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APPENDIX A

Shortcut Distillation Output

Feed 1 scheme 1

UNIT 1, 'COL1', 'DEISOB'

FEEDS

STREAM PHASE
1 LIQUID

PRODUCTS

		TOTAL STREAM RATES					
STREAM + PHASE	PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
2	V	1156.94	51009.11	1611.25	439041.05	1	26.46
3	L	387.58	22503.29	641.17	147080.13	2	68.75
4	L	372.33	21965.47	599.86	141292.13		
TOTALS		1916.84	95477.87	2852.28	727413.31		95.21

Feed 1 scheme 2

UNIT 1, 'COL1', 'DEPRO'

FEEDS

STREAM PHASE
1 LIQUID

PRODUCTS

		TOTAL STREAM RATES					
STREAM + PHASE	PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
2	V	1157.81	51071.45	1612.91	439373.31	1	20.45
3	L	759.03	44431.03	1239.59	288039.99		
TOTALS		1916.84	95502.48	2852.51	727413.31		20.45

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.59476
 FEED CONDITION Q 1.38099
 FENSKE MINIMUM TRAYS 20.44599
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
47	18	1.150	2.277	1.834	-1.215E+01	2.384E+01
43	17	1.225	2.117	1.954	-1.294E+01	2.464E+01
41	16	1.300	1.987	2.073	-1.373E+01	2.543E+01
38	15	1.375	1.881	2.193	-1.452E+01	2.622E+01
37	14	1.450	1.791	2.312	-1.532E+01	2.701E+01

UNIT 2, 'COL2', 'DEISOB'

FEEDS

STREAM PHASE
3 LIQUID

PRODUCTS		TOTAL STREAM RATES						
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS	
4	L	386.82	22471.40	639.97	146792.11	1	56.64	
5	L	372.21	21959.63	599.62	141247.89			
TOTALS		759.03	44431.03	1239.59	288039.99		56.64	

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 6.12676
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 56.64139
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
120	46	1.150	2.112	7.046	-2.412E+01	2.179E+01
110	42	1.225	1.936	7.505	-2.550E+01	2.317E+01
102	39	1.300	1.801	7.965	-2.688E+01	2.455E+01
96	37	1.375	1.694	8.424	-2.826E+01	2.593E+01
92	35	1.450	1.633	8.884	-2.963E+01	2.730E+01

Feed 1 scheme 3

UNIT 1, 'COL1', 'DEBUT'

FEEDS

STREAM PHASE
1 LIQUID

PRODUCTS		TOTAL STREAM RATES						
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS	
2	L	1544.31	73524.14	2252.34	586043.11	1	58.97	
3	L	372.53	21978.36	600.17	141370.19			
TOTALS		1916.84	95502.50	2852.51	727413.31		58.97	

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 2.22029
 FEED CONDITION Q 1.38099
 FENSKE MINIMUM TRAYS 58.96978
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
130	75	1.150	2.197	2.553	-3.572E+01	3.921E+01
120	70	1.225	2.034	2.720	-3.739E+01	4.088E+01
112	65	1.300	1.905	2.886	-3.906E+01	4.256E+01
106	62	1.375	1.799	3.053	-4.074E+01	4.423E+01
101	59	1.450	1.712	3.219	-4.241E+01	4.591E+01

UNIT 3, 'COL2', 'DEISOB'

FEEDS

STREAM	PHASE
4	LIQUID

PRODUCTS

STREAM + PHASE		TOTAL STREAM RATES				SECTION	NUM TRAYS
		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR		
5	V	1156.49	50990.18	1610.64	438870.26	1	23.92
6	L	387.82	22533.95	641.69	147172.85		
TOTALS		1544.31	73524.12	2252.34	586043.11		23.92

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.56153
FEED CONDITION Q	1.10905
FENSKE MINIMUM TRAYS	23.91532
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
54	32	1.150	2.271	1.796	-1.187E+01	1.977E+01
51	30	1.225	2.113	1.913	-1.264E+01	2.054E+01
47	28	1.300	1.984	2.030	-1.341E+01	2.132E+01
45	26	1.375	1.879	2.147	-1.419E+01	2.209E+01
43	25	1.450	1.790	2.264	-1.496E+01	2.286E+01

Feed 1 scheme 4

UNIT 1, 'COL1', 'DEPRO'

FEEDS

STREAM	PHASE
1	LIQUID

PRODUCTS

STREAM + PHASE		TOTAL STREAM RATES				SECTION	NUM TRAYS
		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR		
2	V	1156.85	51015.36	1611.32	439009.08	1	21.70
3	L	759.99	44487.06	1241.19	288404.23		
TOTALS		1916.84	95502.42	2852.51	727413.31		21.70

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.60209
FEED CONDITION Q	1.38099
FENSKE MINIMUM TRAYS	21.70103
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
49	23	1.150	2.273	1.842	-1.218E+01	2.387E+01
46	21	1.225	2.113	1.963	-1.298E+01	2.467E+01
43	20	1.300	1.984	2.083	-1.377E+01	2.546E+01
41	19	1.375	1.878	2.203	-1.457E+01	2.626E+01
39	18	1.450	1.788	2.323	-1.536E+01	2.705E+01

UNIT 2, 'COL2', 'DEISOB1'

FEEDS

STREAM	PHASE
3	LIQUID

PRODUCTS		TOTAL STREAM RATES					
		MOLES	WEIGHT	LIQUID VOL	NORM VAPOR(1)		NUM
STREAM + PHASE		LB-MOL/HR	LB/HR	FT3/HR	FT3/HR	SECTION	TRAYS
4	L	457.33	26570.22	752.48	173551.21	1	35.29
5	L	302.65	17916.85	488.70	114853.02		
TOTALS		759.99	44487.06	1241.19	288404.23		35.29

SUMMARY OF UNDERWOOD CALCULATIONS
 MINIMUM REFLUX RATIO 3.98446
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 35.28775
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR CONDENSER	REBOILER
76	6	1.150	2.153	4.582	-1.976E+01	1.758E+01
70	5	1.225	1.979	4.881	-2.082E+01	1.864E+01
65	5	1.300	1.844	5.180	-2.188E+01	1.970E+01
61	5	1.375	1.737	5.479	-2.294E+01	2.076E+01
59	4	1.450	1.662	5.777	-2.400E+01	2.181E+01

UNIT 3, 'COL3', 'DEISOB2'

FEEDS

STREAM PHASE
4 LIQUID

PRODUCTS		TOTAL STREAM RATES					
		MOLES	WEIGHT	LIQUID VOL	NORM VAPOR(1)		NUM
STREAM + PHASE		LB-MOL/HR	LB/HR	FT3/HR	FT3/HR	SECTION	TRAYS
6	L	386.83	22472.03	639.99	146794.61	1	42.11
7	L	70.51	4098.19	112.50	26756.61		
TOTALS		457.33	26570.22	752.48	173551.21		42.11

SUMMARY OF UNDERWOOD CALCULATIONS
 MINIMUM REFLUX RATIO 3.72041
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 42.11247
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR CONDENSER	REBOILER
91	55	1.150	2.154	4.278	-1.583E+01	1.575E+01
83	51	1.225	1.981	4.557	-1.666E+01	1.658E+01
78	47	1.300	1.847	4.837	-1.750E+01	1.742E+01
73	44	1.375	1.740	5.116	-1.834E+01	1.826E+01
70	42	1.450	1.663	5.395	-1.917E+01	1.909E+01

Feed 2 scheme 1

UNIT 1, 'COL1', 'DEISOB'

FEEDS

STREAM PHASE
2 LIQUID

PRODUCTS		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
3	V	1061.8	46770.04	1300.05	402529.53	1	19.98
4	L	270.1	15610.09	540.38	102333.14	2	68.62
5	L	264.0	15601.11	510.57	100773.74		
TOTALS		1595.9	77981.24	2351.00	605636.41		88.60

Feed 2 scheme 2

'COL1', 'DEPRO'

FEEDS

STREAM PHASE
2 LIQUID

PRODUCTS		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
3	V	1062.83	46751.25	1480.06	403329.62	1	21.82
4	L	533.12	31229.94	870.94	202309.25		
TOTALS		1595.95	77981.19	2351.00	605638.87		21.82

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.48518
 FEED CONDITION Q 1.42049
 FENSKE MINIMUM TRAYS 21.81877
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
50	19	1.150	2.283	1.708	-1.033E+01	2.108E+01
46	17	1.225	2.125	1.819	-1.100E+01	2.175E+01
44	16	1.300	1.998	1.931	-1.167E+01	2.243E+01
41	15	1.375	1.892	2.042	-1.235E+01	2.310E+01
39	15	1.450	1.803	2.154	-1.302E+01	2.377E+01

'COL2', 'DEISOB'

FEEDS

STREAM PHASE
4 LIQUID

PRODUCTS		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
5	L	268.54	15603.28	444.33	101906.91	1	47.06
6	L	264.58	15626.65	426.61	100402.34		
TOTALS		533.12	31229.94	870.94	202309.25		47.06

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 6.16033
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 47.06480
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
100	49	1.150	2.116	7.084	-1.683E+01	1.515E+01
91	45	1.225	1.939	7.546	-1.779E+01	1.611E+01
85	42	1.300	1.804	8.008	-1.875E+01	1.707E+01
80	39	1.375	1.696	8.470	-1.971E+01	1.804E+01
77	38	1.450	1.635	8.932	-2.067E+01	1.900E+01

Feed 2 scheme 3

'COL1', 'DEBUT'

FEEDS

STREAM 2
PHASE LIQUID

PRODUCTS		TOTAL STREAM RATES					NUM
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	TRAYS	
3	L	1331.12	62339.90	1923.98	505140.92	1	59.21
4	L	264.83	15641.30	427.02	100497.96		
TOTALS		1595.95	77981.20	2351.00	605638.87		59.21

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.93865
 FEED CONDITION Q 1.42049
 FENSKE MINIMUM TRAYS 59.21027
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
131	81	1.150	2.213	2.229	-2.737E+01	3.097E+01
122	75	1.225	2.053	2.375	-2.860E+01	3.220E+01
114	71	1.300	1.925	2.520	-2.984E+01	3.344E+01
108	67	1.375	1.820	2.666	-3.107E+01	3.467E+01
103	64	1.450	1.733	2.811	-3.230E+01	3.590E+01

'COL2', 'DEISOB'

FEEDS

STREAM 5
PHASE LIQUID

PRODUCTS		TOTAL STREAM RATES					NUM
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	TRAYS	
6	V	1062.58	46736.62	1479.64	403232.43	1	21.57
7	L	268.54	15603.27	444.33	101908.48		
TOTALS		1331.12	62339.90	1923.98	505140.92		21.57

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.47464
 FEED CONDITION Q 1.09223
 FENSKE MINIMUM TRAYS 21.56710
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
49	22	1.150	2.285	1.696	-1.025E+01	1.723E+01
46	20	1.225	2.127	1.806	-1.092E+01	1.790E+01
43	19	1.300	1.999	1.917	-1.158E+01	1.856E+01
41	18	1.375	1.894	2.028	-1.225E+01	1.923E+01
39	17	1.450	1.805	2.138	-1.292E+01	1.990E+01

Feed 2 scheme 4

'COL1', 'DEPRO'

FEEDS

STREAM 2
PHASE LIQUID

PRODUCTS		TOTAL STREAM RATES					NUM
STREAM + PHASE	PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	TRAYS
3	V	1062.28	46722.54	1479.21	403118.72	1	21.60
4	L	533.67	31258.66	871.79	202520.15		
TOTALS		1595.95	77981.20	2351.00	605638.87		21.60

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.48806
 FEED CONDITION Q 1.42049
 FENSKE MINIMUM TRAYS 21.60454
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
49	23	1.150	2.283	1.711	-1.034E+01	2.109E+01
46	21	1.225	2.126	1.823	-1.101E+01	2.176E+01
43	20	1.300	1.998	1.934	-1.169E+01	2.244E+01
41	19	1.375	1.892	2.046	-1.236E+01	2.311E+01
39	18	1.450	1.803	2.158	-1.303E+01	2.378E+01

'COL2', 'DEISOB1'

FEEDS

STREAM 4
PHASE LIQUID

PRODUCTS		TOTAL STREAM RATES					NUM
STREAM + PHASE	PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	TRAYS
5	L	318.40	18497.62	523.82	120827.12	1	35.32
6	L	215.27	12761.03	347.97	81693.03		
TOTALS		533.67	31258.66	871.79	202520.15		35.32

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 4.00014
 FEED CONDITION Q .99926
 FENSKE MINIMUM TRAYS 35.32378
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
76	6	1.150	2.153	4.600	-1.381E+01	1.224E+01
70	5	1.225	1.979	4.900	-1.455E+01	1.298E+01
65	5	1.300	1.844	5.200	-1.529E+01	1.371E+01
61	5	1.375	1.736	5.500	-1.603E+01	1.445E+01
59	4	1.450	1.662	5.800	-1.677E+01	1.519E+01

'COL3', 'DEISOB2'

FEEDS

STREAM	PHASE	TOTAL STREAM RATES					NUM
5	LIQUID	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	TRAYS
7	L	268.54	15599.70	444.28	101906.90	1	43.39
8	L	49.86	2897.92	79.55	18920.22		
TOTALS		318.40	18497.62	523.82	120827.12		43.39

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 3.73705
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 43.38839
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
93	59	1.150	2.153	4.298	-1.103E+01	1.097E+01
86	54	1.225	1.980	4.578	-1.161E+01	1.156E+01
80	50	1.300	1.846	4.858	-1.219E+01	1.214E+01
75	47	1.375	1.739	5.138	-1.278E+01	1.272E+01
72	45	1.450	1.663	5.419	-1.336E+01	1.331E+01

Feed 3 scheme 1

UNIT 1, 'COL1', 'DEISOB'

FEEDS

STREAM	PHASE	TOTAL STREAM RATES					NUM
1	LIQUID	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	TRAYS
3	V	782.4	34490.84	1201.09	297121.71	1	26.79
4	L	300.2	17740.09	420.51	114067.57	2	75.58
5	L	270.0	16484.11	397.27	102116.33		
TOTALS		1352.6	67715.04	2018.87	513305.60		102.37

Feed 3 scheme 2

'COL1', 'DEPRO'

FEEDS

STREAM	PHASE
1	LIQUID

PRODUCTS

----- TOTAL STREAM RATES -----						
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
2	V	782.58	34489.80	1089.96	1	21.39
3	L	570.07	33225.17	928.90		
TOTALS		1352.64	67714.97	2018.87		21.39

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.61687

FEED CONDITION Q 1.54636

FENSKE MINIMUM TRAYS 21.39061

OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
49	24	1.150	2.272	1.859	-8.308E+00	1.702E+01
45	22	1.225	2.112	1.981	-8.850E+00	1.757E+01
42	21	1.300	1.983	2.102	-9.392E+00	1.811E+01
40	20	1.375	1.876	2.223	-9.934E+00	1.865E+01
38	19	1.450	1.787	2.344	-1.048E+01	1.919E+01

'COL2', 'DEISOB'

FEEDS

STREAM	PHASE
3	LIQUID

PRODUCTS

----- TOTAL STREAM RATES -----						
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
4	L	299.55	17399.24	495.55	1	52.26
5	L	270.52	15825.93	433.35		
TOTALS		570.07	33225.17	928.90		52.26

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 6.00045

FEED CONDITION Q 1.00000

FENSKE MINIMUM TRAYS 52.26199

OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
111	83	1.150	2.115	6.901	-1.834E+01	1.659E+01
101	76	1.225	1.939	7.351	-1.939E+01	1.763E+01
94	71	1.300	1.804	7.801	-2.043E+01	1.868E+01
89	67	1.375	1.697	8.251	-2.148E+01	1.972E+01
85	64	1.450	1.635	8.701	-2.252E+01	2.077E+01

Feed 3 scheme 3

'COL1', 'DEBUT'

FEEDS

STREAM	PHASE
1	LIQUID

PRODUCTS

----- TOTAL STREAM RATES -----						
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
2	L	1082.87	51932.55	1586.73	1	59.13
3	L	269.77	15782.44	432.13		
TOTALS		1352.64	67714.99	2018.87		59.13

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	2.30745
FEED CONDITION Q	1.54636
FENSKE MINIMUM TRAYS	59.12681
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
130	75	1.150	2.193	2.654	-2.601E+01	2.902E+01
120	69	1.225	2.029	2.827	-2.724E+01	3.025E+01
112	65	1.300	1.899	3.000	-2.847E+01	3.148E+01
106	61	1.375	1.794	3.173	-2.970E+01	3.272E+01
101	58	1.450	1.707	3.346	-3.094E+01	3.395E+01

'COL2', 'DEISOB'

FEEDS

STREAM	PHASE
4	LIQUID

PRODUCTS

----- TOTAL STREAM RATES -----						
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
5	V	783.32	34527.81	1091.10	1	20.77
6	L	299.55	17404.73	495.64		
TOTALS		1082.87	51932.53	1586.73		20.77

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.60815
FEED CONDITION Q	1.11936
FENSKE MINIMUM TRAYS	20.76740
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
47	20	1.150	2.275	1.849	-8.275E+00	1.375E+01
44	18	1.225	2.115	1.970	-8.814E+00	1.429E+01
41	17	1.300	1.985	2.091	-9.354E+00	1.483E+01
39	16	1.375	1.879	2.211	-9.894E+00	1.537E+01
37	16	1.450	1.789	2.332	-1.043E+01	1.591E+01

Feed 3 scheme 4

'COL1', 'DEPRO'

FEEDS

STREAM	PHASE
1	LIQUID

PRODUCTS

STREAM + PHASE	PHASE	TOTAL STREAM RATES					SECTION	NUM TRAYS
		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR			
2	V	782.77	34498.75	1090.24	297051.38	1	21.76	
3	L	569.87	33216.20	928.62	216256.28			
TOTALS		1352.64	67714.95	2018.87	513307.66		21.76	

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.61686
FEED CONDITION Q	1.54636
FENSKE MINIMUM TRAYS	21.76029
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
49	23	1.150	2.272	1.859	-8.311E+00	1.703E+01
46	22	1.225	2.111	1.981	-8.853E+00	1.757E+01
43	20	1.300	1.982	2.102	-9.395E+00	1.811E+01
41	19	1.375	1.876	2.223	-9.937E+00	1.865E+01
39	18	1.450	1.786	2.344	-1.048E+01	1.919E+01

'COL2', 'DEISOBI'

FEEDS

STREAM	PHASE
3	LIQUID

PRODUCTS

STREAM + PHASE	PHASE	TOTAL STREAM RATES					SECTION	NUM TRAYS
		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR			
4	L	352.58	20484.38	580.21	133800.53	1	35.39	
5	L	217.28	12731.82	348.41	82455.75			
TOTALS		569.87	33216.20	928.62	216256.28		35.39	

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	3.91216
FEED CONDITION Q	1.00000
FENSKE MINIMUM TRAYS	35.39317
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
76	6	1.150	2.155	4.499	-1.500E+01	1.336E+01
70	5	1.225	1.981	4.792	-1.581E+01	1.416E+01
65	5	1.300	1.846	5.086	-1.661E+01	1.496E+01
62	5	1.375	1.739	5.379	-1.741E+01	1.576E+01
59	4	1.450	1.663	5.673	-1.821E+01	1.657E+01

'COL3', 'DEISOB2'

FEEDS

STREAM PHASE
4 LIQUID

PRODUCTS

STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	TOTAL STREAM RATES		SECTION	NUM TRAYS
			LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR		
6 L	299.55	17401.91	495.59	113675.45	1	41.95
7 L	53.03	3082.47	84.62	20125.09		
TOTALS	352.58	20484.38	580.21	133800.53		41.95

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 3.70308
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 41.95407
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
90	56	1.150	2.154	4.259	-1.221E+01	1.215E+01
83	51	1.225	1.982	4.536	-1.285E+01	1.279E+01
78	48	1.300	1.848	4.814	-1.350E+01	1.344E+01
73	45	1.375	1.741	5.092	-1.414E+01	1.408E+01
70	43	1.450	1.664	5.369	-1.479E+01	1.473E+01

Feed 4 scheme 2

'COL1', 'DEPRO'

FEEDS

STREAM PHASE
2 LIQUID

PRODUCTS

STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	TOTAL STREAM RATES		SECTION	NUM TRAYS
			LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR		
3 V	2219.49	97761.70	3091.18	842264.23	1	20.95
4 L	1293.30	75721.89	2112.33	490787.95		
TOTALS	3512.79	173483.60	5203.51	1333052.18		20.95

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.54428
 FEED CONDITION Q 1.38807
 FENSKE MINIMUM TRAYS 20.94839
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
48	21	1.150	2.280	1.776	-2.248E+01	4.491E+01
44	20	1.225	2.121	1.892	-2.394E+01	4.638E+01
42	19	1.300	1.992	2.008	-2.541E+01	4.784E+01
40	18	1.375	1.886	2.123	-2.688E+01	4.931E+01
38	17	1.450	1.797	2.239	-2.834E+01	5.077E+01

'COL2', 'DEISOB'

FEEDS

STREAM	PHASE					
4	LIQUID					

PRODUCTS

		----- TOTAL STREAM RATES -----					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
5	L	655.35	38067.98	1084.20	248696.15	1	51.20
6	L	637.95	37653.91	1028.13	242091.80		
TOTALS		1293.30	75721.89	2112.33	490787.95		51.20

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	6.14308
FEED CONDITION Q	1.00000
FENSKE MINIMUM TRAYS	51.20124
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
108	70	1.150	2.114	7.065	-4.096E+01	3.695E+01
99	64	1.225	1.938	7.525	-4.331E+01	3.929E+01
92	59	1.300	1.802	7.986	-4.565E+01	4.163E+01
87	56	1.375	1.695	8.447	-4.799E+01	4.397E+01
84	54	1.450	1.634	8.907	-5.033E+01	4.631E+01

Feed 4 scheme 3

'COL1', 'DEBUT'

FEEDS

STREAM	PHASE					
2	LIQUID					

PRODUCTS

		----- TOTAL STREAM RATES -----					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
3	L	2875.43	135864.05	4176.31	1091184.12	1	59.16
4	L	637.36	37619.65	1027.20	241868.06		
TOTALS		3512.79	173483.70	5203.51	1333052.18		59.16

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	2.09865
FEED CONDITION Q	1.38807
FENSKE MINIMUM TRAYS	59.16286
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
130	78	1.150	2.203	2.413	-6.321E+01	7.031E+01
121	72	1.225	2.042	2.571	-6.613E+01	7.323E+01
113	68	1.300	1.913	2.728	-6.904E+01	7.614E+01
107	64	1.375	1.808	2.886	-7.196E+01	7.906E+01
102	61	1.450	1.721	3.043	-7.487E+01	8.197E+01

'COL2', 'DEISOB'

FEEDS

STREAM	PHASE					
5	LIQUID					

PRODUCTS

		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
6	V	2220.08	97785.96	3091.97	842489.08	1	21.38
7	L	655.35	38078.10	1084.34	248695.03		
TOTALS		2875.43	135864.05	4176.31	1091184.12		21.38

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.51389
FEED CONDITION Q	1.10057
FENSKE MINIMUM TRAYS	21.37991
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
49	21	1.150	2.282	1.741	-2.204E+01	3.692E+01
45	19	1.225	2.123	1.855	-2.348E+01	3.836E+01
43	18	1.300	1.995	1.968	-2.492E+01	3.979E+01
40	17	1.375	1.889	2.082	-2.635E+01	4.123E+01
38	16	1.450	1.800	2.195	-2.779E+01	4.267E+01

Feed 4 scheme 4

'COL1', 'DEPRO'

FEEDS

STREAM	PHASE					
2	LIQUID					

PRODUCTS

		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
3	V	2219.12	97737.35	3090.51	842123.45	1	21.66
4	L	1293.67	75746.18	2112.99	490928.73		
TOTALS		3512.79	173483.54	5203.51	1333052.18		21.66

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.54678
FEED CONDITION Q	1.38807
FENSKE MINIMUM TRAYS	21.65928
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
49	23	1.150	2.278	1.779	-2.251E+01	4.494E+01
46	21	1.225	2.119	1.895	-2.397E+01	4.640E+01
43	20	1.300	1.990	2.011	-2.544E+01	4.787E+01
41	19	1.375	1.884	2.127	-2.691E+01	4.934E+01
39	18	1.450	1.795	2.243	-2.838E+01	5.081E+01

'COL2', 'DEISOB1'

FEEDS

STREAM PHASE
4 LIQUID

PRODUCTS

STREAM + PHASE	PHASE	TOTAL STREAM RATES				SECTION	NUM TRAYS
		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR		
5	L	775.74	45068.45	1276.33	294383.61	1	35.36
6	L	517.93	30677.74	836.66	196545.12		
TOTALS		1293.67	75746.18	2112.99	490928.73		35.36

SPECIFICATIONS

PARAMETER TYPE	COMP. NUM	SPECIFICATION TYPE	SPECIFIED VALUE	CALCULATED VALUE
STRM 5	3	MOL RATIO	9.998E-01	9.996E-01
STRM 6	4	MOL RATIO	8.000E-01	7.998E-01

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 3.99053
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 35.35598
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
76	6	1.150	2.153	4.589	-3.357E+01	2.981E+01
70	5	1.225	1.979	4.888	-3.537E+01	3.161E+01
65	5	1.300	1.844	5.188	-3.716E+01	3.340E+01
61	5	1.375	1.737	5.487	-3.896E+01	3.520E+01
59	4	1.450	1.662	5.786	-4.076E+01	3.700E+01

'COL3', 'DEISOB2'

FEEDS

STREAM PHASE
5 LIQUID

PRODUCTS

STREAM + PHASE	PHASE	TOTAL STREAM RATES				SECTION	NUM TRAYS
		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR		
7	L	655.35	38070.47	1084.23	248694.62	1	42.70
8	L	120.40	6997.97	192.10	45688.99		
TOTALS		775.74	45068.45	1276.33	294383.61		42.70

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 3.72805
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 42.69906
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
92	57	1.150	2.153	4.287	-2.686E+01	2.672E+01
85	52	1.225	1.981	4.567	-2.828E+01	2.814E+01
79	49	1.300	1.847	4.846	-2.970E+01	2.956E+01
74	46	1.375	1.740	5.126	-3.112E+01	3.098E+01
71	44	1.450	1.663	5.406	-3.254E+01	3.240E+01

Feed 5 scheme 2

'COL1', 'DEPRO'

FEEDS

STREAM	PHASE
1	LIQUID

PRODUCTS

		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
2	V	1939.28	85499.44	2701.09	735927.37	1	21.26
3	L	1330.21	77717.97	2170.28	504793.60		
TOTALS		3269.48	163217.41	4871.37	1240720.97		21.26

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.61413
FEED CONDITION Q	1.41191
FENSKE MINIMUM TRAYS	21.25697
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
				CONDENSER		REBOILER
48	23	1.150	2.273	1.856	-2.058E+01	4.097E+01
45	22	1.225	2.113	1.977	-2.193E+01	4.232E+01
42	21	1.300	1.983	2.098	-2.327E+01	4.366E+01
40	19	1.375	1.877	2.219	-2.461E+01	4.500E+01
38	18	1.450	1.788	2.340	-2.595E+01	4.634E+01

'COL2', 'DEISOB'

FEEDS

STREAM	PHASE
3	LIQUID

PRODUCTS

		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
4	L	686.37	39867.95	1135.49	260468.01	1	51.96
5	L	643.83	37850.02	1034.80	244325.59		
TOTALS		1330.21	77717.97	2170.28	504793.60		51.96

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	6.07058
FEED CONDITION Q	1.00000
FENSKE MINIMUM TRAYS	51.95634
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
				CONDENSER		REBOILER
110	80	1.150	2.114	6.981	-4.246E+01	3.838E+01
101	74	1.225	1.938	7.436	-4.488E+01	4.081E+01
94	69	1.300	1.803	7.892	-4.730E+01	4.323E+01
88	65	1.375	1.696	8.347	-4.973E+01	4.565E+01
85	62	1.450	1.634	8.802	-5.215E+01	4.807E+01

Feed 5 scheme 3

'COL1', 'DEBUT'

FEEDS

STREAM	PHASE
1	LIQUID

PRODUCTS

STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	TOTAL STREAM RATES		SECTION	NUM TRAYS	
			LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR			
2	L	2627.17	125455.64	3839.04	996971.03	1	59.09
3	L	642.32	37761.85	1032.34	243749.94		
TOTALS		3269.48	163217.49	4871.38	1240720.97		59.09

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 2.27013
 FEED CONDITION Q 1.41191
 FENSKE MINIMUM TRAYS 59.08954
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
130	75	1.150	2.194	2.611	-6.197E+01	6.849E+01
120	70	1.225	2.031	2.781	-6.489E+01	7.142E+01
112	65	1.300	1.901	2.951	-6.782E+01	7.434E+01
106	62	1.375	1.796	3.121	-7.074E+01	7.726E+01
101	59	1.450	1.709	3.292	-7.366E+01	8.018E+01

'COL2', 'DEISOB'

FEEDS

STREAM	PHASE
4	LIQUID

PRODUCTS

STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	TOTAL STREAM RATES		SECTION	NUM TRAYS	
			LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR			
5	V	1940.80	85575.61	2703.38	736504.22	1	20.82
6	L	686.37	39880.03	1135.66	260466.81		
TOTALS		2627.17	125455.64	3839.04	996971.03		20.82

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.57270
 FEED CONDITION Q 1.11172
 FENSKE MINIMUM TRAYS 20.82479
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR	
					CONDENSER	REBOILER
47	20	1.150	2.278	1.809	-2.008E+01	3.344E+01
44	19	1.225	2.118	1.927	-2.139E+01	3.475E+01
41	17	1.300	1.989	2.045	-2.269E+01	3.606E+01
39	17	1.375	1.883	2.162	-2.400E+01	3.737E+01
37	16	1.450	1.793	2.280	-2.531E+01	3.868E+01

Feed 5 scheme 4

'COL1', 'DEPRO'

FEEDS

STREAM PHASE
1 LIQUID

PRODUCTS		TOTAL STREAM RATES					
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS	
2	V	1939.66	85515.72	2701.61	736072.21	1	21.70
3	L	1329.82	77701.66	2169.76	504648.76		
TOTALS		3269.48	163217.38	4871.37	1240720.97		21.70

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 1.61444
 FEED CONDITION Q 1.41191
 FENSKE MINIMUM TRAYS 21.70194
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR CONDENSER	REBOILER
49	23	1.150	2.272	1.857	-2.059E+01	4.098E+01
46	21	1.225	2.112	1.978	-2.193E+01	4.233E+01
43	20	1.300	1.983	2.099	-2.328E+01	4.367E+01
41	19	1.375	1.876	2.220	-2.462E+01	4.501E+01
39	18	1.450	1.787	2.341	-2.596E+01	4.636E+01

'COL2', 'DEISOBI'

FEEDS

STREAM PHASE
3 LIQUID

PRODUCTS		TOTAL STREAM RATES					
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS	
4	L	809.89	47053.00	1332.65	307340.07	1	35.37
5	L	519.94	30648.66	837.11	197308.69		
TOTALS		1329.82	77701.66	2169.76	504648.76		35.37

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 3.95344
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 35.37398
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR CONDENSER	REBOILER
76	6	1.150	2.154	4.546	-3.477E+01	3.096E+01
70	5	1.225	1.980	4.843	-3.663E+01	3.282E+01
65	5	1.300	1.845	5.139	-3.849E+01	3.468E+01
61	5	1.375	1.738	5.436	-4.035E+01	3.653E+01
59	4	1.450	1.662	5.732	-4.221E+01	3.839E+01

'COL3', 'DEISOB2'

FEEDS

STREAM	PHASE
4	LIQUID

PRODUCTS

----- TOTAL STREAM RATES -----						
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	NUM SECTION TRAYS
6	L	686.37	39873.73	1135.57	260467.45	1 41.96
7	L	123.52	7179.26	197.08	46872.62	
TOTALS		809.89	47053.00	1332.65	307340.07	41.96

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	3.71226
FEED CONDITION Q	1.00000
FENSKE MINIMUM TRAYS	41.95983
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR CONDENSER	REBOILER
90	55	1.150	2.154	4.269	-2.803E+01	2.789E+01
83	50	1.225	1.982	4.548	-2.951E+01	2.937E+01
78	47	1.300	1.848	4.826	-3.099E+01	3.085E+01
73	44	1.375	1.741	5.104	-3.248E+01	3.233E+01
70	42	1.450	1.664	5.383	-3.396E+01	3.382E+01

Feed 6 scheme 2

'COL1', 'DEPRO'

FEEDS

STREAM	PHASE
2	LIQUID

PRODUCTS

----- TOTAL STREAM RATES -----						
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	NUM SECTION TRAYS
3	V	1844.84	81213.18	2569.18	700089.67	1 21.26
4	L	1103.75	64482.92	1800.68	418856.87	
TOTALS		2948.59	145696.10	4369.86	1118946.53	21.26

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.55553
FEED CONDITION Q	1.42899
FENSKE MINIMUM TRAYS	21.25515
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR CONDENSER	REBOILER
48	23	1.150	2.278	1.789	-1.879E+01	3.825E+01
45	22	1.225	2.119	1.906	-2.002E+01	3.948E+01
42	20	1.300	1.990	2.022	-2.124E+01	4.071E+01
40	19	1.375	1.884	2.139	-2.247E+01	4.193E+01
38	18	1.450	1.795	2.256	-2.369E+01	4.316E+01

'COL2', 'DEISOB'

FEEDS

STREAM	PHASE
4	LIQUID

PRODUCTS

		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
5	L	568.09	32997.15	939.80	215581.05	1	52.80
6	L	535.66	31485.77	860.88	203275.82		
TOTALS		1103.75	64482.92	1800.68	418856.87		52.80

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	6.08067
FEED CONDITION Q	1.00000
FENSKE MINIMUM TRAYS	52.80078
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR CONDENSER	REBOILER
112	83	1.150	2.114	6.993	-3.519E+01	3.175E+01
102	76	1.225	1.938	7.449	-3.720E+01	3.376E+01
95	71	1.300	1.803	7.905	-3.921E+01	3.577E+01
90	67	1.375	1.696	8.361	-4.122E+01	3.777E+01
86	64	1.450	1.634	8.817	-4.323E+01	3.978E+01

Feed 6 scheme 3

'COL1', 'DEBUT'

FEEDS

STREAM	PHASE
2	LIQUID

PRODUCTS

		TOTAL STREAM RATES					
STREAM + PHASE		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS
3	L	2414.01	114272.99	3510.72	916079.19	1	59.21
4	L	534.59	31423.20	859.14	202867.35		
TOTALS		2948.59	145696.20	4369.87	1118946.53		59.21

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	2.12068
FEED CONDITION Q	1.42899
FENSKE MINIMUM TRAYS	59.21312
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM BTU/HR CONDENSER	REBOILER
130	78	1.150	2.202	2.439	-5.366E+01	6.025E+01
121	72	1.225	2.040	2.598	-5.614E+01	6.273E+01
113	68	1.300	1.911	2.757	-5.862E+01	6.522E+01
107	64	1.375	1.806	2.916	-6.110E+01	6.770E+01
102	61	1.450	1.719	3.075	-6.358E+01	7.018E+01

'COL2', 'DEISOB'

FEEDS

STREAM	PHASE
5	LIQUID

PRODUCTS

STREAM + PHASE		TOTAL STREAM RATES				SECTION	NUM TRAYS
		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR		
6	V	1845.92	81265.82	2570.78	700500.90	1	21.35
7	L	568.08	33007.16	939.94	215578.29		
TOTALS		2414.01	114272.98	3510.72	916079.19		21.35

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.53098
FEED CONDITION Q	1.10299
FENSKE MINIMUM TRAYS	21.34536
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
49	21	1.150	2.280	1.761	-1.851E+01	3.098E+01
45	19	1.225	2.121	1.875	-1.972E+01	3.218E+01
43	18	1.300	1.993	1.990	-2.092E+01	3.339E+01
40	17	1.375	1.887	2.105	-2.213E+01	3.460E+01
38	16	1.450	1.798	2.220	-2.334E+01	3.581E+01

Feed 6 scheme 4

'COL1', 'DEPRO'

FEEDS

STREAM	PHASE
2	LIQUID

PRODUCTS

STREAM + PHASE		TOTAL STREAM RATES				SECTION	NUM TRAYS
		MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR		
3	V	1845.02	81219.43	2569.40	700156.21	1	21.69
4	L	1103.57	64476.63	1800.47	418790.33		
TOTALS		2948.59	145696.06	4369.86	1118946.53		21.69

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO	1.55617
FEED CONDITION Q	1.42899
FENSKE MINIMUM TRAYS	21.69418
OPERATING REFLUX RATIO	1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
49	23	1.150	2.277	1.790	-1.880E+01	3.827E+01
46	22	1.225	2.118	1.906	-2.003E+01	3.949E+01
43	20	1.300	1.989	2.023	-2.125E+01	4.072E+01
41	19	1.375	1.883	2.140	-2.248E+01	4.194E+01
39	18	1.450	1.794	2.256	-2.370E+01	4.317E+01

'COL2', 'DEISOB1'

FEEDS

STREAM PHASE
4 LIQUID

PRODUCTS		TOTAL STREAM RATES					
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS	
5	L	671.02	38983.91	1104.09	254642.42	1	35.35
6	L	432.55	25492.72	696.37	164147.91		
TOTALS		1103.57	64476.63	1800.47	418790.33		35.35

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 3.95355
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 35.35411
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
76	6	1.150	2.154	4.547	-2.881E+01	2.559E+01
70	5	1.225	1.980	4.843	-3.035E+01	2.713E+01
65	5	1.300	1.845	5.140	-3.189E+01	2.867E+01
61	5	1.375	1.738	5.436	-3.343E+01	3.021E+01
59	4	1.450	1.662	5.733	-3.497E+01	3.175E+01

'COL3', 'DEISOB2'

FEEDS

STREAM PHASE
5 LIQUID

PRODUCTS		TOTAL STREAM RATES					
STREAM + PHASE	MOLES LB-MOL/HR	WEIGHT LB/HR	LIQUID VOL FT3/HR	NORM VAPOR(1) FT3/HR	SECTION	NUM TRAYS	
7	L	568.09	33001.19	939.86	215581.89	1	42.77
8	L	102.93	5982.72	164.23	39060.53		
TOTALS		671.02	38983.91	1104.09	254642.42		42.77

SUMMARY OF UNDERWOOD CALCULATIONS

MINIMUM REFLUX RATIO 3.72036
 FEED CONDITION Q 1.00000
 FENSKE MINIMUM TRAYS 42.76838
 OPERATING REFLUX RATIO 1.30 * R-MINIMUM

TOTAL TRAYS	FEED TRAY	R/R-MIN	M/M-MIN	REFLUX RATIO	DUTY, MM CONDENSER	BTU/HR REBOILER
92	58	1.150	2.153	4.278	-2.324E+01	2.313E+01
85	53	1.225	1.981	4.557	-2.447E+01	2.435E+01
79	50	1.300	1.847	4.836	-2.570E+01	2.558E+01
74	47	1.375	1.740	5.115	-2.693E+01	2.681E+01
71	45	1.450	1.663	5.395	-2.816E+01	2.804E+01

Scheme 2

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	1595.95	1062.83	16	28	1.931	1	110423.1	199.5
Col2		268.54	42	43	8.008	0	208034.6	

Scheme 3

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	1595.95	1331.12	71	43	2.520	0	538838.0	407.1
Col2		1062.58	19	24	1.917	1	110877.8	

Scheme 4

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	1595.95	1062.28	20	23	1.934	1	112703.4	232.1
Col2		318.40	5	60	5.200	0	130288.3	
Col3		268.54	50	30	4.858	0	127421.6	

Feed 3

Scheme 1

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	-	-	-	-	-	-	-	>1000

Scheme 2

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	1352.64	782.58	21	21	2.102	1	87950.6	250.2
Col2		299.55	71	23	7.801	0	250452.3	

Scheme 3

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	1352.64	1082.87	65	47	3.000	0	489459.2	423.1
Col2		783.32	17	24	2.091	1	82892.6	

Scheme 4

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	1352.64	782.77	20	23	2.102	1	88835.5	272.1
Col2		352.58	5	60	5.086	0	141624.7	
Col3		299.55	48	30	4.814	0	137585.9	

Feed 4

Scheme 2

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	3512.79	2219.49	19	23	2.008	1	236029.6	223.1
Col2		655.35	59	33	7.986	0	547675.9	

Scheme 3

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	3512.79	2875.43	68	45	2.728	0	1222035.9	} 414.6
Col2		2220.08	18	25	1.968	1	234423.1	

Scheme 4

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	3512.79	2219.12	20	23	2.011	1	242958.2	} 246.6
Col2		775.74	5	60	5.188	0	316820.3	
Col3		655.35	49	30	4.846	0	306492.9	

Feed 5

Scheme 2

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	3269.49	1939.28	21	21	2.098	1	217614.2	} 243.9
Col2		686.37	69	25	7.892	0	579805.9	

Scheme 3

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	3269.49	2627.17	65	47	2.951	0	1172932.9	} 420.4
Col2		1940.80	17	24	2.045	1	201629.5	

Scheme 4

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	3269.49	1939.66	20	23	2.099	1	219872.1	} 264.2
Col2		809.89	5	60	5.139	0	328145.1	
Col3		686.37	47	31	4.826	0	315904.8	

Feed 6

Scheme 2

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	2948.59	1844.84	20	22	2.022	1	199143.2	} 232.2
Col2		568.09	71	24	7.905	0	485647.2	

Scheme 3

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	j	$[(N_S+N_R+1) * (R+1) - N_S * j] * D$	K_{OV}
Col1	2948.59	2414.01	68	45	2.757	0	1033913.6	} 417.4
Col2		1845.92	18	25	1.990	1	196701.7	

Scheme 4

Unit	F (lb-mol/hr)	D (lb-mol/hr)	N_R	N_S	R	ϕ	$[(N_S+N_R+1) * (R+1) - N_S * \phi] * D$	K_{OV}
Col1	2948.59	1845.02	20	23	2.023	1	202973.9	} 251.0
Col2		671.02	5	60	5.140	0	271924.4	
Col3		568.09	50	29	4.836	0	265230.0	

APPENDIX C

Rigorous Simulation and Sizing Output

Feed 1 scheme 1

RIGOROUS COLUMN SUMMARY

UNIT 1, 'T1'							
COLUMN SUMMARY							
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	NET FLOW RATES LB-MOL/HR		PRODUCT	HEATER DUTIES MM BTU/HR
				VAPOR	FEED		
1C	110.3	218.00	867722.8			1157.1V	-4975.2583
2	112.3	223.00	876358.7	868879.9			
3	112.6	223.00	874755.4	877515.8			
52	186.3	223.13	827668.3	828832.1			
53	186.3	223.13	827272.7	828825.4		387.6L	
54	186.3	223.14	827262.1	828817.3			
144	211.0	223.38	764634.4	766180.1			
145	211.0	223.38	767219.3	766179.1	1916.8L		
146	211.1	223.38	767394.8	766847.2			
189	212.6	223.49	762875.3	764411.9			
190	213.5	223.50	759804.0	762503.2			
191R	214.8	223.50		759431.8		372.2L	4984.2350

REFLUX RATIOS				REFLUX RATIOS		
				MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM FEED1				452.6834	400.8975	423.8138
REFLUX / VAPOR DISTILLATE				749.8975	750.2587	750.0638

Feed 1 scheme 2

RIGOROUS COLUMN SUMMARY

'T1'							
COLUMN SUMMARY							
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	NET FLOW RATES LB-MOL/HR		PRODUCT	HEATER DUTIES MM BTU/HR
				VAPOR	FEED		
1C	110.4	218.00	2329.3			1157.6V	-13.3783
2	112.3	223.00	2352.2	3486.9			
3	112.6	223.13	2349.6	3509.8			
15	131.6	224.67	2136.1	3323.0			
16	134.9	224.79	4750.3	3293.7	1916.8L		
17	135.5	224.92	4745.4	3991.1			
39	198.4	227.74	4790.9	4044.2			
40	199.6	227.87	4770.0	4031.7			

41R 201.4 228.00 4010.8 759.3L 25.0730

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S1	1.2152	1.0764	1.1378
REFLUX / VAPOR DISTILLATE	2.0122	2.0134	2.0128

'T2'

COLUMN SUMMARY

TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR
			LIQUID	VAPOR	FEED PRODUCT	
				LB-MOL/HR		
1C	110.4	86.00	2990.3			386.8L -26.4285
2	114.5	91.00	3047.6	3377.1		
3	114.6	91.05	3048.0	3434.5		
53	127.6	93.55	2927.9	3320.1		
54	128.1	93.60	3396.5	3314.8	759.3M	
55	128.4	93.65	3395.3	3024.1		
100	142.8	95.90	3314.1	2946.3		
101	143.4	95.95	3303.3	2941.6		
102R	144.8	96.00		2930.8		372.4L 24.0978

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	3.9384	3.9086	3.9898
REFLUX / LIQUID DISTILLATE	7.7305	7.7305	7.7305

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 40	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN		DOWNCOMER WIDTHS			
SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP OF VALVES OR CAPS	SIDE IN	CENTER IN	OFF-CENTER IN	
1	37	102.	2	452	14.144	13.485	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 101	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN		DOWNCOMER WIDTHS			
SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	CENTER IN	OFF-CENTER IN
1	14	96.	1	486	14.711	N/A	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID	PHASE	S1 LIQUID	S2 VAPOR	S3 LIQUID	S4 LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	.7667	.7667	9.5435E-13	9.3512E-13
2	PROPANE	1156.0476	1155.1916	.8560	.8560
3	IBUTANE	387.5855	1.5503	386.0352	385.6563
4	BUTANE	349.2487	.0753	349.1734	.3046
5	IPENTANE	20.5102	1.9108E-07	20.5102	1.6008E-14
6	PENTANE	2.6836	7.9677E-09	2.6836	2.5920E-14
TOTAL RATE, LB-MOL/HR		1916.8423	1157.5839	759.2584	386.8169
STREAM ID	PHASE	S5 LIQUID			
FLUID RATES, LB-MOL/HR					
1	ETHANE	1.9219E-14			
2	PROPANE	1.9278E-14			
3	IBUTANE	.3787			
4	BUTANE	348.8689			
5	IPENTANE	20.5102			
6	PENTANE	2.6836			
TOTAL RATE, LB-MOL/HR		372.4415			

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID	PHASE	S1 LIQUID	S2 VAPOR	S3 LIQUID	S4 LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	4.0000E-04	6.6236E-04	1.2569E-15	2.4175E-15
2	PROPANE	.6031	.9979	1.1275E-03	2.2130E-03
3	IBUTANE	.2022	1.3393E-03	.5084	.9970
4	BUTANE	.1822	6.5014E-05	.4599	7.8736E-04
5	IPENTANE	.0107	1.6507E-10	.0270	4.1383E-17
6	PENTANE	1.4000E-03	6.8830E-12	3.5345E-03	6.7008E-17
TOTAL RATE, LB-MOL/HR		1916.8423	1157.5839	759.2584	386.8169
TEMPERATURE, F		76.4600	110.3697	201.4134	110.3999
PRESSURE, PSIA		232.2525	218.0000	228.0000	86.0000
ENTHALPY, MM BTU/HR		2.3080	9.2272	4.7755	.9904
MOLECULAR WEIGHT		49.8228	44.1074	58.5367	58.0930
WEIGHT FRAC VAPOR		.0000	1.0000	.0000	.0000
WEIGHT FRAC LIQUID		1.0000	.0000	1.0000	1.0000
STREAM ID	PHASE	S5 LIQUID			
FLUID MOLAR FRACTIONS					
1	ETHANE	5.1603E-17			
2	PROPANE	5.1761E-17			
3	IBUTANE	1.0169E-03			
4	BUTANE	.9367			
5	IPENTANE	.0551			
6	PENTANE	7.2054E-03			
TOTAL RATE, LB-MOL/HR		372.4415			

TEMPERATURE, F	144.7696
PRESSURE, PSIA	96.0000
ENTHALPY, MM BTU/HR	1.4546
MOLECULAR WEIGHT	58.9975
WEIGHT FRAC VAPOR	.0000
WEIGHT FRAC LIQUID	1.0000

Feed 1 scheme 4

RIGOROUS COLUMN SUMMARY

COLUMN SUMMARY			'T1'				HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			PRODUCT	DUTIES MM BTU/HR
			LIQUID	VAPOR	FEED		
1C	110.4	218.00	2164.2			1157.6V	-12.4307
2	112.3	223.00	2185.7	3321.7			
3	112.5	223.12	2183.6	3343.2			
19	135.4	225.07	1964.3	3140.4			
20	137.6	225.20	4573.2	3121.9	1916.8L		
21	139.0	225.32	4561.2	3813.9			
41	198.4	227.76	4638.6	3891.2			
42	199.6	227.88	4618.5	3879.3			
43R	201.4	228.00		3859.2		759.3L	24.1249

REFLUX RATIOS		REFLUX RATIOS		
		MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S1		1.1290	1.0001	1.0572
REFLUX / VAPOR DISTILLATE		1.8696	1.8707	1.8701

COLUMN SUMMARY			'T2'				HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			PRODUCT	DUTIES MM BTU/HR
			LIQUID	VAPOR	FEED		
1C	119.9	94.00	2338.6			456.4L	-21.8343
2	124.5	99.00	2373.8	2795.0			
3	125.4	99.08	2366.7	2830.2			
13	132.0	99.87	2316.6	2778.3			
14	132.7	99.95	2798.7	2773.0	759.3M		
15	132.9	100.03	2797.4	2495.9			
63	149.0	103.84	2733.5	2435.5			
64	149.8	103.92	2722.6	2430.6			
65R	151.4	104.00		2419.7		302.9L	19.6565

REFLUX RATIOS		REFLUX RATIOS		
		MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3		3.0800	3.0569	3.1031
REFLUX / LIQUID DISTILLATE		5.1240	5.1240	5.1240

'T3'

COLUMN SUMMARY

TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR	
			LIQUID	VAPOR	FEED PRODUCT		
			LB-MOL/HR				
1C	110.4	86.00	2302.7			386.7L	-21.0469
2	114.5	91.00	2346.9	2689.4			
3	114.6	91.07	2347.2	2733.6			
39	118.9	93.43	2330.8	2719.3			
40	119.2	93.50	2785.4	2717.5	456.4M		
41	119.4	93.57	2784.3	2715.7			
76	141.7	95.87	2644.0	2574.6			
77	141.8	95.93	2643.7	2574.3			
78R	141.8	96.00		2574.1		69.7L	20.9849

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S4	5.0454	5.0450	5.0733
REFLUX / LIQUID DISTILLATE	5.9546	5.9546	5.9546

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 42	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN		DOWNCOMER WIDTHS			
SECTION	TRAY NUMBER	DESIGN DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	CENTER IN	OFF-CENTER IN
1	39	96.	2	381	14.156	13.885	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 64	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN		DOWNCOMER WIDTHS			
SECTION	TRAY NUMBER	DESIGN DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	CENTER IN	OFF-CENTER IN
1	14	90.	1	421	14.300	N/A	N/A

'T3'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 77	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN					
SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS CENTER IN	OFF-CENTER IN
1	40	90.	1	421	14.279	N/A	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID	PHASE	S1	S2	S3	S4
		LIQUID	VAPOR	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	.7667	.7667	5.9056E-12	5.8837E-12
2	PROPANE	1156.0476	1155.2144	.8332	.8332
3	IBUTANE	387.5855	1.5510	386.0345	385.7302
4	BUTANE	349.2487	.0356	349.2131	69.8335
5	IPENTANE	20.5102	7.6595E-09	20.5102	2.4803E-04
6	PENTANE	2.6836	2.2792E-10	2.6836	5.2272E-06
TOTAL RATE, LB-MOL/HR		1916.8423	1157.5678	759.2746	456.3971
STREAM ID	PHASE	S5	S6	S7	
		LIQUID	LIQUID	LIQUID	
FLUID RATES, LB-MOL/HR					
1	ETHANE	2.1875E-14	5.8785E-12	5.2705E-15	
2	PROPANE	1.6001E-19	.8332	3.0767E-15	
3	IBUTANE	.3042	385.5666	.1636	
4	BUTANE	279.3797	.3163	69.5172	
5	IPENTANE	20.5100	2.8378E-14	2.4803E-04	
6	PENTANE	2.6836	2.8615E-14	5.2272E-06	
TOTAL RATE, LB-MOL/HR		302.8775	386.7160	69.6811	

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID	PHASE	S1	S2	S3	S4
		LIQUID	VAPOR	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	4.0000E-04	6.6237E-04	7.7780E-15	1.2892E-14
2	PROPANE	.6031	.9980	1.0974E-03	1.8256E-03
3	IBUTANE	.2022	1.3399E-03	.5084	.8452
4	BUTANE	.1822	3.0739E-05	.4599	.1530
5	IPENTANE	.0107	6.6169E-12	.0270	5.4345E-07
6	PENTANE	1.4000E-03	1.9690E-13	3.5344E-03	1.1453E-08
TOTAL RATE, LB/HR		95502.4936	51056.7658	44445.7279	26515.9422
TEMPERATURE, F		76.4600	110.3639	201.4173	119.8550
PRESSURE, PSIA		232.2525	218.0000	228.0000	94.0000
ENTHALPY, MM BTU/HR		2.3080	9.2269	4.7757	1.3322
MOLECULAR WEIGHT		49.8228	44.1069	58.5371	58.0984
WEIGHT FRAC VAPOR		.0000	1.0000	.0000	.0000
WEIGHT FRAC LIQUID		1.0000	.0000	1.0000	1.0000

STREAM ID	S5	S6	S7
PHASE	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS			
1 ETHANE	7.2222E-17	1.5201E-14	7.5637E-17
2 PROPANE	.0000	2.1546E-03	4.4154E-17
3 IBUTANE	1.0044E-03	.9970	2.3480E-03
4 BUTANE	.9224	8.1781E-04	.9976
5 IPENTANE	.0677	7.3382E-17	3.5595E-06
6 PENTANE	8.8603E-03	7.3996E-17	7.5016E-08
TOTAL RATE, LB/HR	17929.7861	22465.7947	4050.1475
TEMPERATURE, F	151.4379	110.4054	141.8447
PRESSURE, PSIA	104.0000	86.0000	96.0000
ENTHALPY, MM BTU/HR	1.2646	.9902	.2627
MOLECULAR WEIGHT	59.1982	58.0938	58.1241
WEIGHT FRAC VAPOR	.0000	.0000	.0000
WEIGHT FRAC LIQUID	1.0000	1.0000	1.0000

Feed 2 scheme 1

RIGOROUS COLUMN SUMMARY

UNIT 1, 'T1'						
COLUMN SUMMARY						
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	NET FLOW RATES VAPOR FEED LB-MOL/HR	PRODUCT	HEATER DUTIES MM BTU/HR
1C	110.3	221.00	827822.1		1062.2V	-4570.2681
2	112.3	221.00	827635.0	828889.1		
3	112.6	221.00	827475.4	827514.0		
52	186.3	223.13	797668.2	798810.0		
53	186.3	223.13	797272.2	798805.3	269.0L	
54	186.3	223.14	797262.0	798801.1		
134	211.0	226.10	747634.4	745180.1		
135	211.0	226.10	747218.1	745179.1	1595.9L	
136	211.1	226.11	747392.8	745847.2		
176	212.6	226.49	725825.1	724410.5		
177	213.5	226.50	724704.0	722502.1		
178R	214.8	226.50		729430.7	364.1L	4580.2470
REFLUX RATIOS						
				REFLUX RATIOS		
				MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM FEED1				400.5121	396.9152	400.5123
REFLUX / VAPOR DISTILLATE				711.3492	711.3492	711.2294

Feed 2 scheme 2

RIGOROUS COLUMN SUMMARY

'T1'

COLUMN SUMMARY			NET FLOW RATES				HEATER DUTIES
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	MM BTU/HR
			LB-MOL/HR				
1C	111.2	222.00	2011.6			1062.9V	-11.4893
2	113.3	227.00	2033.0	3074.5			
3	113.5	227.12	2031.9	3095.8			
15	127.6	228.55	1879.6	2969.5			
16	130.7	228.67	4162.0	2942.5	1595.9L		
17	131.0	228.79	4163.3	3629.0			
42	200.1	231.76	4137.1	3617.1			
43	201.5	231.88	4116.7	3604.0			
44R	203.3	232.00		3583.6		533.1L	22.2441

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S6	1.2605	1.1370	1.1920
REFLUX / VAPOR DISTILLATE	1.8926	1.8964	1.8933

'T2'

COLUMN SUMMARY

COLUMN SUMMARY			NET FLOW RATES				HEATER DUTIES
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	MM BTU/HR
			LB-MOL/HR				
1C	110.5	86.00	2329.6			268.5L	-20.3325
2	114.5	91.00	2374.1	2598.1			
3	114.6	91.06	2374.2	2642.6			
41	126.6	93.35	2287.3	2561.5			
42	127.4	93.41	2608.8	2555.9	533.1M		
43	127.7	93.47	2606.6	2344.2			
83	142.8	95.88	2541.0	2280.5			
84	143.5	95.94	2532.1	2276.5			
85R	145.0	96.00		2267.6		264.5L	18.6558

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	4.3701	4.3346	4.4261
REFLUX / LIQUID DISTILLATE	8.6752	8.6752	8.6752

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 43	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN					
SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS CENTER IN	OFF-CENTER IN
1	39	96.	2	404	13.161	12.481	N/A

T2

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 84	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN					
SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS CENTER IN	OFF-CENTER IN
1	42	84.	1	361	13.872	N/A	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID	PHASE	S1 LIQUID	S2 VAPOR	S3 LIQUID	S4 LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	9.2565	9.2565	4.6431E-13	4.5563E-13
2	PROPANE	1053.0075	1052.6251	.3824	.3824
3	IBUTANE	269.0771	.9365	268.1406	267.7328
4	BUTANE	246.8934	.0502	246.8432	.4204
5	IPENTANE	17.3959	1.6715E-07	17.3959	9.5569E-15
6	PENTANE	.3192	1.0276E-09	.3192	6.2430E-15
TOTAL RATE, LB-MOL/HR		1595.9495	1062.8683	533.0812	268.5356

STREAM ID	PHASE	S5 LIQUID	PUMPED LIQUID
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FLUID RATES, LB-MOL/HR			
1	ETHANE	8.6779E-15	9.2565
2	PROPANE	1.2964E-14	1053.0075
3	IBUTANE	.4077	269.0771
4	BUTANE	246.4228	246.8934
5	IPENTANE	17.3959	17.3959
6	PENTANE	.3192	.3192
TOTAL RATE, LB-MOL/HR		264.5456	1595.9495

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID	PHASE	S1 LIQUID	S2 VAPOR	S3 LIQUID	S4 LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	5.8000E-03	8.7090E-03	8.7099E-16	1.6967E-15
2	PROPANE	.6598	.9904	7.1740E-04	1.4241E-03
3	IBUTANE	.1686	8.8113E-04	.5030	.9970
4	BUTANE	.1547	4.7253E-05	.4630	1.5655E-03
5	IPENTANE	.0109	1.5726E-10	.0326	3.5589E-17
6	PENTANE	2.0000E-04	9.6685E-13	5.9876E-04	2.3248E-17

TOTAL RATE, LB/HR	77981.2423	77981.2423	46753.2968	31227.9456
TEMPERATURE, F	60.0669	59.7200	111.2044	203.3344
PRESSURE, PSIA	230.0000	200.3442	222.0000	232.0000
ENTHALPY, MM BTU/HR	1.0961	1.0775	8.4510	3.3998
MOLECULAR WEIGHT	48.8620	48.8620	43.9879	58.5801
WEIGHT FRAC VAPOR	.0000	.0000	1.0000	.0000
WEIGHT FRAC LIQUID	1.0000	1.0000	.0000	1.0000

STREAM ID	S5	PUMPED
PHASE	LIQUID	LIQUID

FLUID MOLAR FRACTIONS

1 ETHANE	3.2803E-17	5.8000E-03
2 PROPANE	4.9006E-17	.6598
3 IBUTANE	1.5413E-03	.1686
4 BUTANE	.9315	.1547
5 IPENTANE	.0658	.0109
6 PENTANE	1.2066E-03	2.0000E-04

TOTAL RATE, LB/HR	15603.2057	15624.7403
TEMPERATURE, F	110.4827	144.9705
PRESSURE, PSIA	86.0000	96.0000
ENTHALPY, MM BTU/HR	.6885	1.0348
MOLECULAR WEIGHT	58.1040	59.0633
WEIGHT FRAC VAPOR	.0000	.0000
WEIGHT FRAC LIQUID	1.0000	1.0000

Feed 2 scheme 4

RIGOROUS COLUMN SUMMARY

'T1'

COLUMN SUMMARY			NET FLOW RATES				HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR				
1C	111.2	222.00	1813.9			1062.6V	-10.3611
2	113.3	227.00	1833.4	2876.5			
3	113.5	227.12	1832.7	2895.9			
19	130.6	229.07	1677.4	2758.4			
20	132.9	229.20	3955.3	2740.0	1595.9L		
21	134.0	229.32	3949.2	3422.0			
41	200.0	231.76	3953.1	3431.4			
42	201.4	231.88	3934.4	3419.8			
43R	203.3	232.00		3401.0		533.4L	21.1148

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S1PUMPED	1.1366	1.0252	1.0748
REFLUX / VAPOR DISTILLATE	1.7071	1.7104	1.7076

'T2'

COLUMN SUMMARY			NET FLOW RATES				HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR				
1C	119.9	94.00	1653.0			317.9L	-15.4001
2	124.5	99.00	1677.9	1970.9			
3	125.4	99.08	1672.8	1995.8			

12	131.8	99.79	1638.4	1960.5			
13	132.5	99.87	1971.8	1956.3	533.4M		
14	132.8	99.95	1971.1	1756.4			
63	149.1	103.84	1924.7	1712.9			
64	149.9	103.92	1916.7	1709.3			
65R	151.7	104.00		1701.2		215.4L	13.8300

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	3.0991	3.0739	3.1212
REFLUX / LIQUID DISTILLATE	5.1990	5.1990	5.1990

'T3'

COLUMN SUMMARY

TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR	
			LIQUID	VAPOR	FEED PRODUCT		
1C	110.4	86.00	1576.9			268.5L	-14.4421
2	114.5	91.00	1607.1	1845.5			
3	114.6	91.06	1607.3	1875.7			
49	121.1	94.01	1585.8	1855.8			
50	121.4	94.08	1900.7	1854.3	317.9L		
51	122.0	94.14	1897.0	1851.3			
78	141.6	95.87	1814.2	1764.7			
79	141.7	95.94	1814.3	1764.8			
80R	141.8	96.00		1764.9		49.4L	14.3872

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S4	4.9598	4.9594	4.9876
REFLUX / LIQUID DISTILLATE	5.8721	5.8721	5.8721

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 42	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

SECTION	VALVE DIAMETER		NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
	DESIGN NUMBER	1.875 IN DIAMETER IN				CENTER IN	OFF-CENTER IN
1	39	90.	2	340	13.049	12.701	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 64	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN					
SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS CENTER IN	OFF-CENTER IN
1	13	72.	1	262	12.228	N/A	N/A

'T3'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 79	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER		1.875 IN					
SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS CENTER IN	OFF-CENTER IN
1	50	72.	1	266	11.853	N/A	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID	PHASE	S1 LIQUID	S1PUMPED LIQUID	S2 VAPOR	S3 LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	9.2565	9.2565	9.2565	5.2999E-11
2	PROPANE	1053.0075	1053.0075	1052.3690	.6385
3	IBUTANE	269.0771	269.0771	.9334	268.1437
4	BUTANE	246.8934	246.8934	.0244	246.8690
5	IPENTANE	17.3959	17.3959	7.0376E-09	17.3959
6	PENTANE	.3192	.3192	3.1989E-11	.3192
TOTAL RATE, LB-MOL/HR		1595.9495	1595.9495	1062.5833	533.3663

STREAM ID	PHASE	S4 LIQUID	S5 LIQUID	S6 LIQUID	S7 LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	5.2992E-11	6.6476E-15	5.2991E-11	1.4389E-15
2	PROPANE	.6385	1.7184E-14	.6385	6.4979E-14
3	IBUTANE	267.9293	.2143	267.7392	.1902
4	BUTANE	49.3700	197.4990	.1666	49.2035
5	IPENTANE	4.1893E-04	17.3955	1.2729E-14	4.1893E-04
6	PENTANE	1.3964E-06	.3192	1.3502E-14	1.3964E-06
TOTAL RATE, LB-MOL/HR		317.9383	215.4279	268.5443	49.3940

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID	PHASE	S1 LIQUID	S1PUMPED LIQUID	S2 VAPOR	S3 LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	5.8000E-03	5.8000E-03	8.7113E-03	9.9367E-14
2	PROPANE	.6598	.6598	.9904	1.1972E-03
3	IBUTANE	.1686	.1686	8.7843E-04	.5027
4	BUTANE	.1547	.1547	2.2960E-05	.4629
5	IPENTANE	.0109	.0109	6.6231E-12	.0326
6	PENTANE	2.0000E-04	2.0000E-04	3.0105E-14	5.9844E-04

TOTAL RATE, LB/HR	77981.2423	77981.2423	46740.3297	31240.9126
TEMPERATURE, F	59.7200	60.0669	111.1997	203.2816
PRESSURE, PSIA	200.3442	230.0000	222.0000	232.0000
ENTHALPY, MM BTU/HR	1.0775	1.0961	8.4486	3.4001
MOLECULAR WEIGHT	48.8620	48.8620	43.9875	58.5731
WEIGHT FRAC VAPOR	.0000	.0000	1.0000	.0000
WEIGHT FRAC LIQUID	1.0000	1.0000	.0000	1.0000
STREAM ID	S4	S5	S6	S7
PHASE	LIQUID	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS				
1 ETHANE	1.6667E-13	3.0858E-17	1.9733E-13	2.9130E-17
2 PROPANE	2.0084E-03	7.9767E-17	2.3778E-03	1.3155E-15
3 IBUTANE	.8427	9.9457E-04	.9970	3.8500E-03
4 BUTANE	.1553	.9168	6.2026E-04	.9961
5 IPENTANE	1.3177E-06	.0807	4.7400E-17	8.4814E-06
6 PENTANE	4.3919E-09	1.4817E-03	5.0279E-17	2.8270E-08
TOTAL RATE, LB/HR	18470.8961	12770.0169	15599.9112	2870.9849
TEMPERATURE, F	119.8864	151.7044	110.3826	141.8034
PRESSURE, PSIA	94.0000	104.0000	86.0000	96.0000
ENTHALPY, MM BTU/HR	.9284	.9013	.6874	.1861
MOLECULAR WEIGHT	58.0958	59.2774	58.0906	58.1241
WEIGHT FRAC VAPOR	.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID	1.0000	1.0000	1.0000	1.0000

Feed 3 scheme 1

RIGOROUS COLUMN SUMMARY

UNIT 1, 'T1'							
COLUMN SUMMARY							
TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR	
			LIQUID	VAPOR	FEED PRODUCT		
			LB-MOL/HR				
1C	110.3	219.00	847825.7			782.7V	-4020.2242
2	112.3	219.00	847635.7	847852.3			
3	112.6	219.00	847475.4	847840.2			
72	186.3	222.12	808166.1	808220.0			
73	186.3	222.12	808072.7	808201.1		300.2L	
74	186.3	222.13	807962.1	808190.3			
174	211.0	224.10	756643.1	755280.1			
175	211.0	224.10	756521.3	755851.1	1352.6L		
176	211.1	224.11	756439.8	755810.2			
202	212.6	224.49	736275.1	735460.5			
203	213.5	224.50	735980.0	735432.0			
204R	214.8	224.50		735410.2		269.6L	4013.2145
REFLUX RATIOS							
			REFLUX RATIOS				
			MOLAR	WEIGHT	STD L VOL		
REFLUX / FEED STREAM FEED1			390.5121	385.1912	490.2133		
REFLUX / VAPOR DISTILLATE			695.4294	695.4352	695.4294		

Feed 3 scheme 2

RIGOROUS COLUMN SUMMARY

'T1'

COLUMN SUMMARY			NET FLOW RATES				HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR				
1C	110.5	219.00	1604.7			782.6V	-9.1993
2	112.5	224.00	1621.2	2387.3			
3	112.6	224.13	1620.3	2403.8			
20	138.4	226.25	1451.2	2245.7			
21	140.6	226.38	3395.0	2233.8	1352.6L		
22	143.0	226.50	3383.1	2825.0			
40	198.0	228.75	3465.7	2902.1			
41	199.1	228.88	3455.4	2895.6			
42R	200.4	229.00		2885.4		570.0L	17.9152

REFLUX RATIOS

		REFLUX RATIOS		
		MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S1		1.1863	1.0452	1.1073
REFLUX / VAPOR DISTILLATE		2.0504	2.0520	2.0509

'T2'

COLUMN SUMMARY			NET FLOW RATES				HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR				
1C	110.3	86.00	2514.4			299.6L	-22.0215
2	114.4	91.00	2562.7	2814.0			
3	114.5	91.05	2563.1	2862.3			
55	126.9	93.88	2475.0	2778.7			
56	127.4	93.93	2825.0	2774.5	570.0M		
57	127.8	93.99	2822.5	2554.5			
92	142.1	95.89	2751.5	2482.7			
93	142.4	95.95	2747.5	2481.0			
94R	143.1	96.00		2477.0		270.5L	20.2666

REFLUX RATIOS

		REFLUX RATIOS		
		MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3		4.4110	4.3960	4.4783
REFLUX / LIQUID DISTILLATE		8.3937	8.3937	8.3937

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA							
SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN	
1	2 - 41	N/A	24.00	1.00	VALVE	15.00	

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
	TRAY NUMBER					CENTER IN	OFF-CENTER IN
1	38	84.	2	296	12.171	11.842	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 93	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
	TRAY NUMBER					CENTER IN	OFF-CENTER IN
1	56	90.	1	422	14.274	N/A	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID	PHASE	S1 LIQUID	S2 VAPOR	S3 LIQUID	S4 LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	2.0290	2.0290	1.1956E-10	1.1955E-10
2	PROPANE	780.7455	779.9116	.8339	.8339
3	IBUTANE	300.1515	.6537	299.4978	298.6592
4	BUTANE	262.4127	.0111	262.4017	.0648
5	IPENTANE	6.0869	4.9130E-10	6.0869	1.1709E-14
6	PENTANE	1.2174	2.0544E-11	1.2174	1.0496E-14
TOTAL RATE, LB-MOL/HR		1352.6429	782.6054	570.0376	299.5578
STREAM ID	S5				
NAME	LIQUID				
PHASE	LIQUID				

FLUID RATES, LB-MOL/HR					
1	ETHANE	1.1224E-14			
2	PROPANE	2.3019E-14			
3	IBUTANE	.8385			
4	BUTANE	262.3369			
5	IPENTANE	6.0869			
6	PENTANE	1.2174			
TOTAL RATE, LB-MOL/HR		270.4797			

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID	PHASE	S1 LIQUID	S2 VAPOR	S3 LIQUID	S4 LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	1.5000E-03	2.5926E-03	2.0974E-13	3.9909E-13
2	PROPANE	.5772	.9966	1.4628E-03	2.7836E-03
3	IBUTANE	.2219	8.3528E-04	.5254	.9970
4	BUTANE	.1940	1.4164E-05	.4603	2.1632E-04
5	IPENTANE	4.5000E-03	6.2777E-13	.0107	3.9089E-17
6	PENTANE	9.0000E-04	2.6251E-14	2.1356E-03	3.5037E-17

TOTAL RATE, LB/HR	67715.0374	34491.9857	33223.0516	17399.5882
TEMPERATURE, F	63.1400	110.5302	200.4207	110.3401
PRESSURE, PSIA	261.2600	219.0000	229.0000	86.0000
ENTHALPY, MM BTU/HR	1.0743	6.2331	3.5564	.7662
MOLECULAR WEIGHT	50.0613	44.0725	58.2832	58.0850
MOLE FRAC VAPOR	.0000	1.0000	.0000	.0000
MOLE FRAC LIQUID	1.0000	.0000	1.0000	1.0000

STREAM ID	S5
PHASE	LIQUID

FLUID MOLAR FRACTIONS

1	ETHANE	4.1496E-17
2	PROPANE	8.5106E-17
3	IBUTANE	3.1002E-03
4	BUTANE	.9699
5	IPENTANE	.0225
6	PENTANE	4.5008E-03

TOTAL RATE, LB/HR	15823.4635
TEMPERATURE, F	143.0646
PRESSURE, PSIA	96.0000
ENTHALPY, MM BTU/HR	1.0353
MOLECULAR WEIGHT	58.5028
MOLE FRAC VAPOR	.0000
MOLE FRAC LIQUID	1.0000

Feed 3 scheme 4

RIGOROUS COLUMN SUMMARY

'T1'

COLUMN SUMMARY			NET FLOW RATES			HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR			
1C	110.5	219.00	1580.7		782.8V	-9.0623
2	112.5	224.00	1597.1	2363.5		
3	112.6	224.12	1596.2	2379.9		
19	136.4	226.07	1435.3	2231.7		
20	138.8	226.20	3383.3	2218.1	1352.6L	
21	140.4	226.32	3374.6	2813.5		
41	198.1	228.76	3444.0	2880.8		
42	199.1	228.88	3433.7	2874.2		
43R	200.5	229.00		2863.8	569.9L	17.7789

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S1	1.1686	1.0296	1.0908
REFLUX / VAPOR DISTILLATE	2.0193	2.0209	2.0198

'T2'

COLUMN SUMMARY			NET FLOW RATES			HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR			
1C	119.8	94.00	1886.1		352.5L	-17.4813
2	124.4	99.00	1914.6	2238.6		
3	125.3	99.08	1909.0	2267.1		

13	131.8	99.87	1870.7	2226.1			
14	132.3	99.95	2231.7	2223.2	569.9M		
15	132.7	100.03	2230.0	2014.4			
63	148.2	103.84	2182.6	1966.8			
64	148.6	103.92	2178.8	1965.3			
65R	149.4	104.00		1961.5		217.3L	15.8394

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	3.3097	3.2990	3.3424
REFLUX / LIQUID DISTILLATE	5.3501	5.3501	5.3501

'T3'

COLUMN SUMMARY

TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR	
			LIQUID	VAPOR	FEED		PRODUCT
1C	110.4	86.00	1561.3			299.6L	-14.5653
2	114.5	91.00	1591.2	1860.8			
3	114.6	91.07	1591.3	1890.7			
47	119.7	93.96	1576.6	1876.7			
48	119.9	94.03	1928.2	1876.1	352.5L		
49	120.1	94.09	1927.0	1875.2			
76	141.2	95.87	1833.2	1780.5			
77	141.4	95.93	1832.9	1780.2			
78R	141.5	96.00		1780.0		53.0L	14.5012

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S4	4.4288	4.4285	4.4526
REFLUX / LIQUID DISTILLATE	5.2120	5.2120	5.2120

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 42	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	39	84.	2	297	12.126	11.778	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 64	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS CENTER IN	OFF-CENTER IN
1	14	78.	1	311	12.907	N/A	N/A

'T3'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 77	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS CENTER IN	OFF-CENTER IN
1	48	72.	1	265	11.981	N/A	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID		S1	S2	S3	S4
PHASE		LIQUID	VAPOR	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	2.0290	2.0290	1.8748E-11	1.8737E-11
2	PROPANE	780.7455	780.1036	.6419	.6419
3	IBUTANE	300.1515	.6453	299.5061	299.4013
4	BUTANE	262.4127	.0138	262.3989	52.4798
5	IPENTANE	6.0869	1.1582E-09	6.0869	6.5205E-05
6	PENTANE	1.2174	5.3710E-11	1.2174	2.1007E-06
TOTAL RATE, LB-MOL/HR		1352.6429	782.7918	569.8512	352.5231
STREAM ID		S5	S6	S7	
NAME		LIQUID	LIQUID	LIQUID	
PHASE		LIQUID	LIQUID	LIQUID	
FLUID RATES, LB-MOL/HR					
1	ETHANE	1.1168E-14	1.8733E-11	3.5099E-15	
2	PROPANE	1.5604E-14	.6419	2.5096E-13	
3	IBUTANE	.1048	298.6540	.7473	
4	BUTANE	209.9191	.2601	52.2197	
5	IPENTANE	6.0868	6.5238E-15	6.5205E-05	
6	PENTANE	1.2174	7.9291E-15	2.1007E-06	
TOTAL RATE, LB-MOL/HR		217.3281	299.5560	52.9671	

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID		S1	S2	S3	S4
NAME					
PHASE		LIQUID	VAPOR	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	1.5000E-03	2.5920E-03	3.2899E-14	5.3150E-14
2	PROPANE	.5772	.9966	1.1264E-03	1.8208E-03
3	IBUTANE	.2219	8.2439E-04	.5256	.8493
4	BUTANE	.1940	1.7691E-05	.4605	.1489
5	IPENTANE	4.5000E-03	1.4796E-12	.0107	1.8497E-07
6	PENTANE	9.0000E-04	6.8614E-14	2.1363E-03	5.9590E-09
TOTAL RATE, LB/HR					
		67715.0374	34499.5546	33215.4828	20481.0476
TEMPERATURE, F					
		63.1400	110.5295	200.4568	119.7686
PRESSURE, PSIA					
		261.2600	219.0000	229.0000	94.0000
ENTHALPY, MM BTU/HR					
		1.0743	6.2346	3.5564	1.0278
MOLECULAR WEIGHT					
		50.0613	44.0725	58.2880	58.0985
WEIGHT FRAC VAPOR					
		.0000	1.0000	.0000	.0000
WEIGHT FRAC LIQUID					
		1.0000	.0000	1.0000	1.0000
STREAM ID		S5	S6	S7	
NAME					
PHASE		LIQUID	LIQUID	LIQUID	
FLUID MOLAR FRACTIONS					
1	ETHANE	5.1388E-17	6.2536E-14	6.6266E-17	
2	PROPANE	7.1799E-17	2.1427E-03	4.7380E-15	
3	IBUTANE	4.8213E-04	.9970	.0141	
4	BUTANE	.9659	8.6835E-04	.9859	
5	IPENTANE	.0280	2.1778E-17	1.2310E-06	
6	PENTANE	5.6016E-03	2.6470E-17	3.9660E-08	
TOTAL RATE, LB/HR					
		12734.4353	17402.3882	3078.6594	
TEMPERATURE, F					
		149.3996	110.4073	141.5204	
PRESSURE, PSIA					
		104.0000	86.0000	96.0000	
ENTHALPY, MM BTU/HR					
		.8866	.7671	.1990	
MOLECULAR WEIGHT					
		58.5954	58.0939	58.1240	
WEIGHT FRAC VAPOR					
		.0000	.0000	.0000	
WEIGHT FRAC LIQUID					
		1.0000	1.0000	1.0000	

Feed 4 scheme 2

RIGOROUS COLUMN SUMMARY

COLUMN SUMMARY		'T1'				HEATER	
TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			DUTIES MM BTU/HR	
			LIQUID	VAPOR	FEED		PRODUCT
			LB-MOL/HR				
1C	110.8	220.00	4095.7			2219.5V	-23.4544
2	112.8	225.00	4137.8	6315.2			
3	113.0	225.13	4135.3	6357.4			

18	132.1	227.00	3760.3	6024.1			
19	134.7	227.12	8646.0	5979.9	3512.8L		
20	135.8	227.25	8629.7	7352.8			

40	199.2	229.75	8700.2	7430.7			
41	200.5	229.87	8660.9	7407.0			
42R	202.3	230.00		7367.7		1293.3L	45.8982

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM PUMPED	1.1659	1.0411	1.0965
REFLUX / VAPOR DISTILLATE	1.8453	1.8475	1.8458

COLUMN SUMMARY

'T2'

TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR
			LIQUID	VAPOR	FEED	
			LB-MOL/HR			
1C	110.4	86.00	5600.7			655.4L
2	114.5	91.00	5708.0	6256.1		
3	114.6	91.06	5708.6	6363.4		
51	127.6	93.72	5489.0	6155.5		
52	128.3	93.78	6277.1	6144.4	1293.3M	
53	128.7	93.83	6271.0	5639.2		
90	142.8	95.89	6123.0	5494.3		
91	143.4	95.94	6102.2	5485.1		
92R	144.8	96.00		5464.4		637.9L
						44.9386

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	4.3307	4.2966	4.3866
REFLUX / LIQUID DISTILLATE	8.5454	8.5454	8.5454

COLUMN SIZING SUMMARY

TRAY SIZING MECHANICAL DATA

'T1'

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 41	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS CENTER IN	OFF-CENTER IN
1	38	138.	2	830	19.072	18.155	N/A

TRAY SIZING MECHANICAL DATA

'T2'

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 91	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN	DIAMETER	NP	NUMBER	SIDE	DOWNCOMER WIDTHS	
	TRAY			OF VALVES		CENTER	OFF-CENTER
	NUMBER	IN		OR CAPS	IN	IN	IN
1	52	126.	2	798	13.536	11.458	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID		GSP1	GSP2	PUMPED	S1
PHASE		LIQUID	LIQUID	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	.7667	9.2565	10.0232	10.0232
2	PROPANE	1156.0462	1053.0069	2209.0531	2209.0531
3	IBUTANE	387.5850	269.0769	656.6620	656.6620
4	BUTANE	349.2482	246.8933	596.1415	596.1415
5	IPENTANE	20.5102	17.3958	37.9060	37.9060
6	PENTANE	2.6836	.3192	3.0028	3.0028
TOTAL RATE, LB-MOL/HR		1916.8400	1595.9487	3512.7887	3512.7887
STREAM ID		S2	S3	S4	S5
PHASE		VAPOR	LIQUID	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	10.0232	6.9826E-11	6.9787E-11	3.9321E-14
2	PROPANE	2207.3897	1.6634	1.6634	4.3190E-14
3	IBUTANE	2.0596	654.6024	653.4257	1.1765
4	BUTANE	.0599	596.0816	.3138	595.7680
5	IPENTANE	2.6973E-08	37.9060	3.2763E-14	37.9061
6	PENTANE	5.5503E-10	3.0028	3.4739E-14	3.0028
TOTAL RATE, LB-MOL/HR		2219.5324	1293.2563	655.4030	637.8533

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID		GSP1	GSP2	PUMPED	S1
PHASE		LIQUID	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	4.0000E-04	5.8000E-03	2.8534E-03	2.8534E-03
2	PROPANE	.6031	.6598	.6289	.6289
3	IBUTANE	.2022	.1686	.1869	.1869
4	BUTANE	.1822	.1547	.1697	.1697
5	IPENTANE	.0107	.0109	.0108	.0108
6	PENTANE	1.4000E-03	2.0000E-04	8.5481E-04	8.5481E-04
TOTAL RATE, LB/HR		95502.3775	77981.2000	173483.5775	173483.5775
TEMPERATURE, F		76.4600	59.7200	69.3113	68.9765
PRESSURE, PSIA		232.2500	200.3400	228.0000	200.3400
ENTHALPY, MM BTU/HR		2.3080	1.0775	3.4242	3.3855
MOLECULAR WEIGHT		49.8228	48.8620	49.3863	49.3863
WEIGHT FRAC VAPOR		.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID		1.0000	1.0000	1.0000	1.0000
STREAM ID		S2	S3	S4	S5
PHASE		VAPOR	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	4.5159E-03	5.3992E-14	1.0648E-13	6.1646E-17
2	PROPANE	.9945	1.2862E-03	2.5380E-03	6.7711E-17
3	IBUTANE	9.2792E-04	.5062	.9970	1.8445E-03
4	BUTANE	2.6984E-05	.4609	4.7880E-04	.9340
5	IPENTANE	1.2153E-11	.0293	4.9989E-17	.0594
6	PENTANE	2.5007E-13	2.3219E-03	5.3004E-17	4.7076E-03
TOTAL RATE, LB/HR		97763.8531	75719.7244	38071.3098	37648.4156
TEMPERATURE, F		110.7744	202.3089	110.3661	144.8316
PRESSURE, PSIA		220.0000	230.0000	86.0000	96.0000
ENTHALPY, MM BTU/HR		17.6695	8.1868	1.6771	2.4923

MOLECULAR WEIGHT	44.0470	58.5497	58.0884	59.0236
WEIGHT FRAC VAPOR	1.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID	.0000	1.0000	1.0000	1.0000

Feed 5 scheme 2

RIGOROUS COLUMN SUMMARY

'T1'

COLUMN SUMMARY			NET FLOW RATES			HEATER	
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR				
1C	110.2	218.00	3892.5			1939.3V	-22.3834
2	112.9	225.00	3949.4	5831.8			
3	113.0	225.13	3947.4	5888.7			
20	137.9	227.25	3539.1	5510.3			
21	140.2	227.37	8101.2	5478.4	3269.5L		
22	142.5	227.50	8071.0	6771.0			
40	198.8	229.75	8251.8	6940.0			
41	200.0	229.87	8221.0	6921.6			
42R	201.6	230.00		6890.9		1330.2L	42.8232

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S1	1.1906	1.0520	1.1132
REFLUX / VAPOR DISTILLATE	2.0072	2.0083	2.0076

'T2'

COLUMN SUMMARY			NET FLOW RATES			HEATER	
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR				
1C	110.3	86.00	5804.9			686.4L	-50.7996
2	114.4	91.00	5916.5	6491.3			
3	114.5	91.05	5917.4	6602.9			
55	127.3	93.88	5705.2	6402.8			
56	127.9	93.93	6517.4	6391.6	1330.2M		
57	128.3	93.99	6511.4	5873.6			
92	142.4	95.89	6348.6	5711.8			
93	142.9	95.95	6332.3	5704.8			
94R	144.0	96.00		5688.5		643.8L	46.6724

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	4.3640	4.3386	4.4250
REFLUX / LIQUID DISTILLATE	8.4575	8.4575	8.4575

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 41	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	38	132.	2	746	18.684	17.983	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 93	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	56	132.	2	890	13.655	11.355	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID	PHASE	GSP1 LIQUID	GSP3 LIQUID	S1 LIQUID	S2 VAPOR
FLUID RATES, LB-MOL/HR					
1	ETHANE	.7667	2.0290	2.7957	2.7957
2	PROPANE	1156.0462	780.7455	1936.7917	1934.8906
3	IBUTANE	387.5850	300.1515	687.7365	1.5814
4	BUTANE	349.2482	262.4127	611.6610	.0278
5	IPENTANE	20.5102	6.0869	26.5971	2.3812E-09
6	PENTANE	2.6836	1.2174	3.9010	7.4100E-11
TOTAL RATE, LB-MOL/HR		1916.8400	1352.6429	3269.4829	1939.2955
STREAM ID	PHASE	S3 LIQUID	S4 LIQUID	S5 LIQUID	
FLUID RATES, LB-MOL/HR					
1	ETHANE	1.5482E-10	1.5481E-10	1.4848E-14	
2	PROPANE	1.9011	1.9011	5.1901E-14	
3	IBUTANE	686.1552	684.3064	1.8486	
4	BUTANE	611.6332	.1595	611.4737	
5	IPENTANE	26.5971	5.4701E-14	26.5971	
6	PENTANE	3.9010	3.8038E-14	3.9010	
TOTAL RATE, LB-MOL/HR		1330.1874	686.3670	643.8204	

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID	PHASE	GSP1	GSP3	S1	S2
		LIQUID	LIQUID	LIQUID	VAPOR
FLUID MOLAR FRACTIONS					
1	ETHANE	4.0000E-04	1.5000E-03	8.5509E-04	1.4416E-03
2	PROPANE	.6031	.5772	.5924	.9977
3	IBUTANE	.2022	.2219	.2104	8.1543E-04
4	BUTANE	.1822	.1940	.1871	1.4344E-05
5	IPENTANE	.0107	4.5000E-03	8.1350E-03	1.2279E-12
6	PENTANE	1.4000E-03	9.0000E-04	1.1931E-03	3.8209E-14
TOTAL RATE, LB/HR		95502.3775	67715.0374	163217.4149	85500.4703
TEMPERATURE, F		76.4600	63.1400	71.0061	110.2432
PRESSURE, PSIA		232.2500	261.2600	232.2500	218.0000
ENTHALPY, MM BTU/HR		2.3080	1.0743	3.3823	15.4478
MOLECULAR WEIGHT		49.8228	50.0613	49.9215	44.0884
WEIGHT FRAC VAPOR		.0000	.0000	.0000	1.0000
WEIGHT FRAC LIQUID		1.0000	1.0000	1.0000	.0000

STREAM ID	PHASE	S3	S4	S5
		LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS				
1	ETHANE	1.1639E-13	2.2555E-13	2.3062E-17
2	PROPANE	1.4292E-03	2.7698E-03	8.0615E-17
3	IBUTANE	.5158	.9970	2.8713E-03
4	BUTANE	.4598	2.3243E-04	.9498
5	IPENTANE	.0200	7.9696E-17	.0413
6	PENTANE	2.9326E-03	5.5419E-17	6.0591E-03
TOTAL RATE, LB/HR		77716.9446	39867.7320	37849.2131
TEMPERATURE, F		201.5980	110.3416	144.0174
PRESSURE, PSIA		230.0000	86.0000	96.0000
ENTHALPY, MM BTU/HR		8.3743	1.7556	2.4925
MOLECULAR WEIGHT		58.4256	58.0851	58.7885
WEIGHT FRAC VAPOR		.0000	.0000	.0000
WEIGHT FRAC LIQUID		1.0000	1.0000	1.0000

Feed 6 scheme 2

RIGOROUS COLUMN SUMMARY

COLUMN SUMMARY			'T1'			HEATER
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	NET FLOW RATES VAPOR FEED PRODUCT LB-MOL/HR		DUTIES MM BTU/HR
1C	110.6	220.00	3445.7		1844.9V	-19.7335
2	112.7	225.00	3482.5	5290.6		
3	112.8	225.13	3481.5	5327.4		
19	132.9	227.12	3158.0	5036.6		
20	135.4	227.25	7372.4	5002.9	2948.6L	
21	136.9	227.37	7354.1	6268.7		
40	198.8	229.75	7434.2	6347.4		
41	200.0	229.87	7406.3	6330.5		
42R	201.6	230.00		6302.6	1103.7L	39.1666

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM PUMPED	1.1686	1.0426	1.0984
REFLUX / VAPOR DISTILLATE	1.8677	1.8704	1.8682

'T2'

COLUMN SUMMARY

TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR
			LIQUID	VAPOR	FEED PRODUCT	
			LB-MOL/HR			
1C	110.3	86.00	4795.2			
2	114.4	91.00	4887.2	5363.3		
3	114.5	91.05	4887.7	5455.2		
54	126.7	93.80	4717.9	5295.8		
55	127.4	93.85	5391.8	5286.0	1103.7M	
56	127.7	93.90	5387.6	4856.1		
93	142.4	95.89	5247.3	4717.3		
94	142.9	95.95	5234.2	4711.6		
95R	144.0	96.00		4698.6		
					535.6L	38.5464

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	4.3446	4.3196	4.4056
REFLUX / LIQUID DISTILLATE	8.4413	8.4413	8.4413

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 41	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	38	126.	2	683	17.696	16.971	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 94	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	55	120.	2	736	12.423	10.334	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID	GSP2	GSP3	PUMPED	S1
PHASE	LIQUID	LIQUID	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR				
1 ETHANE	9.2565	2.0290	11.2855	11.2855
2 PROPANE	1053.0069	780.7455	1833.7524	1833.7524
3 IBUTANE	269.0769	300.1515	569.2284	569.2284
4 BUTANE	246.8933	262.4127	509.3060	509.3060
5 IPENTANE	17.3958	6.0869	23.4827	23.4827
6 PENTANE	.3192	1.2174	1.5366	1.5366
TOTAL RATE, LB-MOL/HR	1595.9487	1352.6429	2948.5916	2948.5916
STREAM ID	S2	S3	S4	S5
PHASE	VAPOR	LIQUID	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR				
1 ETHANE	11.2855	2.0407E-10	2.0405E-10	2.0220E-14
2 PROPANE	1832.1704	1.5821	1.5820	2.4139E-14
3 IBUTANE	1.3870	567.8414	566.3587	1.4826
4 BUTANE	.0321	509.2739	.1291	509.1449
5 IPENTANE	5.5386E-09	23.4827	4.0646E-14	23.4828
6 PENTANE	8.7224E-11	1.5366	1.1574E-14	1.5366
TOTAL RATE, LB-MOL/HR	1844.8750	1103.7166	568.0698	535.6468

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID	GSP2	GSP3	PUMPED	S1
PHASE	LIQUID	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS				
1 ETHANE	5.8000E-03	1.5000E-03	3.8274E-03	3.8274E-03
2 PROPANE	.6598	.5772	.6219	.6219
3 IBUTANE	.1686	.2219	.1931	.1931
4 BUTANE	.1547	.1940	.1727	.1727
5 IPENTANE	.0109	4.5000E-03	7.9641E-03	7.9641E-03
6 PENTANE	2.0000E-04	9.0000E-04	5.2112E-04	5.2112E-04
TOTAL RATE, LB/HR	77981.2000	67715.0377	145696.2377	145696.2377
TEMPERATURE, F	59.7200	63.1400	61.6885	61.3551
PRESSURE, PSIA	200.3400	261.2600	229.0000	200.3400
ENTHALPY, MM BTU/HR	1.0775	1.0743	2.1852	2.1519
MOLECULAR WEIGHT	48.8620	50.0613	49.4121	49.4121
WEIGHT FRAC VAPOR	.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID	1.0000	1.0000	1.0000	1.0000
STREAM ID	S2	S3	S4	S5
PHASE	VAPOR	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS				
1 ETHANE	6.1172E-03	1.8489E-13	3.5920E-13	3.7749E-17
2 PROPANE	.9931	1.4334E-03	2.7850E-03	4.5065E-17
3 IBUTANE	7.5184E-04	.5145	.9970	2.7678E-03
4 BUTANE	1.7410E-05	.4614	2.2721E-04	.9505
5 IPENTANE	3.0022E-12	.0213	7.1552E-17	.0438
6 PENTANE	4.7279E-14	1.3922E-03	2.0375E-17	2.8686E-03
TOTAL RATE, LB/HR	81215.0591	64481.1786	32996.2968	31484.8822
TEMPERATURE, F	110.6418	201.6071	110.3402	143.9867
PRESSURE, PSIA	220.0000	230.0000	86.0000	96.0000
ENTHALPY, MM BTU/HR	14.6742	6.9483	1.4530	2.0720
MOLECULAR WEIGHT	44.0220	58.4219	58.0849	58.7792
WEIGHT FRAC VAPOR	1.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID	.0000	1.0000	1.0000	1.0000

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID		S1	S2	S3	S4
NAME					
PHASE		LIQUID	VAPOR	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	1.5000E-03	2.5920E-03	3.2899E-14	5.3150E-14
2	PROPANE	.5772	.9966	1.1264E-03	1.8208E-03
3	IBUTANE	.2219	8.2439E-04	.5256	.8493
4	BUTANE	.1940	1.7691E-05	.4605	.1489
5	IPENTANE	4.5000E-03	1.4796E-12	.0107	1.8497E-07
6	PENTANE	9.0000E-04	6.8614E-14	2.1363E-03	5.9590E-09
TOTAL RATE, LB/HR					
		67715.0374	34499.5546	33215.4828	20481.0476
TEMPERATURE, F					
		63.1400	110.5295	200.4568	119.7686
PRESSURE, PSIA					
		261.2600	219.0000	229.0000	94.0000
ENTHALPY, MM BTU/HR					
		1.0743	6.2346	3.5564	1.0278
MOLECULAR WEIGHT					
		50.0613	44.0725	58.2880	58.0985
WEIGHT FRAC VAPOR					
		.0000	1.0000	.0000	.0000
WEIGHT FRAC LIQUID					
		1.0000	.0000	1.0000	1.0000
STREAM ID		S5	S6	S7	
NAME					
PHASE		LIQUID	LIQUID	LIQUID	
FLUID MOLAR FRACTIONS					
1	ETHANE	5.1388E-17	6.2536E-14	6.6266E-17	
2	PROPANE	7.1799E-17	2.1427E-03	4.7380E-15	
3	IBUTANE	4.8213E-04	.9970	.0141	
4	BUTANE	.9659	8.6835E-04	.9859	
5	IPENTANE	.0280	2.1778E-17	1.2310E-06	
6	PENTANE	5.6016E-03	2.6470E-17	3.9660E-08	
TOTAL RATE, LB/HR					
		12734.4353	17402.3882	3078.6594	
TEMPERATURE, F					
		149.3996	110.4073	141.5204	
PRESSURE, PSIA					
		104.0000	86.0000	96.0000	
ENTHALPY, MM BTU/HR					
		.8866	.7671	.1990	
MOLECULAR WEIGHT					
		58.5954	58.0939	58.1240	
WEIGHT FRAC VAPOR					
		.0000	.0000	.0000	
WEIGHT FRAC LIQUID					
		1.0000	1.0000	1.0000	

Feed 4 scheme 2

RIGOROUS COLUMN SUMMARY

COLUMN SUMMARY			'T1'				HEATER DUTIES
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	MM BTU/HR
			NET FLOW RATES				
			LB-MOL/HR				
1C	110.8	220.00	4095.7			2219.5V	-23.4544
2	112.8	225.00	4137.8	6315.2			
3	113.0	225.13	4135.3	6357.4			

18	132.1	227.00	3760.3	6024.1			
19	134.7	227.12	8646.0	5979.9	3512.8L		
20	135.8	227.25	8629.7	7352.8			

40	199.2	229.75	8700.2	7430.7			
41	200.5	229.87	8660.9	7407.0			
42R	202.3	230.00		7367.7		1293.3L	45.8982

REFLUX RATIOS

REFLUX RATIOS			
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM PUMPED	1.1659	1.0411	1.0965
REFLUX / VAPOR DISTILLATE	1.8453	1.8475	1.8458

'T2'

COLUMN SUMMARY

TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			PRODUCT	HEATER DUTIES MM BTU/HR
			LIQUID	VAPOR	FEED		
			LB-MOL/HR				
1C	110.4	86.00	5600.7			655.4L	-48.9587
2	114.5	91.00	5708.0	6256.1			
3	114.6	91.06	5708.6	6363.4			
51	127.6	93.72	5489.0	6155.5			
52	128.3	93.78	6277.1	6144.4	1293.3M		
53	128.7	93.83	6271.0	5639.2			
90	142.8	95.89	6123.0	5494.3			
91	143.4	95.94	6102.2	5485.1			
92R	144.8	96.00		5464.4		637.9L	44.9386

REFLUX RATIOS

REFLUX RATIOS			
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	4.3307	4.2966	4.3866
REFLUX / LIQUID DISTILLATE	8.5454	8.5454	8.5454

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 41	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	38	138.	2	830	19.072	18.155	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 91	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN	DIAMETER IN	NP	NUMBER	SIDE	DOWNCOMER WIDTHS	
	TRAY NUMBER			OF VALVES OR CAPS		IN	CENTER IN
1	52	126.	2	798	13.536	11.458	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID		GSP1	GSP2	PUMPED	S1
PHASE		LIQUID	LIQUID	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	.7667	9.2565	10.0232	10.0232
2	PROPANE	1156.0462	1053.0069	2209.0531	2209.0531
3	IBUTANE	387.5850	269.0769	656.6620	656.6620
4	BUTANE	349.2482	246.8933	596.1415	596.1415
5	IPENTANE	20.5102	17.3958	37.9060	37.9060
6	PENTANE	2.6836	.3192	3.0028	3.0028
TOTAL RATE, LB-MOL/HR		1916.8400	1595.9487	3512.7887	3512.7887
STREAM ID		S2	S3	S4	S5
PHASE		VAPOR	LIQUID	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	10.0232	6.9826E-11	6.9787E-11	3.9321E-14
2	PROPANE	2207.3897	1.6634	1.6634	4.3190E-14
3	IBUTANE	2.0596	654.6024	653.4257	1.1765
4	BUTANE	.0599	596.0816	.3138	595.7680
5	IPENTANE	2.6973E-08	37.9060	3.2763E-14	37.9061
6	PENTANE	5.5503E-10	3.0028	3.4739E-14	3.0028
TOTAL RATE, LB-MOL/HR		2219.5324	1293.2563	655.4030	637.8533

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID		GSP1	GSP2	PUMPED	S1
PHASE		LIQUID	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	4.0000E-04	5.8000E-03	2.8534E-03	2.8534E-03
2	PROPANE	.6031	.6598	.6289	.6289
3	IBUTANE	.2022	.1686	.1869	.1869
4	BUTANE	.1822	.1547	.1697	.1697
5	IPENTANE	.0107	.0109	.0108	.0108
6	PENTANE	1.4000E-03	2.0000E-04	8.5481E-04	8.5481E-04
TOTAL RATE, LB/HR		95502.3775	77981.2000	173483.5775	173483.5775
TEMPERATURE, F		76.4600	59.7200	69.3113	68.9765
PRESSURE, PSIA		232.2500	200.3400	228.0000	200.3400
ENTHALPY, MM BTU/HR		2.3080	1.0775	3.4242	3.3855
MOLECULAR WEIGHT		49.8228	48.8620	49.3863	49.3863
WEIGHT FRAC VAPOR		.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID		1.0000	1.0000	1.0000	1.0000
STREAM ID		S2	S3	S4	S5
PHASE		VAPOR	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	4.5159E-03	5.3992E-14	1.0648E-13	6.1646E-17
2	PROPANE	.9945	1.2862E-03	2.5380E-03	6.7711E-17
3	IBUTANE	9.2792E-04	.5062	.9970	1.8445E-03
4	BUTANE	2.6984E-05	.4609	4.7880E-04	.9340
5	IPENTANE	1.2153E-11	.0293	4.9989E-17	.0594
6	PENTANE	2.5007E-13	2.3219E-03	5.3004E-17	4.7076E-03
TOTAL RATE, LB/HR		97763.8531	75719.7244	38071.3098	37648.4156
TEMPERATURE, F		110.7744	202.3089	110.3661	144.8316
PRESSURE, PSIA		220.0000	230.0000	86.0000	96.0000
ENTHALPY, MM BTU/HR		17.6695	8.1868	1.6771	2.4923

MOLECULAR WEIGHT	44.0470	58.5497	58.0884	59.0236
WEIGHT FRAC VAPOR	1.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID	.0000	1.0000	1.0000	1.0000

Feed 5 scheme 2

RIGOROUS COLUMN SUMMARY

' T1 '

COLUMN SUMMARY			NET FLOW RATES			HEATER	
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR				
1C	110.2	218.00	3892.5			1939.3V	-22.3834
2	112.9	225.00	3949.4	5831.8			
3	113.0	225.13	3947.4	5888.7			
20	137.9	227.25	3539.1	5510.3			
21	140.2	227.37	8101.2	5478.4	3269.5L		
22	142.5	227.50	8071.0	6771.0			
40	198.8	229.75	8251.8	6940.0			
41	200.0	229.87	8221.0	6921.6			
42R	201.6	230.00		6890.9		1330.2L	42.8232

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S1	1.1906	1.0520	1.1132
REFLUX / VAPOR DISTILLATE	2.0072	2.0083	2.0076

' T2 '

COLUMN SUMMARY			NET FLOW RATES			HEATER	
TRAY	TEMP DEG F	PRESSURE PSIA	LIQUID	VAPOR	FEED	PRODUCT	DUTIES MM BTU/HR
			LB-MOL/HR				
1C	110.3	86.00	5804.9			686.4L	-50.7996
2	114.4	91.00	5916.5	6491.3			
3	114.5	91.05	5917.4	6602.9			
55	127.3	93.88	5705.2	6402.8			
56	127.9	93.93	6517.4	6391.6	1330.2M		
57	128.3	93.99	6511.4	5873.6			
92	142.4	95.89	6348.6	5711.8			
93	142.9	95.95	6332.3	5704.8			
94R	144.0	96.00		5688.5		643.8L	46.6724

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	4.3640	4.3386	4.4250
REFLUX / LIQUID DISTILLATE	8.4575	8.4575	8.4575

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 41	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	38	132.	2	746	18.684	17.983	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 93	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	56	132.	2	890	13.655	11.355	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID	PHASE	GSP1 LIQUID	GSP3 LIQUID	S1 LIQUID	S2 VAPOR
FLUID RATES, LB-MOL/HR					
1	ETHANE	.7667	2.0290	2.7957	2.7957
2	PROPANE	1156.0462	780.7455	1936.7917	1934.8906
3	IBUTANE	387.5850	300.1515	687.7365	1.5814
4	BUTANE	349.2482	262.4127	611.6610	.0278
5	IPENTANE	20.5102	6.0869	26.5971	2.3812E-09
6	PENTANE	2.6836	1.2174	3.9010	7.4100E-11
TOTAL RATE, LB-MOL/HR		1916.8400	1352.6429	3269.4829	1939.2955
STREAM ID	PHASE	S3 LIQUID	S4 LIQUID	S5 LIQUID	
FLUID RATES, LB-MOL/HR					
1	ETHANE	1.5482E-10	1.5481E-10	1.4848E-14	
2	PROPANE	1.9011	1.9011	5.1901E-14	
3	IBUTANE	686.1552	684.3064	1.8486	
4	BUTANE	611.6332	.1595	611.4737	
5	IPENTANE	26.5971	5.4701E-14	26.5971	
6	PENTANE	3.9010	3.8038E-14	3.9010	
TOTAL RATE, LB-MOL/HR		1330.1874	686.3670	643.8204	

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID	PHASE	GSP1 LIQUID	GSP3 LIQUID	S1 LIQUID	S2 VAPOR
FLUID MOLAR FRACTIONS					
1	ETHANE	4.0000E-04	1.5000E-03	8.5509E-04	1.4416E-03
2	PROPANE	.6031	.5772	.5924	.9977
3	IBUTANE	.2022	.2219	.2104	8.1543E-04
4	BUTANE	.1822	.1940	.1871	1.4344E-05
5	IPENTANE	.0107	4.5000E-03	8.1350E-03	1.2279E-12
6	PENTANE	1.4000E-03	9.0000E-04	1.1931E-03	3.8209E-14
TOTAL RATE, LB/HR					
		95502.3775	67715.0374	163217.4149	85500.4703
TEMPERATURE, F					
		76.4600	63.1400	71.0061	110.2432
PRESSURE, PSIA					
		232.2500	261.2600	232.2500	218.0000
ENTHALPY, MM BTU/HR					
		2.3080	1.0743	3.3823	15.4478
MOLECULAR WEIGHT					
		49.8228	50.0613	49.9215	44.0884
WEIGHT FRAC VAPOR					
		.0000	.0000	.0000	1.0000
WEIGHT FRAC LIQUID					
		1.0000	1.0000	1.0000	.0000

STREAM ID	PHASE	S3 LIQUID	S4 LIQUID	S5 LIQUID
FLUID MOLAR FRACTIONS				
1	ETHANE	1.1639E-13	2.2555E-13	2.3062E-17
2	PROPANE	1.4292E-03	2.7698E-03	8.0615E-17
3	IBUTANE	.5158	.9970	2.8713E-03
4	BUTANE	.4598	2.3243E-04	.9498
5	IPENTANE	.0200	7.9696E-17	.0413
6	PENTANE	2.9326E-03	5.5419E-17	6.0591E-03
TOTAL RATE, LB/HR				
		77716.9446	39867.7320	37849.2131
TEMPERATURE, F				
		201.5980	110.3416	144.0174
PRESSURE, PSIA				
		230.0000	86.0000	96.0000
ENTHALPY, MM BTU/HR				
		8.3743	1.7556	2.4925
MOLECULAR WEIGHT				
		58.4256	58.0851	58.7885
WEIGHT FRAC VAPOR				
		.0000	.0000	.0000
WEIGHT FRAC LIQUID				
		1.0000	1.0000	1.0000

Feed 6 scheme 2

RIGOROUS COLUMN SUMMARY

COLUMN SUMMARY						
TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR
			LIQUID	VAPOR	FEED PRODUCT	
			LB-MOL/HR			
1C	110.6	220.00	3445.7		1844.9V	-19.7335
2	112.7	225.00	3482.5	5290.6		
3	112.8	225.13	3481.5	5327.4		
19	132.9	227.12	3158.0	5036.6		
20	135.4	227.25	7372.4	5002.9	2948.6L	
21	136.9	227.37	7354.1	6268.7		
40	198.8	229.75	7434.2	6347.4		
41	200.0	229.87	7406.3	6330.5		
42R	201.6	230.00		6302.6	1103.7L	39.1666

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM PUMPED	1.1686	1.0426	1.0984
REFLUX / VAPOR DISTILLATE	1.8677	1.8704	1.8682

'T2'

COLUMN SUMMARY

TRAY	TEMP DEG F	PRESSURE PSIA	NET FLOW RATES			HEATER DUTIES MM BTU/HR	
			LIQUID	VAPOR	FEED		PRODUCT
1C	110.3	86.00	4795.2			568.1L	-41.9722
2	114.4	91.00	4887.2	5363.3			
3	114.5	91.05	4887.7	5455.2			
54	126.7	93.80	4717.9	5295.8			
55	127.4	93.85	5391.8	5286.0	1103.7M		
56	127.7	93.90	5387.6	4856.1			
93	142.4	95.89	5247.3	4717.3			
94	142.9	95.95	5234.2	4711.6			
95R	144.0	96.00		4698.6		535.6L	38.5464

REFLUX RATIOS

	REFLUX RATIOS		
	MOLAR	WEIGHT	STD L VOL
REFLUX / FEED STREAM S3	4.3446	4.3196	4.4056
REFLUX / LIQUID DISTILLATE	8.4413	8.4413	8.4413

COLUMN SIZING SUMMARY

'T1'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 41	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	38	126.	2	683	17.696	16.971	N/A

'T2'

TRAY SIZING MECHANICAL DATA

SECTION	TRAY NUMBERS	TRAY PASSES	TRAY SPACING IN	SYSTEM FACTOR	TRAY TYPE	MIN DIAMETER IN
1	2 - 94	N/A	24.00	1.00	VALVE	15.00

TRAY SIZING RESULTS

VALVE DIAMETER 1.875 IN

SECTION	DESIGN TRAY NUMBER	DIAMETER IN	NP	NUMBER OF VALVES OR CAPS	SIDE IN	DOWNCOMER WIDTHS	
						CENTER IN	OFF-CENTER IN
1	55	120.	2	736	12.423	10.334	N/A

STREAM MOLAR COMPONENT RATES

STREAM ID		GSP2	GSP3	PUMPED	S1
PHASE		LIQUID	LIQUID	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	9.2565	2.0290	11.2855	11.2855
2	PROPANE	1053.0069	780.7455	1833.7524	1833.7524
3	IBUTANE	269.0769	300.1515	569.2284	569.2284
4	BUTANE	246.8933	262.4127	509.3060	509.3060
5	IPENTANE	17.3958	6.0869	23.4827	23.4827
6	PENTANE	.3192	1.2174	1.5366	1.5366
TOTAL RATE, LB-MOL/HR		1595.9487	1352.6429	2948.5916	2948.5916
STREAM ID		S2	S3	S4	S5
PHASE		VAPOR	LIQUID	LIQUID	LIQUID
FLUID RATES, LB-MOL/HR					
1	ETHANE	11.2855	2.0407E-10	2.0405E-10	2.0220E-14
2	PROPANE	1832.1704	1.5821	1.5820	2.4139E-14
3	IBUTANE	1.3870	567.8414	566.3587	1.4826
4	BUTANE	.0321	509.2739	.1291	509.1449
5	IPENTANE	5.5386E-09	23.4827	4.0646E-14	23.4828
6	PENTANE	8.7224E-11	1.5366	1.1574E-14	1.5366
TOTAL RATE, LB-MOL/HR		1844.8750	1103.7166	568.0698	535.6468

STREAM MOLAR COMPONENT FRACTIONS

STREAM ID		GSP2	GSP3	PUMPED	S1
PHASE		LIQUID	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	5.8000E-03	1.5000E-03	3.8274E-03	3.8274E-03
2	PROPANE	.6598	.5772	.6219	.6219
3	IBUTANE	.1686	.2219	.1931	.1931
4	BUTANE	.1547	.1940	.1727	.1727
5	IPENTANE	.0109	4.5000E-03	7.9641E-03	7.9641E-03
6	PENTANE	2.0000E-04	9.0000E-04	5.2112E-04	5.2112E-04
TOTAL RATE, LB/HR		77981.2000	67715.0377	145696.2377	145696.2377
TEMPERATURE, F		59.7200	63.1400	61.6885	61.3551
PRESSURE, PSIA		200.3400	261.2600	229.0000	200.3400
ENTHALPY, MM BTU/HR		1.0775	1.0743	2.1852	2.1519
MOLECULAR WEIGHT		48.8620	50.0613	49.4121	49.4121
WEIGHT FRAC VAPOR		.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID		1.0000	1.0000	1.0000	1.0000
STREAM ID		S2	S3	S4	S5
PHASE		VAPOR	LIQUID	LIQUID	LIQUID
FLUID MOLAR FRACTIONS					
1	ETHANE	6.1172E-03	1.8489E-13	3.5920E-13	3.7749E-17
2	PROPANE	.9931	1.4334E-03	2.7850E-03	4.5065E-17
3	IBUTANE	7.5184E-04	.5145	.9970	2.7678E-03
4	BUTANE	1.7410E-05	.4614	2.2721E-04	.9505
5	IPENTANE	3.0022E-12	.0213	7.1552E-17	.0438
6	PENTANE	4.7279E-14	1.3922E-03	2.0375E-17	2.8686E-03
TOTAL RATE, LB/HR		81215.0591	64481.1786	32996.2968	31484.8822
TEMPERATURE, F		110.6418	201.6071	110.3402	143.9867
PRESSURE, PSIA		220.0000	230.0000	86.0000	96.0000
ENTHALPY, MM BTU/HR		14.6742	6.9483	1.4530	2.0720
MOLECULAR WEIGHT		44.0220	58.4219	58.0849	58.7792
WEIGHT FRAC VAPOR		1.0000	.0000	.0000	.0000
WEIGHT FRAC LIQUID		.0000	1.0000	1.0000	1.0000

APPENDIX D
Estimation of Capital Investment

Feed 1 scheme 2

Marshall&Swift index	Jan.1990=	904	3rd Q. 1999=	1069.9	
					Column1 Column2
Diameter, ft				8.5	8.0
Number of trays				39	100
Cost of valve trays in plate column,\$/tray(Jan.1990				1,500	1,350
Cost of trays, \$				69,236	159,775
Cost of shell & Auxiliaries, \$				461,572	1,065,166
Purchased equipment cost, \$				530,808	1,224,941
Total purchased equipment, \$					1,755,749
Direct costs					1,755,749
Purchased equipment (E)					1,755,749
Purchased equipment installation (47%E)					825,202
Instrumentation and controls (installed, 18%E)					316,035
Piping (installed, 66%E)					1,158,794
Electrical (installed, 11%E)					193,132
Buildings (including services, 18%E)					316,035
Yard improvements (10%E)					175,575
Service facilities (installed, 70%E)					1,229,024
Total direct plant cost, \$ (340%E)					5,969,545
Indirect costs					5,969,545
Engineering and supervision					579,397
Construction expenses					719,857
Total direct and indirect plant costs					7,268,799
Contractor's fee (5% direct and indirect costs)					368,707
Contingency (10% direct and indirect costs)					719,857
Fixed-capital investment = direct cost + indirect cost					8,357,363
Working capital (15% of total investment)					1,474,829
Total capital investment					9,832,192

Feed 2 scheme 2

Marshall&Swift index Jan.1990= 904 3rd Q. 1999= 1069.9		
	Column 1	Column 2
Diameter, ft	8.0	7.0
Number of trays	42	83
Cost of valve trays in plate column,\$/tray (Jan.1990	1,350	1,070
Cost of trays, \$	67,105	105,108
Cost of shell & Auxiliaries, \$	447,370	700,721
Purchased equipment cost, \$	514,475	805,830
Total purchased equipment, \$		<u>\$1,320,305</u>
Direct costs		
Purchased equipment (E)		1,320,305
Purchased equipment installation (47%E)		620,543.22
Instrumentation and controls (installed, 18%E)		237,655
Piping (installed, 66%E)		871,401
Electrical (installed, 11%E)		145,234
Buildings (including services, 18%E)		237,655
Yard improvements (10%E)		132,030
Service facilities (installed, 70%E)		924,213
Total direct plant cost, \$ (340%E)		<u>\$4,489,036</u>
Indirect costs		
Engineering and supervision		435,701
Construction expenses		541,325
Total direct and indirect plant costs		<u>\$5,466,062</u>
Contactors' fee (5% direct and indirect costs)		277,264
Contingency (10% direct and indirect costs)		541,325
Fixed-capital investment = direct cost + indirect cost		<u>\$6,284,651</u>
Working capital (15% of total investment)		<u>\$1,109,056</u>
Total capital investment		<u><u>\$7,393,706</u></u>

Feed 3 scheme 2

Marshall&Swift index Jan.1990= 904	3rd Q. 1999= 1069.9	
	Column 1	Column 2
Diameter, ft	7.0	7.5
Number of trays	40	92
Cost of valve trays in plate column, \$/tray (Jan.1990)	1,070	1,200
Cost of trays, \$	50,655	130,660
Cost of shell & Auxiliaries, \$	337,697	871,069
Purchased equipment cost, \$	388,352	1,001,729
		<hr/>
Total purchased equipment, \$		\$1,390,081
		<hr/> <hr/>
Direct costs		
Purchased equipment (E)		1,390,081
Purchased equipment installation (47%E)		653,338.06
Instrumentation and controls (installed, 18%E)		250,215
Piping (installed, 66%E)		917,453
Electrical (installed, 11%E)		152,909
Buildings (including services, 18%E)		250,215
Yard improvements (10%E)		139,008
Service facilities (installed, 70%E)		973,057
Total direct plant cost, \$ (340%E)		\$4,726,275
		<hr/>
Indirect costs		
Engineering and supervision		458,727
Construction expenses		569,933
Total direct and indirect plant costs		\$5,754,935
		<hr/>
Contractor's fee (5% direct and indirect costs)		291,917
Contingency (10% direct and indirect costs)		569,933
Fixed-capital investment = direct cost + indirect cost		\$6,616,786
		<hr/>
Working capital (15% of total investment)		\$1,167,668
		<hr/>
Total capital investment		\$7,784,454
		<hr/> <hr/>

Feed 4 scheme 2

Marshall&Swift index Jan.1990= 904 3rd Q. 1999= 1069.9		
	Column1	Column 2
Diameter, ft	11.5	10.5
Number of trays	40	90
Cost of valve trays in plate column,\$/tray(Jan.1990	2,350	2,050
Cost of trays, \$	111,251	218,359
Cost of shell & Auxiliaries, \$	741,671	1,455,727
Purchased equipment cost, \$	852,922	1,674,086
Total purchased equipment, \$		<u>2,527,008</u>
Direct costs		
Purchased equipment (E)		2,527,008
Purchased equipment installation (47%E)		1,187,694
Instrumentation and controls (installed, 18%E)		454,861
Piping (installed, 66%E)		1,667,825
Electrical (installed, 11%E)		277,971
Buildings (including services, 18%E)		454,861
Yard improvements (10%E)		252,701
Service facilities (installed, 70%E)		1,768,905
Total direct plant cost, \$ (340%E)		<u>8,591,826</u>
Indirect costs		
Engineering and supervision		833,912
Construction expenses		1,036,073
Total direct and indirect plant costs		<u>10,461,811</u>
Contactor's fee (5% direct and indirect costs)		530,672
Contingency (10% direct and indirect costs)		1,036,073
Fixed-capital investment = direct cost + indirect cost		<u>12,028,556</u>
Working capital (15% of total investment)		<u>2,122,686</u>
Total capital investment		<u>14,151,242</u>

Feed 5 scheme 2

Marshall&Swift index Jan.1990= 904	3rd Q. 1999= 1069.9	
	Column1	Column 2
Diameter, ft	11.0	11.0
Number of trays	40	92
Cost of valve trays in plate column,\$/tray(Jan.1990	2,200	2,200
Cost of trays, \$	104,150	239,544
Cost of shell & Auxiliaries, \$	694,330	1,596,960
Purchased equipment cost, \$	798,480	1,836,504
Total purchased equipment, \$		<u>2,634,984</u>
Direct costs		
Purchased equipment (E)		2,634,984
Purchased equipment installation (47%E)		1,238,442
Instrumentation and controls (installed, 18%E)		474,297
Piping (installed, 66%E)		1,739,089
Electrical (installed, 11%E)		289,848
Buildings (including services, 18%E)		474,297
Yard improvements (10%E)		263,498
Service facilities (installed, 70%E)		1,844,489
Total direct plant cost, \$ (340%E)		<u>\$8,958,945</u>
Indirect costs		
Engineering and supervision		869,545
Construction expenses		1,080,343
Total direct and indirect plant costs		<u>10,908,833</u>
Contactor's fee (5% direct and indirect costs)		553,347
Contingency (10% direct and indirect costs)		1,080,343
Fixed-capital investment = direct cost + indirect cost		<u>12,542,523</u>
Working capital (15% of total investment)		<u>\$2,213,386</u>
Total capital investment		<u><u>14,755,909</u></u>

Feed 6 scheme 2

Marshall&Swift index Jan.1990= 904 3rd Q. 1999= 1069.9		
	Column1	Column 2
Diameter, ft	10.5	10.0
Number of trays	40	93
Cost of valve trays in plate column,\$/tray(Jan.1990	2,050	1,910
Cost of trays, \$	97,048	210,228
Cost of shell & Auxiliaries, \$	646,990	1,401,522
Purchased equipment cost, \$	744,038	1,611,750
		<hr/>
Total purchased equipment, \$		\$2,355,788
		<hr/> <hr/>
Direct costs		
Purchased equipment (E)		2,355,788
Purchased equipment installation (47%E)		1,107,220
Instrumentation and controls (installed, 18%E)		424,042
Piping (installed, 66%E)		1,554,820
Electrical (installed, 11%E)		259,137
Buildings (including services, 18%E)		424,042
Yard improvements (10%E)		235,579
Service facilities (installed, 70%E)		1,649,052
Total direct plant cost, \$ (340%E)		\$8,009,679
		<hr/>
Indirect costs		
Engineering and supervision		777,410
Construction expenses		965,873
Total direct and indirect plant costs		\$9,752,962
		<hr/>
Contactor's fee (5% direct and indirect costs)		494,715
Contingency (10% direct and indirect costs)		965,873
Fixed-capital investment = direct cost + indirect cost		11,213,551
		<hr/>
Working capital (15% of total investment)		\$1,978,862
		<hr/>
Total capital investment		13,192,413
		<hr/> <hr/>

(The capital investment calculations for feed 1-6 scheme 4 are not included but can be calculated in the same method)

APPENDIX E

Estimation of Process Profitability

Estimation of return on investment

	Feed 1 Sc 2	Feed 2 Sc2	Feed 3 Sc 2
Total capital investment	9,832,192	7,393,706	7,784,454
Flowrate of propane product, ton/yr	189,147	173,199	127,773
Cost of propane product (270 \$/ton)	51,069,604	46,763,626	34,498,839
Flowrate of isobutane product, ton/yr	83,245	57,802	64,455
Cost of isobutane product (332.1 \$/ton)	27,645,612	19,196,052	21,405,634
Flowrate of LPG product, ton/yr	81,400	57,880	58,617
Cost of LPG product (270 \$/ton)	21,977,994	15,627,551	15,826,596
Annual income (before tax)	100,693,210	81,587,228	71,731,069
Flowrate of LPG feed, ton/yr	353,792	288,884	250,853
Cost of LPG feed (270 \$/ton)	95,523,705	77,998,723	67,730,390
Flow rate of cooling water (Tin=86 F, Tout=104 F), ton/yr	8,192,561	6,549,184	6,425,493
Cost of cooling water (0.08 \$/ton)	655,405	523,935	514,039
Flow rate of steam (SM,T=532 F, P=171 psia), ton/yr	192,350	159,995	149,362
Cost of steam (4.5 \$/ton)	865,575	719,979	672,131
Annual depreciation	496,218	373,151	392,872
Annual cost =Raw material cost+operating cost	97,044,685	79,242,636	68,916,560
Annual profit before taxes = income - cost - depreciation	3,152,306	1,971,441	2,421,637
Annual after 30% tax	2,206,614	1,380,009	1,695,146
Return on Investment (% ROI)	22.4	18.7	21.8

Estimation of return on investment (cont'd)

	Feed 4 Sc 2	Feed 5 Sc2	Feed 6 Sc 2
Total capital investment	14,151,242	14,755,909	13,192,413
Flowrate of propane product, ton/yr	362,167	316,739	300,865
Cost of propane product (270 \$/ton)	97,785,219	85,519,432	81,233,458
Flowrate of isobutane product, ton/yr	141,036	147,689	122,235
Cost of isobutane product (332.1 \$/ton)	46,837,973	49,047,555	40,594,304
Flowrate of LPG product, ton/yr	139,469	140,213	116,634
Cost of LPG product (270 \$/ton)	37,656,556	37,857,602	31,491,155
Annual income (before tax)	182,279,748	172,424,589	153,318,917
Flowrate of LPG feed, ton/yr	642,676	604,645	539,737
Cost of LPG feed (270 \$/ton)	173,522,428	163,254,095	145,729,113
Flow rate of cooling water (Tin=86 F, Tout=104 F), ton/yr	14,903,201	15,061,653	12,699,532
Cost of cooling water (0.08 \$/ton)	1,192,256	1,204,932	1,015,963
Flow rate of steam (SM,T=532 F, P=171 psia), ton/yr	355,342	350,096	304,004
Cost of steam (4.5 \$/ton)	1,599,040	1,575,430	1,368,016
Annual depreciation	714,196	744,712	665,805
Annual cost =Raw material cost+operating cost	176,313,724	166,034,457	148,113,091
Annual profit before taxes = income - cost - depreciation	5,251,828	5,645,419	4,540,022
Annual after 30% tax	3,676,280	3,951,793	3,178,015
Return on Investment (% ROI)	26.0	26.8	24.1

Estimation of presenting discounted-cash flow, present-value, and net-present-value

Feed 1 Scheme 2		year						
line	Item	0	1	2	3	4	5	6
1	Fixed-capital investment	8,357,363						
2	Working capital	1,474,829						
3	Total investment	9,832,192						
4	Annual income	100,693,210	100,693,210	100,693,210	100,693,210	100,693,210	100,693,210	100,693,210
5	Annual manufacturing cost	97,044,685	97,044,685	97,044,685	97,044,685	97,044,685	97,044,685	97,044,685
6	Annual operating income (4-5)	3,648,525	3,648,525	3,648,525	3,648,525	3,648,525	3,648,525	3,648,525
7	Annual depreciation	496,218	496,218	496,218	496,218	496,218	496,218	496,218
8	Income before tax	3,152,306	3,152,306	3,152,306	3,152,306	3,152,306	3,152,306	3,152,306
9	Income after 30% tax (0.7*8)	2,206,614	2,206,614	2,206,614	2,206,614	2,206,614	2,206,614	2,206,614
10	Annual cash income (7+9)	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833
11	Annual cash flow (3+10)	12,535,025	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833
12	Discount factor for 10% interest	1.000	0.952	0.861	0.779	0.705	0.638	0.577
13	Annual present value (11*12)	12,535,025	2,572,085	2,327,319	2,105,845	1,905,448	1,724,120	1,560,049
14	Total present value of annual cash flows (sum of line 13 not including 0 year)						21,571,403	\$
15	Net present value (14-3)						11,739,211	\$

year									
7	8	9	10	11	12	13	14	15	16
100,693,210	100,693,210	100,693,210	100,693,210	100,693,210	100,693,210	100,693,210	100,693,210	100,693,210	100,693,210
97,044,685	97,044,685	97,044,685	97,044,685	97,044,685	97,044,685	97,044,685	97,044,685	97,044,685	97,044,685
3,648,525	3,648,525	3,648,525	3,648,525	3,648,525	3,648,525	3,648,525	3,648,525	3,648,525	3,648,525
496,218	496,218	496,218	496,218	496,218	496,218	496,218	496,218	496,218	496,218
3,152,306	3,152,306	3,152,306	3,152,306	3,152,306	3,152,306	3,152,306	3,152,306	3,152,306	3,152,306
2,206,614	2,206,614	2,206,614	2,206,614	2,206,614	2,206,614	2,206,614	2,206,614	2,206,614	2,206,614
2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833
2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833	2,702,833
0.522	0.473	0.428	0.387	0.350	0.317	0.287	0.259	0.235	0.212
1,411,590	1,277,260	1,155,713	1,045,732	946,217	856,173	774,697	700,975	634,268	573,910

Feed 2 Scheme 2		year						
line	Item	0	1	2	3	4	5	6
1	Fixed-capital investment	6,284,650						
2	Working capital	1,109,056						
3	Total investment	7,393,706						
4	Annual income	81,587,228	81,587,228	81,587,228	81,587,228	81,587,228	81,587,228	81,587,228
5	Annual manufacturing cost	79,242,636	79,242,636	79,242,636	79,242,636	79,242,636	79,242,636	79,242,636
6	Annual operating income (4-5)	2,344,592	2,344,592	2,344,592	2,344,592	2,344,592	2,344,592	2,344,592
7	Annual depreciation	373,151	373,151	373,151	373,151	373,151	373,151	373,151
8	Income before tax	1,971,441	1,971,441	1,971,441	1,971,441	1,971,441	1,971,441	1,971,441
9	Income after 30% tax (0.7*8)	1,380,009	1,380,009	1,380,009	1,380,009	1,380,009	1,380,009	1,380,009
10	Annual cash income (7+9)	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160
11	Annual cash flow (3+10)	9,146,866	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160
12	Discount factor for 10% interest	1.000	0.952	0.861	0.779	0.705	0.638	0.577
13	Annual present value (11*12)	9,146,866	1,668,352	1,509,587	1,365,931	1,235,946	1,118,330	1,011,907
14	Total present value of annual cash flows (sum of line 13 not including 0 year)						13,992,028	\$
15	Net present value (14-3)						6,598,322	\$

year									
7	8	9	10	11	12	13	14	15	16
81,587,228	81,587,228	81,587,228	81,587,228	81,587,228	81,587,228	81,587,228	81,587,228	81,587,228	81,587,228
79,242,636	79,242,636	79,242,636	79,242,636	79,242,636	79,242,636	79,242,636	79,242,636	79,242,636	79,242,636
2,344,592	2,344,592	2,344,592	2,344,592	2,344,592	2,344,592	2,344,592	2,344,592	2,344,592	2,344,592
373,151	373,151	373,151	373,151	373,151	373,151	373,151	373,151	373,151	373,151
1,971,441	1,971,441	1,971,441	1,971,441	1,971,441	1,971,441	1,971,441	1,971,441	1,971,441	1,971,441
1,380,009	1,380,009	1,380,009	1,380,009	1,380,009	1,380,009	1,380,009	1,380,009	1,380,009	1,380,009
1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160
1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160	1,753,160
0.522	0.473	0.428	0.387	0.350	0.317	0.287	0.259	0.235	0.212
915,611	828,479	749,639	678,301	613,752	555,346	502,498	454,679	411,411	372,260

Feed 3 Scheme 2		year						
line	Item	0	1	2	3	4	5	6
1	Fixed-capital investment	6,616,786						
2	Working capital	1,167,668						
3	Total investment	7,784,454						
4	Annual income	71,731,069	71,731,069	71,731,069	71,731,069	71,731,069	71,731,069	71,731,069
5	Annual manufacturing cost	68,916,560	68,916,560	68,916,560	68,916,560	68,916,560	68,916,560	68,916,560
6	Annual operating income (4-5)	2,814,509	2,814,509	2,814,509	2,814,509	2,814,509	2,814,509	2,814,509
7	Annual depreciation	392,872	392,872	392,872	392,872	392,872	392,872	392,872
8	Income before tax	2,421,637	2,421,637	2,421,637	2,421,637	2,421,637	2,421,637	2,421,637
9	Income after 30% tax (0.7*8)	1,695,146	1,695,146	1,695,146	1,695,146	1,695,146	1,695,146	1,695,146
10	Annual cash income (7+9)	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018
11	Annual cash flow (3+10)	9,872,472	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018
12	Discount factor for 10% interest	1.000	0.952	0.861	0.779	0.705	0.638	0.577
13	Annual present value (11*12)	9,872,472	1,987,011	1,797,922	1,626,827	1,472,014	1,331,934	1,205,183
14	Total present value of annual cash flows (sum of line 13 not including 0 year)						16,664,541	\$
15	Net present value (14-3)						8,880,087	\$

year									
7	8	9	10	11	12	13	14	15	16
71,731,069	71,731,069	71,731,069	71,731,069	71,731,069	71,731,069	71,731,069	71,731,069	71,731,069	71,731,069
68,916,560	68,916,560	68,916,560	68,916,560	68,916,560	68,916,560	68,916,560	68,916,560	68,916,560	68,916,560
2,814,509	2,814,509	2,814,509	2,814,509	2,814,509	2,814,509	2,814,509	2,814,509	2,814,509	2,814,509
392,872	392,872	392,872	392,872	392,872	392,872	392,872	392,872	392,872	392,872
2,421,637	2,421,637	2,421,637	2,421,637	2,421,637	2,421,637	2,421,637	2,421,637	2,421,637	2,421,637
1,695,146	1,695,146	1,695,146	1,695,146	1,695,146	1,695,146	1,695,146	1,695,146	1,695,146	1,695,146
2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018
2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018	2,088,018
0.522	0.473	0.428	0.387	0.350	0.317	0.287	0.259	0.235	0.212
1,090,495	986,721	892,822	807,859	730,981	661,419	598,476	541,524	489,991	443,362

Feed 4 Scheme 2		year						
line	Item	0	1	2	3	4	5	6
1	Fixed-capital investment	12,028,556						
2	Working capital	2,122,686						
3	Total investment	14,151,242						
4	Annual income	182,279,748	182,279,748	182,279,748	182,279,748	182,279,748	182,279,748	182,279,748
5	Annual manufacturing cost	176,313,724	176,313,724	176,313,724	176,313,724	176,313,724	176,313,724	176,313,724
6	Annual operating income (4-5)	5,966,024	5,966,024	5,966,024	5,966,024	5,966,024	5,966,024	5,966,024
7	Annual depreciation	714,195	714,195	714,195	714,195	714,195	714,195	714,195
8	Income before tax	5,251,828	5,251,828	5,251,828	5,251,828	5,251,828	5,251,828	5,251,828
9	Income after 30% tax (0.7*8)	3,676,280	3,676,280	3,676,280	3,676,280	3,676,280	3,676,280	3,676,280
10	Annual cash income (7+9)	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475
11	Annual cash flow (3+10)	18,541,717	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475
12	Discount factor for 10% interest	1.000	0.952	0.861	0.779	0.705	0.638	0.577
13	Annual present value (11*12)	18,541,717	4,178,090	3,780,492	3,420,731	3,095,205	2,800,657	2,534,140
14	Total present value of annual cash flows (sum of line 13 not including 0 year)						35,040,537	\$
15	Net present value (14-3)						20,889,295	\$

year									
7	8	9	10	11	12	13	14	15	16
182,279,748	182,279,748	182,279,748	182,279,748	182,279,748	182,279,748	182,279,748	182,279,748	182,279,748	182,279,748
176,313,724	176,313,724	176,313,724	176,313,724	176,313,724	176,313,724	176,313,724	176,313,724	176,313,724	176,313,724
5,966,024	5,966,024	5,966,024	5,966,024	5,966,024	5,966,024	5,966,024	5,966,024	5,966,024	5,966,024
714,195	714,195	714,195	714,195	714,195	714,195	714,195	714,195	714,195	714,195
5,251,828	5,251,828	5,251,828	5,251,828	5,251,828	5,251,828	5,251,828	5,251,828	5,251,828	5,251,828
3,676,280	3,676,280	3,676,280	3,676,280	3,676,280	3,676,280	3,676,280	3,676,280	3,676,280	3,676,280
4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475
4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475	4,390,475
0.522	0.473	0.428	0.387	0.350	0.317	0.287	0.259	0.235	0.212
2,292,984	2,074,778	1,877,337	1,698,685	1,537,033	1,390,765	1,258,416	1,138,662	1,030,304	932,258

Feed 5 Scheme 2		year						
line	Item	0	1	2	3	4	5	6
1	Fixed-capital investment	12,542,523						
2	Working capital	2,213,386						
3	Total investment	14,755,909						
4	Annual income	172,424,589	172,424,589	172,424,589	172,424,589	172,424,589	172,424,589	172,424,589
5	Annual manufacturing cost	166,034,457	166,034,457	166,034,457	166,034,457	166,034,457	166,034,457	166,034,457
6	Annual operating income (4-5)	6,390,131	6,390,131	6,390,131	6,390,131	6,390,131	6,390,131	6,390,131
7	Annual depreciation	744,712	744,712	744,712	744,712	744,712	744,712	744,712
8	Income before tax	5,645,419	5,645,419	5,645,419	5,645,419	5,645,419	5,645,419	5,645,419
9	Income after 30% tax (0.7*8)	3,951,793	3,951,793	3,951,793	3,951,793	3,951,793	3,951,793	3,951,793
10	Annual cash income (7+9)	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506
11	Annual cash flow (3+10)	19,452,415	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506
12	Discount factor for 10% interest	1.000	0.952	0.861	0.779	0.705	0.638	0.577
13	Annual present value (11*12)	19,452,415	4,469,316	4,044,004	3,659,166	3,310,951	2,995,872	2,710,777
14	Total present value of annual cash flows (sum of line 13 not including 0 year)						37,482,975	\$
15	Net present value (14-3)						22,727,066	\$

year									
7	8	9	10	11	12	13	14	15	16
172,424,589	172,424,589	172,424,589	172,424,589	172,424,589	172,424,589	172,424,589	172,424,589	172,424,589	172,424,589
166,034,457	166,034,457	166,034,457	166,034,457	166,034,457	166,034,457	166,034,457	166,034,457	166,034,457	166,034,457
6,390,131	6,390,131	6,390,131	6,390,131	6,390,131	6,390,131	6,390,131	6,390,131	6,390,131	6,390,131
744,712	744,712	744,712	744,712	744,712	744,712	744,712	744,712	744,712	744,712
5,645,419	5,645,419	5,645,419	5,645,419	5,645,419	5,645,419	5,645,419	5,645,419	5,645,419	5,645,419
3,951,793	3,951,793	3,951,793	3,951,793	3,951,793	3,951,793	3,951,793	3,951,793	3,951,793	3,951,793
4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506
4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506	4,696,506
0.522	0.473	0.428	0.387	0.350	0.317	0.287	0.259	0.235	0.212
2,452,813	2,219,397	2,008,193	1,817,088	1,644,169	1,487,706	1,346,132	1,218,031	1,102,120	997,239

Feed 6 Scheme 2		year						
line	Item	0	1	2	3	4	5	6
1	Fixed-capital investment	11,213,551						
2	Working capital	1,978,862						
3	Total investment	13,192,413						
4	Annual income	153,318,917	153,318,917	153,318,917	153,318,917	153,318,917	153,318,917	153,318,917
5	Annual manufacturing cost	148,113,091	148,113,091	148,113,091	148,113,091	148,113,091	148,113,091	148,113,091
6	Annual operating income (4-5)	5,205,826	5,205,826	5,205,826	5,205,826	5,205,826	5,205,826	5,205,826
7	Annual depreciation	665,805	665,805	665,805	665,805	665,805	665,805	665,805
8	Income before tax	4,540,022	4,540,022	4,540,022	4,540,022	4,540,022	4,540,022	4,540,022
9	Income after 30% tax (0.7*8)	3,178,015	3,178,015	3,178,015	3,178,015	3,178,015	3,178,015	3,178,015
10	Annual cash income (7+9)	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820
11	Annual cash flow (3+10)	17,036,233	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820
12	Discount factor for 10% interest	1.000	0.952	0.861	0.779	0.705	0.638	0.577
13	Annual present value (11*12)	17,036,233	3,657,878	3,309,785	2,994,817	2,709,823	2,451,949	2,218,615
14	Total present value of annual cash flows (sum of line 13 not including 0 year)						30,677,659	\$
15	Net present value (14-3)						17,485,246	\$

year									
7	8	9	10	11	12	13	14	15	16
153,318,917	153,318,917	153,318,917	153,318,917	153,318,917	153,318,917	153,318,917	153,318,917	153,318,917	153,318,917
148,113,091	148,113,091	148,113,091	148,113,091	148,113,091	148,113,091	148,113,091	148,113,091	148,113,091	148,113,091
5,205,826	5,205,826	5,205,826	5,205,826	5,205,826	5,205,826	5,205,826	5,205,826	5,205,826	5,205,826
665,805	665,805	665,805	665,805	665,805	665,805	665,805	665,805	665,805	665,805
4,540,022	4,540,022	4,540,022	4,540,022	4,540,022	4,540,022	4,540,022	4,540,022	4,540,022	4,540,022
3,178,015	3,178,015	3,178,015	3,178,015	3,178,015	3,178,015	3,178,015	3,178,015	3,178,015	3,178,015
3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820
3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820	3,843,820
0.522	0.473	0.428	0.387	0.350	0.317	0.287	0.259	0.235	0.212
2,007,486	1,816,448	1,643,591	1,487,182	1,345,658	1,217,602	1,101,732	996,888	902,022	816,183

CURRICULUM VITAE

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