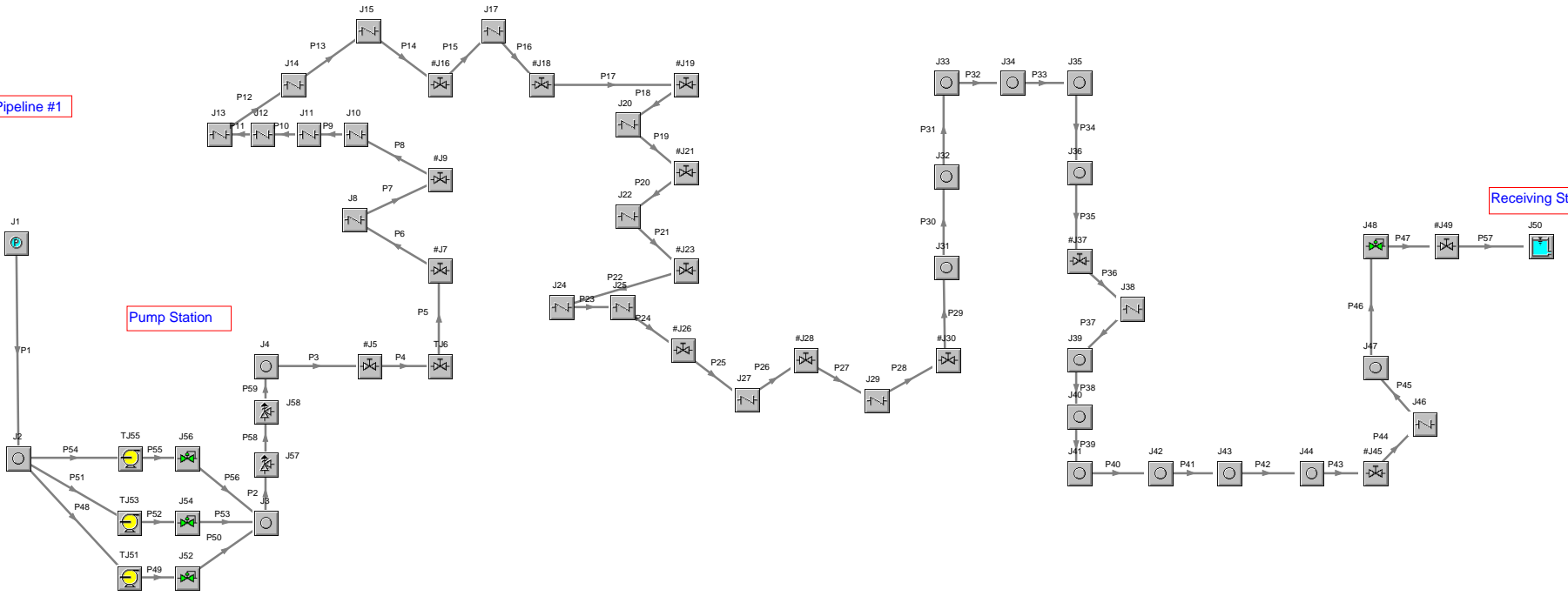


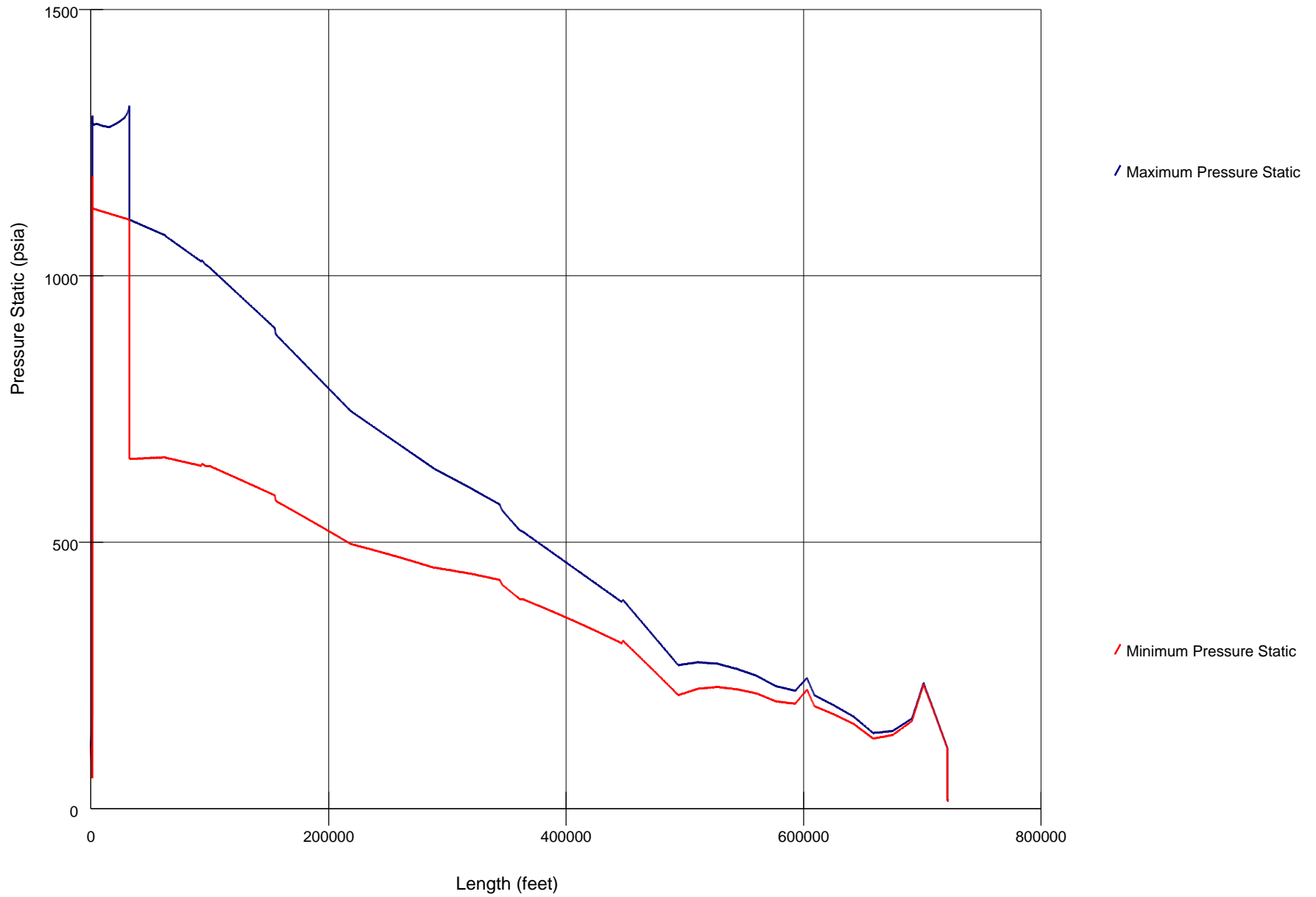
Pipeline #1

Pump Station

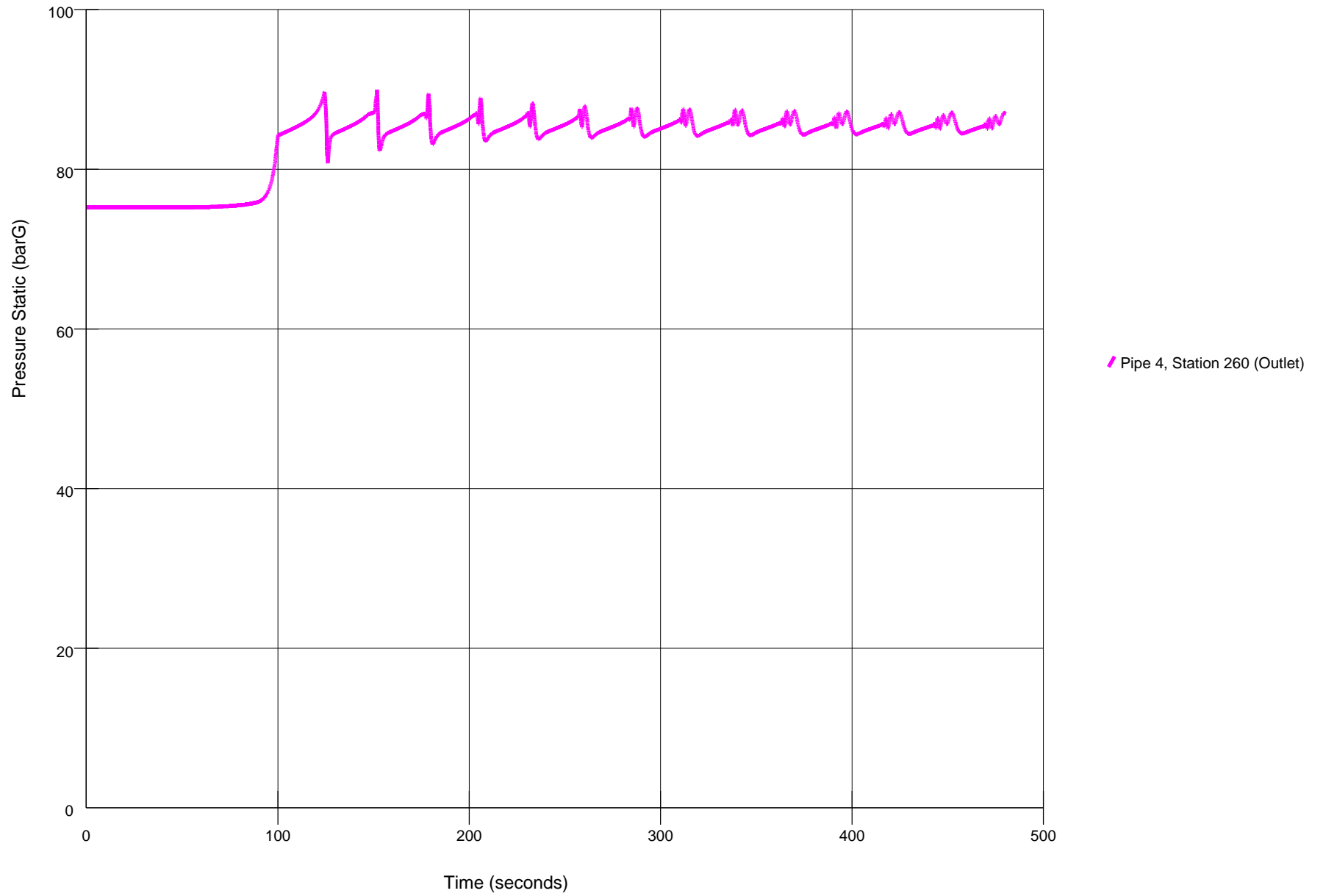
Receiving Station



Maximum / Minimum Pressure Static vs. Length, Pipe 1 - 57



Pressure Static vs. Time



AFT Impulse Model

Title: AFT Impulse Model
 Analysis run on: 7/18/2008 9:04:11 AM
 Application version: AFT Impulse Version 4.0 (2008.08.08)
 Input File: C:\AFT Mark\Samples\Imp\Oil Pipeline.imp
 Output File: C:\AFT Mark\Samples\Imp\Oil Pipeline_1.out

Steady-State Execution Time= 2.70 seconds
 Total Number Of Head/Pressure Iterations= 0
 Total Number Of Flow Iterations= 2
 Number Of Pipes= 59
 Number Of Junctions= 58
 Matrix Method= Gaussian Elimination

Transient Execution Time= 2:33.73 (153.73 seconds)
 Model Start Time= 0 seconds
 Model Stop Time= 480 seconds
 Time Step Size= 4.937522E-02 seconds
 Total Number of Time Steps= 9721
 Transient Cavitation Model= Discrete Vapor Cavity Model
 Artificial Transient Criteria= 0.5%
 Artificial Transient Criteria Minimum Flow= 0 gal/min
 Time Step Output Written to File= 1
 Psi= 0.5

Pressure/Head Tolerance= 0.00001 relative change
 Flow Rate Tolerance= 0.00001 relative change
 Flow Relaxation= (Automatic)
 Pressure Relaxation= (Automatic)

Constant Fluid Property Model
 Fluid Database: Unspecified
 Fluid= Diluente
 Density= 48.8 lbm/ft3
 Viscosity= 0.75 centipoise
 Bulk Modulus= 141250.5 psia
 Vapor Pressure= 1.9 psia
 Viscosity Model= Newtonian

Atmospheric Pressure= 1 atm
 Gravitational Acceleration= 1 g
 Turbulent Flow Above Reynolds Number= 4000
 Laminar Flow Below Reynolds Number= 2300

Total Inflow= 4,566 gal/min
 Total Outflow= 4,566 gal/min

Maximum Steady-State Pressure is 1,262 psia at Junction 51 (P-001-A) Outlet.
 Minimum Steady-State Pressure is 14.70 psia at Junction 57 (Relief Valve) Outlet.
 Maximum Transient Pressure is 1,319 psia at Pipe 4 Station 260.
 Minimum Transient Pressure is 14.83 psia at Pipe 57 Station 0.

Pump Summary

Jct	Name	Vol. Flow (gal/min)	Mass Flow (lbm/sec)	dP (psid)	dH (feet)	Overall Efficiency (Percent)	Speed (Percent)	Overall Power (hp)	BEP (gal/min)	% of BEP (Percent)	NPSHA (feet)	NPSHR (feet)
51	P-001-A	1,522	165.5	1,148	3,387	86.69	100.0	1,175	1,053	144.5	330.7	N/A
53	P-001-A	1,522	165.5	1,148	3,387	86.69	100.0	1,175	1,053	144.5	330.7	N/A
55	P-001-A	1,522	165.5	1,148	3,387	86.69	100.0	1,175	1,053	144.5	330.7	N/A

Valve Summary

AFT Impulse Model

Jct	Name	Valve Type	Vol. Flow (gal/min)	Mass Flow (lbm/sec)	dP Stag. (psid)	dH (feet)	P Inlet Static (psia)	Cv	K	Valve State
48	Control Valve	PSV	4,566	496.4	99.36	293.2	114.7	405.2	744.7	Open
52	Control Valve	FCV	1,522	165.5	134.67	397.4	1,261.1	116.0	1,459.7	Open
54	Control Valve	FCV	1,522	165.5	134.67	397.4	1,261.1	116.0	1,459.7	Open
56	Control Valve	FCV	1,522	165.5	134.67	397.4	1,261.1	116.0	1,459.7	Open
57	Relief Valve	RELIEF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Closed
58	Relief Valve	RELIEF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Closed

Pipe Output Table

Pipe	Name	Vol. Flow (gal/min)	Velocity (feet/sec)	P Static Max (psig)	P Static Min (psig)	dP Static Total (psid)	dP Gravity (psid)	P Static In (psig)	P Static Out (psig)
1	Pipe	4,566	4.937	100.0000	99.2898	0.71019	0.000000	100.0000	99.2898
2	Pipe	4,566	4.937	1,111.6843	1,111.5671	0.11718	0.000000	1,111.6843	1,111.5671
3	Pipe	4,566	4.937	1,111.3328	1,110.9777	0.35509	0.000000	1,111.3328	1,110.9777
4	Pipe	4,566	4.937	1,110.9669	1,090.6414	20.32556	-12.087481	1,110.9669	1,090.6414
5	Pipe	4,566	4.937	1,090.6305	1,061.5361	29.09436	-3.176639	1,090.6305	1,061.5361
6	Pipe	4,566	4.937	1,061.5253	1,059.3995	2.12574	1.032568	1,061.5253	1,059.3995
7	Pipe	4,566	4.937	1,059.3225	1,012.4993	46.82317	14.850960	1,059.3225	1,012.4993
8	Pipe	4,566	4.937	1,014.5284	1,012.4885	-2.03989	-3.176639	1,012.4885	1,014.5284
9	Pipe	4,566	4.937	1,014.4514	1,010.9777	3.47367	1.111840	1,014.4514	1,010.9777
10	Pipe	4,566	4.937	1,010.9007	1,007.0354	3.86525	2.068023	1,010.9007	1,007.0354
11	Pipe	4,566	4.937	1,006.9584	1,004.8984	2.06000	0.000000	1,006.9584	1,004.8984
12	Pipe	4,566	4.937	1,004.8214	1,002.7614	2.06000	0.000000	1,004.8214	1,002.7614
13	Pipe	4,566	4.937	1,002.6844	1,001.1825	1.50192	0.155661	1,002.6844	1,001.1825
14	Pipe	4,566	4.937	1,001.1055	887.1216	113.98392	53.844635	1,001.1055	887.1216
15	Pipe	4,566	4.937	887.1107	874.9058	12.20496	10.642097	887.1107	874.9058
16	Pipe	4,566	4.937	874.8287	731.5262	143.30258	75.128487	874.8287	731.5262
17	Pipe	4,566	4.937	731.5153	624.5112	107.00417	31.766716	731.5153	624.5112
18	Pipe	4,566	4.937	624.5003	621.7330	2.76729	-0.002896	624.5003	621.7330
19	Pipe	4,566	4.937	621.6560	584.7350	36.92097	3.179876	621.6560	584.7350
20	Pipe	4,566	4.937	584.7242	582.8418	1.88245	0.000000	584.7242	582.8418
21	Pipe	4,566	4.937	582.7648	557.0046	25.76013	3.176628	582.7648	557.0046
22	Pipe	4,566	4.937	556.9938	555.7757	1.21810	0.003227	556.9938	555.7757
23	Pipe	4,566	4.937	555.6987	544.8906	10.80814	7.938530	555.6987	544.8906
24	Pipe	4,566	4.937	544.8135	508.5031	36.31052	20.648333	544.8135	508.5031
25	Pipe	4,566	4.937	508.4922	503.9338	4.55841	-0.001448	508.4922	503.9338
26	Pipe	4,566	4.937	503.8568	373.3947	130.46217	41.298420	503.8568	373.3947
27	Pipe	4,566	4.937	377.1841	373.3838	-3.80026	-5.241422	373.3838	377.1841
28	Pipe	4,566	4.937	377.1071	254.6686	122.43851	71.951836	377.1071	254.6686
29	Pipe	4,566	5.033	260.0471	254.6526	-5.39445	-24.031532	254.6526	260.0471
30	Pipe	4,566	5.033	260.0471	257.3093	2.73775	-15.899337	260.0471	257.3093
31	Pipe	4,566	5.033	257.3093	247.5670	9.74235	-8.894737	257.3093	247.5670
32	Pipe	4,566	5.033	247.5670	234.9338	12.63316	-6.003922	247.5670	234.9338
33	Pipe	4,566	5.033	234.9338	215.2961	19.63774	1.000657	234.9338	215.2961
34	Pipe	4,566	5.033	215.2961	206.5544	8.74173	-9.895352	215.2961	206.5544
35	Pipe	4,566	5.033	230.3071	206.5544	-23.75269	-35.022999	206.5544	230.3071
36	Pipe	4,566	5.033	230.2962	225.5449	4.75132	3.446722	230.2962	225.5449
37	Pipe	4,566	5.033	225.4648	197.8561	27.60875	21.458509	225.4648	197.8561
38	Pipe	4,566	5.033	197.8561	178.8854	18.97066	0.333573	197.8561	178.8854
39	Pipe	4,566	5.033	178.8854	157.9135	20.97193	2.334846	178.8854	157.9135
40	Pipe	4,566	5.033	157.9135	127.2685	30.64497	12.007886	157.9135	127.2685
41	Pipe	4,566	5.033	131.0907	127.2685	-3.82210	-22.459187	127.2685	131.0907

AFT Impulse Model

Pipe	Name	Vol. Flow (gal/min)	Velocity (feet/sec)	P Static Max (psig)	P Static Min (psig)	dP Static Total (psid)	dP Gravity (psid)	P Static In (psig)	P Static Out (psig)
42	Pipe	4,566	5.033	154.5923	131.0907	-23.50165	-42.138737	131.0907	154.5923
43	Pipe	4,566	5.033	221.5955	154.5923	-67.00323	-78.273537	154.5923	221.5955
44	Pipe	4,566	5.033	221.5847	213.6091	7.97562	6.671027	221.5847	213.6091
45	Pipe	4,566	5.033	213.5290	181.8065	31.72256	25.572325	213.5290	181.8065
46	Pipe	4,566	5.033	181.8065	100.0000	81.80644	66.710411	181.8065	100.0000
47	Pipe	4,566	5.033	0.6353	0.2626	0.37274	0.000000	0.6353	0.2626
48	Pipe	1,522	2.609	99.3823	99.2415	0.14083	0.000000	99.3823	99.2415
49	Pipe	1,522	4.185	1,246.8905	1,246.4362	0.45435	0.000000	1,246.8905	1,246.4362
50	Pipe	1,522	1.678	1,111.8455	1,111.7979	0.04760	0.000000	1,111.8455	1,111.7979
51	Pipe	1,522	2.609	99.3823	99.2415	0.14083	0.000000	99.3823	99.2415
52	Pipe	1,522	4.185	1,246.8905	1,246.4362	0.45435	0.000000	1,246.8905	1,246.4362
53	Pipe	1,522	1.646	1,111.8438	1,111.7983	0.04539	0.000000	1,111.8438	1,111.7983
54	Pipe	1,522	2.609	99.3823	99.2415	0.14083	0.000000	99.3823	99.2415
55	Pipe	1,522	4.185	1,246.8905	1,246.4362	0.45435	0.000000	1,246.8905	1,246.4362
56	Pipe	1,522	1.646	1,111.8438	1,111.7983	0.04539	0.000000	1,111.8438	1,111.7983
57	Pipe	4,566	5.100	3.2519	0.2482	-3.00370	-3.388868	0.2482	3.2519
58	Pipe	4,566	4.937	1,111.5671	1,111.4500	0.11718	0.000000	1,111.5671	1,111.4500
59	Pipe	4,566	4.937	1,111.4500	1,111.3328	0.11718	0.000000	1,111.4500	1,111.3328

Pipe Transient Max/Min Results

Pipe	Max. Static Pressure (psig)	Max. Static Pressure Time (seconds)	Max. Static Pressure Station	Min. Static Pressure (psig)	Min. Static Pressure Time (seconds)	Min. Static Pressure Station
1	152.3385	112.2	6	48.4930	115.5	6
2	1,269.9670	137.7	0	1,111.5671	5.333	1
3	1,269.4253	137.4	0	1,110.9777	4.691	3
4	1,304.4366	151.8	260	1,090.6412	0.000	260
5	1,090.6305	0.000	0	641.6121	480.0	0
6	1,061.5253	4.296	0	643.7724	480.0	8
7	1,059.3225	1.136	0	628.8061	480.0	256
8	1,014.5284	11.60	5	628.8061	480.0	0
9	1,014.4514	23.11	0	630.8342	480.0	15
10	1,010.9007	10.96	0	628.7457	480.0	10
11	1,006.9584	24.98	0	628.7222	480.0	12
12	1,004.8214	19.50	0	628.6974	480.0	12
13	1,002.6844	16.79	0	628.5229	480.0	7
14	1,001.1055	23.60	0	573.1349	480.0	478
15	887.1108	26.02	0	562.4150	480.0	8
16	874.8288	19.70	0	482.0049	480.0	546
17	731.5154	74.61	0	437.8112	480.0	603
18	624.5004	76.14	0	437.1812	480.0	18
19	621.6561	68.78	0	425.4294	480.0	271
20	584.7242	58.36	0	424.8788	480.0	11
21	582.7648	54.81	0	414.7771	480.0	180
22	556.9938	60.39	0	414.3575	480.0	6
23	555.6987	63.40	0	405.4303	480.0	19
24	544.8136	24.39	0	379.3240	480.0	124
25	508.4922	50.56	0	377.6416	480.0	32
26	503.8568	54.56	0	295.8038	480.0	714
27	377.1841	18.47	11	295.7975	480.0	0
28	377.1071	0.000	0	198.3955	480.0	404
29	260.0471	37.62	138	198.3848	480.0	0

AFT Impulse Model

Pipe	Max. Static Pressure (psig)	Max. Static Pressure Time (seconds)	Max. Static Pressure Station	Min. Static Pressure (psig)	Min. Static Pressure Time (seconds)	Min. Static Pressure Station
30	260.0471	37.62	0	210.3216	480.0	0
31	257.3094	31.35	0	209.3246	480.0	138
32	247.5670	20.79	0	201.7304	480.0	138
33	234.9338	17.73	0	186.7088	480.0	138
34	215.2961	10.91	0	182.1946	480.0	138
35	230.3071	0.000	83	182.1946	480.0	0
36	230.2962	0.4444	0	203.8365	480.0	10
37	225.4649	2.222	0	177.4037	480.0	46
38	197.8561	6.863	0	161.9974	480.0	138
39	178.8855	13.63	0	144.3331	480.0	138
40	157.9135	20.49	0	116.7618	480.0	138
41	131.0907	39.85	138	116.7618	480.0	0
42	154.5923	4.543	138	123.4823	480.0	0
43	221.5955	0.4938	83	149.7529	480.0	0
44	221.5847	0.000	0	210.5832	480.0	10
45	213.5290	1.975	0	179.6670	480.0	46
46	181.8065	4.246	0	100.0000	372.8	112
47	0.7758	392.7	0	0.1459	392.3	3
48	158.5708	112.1	3	42.5518	115.4	3
49	1,286.0005	111.1	3	1,165.8729	112.7	0
50	1,271.1831	137.7	0	1,111.7979	2,370	3
51	158.8113	114.5	3	42.2068	117.7	3
52	1,286.0026	111.1	3	1,165.4441	112.7	0
53	1,271.1094	137.7	0	1,111.7983	2,370	3
54	158.8113	114.5	3	42.2068	117.7	3
55	1,286.0026	111.1	3	1,165.4441	112.7	0
56	1,271.1094	137.7	0	1,111.7983	2,370	3
57	3.2671	479.6	3	0.1318	392.3	0
58	1,269.6241	137.5	0	1,111.4500	5,431	1
59	1,269.5229	137.5	0	1,111.3328	5,481	1

All Junction Table

Jct	Name	P Static In (psig)	P Static Out (psig)	P Stag. In (psia)	P Stag. Out (psia)	Vol. Flow Rate Jct Net (gal/min)	Mass Flow Rate Jct Net (lbm/sec)	Loss Factor (K)
1	Assigned Pressure	100.0000	100.0000	114.82	114.82	4,566	496.4	0.00000
2	Branch	99.3645	99.3645	114.11	114.11	0	0.0	0.00000
3	Branch	1,111.7803	1,111.7803	1,126.51	1,126.51	0	0.0	0.00000
4	Branch	1,111.3328	1,111.3328	1,126.16	1,126.16	0	0.0	0.00000
5	212MV	1,110.9777	1,110.9669	1,125.80	1,125.79	0	0.0	0.08441
6	211MV	1,090.6414	1,090.6305	1,105.47	1,105.45	0	0.0	0.08441
7	210MV	1,061.5361	1,061.5253	1,076.36	1,076.35	0	0.0	0.08441
8	Check Valve 1	1,059.3995	1,059.3225	1,074.22	1,074.15	0	0.0	0.60000
9	209MV	1,012.4993	1,012.4885	1,027.32	1,027.31	0	0.0	0.08441
10	Check Valve 2	1,014.5284	1,014.4514	1,029.35	1,029.28	0	0.0	0.60000
11	Check Valve 3	1,010.9777	1,010.9007	1,025.80	1,025.72	0	0.0	0.60000
12	Check Valve 4	1,007.0354	1,006.9584	1,021.86	1,021.78	0	0.0	0.60000
13	Check Valve 5	1,004.8984	1,004.8214	1,019.72	1,019.65	0	0.0	0.60000
14	Check Valve 6	1,002.7614	1,002.6844	1,017.59	1,017.51	0	0.0	0.60000
15	Check Valve 7	1,001.1825	1,001.1055	1,016.01	1,015.93	0	0.0	0.60000
16	208MV	887.1216	887.1107	901.95	901.94	0	0.0	0.08441
17	Check Valve	874.9058	874.8287	889.73	889.65	0	0.0	0.60000

AFT Impulse Model

Jct	Name	P Static In (psig)	P Static Out (psig)	P Stag. In (psia)	P Stag. Out (psia)	Vol. Flow Rate Jct Net (gal/min)	Mass Flow Rate Jct Net (lbm/sec)	Loss Factor (K)
18	207MV	731.5262	731.5153	746.35	746.34	0	0.0	0.08441
19	206MV	624.5112	624.5003	639.34	639.32	0	0.0	0.08441
20	Check Valve 9	621.7330	621.6560	636.56	636.48	0	0.0	0.60000
21	205MV	584.7350	584.7242	599.56	599.55	0	0.0	0.08441
22	Check Valve 10	582.8418	582.7648	597.67	597.59	0	0.0	0.60000
23	204MV	557.0046	556.9938	571.83	571.82	0	0.0	0.08441
24	Check Valve 11	555.7757	555.6987	570.60	570.52	0	0.0	0.60000
25	Check Valve 12	544.8906	544.8135	559.71	559.64	0	0.0	0.60000
26	203MV	508.5031	508.4922	523.33	523.32	0	0.0	0.08441
27	Check Valve 13	503.9338	503.8568	518.76	518.68	0	0.0	0.60000
28	202MV	373.3947	373.3838	388.22	388.21	0	0.0	0.08441
29	Check Valve 14	377.1841	377.1071	392.01	391.93	0	0.0	0.60000
30	PTO	254.6686	254.6526	269.49	269.48	0	0.0	0.08441
31	Branch	260.0471	260.0471	274.88	274.88	0	0.0	0.00000
32	Branch	257.3093	257.3093	272.14	272.14	0	0.0	0.00000
33	Branch	247.5670	247.5670	262.40	262.40	0	0.0	0.00000
34	Branch	234.9338	234.9338	249.76	249.76	0	0.0	0.00000
35	Branch	215.2961	215.2961	230.13	230.13	0	0.0	0.00000
36	Branch	206.5544	206.5544	221.38	221.38	0	0.0	0.00000
37	101MV	230.3071	230.2962	245.14	245.13	0	0.0	0.08119
38	Check Valve 15	225.5449	225.4648	240.37	240.29	0	0.0	0.60000
39	Branch	197.8561	197.8561	212.69	212.69	0	0.0	0.00000
40	Branch	178.8854	178.8854	193.71	193.71	0	0.0	0.00000
41	Branch	157.9135	157.9135	172.74	172.74	0	0.0	0.00000
42	Branch	127.2685	127.2685	142.10	142.10	0	0.0	0.00000
43	Branch	131.0907	131.0907	145.92	145.92	0	0.0	0.00000
44	Branch	154.5923	154.5923	169.42	169.42	0	0.0	0.00000
45	101MV	221.5955	221.5847	236.42	236.41	0	0.0	0.08119
46	Check Valve 16	213.6091	213.5290	228.44	228.36	0	0.0	0.60000
47	Branch	181.8065	181.8065	196.64	196.64	0	0.0	0.00000
48	Control Valve	100.0000	0.6353	114.83	15.46	0	0.0	744.70111
49	101MV	0.2626	0.2482	15.09	15.08	0	0.0	0.08119
50	Reservoir	0.0000	3.3889	14.70	18.08	-4.566	-496.4	0.00000
51	P-001-A	99.2415	1,246.8905	113.97	1,261.68	0	0.0	0.00000
52	Control Valve	1,246.4362	1,111.8455	1,261.22	1,126.56	0	0.0	1,459.70239
53	P-001-A	99.2415	1,246.8905	113.97	1,261.68	0	0.0	0.00000
54	Control Valve	1,246.4362	1,111.8438	1,261.22	1,126.55	0	0.0	1,459.72632
55	P-001-A	99.2415	1,246.8905	113.97	1,261.68	0	0.0	0.00000
56	Control Valve	1,246.4362	1,111.8438	1,261.22	1,126.55	0	0.0	1,459.72632
57	Relief Valve	N/A	0.0000	1,126.39	14.70	0	0.0	0.00000
58	Relief Valve	N/A	0.0000	1,126.27	14.70	0	0.0	0.00000