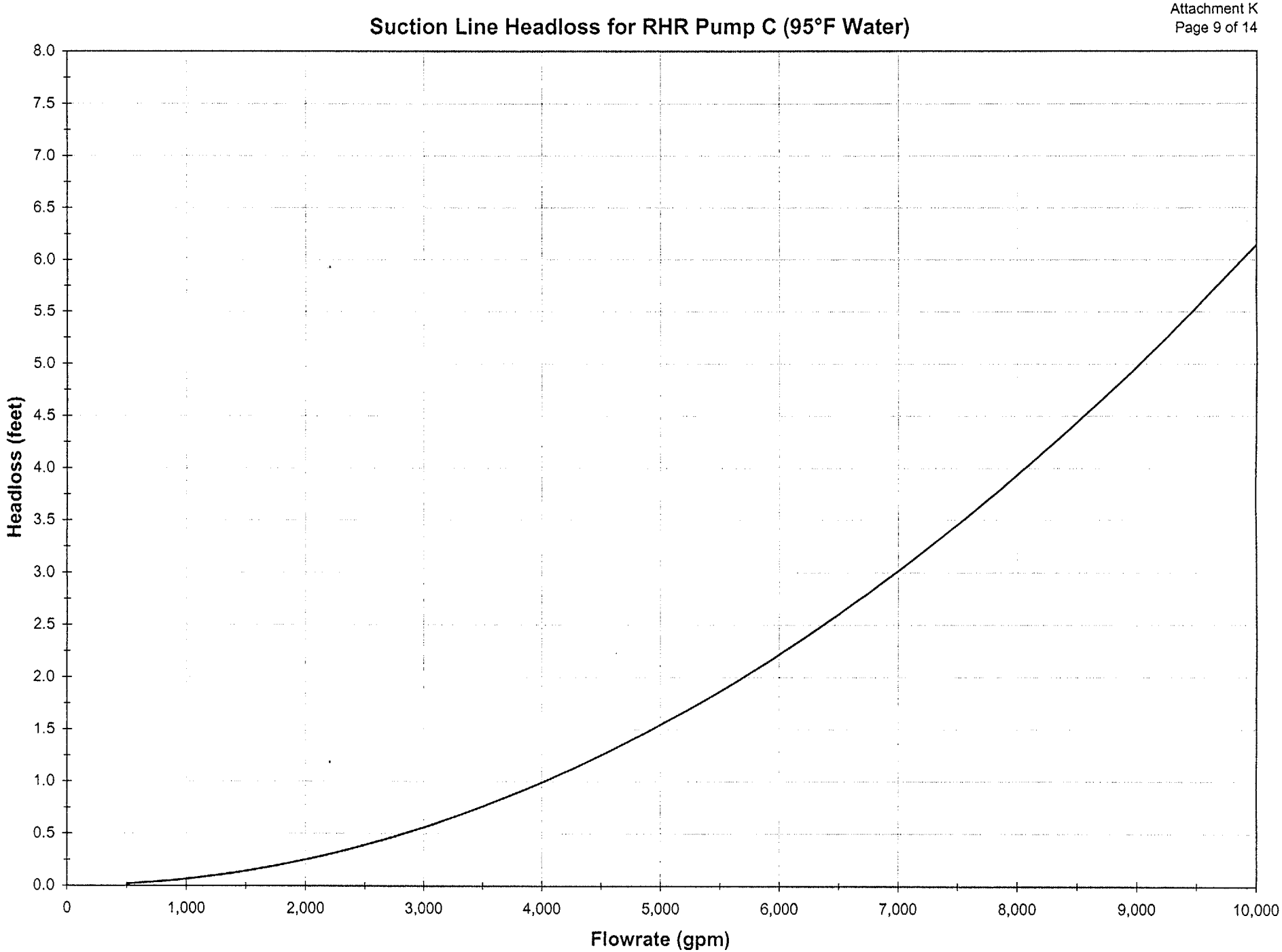


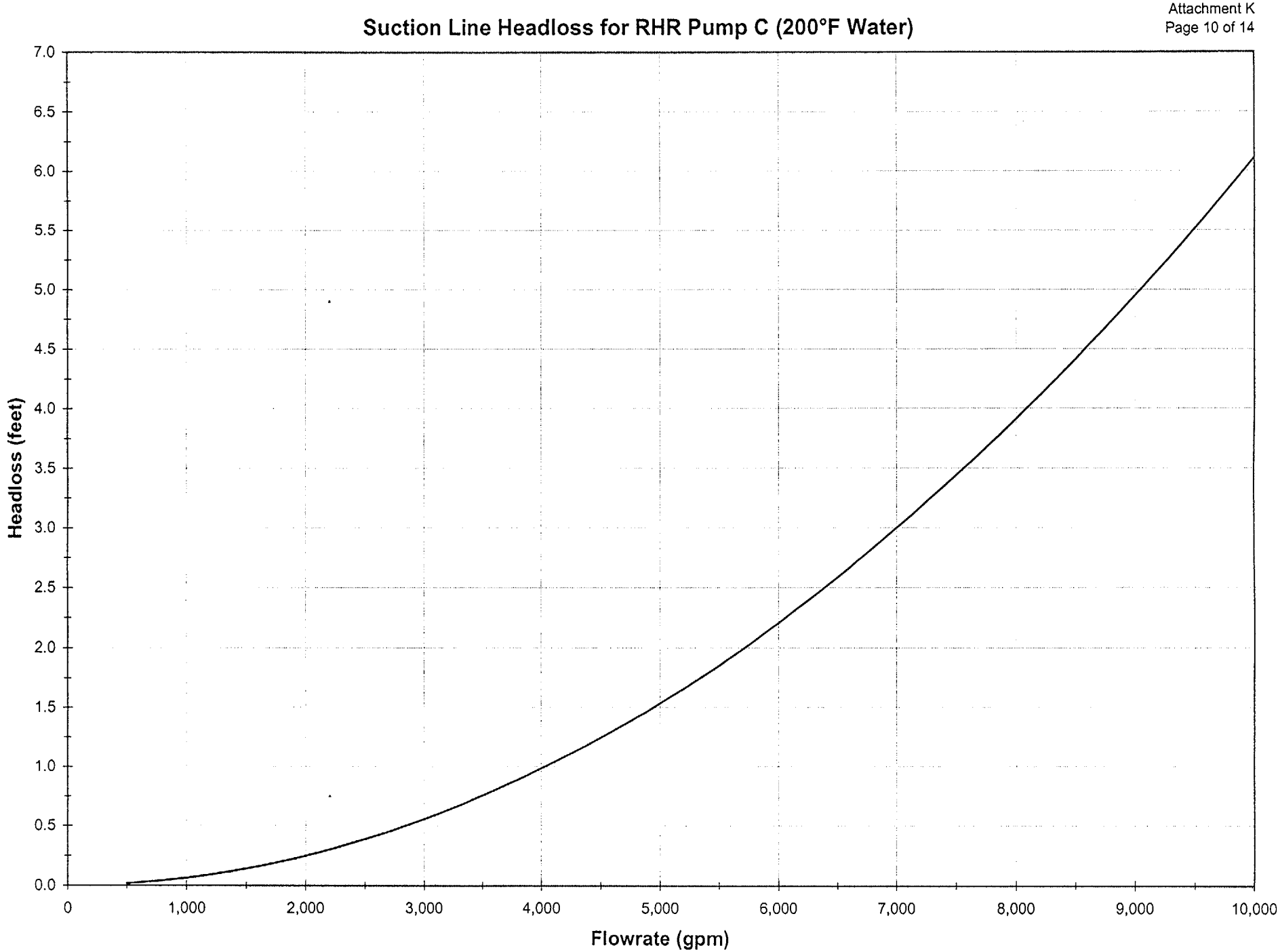

Suction Line Headloss for RHR Pump A (95°F Water)
Headloss (feet)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Flowrate (gpm)


Suction Line Headloss for RHR Pump A (200°F Water)
Headloss (feet)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Flowrate (gpm)

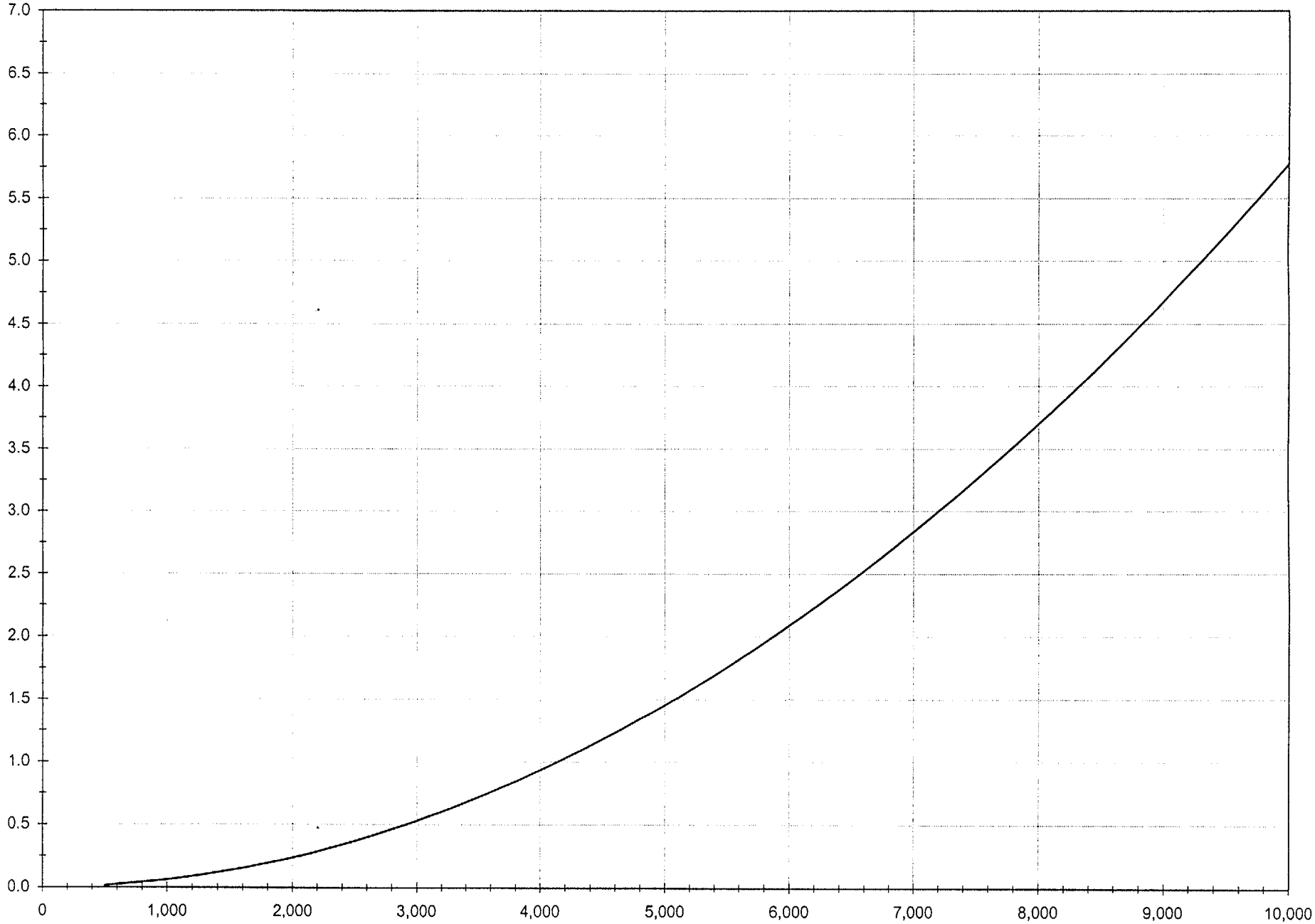

Suction Line Headloss for RHR Pump B (95°F Water)
Headloss (feet)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Flowrate (gpm)


Suction Line Headloss for RHR Pump B (200°F Water)
Headloss (feet)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Flowrate (gpm)

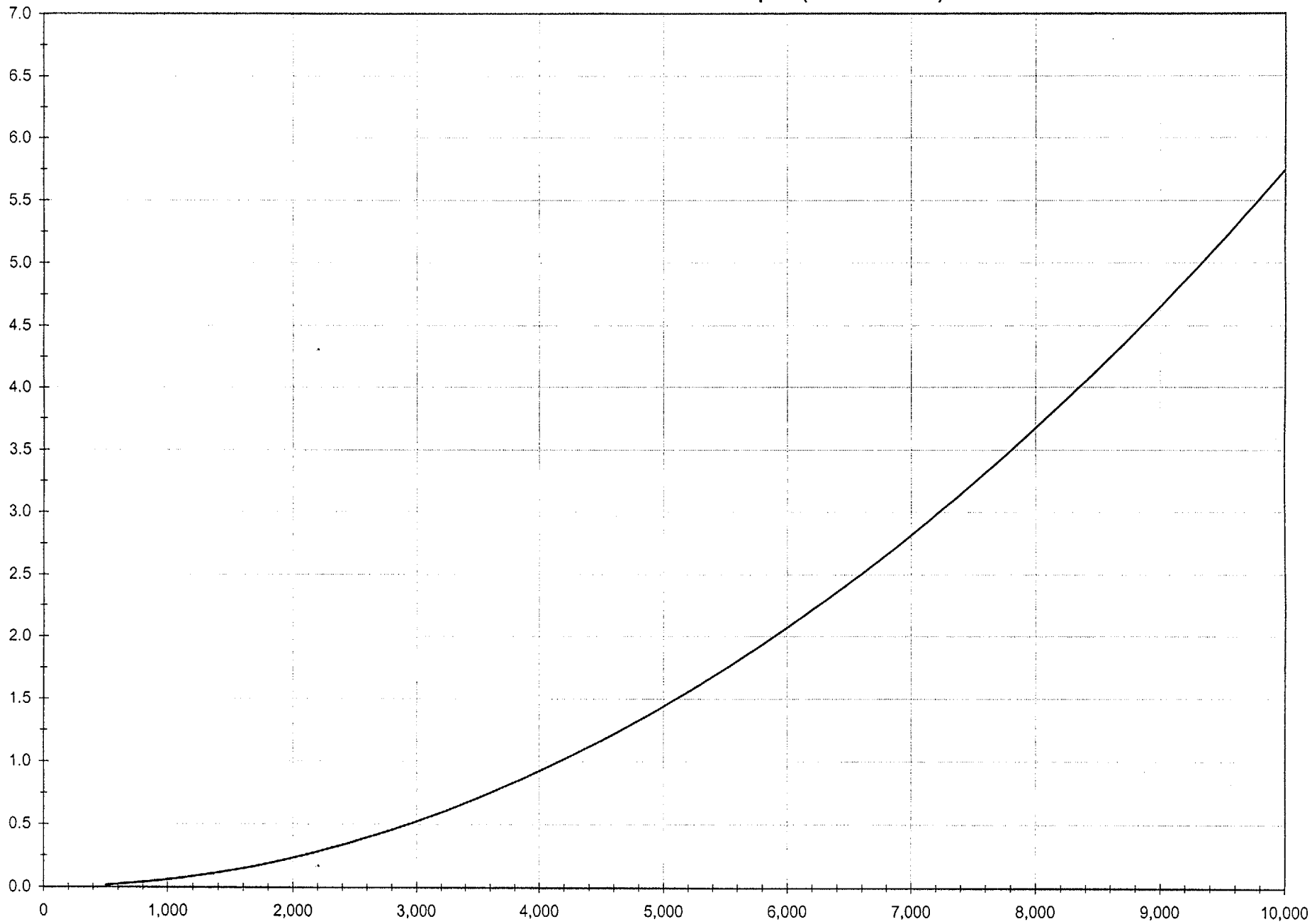

Suction Line Headloss for RHR Pump C (95°F Water)
Headloss (feet)
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Flowrate (gpm)


Suction Line Headloss for RHR Pump C (200°F Water)
Headloss (feet)
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Flowrate (gpm)

Suction Line Headloss for RHR Pump D (95°F Water)



Suction Line Headloss for RHR Pump D (200°F Water)



HEAD LOSS WORKSHEET								
INPUTS								
			Core Spray		**RHR A**		**RHR B**	
Strainer Outlet Dia =			15.25	in	19.25	in	19.25	in
Flowrate =			10000	gpm	10000	gpm	10000	gpm
Water Temperature =			200	°F				
		mu =	6.37E-06	lb-s/ft^2	or	0.3100	Centipoise	
		Rho =	1.868	slugs/ft^3	or	60.10699	lb/ft^3	lb/ft^3
		Vapor Pressure =				11.52600	psia	
Clean Headloss =			9.08	ft	2.09	ft	2.09	ft

Calculated Headloss (feet) as a Function of Flowrate (gpm) @ 95°F Water								
Division 1					Division 2			
	CS	RHR				CS	RHR	
Flow	Pump A	Pump A	Pump B			Pump B	Pump C	Pump D
500	0.07	0.02	0.02		500	0.07	0.02	0.02
1,000	0.26	0.06	0.06		1,000	0.27	0.06	0.06
1,500	0.59	0.13	0.14		1,500	0.60	0.14	0.13
2,000	1.04	0.24	0.25		2,000	1.05	0.25	0.24
2,500	1.63	0.37	0.39		2,500	1.64	0.39	0.37
3,000	2.33	0.52	0.56		3,000	2.35	0.56	0.53
3,500	3.17	0.71	0.76		3,500	3.19	0.76	0.72
4,000	4.13	0.93	0.99		4,000	4.17	0.99	0.93
4,500	5.23	1.17	1.25		4,500	5.27	1.25	1.18
5,000	6.45	1.45	1.54		5,000	6.49	1.55	1.45
5,500	7.79	1.75	1.87		5,500	7.85	1.87	1.76
6,000	9.27	2.08	2.22		6,000	9.33	2.22	2.09
6,500	10.87	2.43	2.60		6,500	10.95	2.60	2.45
7,000	12.60	2.82	3.02		7,000	12.69	3.02	2.84
7,500	14.45	3.24	3.46		7,500	14.56	3.46	3.25
8,000	16.44	3.68	3.93		8,000	16.55	3.94	3.70
8,500	18.55	4.15	4.44		8,500	18.68	4.44	4.17
9,000	20.78	4.65	4.98		9,000	20.93	4.98	4.68
9,500	23.15	5.18	5.54		9,500	23.32	5.54	5.21
10,000	25.64	5.74	6.14		10,000	25.83	6.14	5.77

Division 1					Division 2			
	CS	RHR				CS	RHR	
Flow	Pump A	Pump A	Pump B			Pump B	Pump C	Pump D
Calculated Headloss (feet) as a Function of Flowrate (gpm) @ 200°F Water								
Division 1					Division 2			
	CS	RHR				CS	RHR	
Flow	Pump A	Pump A	Pump B		Flow	Pump B	Pump C	Pump D
500	0.07	0.01	0.02		500	0.07	0.02	0.02
1,000	0.26	0.06	0.06		1,000	0.26	0.06	0.06
1,500	0.58	0.13	0.14		1,500	0.59	0.14	0.13
2,000	1.03	0.23	0.25		2,000	1.04	0.25	0.23
2,500	1.61	0.36	0.39		2,500	1.62	0.39	0.36
3,000	2.31	0.52	0.55		3,000	2.33	0.55	0.52
3,500	3.15	0.70	0.75		3,500	3.17	0.75	0.71
4,000	4.11	0.92	0.98		4,000	4.13	0.98	0.92
4,500	5.19	1.16	1.24		4,500	5.23	1.24	1.17
5,000	6.41	1.43	1.53		5,000	6.45	1.53	1.44
5,500	7.75	1.73	1.85		5,500	7.80	1.85	1.74
6,000	9.22	2.06	2.21		6,000	9.28	2.21	2.07
6,500	10.81	2.42	2.59		6,500	10.89	2.59	2.43
7,000	12.54	2.80	3.00		7,000	12.63	3.00	2.82
7,500	14.39	3.22	3.44		7,500	14.49	3.44	3.23
8,000	16.37	3.66	3.91		8,000	16.48	3.92	3.68
8,500	18.47	4.13	4.42		8,500	18.60	4.42	4.15
9,000	20.71	4.63	4.95		9,000	20.85	4.95	4.65
9,500	23.07	5.15	5.52		9,500	23.23	5.52	5.18
10,000	25.56	5.71	6.11		10,000	25.74	6.11	5.74

Cooper
RMI Summary
Output Table

	RHR	CS	
RMI Type	CEESI/CDI	CEESI/CDI	
Us for RMI Type	0.25	0.25	ft/sec
Kt for RMI Type	0.01	0.01	ft
Kp for RMI Type	4.9	4.9	ft water/(ft^3/s^2)
t,max	1.59	1.26	ft
t,a	0	0	ft
t,p	1.59	1.26	ft
Headloss	1.21	0.92	ft

NOTE, THESE LOSSES ARE MUCH LESS THAN THE FIBROUS DEBRIS HEADLOSS, AND THEREFORE NOT LIMITING.

Note: Due to lack of RMI input, the worst case of settling velocity and proportionality constants have been selected for conservatism.

RHR FLOWRATE USED (REF URG PG 81 & 82) (PREPARED BY C. Kerr 3/10/99) Checked by: A. Wu 4/6/99

$$u = \sqrt{\frac{\Delta h}{K_p t_p}} = \sqrt{\frac{1.21\,ft}{4.9\left(\frac{ft - s^2}{ft^3}\right)(1.59\,ft)}} = 0.39409\,ft/s$$

$$Q = u(450)\,(\text{STRAINER'S CIRCUMSCRIBED AREA})$$

$$\cong 0.39409(450)(52.8) \cong 9364\,gpm$$ (CONSIDERING ROUND-OFF ERRORS, GE USED THE RUN-OUT VALUE OF 9,349 gpm)

CS FLOWRATE USED

$$u = \sqrt{\frac{0.92\,ft}{4.9\left(\frac{ft - s^2}{ft^3}\right)(1.26\,ft)}} \cong 0.38602\,ft/s$$

$$Q \cong 0.38602(450)(35.34) \cong 6,139\,gpm$$ (AGAIN CONSIDERING ROUND-OFF ERRORS, GE OBVIOUSLY USED THE THEN ASSUMED RUN-OUT VALUE OF 6,135 gpm)

NOTE, RUN-OUT HAS BEEN SUBSEQUENTLY INCREASED TO 6,500 GPM

An important step in the hydraulic sizing of GE strainer is the calculation of head loss for the design conditions of flow rate, debris loading and Net Positive Suction Head (NPSH) margin available for the strainer. The head loss calculation is performed using the GE proprietary design correlation developed based on BWROG suction strainer test data and GE prototype test data.

The following is the step by step process used by GE to calculate the head loss of the strainer when designing for Reflective Metal Insulation (RMI).

1) Input the strainer outside diameter, D = ? ft.

2) Input the strainer active (hydraulic) length, L = ? ft.

3) Calculate the strainer circumscribed strainer area, $A_c = \pi DL = ?\ ft^2$

4) Input the strainer blockage (due to plastic sheets or other such material debris in the pool), $B = ?\ ft^2$. Usually this value is specified as design input.

5) Calculate the corrected strainer circumscribed area, $A_{c,cor} = A_c - B = ?\ ft^2$

6) Input the flow rate per strainer, Q = ? gpm

7) Calculate the strainer approach velocity at the strainer surface,

$$U = \frac{Q}{450 \cdot A_{c,cor}} = ?\ ft/sec$$

8) Calculate the average settling velocity, U_s, from Table B-2 of Appendix B of the URG. The table is reproduced below for quick reference.

Table B-1: Average settling velocity, U_s, for different materials

1.5 mil Aluminum	6 mil Aluminum	2.5 mil Stainless	2.5 mil Stainless
CEESI	CEESI	NRC	C.D.I
0.26	0.25	0.47	0.39

9) Calculate the maximum RMI foil thickness by finding the radius at which the settling velocity and approach velocity are equal.

$$t_{max} = \frac{\sqrt{DL}}{2}\left\{\sqrt{\frac{2U}{U_s} - 1}\right\} = ?\ ft$$

10) Seek the empirical thickness constant, K_t, from Table B-2 of Appendix B of the URG. The table is reproduced below for quick reference.

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Table B-2: Thickness constant, Kt, for different RMI liner materials

Material	K_t, ft
1.5 mil Aluminum	0.009
6 mil Aluminum	0.073
2.5 mil Stainless Steel (from NRC)	0.015
2.5 mil Stainless Steel (Processed by C.D.I)	0.014

11) Input the area of RMI foils transported to a single strainer,

$A_{foil} = ?\ ft^2$

12) Calculate the theoretical RMI bed thickness,

$t_a = K_t A_{foil}/A_c = ?\ ft$

13) Calculated the projected bed thickness as the smaller values of t_{max} and t_a.

$t_p = ?\ ft$

14) Seek the value of proportionality constant from Table B-3 2 of Appendix B of the URG. The table is reproduced below for quick reference.

Table B-3: Proportionality Constant, K_p (ft water/(ft^3/s^2), for different strainers and materials

Strainer	1.5 mil Al	6 mil Al	2.5 mil SS NRC	2.5 mil SS C.D.I.
Stacked disk	2.5	0.05	2.0	4.9
Truncated cone	12.5	2.5	10.0	25
60-point star	4.7	0.9	3.7	9.3

15) Calculate the head loss across the RMI bed,

$D_h = K_p U^2 t_p = ?$ ft of water

This value shall be less than 10 feet of water, which is 66% of the maximum tested pressure drop for the different materials where significant bed compression does not occur, and the values of K_p shown in Table B-3 are appropriate.

16) Input NPSH limit available for the strainer design.

$NPSH_D = ?\ ft$

17) Calculate the NPSH design margin left,

$M = D_h - NPSH_D = ?\ ft$

Definition of variables and the associated symbols

Description	Variable	Units
Strainer circumscribed area	A_c	ft^2
Strainer corrected circumscribed area	$A_{c,cor}$	ft^2
Area of RMI foil	A_{foil}	ft^2
Strainer flow rate	Q	gpm
Strainer blockage area	B	ft^2
Strainer Outside diameter	D	ft
Strainer active (hydraulic) length	L	ft
Strainer approach velocity	U	ft/sec
RMI average settling velocity	U_s	ft/sec
Radius for $U=U_s$	t_{max}	ft
Theoretical RMI bed thickness	t_z	ft
Projected bed thickness	t_p	ft
Empirical thickness constant	K_t	ft
Proportionality Constant	K_p	ft $H_2O/(ft^3/s^2)$
Strainer head loss	D_h	ft H_2O
Design head loss limit	$NPSH_D$	ft
NPSH design margin left	M	ft H_2O

6/15/01

This worksheet estimates the increased pool temperature associated with all six ECCS pumps operating during the first 10 minutes		
Core Spray Pump Horsepower @ runout, Hp =	1325	See OPL-4A sheet in NEDC 99-008, or in GE report
RHR Pump Horsepower @ runout, Hp =	1250	See OPL-4A sheet in NEDC 99-008, or in GE report
Total Number of Core Spray Pumps	2	
Total Number of RHR Pumps	4	
Total Number of Core Spray Pumps in GE Analysis	1	See GE containment Analysis Report in NEDC 94-034
Total Number of RHR Pumps in GE Analysis	1	
Duration of run-out flow =	10	min
Conversion from horsepower to Btu's/sec =	0.70679	Btu/sec/hp
Additional Heat Input from Core Spray, Btu's =	561,896.50	
Additional Heat Input from RHR, Btu's =	1,590,273.13	
Total Heat Added	2,152,169.63	Btu
Volume of water in Pool, ft.^3	87,650.00	See OPL-4A sheet
Density of Water, lb'ft^3	62.0578379	based on 95°F initial water temperature
Mass of Water in Suppression Pool, lbm. =	5,439,369	lbm
Specific Heat of Water, Btu/lb-°F =	1	
Pool Heat-up due to pump horsepower	0.4	°F
And this part estimates the increased pool temperature associated with all six ECCS pumps operating during the first 30 minutes		
Core Spray Pump Horsepower @ runout, Hp =	1325	See OPL-4A sheet in NEDC 99-008, or in GE report
RHR Pump Horsepower @ runout, Hp =	1250	See OPL-4A sheet in NEDC 99-008, or in GE report
Total Number of Core Spray Pumps	2	
Total Number of RHR Pumps	4	
Total Number of Core Spray Pumps in GE Analysis	1	See GE containment Analysis Report in NEDC 94-034
Total Number of RHR Pumps in GE Analysis	1	
Duration of run-out flow =	30	min
Conversion from horsepower to Btu's/sec =	0.70679	Btu/sec/hp
Additional Heat Input from Core Spray, Btu's =	1,685,689.51	
Additional Heat Input from RHR, Btu's =	4,770,819.38	
Total Heat Added	6,456,508.89	Btu
Volume of water in Pool, ft.^3	87,650.00	See OPL-4A sheet
Density of Water, lb'ft^3	62.0578379	based on 95°F initial water temperature
Mass of Water in Suppression Pool, lbm. =	5,439,369	lbm
Specific Heat of Water, Btu/lb-°F =	1	
Pool Heat-up due to pump horsepower	1.2	°F

GE Nuclear Energy

SIL
Services Information Letter

Limiting conditions for NPSH calculations

SIL No. 603

September 19, 1996

Introduction

Recently, at a BWR/4 located in the United States, it was discovered that the assumptions used for the design basis calculations for Net Positive Suction Head (NPSH) of the low pressure Emergency Core Cooling Systems (ECCS) may not be consistent with the licensing basis for the plant. This plant was designed prior to the issuance of Regulatory Guide 1.1 (Safety Guide 1), but had later applied Regulatory Guide 1.1 in calculations to demonstrate NPSH margins. Regulatory Guide 1.1 requires NPSH calculations to be performed without taking credit for containment pressurization.

The purpose of this SIL is to advise owners of GE BWRs that the limiting conditions assumed for NPSH analyses can change, based on changes to analysis assumptions or system modifications. This "information only" SIL is applicable to BWR/2s, BWR/3s, and BWR/4s that were not originally designed in accordance with the requirements of Regulatory Guide 1.1.

Discussion

NPSH is calculated by evaluating the different modes of operation as specified on the Process Flow Diagram for each system. For the low pressure ECCS pumps on BWRs that are not required to comply with Regulatory Guide 1.1, the limiting NPSH generally occurs during "long-term" system operation, several hours following a Loss of Coolant Accident (LOCA), when the suppression pool has heated to its maximum value. The "short-term" NPSH (the first 10 minutes of system operation) is generally non-limiting.

However, recent evaluations have shown that certain changes can have the combined effect of making the short-term condition more limiting. For example, analyses for evaluating ECCS pump NPSH may use different core decay heat and feedwater system energy content assumptions than the assumptions used during the original design basis evaluations. When the suppression pool temperature response during the early stages of a LOCA is considered in combination with maximum ECCS flow conditions (no operator action to throttle pump flow is assumed for 10 minutes), and no credit is taken for containment pressure, the short-term condition can become limiting for evaluation of available ECCS pump NPSH.

Examples of changes that can affect calculated ECCS pump NPSH include: 1) system design changes (such as the LPCI-Mod[1] or suppression pool suction strainer modifications); 2) licensing basis changes, (such as application of Regulatory Guide 1.1 or adoption of a higher Technical Specification suppression pool temperature limit), and 3) changes in the analytical assumptions (from those found in the FSAR) used for evaluating ECCS pump NPSH. Other changes can also affect calculated NPSH. Therefore, when low pressure ECCS design or licensing bases are changed, it is important not only to review NPSH analyses, but also to consider whether or not the proposed changes affect the limiting NPSH condition (i.e., the limiting condition may change from long-term to short-term).

At the BWR/4 under discussion, reevaluation indicated that the short-term condition had become the limiting NPSH condition for the Low Pressure Coolant Injection mode of the Residual Heat Removal System. Subsequent evaluations determined that all NPSH requirements were met, and plant safety was not affected.

[1] The LPCI-Mod eliminated the loop selection logic and changed the injection line-up so that two pumps inject into each recirculation loop. No recirculation loop isolation occurs, and if a recirculation loop is broken, the injection flow into that loop is lost through the break.

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To receive additional information on this subject or for assistance in implementing a recommendation, please contact your local GE Nuclear Energy Service Representative.

This SIL pertains only to GE BWRs. The conditions under which GE Nuclear Energy issues SILs are stated in SIL No. 001 Revision 4, the provisions of which are incorporated into this SIL by reference.

Product reference

E11 — Residual Heat Removal
E21 — Core Spray

Technical source

R. W. Howard

Issued by

Original signed by

R. M. Fairfield, Project Manager
Service Information Communications
GE Nuclear Energy
175 Curtner Avenue, San Jose, CA 95125