

FRACTIONATION RESEARCH, INC.

REPORT OF RASCHIG SUPER-RING[®] No. 0.3 TEST

(Released to Raschig GmbH as They See Fit)

by

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SUMMARY

Raschig-Super Ring[®] No. 0.3 (RSR No. 0.3), a random packing designed and manufactured by Raschig GmbH, was tested in the 4-foot (1.22 m) section of the FRI_(SM) low pressure distillation column with an 8 foot (2.44 m) bed depth. The test was first conducted with the cyclohexane/n-heptane (C₆/C₇) system at 4.5 and 23.5 psia (0.31 and 1.62 bar) and the o/p xylene system at 14.7 psia (1.0 bar). The measured flooding capacity factors C_s at total reflux for these three systems were 0.293 ft/s (0.089 m/s), 0.260 ft/s (0.079 m/s), and 0.275 ft/s (0.084 m/s), respectively. Additional tests were performed with the iso-butane/n-butane (iC₄/nC₄) system at 165 and 100 psia (11.4 and 6.9 bar), and the flood capacities measured at these two pressures were 0.206 ft/s (0.063 m/s) and 0.215 ft/s (0.066 m/s), respectively. The installation and portions of the tests were observed and approved by a Raschig GmbH representative.

INTRODUCTION

The majority of FRI random packing experimental data have been collected with large to medium size packings (larger than the equivalent of 5/8 inch (16 mm) Pall rings). As shown in **Figure 1**, for small sizes of random packings, FRI efficiency models tend to predict higher efficiencies than what are measured. The objectives of this test are to collect more test data with small size (high surface area) random packings, and to check/verify the current random packing efficiency models with newly acquired test results.

The RSR No. 0.3 was selected by the FRI membership as 2007 Category 1 packing test⁽²⁾. The test and data analysis closely followed the Proprietary Device Test Procedures amended at the May 2005 TAC meeting⁽³⁾.

The packing was first tested for capacity, efficiency, and pressure drop using the C₆/C₇ system at 4.5 and 23.5 psia (0.31 and 1.62 bar) column pressures, and the o/p xylene system at 14.7 psia (1.0 bar). During the FRI Technical Committee meeting⁽⁴⁾ on October 15 2008, additional opportunity research with the iC₄/nC₄ system at 165 and 100 psia (11.4 and 6.9 bar) was approved by the committee. The additional test was carried out after the meeting. For all test systems, the gamma scan system was used to measure the liquid holdups inside the packed bed.

DESCRIPTION OF EQUIPMENT

Packing - RSR No. 0.3 is a wavy shaped proprietary random packing. Raschig reports that this packing has a specific surface area of 96.0 ft²/ft³ (315 m²/m³) and a void fraction of 0.96, compared to those of 98.5 ft²/ft³ (323 m²/m³) and 0.959 measured by FRI. A photograph of the packing along with a tape measure is shown in **Figure 2**. For comparison, the surface area and void fraction of 5/8 inch (16 mm) Pall rings are 104 ft²/ft³ (341m²/m³) and 0.93, respectively.

Liquid Distributors – Three DT-S liquid distributors, supplied by Raschig, were used for these tests. All three distributors were trough type distributors with pre-distributors as shown in **Figure 3**. They were identical except for the sizes of the drip holes. There were a total 142 drip holes for each distributor. The pour point density was 11.4 points/ft² (123 points/m²) for a column with a 4-foot (1.22 m) diameter. For the operation with the C₆/C₇ system at 4.5 psia (0.31 bar) a distributor with a drip hole diameter of 4.3 mm was used,. The second distributor, with 5.9 mm diameter holes, was used with the C₆/C₇ system at 23.5 psia (1.62 bar) and the o/p xylene system at 14.7 psia (1.0 bar) was utilized. The third distributor, with 6.9 mm drip holes, was used for the iC₄/nC₄ operations at 165 and 100 psia (11.4 and 6.9 bar). All 142 drip holes are located 1-9/16 inch (40 mm) above the bottom of the distributor trough. The liquid distributors with the 4.3 and 5.9 mm drip holes were water tested outside the column.

After the completion of the test with the iC_4/nC_4 system, the distributor with the 6.9 mm drip holes was water tested as well. The water test results, in terms of the ratios of standard deviation to the mean flow, are shown in **Figures 4-9**.

Figures 4 and 5 provide the water test results for the distributor with 4.3 mm drip holes. **Figure 4** is the ratio of the standard deviation to the mean flow Cv in terms of the liquid head from the bottom of the trough. **Figure 5** is plotted vs. the total liquid rate flowing through the distributor. Except at very low heads, corresponding to low liquid rates, the distributor performed very well with Cv's below 5 percent as shown in **Figures 4 and 5**. Similar water test results were obtained for the distributors with 5.9 mm and 6.9 mm drip holes as shown in **Figures 6 and 7**. Included in those figures are the water test results, independently obtained by Raschig before the distributors were shipped to FRI, which are very close to the FRI water test results.

Support Plate - The packing support plate for the tests was supplied by Raschig. It was a gas-injection type support plate.

Samplers - No in-bed sampler was used for this test. The below bed sampler used in this test was the FRI center-draw cross sampler. A description of the sampler and other details are given in Topical Report No. 129⁽⁵⁾.

Gamma Ray Scanning Equipment - The gamma ray scanning equipment was the same as that described in Topical Report No. 166⁽⁶⁾.

INSTALLATION OF EQUIPMENT

Figure 10 shows the column configuration, locating the packing support plate, samplers, packed bed, thermowells, taps for pressure drops, liquid distributor, and other equipment. No vapor distributor/liquid collector was used (beneath the packed bed) for this test. To maximize the range of gamma scan and to avoid the slightly out-of-roundness column section, the packing support plate was installed 149 inch (3.78 m) above the column head-seam. A cross sampler was installed below the packing support plate to collect samples of the liquid exiting the bottom of the packed bed. A thermowell was attached to the center of the cross sampler to measure the liquid temperature. A thermowell was installed at 1.5 inch (38.1 mm) below the top of the bed. No mid-bed sampler was installed for this test. A thermowell was installed in the middle of the packed bed. The packing was dry packed to a bed depth of 8 feet (2.44 m). Care was taken to pack the bed without any voids beneath the thermowell and around the support plate. The hold down device was a high open area steel grid placed on the top of the bed and held in place by bolting to the DT-S liquid distributor. Wall wipers were installed between the 4-foot (1.22) column section and conical transition section to collect vapor condensate along the column wall and guide this condensate to the distributor troughs. The bottom of distributor trough was placed 4-1/3 inch (110 mm) above the top of the packed bed. The distributor was suspended with four adjustable rods secured to brackets, carefully centered and leveled with water. The liquid composition of distributor was obtained with samples using a brass tapping inserted in the pan floor and 3/8 inch (9.5 mm) copper withdrawal tubing. The distributor liquid temperature was measured using a thermowell located near the bottom of the distributor.

Packing pressure drop was measured with three differential pressure transmitters. One was for the bottom half of the bed 0-46 inch (0-1.17 m), the second one for the top half of the bed 46-96 inch (1.17-2.44 m), and the third for the overall bed 0-96 inch (0-2.44 m). All distances were measured from the bottom of the support plate. Pressure drops were also measured across the liquid distributor. A bubbler connected to a pressure transmitter was installed inside the liquid distributor to measure the liquid head. Each pressure transmitter had its own independent leg and column connection. The legs were

continuously purged with a constant flow of nitrogen. Installation of the equipment was witnessed and approved by a representative of Raschig. After finishing the tests, the packing and other equipment were unloaded and inspected. The packing did not appear to have any damage and no anomalies were found for all of the equipment.

Gamma Ray - The calibration, operation, and calibration procedures were the same as those described in Topical Report No. 166⁽⁶⁾. Three different bed elevations were scanned: 23, 33 and 48 inches (584, 838 and 1219 mm) from the bottom of the support plate. For each vertical location, the packed bed was scanned at three different horizontal locations as follows: Centerline, 10, and 20 inches (254 and 508 mm) off the centerline.

EXPERIMENTAL PROCEDURE

A process flow diagram of the FRI low pressure column as configured for this test is shown in **Figure 11**. The tests were conducted with the C₆/C₇ system at 4.5 and 23.5 psia (0.31 and 1.62 bar) column pressures, and the o/p xylene at 14.7 psia (1.0 bar bar), followed by the iC₄/nC₄ system at 165 and 100 psia (11.4 and 6.9 bar).

Standard FRI operating procedure is to establish the flood point, decrease the vapor load to about 20 per cent of flood to unload the bed, and then run a total reflux efficiency series. A procedure similar to this was followed for most of the data taken. In addition to the total reflux runs, several series of flood runs at L/V < 1 or > 1 were conducted. For some non total reflux series, pressure drop data were collected at constant liquid rate for all of the C₆/C₇ runs, the o/p xylene runs, and the iC₄/nC₄ runs at 165 psia (11.4 bar).

RESULTS

Summary of Test Results

Experimental results of the RSR No. 0.3 are tabulated in **Tables I to V**. The liquid composition data for the iC₄/nC₄ system are presented in **Table VI**. A summary of the run conditions for all of the test systems is listed as follows:

<u>Run No.</u>	<u>System</u>	<u>Pressure psia (bar)</u>	<u>Table No.</u>	<u>Run Type</u>
23314-23337	C ₆ /C ₇	4.5 (0.31)	I	Total Reflux
23338-23341 & 23344	C ₆ /C ₇	4.5 (0.31)	I	L/V < 1 Flood
23342-23343	C ₆ /C ₇	4.5 (0.31)	I	L/V > 1 Flood
23345-23361	C ₆ /C ₇	4.5 (0.31)	I	L/V < 1
23362-23371	C ₆ /C ₇	4.5 (0.31)	I	L/V > 1
23372-23399	C ₆ /C ₇	23.5 (1.62)	II	Total Reflux
23400-23403	C ₆ /C ₇	23.5 (1.62)	II	L/V < 1 Flood
23404	C ₆ /C ₇	23.5 (1.62)	II	L/V > 1 Flood
23405-23428	C ₆ /C ₇	23.5 (1.62)	II	L/V < 1
23429-23433	C ₆ /C ₇	23.5 (1.62)	II	L/V > 1

<u>Run No.</u>	<u>System</u>	<u>Pressure psia (bar)</u>	<u>Table No.</u>	<u>Run Type</u>
23434-23459	o/p xylene	14.7 (1.0)	III	Total Reflux
23460-23463	o/p xylene	14.7 (1.0)	III	L/V<1 Flood
&23466-23467				
23464-23465	o/p xylene	14.7 (1.0)	III	L/V>1 Flood
23468-23492	o/p xylene	14.7 (1.0)	III	L/V<1
23493-23504	o/p xylene	14.7 (1.0)	III	L/V>1
23505-23528	iC ₄ /nC ₄	165 (11.4)	IV	Total Reflux
&23594-23597				
23564-23568	iC ₄ /nC ₄	165 (11.4)	IV	L/V<1 Flood
23569-23593	iC ₄ /nC ₄	165 (11.4)	IV	L/V<1
23529-23558	iC ₄ /nC ₄	100 (6.9)	V	Total Reflux
23559-23563	iC ₄ /nC ₄	100 (6.9)	V	L/V<1 Flood

In **Tables I to V**, the liquid hold up in the packed bed was measured at 48 inch (1.22 m) above the packing support grid at the center of the column. Gamma scan results for other locations are available to the Membership upon request.

Notes on the Results

For the RSR No. 0.3 test, for all of the total reflux runs prior to flood conditions, the below bed C₆ compositions were adjusted so that the mid-bed C₆ compositions were around 50% (unless specified otherwise). The capacity factors, C_s, in all plots, are based on physical properties at the bottom of the packed bed unless specified otherwise.

NOMENCLATURE

C ₆	cyclo-hexane
C ₇	normal-heptane
C _s	Capacity factor, $u_s (\rho_v/(\rho_L-\rho_v))^{0.5}$, ft/s (m/s)
F _s	Superficial F Factor, $u_s (\rho_v)^{0.5}$, ft/s(lb/ft ³) ^{0.5} (m/s(kg/m ³) ^{0.5})
HETP	Height equivalent to a theoretical plate, inches (mm)
iC ₄	Iso-butane
nC ₄	Normal-butane
o/p	ortho/para
u _s	Superficial vapor velocity based on column cross sectional area 12.44 ft ² (1.16 m ²), ft/s (m/s)
ρ _L	Liquid density, lb/ft ³ (kg/m ³)
ρ _v	Vapor density, lb/ft ³ (kg/m ³)

ABBREVIATIONS

Dist	Distributor
DP	Bed pressure drop
DT-S	DT-S distributor supplied by Raschig
FL	Non-total reflux flood runs
FT	Total reflux flood runs
Mid	Middle bed
OHP	Overhead product runs (L/V<1)
Pt	Points
TF	Top feed runs (L/V>1)
TR	Total reflux efficiency runs
Vol	Volume

CONVERSION FACTORS

Parameter	US Engineering Units	x	Multiplying Factor	=	SI Units
Area	ft ²		0.0929		m ²
Capacity Factor C _s	ft/s		0.3048		m/s
Density	lb/ft ³		16.019		kg/m ³
Duty	M Btu/h		0.2929		MW
Length	ft		0.3048		m
Height	inch		25.4		mm
Liquid flow rate	gpm		0.2271		m ³ /h
Liquid flux	gpm/ft ²		2.4448		m ³ /h.m ²
Mass flow rate	k lb/h		0.126		kg/s
Pressure	psia		0.06895		bar
Pressure drop	inch H ₂ O/ft		8.167		mbar/m
Superficial F-factor F _s	ft/s (lb/ft ³) ^{0.5}		1.22		m/s(kg/m ³) ^{0.5}
Temperature	°F		(°F-32)/1.8		°C

REFERENCES

1. FRI Progress Report July-August, 1982
2. Minutes of FRI Technical Advisory Committee Meeting, November, 2006
3. Minutes of FRI Technical Advisory Committee Meeting, May, 2005
4. Minutes of FRI Technical Committee Meeting, October, 2008
5. FRI Topical Report 129
6. FRI Topical Report 166

Figure 1. Comparison of Measured and Predicted HETP's

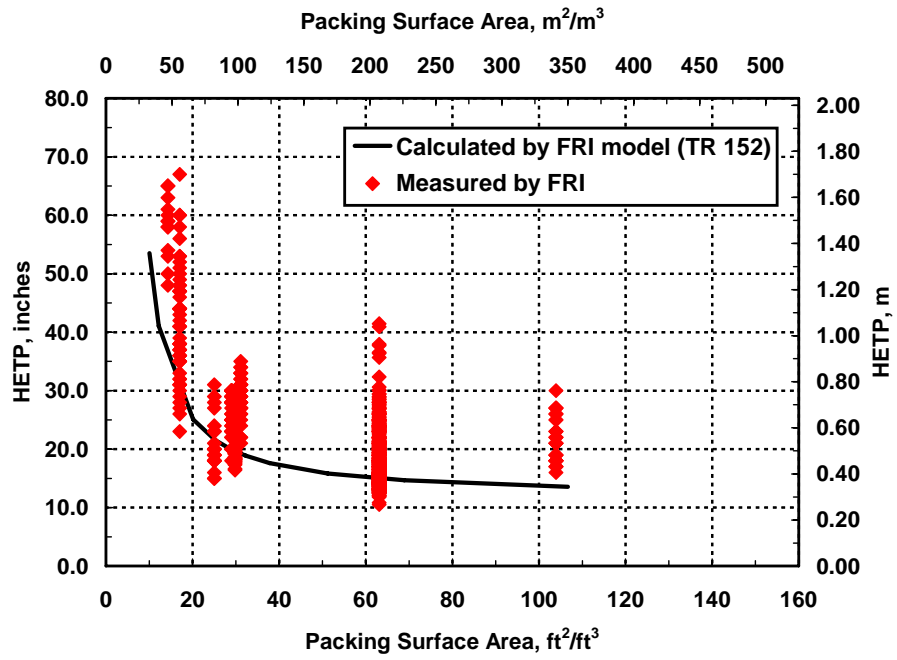


Figure 2. Raschig Super-Ring No. 0.3



Figure 3. Raschig DT-S Liquid Distributor



Figure 4. Raschig Liquid Distributor 4.3 mm Water Test Results

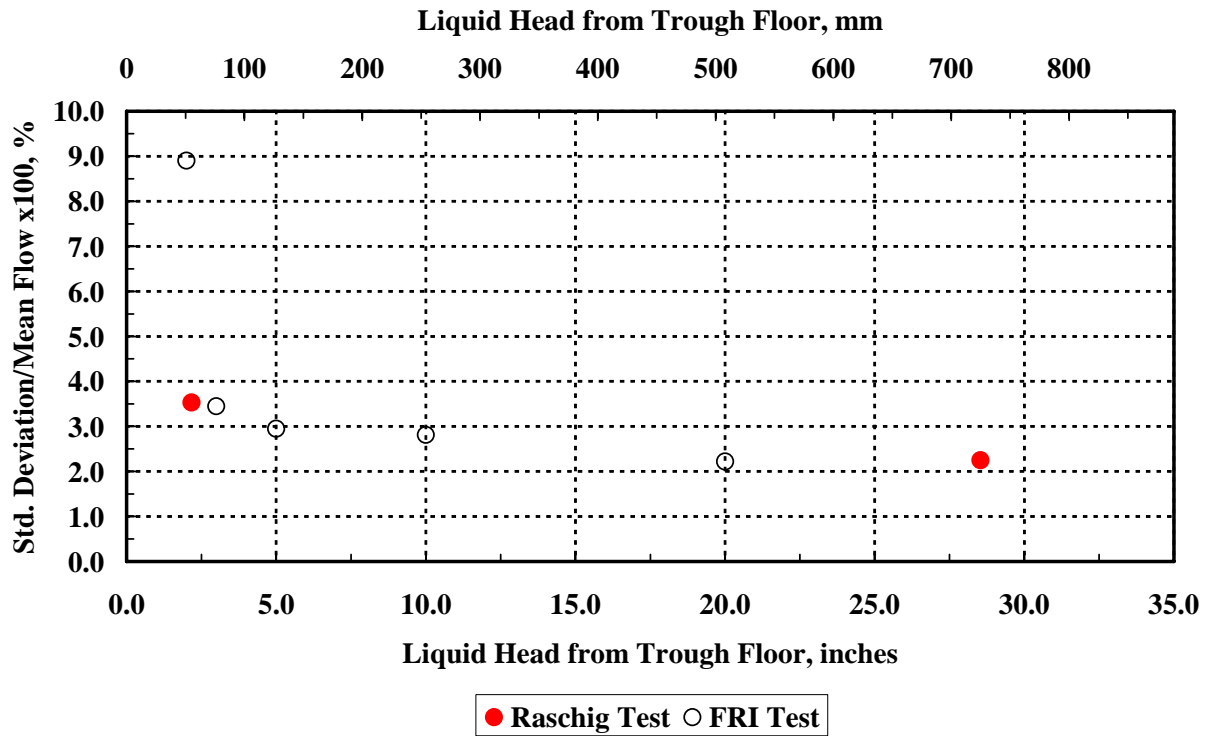


Figure 5. Raschig Liquid Distributor 4.3 mm Water Test Results

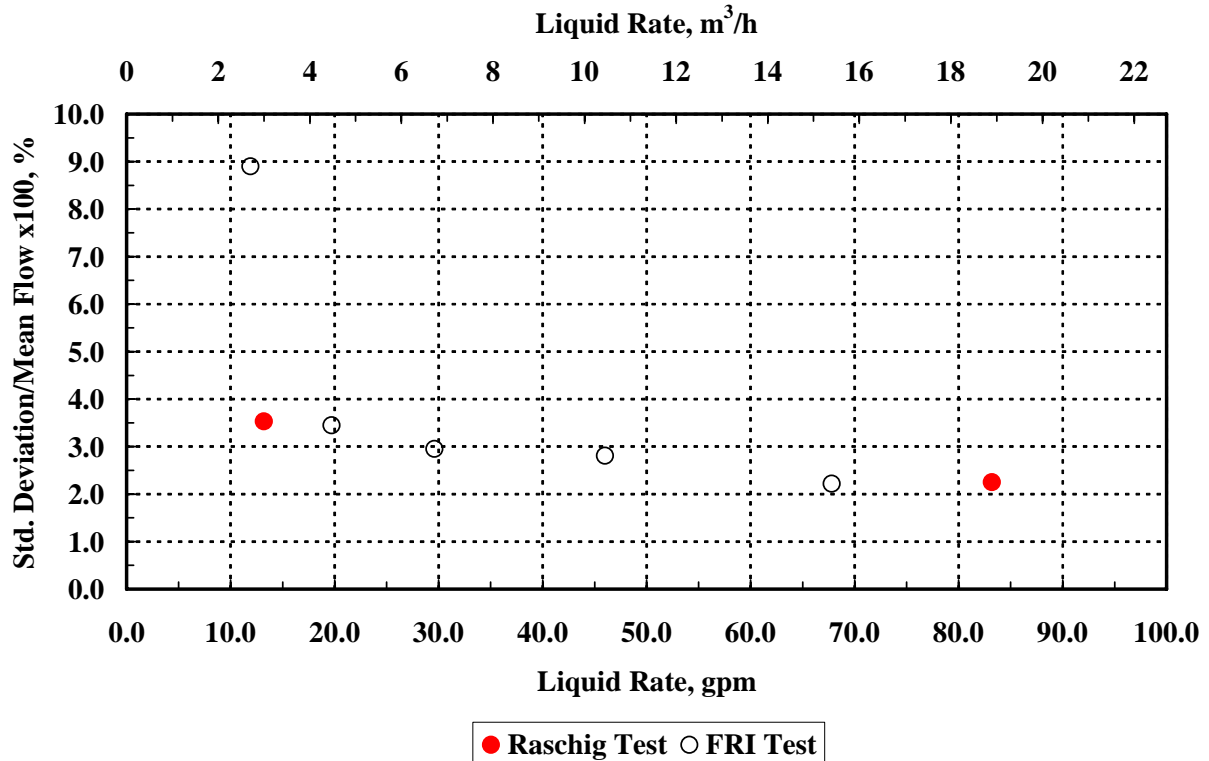


Figure 6. Raschig Liquid Distributor 5.9 mm Water Test Results

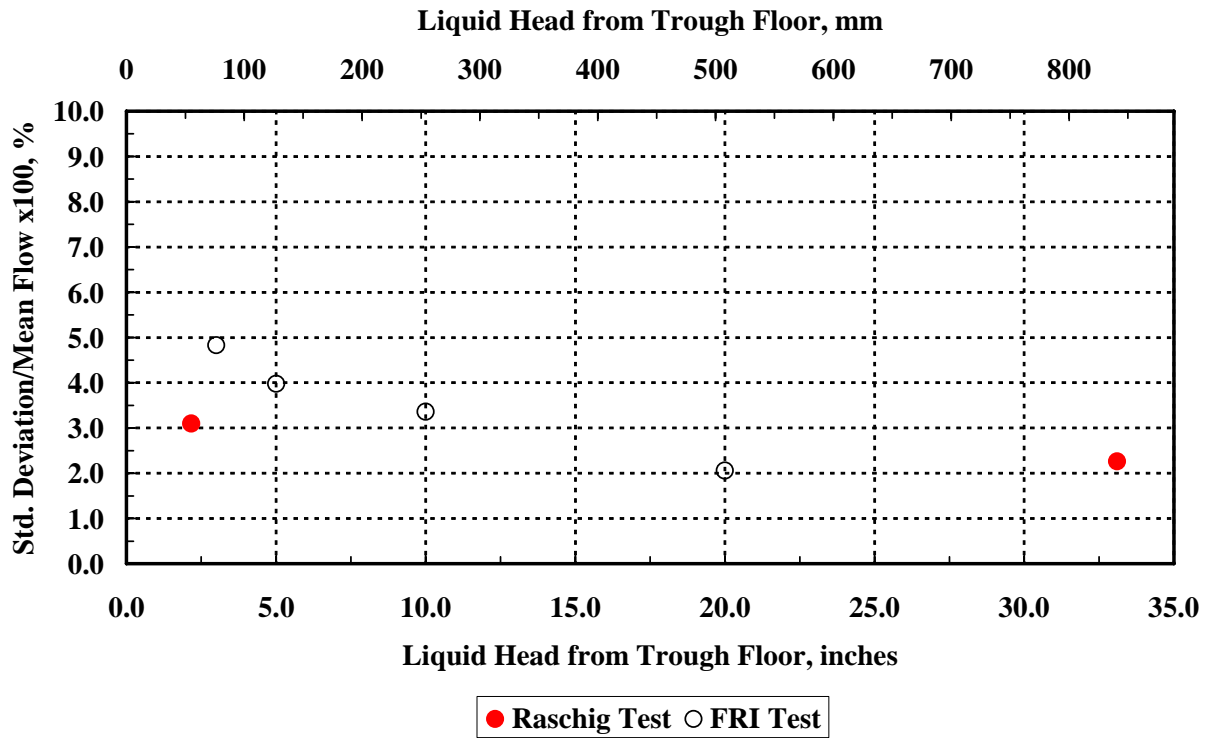


Figure 7. Raschig Liquid Distributor 5.9 mm Water Test Results

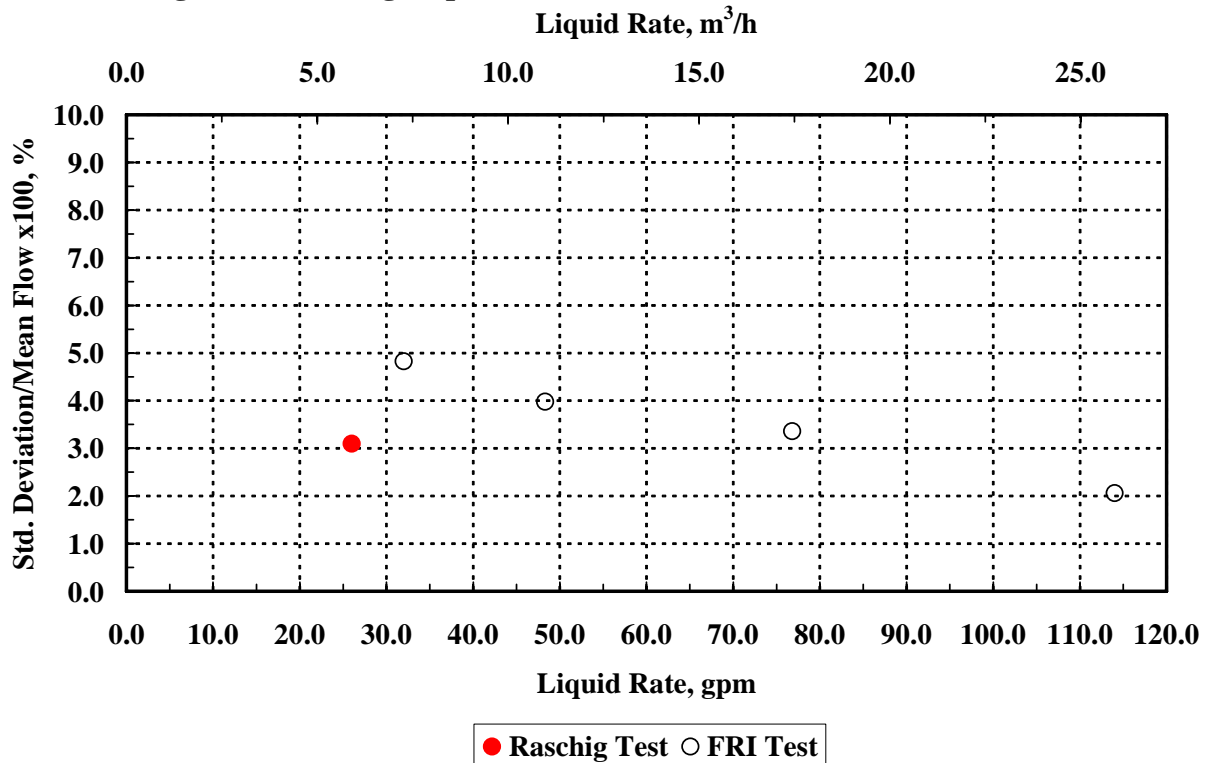


Figure 10. Column Configuration for the RSR No. 0.3 Test

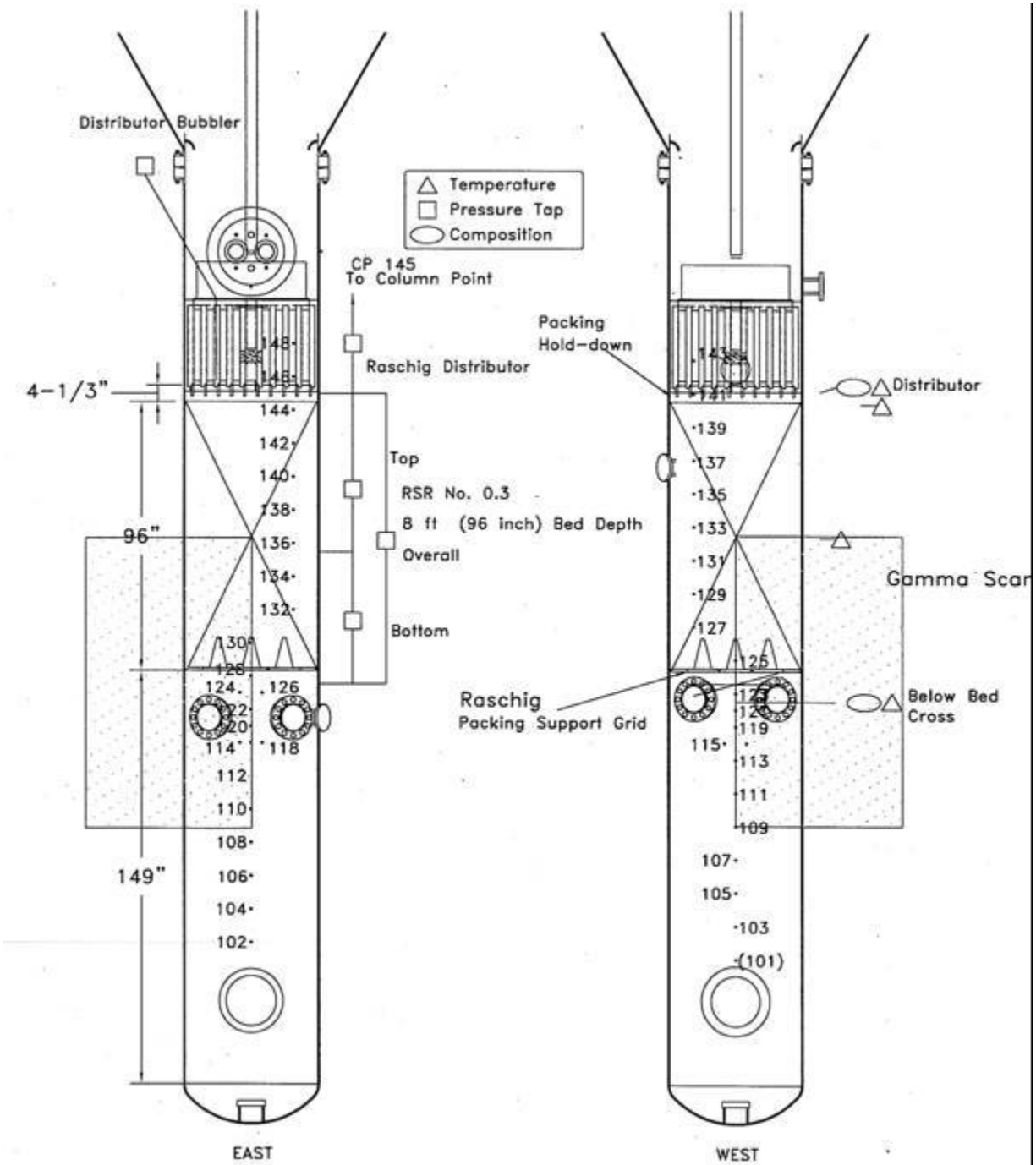


Figure 11. Process Flow Diagram for RSR No. 0.3 Test

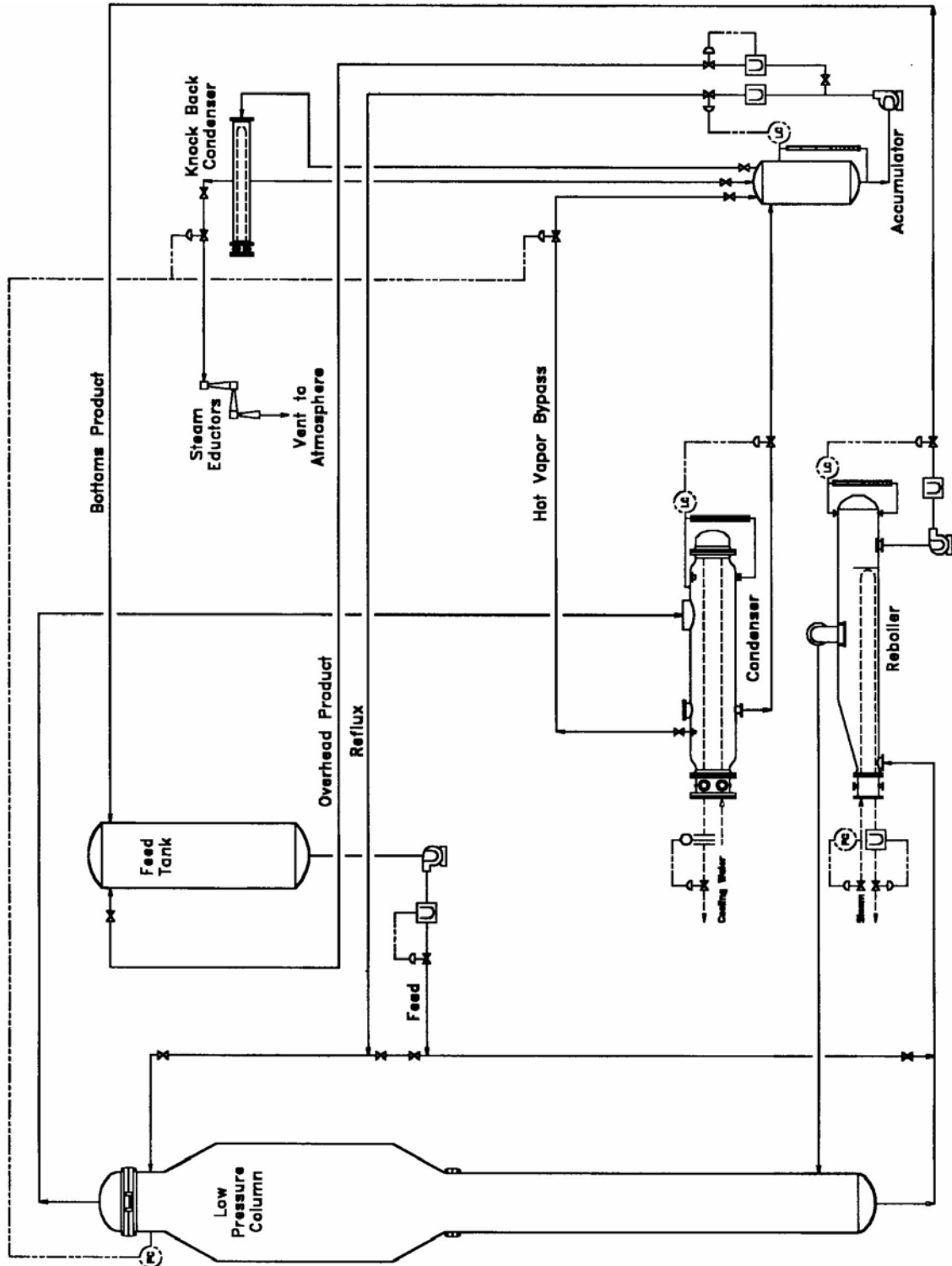


Table I (US Engineering Units)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System 4.5 psia

Run Number		23326	23327	23318	23319	23320	23321
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.4	4.3	4.5	4.5
Reboiler Duty	M Btu/h	1.29	1.30	1.40	1.44	1.59	1.62
Condenser Duty	M Btu/h	2.12	1.42	1.67	1.70	1.85	1.86
Reflux Rate	k lb/h	8.5	8.8	10.2	10.3	10.8	11.1
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.22	0.22	0.29	0.30	0.33	0.33
Top	inch H ₂ O / ft	0.19	0.19	0.26	0.27	0.29	0.29
Bottom	inch H ₂ O / ft	0.15	0.15	0.22	0.22	0.25	0.25
Dist. Pressure Drop	inch H ₂ O			0.03	0.04	0.07	0.07
Dist Bubbler	inch Hot Liq	3.68	3.67	4.81	4.84	5.39	5.50
Liquid Holdup	Vol. Fraction	0.08		0.08		0.09	
Temperature Profiles							
	°F						
Reflux		115.0	116.9	115.0	114.8	117.3	117.7
Overhead Vapor		118.2	118.0	116.7	116.1	117.6	118.0
Distributor		115.9	115.8	114.6	114.1	115.7	116.0
Top Bed		117.6	117.0	115.8	115.2	116.9	117.3
Mid Bed		124.1	121.4	119.5	119.1	120.7	121.0
Below Bed		143.4	140.3	139.3	138.9	140.7	141.1
Composition of Liquid							
	Mol % C ₆						
Reflux		93.69	93.75	94.05	94.26	94.19	94.13
Distributor		93.74	93.68	94.14	94.14	93.93	93.80
Below Bed		14.10	13.80	14.39	14.16	14.60	14.19
Bottoms		7.86	7.80	8.07	8.09	7.82	7.79
Feed		7.91	7.95	8.20	8.09	7.86	7.83
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	14.10	13.80	14.39	14.16	14.60	14.19
Temperature	°F	143.4	140.3	139.3	138.9	140.7	141.1
Liquid Density	lb/ft ³	41.0	41.1	41.2	41.2	41.1	41.1
Vapor Density	lb/ft ³	0.076	0.071	0.070	0.070	0.072	0.073
Vapor Rate	k lb/h	8.7	8.7	9.4	9.6	10.7	10.9
Liquid Rate	gpm	26.5	26.4	28.4	29.1	32.4	33.0
Capacity Factor, Cs	ft/s	0.110	0.114	0.123	0.127	0.139	0.141
HETP 2 pt							
	inch						
DIST & below bed		12.9	12.9	12.8	12.8	12.9	12.9
DIST & bottoms		12.7	12.8	12.7	12.8	12.7	12.7
Relative Volatility		1.858	1.871	1.875	1.877	1.869	1.867
Capacity Factor, Top	ft/s	0.104	0.104	0.114	0.117	0.128	0.130
Capacity Factor, Mid	ft/s	0.106	0.108	0.117	0.121	0.132	0.133

Table I (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System 4.5 psia

Run Number		23315	23329	23328	23322	23323	23324
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.5	4.4	4.4	4.5
Reboiler Duty	M Btu/h	1.94	1.94	1.95	2.26	2.27	2.59
Condenser Duty	M Btu/h	1.91	1.89	1.74	2.35	2.33	2.60
Reflux Rate	k lb/h	11.5	11.5	11.5	13.8	13.9	15.8
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.35	0.35	0.35	0.51	0.51	0.67
Top	inch H ₂ O / ft	0.32	0.33	0.33	0.49	0.49	0.66
Bottom	inch H ₂ O / ft	0.27	0.27	0.27	0.43	0.43	0.58
Dist. Pressure Drop	inch H ₂ O	0.03			0.05	0.04	0.02
Dist Bubbler	inch Hot Liq	5.81	5.86	5.87	7.87	7.82	9.86
Liquid Holdup	Vol. Fraction	0.09		0.10	0.10		0.11
Temperature Profiles							
	°F						
Reflux		114.9	114.4	116.9	115.8	115.5	115.2
Overhead Vapor		117.7	118.1	118.0	117.1	116.9	118.2
Distributor		115.1	115.5	115.8	115.1	114.9	115.9
Top Bed		116.9	117.1	117.0	116.4	116.2	117.6
Mid Bed		120.2	121.1	121.4	121.3	121.1	124.1
Below Bed		140.7	141.6	140.3	141.5	141.3	143.4
Composition of Liquid							
	Mol % C ₆						
Reflux		94.62	93.59	93.62	94.20	94.23	94.01
Distributor		94.55	93.57	93.68	94.07	94.08	93.93
Below Bed		18.42	12.39	12.13	12.45	11.65	10.82
Bottoms		8.92	6.81	6.83	7.20	7.21	6.25
Feed		9.03	6.80	6.52	7.19	7.18	6.23
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	18.42	12.39	12.13	12.45	11.65	10.82
Temperature	°F	140.7	141.6	140.3	141.5	141.3	143.4
Liquid Density	lb/ft ³	41.3	41.0	41.0	41.0	41.0	40.9
Vapor Density	lb/ft ³	0.074	0.072	0.071	0.072	0.072	0.074
Vapor Rate	k lb/h	13.0	13.1	13.1	15.2	15.3	17.5
Liquid Rate	gpm	39.3	39.8	39.8	46.3	46.4	53.3
Capacity Factor, Cs	ft/s	0.167	0.170	0.172	0.197	0.199	0.224
HETP 2 pt							
	inch						
DIST & below bed		13.4	12.6	12.5	12.4	12.2	12.0
DIST & bottoms		12.7	12.4	12.4	12.4	12.4	12.0
Relative Volatility		1.863	1.868	1.874	1.868	1.870	1.863
Capacity Factor, Top	ft/s	0.155	0.157	0.157	0.183	0.184	0.208
Capacity Factor, Mid	ft/s	0.159	0.161	0.162	0.188	0.189	0.213

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **4.5 psia**

Run Number		23325	23330	23331	23334	23332	23333
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	4.5	4.4	4.3	4.4	4.5	4.5
Reboiler Duty	M Btu/h	2.59	2.91	2.91	3.42	3.23	3.23
Condenser Duty	M Btu/h	2.58	2.88	2.95	3.39	3.28	3.27
Reflux Rate	k lb/h	15.8	17.4	17.6	20.6	19.4	19.4
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.66	0.90	0.93	2.00	1.21	1.21
Top	inch H ₂ O / ft	0.65	0.90	0.92	2.12	1.20	1.20
Bottom	inch H ₂ O / ft	0.57	0.82	0.85	1.80	1.13	1.14
Dist. Pressure Drop	inch H ₂ O	0.02	0.05	0.05	0.03	0.08	0.07
Dist Bubbler	inch Hot Liq	9.83	11.93	11.97	16.60	14.39	14.38
Liquid Holdup	Vol. Fraction		0.12		0.23	0.14	
Temperature Profiles							
	°F						
Reflux		115.0	113.6	113.2	114.4	114.5	114.3
Overhead Vapor		118.2	116.7	115.9	118.5	115.7	115.7
Distributor		115.9	114.4	113.8	115.5	114.6	114.5
Top Bed		117.6	116.1	115.4	118.0	115.5	115.5
Mid Bed		124.1	123.9	123.3	134.8	119.6	119.6
Below Bed		143.4	143.5	142.9	144.6	141.6	141.7
Composition of Liquid							
	Mol % C ₆						
Reflux		93.96	93.95	93.99	90.81	97.54	97.52
Distributor		93.85	93.75	93.68	90.79	97.41	97.47
Below Bed		10.46	8.38	8.06	26.66	17.37	17.13
Bottoms		6.17	4.32	4.47	11.70	9.21	9.18
Feed		6.21	4.53	4.52	11.96	9.22	9.22
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	10.46	8.38	8.06	26.66	17.37	17.13
Temperature	°F	143.4	143.5	142.9	144.6	141.6	141.7
Liquid Density	lb/ft ³	40.9	40.8	40.8	41.6	41.2	41.2
Vapor Density	lb/ft ³	0.074	0.073	0.072	0.083	0.075	0.075
Vapor Rate	k lb/h	17.5	19.7	19.7	22.9	21.7	21.7
Liquid Rate	gpm	53.3	60.2	60.2	68.7	65.6	65.6
Capacity Factor, Cs	ft/s	0.224	0.254	0.256	0.275	0.276	0.276
HETP 2 pt							
	inch						
DIST & below bed		11.9	11.4	11.4	17.5	11.2	11.1
DIST & bottoms		12.0	11.2	11.4	15.5	10.9	10.9
Relative Volatility		1.863	1.865	1.868	1.836	1.861	1.861
Capacity Factor, Top	ft/s	0.208	0.237	0.239	0.279	0.260	0.260
Capacity Factor, Mid	ft/s	0.213	0.242	0.243	0.275	0.265	0.265

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor

C₆/C₇ System 4.5 psia

Run Number		23335	23336	23316	23337	23314	23317
Run Type		TR	TR	FT	TR	TR	FT
Column Pressure:	psia	4.4	4.4	4.5	4.44	4.5	4.5
Reboiler Duty	M Btu/h	3.43	3.52	3.62	3.53	3.57	3.61
Condenser Duty	M Btu/h	3.38	3.48	3.51	3.48	3.43	3.51
Reflux Rate	k lb/h	20.5	21.5	21.8	21.5	21.2	21.8
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.2	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	1.98	2.37	2.59	2.32	2.10	2.64
Top	inch H ₂ O / ft	2.09	2.78	3.02	2.72	2.22	3.11
Bottom	inch H ₂ O / ft	1.80	1.89	1.99	1.85	1.89	2.03
Dist. Pressure Drop	inch H ₂ O	0.03	0.17	0.55	0.13	0.07	0.60
Dist Bubbler	inch Hot Liq	16.52	20.70	25.23	20.00	17.13	25.84
Liquid Holdup	Vol. Fraction		0.18	0.22		0.20	
Temperature Profiles	°F						
Reflux		114.3	116.3	114.8	116.3	111.4	114.9
Overhead Vapor		118.4	124.8	128.4	124.9	119.6	128.4
Distributor		115.4	118.7	118.9	118.9	114.1	119.0
Top Bed		117.8	132.5	133.7	133.7	119.6	134.4
Mid Bed		134.2	138.1	139.7	138.5	135.2	141.1
Below Bed		144.6	142.0	143.6	142.0	139.9	144.6
Composition of Liquid	Mol % C ₆						
Reflux		90.71	74.38	66.07	74.12	90.32	65.48
Distributor		90.61	74.20	67.26	73.67	90.44	65.11
Below Bed		24.78	31.49	33.71	29.02	35.19	24.89
Bottoms		11.87	18.14	16.01	18.31	21.19	16.39
Feed		11.90	17.98	16.53	18.27	21.23	16.57
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	24.78	31.49	33.71	29.02	35.19	24.89
Temperature	°F	144.6	142.0	143.6	142.0	139.9	144.6
Liquid Density	lb/ft ³	41.5	41.9	42.0	41.8	42.2	41.5
Vapor Density	lb/ft ³	0.082	0.081	0.085	0.080	0.079	0.082
Vapor Rate	k lb/h	22.9	23.4	24.0	23.5	23.6	24.2
Liquid Rate	gpm	68.9	69.7	71.4	70.1	69.8	72.7
Capacity Factor, Cs	ft/s	0.278	0.284	0.285	0.287	0.288	0.293
HETP 2 pt	inch						
DIST & below bed		17.1	31.7	41.5	30.7	20.2	33.7
DIST & bottoms		15.7	29.7	32.6	30.9	19.5	35.4
Relative Volatility		1.838	1.839	1.829	1.842	1.841	1.838
Capacity Factor, Top	ft/s	0.280	0.295	0.309	0.295	0.295	0.311
Capacity Factor, Mid	ft/s	0.276	0.288	0.296	0.290	0.290	0.300

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **4.5 psia**

Run Number		23361	23360	23359	23358	23357	23344
Run Type		OHP	OHP	OHP	OHP	OHP	FL OHP
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.5	4.5
Reboiler Duty	M Btu/h	2.61	2.93	3.26	3.58	3.90	4.25
Condenser Duty	M Btu/h	2.56	2.85	3.19	3.51	3.82	4.24
Reflux Rate	k lb/h	7.8	8.0	8.1	8.2	8.6	8.9
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	60.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.58	0.75	0.96	1.21	1.56	2.48
Top	inch H ₂ O / ft	0.56	0.74	0.98	1.25	1.65	2.94
Bottom	inch H ₂ O / ft	0.48	0.63	0.82	1.04	1.35	1.93
Dist. Pressure Drop	inch H ₂ O	0.31	0.32	0.33	0.35	0.36	0.47
Dist Bubbler	inch Hot Liq	3.38	3.53	3.70	3.83	4.07	7.65
Liquid Holdup	Vol. Fraction	0.08	0.09	0.09	0.10	0.12	0.16
Temperature Profiles	°F						
Reflux		114.7	115.2	115.3	115.5	115.6	124.4
Overhead Vapor		132.7	133.2	133.7	134.1	134.4	134.1
Distributor		124.3	124.9	125.3	125.6	125.9	130.1
Top Bed		133.3	134.0	134.6	135.0	135.8	135.3
Mid Bed		136.7	136.7	137.2	137.6	138.3	139.5
Below Bed		137.6	137.9	138.6	139.4	140.5	142.7
Composition of Liquid	Mol % C ₆						
Reflux		51.83	48.94	47.16	45.86	44.68	46.50
Distributor		51.23	47.59	46.41	44.55	55.57	42.04
Below Bed		24.90	24.69	24.45	24.47	23.30	27.24
Bottoms		25.36	25.71	25.51	25.29	25.21	28.57
Feed		32.70	33.80	34.37	35.07	35.66	34.15
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	24.90	24.69	24.45	24.47	23.30	27.24
Temperature	°F	137.6	137.9	138.6	139.4	140.5	142.7
Liquid Density	lb/ft ³	41.7	41.7	41.7	41.6	41.5	41.7
Vapor Density	lb/ft ³	0.080	0.079	0.080	0.081	0.083	0.087
Vapor Rate	k lb/h	17.1	19.2	21.3	23.4	25.5	27.6
Liquid Rate	gpm	27.9	28.6	29.3	29.9	31.0	28.6
Capacity Factor, Cs	ft/s	0.209	0.236	0.261	0.285	0.307	0.324
L/V		0.55	0.50	0.46	0.43	0.40	0.35
OHP Flow	k lb/h	7.72	9.63	11.53	13.42	15.20	18.02
Capacity Factor, Top	ft/s	0.232	0.262	0.292	0.321	0.344	0.364
Capacity Factor, Mid	ft/s	0.220	0.249	0.276	0.303	0.325	0.344

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
C₆/C₇ System **4.5 psia**

Run Number		23345	23346	23347	23348	23349	23341
Run Type		OHP	OHP	OHP	OHP	OHP	FL OHP
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.5	4.4
Reboiler Duty	M Btu/h	2.60	2.93	3.25	3.57	3.90	4.06
Condenser Duty	M Btu/h	2.52	2.81	3.10	3.52	3.83	3.98
Reflux Rate	k lb/h	10.8	10.9	11.0	11.3	11.3	10.5
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.62	0.80	1.03	1.36	1.99	2.41
Top	inch H ₂ O / ft	0.59	0.80	1.04	1.41	2.31	2.78
Bottom	inch H ₂ O / ft	0.52	0.68	0.89	1.18	1.55	1.96
Dist. Pressure Drop	inch H ₂ O	0.16	0.16	0.38	0.39	0.43	0.15
Dist Bubbler	inch Hot Liq	5.42	5.58	5.70	6.01	6.30	7.94
Liquid Holdup	Vol. Fraction	0.09	0.10	0.10	0.12	0.15	0.14
Temperature Profiles	°F						
Reflux		114.3	113.5	113.9	116.1	115.7	119.1
Overhead Vapor		129.3	131.0	132.1	132.8	133.4	133.6
Distributor		121.0	121.6	122.5	123.9	124.4	127.0
Top Bed		129.5	131.8	133.0	134.2	136.3	136.2
Mid Bed		137.0	137.5	137.7	138.2	139.4	139.0
Below Bed		138.8	138.9	139.3	140.1	141.9	142.5
Composition of Liquid	Mol % C ₆						
Reflux		62.57	56.99	52.96	50.38	48.27	46.19
Distributor		62.36	57.18	52.41	50.20	47.58	44.47
Below Bed		22.01	22.73	23.30	23.62	23.83	24.99
Bottoms		22.04	23.38	24.19	24.35	24.73	25.69
Feed		29.14	31.36	33.01	34.05	35.04	36.39
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	22.01	22.73	23.30	23.62	23.83	24.99
Temperature	°F	138.8	138.9	139.3	140.1	141.9	142.5
Liquid Density	lb/ft ³	41.5	41.6	41.6	41.6	41.5	41.6
Vapor Density	lb/ft ³	0.083	0.082	0.082	0.083	0.085	0.086
Vapor Rate	k lb/h	17.1	19.2	21.3	23.4	25.5	26.4
Liquid Rate	gpm	37.3	38.0	38.4	38.8	39.6	36.3
Capacity Factor, Cs	ft/s	0.206	0.233	0.258	0.282	0.303	0.313
L/V		0.73	0.66	0.60	0.55	0.52	0.46
OHP Flow	k lb/h	4.66	6.55	8.51	10.44	12.30	14.36
Capacity Factor, Top	ft/s	0.231	0.263	0.294	0.320	0.351	0.358
Capacity Factor, Mid	ft/s	0.218	0.247	0.275	0.300	0.326	0.335

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **4.5 psia**

Run Number		23353	23352	23351	23350	23340	23354
Run Type		OHP	OHP	OHP	OHP	FL OHP	OHP
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.4	4.5
Reboiler Duty	M Btu/h	2.60	2.92	3.25	3.57	3.86	2.92
Condenser Duty	M Btu/h	2.60	2.91	3.21	3.48	3.78	2.89
Reflux Rate	k lb/h	13.8	14.0	14.1	14.1	13.3	15.2
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.64	0.86	1.14	1.51	2.37	0.86
Top	inch H ₂ O / ft	0.60	0.83	1.14	1.56	2.71	0.83
Bottom	inch H ₂ O / ft	0.55	0.75	1.00	1.34	1.94	0.77
Dist. Pressure Drop	inch H ₂ O	0.36	0.36	0.37	0.37	0.16	0.36
Dist Bubbler	inch Hot Liq	7.36	7.84	8.17	8.35	9.68	8.75
Liquid Holdup	Vol. Fraction	0.10	0.11	0.12	0.14	0.15	0.11
Temperature Profiles	°F						
Reflux		114.4	115.6	116.1	115.9	118.9	113.7
Overhead Vapor		122.6	126.9	129.3	130.9	132.4	122.6
Distributor		117.6	120.1	121.5	122.2	125.3	117.2
Top Bed		121.8	127.3	130.2	132.5	136.3	122.4
Mid Bed		132.0	137.3	138.4	139.0	139.5	134.9
Below Bed		141.0	140.4	140.5	141.2	142.5	142.1
Composition of Liquid	Mol % C ₆						
Reflux		80.36	68.81	61.62	56.01	50.36	81.23
Distributor		78.08	67.53	60.58	55.50	49.78	80.42
Below Bed		16.53	18.89	20.68	21.78	23.96	14.77
Bottoms		15.49	19.30	21.30	22.76	24.46	14.48
Feed		20.33	26.31	29.54	31.87	34.29	19.86
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	16.53	18.89	20.68	21.78	23.96	14.77
Temperature	°F	141.0	140.4	140.5	141.2	142.5	142.1
Liquid Density	lb/ft ³	41.2	41.3	41.4	41.4	41.5	41.1
Vapor Density	lb/ft ³	0.088	0.085	0.085	0.085	0.086	0.090
Vapor Rate	k lb/h	17.2	19.3	21.4	23.5	25.3	19.4
Liquid Rate	gpm	47.2	47.6	47.9	48.4	44.2	52.7
Capacity Factor, Cs	ft/s	0.203	0.229	0.255	0.279	0.298	0.226
L/V		0.91	0.82	0.74	0.69	0.58	0.90
OHP Flow	k lb/h	1.63	3.51	5.45	7.36	10.55	2.04
Capacity Factor, Top	ft/s	0.228	0.258	0.289	0.320	0.342	0.256
Capacity Factor, Mid	ft/s	0.215	0.243	0.271	0.299	0.319	0.240

Table I (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **4.5 psia**

Run Number		23355	23356	23339	23338		
Run Type		OHP	OHP	FL OHP	FL OHP		
Column Pressure:	psia	4.5	4.5	4.4	4.4		
Reboiler Duty	M Btu/h	3.24	3.56	3.70	3.63		
Condenser Duty	M Btu/h	3.19	3.51	3.63	3.55		
Reflux Rate	k lb/h	15.5	15.7	15.5	17.9		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0		
Pressure Drops:							
Overall	inch H₂O / ft	1.19	1.90	2.24	2.34		
Top	inch H₂O / ft	1.18	2.14	2.56	2.72		
Bottom	inch H₂O / ft	1.07	1.54	1.84	1.89		
Dist. Pressure Drop	inch H₂O	0.36	0.37	0.10	0.15		
Dist Bubbler	inch Hot Liq	9.28	9.83	11.83	15.42		
Liquid Holdup	Vol. Fraction	0.13	0.18	0.16	0.17		
Temperature Profiles	°F						
Reflux		114.2	115.4	118.4	117.8		
Overhead Vapor		126.1	129.2	130.5	128.7		
Distributor		118.9	120.9	123.4	121.8		
Top Bed		126.7	130.0	136.2	135.6		
Mid Bed		139.1	139.2	139.7	139.2		
Below Bed		142.3	143.0	142.7	143.0		
Composition of Liquid	Mol % C₆						
Reflux		72.67	62.41	56.60	62.28		
Distributor		73.73	65.45	56.33	62.25		
Below Bed		14.79	19.31	23.67	24.34		
Bottoms		16.40	19.93	22.66	20.93		
Feed		24.19	28.88	31.19	27.36		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C₆	14.79	19.31	23.67	24.34		
Temperature	°F	142.3	143.0	142.7	143.0		
Liquid Density	lb/ft³	41.1	41.3	41.5	41.5		
Vapor Density	lb/ft³	0.089	0.089	0.088	0.089		
Vapor Rate	k lb/h	21.5	23.5	24.3	23.8		
Liquid Rate	gpm	53.2	53.4	52.3	58.9		
Capacity Factor, Cs	ft/s	0.251	0.273	0.284	0.277		
L/V		0.82	0.75	0.72	0.82		
OHP Flow	k lb/h	3.93	5.80	6.87	4.21		
Capacity Factor, Top	ft/s	0.286	0.315	0.326	0.259		
Capacity Factor, Mid	ft/s	0.267	0.293	0.304	0.268		

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **4.5 psia**

Run Number		23366	23364	23363	23362	23342	23367
Run Type		TF	TF	TF	TF	FL TF	TF
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.4	4.5
Reboiler Duty	M Btu/h	1.32	2.61	2.93	3.25	3.47	1.28
Condenser Duty	M Btu/h	1.28	2.46	2.83	3.12	3.40	1.21
Reflux Rate	k lb/h	7.8	15.3	17.3	19.0	20.9	8.0
Feed Location		TOP	TOP	TOP	TOP	TOP	TOP
Mass Feed Flow Rate	k lb/h	19.8	12.0	10.0	7.9	4.5	23.1
Pressure Drops:							
Overall	inch H ₂ O / ft	0.20	0.69	0.96	1.37	2.36	0.21
Top	inch H ₂ O / ft	0.15	0.67	0.95	1.36	2.77	0.16
Bottom	inch H ₂ O / ft	0.13	0.59	0.84	1.25	1.86	0.14
Dist. Pressure Drop	inch H ₂ O	0.27	0.29	0.29	0.31	0.23	0.27
Dist Bubbler	inch Hot Liq	29.73	28.22	27.95	26.59	25.56	34.55
Liquid Holdup	Vol. Fraction	0.11	0.13	0.14	0.17	0.19	0.11
Temperature Profiles	°F						
Reflux		132.2	125.0	123.6	119.5	123.1	132.4
Overhead Vapor		132.6	128.9	127.4	125.3	125.3	132.8
Distributor		131.8	125.6	124.2	120.7	123.4	132.0
Top Bed		132.0	128.4	126.9	125.0	130.0	132.2
Mid Bed		132.1	129.3	128.3	126.9	135.6	132.4
Below Bed		132.9	134.6	135.7	137.6	140.8	133.1
Composition of Liquid	Mol % C ₆						
Reflux		52.77	64.28	68.76	74.86	70.73	51.82
Distributor		37.10	48.07	53.47	61.20	63.21	36.07
Below Bed		35.24	34.36	33.29	30.39	32.31	34.73
Bottoms		29.90	25.16	23.05	20.22	22.53	30.33
Feed		29.85	24.40	22.11	19.18	19.56	30.24
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	35.24	34.36	33.29	30.39	32.31	34.73
Temperature	°F	132.9	134.6	135.7	137.6	140.8	133.1
Liquid Density	lb/ft ³	42.4	42.3	42.2	42.0	42.0	42.3
Vapor Density	lb/ft ³	0.069	0.073	0.075	0.079	0.072	0.069
Vapor Rate	k lb/h	8.1	16.7	18.9	21.2	22.9	7.9
Liquid Rate	gpm	82.1	84.6	85.3	86.6	81.2	91.4
Capacity Factor, Cs	ft/s	0.106	0.213	0.238	0.261	0.293	0.103
L/V		3.43	1.72	1.53	1.37	1.20	3.93
Capacity Factor, Top	ft/s	0.106	0.219	0.247	0.280	0.270	0.102
Capacity Factor, Mid	ft/s	0.106	0.216	0.242	0.270	0.281	0.103

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
C₆/C₇ System **4.5 psia**

Run Number		23368	23369	23370	23371	23343	
Run Type		TF	TF	TF	TF	FL TF	
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.4	
Reboiler Duty	M Btu/h	1.96	2.28	2.61	2.93	3.44	
Condenser Duty	M Btu/h	1.92	2.18	2.61	2.96	3.44	
Reflux Rate	k lb/h	12.5	13.6	15.7	17.6	21.1	
Feed Location		TOP	TOP	TOP	TOP	TOP	
Mass Feed Flow Rate	k lb/h	19.2	17.3	15.4	13.4	7.5	
Pressure Drops:							
Overall	inch H₂O / ft	0.45	0.53	0.73	1.05	2.53	
Top	inch H₂O / ft	0.41	0.49	0.71	1.04	3.05	
Bottom	inch H₂O / ft	0.36	0.44	0.63	0.93	1.93	
Dist. Pressure Drop	inch H₂O	0.28	0.29	0.30	0.32	0.51	
Dist Bubbler	inch Hot Liq	34.59	34.55	34.53	34.47	33.59	
Liquid Holdup	Vol. Fraction	0.12	0.12	0.13	0.15	0.19	
Temperature Profiles	°F						
Reflux		129.1	129.4	129.1	127.5	127.8	
Overhead Vapor		131.5	130.9	130.0	128.8	126.8	
Distributor		129.2	129.3	129.0	127.5	127.0	
Top Bed		130.9	130.4	129.6	128.5	129.6	
Mid Bed		131.4	130.9	130.4	129.7	134.9	
Below Bed		133.6	133.7	134.3	135.4	140.0	
Composition of Liquid	Mol % C₆						
Reflux		55.90	57.50	60.15	63.57	64.57	
Distributor		39.70	41.13	44.00	47.83	55.22	
Below Bed		35.36	35.03	34.49	33.87	33.46	
Bottoms		28.21	27.33	25.89	24.04	23.62	
Feed		28.32	27.26	25.90	24.03	22.77	
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C₆	35.36	35.03	34.49	33.87	33.46	
Temperature	°F	133.6	133.7	134.3	135.4	140.0	
Liquid Density	lb/ft³	42.4	42.3	42.3	42.2	42.1	
Vapor Density	lb/ft³	0.070	0.071	0.072	0.074	0.082	
Vapor Rate	k lb/h	12.4	14.5	16.6	18.8	22.4	
Liquid Rate	gpm	93.1	93.7	94.4	95.1	88.6	
Capacity Factor, Cs	ft/s	0.161	0.187	0.214	0.238	0.269	
L/V		2.55	2.20	1.93	1.72	1.34	
Capacity Factor, Top	ft/s	0.161	0.188	0.215	0.243	0.284	
Capacity Factor, Mid	ft/s	0.161	0.188	0.214	0.241	0.276	

Table II (US Engineering Units)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System 23.5 psia

Run Number		23374	23375	23397	23396	23377	23376
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	23.0	22.9	23.6	23.4	23.5	23.4
Reboiler Duty	M Btu/h	1.46	1.50	1.49	1.49	1.77	1.80
Condenser Duty	M Btu/h	1.13	1.12	1.40	1.39	1.27	1.28
Reflux Rate	k lb/h	6.6	7.1	8.4	8.5	7.6	7.9
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.12	0.12	0.13	0.13	0.13	0.13
Top	inch H ₂ O / ft	0.07	0.08	0.09	0.09	0.09	0.09
Bottom	inch H ₂ O / ft	0.04	0.04	0.06	0.06	0.05	0.05
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	1.43	1.47	1.68	1.70	1.60	1.64
Liquid Holdup	Vol. Fraction	0.07			0.07		0.07
Temperature Profiles							
	°F						
Reflux		164.7	165.3	164.8	165.2	158.1	158.2
Overhead Vapor		211.5	211.2	213.9	213.5	213.0	212.9
Distributor		194.5	194.5	193.0	192.7	191.9	191.8
Top Bed		209.3	209.1	211.5	211.1	210.6	210.6
Mid Bed		215.8	215.2	216.9	216.3	216.1	215.8
Below Bed		233.9	233.7	235.9	235.4	235.3	235.2
Composition of Liquid							
	Mol % C ₆						
Reflux		88.72	89.17	86.91	86.69	88.65	88.66
Distributor		88.40	89.16	86.86	86.30	88.62	88.68
Below Bed		13.29	12.52	11.83	12.56	12.67	13.94
Bottoms		7.28	7.18	6.52	6.55	6.66	6.60
Feed		7.34	7.37	6.71	6.68	6.64	6.68
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	13.29	12.52	11.83	12.56	12.67	13.94
Temperature	°F	233.9	233.7	235.9	235.4	235.3	235.2
Liquid Density	lb/ft ³	37.9	37.9	37.8	37.8	37.8	37.9
Vapor Density	lb/ft ³	0.329	0.327	0.336	0.335	0.335	0.336
Vapor Rate	k lb/h	9.8	10.1	10.3	10.4	11.9	12.2
Liquid Rate	gpm	32.1	33.2	34.1	34.3	39.4	40.0
Capacity Factor, Cs	ft/s	0.062	0.064	0.065	0.065	0.075	0.076
HETP 2 pt							
	inch						
DIST & below bed		11.0	10.6	11.0	11.3	10.7	11.0
DIST & bottoms		10.4	10.2	10.4	10.6	10.1	10.0
Relative Volatility		1.567	1.569	1.563	1.564	1.564	1.564
Capacity Factor, Top	ft/s	0.061	0.063	0.065	0.066	0.075	0.077
Capacity Factor, Mid	ft/s	0.061	0.063	0.064	0.065	0.075	0.076

Table II (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, 8.0 ft Packing Depth
 Raschig DT-S Distributor
 C₆/C₇ System 23.5 psia

Run Number		23398	23399	23378	23379	23381	23380
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	23.5	23.2	23.2	23.4	23.3	23.2
Reboiler Duty	M Btu/h	1.79	1.79	2.35	2.37	2.96	2.97
Condenser Duty	M Btu/h	1.56	1.66	2.04	2.05	2.56	2.58
Reflux Rate	k lb/h	9.2	9.7	12.0	12.1	15.2	15.3
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	29.7	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.15	0.15	0.19	0.19	0.24	0.25
Top	inch H ₂ O / ft	0.11	0.11	0.15	0.15	0.21	0.21
Bottom	inch H ₂ O / ft	0.07	0.07	0.10	0.11	0.16	0.16
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	1.93	2.03	2.74	2.76	3.70	3.73
Liquid Holdup	Vol. Fraction	0.08		0.08			0.09
Temperature Profiles	°F						
Reflux		158.3	159.4	157.0	156.9	162.2	162.0
Overhead Vapor		213.8	213.1	213.8	213.6	213.5	213.3
Distributor		188.8	188.3	184.9	184.9	184.8	184.6
Top Bed		211.2	210.3	211.1	210.9	210.6	210.4
Mid Bed		215.6	214.4	215.0	214.9	214.9	214.7
Below Bed		235.6	234.7	235.7	235.5	235.4	235.2
Composition of Liquid	Mol % C ₆						
Reflux		86.49	86.39	86.59	86.60	86.11	86.10
Distributor		86.47	86.42	86.43	86.56	86.13	86.06
Below Bed		11.53	11.92	11.66	11.12	11.17	10.76
Bottoms		6.31	6.23	5.97	5.93	5.36	5.37
Feed		6.33	6.30	6.07	5.96	5.42	5.37
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	11.53	11.92	11.66	11.12	11.17	10.76
Temperature	°F	235.6	234.7	235.7	235.5	235.4	235.2
Liquid Density	lb/ft ³	37.8	37.8	37.8	37.8	37.8	37.8
Vapor Density	lb/ft ³	0.335	0.331	0.335	0.334	0.333	0.332
Vapor Rate	k lb/h	12.5	12.5	17.0	17.2	21.7	21.8
Liquid Rate	gpm	41.2	41.3	56.1	56.7	71.7	71.9
Capacity Factor, Cs	ft/s	0.079	0.079	0.107	0.108	0.137	0.138
HETP 2 pt	inch						
DIST & below bed		11.0	11.1	11.0	10.9	11.0	10.9
DIST & bottoms		10.4	10.4	10.3	10.2	10.1	10.1
Relative Volatility		1.564	1.566	1.564	1.564	1.565	1.566
Capacity Factor, Top	ft/s	0.081	0.081	0.112	0.114	0.144	0.144
Capacity Factor, Mid	ft/s	0.079	0.080	0.109	0.110	0.139	0.140

Table II (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, 8.0 ft Packing Depth
 Raschig DT-S Distributor

C₆/C₇ System 23.5 psia

Run Number		23382	23383	23385	23384	23387	23386
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	23.5	23.5	23.5	23.5	23.6	23.5
Reboiler Duty	M Btu/h	3.56	3.56	4.15	4.15	4.45	4.45
Condenser Duty	M Btu/h	3.10	3.14	3.70	3.71	4.17	4.15
Reflux Rate	k lb/h	18.5	18.5	21.1	21.3	23.3	23.4
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.33	0.33	0.45	0.45	0.54	0.55
Top	inch H ₂ O / ft	0.30	0.30	0.41	0.42	0.50	0.50
Bottom	inch H ₂ O / ft	0.25	0.25	0.37	0.37	0.46	0.47
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	4.90	4.89	6.06	6.12	7.03	7.10
Liquid Holdup	Vol. Fraction	0.10			0.11		0.12
Temperature Profiles							
	°F						
Reflux		160.5	160.3	153.6	154.5	158.4	158.8
Overhead Vapor		214.4	214.5	214.0	214.1	212.7	212.4
Distributor		181.5	181.5	174.4	174.8	175.4	175.4
Top Bed		211.5	211.5	211.3	211.5	210.5	210.1
Mid Bed		216.3	216.5	216.6	216.8	214.7	214.3
Below Bed		236.0	236.1	235.9	236.1	235.1	234.6
Composition of Liquid							
	Mol % C ₆						
Reflux		85.41	85.46	85.70	85.72	89.53	89.43
Distributor		85.43	85.36	85.78	85.88	89.59	89.42
Below Bed		10.51	9.87	9.43	8.88	12.32	12.66
Bottoms		5.25	5.22	5.07	5.03	7.44	7.44
Feed		5.27	5.30	5.15	5.09	7.60	7.52
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	10.51	9.87	9.43	8.88	12.32	12.66
Temperature	°F	236.0	236.1	235.9	236.1	235.1	234.6
Liquid Density	lb/ft ³	37.7	37.7	37.7	37.6	37.8	37.9
Vapor Density	lb/ft ³	0.335	0.335	0.333	0.333	0.333	0.332
Vapor Rate	k lb/h	26.0	26.0	30.3	30.4	32.6	32.7
Liquid Rate	gpm	85.9	86.0	100.3	100.6	107.5	107.5
Capacity Factor, Cs	ft/s	0.164	0.164	0.192	0.192	0.206	0.207
HETP 2 pt							
	inch						
DIST & below bed		10.9	10.8	10.5	10.3	10.4	10.5
DIST & bottoms		10.1	10.1	10.0	10.0	10.1	10.2
Relative Volatility		1.564	1.564	1.564	1.564	1.565	1.566
Capacity Factor, Top	ft/s	0.176	0.176	0.214	0.214	0.227	0.228
Capacity Factor, Mid	ft/s	0.168	0.168	0.200	0.200	0.213	0.214

Table II (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, 8.0 ft Packing Depth

Raschig DT-S Distributor
C₆/C₇ System 23.5 psia

Run Number		23389	23388	23390	23391	23392	23372
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	23.5	23.4	23.5	23.5	23.5	23.5
Reboiler Duty	M Btu/h	5.03	5.03	5.33	5.33	5.48	5.65
Condenser Duty	M Btu/h	4.61	4.58	4.90	4.87	5.01	5.09
Reflux Rate	k lb/h	26.5	26.5	29.6	29.6	30.4	30.6
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.81	0.82	1.03	1.03	1.57	1.85
Top	inch H ₂ O / ft	0.73	0.73	0.89	0.89	1.40	2.00
Bottom	inch H ₂ O / ft	0.78	0.79	1.06	1.05	1.62	1.59
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	8.64	8.68	10.19	10.17	10.92	11.76
Liquid Holdup	Vol. Fraction		0.14	0.15		0.25	0.23
Temperature Profiles							
	°F						
Reflux		154.1	153.8	168.5	168.6	171.1	165.6
Overhead Vapor		212.4	212.2	210.8	210.7	212.7	216.3
Distributor		171.0	170.8	179.3	179.4	181.3	177.8
Top Bed		210.1	210.0	208.8	208.8	210.9	214.9
Mid Bed		214.4	214.2	211.7	211.6	229.5	230.3
Below Bed		235.9	235.7	234.3	234.3	235.5	231.9
Composition of Liquid							
	Mol % C ₆						
Reflux		89.88	89.86	93.97	93.94	89.39	80.28
Distributor		89.90	89.91	93.74	93.93	89.58	79.01
Below Bed		10.06	9.99	14.78	14.49	14.50	23.88
Bottoms		5.99	5.97	8.98	9.01	11.95	19.47
Feed		6.11	6.02	8.96	9.05	11.99	19.65
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	10.06	9.99	14.78	14.49	14.50	23.88
Temperature	°F	235.9	235.7	234.3	234.3	235.5	231.9
Liquid Density	lb/ft ³	37.7	37.7	38.0	38.0	37.9	38.5
Vapor Density	lb/ft ³	0.334	0.333	0.333	0.332	0.338	0.334
Vapor Rate	k lb/h	37.1	37.2	39.3	39.3	40.3	40.9
Liquid Rate	gpm	122.7	123.0	128.9	129.0	132.6	132.6
Capacity Factor, Cs	ft/s	0.235	0.235	0.248	0.248	0.253	0.256
HETP 2 pt							
	inch						
DIST & below bed		9.8	9.8	9.6	9.5	10.9	17.3
DIST & bottoms		9.5	9.5	9.4	9.3	11.5	18.7
Relative Volatility		1.564	1.565	1.566	1.566	1.563	1.567
Capacity Factor, Top	ft/s	0.265	0.266	0.264	0.264	0.271	0.294
Capacity Factor, Mid	ft/s	0.245	0.246	0.253	0.253	0.259	0.272

Table II (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System 23.5 psia

Run Number		23395	23393	23373	23394		
Run Type		TR	TR	FT	FT		
Column Pressure:	psia	23.5	23.6	23.5	23.5		
Reboiler Duty	M Btu/h	5.73	5.48	5.68	5.72		
Condenser Duty	M Btu/h	5.19	5.07	5.18	5.29		
Reflux Rate	k lb/h	30.9	30.5	30.9	31.1		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0		
Pressure Drops:							
Overall	inch H ₂ O / ft	2.02	1.56	1.89	2.10		
Top	inch H ₂ O / ft	2.31	1.39	2.06	2.39		
Bottom	inch H ₂ O / ft	1.62	1.62	1.61	1.70		
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	10.87	10.90	11.77	11.04		
Liquid Holdup	Vol. Fraction				0.22		
Temperature Profiles							
	°F						
Reflux		160.8	170.3	165.5	164.4		
Overhead Vapor		217.1	212.7	216.3	220.2		
Distributor		173.5	180.7	177.6	176.8		
Top Bed		217.1	211.0	215.3	220.0		
Mid Bed		225.2	229.2	230.2	226.4		
Below Bed		226.9	235.7	231.8	230.1		
Composition of Liquid							
	Mol % C ₆						
Reflux		68.28	89.84	81.06	69.85		
Distributor		68.82	89.84	80.51	69.49		
Below Bed		27.21	13.83	23.62	26.92		
Bottoms		22.28	11.57	18.66	22.20		
Feed		22.26	11.57	19.38	22.06		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	27.21	13.83	23.62	26.92		
Temperature	°F	226.9	235.7	231.8	230.1		
Liquid Density	lb/ft ³	38.8	37.9	38.5	38.7		
Vapor Density	lb/ft ³	0.315	0.338	0.333	0.329		
Vapor Rate	k lb/h	41.3	40.4	41.1	41.4		
Liquid Rate	gpm	132.7	132.9	133.4	133.4		
Capacity Factor, Cs	ft/s	0.265	0.253	0.258	0.260		
HETP 2 pt							
	inch						
DIST & below bed		24.5	10.7	16.6	23.6		
DIST & bottoms		27.4	11.3	17.6	26.4		
Relative Volatility		1.577	1.563	1.567	1.570		
Capacity Factor, Top	ft/s	0.317	0.272	0.294	0.310		
Capacity Factor, Mid	ft/s	0.287	0.259	0.273	0.281		

Table II (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **23.5 psia**

Run Number		23428	23427	23426	23424	23417	23418
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	psia	23.5	23.5	23.3	23.4	23.5	23.5
Reboiler Duty	M Btu/h	3.59	4.80	6.02	7.27	4.49	5.10
Condenser Duty	M Btu/h	3.22	4.32	5.46	6.42	4.09	4.65
Reflux Rate	k lb/h	11.2	9.7	8.5	5.3	12.7	11.6
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	60.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.30	0.44	0.67	0.86	0.43	0.53
Top	inch H ₂ O / ft	0.27	0.42	0.67	0.88	0.41	0.51
Bottom	inch H ₂ O / ft	0.20	0.34	0.55	0.73	0.34	0.42
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	2.70	2.27	1.94	1.39	3.26	2.91
Liquid Holdup	Vol. Fraction						
Temperature Profiles	°F						
Reflux		164.0	166.4	163.7	150.7	170.2	170.6
Overhead Vapor		226.2	228.5	228.5	226.5	228.0	229.0
Distributor		194.8	199.1	200.4	206.3	197.0	199.1
Top Bed		225.2	227.8	227.8	225.5	227.3	228.3
Mid Bed		229.1	229.2	228.4	225.8	230.1	230.0
Below Bed		229.7	229.4	228.7	226.2	230.5	230.3
Composition of Liquid	Mol % C ₆						
Reflux		51.30	45.31	42.69	40.67	46.20	42.81
Distributor		51.31	45.36	42.22	40.59	46.02	42.97
Below Bed		26.85	28.32	28.80	28.77	25.01	25.89
Bottoms		27.25	28.31	28.25	28.33	24.37	25.25
Feed		30.67	33.20	34.63	35.63	34.20	36.03
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	26.85	28.32	28.80	28.77	25.01	25.89
Temperature	°F	229.7	229.4	228.7	226.2	230.5	230.3
Liquid Density	lb/ft ³	38.7	38.8	38.8	38.9	38.6	38.6
Vapor Density	lb/ft ³	0.346	0.342	0.337	0.325	0.346	0.343
Vapor Rate	k lb/h	26.1	34.9	43.7	52.7	32.7	37.1
Liquid Rate	gpm	58.9	59.4	60.5	60.8	66.1	65.7
Capacity Factor, Cs	ft/s	0.160	0.215	0.271	0.333	0.201	0.229
L/V		0.70	0.53	0.43	0.36	0.63	0.55
OHP Flow	k lb/h	7.81	16.40	24.87	33.78	12.23	16.79
Capacity Factor, Top	ft/s	0.197	0.265	0.335	0.388	0.249	0.284
Capacity Factor, Mid	ft/s	0.177	0.238	0.301	0.359	0.223	0.254

Table II (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **23.5 psia**

Run Number		23419	23420	23421	23423	23422	23416
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	psia	23.4	23.5	23.6	23.5	23.6	23.5
Reboiler Duty	M Btu/h	5.72	6.61	7.23	7.86	8.16	3.88
Condenser Duty	M Btu/h	5.02	6.02	6.66	7.21	7.63	3.53
Reflux Rate	k lb/h	10.1	9.7	8.3	4.8	4.9	15.9
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	48.0	48.0	48.0	60.0	60.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.62	0.88	1.03	1.02	1.14	0.36
Top	inch H ₂ O / ft	0.62	0.90	1.06	1.05	1.18	0.34
Bottom	inch H ₂ O / ft	0.51	0.75	0.88	0.87	0.98	0.28
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	2.47	2.32	1.96	1.30	1.34	4.23
Liquid Holdup	Vol. Fraction						
Temperature Profiles	°F						
Reflux		167.3	170.0	166.1	153.1	156.7	167.7
Overhead Vapor		225.9	229.5	230.3	230.1	230.4	223.1
Distributor		198.7	202.8	203.3	212.2	213.0	190.4
Top Bed		226.5	228.7	229.4	228.9	229.2	221.4
Mid Bed		228.1	229.5	229.9	229.2	229.6	229.4
Below Bed		228.3	229.9	230.4	229.7	230.1	232.4
Composition of Liquid	Mol % C ₆						
Reflux		43.25	41.43	40.24	39.96	39.65	62.60
Distributor		43.23	41.37	40.43	39.89	39.64	62.87
Below Bed		27.73	27.79	27.73	28.70	28.49	20.16
Bottoms		27.17	27.29	27.02	28.22	28.00	18.98
Feed		34.84	36.11	36.49	36.08	36.27	26.70
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	27.73	27.79	27.73	28.70	28.49	20.16
Temperature	°F	228.3	229.9	230.4	229.7	230.1	232.4
Liquid Density	lb/ft ³	38.8	38.7	38.7	38.8	38.7	38.3
Vapor Density	lb/ft ³	0.335	0.342	0.343	0.340	0.342	0.363
Vapor Rate	k lb/h	41.4	48.1	52.7	57.3	59.5	28.3
Liquid Rate	gpm	64.5	66.1	66.4	61.7	62.6	75.4
Capacity Factor, Cs	ft/s	0.257	0.297	0.324	0.354	0.367	0.170
L/V		0.49	0.43	0.39	0.33	0.33	0.82
OHP Flow	k lb/h	21.31	27.60	32.10	38.12	40.08	5.14
Capacity Factor, Top	ft/s	0.319	0.364	0.399	0.405	0.419	0.210
Capacity Factor, Mid	ft/s	0.286	0.328	0.359	0.379	0.392	0.188

Table II (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **23.5 psia**

Run Number		23425	23403	23402	23415	23414	23413
Run Type		OHP	FL OHP	FL OHP	OHP	OHP	OHP
Column Pressure:	psia	23.4	23.5	23.5	23.5	23.5	23.4
Reboiler Duty	M Btu/h	6.62	8.63	7.94	3.87	4.18	4.78
Condenser Duty	M Btu/h	6.11	8.04	7.42	3.39	3.65	4.16
Reflux Rate	k lb/h	11.2	8.2	10.7	18.0	18.1	18.7
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.91	2.37	2.27	0.37	0.41	0.55
Top	inch H ₂ O / ft	0.93	2.80	2.68	0.34	0.39	0.54
Bottom	inch H ₂ O / ft	0.78	1.82	1.75	0.29	0.33	0.47
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	2.82	2.57	3.09	4.98	5.13	5.46
Liquid Holdup	Vol. Fraction		0.16	0.16	0.10	0.10	0.10
Temperature Profiles							
Reflux	°F	158.9	160.0	165.7	164.1	162.7	161.6
Overhead Vapor		228.7	230.0	229.8	219.2	221.8	224.2
Distributor		193.9	204.5	200.9	184.4	184.7	184.4
Top Bed		227.9	229.5	229.5	216.6	219.6	222.4
Mid Bed		229.1	230.3	230.4	223.9	227.1	229.5
Below Bed		229.5	231.2	231.2	233.1	232.4	231.9
Composition of Liquid							
Reflux	Mol % C ₆	43.18	39.19	40.08	70.71	62.84	56.77
Distributor		42.64	38.90	39.98	71.20	63.11	56.90
Below Bed		28.15	27.07	26.86	18.13	20.15	21.20
Bottoms		27.66	26.74	26.78	17.14	19.74	20.76
Feed		34.69	35.34	34.73	22.26	26.21	29.68
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	28.15	27.07	26.86	18.13	20.15	21.20
Temperature	°F	229.5	231.2	231.2	233.1	232.4	231.9
Liquid Density	lb/ft ³	38.8	38.6	38.6	38.2	38.3	38.3
Vapor Density	lb/ft ³	0.341	0.346	0.347	0.368	0.361	0.357
Vapor Rate	k lb/h	48.1	62.9	57.8	28.6	30.7	34.9
Liquid Rate	gpm	74.8	75.6	78.2	86.3	88.6	92.9
Capacity Factor, Cs	ft/s	0.297	0.386	0.354	0.171	0.185	0.212
L/V		0.48	0.37	0.42	0.93	0.89	0.82
OHP Flow	k lb/h	24.84	39.42	33.61	2.13	3.46	6.36
Capacity Factor, Top	ft/s	0.386	0.474	0.447	0.212	0.234	0.275
Capacity Factor, Mid	ft/s	0.337	0.427	0.397	0.189	0.206	0.240

Table II (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **23.5 psia**

Run Number		23401	23412	23411	23410	23409	23408
Run Type		FL OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	psia	23.2	23.5	23.6	23.6	23.4	23.6
Reboiler Duty	M Btu/h	7.12	5.38	5.98	6.57	4.75	5.05
Condenser Duty	M Btu/h	6.44	4.89	5.52	6.08	4.18	4.50
Reflux Rate	k lb/h	15.6	19.6	20.7	21.8	23.5	23.3
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	59.4	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	2.09	0.76	1.13	2.31	0.62	0.76
Top	inch H ₂ O / ft	2.45	0.75	1.11	2.77	0.57	0.71
Bottom	inch H ₂ O / ft	1.61	0.67	1.03	1.71	0.55	0.69
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	4.39	5.93	6.49	7.22	7.28	7.51
Liquid Holdup	Vol. Fraction	0.19	0.12	0.16		0.12	0.13
Temperature Profiles							
	°F						
Reflux		163.3	163.6	168.0	172.0	160.3	154.0
Overhead Vapor		229.1	226.1	227.3	228.5	215.2	220.7
Distributor		194.0	185.6	188.0	190.9	176.9	176.5
Top Bed		229.7	224.8	225.8	229.0	212.5	218.0
Mid Bed		230.6	230.5	231.2	231.4	219.4	227.1
Below Bed		231.3	231.8	232.1	232.3	234.5	235.3
Composition of Liquid							
	Mol % C ₆						
Reflux		42.67	51.85	48.21	44.84	82.02	68.35
Distributor		42.72	51.62	48.58	44.69	80.92	68.37
Below Bed		26.34	22.40	22.58	25.45	13.48	13.33
Bottoms		26.01	22.11	22.68	23.54	10.86	12.80
Feed		33.10	32.54	34.19	35.35	15.01	19.08
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	26.34	22.40	22.58	25.45	13.48	13.33
Temperature	°F	231.3	231.8	232.1	232.3	234.5	235.3
Liquid Density	lb/ft ³	38.6	38.4	38.4	38.5	37.9	37.9
Vapor Density	lb/ft ³	0.348	0.354	0.353	0.353	0.378	0.375
Vapor Rate	k lb/h	51.8	39.3	43.6	48.0	35.4	37.5
Liquid Rate	gpm	91.7	97.3	102.4	106.8	112.2	114.7
Capacity Factor, Cs	ft/s	0.317	0.239	0.266	0.292	0.210	0.223
L/V		0.55	0.76	0.72	0.69	0.96	0.93
OHP Flow	k lb/h	23.44	9.28	12.12	14.99	1.25	2.66
Capacity Factor, Top	ft/s	0.413	0.314	0.348	0.381	0.266	0.295
Capacity Factor, Mid	ft/s	0.360	0.272	0.303	0.331	0.234	0.254

Table II (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **23.5 psia**

Run Number		23407	23406	23405	23400		
Run Type		OHP	OHP	OHP	FL OHP		
Column Pressure:	psia	23.5	23.5	23.6	23.5		
Reboiler Duty	M Btu/h	5.36	5.96	6.08	6.52		
Condenser Duty	M Btu/h	4.88	5.41	5.58	5.90		
Reflux Rate	k lb/h	23.6	24.7	23.7	21.8		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0		
Pressure Drops:							
Overall	inch H ₂ O / ft	0.93	1.90	1.92	2.25		
Top	inch H ₂ O / ft	0.88	2.13	2.16	2.69		
Bottom	inch H ₂ O / ft	0.87	1.56	1.58	1.68		
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	7.85	8.78	8.33	7.16		
Liquid Holdup	Vol. Fraction	0.14	0.22	0.22	0.20		
Temperature Profiles	°F						
Reflux		154.5	160.1	160.0	161.6		
Overhead Vapor		222.4	225.1	226.2	228.5		
Distributor		177.3	181.3	182.4	185.5		
Top Bed		219.9	224.2	225.6	230.2		
Mid Bed		229.1	232.0	232.3	231.8		
Below Bed		234.4	233.3	233.5	232.6		
Composition of Liquid	Mol % C ₆						
Reflux		62.70	54.09	51.99	45.06		
Distributor		62.79	54.14	50.68	45.18		
Below Bed		15.60	19.90	20.64	23.48		
Bottoms		15.34	19.04	19.75	22.14		
Feed		23.13	28.34	29.85	33.10		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	15.60	19.90	20.64	23.48		
Temperature	°F	234.4	233.3	233.5	232.6		
Liquid Density	lb/ft ³	38.0	38.2	38.3	38.4		
Vapor Density	lb/ft ³	0.369	0.361	0.360	0.354		
Vapor Rate	k lb/h	39.6	43.8	44.6	47.7		
Liquid Rate	gpm	116.4	120.1	118.0	111.9		
Capacity Factor, Cs	ft/s	0.237	0.264	0.270	0.290		
L/V		0.90	0.84	0.81	0.72		
OHP Flow	k lb/h	4.11	6.95	8.39	13.20		
Capacity Factor, Top	ft/s	0.317	0.353	0.362	0.391		
Capacity Factor, Mid	ft/s	0.271	0.303	0.310	0.334		

Table II (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **23.5 psia**

Run Number		23433	23432	23431	23430	23429	23404
Run Type		TF	TF	TF	TF	TF	FL TF
Column Pressure:	psia	23.5	23.5	23.6	23.5	23.5	23.6
Reboiler Duty	M Btu/h	2.39	2.99	3.58	4.17	4.74	5.23
Condenser Duty	M Btu/h	2.06	2.62	3.20	3.84	4.31	4.78
Reflux Rate	k lb/h	12.4	15.6	19.0	23.0	26.4	27.1
Feed Location		TOP	TOP	TOP	TOP	TOP	TOP
Mass Feed Flow Rate	k lb/h	28.5	23.1	17.7	12.6	6.3	11.3
Pressure Drops:							
Overall	inch H ₂ O / ft	0.22	0.30	0.40	0.54	0.76	2.08
Top	inch H ₂ O / ft	0.18	0.27	0.37	0.52	0.70	2.48
Bottom	inch H ₂ O / ft	0.14	0.21	0.30	0.44	0.70	1.56
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	18.12	16.25	15.26	14.59	12.54	14.34
Liquid Holdup	Vol. Fraction						0.24
Temperature Profiles	°F						
Reflux		208.1	200.0	193.0	188.5	177.8	173.5
Overhead Vapor		227.2	226.3	224.9	222.4	218.7	224.1
Distributor		210.5	204.1	198.6	194.5	186.0	183.2
Top Bed		226.0	225.1	223.7	221.1	216.8	222.9
Mid Bed		226.0	225.1	223.7	221.4	218.9	226.1
Below Bed		226.8	226.8	227.1	227.5	233.5	230.9
Composition of Liquid	Mol % C ₆						
Reflux		48.56	51.43	56.27	64.23	71.67	58.74
Distributor		36.07	38.36	43.28	50.96	66.72	48.33
Below Bed		35.03	35.06	34.80	32.76	16.60	26.04
Bottoms		30.00	29.07	27.20	25.94	12.87	21.55
Feed		30.21	28.69	26.38	22.09	26.74	21.04
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % C ₆	35.03	35.06	34.80	32.76	16.60	26.04
Temperature	°F	226.8	226.8	227.1	227.5	233.5	230.9
Liquid Density	lb/ft ³	39.2	39.2	39.2	39.0	38.1	38.6
Vapor Density	lb/ft ³	0.324	0.324	0.327	0.332	0.361	0.343
Vapor Rate	k lb/h	17.0	21.3	25.7	30.2	35.3	38.4
Liquid Rate	gpm	144.6	141.3	138.3	136.8	136.4	160.8
Capacity Factor, Cs	ft/s	0.107	0.134	0.161	0.188	0.214	0.237
L/V		2.68	2.08	1.69	1.42	1.18	1.29
Capacity Factor, Top	ft/s	0.102	0.134	0.169	0.205	0.247	0.281
Capacity Factor, Mid	ft/s	0.105	0.134	0.165	0.196	0.228	0.256

Table III (US Engineering Units)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System **14.7 psia**

Run Number		23436	23437	23438	23439	23441	23440
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	14.7	14.7	14.7	14.7	14.7	14.7
Reboiler Duty	M Btu/h	1.13	1.13	1.69	1.69	2.25	2.25
Condenser Duty	M Btu/h	0.75	0.75	1.23	1.23	1.78	1.80
Reflux Rate	k lb/h	4.34	4.51	7.12	7.10	10.06	10.07
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H2O / ft	0.11	0.11	0.14	0.14	0.19	0.20
Top	inch H2O / ft	0.06	0.07	0.10	0.10	0.16	0.16
Bottom	inch H2O / ft	0.03	0.03	0.06	0.06	0.11	0.11
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	1.22	1.22	1.53	1.53	2.05	2.07
Liquid Holdup	Vol. Fraction	0.06	0.06	0.07	0.07	0.08	0.08
Temperature Profiles	°F						
Reflux		219.2	218.4	216.3	215.8	205.9	206.5
Overhead Vapor		286.4	286.4	286.1	286.0	286.0	286.0
Distributor		272.3	272.2	265.1	265.1	255.8	255.9
Top Bed		285.7	285.7	284.2	284.1	283.9	284.0
Mid Bed		287.0	286.9	285.3	285.2	284.8	284.9
Below Bed		287.8	287.8	288.0	287.9	288.0	288.0
Composition of Liquid	Mol% p-xylene						
Reflux		69.18	69.18	72.67	73.51	74.30	74.27
Distributor		66.17	66.17	68.74	71.09	73.21	73.02
Below Bed		36.69	36.60	36.24	36.16	36.33	36.03
Bottoms		32.42	32.42	30.87	30.74	30.07	30.08
Feed		32.58	32.51	30.93	30.83	30.08	30.09
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	36.69	36.60	36.24	36.16	36.33	36.03
Temperature	°F	287.8	287.8	288.0	287.9	288.0	288.0
Liquid Density	lb/ft ³	47.5	47.5	47.5	47.5	47.5	47.5
Vapor Density	lb/ft ³	0.195	0.195	0.195	0.195	0.195	0.195
Vapor Rate	k lb/h	6.93	6.93	10.85	10.84	14.69	14.72
Liquid Rate	gpm	18.2	18.2	28.5	28.5	38.6	38.6
Capacity Factor, Cs	ft/s	0.051	0.051	0.080	0.080	0.108	0.108
HETP 2pt	inch						
DIST & below bed		12.0	11.9	10.8	9.9	9.3	9.3
DIST & bottoms		11.6	11.6	10.1	9.3	8.6	8.6
Relative Volatility		1.163	1.163	1.163	1.163	1.163	1.163
Capacity Factor, Top	ft/s	0.050	0.050	0.078	0.078	0.105	0.105
Capacity Factor, Mid	ft/s	0.050	0.050	0.079	0.079	0.107	0.107

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23443	23442	23444	23445	23446	23447
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	14.8	14.7	14.8	14.7	14.7	14.7
Reboiler Duty	M Btu/h	2.54	2.54	3.10	3.10	3.66	3.66
Condenser Duty	M Btu/h	2.00	2.01	2.61	2.61	3.09	3.08
Reflux Rate	k lb/h	10.98	11.09	13.83	13.75	15.94	16.02
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H2O / ft	0.22	0.23	0.32	0.32	0.42	0.42
Top	inch H2O / ft	0.19	0.19	0.28	0.29	0.39	0.39
Bottom	inch H2O / ft	0.14	0.14	0.23	0.23	0.32	0.32
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	2.39	2.40	3.18	3.18	3.85	3.85
Liquid Holdup	Vol. Fraction	0.08	0.08	0.09	0.09	0.10	0.10
Temperature Profiles	°F						
Reflux		198.7	198.9	189.4	189.2	184.2	184.2
Overhead Vapor		286.3	286.2	286.1	286.0	285.9	285.9
Distributor		249.7	249.6	239.7	239.7	233.7	233.6
Top Bed		284.2	284.0	284.0	284.0	283.9	283.9
Mid Bed		285.0	284.9	285.0	284.9	285.0	284.9
Below Bed		288.2	288.1	288.3	288.2	288.3	288.3
Composition of Liquid	Mol% p-xylene						
Reflux		74.37	74.35	74.57	74.58	74.37	74.38
Distributor		73.44	73.32	74.38	74.46	74.19	74.18
Below Bed		36.29	36.28	36.40	36.17	35.88	35.59
Bottoms		29.83	29.83	29.42	29.39	29.12	29.08
Feed		29.82	29.90	29.39	29.47	29.12	29.10
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	36.29	36.28	36.40	36.17	35.88	35.59
Temperature	°F	288.2	288.1	288.3	288.2	288.3	288.3
Liquid Density	lb/ft ³	47.5	47.5	47.5	47.5	47.5	47.5
Vapor Density	lb/ft ³	0.196	0.195	0.196	0.196	0.196	0.196
Vapor Rate	k lb/h	16.53	16.55	20.41	20.45	24.00	24.00
Liquid Rate	gpm	43.4	43.4	53.6	53.7	63.0	63.0
Capacity Factor, Cs	ft/s	0.121	0.122	0.150	0.150	0.176	0.176
HETP 2pt	inch						
DIST & below bed		9.2	9.2	9.0	8.9	8.9	8.8
DIST & bottoms		8.5	8.5	8.1	8.1	8.1	8.1
Relative Volatility		1.163	1.163	1.163	1.163	1.163	1.163
Capacity Factor, Top	ft/s	0.118	0.118	0.146	0.146	0.172	0.172
Capacity Factor, Mid	ft/s	0.120	0.120	0.148	0.148	0.174	0.174

Table III (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System **14.7 psia**

Run Number		23449	23448	23450	23451	23453	23452
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	14.7	14.7	14.7	14.7	14.7	14.7
Reboiler Duty	M Btu/h	4.22	4.22	4.78	4.78	5.06	5.05
Condenser Duty	M Btu/h	3.56	3.58	4.06	4.06	4.23	4.49
Reflux Rate	k lb/h	18.54	18.65	21.15	21.10	22.15	22.75
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0	29.9
Pressure Drops:							
Overall	inch H2O / ft	0.56	0.57	0.79	0.79	0.94	1.00
Top	inch H2O / ft	0.55	0.55	0.78	0.78	0.94	1.01
Bottom	inch H2O / ft	0.46	0.46	0.67	0.67	0.81	0.87
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	4.62	4.65	5.50	5.49	5.91	6.13
Liquid Holdup	Vol. Fraction	0.11	0.11	0.12	0.12	0.14	0.14
Temperature Profiles	°F						
Reflux		179.8	180.1	176.6	176.7	174.6	177.2
Overhead Vapor		286.1	286.1	286.2	286.1	285.9	285.8
Distributor		227.1	227.1	223.0	223.1	221.3	222.6
Top Bed		284.0	284.0	284.1	284.0	283.7	283.7
Mid Bed		285.2	285.2	285.4	285.4	285.2	285.2
Below Bed		288.5	288.5	288.9	288.9	288.9	288.9
Composition of Liquid	Mol% p-xylene						
Reflux		74.05	73.88	74.45	74.52	75.48	75.46
Distributor		73.86	73.87	74.26	74.27	75.34	75.08
Below Bed		35.49	35.04	34.27	34.01	33.37	33.31
Bottoms		28.78	28.77	27.89	27.90	27.24	27.11
Feed		28.76	28.83	27.95	27.93	27.20	27.18
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	35.49	35.04	34.27	34.01	33.37	33.31
Temperature	°F	288.5	288.5	288.9	288.9	288.9	288.9
Liquid Density	lb/ft ³	47.5	47.5	47.5	47.5	47.5	47.5
Vapor Density	lb/ft ³	0.196	0.196	0.197	0.197	0.196	0.197
Vapor Rate	k lb/h	27.79	27.83	31.57	31.57	33.38	33.72
Liquid Rate	gpm	72.9	73.0	82.8	82.8	87.6	88.5
Capacity Factor, Cs	ft/s	0.204	0.204	0.231	0.231	0.245	0.247
HETP 2pt	inch						
DIST & below bed		8.9	8.8	8.5	8.4	8.0	8.1
DIST & bottoms		8.1	8.1	7.8	7.8	7.5	7.5
Relative Volatility		1.163	1.163	1.163	1.163	1.163	1.163
Capacity Factor, Top	ft/s	0.199	0.199	0.225	0.225	0.238	0.241
Capacity Factor, Mid	ft/s	0.201	0.201	0.228	0.228	0.241	0.244

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23455	23454	23457	23456	23435	23434
Run Type		TR	TR	TR	TR	FT	FT
Column Pressure:	psia	14.7	14.7	14.7	14.7	14.8	14.8
Reboiler Duty	M Btu/h	5.33	5.33	5.51	5.51	5.64	5.65
Condenser Duty	M Btu/h	4.50	4.49	4.58	4.61	5.16	5.13
Reflux Rate	k lb/h	23.79	23.68	23.95	23.97	26.58	26.55
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.1	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H2O / ft	1.18	1.17	1.28	1.30	2.48	2.49
Top	inch H2O / ft	1.20	1.19	1.30	1.32	2.95	2.95
Bottom	inch H2O / ft	1.04	1.03	1.13	1.15	1.91	1.91
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	6.46	6.47	6.57	6.63	7.74	7.77
Liquid Holdup	Vol. Fraction	0.15	0.15	0.17	0.17	0.23	0.23
Temperature Profiles	°F						
Reflux		176.7	176.4	173.5	174.3	188.8	189.6
Overhead Vapor		286.1	286.1	286.1	286.1	287.7	287.4
Distributor		222.1	221.9	220.6	220.8	226.1	226.5
Top Bed		283.9	283.8	283.8	283.8	286.0	285.8
Mid Bed		285.6	285.6	285.6	285.7	288.1	287.8
Below Bed		289.5	289.4	289.7	289.8	291.1	290.9
Composition of Liquid	Mol% p-xylene						
Reflux		76.14	75.92	76.82	76.80	61.23	62.10
Distributor		75.84	75.87	76.47	76.59	61.21	52.95
Below Bed		32.86	32.52	32.52	32.33	37.73	38.10
Bottoms		26.70	26.75	26.35	26.34	32.00	31.56
Feed		26.68	26.76	26.35	26.35	31.87	31.62
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	32.86	32.52	32.52	32.33	37.73	38.10
Temperature	°F	289.5	289.4	289.7	289.8	291.1	290.9
Liquid Density	lb/ft ³	47.4	47.5	47.5	47.5	47.4	47.4
Vapor Density	lb/ft ³	0.203	0.198	0.198	0.199	0.204	0.203
Vapor Rate	k lb/h	35.48	35.07	35.95	36.02	37.63	37.63
Liquid Rate	gpm	93.4	92.0	94.4	94.5	99.0	99.0
Capacity Factor, Cs	ft/s	0.256	0.256	0.262	0.262	0.271	0.271
HETP 2pt	inch						
DIST & below bed		7.8	7.7	7.6	7.5	15.1	24.0
DIST & bottoms		7.2	7.3	7.1	7.0	13.6	19.5
Relative Volatility		1.162	1.163	1.162	1.162	1.162	1.162
Capacity Factor, Top	ft/s	0.257	0.250	0.256	0.256	0.270	0.272
Capacity Factor, Mid	ft/s	0.256	0.253	0.259	0.259	0.270	0.272

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23458	23459				
Run Type		FT	FT				
Column Pressure:	psia	14.7	14.7				
Reboiler Duty	M Btu/h	5.80	5.80				
Condenser Duty	M Btu/h	4.90	4.92				
Reflux Rate	k lb/h	25.47	25.45				
Feed Location		Bottom	Bottom				
Mass Feed Flow Rate	k lb/h	30.0	30.0				
Pressure Drops:							
Overall	inch H2O / ft	2.53	2.55				
Top	inch H2O / ft	3.03	3.07				
Bottom	inch H2O / ft	1.90	1.92				
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	6.49	6.39				
Liquid Holdup	Vol. Fraction	0.22	0.22				
Temperature Profiles	°F						
Reflux		174.7	175.1				
Overhead Vapor		287.7	287.9				
Distributor		219.8	220.2				
Top Bed		285.7	286.0				
Mid Bed		288.0	288.3				
Below Bed		290.8	290.8				
Composition of Liquid	Mol% p-xylene						
Reflux		61.85	59.68				
Distributor		61.40	59.33				
Below Bed		36.14	36.18				
Bottoms		30.32	31.08				
Feed		29.82	30.53				
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	36.14	36.18				
Temperature	°F	290.8	290.8				
Liquid Density	lb/ft³	47.4	47.4				
Vapor Density	lb/ft³	0.203	0.202				
Vapor Rate	k lb/h	38.09	38.12				
Liquid Rate	gpm	100.2	100.2				
Capacity Factor, Cs	ft/s	0.275	0.275				
HETP 2pt	inch						
DIST & below bed		14.0	15.3				
DIST & bottoms		12.6	14.1				
Relative Volatility		1.162	1.162				
Capacity Factor, Top	ft/s	0.273	0.273				
Capacity Factor, Mid	ft/s	0.274	0.274				

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23488	23489	23490	23491	23487	23486
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	psia	14.6	14.3	14.7	14.7	14.7	14.7
Reboiler Duty	M Btu/h	2.83	3.98	5.11	5.68	4.23	4.80
Condenser Duty	M Btu/h	2.04	3.21	4.40	5.07	3.73	4.19
Reflux Rate	k lb/h	7.43	5.27	3.59	3.38	13.08	11.69
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	60.0	60.0	60.0
Pressure Drops:							
Overall	inch H2O / ft	0.22	0.34	0.49	0.60	0.47	0.55
Top	inch H2O / ft	0.18	0.31	0.47	0.59	0.45	0.54
Bottom	inch H2O / ft	0.13	0.24	0.38	0.48	0.37	0.45
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	1.76	1.44	1.28	1.26	2.96	2.62
Liquid Holdup	Vol. Fraction	0.07	0.07	0.07	0.07		0.09
Temperature Profiles	°F						
Reflux		185.6	170.0	169.3	173.2	181.1	178.8
Overhead Vapor		288.4	287.3	289.7	289.8	288.7	289.1
Distributor		258.9	264.3	275.0	276.3	237.7	240.2
Top Bed		286.2	285.2	287.6	287.7	286.6	287.0
Mid Bed		286.9	285.5	287.8	288.0	287.6	287.7
Below Bed		287.3	285.8	288.2	288.4	288.2	288.2
Composition of Liquid	Mol% p-xylene						
Reflux		49.66	45.02	43.53	43.09	49.54	46.71
Distributor		49.81	45.24	43.73	43.51	48.54	46.42
Below Bed		37.51	38.16	38.68	38.63	37.24	37.70
Bottoms		36.19	37.29	37.28	37.10	35.66	36.45
Feed		37.20	38.91	39.44	39.63	37.26	38.32
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	37.51	38.16	38.68	38.63	37.24	37.70
Temperature	°F	287.3	285.8	288.2	288.4	288.2	288.2
Liquid Density	lb/ft ³	47.5	47.6	47.5	47.5	47.5	47.5
Vapor Density	lb/ft ³	0.194	0.190	0.196	0.197	0.196	0.196
Vapor Rate	k lb/h	19.27	27.08	34.93	38.80	28.84	32.76
Liquid Rate	gpm	39.9	40.1	39.8	40.2	60.0	60.0
Capacity Factor, Cs	ft/s	0.142	0.202	0.256	0.284	0.212	0.240
L/V		0.79	0.57	0.43	0.39	0.79	0.70
OHP Flow	k lb/h	4.05	11.78	19.79	23.51	6.00	9.90
Capacity Factor, Top	ft/s	0.139	0.198	0.252	0.280	0.209	0.237
Capacity Factor, Mid	ft/s	0.141	0.200	0.254	0.281	0.210	0.238

Table III (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System **14.7 psia**

Run Number		23485	23484	23492	23483	23482	23481
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	psia	14.7	14.7	14.7	14.7	14.7	14.7
Reboiler Duty	M Btu/h	5.38	5.96	6.82	7.14	8.31	9.17
Condenser Duty	M Btu/h	4.84	5.46	6.15	6.56	7.73	8.58
Reflux Rate	k lb/h	10.49	9.21	6.14	6.84	5.68	4.58
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	60.0	60.0	60.0
Pressure Drops:							
Overall	inch H2O / ft	0.66	0.76	0.97	1.05	1.45	1.77
Top	inch H2O / ft	0.65	0.77	1.00	1.09	1.52	1.86
Bottom	inch H2O / ft	0.55	0.65	0.83	0.91	1.27	1.56
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	2.31	2.03	1.55	1.70	1.61	1.51
Liquid Holdup	Vol. Fraction	0.09	0.10	0.09	0.10	0.09	0.10
Temperature Profiles							
	°F						
Reflux		177.2	175.7	183.9	172.1	172.8	171.6
Overhead Vapor		289.2	289.3	289.7	289.4	289.5	289.6
Distributor		243.2	246.6	265.9	258.5	265.5	271.4
Top Bed		287.2	287.3	287.6	287.4	287.6	287.8
Mid Bed		287.8	287.8	288.2	288.1	288.5	288.7
Below Bed		288.3	288.4	288.9	288.8	289.4	289.9
Composition of Liquid							
	Mol% p-xylene						
Reflux		45.35	44.31	43.13	43.20	42.56	42.10
Distributor		45.39	44.36	43.45	43.33	42.81	42.90
Below Bed		38.02	38.19	38.30	38.38	38.24	38.10
Bottoms		36.62	36.83	36.68	36.73	36.56	36.53
Feed		38.87	39.28	39.77	39.82	40.18	40.45
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	38.02	38.19	38.30	38.38	38.24	38.10
Temperature	°F	288.3	288.4	288.9	288.8	289.4	289.9
Liquid Density	lb/ft ³	47.5	47.5	47.5	47.5	47.4	47.4
Vapor Density	lb/ft ³	0.196	0.197	0.198	0.198	0.199	0.201
Vapor Rate	k lb/h	36.71	40.69	46.55	48.70	56.68	62.54
Liquid Rate	gpm	59.4	59.2	51.4	58.2	59.8	59.9
Capacity Factor, Cs	ft/s	0.269	0.298	0.340	0.356	0.412	0.454
L/V		0.62	0.55	0.42	0.45	0.40	0.36
OHP Flow	k lb/h	14.08	18.14	27.00	26.57	33.95	39.76
Capacity Factor, Top	ft/s	0.265	0.294	0.336	0.352	0.410	0.452
Capacity Factor, Mid	ft/s	0.267	0.296	0.338	0.354	0.411	0.453

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23467	23475	23476	23477	23478	23479
Run Type		FL OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	psia	14.7	14.7	14.7	14.7	14.7	14.7
Reboiler Duty	M Btu/h	10.23	4.51	5.08	5.67	6.83	7.42
Condenser Duty	M Btu/h	9.49	3.87	4.42	4.89	6.14	6.76
Reflux Rate	k lb/h	3.01	16.03	14.89	13.66	11.97	10.94
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	39.0	39.0	39.0	42.0	42.0
Pressure Drops:							
Overall	inch H2O / ft	2.75	0.58	0.70	0.83	1.22	1.46
Top	inch H2O / ft	3.15	0.57	0.69	0.83	1.25	1.51
Bottom	inch H2O / ft	2.23	0.48	0.59	0.71	1.06	1.28
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	1.63	3.76	3.48	3.20	2.77	2.58
Liquid Holdup	Vol. Fraction	0.14	0.03	0.03	0.11	0.12	0.12
Temperature Profiles	°F						
Reflux		165.3	176.7	176.5	177.4	177.5	176.6
Overhead Vapor		289.7	288.0	288.9	289.2	289.4	289.4
Distributor		276.9	230.5	232.8	235.2	240.4	243.6
Top Bed		287.9	285.8	286.7	287.1	287.4	287.4
Mid Bed		289.6	287.1	287.9	288.0	288.2	288.3
Below Bed		291.2	288.5	288.6	288.7	289.1	289.4
Composition of Liquid	Mol% p-xylene						
Reflux		41.80	57.15	50.21	46.55	44.18	43.46
Distributor		41.99	57.17	52.98	46.92	45.77	44.08
Below Bed		37.95	34.53	35.16	36.83	37.32	37.95
Bottoms		36.34	32.22	33.96	34.96	35.49	35.42
Feed		40.89	34.85	37.45	38.79	39.84	40.25
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	37.95	34.53	35.16	36.83	37.32	37.95
Temperature	°F	291.2	288.5	288.6	288.7	289.1	289.4
Liquid Density	lb/ft ³	47.4	47.5	47.5	47.5	47.5	47.4
Vapor Density	lb/ft ³	0.204	0.196	0.196	0.197	0.198	0.199
Vapor Rate	k lb/h	69.68	30.76	34.70	38.67	46.60	50.60
Liquid Rate	gpm	59.4	70.2	70.2	70.1	70.3	70.3
Capacity Factor, Cs	ft/s	0.501	0.226	0.254	0.283	0.340	0.368
L/V		0.32	0.87	0.77	0.69	0.57	0.53
OHP Flow	k lb/h	47.11	4.00	7.95	11.96	19.83	23.84
<i>Capacity Factor, Top</i>	ft/s	0.505	0.221	0.249	0.279	0.337	0.366
<i>Capacity Factor, Mid</i>	ft/s	0.504	0.223	0.252	0.281	0.338	0.367

Table III (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System **14.7 psia**

Run Number		23480	23463	23466	23462	23474	23473
Run Type		OHP	FL OHP	FL OHP	FL OHP	OHP	OHP
Column Pressure:	psia	14.7	14.7	14.7	14.7	14.7	14.7
Reboiler Duty	M Btu/h	7.70	8.21	9.01	7.66	5.06	5.64
Condenser Duty	M Btu/h	7.07	7.30	8.20	6.79	4.38	4.87
Reflux Rate	k lb/h	10.39	10.28	7.44	13.25	20.52	19.31
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	48.0	60.0	60.0	48.0	39.0	39.0
Pressure Drops:							
Overall	inch H2O / ft	1.55	2.52	2.80	2.51	0.87	1.07
Top	inch H2O / ft	1.62	2.91	3.25	2.90	0.87	1.09
Bottom	inch H2O / ft	1.37	2.02	2.23	1.99	0.75	0.94
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	2.42	2.50	2.15	3.19	5.12	4.73
Liquid Holdup	Vol. Fraction	0.13	0.18	0.17	0.19	0.04	0.14
Temperature Profiles	°F						
Reflux		176.5	194.9	178.5	197.2	177.9	177.0
Overhead Vapor		289.4	289.5	289.6	289.5	287.8	288.5
Distributor		246.5	253.5	258.3	248.3	225.3	226.1
Top Bed		287.5	287.7	287.8	287.8	285.6	286.3
Mid Bed		288.4	289.3	289.5	289.3	287.0	287.9
Below Bed		289.5	290.8	291.1	290.8	289.0	289.2
Composition of Liquid	Mol% p-xylene						
Reflux		43.31	43.10	42.58	43.69	58.55	52.44
Distributor		43.84	43.67	42.78	44.49	58.70	52.60
Below Bed		37.71	37.77	38.01	37.36	34.68	35.20
Bottoms		35.84	36.34	40.43	35.61	31.93	33.29
Feed		40.19	39.97	36.53	39.98	33.96	36.64
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	37.71	37.77	38.01	37.36	34.68	35.20
Temperature	°F	289.5	290.8	291.1	290.8	289.0	289.2
Liquid Density	lb/ft ³	47.4	47.4	47.4	47.4	47.5	47.5
Vapor Density	lb/ft ³	0.200	0.203	0.204	0.203	0.197	0.198
Vapor Rate	k lb/h	52.55	55.93	61.41	52.20	34.55	38.47
Liquid Rate	gpm	69.8	68.3	66.9	74.2	84.7	84.9
Capacity Factor, Cs	ft/s	0.382	0.404	0.442	0.377	0.253	0.281
L/V		0.51	0.46	0.41	0.54	0.93	0.84
OHP Flow	k lb/h	25.99	29.99	35.99	23.98	2.28	6.12
<i>Capacity Factor, Top</i>	ft/s	0.380	0.405	0.445	0.377	0.248	0.277
<i>Capacity Factor, Mid</i>	ft/s	0.381	0.405	0.444	0.378	0.250	0.279

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23472	23471	23470	23461		
Run Type		OHP	OHP	OHP	FL OHP		
Column Pressure:	psia	14.7	14.7	14.7	14.7		
Reboiler Duty	M Btu/h	5.92	6.21	6.78	7.09		
Condenser Duty	M Btu/h	5.16	5.47	6.05	6.24		
Reflux Rate	k lb/h	18.60	18.21	17.34	17.69		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	k lb/h	42.0	42.0	42.0	36.0		
Pressure Drops:							
Overall	inch H2O / ft	1.18	1.34	1.82	2.61		
Top	inch H2O / ft	1.21	1.37	1.90	3.09		
Bottom	inch H2O / ft	1.04	1.18	1.63	2.00		
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	4.50	4.34	4.05	4.29		
Liquid Holdup	Vol. Fraction	0.14	0.15	0.20	0.21		
Temperature Profiles	°F						
Reflux		176.5	177.1	176.6	194.3		
Overhead Vapor		288.8	288.9	289.2	289.0		
Distributor		226.7	227.6	229.2	238.5		
Top Bed		286.6	286.8	287.1	287.5		
Mid Bed		288.1	288.4	288.7	289.2		
Below Bed		289.3	289.4	290.0	290.7		
Composition of Liquid	Mol% p-xylene						
Reflux		49.99	48.30	46.75	45.04		
Distributor		50.22	48.53	47.01	46.82		
Below Bed		35.80	36.19	36.45	36.96		
Bottoms		34.11	34.53	34.67	34.34		
Feed		37.57	38.24	38.98	39.68		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	35.80	36.19	36.45	36.96		
Temperature	°F	289.3	289.4	290.0	290.7		
Liquid Density	lb/ft ³	47.5	47.5	47.4	47.4		
Vapor Density	lb/ft ³	0.198	0.199	0.200	0.203		
Vapor Rate	k lb/h	40.43	42.37	46.30	48.35		
Liquid Rate	gpm	85.0	84.9	85.0	84.6		
Capacity Factor, Cs	ft/s	0.295	0.309	0.336	0.349		
L/V		0.80	0.76	0.70	0.67		
OHP Flow	k lb/h	8.08	10.06	13.95	16.19		
<i>Capacity Factor, Top</i>	ft/s	0.292	0.306	0.334	0.350		
<i>Capacity Factor, Mid</i>	ft/s	0.293	0.307	0.335	0.350		

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23469	23468	23460			
Run Type		OHP	OHP	FL OHP			
Column Pressure:	psia	14.7	14.7	14.7			
Reboiler Duty	M Btu/h	5.73	6.08	6.32			
Condenser Duty	M Btu/h	5.05	5.37	5.50			
Reflux Rate	k lb/h	22.94	22.00	21.82			
Feed Location		Bottom	Bottom	Bottom			
Mass Feed Flow Rate	k lb/h	39.0	39.0	30.0			
Pressure Drops:							
Overall	inch H2O / ft	1.45	1.74	2.42			
Top	inch H2O / ft	1.49	1.80	2.78			
Bottom	inch H2O / ft	1.30	1.57	1.94			
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	6.05	5.66	5.72			
Liquid Holdup	Vol. Fraction	0.18	0.21	0.22			
Temperature Profiles	°F						
Reflux		177.5	177.5	192.4			
Overhead Vapor		287.6	288.1	288.6			
Distributor		222.8	224.2	232.3			
Top Bed		285.4	285.9	286.9			
Mid Bed		287.4	288.2	288.8			
Below Bed		289.7	290.0	290.7			
Composition of Liquid	Mol% p-xylene						
Reflux		58.86	54.48	49.55			
Distributor		63.39	54.62	55.61			
Below Bed		33.73	34.33	35.50			
Bottoms		31.31	32.53	32.93			
Feed		34.04	36.13	37.71			
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	33.73	34.33	35.50			
Temperature	°F	289.7	290.0	290.7			
Liquid Density	lb/ft³	47.5	47.5	47.4			
Vapor Density	lb/ft³	0.199	0.200	0.202			
Vapor Rate	k lb/h	39.16	41.50	43.12			
Liquid Rate	gpm	95.0	94.0	92.9			
Capacity Factor, Cs	ft/s	0.285	0.302	0.312			
L/V		0.92	0.86	0.82			
OHP Flow	k lb/h	2.99	5.69	7.79			
Capacity Factor, Top	ft/s	0.280	0.299	0.309			
Capacity Factor, Mid	ft/s	0.283	0.300	0.311			

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23498	23497	23496	23495		
Run Type		TF	TF	TF	TF		
Column Pressure:	psia	14.7	14.7	14.7	14.7		
Reboiler Duty	M Btu/h	1.97	2.25	2.81	3.37		
Condenser Duty	M Btu/h	1.43	1.71	2.27	2.81		
Reflux Rate	k lb/h	8.12	9.45	12.28	14.63		
Feed Location		TOP	TOP	TOP	TOP		
Mass Feed Flow Rate	k lb/h	36.8	34.9	30.6	27.0		
Pressure Drops:							
Overall	inch H2O / ft	0.19	0.22	0.32	0.44		
Top	inch H2O / ft	0.15	0.18	0.28	0.41		
Bottom	inch H2O / ft	0.11	0.14	0.23	0.35		
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	15.81	15.31	14.40	13.68		
Liquid Holdup	Vol. Fraction	0.04	0.04	0.04	0.13		
Temperature Profiles	°F						
Reflux		268.5	264.3	256.0	246.0		
Overhead Vapor		289.7	289.7	289.6	289.6		
Distributor		271.9	268.7	262.4	254.9		
Top Bed		287.6	287.6	287.5	287.4		
Mid Bed		287.7	287.8	287.7	287.7		
Below Bed		287.8	287.8	287.9	288.0		
Composition of Liquid	Mol% p-xylene						
Reflux		44.57	44.74	44.52	46.14		
Distributor		40.32	40.63	41.16	41.50		
Below Bed		40.35	40.61	40.87	41.00		
Bottoms		38.56	38.47	38.25	38.12		
Feed		38.55	38.44	38.24	37.87		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	40.35	40.61	40.87	41.00		
Temperature	°F	287.8	287.8	287.9	288.0		
Liquid Density	lb/ft ³	47.5	47.5	47.4	47.4		
Vapor Density	lb/ft ³	0.196	0.196	0.196	0.197		
Vapor Rate	k lb/h	14.09	16.03	19.85	23.76		
Liquid Rate	gpm	133.6	133.7	132.5	133.4		
Capacity Factor, Cs	ft/s	0.103	0.118	0.146	0.174		
L/V		3.61	3.17	2.54	2.14		
Capacity Factor, Top	ft/s	0.097	0.111	0.139	0.167		
Capacity Factor, Mid	ft/s	0.098	0.112	0.140	0.167		

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23494	23493	23464	23499	23500	23501
Run Type		TF	TF	FL TF	TF	TF	TF
Column Pressure:	psia	14.7	14.7	14.7	14.7	14.7	14.7
Reboiler Duty	M Btu/h	4.21	4.76	5.15	1.69	2.25	2.81
Condenser Duty	M Btu/h	3.61	4.12	4.39	1.14	1.69	2.20
Reflux Rate	k lb/h	18.84	21.70	23.60	6.83	9.67	12.25
Feed Location		TOP	TOP	TOP	TOP	TOP	TOP
Mass Feed Flow Rate	k lb/h	21.3	17.1	14.5	51.8	48.1	44.4
Pressure Drops:							
Overall	inch H2O / ft	0.74	1.18	2.45	0.17	0.23	0.33
Top	inch H2O / ft	0.72	1.16	2.89	0.12	0.19	0.30
Bottom	inch H2O / ft	0.64	1.08	1.90	0.09	0.15	0.25
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	12.72	12.45	11.49	23.86	23.75	21.90
Liquid Holdup	Vol. Fraction	0.15	0.18	0.26	0.13	0.13	0.14
Temperature Profiles	°F						
Reflux		232.8	223.1	219.8	275.8	271.3	264.6
Overhead Vapor		289.3	289.1	288.7	289.9	289.8	289.7
Distributor		245.2	238.4	236.9	276.7	273.0	267.8
Top Bed		287.2	287.0	287.0	287.7	287.6	287.6
Mid Bed		287.7	287.7	288.5	287.8	287.8	287.8
Below Bed		288.4	288.9	290.2	287.8	287.9	288.0
Composition of Liquid	Mol% p-xylene						
Reflux		47.89	49.45	49.86	44.19	44.27	44.63
Distributor		42.84	44.44	45.04	40.06	40.19	40.37
Below Bed		41.26	40.93	40.01	40.17	40.36	40.53
Bottoms		37.78	37.05	36.04	38.74	38.62	38.51
Feed		37.12	36.65	35.94	38.73	38.60	38.45
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	41.26	40.93	40.01	40.17	40.36	40.53
Temperature	°F	288.4	288.9	290.2	287.8	287.9	288.0
Liquid Density	lb/ft ³	47.4	47.4	47.4	47.5	47.5	47.5
Vapor Density	lb/ft ³	0.198	0.199	0.202	0.196	0.196	0.196
Vapor Rate	k lb/h	29.57	33.52	36.35	12.20	15.93	19.77
Liquid Rate	gpm	133.7	133.2	133.7	168.2	168.2	168.7
Capacity Factor, Cs	ft/s	0.216	0.244	0.263	0.090	0.117	0.145
L/V		1.72	1.51	1.40	5.25	4.02	3.25
Capacity Factor, Top	ft/s	0.208	0.235	0.255	0.084	0.111	0.139
Capacity Factor, Mid	ft/s	0.209	0.236	0.255	0.084	0.112	0.140

Table III (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **14.7 psia**

Run Number		23502	23503	23504	23465		
Run Type		TF	TF	TF	FL TF		
Column Pressure:	psia	14.7	14.7	14.7	14.7		
Reboiler Duty	M Btu/h	3.37	3.93	4.49	4.85		
Condenser Duty	M Btu/h	2.73	3.27	3.84	4.03		
Reflux Rate	k lb/h	14.80	17.50	20.27	20.87		
Feed Location		TOP	TOP	TOP	TOP		
Mass Feed Flow Rate	k lb/h	40.7	36.9	33.1	31.2		
Pressure Drops:							
Overall	inch H2O / ft	0.47	0.69	1.16	2.67		
Top	inch H2O / ft	0.44	0.66	1.12	3.33		
Bottom	inch H2O / ft	0.39	0.60	1.08	1.89		
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	20.44	19.42	18.61	17.84		
Liquid Holdup	Vol. Fraction	0.14	0.31	0.19	0.29		
Temperature Profiles	°F						
Reflux		257.5	250.6	244.6	237.9		
Overhead Vapor		289.7	289.6	289.5	289.3		
Distributor		262.0	256.6	252.1	246.8		
Top Bed		287.5	287.5	287.4	287.3		
Mid Bed		287.9	287.9	288.1	289.2		
Below Bed		288.1	288.4	289.0	290.7		
Composition of Liquid	Mol% p-xylene						
Reflux		45.02	45.50	46.01	46.01		
Distributor		40.60	40.95	41.32	43.18		
Below Bed		40.69	40.90	40.87	40.75		
Bottoms		38.29	38.05	37.77	37.59		
Feed		38.29	38.06	37.76	37.58		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	40.69	40.90	40.87	40.75		
Temperature	°F	288.1	288.4	289.0	290.7		
Liquid Density	lb/ft ³	47.4	47.4	47.4	47.3		
Vapor Density	lb/ft ³	0.197	0.198	0.199	0.204		
Vapor Rate	k lb/h	23.60	27.39	31.25	34.36		
Liquid Rate	gpm	168.9	168.9	169.3	172.6		
Capacity Factor, Cs	ft/s	0.173	0.200	0.228	0.248		
L/V		2.72	2.35	2.06	1.91		
Capacity Factor, Top	ft/s	0.167	0.194	0.222	0.239		
Capacity Factor, Mid	ft/s	0.167	0.195	0.222	0.239		

Table IV (US Engineering Units)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
Raschig **DT-S** Distributor
iC₄/nC₄ System 165 psia

Run Number		23507	23508	23510	23509	23512	23511
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	165.1	165.0	165.1	165.0	164.6	164.7
Reboiler Duty	M Btu/h	2.51	2.51	3.14	3.14	3.77	3.76
Condenser Duty	M Btu/h	2.21	2.22	2.75	2.75	3.43	3.44
Reflux Rate	k lb/h	15.9	16.0	20.0	20.0	24.9	25.0
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.14	0.14	0.17	0.17	0.20	0.20
Top	inch H ₂ O / ft	0.10	0.10	0.13	0.13	0.17	0.17
Bottom	inch H ₂ O / ft	0.06	0.06	0.08	0.08	0.12	0.12
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	2.44	2.46	4.02	4.01	6.26	6.29
Liquid Holdup	Vol. Fraction	0.08	0.08	0.09	0.09	0.09	0.09
Temperature Profiles	°F						
Reflux		119.3	119.6	121.4	120.9	122.9	123.0
Overhead Vapor		162.9	162.9	163.2	163.1	163.4	163.5
Distributor		133.5	133.6	132.8	132.5	132.4	132.4
Top Bed		163.6	163.5	163.6	163.6	163.6	163.7
Mid Bed		166.2	166.1	166.4	166.4	166.3	166.4
Below Bed		176.7	176.8	176.8	176.8	176.8	176.8
Composition of Liquid	Mol % iC ₄						
Reflux		83.66	82.35	84.07	82.30	82.93	82.88
Distributor		83.59	82.66	83.16	83.06	83.08	82.47
Below Bed		34.64	34.97	33.93	33.55	34.24	34.04
Bottoms		28.25	28.03	27.02	26.90	27.11	27.69
Feed		27.64	28.37	27.23	28.04	27.91	27.69
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	34.64	34.97	33.93	33.55	34.24	34.04
Temperature	°F	176.7	176.8	176.8	176.8	176.8	176.8
Liquid Density	lb/ft ³	30.5	30.5	30.5	30.5	30.5	30.5
Vapor Density	lb/ft ³	1.781	1.785	1.778	1.775	1.779	1.780
Vapor Rate	k lb/h	20.5	20.6	25.9	25.9	31.2	31.3
Liquid Rate	gpm	84.0	84.3	106.0	106.0	127.6	127.9
Capacity Factor, Cs	ft/s	0.064	0.064	0.081	0.081	0.097	0.098
HETP 2pt	inch						
DIST & below bed		7.9	8.0	8.0	7.9	8.2	8.3
DIST & bottoms		7.6	7.7	7.6	7.6	7.9	8.0
Relative Volatility		1.232	1.232	1.232	1.232	1.232	1.232
Capacity Factor, Top	ft/s	0.066	0.066	0.083	0.083	0.100	0.100
Capacity Factor, Mid	ft/s	0.065	0.065	0.082	0.082	0.099	0.099

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 165 psia

Run Number		23513	23514	23516	23515	23517	23518
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	164.7	164.9	165.0	164.9	165.0	165.0
Reboiler Duty	M Btu/h	4.08	4.08	4.71	4.71	5.64	5.64
Condenser Duty	M Btu/h	3.70	3.67	4.17	4.23	5.21	5.21
Reflux Rate	k lb/h	27.1	26.9	30.4	30.7	37.2	37.2
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.1	30.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.22	0.22	0.27	0.27	0.42	0.42
Top	inch H ₂ O / ft	0.19	0.19	0.24	0.24	0.40	0.40
Bottom	inch H ₂ O / ft	0.14	0.14	0.18	0.19	0.33	0.33
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	7.27	7.18	9.18	9.33	12.93	12.94
Liquid Holdup	Vol. Fraction	0.10	0.10	0.11	0.11	0.13	0.13
Temperature Profiles	°F						
Reflux		124.4	124.4	125.2	125.2	123.9	123.8
Overhead Vapor		163.6	163.6	163.8	163.8	163.9	163.9
Distributor		132.9	132.9	132.8	132.7	130.1	130.0
Top Bed		163.7	163.7	163.8	163.8	163.7	163.7
Mid Bed		166.5	166.5	166.6	166.5	166.7	166.7
Below Bed		177.0	177.0	177.3	177.3	177.6	177.6
Composition of Liquid	Mol % iC ₄						
Reflux		82.65	82.56	82.22	81.92	81.46	80.98
Distributor		81.28	82.68	82.17	82.10	81.21	81.21
Below Bed		33.88	32.06	31.39	31.10	29.26	30.27
Bottoms		26.69	27.37	25.01	24.95	24.12	24.02
Feed		27.57	27.02	25.16	25.27	24.24	24.19
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	33.88	32.06	31.39	31.10	29.26	30.27
Temperature	°F	177.0	177.0	177.3	177.3	177.6	177.6
Liquid Density	lb/ft ³	30.5	30.5	30.5	30.5	30.5	30.5
Vapor Density	lb/ft ³	1.782	1.771	1.773	1.770	1.766	1.772
Vapor Rate	k lb/h	33.8	33.7	38.8	38.8	46.6	46.7
Liquid Rate	gpm	138.2	137.8	158.4	158.4	190.1	190.6
Capacity Factor, Cs	ft/s	0.106	0.106	0.121	0.121	0.146	0.146
HETP 2pt	inch						
DIST & below bed		8.5	8.1	8.1	8.1	8.0	8.2
DIST & bottoms		8.1	8.0	7.8	7.8	7.9	7.9
Relative Volatility		1.232	1.232	1.232	1.232	1.232	1.232
Capacity Factor, Top	ft/s	0.108	0.108	0.124	0.124	0.150	0.150
Capacity Factor, Mid	ft/s	0.107	0.107	0.123	0.123	0.148	0.148

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System 165 psia

Run Number		23595	23594	23520	23519	23522	23521
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	164.7	164.8	165.1	164.9	164.9	165.0
Reboiler Duty	M Btu/h	5.91	5.92	6.58	6.57	7.20	7.20
Condenser Duty	M Btu/h	5.36	5.40	6.20	6.18	6.51	6.47
Reflux Rate	k lb/h	37.2	37.3	43.8	43.8	47.0	46.8
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	30.1	29.9	30.0	30.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.48	0.48	0.76	0.75	1.12	1.11
Top	inch H ₂ O / ft	0.46	0.46	0.77	0.76	1.18	1.16
Bottom	inch H ₂ O / ft	0.38	0.39	0.63	0.63	0.95	0.94
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	12.69	12.74	17.06	16.96	19.48	19.37
Liquid Holdup	Vol. Fraction	0.14	0.14	0.18	0.18	0.26	0.26
Temperature Profiles	°F						
Reflux		112.1	111.9	120.6	120.6	120.7	120.6
Overhead Vapor		165.9	165.9	164.1	163.9	164.4	164.4
Distributor		121.1	121.0	126.5	126.4	126.1	126.0
Top Bed		165.2	165.3	163.6	163.4	164.0	164.0
Mid Bed		168.1	168.1	167.4	167.3	169.6	169.4
Below Bed		179.1	179.2	178.5	178.3	179.1	179.1
Composition of Liquid	Mol % iC ₄						
Reflux		77.08	77.05	80.04	81.84	80.46	80.53
Distributor		76.71	76.64	79.82	80.16	80.38	80.18
Below Bed		22.09	22.24	27.47	27.56	24.76	24.50
Bottoms		17.86	17.90	23.07	22.77	20.63	20.58
Feed		17.96	17.91	22.16	24.77	20.67	20.55
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	22.09	22.24	27.47	27.56	24.76	24.50
Temperature	°F	179.1	179.2	178.5	178.3	179.1	179.1
Liquid Density	lb/ft ³	30.6	30.6	30.5	30.5	30.5	30.6
Vapor Density	lb/ft ³	1.754	1.756	1.774	1.771	1.770	1.768
Vapor Rate	k lb/h	48.4	48.5	54.4	54.4	59.5	59.4
Liquid Rate	gpm	197.2	197.6	222.2	222.1	242.7	242.6
Capacity Factor, Cs	ft/s	0.152	0.152	0.170	0.170	0.186	0.186
HETP 2pt	inch						
DIST & below bed		8.0	8.1	7.7	7.7	7.6	7.6
DIST & bottoms		7.9	7.9	7.6	7.6	7.5	7.5
Relative Volatility		1.233	1.232	1.232	1.232	1.232	1.232
Capacity Factor, Top	ft/s	0.156	0.156	0.175	0.175	0.191	0.191
Capacity Factor, Mid	ft/s	0.154	0.154	0.172	0.172	0.188	0.188

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System 165 psia

Run Number		23596	23597	23524	23523	23526	23525
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	164.8	165.0	164.8	164.8	164.9	164.8
Reboiler Duty	M Btu/h	7.36	7.36	7.54	7.54	7.73	7.73
Condenser Duty	M Btu/h	6.92	7.00	6.85	6.84	7.10	7.06
Reflux Rate	k lb/h	46.0	46.1	49.7	49.7	51.9	51.8
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.1	60.0	30.0	30.0	45.0	45.0
Pressure Drops:							
Overall	inch H ₂ O / ft	1.78	1.78	1.86	1.86	1.98	2.00
Top	inch H ₂ O / ft	2.20	2.21	2.36	2.36	2.47	2.50
Bottom	inch H ₂ O / ft	1.24	1.24	1.24	1.25	1.38	1.40
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	18.04	18.07	21.58	21.53	23.65	23.98
Liquid Holdup	Vol. Fraction	0.15	0.15	0.30	0.30	0.35	0.35
Temperature Profiles	°F						
Reflux		115.9	116.4	131.9	131.8	136.5	135.9
Overhead Vapor		170.0	170.5	170.5	170.5	171.4	171.2
Distributor		123.5	124.0	136.2	136.1	140.0	139.5
Top Bed		169.3	169.6	168.4	168.2	170.4	169.3
Mid Bed		171.7	171.8	171.4	171.5	171.8	171.2
Below Bed		177.8	177.5	175.4	175.4	175.0	174.9
Composition of Liquid	Mol % iC ₄						
Reflux		60.60	60.40	57.93	57.65	54.62	56.34
Distributor		60.39	60.32	57.95	57.54	54.45	56.10
Below Bed		28.67	28.65	39.03	37.44	40.55	40.35
Bottoms		26.59	26.97	34.59	34.83	36.74	34.18
Feed		25.77	27.82	34.56	34.95	36.62	35.34
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	28.67	28.65	39.03	37.44	40.55	40.35
Temperature	°F	177.8	177.5	175.4	175.4	175.0	174.9
Liquid Density	lb/ft ³	30.5	30.6	30.5	30.5	30.5	30.5
Vapor Density	lb/ft ³	1.766	1.759	1.781	1.769	1.780	1.776
Vapor Rate	k lb/h	60.7	60.8	62.8	62.7	64.4	64.3
Liquid Rate	gpm	247.8	248.1	257.1	256.2	263.5	263.3
Capacity Factor, Cs	ft/s	0.190	0.191	0.196	0.196	0.201	0.201
HETP 2pt	inch						
DIST & below bed		14.7	14.8	24.5	23.1	33.0	29.9
DIST & bottoms		15.9	16.3	25.1	26.0	35.0	28.2
Relative Volatility		1.232	1.233	1.232	1.233	1.233	1.233
Capacity Factor, Top	ft/s	0.193	0.193	0.198	0.198	0.202	0.203
Capacity Factor, Mid	ft/s	0.191	0.192	0.197	0.197	0.202	0.202

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System 165 psia

Run Number		23505	23506	23528	23527		
Run Type		TR	TR	FT	FT		
Column Pressure:	psia	164.9	165.0	165.1	165.0		
Reboiler Duty	M Btu/h	7.86	7.86	7.92	7.92		
Condenser Duty	M Btu/h	7.37	7.36	7.31	7.29		
Reflux Rate	k lb/h	53.4	53.4	53.0	53.0		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	k lb/h	60.0	60.0	45.0	45.0		
Pressure Drops:							
Overall	inch H ₂ O / ft	2.12	2.11	1.99	2.09		
Top	inch H ₂ O / ft	2.71	2.69	2.48	2.67		
Bottom	inch H ₂ O / ft	1.42	1.42	1.38	1.41		
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	25.16	25.23	24.42	24.50		
Liquid Holdup	Vol. Fraction	0.42	0.42	0.34	0.34		
Temperature Profiles	°F						
Reflux		137.1	137.5	135.5	135.9		
Overhead Vapor		171.0	171.0	171.8	171.9		
Distributor		140.4	140.8	139.2	139.5		
Top Bed		169.1	169.2	171.2	170.8		
Mid Bed		170.5	170.6	171.9	171.4		
Below Bed		174.0	174.1	175.0	174.7		
Composition of Liquid	Mol % iC ₄						
Reflux		56.10	56.05	53.81	53.70		
Distributor		54.48	55.91	53.61	53.09		
Below Bed		44.20	44.38	41.49	41.69		
Bottoms		40.19	39.86	37.46	37.25		
Feed		40.22	40.18	37.31	37.07		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	44.20	44.38	41.49	41.69		
Temperature	°F	174.0	174.1	175.0	174.7		
Liquid Density	lb/ft ³	30.4	30.4	30.4	30.4		
Vapor Density	lb/ft ³	1.782	1.785	1.786	1.781		
Vapor Rate	k lb/h	65.3	65.5	66.1	66.0		
Liquid Rate	gpm	267.6	268.4	270.6	270.4		
Capacity Factor, Cs	ft/s	0.204	0.205	0.206	0.206		
HETP 2pt	inch						
DIST & below bed		43.6	38.3	37.5	40.0		
DIST & bottoms		48.3	40.2	39.9	40.8		
Relative Volatility		1.233	1.233	1.232	1.233		
Capacity Factor, Top	ft/s	0.205	0.206	0.207	0.207		
Capacity Factor, Mid	ft/s	0.205	0.205	0.207	0.207		

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System **165 psia**

Run Number		23581	23582	23583	23584	23586	23587
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	psia	165.0	165.0	165.0	164.9	164.8	164.8
Reboiler Duty	M Btu/h	4.39	5.03	6.29	7.56	9.47	10.74
Condenser Duty	M Btu/h	4.03	4.66	5.94	7.13	8.91	10.16
Reflux Rate	k lb/h	15.3	15.0	14.1	12.7	9.6	8.0
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.1	60.0	60.0	60.0	72.0	77.9
Pressure Drops:							
Overall	inch H2O / ft	0.18	0.21	0.26	0.33	0.47	0.60
Top	inch H2O / ft	0.14	0.17	0.22	0.30	0.45	0.59
Bottom	inch H2O / ft	0.11	0.13	0.18	0.25	0.38	0.50
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	2.42	2.21	1.82	1.36	0.62	0.28
Liquid Holdup	Vol. Fraction	0.08	0.08	0.08	0.08	0.08	
Temperature Profiles	°F						
Reflux		118.7	125.1	129.1	132.8	131.0	130.1
Overhead Vapor		173.2	173.8	174.4	174.8	175.0	175.1
Distributor		138.0	142.3	145.6	148.9	151.0	153.0
Top Bed		173.7	174.0	174.3	174.5	174.4	174.3
Mid Bed		175.1	174.8	174.6	174.6	174.4	174.3
Below Bed		175.3	174.9	174.7	174.7	174.4	174.4
Composition of Liquid	Mol % iC ₄						
Reflux		50.47	48.54	46.79	46.43	45.71	45.42
Distributor		50.16	48.82	47.14	46.17	45.58	45.36
Below Bed		37.04	38.60	39.05	39.05	39.47	39.56
Bottoms		37.20	37.79	38.27	38.33	38.56	38.53
Feed		39.99	41.29	42.49	43.59	44.08	44.31
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	37.04	38.60	39.05	39.05	39.47	39.56
Temperature	°F	175.3	174.9	174.7	174.7	174.4	174.4
Liquid Density	lb/ft ³	30.5	30.5	30.5	30.5	30.5	30.5
Vapor Density	lb/ft ³	1.764	1.767	1.764	1.763	1.760	1.759
Vapor Rate	k lb/h	36.5	41.9	52.5	63.2	79.3	90.0
Liquid Rate	gpm	100.4	101.3	103.2	102.9	102.5	103.0
Capacity Factor, Cs	ft/s	0.115	0.131	0.165	0.198	0.249	0.282
L/V		0.67	0.59	0.48	0.40	0.32	0.28
OHP Flow	k lb/h	11.99	17.10	27.26	38.03	54.19	64.76
Capacity Factor, Top	ft/s	0.115	0.132	0.165	0.198	0.248	0.281
Capacity Factor, Mid	ft/s	0.115	0.132	0.165	0.198	0.248	0.282

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System **165 psia**

Run Number		23568	23593	23592	23591	23585	23590
Run Type		FL OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	psia	164.8	164.6	165.0	165.1	165.2	165.0
Reboiler Duty	M Btu/h	13.85	4.69	6.28	7.87	8.82	9.15
Condenser Duty	M Btu/h	13.22	4.16	5.69	7.29	8.34	8.47
Reflux Rate	k lb/h	7.2	23.1	20.1	17.5	15.2	16.1
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	120.0	59.9	78.0	77.9	60.0	78.0
Pressure Drops:							
Overall	inch H ₂ O / ft	1.60	0.23	0.30	0.39	0.50	0.52
Top	inch H ₂ O / ft	1.90	0.19	0.26	0.36	0.47	0.49
Bottom	inch H ₂ O / ft	1.17	0.15	0.22	0.30	0.40	0.42
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	0.37	5.87	4.47	3.30	2.02	2.74
Liquid Holdup	Vol. Fraction	0.18	0.10	0.10	0.10	0.10	0.11
Temperature Profiles	°F						
Reflux		135.4	110.9	112.5	113.8	134.6	118.4
Overhead Vapor		175.1	170.8	173.3	174.1	175.0	174.5
Distributor		157.2	127.3	130.8	133.9	148.3	137.8
Top Bed		174.3	171.1	173.7	174.1	174.7	174.2
Mid Bed		174.3	174.1	174.9	174.6	174.9	174.5
Below Bed		174.5	176.7	175.2	174.7	174.9	174.6
Composition of Liquid	Mol % iC ₄						
Reflux		45.76	57.68	49.48	47.31	46.00	46.81
Distributor		45.46	58.02	49.41	47.56	45.93	46.67
Below Bed		40.32	32.38	37.45	38.75	38.92	39.07
Bottoms		39.13	31.94	37.26	38.26	38.06	38.51
Feed		44.24	34.38	40.23	42.23	44.15	43.07
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	40.32	32.38	37.45	38.75	38.92	39.07
Temperature	°F	174.5	176.7	175.2	174.7	174.9	174.6
Liquid Density	lb/ft ³	30.5	30.5	30.5	30.5	30.5	30.5
Vapor Density	lb/ft ³	1.767	1.765	1.764	1.762	1.767	1.761
Vapor Rate	k lb/h	116.1	38.9	52.3	65.7	73.8	76.4
Liquid Rate	gpm	106.7	139.3	140.9	141.5	119.4	142.0
Capacity Factor, Cs	ft/s	0.364	0.122	0.164	0.206	0.231	0.240
L/V		0.22	0.88	0.66	0.53	0.40	0.45
OHP Flow	k lb/h	90.04	4.83	17.79	31.03	44.58	41.64
<i>Capacity Factor, Top</i>	ft/s	0.362	0.124	0.165	0.206	0.231	0.240
<i>Capacity Factor, Mid</i>	ft/s	0.363	0.123	0.164	0.206	0.231	0.240

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System 165 psia

Run Number		23589	23588	23567	23580	23579	23578
Run Type		OHP	OHP	FL OHP	OHP	OHP	OHP
Column Pressure:	psia	165.3	165.0	164.8	164.9	165.0	165.2
Reboiler Duty	M Btu/h	10.10	11.04	12.76	6.26	7.86	8.49
Condenser Duty	M Btu/h	9.39	10.37	12.14	5.80	7.31	7.89
Reflux Rate	k lb/h	15.5	15.8	17.3	28.5	25.8	25.4
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	78.0	78.0	90.0	60.0	60.1	60.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.67	0.93	1.86	0.38	0.54	0.65
Top	inch H ₂ O / ft	0.65	0.93	2.18	0.35	0.51	0.63
Bottom	inch H ₂ O / ft	0.56	0.81	1.41	0.30	0.45	0.55
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	2.44	2.40	3.12	8.24	6.93	6.65
Liquid Holdup	Vol. Fraction	0.12	0.15	0.26	0.11	0.13	0.14
Temperature Profiles	°F						
Reflux		122.8	128.4	140.0	116.0	118.7	121.2
Overhead Vapor		174.9	174.9	175.0	172.1	173.7	174.1
Distributor		141.2	144.3	150.9	128.9	132.3	134.4
Top Bed		174.5	174.4	174.3	171.9	173.6	173.9
Mid Bed		174.7	174.6	174.5	175.0	175.1	175.1
Below Bed		174.7	174.7	174.8	176.3	175.4	175.3
Composition of Liquid	Mol % iC ₄						
Reflux		46.34	46.00	45.54	54.51	48.47	48.34
Distributor		46.26	45.91	45.81	54.42	48.37	48.10
Below Bed		39.29	38.98	39.41	33.97	27.79	37.85
Bottoms		38.49	38.31	38.36	33.61	36.63	37.02
Feed		43.64	44.12	44.32	37.57	41.85	42.66
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	39.29	38.98	39.41	33.97	27.79	37.85
Temperature	°F	174.7	174.7	174.8	176.3	175.4	175.3
Liquid Density	lb/ft ³	30.5	30.5	30.5	30.5	30.7	30.5
Vapor Density	lb/ft ³	1.766	1.762	1.767	1.768	1.708	1.770
Vapor Rate	k lb/h	84.4	92.3	106.8	52.0	64.6	70.8
Liquid Rate	gpm	142.4	142.6	142.1	170.1	166.8	171.9
Capacity Factor, Cs	ft/s	0.265	0.290	0.335	0.163	0.205	0.222
L/V		0.41	0.38	0.33	0.80	0.64	0.59
OHP Flow	k lb/h	49.61	57.42	72.00	10.37	23.51	28.73
Capacity Factor, Top	ft/s	0.264	0.289	0.334	0.165	0.206	0.223
Capacity Factor, Mid	ft/s	0.265	0.289	0.334	0.164	0.206	0.222

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 165 psia

Run Number		23577	23576	23566	23571	23572	23573
Run Type		OHP	OHP	FL OHP	OHP	OHP	OHP
Column Pressure:	psia	165.0	165.0	164.7	165.5	165.0	164.9
Reboiler Duty	M Btu/h	9.43	10.06	10.74	6.55	7.19	7.82
Condenser Duty	M Btu/h	8.87	9.48	10.13	6.05	6.62	7.34
Reflux Rate	k lb/h	25.3	25.1	24.5	35.3	35.6	36.1
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	90.0	30.0	30.0	30.0
Pressure Drops:							
Overall	inch H2O / ft	0.89	1.20	1.83	0.52	0.65	0.80
Top	inch H2O / ft	0.89	1.21	2.26	0.50	0.63	0.80
Bottom	inch H2O / ft	0.77	1.07	1.27	0.43	0.54	0.69
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	6.44	6.33	6.39	11.62	11.82	12.02
Liquid Holdup	Vol. Fraction	0.17	0.22	0.24	0.14	0.15	0.17
Temperature Profiles	°F						
Reflux		127.2	130.8	135.0	118.9	124.8	133.6
Overhead Vapor		174.5	174.8	174.4	171.0	172.4	173.6
Distributor		138.8	141.5	144.6	128.1	133.1	140.1
Top Bed		174.2	174.5	174.1	170.3	171.8	173.1
Mid Bed		175.1	175.2	174.6	174.2	175.5	176.0
Below Bed		175.0	175.3	174.9	178.1	177.3	176.7
Composition of Liquid	Mol % iC ₄						
Reflux		47.39	46.90	47.18	60.50	55.20	51.08
Distributor		47.34	46.98	47.07	60.42	54.78	50.69
Below Bed		48.11	38.15	38.84	29.01	31.43	33.59
Bottoms		37.28	37.52	38.49	27.70	29.97	32.74
Feed		43.67	44.27	43.37	34.84	39.62	43.10
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	48.11	38.15	38.84	29.01	31.43	33.59
Temperature	°F	175.0	175.3	174.9	178.1	177.3	176.7
Liquid Density	lb/ft ³	30.3	30.5	30.5	30.5	30.5	30.5
Vapor Density	lb/ft ³	1.830	1.771	1.766	1.776	1.773	1.774
Vapor Rate	k lb/h	79.7	84.0	89.6	54.4	59.7	65.0
Liquid Rate	gpm	176.6	172.1	170.2	197.6	199.9	199.9
Capacity Factor, Cs	ft/s	0.247	0.263	0.281	0.170	0.187	0.203
L/V		0.54	0.50	0.46	0.89	0.82	0.75
OHP Flow	k lb/h	36.78	41.93	47.99	6.02	10.77	16.12
Capacity Factor, Top	ft/s	0.247	0.264	0.281	0.173	0.189	0.205
Capacity Factor, Mid	ft/s	0.247	0.263	0.281	0.171	0.188	0.204

Table IV (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System 165 psia

Run Number		23574	23575	23565	23570	23569	23564
Run Type		OHP	OHP	FL OHP	OHP	OHP	FL OHP
Column Pressure:	psia	165.0	165.0	164.7	164.9	165.0	165.1
Reboiler Duty	M Btu/h	8.14	8.78	9.65	7.17	7.81	8.25
Condenser Duty	M Btu/h	7.64	8.24	9.11	6.69	7.30	7.70
Reflux Rate	k lb/h	36.1	34.7	34.8	40.9	41.6	41.8
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	60.0	30.0	30.0	60.0
Pressure Drops:							
Overall	inch H2O / ft	0.91	1.17	1.88	0.84	1.16	1.84
Top	inch H2O / ft	0.91	1.19	2.33	0.85	1.19	2.30
Bottom	inch H2O / ft	0.80	1.05	1.32	0.72	1.01	1.27
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	12.07	11.22	11.54	14.89	15.41	15.59
Liquid Holdup	Vol. Fraction	0.19	0.24	0.34	0.19	0.23	0.30
Temperature Profiles	°F						
Reflux		136.3	134.3	134.7	115.2	122.0	128.0
Overhead Vapor		174.0	174.4	174.1	169.3	171.5	173.0
Distributor		142.2	141.2	141.4	123.6	129.5	134.6
Top Bed		173.5	174.1	173.7	168.4	170.9	172.0
Mid Bed		176.1	176.1	174.1	172.8	175.7	173.8
Below Bed		176.6	176.5	175.3	178.6	177.9	176.2
Composition of Liquid	Mol % iC ₄						
Reflux		49.56	48.29	48.32	64.87	57.57	52.82
Distributor		49.97	48.35	48.37	65.28	57.67	52.29
Below Bed		34.11	34.88	37.12	26.10	29.47	35.71
Bottoms		33.24	33.99	37.17	24.82	28.67	34.54
Feed		44.13	45.80	42.57	30.81	37.81	38.42
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	34.11	34.88	37.12	26.10	29.47	35.71
Temperature	°F	176.6	176.5	175.3	178.6	177.9	176.2
Liquid Density	lb/ft ³	30.5	30.5	30.5	30.5	30.5	30.5
Vapor Density	lb/ft ³	1.776	1.777	1.764	1.769	1.774	1.776
Vapor Rate	k lb/h	67.7	73.1	80.4	59.4	64.7	68.7
Liquid Rate	gpm	200.0	200.7	206.0	226.4	229.5	231.9
Capacity Factor, Cs	ft/s	0.212	0.228	0.252	0.186	0.202	0.215
L/V		0.72	0.67	0.63	0.93	0.87	0.83
OHP Flow	k lb/h	18.77	24.01	29.98	3.97	8.58	12.01
Capacity Factor, Top	ft/s	0.213	0.230	0.253	0.190	0.206	0.217
Capacity Factor, Mid	ft/s	0.213	0.229	0.253	0.188	0.204	0.216

Table V (US Engineering Units)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 100 psia

Run Number		23532	23531	23534	23533	23536	23535
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	99.5	99.6	99.6	99.5	99.5	99.6
Reboiler Duty	M Btu/h	2.28	2.28	2.60	2.60	3.25	3.25
Condenser Duty	M Btu/h	2.10	2.13	2.42	2.40	3.05	3.06
Reflux Rate	k lb/h	15.4	15.6	17.7	17.7	22.2	22.2
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	60.0	60.0	60.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.11	0.11	0.13	0.13	0.16	0.16
Top	inch H ₂ O / ft	0.07	0.07	0.09	0.09	0.12	0.12
Bottom	inch H ₂ O / ft	0.03	0.03	0.05	0.04	0.07	0.07
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	1.70	1.72	2.44	2.43	4.23	4.24
Liquid Holdup	Vol. Fraction	0.08	0.08	0.08	0.08	0.09	0.09
Temperature Profiles							
Reflux	°F	106.9	107.4	105.3	105.1	105.2	105.1
Overhead Vapor		123.9	124.0	123.9	123.9	124.3	124.3
Distributor		111.7	112.0	110.2	110.1	109.4	109.4
Top Bed		123.6	123.7	123.6	123.5	123.9	123.9
Mid Bed		126.1	126.2	126.1	126.1	126.7	126.7
Below Bed		137.6	137.8	137.8	137.8	138.2	138.2
Composition of Liquid							
Reflux	Mol % iC ₄	84.96	84.39	82.28	82.17	85.20	85.08
Distributor		84.67	87.05	81.47	80.22	85.67	85.08
Below Bed		28.06	28.81	27.62	28.86	28.91	28.91
Bottoms		21.95	22.15	22.01	22.21	23.02	24.63
Feed		20.97	21.36	20.80	20.89	24.13	24.63
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	28.06	28.81	27.62	28.86	28.91	28.91
Temperature	°F	137.6	137.8	137.8	137.8	138.2	138.2
Liquid Density	lb/ft ³	32.9	32.9	32.9	32.9	32.8	32.8
Vapor Density	lb/ft ³	1.048	1.053	1.049	1.053	1.059	1.059
Vapor Rate	k lb/h	16.9	16.9	19.3	19.4	24.2	24.2
Liquid Rate	gpm	64.1	64.3	73.3	73.4	91.9	91.9
Capacity Factor, Cs	ft/s	0.065	0.065	0.075	0.075	0.093	0.093
HETP 2pt	inch						
DIST & below bed		8.4	8.6	8.4	8.6	8.8	8.8
DIST & bottoms		8.3	8.4	8.5	8.5	8.7	8.9
Relative Volatility		1.30	1.30	1.30	1.30	1.30	1.30
Capacity Factor, Top	ft/s	0.067	0.067	0.077	0.077	0.096	0.096
Capacity Factor, Mid	ft/s	0.066	0.066	0.076	0.076	0.095	0.095

Table V (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System **100 psia**

Run Number		23538	23537	23539	23540	23558	23557
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	99.5	99.5	99.6	99.6	99.6	99.4
Reboiler Duty	M Btu/h	3.90	3.90	4.55	4.55	5.19	5.19
Condenser Duty	M Btu/h	3.66	3.68	4.36	4.40	4.96	4.93
Reflux Rate	k lb/h	26.5	26.6	31.1	31.3	38.4	38.3
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	60.0	60.0	60.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.20	0.20	0.26	0.26	0.34	0.34
Top	inch H ₂ O / ft	0.16	0.16	0.22	0.23	0.32	0.32
Bottom	inch H ₂ O / ft	0.11	0.11	0.17	0.17	0.25	0.25
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	6.31	6.34	8.90	8.89	13.70	13.67
Liquid Holdup	Vol. Fraction	0.10	0.10	0.10	0.10	0.11	0.11
Temperature Profiles	°F						
Reflux		104.0	103.9	105.3	105.5	121.3	121.1
Overhead Vapor		124.3	124.3	124.4	124.3	125.6	125.5
Distributor		107.9	107.8	108.5	108.6	121.9	121.8
Top Bed		123.9	123.9	124.0	123.9	124.9	124.8
Mid Bed		126.8	126.8	127.0	127.0	128.3	128.3
Below Bed		138.1	138.1	138.2	138.2	139.5	139.4
Composition of Liquid	Mol % iC ₄						
Reflux		84.87	84.65	85.08	85.08	85.03	85.14
Distributor		85.51	86.17	85.00	85.01	84.90	84.29
Below Bed		28.00	27.89	24.86	25.17	25.00	25.08
Bottoms		20.87	21.79	19.19	19.13	16.77	16.82
Feed		20.87	19.90	19.19	19.34	16.85	16.78
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	28.00	27.89	24.86	25.17	25.00	25.08
Temperature	°F	138.1	138.1	138.2	138.2	139.5	139.4
Liquid Density	lb/ft ³	32.9	32.9	32.9	32.9	32.8	32.8
Vapor Density	lb/ft ³	1.054	1.053	1.046	1.047	1.063	1.063
Vapor Rate	k lb/h	29.0	29.0	33.7	33.7	38.6	38.6
Liquid Rate	gpm	110.0	110.0	127.7	127.8	146.6	146.7
Capacity Factor, Cs	ft/s	0.112	0.112	0.130	0.130	0.148	0.148
HETP 2pt	inch						
DIST & below bed		8.6	8.6	8.6	8.6	9.0	9.2
DIST & bottoms		8.3	8.5	8.4	8.4	8.3	8.4
Relative Volatility		1.296	1.296	1.296	1.296	1.294	1.294
Capacity Factor, Top	ft/s	0.115	0.115	0.134	0.135	0.153	0.153
Capacity Factor, Mid	ft/s	0.114	0.114	0.133	0.133	0.151	0.151

Table V (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 100 psia

Run Number		23541	23542	23544	23543	23545	23546
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	99.6	99.4	99.5	99.4	99.6	99.5
Reboiler Duty	M Btu/h	5.84	5.84	6.49	6.49	6.81	6.81
Condenser Duty	M Btu/h	5.67	5.64	6.21	6.23	6.50	6.46
Reflux Rate	k lb/h	40.7	40.6	45.7	45.7	48.1	48.0
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	60.0	60.0	60.0
Pressure Drops:							
Overall	inch H ₂ O / ft	0.50	0.49	0.76	0.76	0.98	0.96
Top	inch H ₂ O / ft	0.48	0.48	0.77	0.77	1.03	1.01
Bottom	inch H ₂ O / ft	0.39	0.39	0.62	0.62	0.81	0.80
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	14.75	14.71	18.47	18.42	20.49	20.39
Liquid Holdup	Vol. Fraction	0.13	0.13	0.17	0.17	0.20	0.20
Temperature Profiles	°F						
Reflux		107.3	107.1	110.1	109.9	111.8	111.8
Overhead Vapor		124.7	124.5	125.1	125.0	125.4	125.4
Distributor		109.6	109.5	111.9	111.6	113.2	113.2
Top Bed		124.1	124.0	124.5	124.4	125.0	124.9
Mid Bed		127.5	127.4	128.4	128.3	129.5	129.3
Below Bed		138.8	138.7	139.6	139.5	140.0	139.9
Composition of Liquid	Mol % iC ₄						
Reflux		84.64	84.36	84.03	84.02	83.95	83.91
Distributor		84.09	84.36	83.86	83.75	82.80	83.91
Below Bed		22.76	24.81	25.42	25.42	25.99	25.33
Bottoms		17.82	17.91	16.85	16.86	16.63	16.53
Feed		17.82	17.91	16.88	16.94	16.63	16.53
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	22.76	24.81	25.42	25.42	25.99	25.33
Temperature	°F	138.8	138.7	139.6	139.5	140.0	139.9
Liquid Density	lb/ft ³	32.9	32.9	32.8	32.8	32.8	32.8
Vapor Density	lb/ft ³	1.047	1.052	1.067	1.065	1.074	1.070
Vapor Rate	k lb/h	43.3	43.4	48.3	48.3	50.8	50.7
Liquid Rate	gpm	163.9	164.4	183.4	183.3	193.0	192.8
Capacity Factor, Cs	ft/s	0.167	0.167	0.185	0.185	0.194	0.194
HETP 2pt	inch						
DIST & below bed		8.5	8.8	9.0	9.0	9.3	8.9
DIST & bottoms		8.4	8.3	8.2	8.2	8.4	8.1
Relative Volatility		1.296	1.295	1.293	1.294	1.293	1.293
Capacity Factor, Top	ft/s	0.173	0.173	0.192	0.192	0.201	0.201
Capacity Factor, Mid	ft/s	0.170	0.170	0.189	0.189	0.198	0.198

Table V (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 100 psia

Run Number		23556	23555	23547	23548	23551	23552
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	99.5	99.5	99.5	99.5	99.5	99.6
Reboiler Duty	M Btu/h	6.94	6.94	7.14	7.14	7.14	7.15
Condenser Duty	M Btu/h	6.64	6.64	6.72	6.76	6.76	6.78
Reflux Rate	k lb/h	51.3	51.4	51.2	51.5	52.2	52.3
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	60.0	60.0	60.0
Pressure Drops:							
Overall	inch H ₂ O / ft	1.10	1.12	1.49	1.66	1.75	1.76
Top	inch H ₂ O / ft	1.17	1.19	1.74	2.04	2.18	2.20
Bottom	inch H ₂ O / ft	0.91	0.93	1.14	1.17	1.20	1.21
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	24.09	24.19	23.68	23.96	25.07	25.10
Liquid Holdup	Vol. Fraction	0.21	0.21	0.26	0.26	0.24	0.24
Temperature Profiles	°F						
Reflux		122.2	122.4	118.5	119.1	124.6	125.2
Overhead Vapor		126.3	126.4	126.5	127.3	129.0	129.5
Distributor		122.8	123.0	119.2	119.9	125.4	125.9
Top Bed		126.1	126.2	126.9	127.1	128.2	128.5
Mid Bed		131.9	132.3	134.7	133.3	132.9	133.5
Below Bed		140.2	140.1	140.0	139.6	139.0	138.8
Composition of Liquid	Mol % iC ₄						
Reflux		81.75	81.80	80.36	81.50	67.93	67.93
Distributor		81.39	81.78	80.15	80.35	69.63	69.63
Below Bed		30.10	30.10	28.46	28.46	27.05	27.05
Bottoms		16.53	16.76	22.77	22.77	23.36	23.36
Feed		16.66	16.56	24.76	22.46	24.59	24.59
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	30.10	30.10	28.46	28.46	27.05	27.05
Temperature	°F	140.2	140.1	140.0	139.6	139.0	138.8
Liquid Density	lb/ft ³	32.7	32.7	32.8	32.8	32.8	32.8
Vapor Density	lb/ft ³	1.090	1.089	1.083	1.076	1.063	1.060
Vapor Rate	k lb/h	52.0	52.0	53.4	53.3	53.2	53.2
Liquid Rate	gpm	198.2	198.1	203.1	202.9	202.1	201.9
Capacity Factor, Cs	ft/s	0.198	0.198	0.203	0.204	0.204	0.205
HETP 2pt	inch						
DIST & below bed		10.9	10.8	10.5	10.6	13.5	13.4
DIST & bottoms		8.9	8.9	10.4	10.4	14.0	13.9
Relative Volatility		1.291	1.292	1.292	1.293	1.294	1.295
Capacity Factor, Top	ft/s	0.204	0.204	0.210	0.209	0.209	0.209
Capacity Factor, Mid	ft/s	0.201	0.201	0.207	0.207	0.207	0.207

Table V (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 100 psia

Run Number		23550	23549	23529	23530	23553	23554
Run Type		TR	TR	FT	FT	FT	FT
Column Pressure:	psia	99.5	99.6	99.6	99.6	99.6	99.5
Reboiler Duty	M Btu/h	7.29	7.29	7.39	7.40	7.49	7.49
Condenser Duty	M Btu/h	6.94	7.01	7.10	7.14	7.04	7.06
Reflux Rate	k lb/h	52.5	52.9	53.2	53.3	53.9	54.1
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	60.0	60.0	60.0	60.0	60.0	60.0
Pressure Drops:							
Overall	inch H ₂ O / ft	1.87	1.91	2.07	2.09	2.07	2.11
Top	inch H ₂ O / ft	2.36	2.46	2.76	2.79	2.66	2.74
Bottom	inch H ₂ O / ft	1.26	1.26	1.28	1.28	1.37	1.36
Dist. Pressure Drop	inch H ₂ O						
Dist Bubbler	inch Hot Liq	25.04	25.39	32.12	32.30	26.56	26.61
Liquid Holdup	Vol. Fraction	0.29	0.29	0.29	0.29	0.32	0.32
Temperature Profiles	°F						
Reflux		126.8	127.2	125.1	125.2	128.4	128.4
Overhead Vapor		131.7	132.0	131.8	131.8	133.0	133.0
Distributor		127.4	127.7	125.7	125.8	129.0	129.0
Top Bed		131.6	130.8	130.3	130.2	133.3	132.9
Mid Bed		132.9	132.8	132.8	133.0	132.3	132.0
Below Bed		136.8	136.5	136.0	136.1	136.7	136.4
Composition of Liquid	Mol % iC ₄						
Reflux		57.02	56.43	56.37	56.32	55.53	54.65
Distributor		57.00	59.90	56.03	55.94	58.18	55.39
Below Bed		34.13	34.62	35.50	35.88	35.78	35.78
Bottoms		30.82	31.18	32.58	32.64	31.76	31.84
Feed		31.03	31.42	32.74	32.67	31.85	31.83
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	34.13	34.62	35.50	35.88	35.78	35.78
Temperature	°F	136.8	136.5	136.0	136.1	136.7	136.4
Liquid Density	lb/ft ³	32.8	32.8	32.8	32.8	32.8	32.8
Vapor Density	lb/ft ³	1.058	1.056	1.053	1.055	1.063	1.059
Vapor Rate	k lb/h	54.5	54.5	55.2	55.3	56.0	56.0
Liquid Rate	gpm	207.0	207.0	209.6	210.2	213.0	212.8
Capacity Factor, Cs	ft/s	0.210	0.210	0.213	0.213	0.215	0.216
HETP 2pt	inch						
DIST & below bed		25.8	23.3	28.6	29.2	27.4	31.3
DIST & bottoms		29.1	25.9	33.6	33.8	30.0	35.0
Relative Volatility		1.297	1.297	1.298	1.298	1.297	1.297
Capacity Factor, Top	ft/s	0.212	0.212	0.215	0.215	0.217	0.217
Capacity Factor, Mid	ft/s	0.211	0.211	0.214	0.214	0.216	0.216

Table V (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **8.0 ft** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 100 psia

Run Number		23563	23562	23561	23560	23559	
Run Type		OHP FL	OHP FL	OHP FL	OHP FL	OHP FL	
Column Pressure:	psia	99.8	99.6	99.3	99.5	99.3	
Reboiler Duty	M Btu/h	11.15	10.44	9.86	8.88	8.23	
Condenser Duty	M Btu/h	10.41	9.74	9.12	8.19	7.65	
Reflux Rate	k lb/h	9.3	21.4	23.0	33.5	41.1	
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	
Mass Feed Flow Rate	k lb/h	90.0	90.0	90.0	60.0	60.0	
Pressure Drops:							
Overall	inch H2O / ft	1.75	2.28	2.08	2.24	2.04	
Top	inch H2O / ft	2.07	3.00	2.52	2.91	2.69	
Bottom	inch H2O / ft	1.31	1.44	1.51	1.47	1.28	
Dist. Pressure Drop	inch H2O						
Dist Bubbler	inch Hot Liq	0.75	13.82	5.22	11.33	16.10	
Liquid Holdup	Vol. Fraction	0.17	0.26	0.24	0.28	0.25	
Temperature Profiles	°F						
Reflux		127.5	130.3	130.1	130.3	129.7	
Overhead Vapor		136.1	135.4	135.1	134.9	134.4	
Distributor		131.8	131.5	131.3	131.2	130.5	
Top Bed		135.6	134.2	134.5	133.3	132.6	
Mid Bed		135.7	135.4	135.1	135.3	135.2	
Below Bed		135.9	135.8	135.5	136.0	136.2	
Composition of Liquid	Mol % iC ₄						
Reflux		45.86	47.03	47.55	48.80	50.18	
Distributor		45.81	46.92	47.53	52.13	59.97	
Below Bed		38.87	38.60	38.50	38.50	36.14	
Bottoms		38.67	38.52	38.54	37.00	35.13	
Feed		44.62	43.81	43.44	43.10	39.83	
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol % iC ₄	38.87	38.60	38.50	38.50	36.14	
Temperature	°F	135.9	135.8	135.5	136.0	136.2	
Liquid Density	lb/ft ³	32.8	32.8	32.8	32.8	32.8	
Vapor Density	lb/ft ³	1.063	1.061	1.057	1.063	1.058	
Vapor Rate	k lb/h	83.7	78.2	73.7	66.4	61.4	
Liquid Rate	gpm	44.6	91.8	97.9	138.5	165.1	
Capacity Factor, Cs	ft/s	0.322	0.301	0.284	0.255	0.237	
L/V		0.14	0.31	0.35	0.55	0.71	
OHP Flow	k lb/h	71.97	54.03	47.99	30.02	17.99	
Capacity Factor, Top	ft/s	0.321	0.301	0.284	0.256	0.237	
Capacity Factor, Mid	ft/s	0.321	0.301	0.284	0.256	0.237	

Table I (SI Units)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **0.31 bar**

Run Number		23326	23327	23318	23319	23320	23321
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	0.31	0.31	0.30	0.30	0.31	0.31
Reboiler Duty	MW	0.38	0.38	0.41	0.42	0.47	0.47
Condenser Duty	MW	0.62	0.42	0.49	0.50	0.54	0.55
Reflux Rate	kg/s	1.1	1.1	1.3	1.3	1.4	1.4
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.8	3.8	3.8	3.8	3.8	3.8
Pressure Drops:							
Overall	mbar/m	1.80	1.79	2.39	2.45	2.68	2.70
Top	mbar/m	1.57	1.56	2.10	2.17	2.37	2.40
Bottom	mbar/m	1.21	1.20	1.77	1.83	2.05	2.08
Dist. Pressure Drop	mbar	0.00	0.00	0.08	0.09	0.18	0.17
Dist Bubbler	mm Hot Liq	93	93	122	123	137	140
Liquid Holdup	Vol. Fraction	0.08		0.08		0.09	
Temperature Profiles	°C						
Reflux		46.1	47.2	46.1	46.0	47.4	47.6
Overhead Vapor		47.9	47.8	47.1	46.7	47.6	47.8
Distributor		46.6	46.6	45.9	45.6	46.5	46.7
Top Bed		47.6	47.2	46.5	46.2	47.2	47.4
Mid Bed		51.2	49.6	48.6	48.4	49.3	49.5
Below Bed		61.9	60.2	59.6	59.4	60.4	60.6
Composition of Liquid	Mol% C ₆						
Reflux		93.69	93.75	94.05	94.26	94.19	94.13
Distributor		93.74	93.68	94.14	94.14	93.93	93.80
Below Bed		14.10	13.80	14.39	14.16	14.60	14.19
Bottoms		7.86	7.80	8.07	8.09	7.82	7.79
Feed		7.91	7.95	8.20	8.09	7.86	7.83
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	14.10	13.80	14.39	14.16	14.60	14.19
Temperature	°C	61.9	60.2	59.6	59.4	60.4	60.6
Liquid Density	kg/m ³	657.1	658.4	659.4	659.4	658.8	658.3
Vapor Density	kg/m ³	1.214	1.143	1.124	1.114	1.157	1.163
Vapor Rate	kg/s	1.098	1.096	1.182	1.212	1.347	1.369
Liquid Rate	m ³ /h	6.01	5.99	6.45	6.62	7.36	7.49
Capacity Factor, Cs	m/s	0.034	0.035	0.038	0.039	0.042	0.043
HEP 2pt	mm						
DIST & below bed		326	327	326	325	329	328
DIST & bottoms		323	325	323	324	322	323
Relative Volatility		1.858	1.871	1.875	1.877	1.869	1.867
Capacity Factor, Top	m/s	0.032	0.032	0.035	0.036	0.039	0.040
Capacity Factor, Mid	m/s	0.032	0.033	0.036	0.037	0.040	0.041

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **0.31 bar**

Run Number		23315	23329	23328	23322	23323	23324
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	0.31	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	0.57	0.57	0.57	0.66	0.66	0.76
Condenser Duty	MW	0.56	0.55	0.51	0.69	0.68	0.76
Reflux Rate	kg/s	1.4	1.4	1.4	1.7	1.8	2.0
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.8	3.8	3.8	3.8	3.8	3.8
Pressure Drops:							
Overall	mbar/m	2.86	2.87	2.87	4.19	4.20	5.44
Top	mbar/m	2.59	2.69	2.70	4.00	3.99	5.35
Bottom	mbar/m	2.22	2.22	2.23	3.51	3.51	4.73
Dist. Pressure Drop	mbar	0.07	0.00	0.00	0.13	0.10	0.05
Dist Bubbler	mm Hot Liq	147	149	149	200	199	250
Liquid Holdup	Vol. Fraction	0.09		0.10	0.10		0.11
Temperature Profiles	°C						
Reflux		46.0	45.8	47.2	46.6	46.4	46.2
Overhead Vapor		47.6	47.9	47.8	47.3	47.2	47.9
Distributor		46.2	46.4	46.6	46.2	46.0	46.6
Top Bed		47.2	47.3	47.2	46.9	46.8	47.6
Mid Bed		49.0	49.5	49.6	49.6	49.5	51.2
Below Bed		60.4	60.9	60.2	60.8	60.7	61.9
Composition of Liquid	Mol% C ₆						
Reflux		94.62	93.59	93.62	94.20	94.23	94.01
Distributor		94.55	93.57	93.68	94.07	94.08	93.93
Below Bed		18.42	12.39	12.13	12.45	11.65	10.82
Bottoms		8.92	6.81	6.83	7.20	7.21	6.25
Feed		9.03	6.80	6.52	7.19	7.18	6.23
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	18.42	12.39	12.13	12.45	11.65	10.82
Temperature	°C	60.4	60.9	60.2	60.8	60.7	61.9
Liquid Density	kg/m ³	661.7	656.8	657.2	656.9	656.4	654.7
Vapor Density	kg/m ³	1.182	1.161	1.131	1.159	1.149	1.189
Vapor Rate	kg/s	1.641	1.649	1.648	1.918	1.922	2.202
Liquid Rate	m ³ /h	8.93	9.04	9.03	10.51	10.54	12.11
Capacity Factor, Cs	m/s	0.051	0.052	0.052	0.060	0.061	0.068
HEP 2pt	mm						
DIST & below bed		340	320	317	314	310	305
DIST & bottoms		323	316	316	314	315	305
Relative Volatility		1.863	1.868	1.874	1.868	1.870	1.863
Capacity Factor, Top	m/s	0.047	0.048	0.048	0.056	0.056	0.063
Capacity Factor, Mid	m/s	0.048	0.049	0.049	0.057	0.057	0.065

Table I (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **0.31 bar**

Run Number		23325	23330	23331	23334	23332	23333
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	0.31	0.30	0.30	0.31	0.31	0.31
Reboiler Duty	MW	0.76	0.85	0.85	1.00	0.95	0.95
Condenser Duty	MW	0.76	0.84	0.86	0.99	0.96	0.96
Reflux Rate	kg/s	2.0	2.2	2.2	2.6	2.4	2.5
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.8	3.8	3.8	3.8	3.8	3.8
Pressure Drops:							
Overall	mbar/m	5.41	7.38	7.57	16.33	9.85	9.85
Top	mbar/m	5.32	7.31	7.51	17.28	9.76	9.76
Bottom	mbar/m	4.70	6.73	6.92	14.71	9.27	9.27
Dist. Pressure Drop	mbar	0.05	0.12	0.13	0.08	0.19	0.17
Dist Bubbler	mm Hot Liq	250	303	304	422	365	365
Liquid Holdup	Vol. Fraction		0.12		0.23	0.14	
Temperature Profiles	°C						
Reflux		46.1	45.3	45.1	45.8	45.8	45.7
Overhead Vapor		47.9	47.0	46.6	48.0	46.5	46.5
Distributor		46.6	45.8	45.4	46.4	45.9	45.9
Top Bed		47.6	46.7	46.3	47.8	46.4	46.4
Mid Bed		51.2	51.0	50.7	57.1	48.7	48.7
Below Bed		61.9	62.0	61.6	62.5	60.9	60.9
Composition of Liquid	Mol% C ₆						
Reflux		93.96	93.95	93.99	90.81	97.54	97.52
Distributor		93.85	93.75	93.68	90.79	97.41	97.47
Below Bed		10.46	8.38	8.06	26.66	17.37	17.13
Bottoms		6.17	4.32	4.47	11.70	9.21	9.18
Feed		6.21	4.53	4.52	11.96	9.22	9.22
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	10.46	8.38	8.06	26.66	17.37	17.13
Temperature	°C	61.9	62.0	61.6	62.5	60.9	60.9
Liquid Density	kg/m ³	654.4	652.9	653.0	666.0	660.4	660.2
Vapor Density	kg/m ³	1.188	1.175	1.160	1.331	1.197	1.196
Vapor Rate	kg/s	2.202	2.479	2.478	2.886	2.733	2.733
Liquid Rate	m ³ /h	12.11	13.67	13.66	15.60	14.90	14.90
Capacity Factor, Cs	m/s	0.068	0.078	0.078	0.084	0.084	0.084
HEP 2pt	mm						
DIST & below bed		303	290	290	443	284	282
DIST & bottoms		305	285	289	395	278	276
Relative Volatility		1.863	1.865	1.868	1.836	1.861	1.861
Capacity Factor, Top	m/s	0.063	0.072	0.073	0.085	0.079	0.079
Capacity Factor, Mid	m/s	0.065	0.074	0.074	0.084	0.081	0.081

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **0.31 bar**

Run Number		23335	23336	23316	23337	23314	23317
Run Type		TR	TR	FT	TR	TR	FT
Column Pressure:	bar	0.31	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	1.00	1.03	1.06	1.03	1.05	1.06
Condenser Duty	MW	0.99	1.02	1.03	1.02	1.00	1.03
Reflux Rate	kg/s	2.6	2.7	2.7	2.71	2.7	2.7
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.8	3.8	3.8	3.78	3.8	3.8
Pressure Drops:							
Overall	mbar/m	16.20	19.39	21.15	18.99	17.17	21.54
Top	mbar/m	17.05	22.72	24.70	22.22	18.10	25.37
Bottom	mbar/m	14.68	15.41	16.25	15.09	15.42	16.62
Dist. Pressure Drop	mbar	0.08	0.42	1.37	0.33	0.17	1.49
Dist Bubbler	mm Hot Liq	420	526	641	508	435	656
Liquid Holdup	Vol. Fraction		0.18	0.22		0.20	
Temperature Profiles	°C						
Reflux		45.7	46.8	46.0	46.8	44.1	46.1
Overhead Vapor		48.0	51.6	53.6	51.6	48.6	53.5
Distributor		46.3	48.2	48.3	48.3	45.6	48.3
Top Bed		47.7	55.8	56.5	56.5	48.6	56.9
Mid Bed		56.8	58.9	59.8	59.2	57.3	60.6
Below Bed		62.5	61.1	62.0	61.1	60.0	62.5
Composition of Liquid	Mol% C ₆						
Reflux		90.71	74.38	66.07	74.12	90.32	65.48
Distributor		90.61	74.20	67.26	73.67	90.44	65.11
Below Bed		24.78	31.49	33.71	29.02	35.19	24.89
Bottoms		11.87	18.14	16.01	18.31	21.19	16.39
Feed		11.90	17.98	16.53	18.27	21.23	16.57
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	24.78	31.49	33.71	29.02	35.19	24.89
Temperature	°C	62.5	61.1	62.0	61.1	60.0	62.5
Liquid Density	kg/m ³	664.5	671.1	672.1	669.1	675.2	664.6
Vapor Density	kg/m ³	1.318	1.299	1.355	1.28	1.273	1.319
Vapor Rate	kg/s	2.891	2.951	3.029	2.96	2.974	3.048
Liquid Rate	m ³ /h	15.66	15.83	16.22	15.9	15.85	16.51
Capacity Factor, Cs	m/s	0.085	0.087	0.087	0.087	0.088	0.089
HEP 2pt	mm						
DIST & below bed		434	805	1053	780	513	856
DIST & bottoms		399	754	829	785	495	899
Relative Volatility		1.838	1.839	1.829	1.842	1.841	1.838
Capacity Factor, Top	m/s	0.085	0.090	0.094	0.090	0.090	0.095
Capacity Factor, Mid	m/s	0.084	0.088	0.090	0.088	0.088	0.092

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **0.31 bar**

Run Number		23361	23360	23359	23358	23357	23344
Run Type		OHP	OHP	OHP	OHP	OHP	FL OHP
Column Pressure:	bar	0.31	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	0.76	0.86	0.95	1.05	1.14	1.24
Condenser Duty	MW	0.75	0.84	0.94	1.03	1.12	1.24
Reflux Rate	kg/s	1.0	1.0	1.0	1.0	1.1	1.1
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.8	3.8	3.8	3.8	3.8	7.6
Pressure Drops:							
Overall	mbar/m	4.74	6.13	7.86	9.91	12.77	20.22
Top	mbar/m	4.55	6.06	7.97	10.25	13.47	24.02
Bottom	mbar/m	3.90	5.16	6.71	8.53	11.03	15.75
Dist. Pressure Drop	mbar	0.76	0.79	0.81	0.86	0.89	1.18
Dist Bubbler	mm Hot Liq	86	90	94	97	103	194
Liquid Holdup	Vol. Fraction	0.08	0.09	0.09	0.10	0.12	0.16
Temperature Profiles	°C						
Reflux		45.9	46.2	46.3	46.4	46.4	51.4
Overhead Vapor		55.9	56.2	56.5	56.7	56.9	56.7
Distributor		51.3	51.6	51.8	52.0	52.2	54.5
Top Bed		56.3	56.6	57.0	57.2	57.6	57.4
Mid Bed		58.2	58.2	58.5	58.7	59.0	59.7
Below Bed		58.7	58.8	59.2	59.6	60.3	61.5
Composition of Liquid	Mol% C₆						
Reflux		51.83	48.94	47.16	45.86	44.68	46.50
Distributor		51.23	47.59	46.41	44.55	55.57	42.04
Below Bed		24.90	24.69	24.45	24.47	23.30	27.24
Bottoms		25.36	25.71	25.51	25.29	25.21	28.57
Feed		32.70	33.80	34.37	35.07	35.66	34.15
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C₆	24.90	24.69	24.45	24.47	23.30	27.24
Temperature	°C	58.7	58.8	59.2	59.6	60.3	61.5
Liquid Density	kg/m³	668.2	667.9	667.3	666.9	665.5	667.4
Vapor Density	kg/m³	1.274	1.270	1.283	1.296	1.335	1.388
Vapor Rate	kg/s	2.150	2.420	2.686	2.951	3.216	3.473
Liquid Rate	m³/h	6.34	6.50	6.65	6.80	7.04	6.49
Capacity Factor, Cs	m/s	0.064	0.072	0.079	0.087	0.093	0.099
L/V		0.55	0.50	0.46	0.43	0.40	0.35
OHP Flow	kg/s	0.97	1.21	1.45	1.69	1.92	2.27
Capacity Factor, Top	m/s	0.071	0.080	0.089	0.098	0.105	0.111
Capacity Factor, Mid	m/s	0.067	0.076	0.084	0.092	0.099	0.105

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **0.31 bar**

Run Number		23345	23346	23347	23348	23349	23341
Run Type		OHP	OHP	OHP	OHP	OHP	FL OHP
Column Pressure:	bar	0.31	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	0.76	0.86	0.95	1.05	1.14	1.19
Condenser Duty	MW	0.74	0.82	0.91	1.03	1.12	1.16
Reflux Rate	kg/s	1.4	1.4	1.4	1.4	1.4	1.3
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.8	3.8	3.8	3.8	3.8	3.8
Pressure Drops:							
Overall	mbar/m	5.05	6.55	8.39	11.08	16.28	19.72
Top	mbar/m	4.86	6.51	8.52	11.48	18.89	22.74
Bottom	mbar/m	4.23	5.58	7.25	9.64	12.64	16.04
Dist. Pressure Drop	mbar	0.39	0.39	0.94	0.98	1.07	0.39
Dist Bubbler	mm Hot Liq	138	142	145	153	160	202
Liquid Holdup	Vol. Fraction	0.09	0.10	0.10	0.12	0.15	0.14
Temperature Profiles	°C						
Reflux		45.7	45.3	45.5	46.7	46.5	48.4
Overhead Vapor		54.1	55.0	55.6	56.0	56.3	56.5
Distributor		49.4	49.8	50.3	51.1	51.3	52.8
Top Bed		54.2	55.4	56.1	56.8	58.0	57.9
Mid Bed		58.3	58.6	58.7	59.0	59.7	59.4
Below Bed		59.3	59.4	59.6	60.1	61.1	61.4
Composition of Liquid	Mol% C ₆						
Reflux		62.57	56.99	52.96	50.38	48.27	46.19
Distributor		62.36	57.18	52.41	50.20	47.58	44.47
Below Bed		22.01	22.73	23.30	23.62	23.83	24.99
Bottoms		22.04	23.38	24.19	24.35	24.73	25.69
Feed		29.14	31.36	33.01	34.05	35.04	36.39
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	22.01	22.73	23.30	23.62	23.83	24.99
Temperature	°C	59.3	59.4	59.6	60.1	61.1	61.4
Liquid Density	kg/m ³	665.4	665.8	666.1	665.9	665.1	665.7
Vapor Density	kg/m ³	1.325	1.316	1.314	1.328	1.365	1.376
Vapor Rate	kg/s	2.154	2.422	2.686	2.947	3.210	3.332
Liquid Rate	m ³ /h	8.47	8.63	8.72	8.82	8.98	8.23
Capacity Factor, Cs	m/s	0.063	0.071	0.079	0.086	0.092	0.095
L/V		0.73	0.66	0.60	0.55	0.52	0.46
OHP Flow	kg/s	0.59	0.83	1.07	1.31	1.55	1.81
Capacity Factor, Top	m/s	0.070	0.080	0.089	0.098	0.107	0.109
Capacity Factor, Mid	m/s	0.066	0.075	0.084	0.091	0.099	0.102

Table I (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **0.31 bar**

Run Number		23353	23352	23351	23350	23340	23354
Run Type		OHP	OHP	OHP	OHP	FL OHP	OHP
Column Pressure:	bar	0.31	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	0.76	0.86	0.95	1.05	1.13	0.85
Condenser Duty	MW	0.76	0.85	0.94	1.02	1.11	0.85
Reflux Rate	kg/s	1.7	1.8	1.8	1.8	1.7	1.9
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.8	3.8	3.8	3.8	3.8	3.8
Pressure Drops:							
Overall	mbar/m	5.21	7.00	9.28	12.37	19.32	7.04
Top	mbar/m	4.89	6.82	9.33	12.76	22.10	6.75
Bottom	mbar/m	4.48	6.12	8.17	10.93	15.87	6.28
Dist. Pressure Drop	mbar	0.89	0.91	0.93	0.93	0.40	0.89
Dist Bubbler	mm Hot Liq	187	199	208	212.08	246	222
Liquid Holdup	Vol. Fraction	0.10	0.11	0.12	0.14	0.15	0.11
Temperature Profiles	°C						
Reflux		45.8	46.4	46.7	46.6	48.3	45.4
Overhead Vapor		50.3	52.7	54.0	55.0	55.8	50.3
Distributor		47.6	49.0	49.7	50.1	51.8	47.3
Top Bed		49.9	52.9	54.5	55.8	57.9	50.2
Mid Bed		55.6	58.5	59.1	59.4	59.7	57.1
Below Bed		60.5	60.2	60.3	60.7	61.4	61.2
Composition of Liquid	Mol% C ₆						
Reflux		80.36	68.81	61.62	56.01	50.36	81.23
Distributor		78.08	67.53	60.58	55.50	49.78	80.42
Below Bed		16.53	18.89	20.68	21.78	23.96	14.77
Bottoms		15.49	19.30	21.30	22.76	24.46	14.48
Feed		20.33	26.31	29.54	31.87	34.29	19.86
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	16.53	18.89	20.68	21.78	23.96	14.77
Temperature	°C	60.5	60.2	60.3	60.7	61.4	61.2
Liquid Density	kg/m ³	660.1	662.2	663.4	663.9	664.9	658.2
Vapor Density	kg/m ³	1.404	1.369	1.359	1.364	1.386	1.438
Vapor Rate	kg/s	2.173	2.431	2.692	2.955	3.184	2.445
Liquid Rate	m ³ /h	10.73	10.81	10.88	11.00	10.04	11.97
Capacity Factor, Cs	m/s	0.062	0.070	0.078	0.085	0.091	0.069
L/V		0.91	0.82	0.74	0.69	0.58	0.90
OHP Flow	kg/s	0.21	0.44	0.69	0.93	1.33	0.26
Capacity Factor, Top	m/s	0.070	0.079	0.088	0.098	0.104	0.078
Capacity Factor, Mid	m/s	0.066	0.074	0.083	0.091	0.097	0.073

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **0.31 bar**

Run Number		23355	23356	23339	23338		
Run Type		OHP	OHP	FL OHP	FL OHP		
Column Pressure:	bar	0.31	0.31	0.31	0.31		
Reboiler Duty	MW	0.95	1.04	1.08	1.06		
Condenser Duty	MW	0.93	1.03	1.06	1.04		
Reflux Rate	kg/s	1.9	2.0	2.0	2.3		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	kg/s	3.8	3.8	3.8	3.8		
Pressure Drops:							
Overall	mbar/m	9.72	15.55	18.29	19.13		
Top	mbar/m	9.66	17.46	20.93	22.19		
Bottom	mbar/m	8.73	12.60	15.00	15.40		
Dist. Pressure Drop	mbar	0.89	0.91	0.26	0.38		
Dist Bubbler	mm Hot Liq	236	249.75	301	392		
Liquid Holdup	Vol. Fraction	0.13	0.18	0.16	0.17		
Temperature Profiles	°C						
Reflux		45.7	46.3	48.0	47.7		
Overhead Vapor		52.3	54.0	54.7	53.7		
Distributor		48.3	49.4	50.8	49.9		
Top Bed		52.6	54.5	57.9	57.5		
Mid Bed		59.5	59.6	59.8	59.6		
Below Bed		61.3	61.7	61.5	61.7		
Composition of Liquid	Mol% C ₆						
Reflux		72.67	62.41	56.60	62.28		
Distributor		73.73	65.45	56.33	62.25		
Below Bed		14.79	19.31	23.67	24.34		
Bottoms		16.40	19.93	22.66	20.93		
Feed		24.19	28.88	31.19	27.36		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	14.79	19.31	23.67	24.34		
Temperature	°C	61.3	61.7	61.5	61.7		
Liquid Density	kg/m ³	658.2	661.1	664.6	665.0		
Vapor Density	kg/m ³	1.429	1.433	1.406	1.428		
Vapor Rate	kg/s	2.703	2.959	3.059	3.004		
Liquid Rate	m ³ /h	12.08	12.14	11.89	13.39		
Capacity Factor, Cs	m/s	0.076	0.083	0.087	0.084		
L/V		0.82	0.75	0.72	0.82		
OHP Flow	kg/s	0.50	0.73	0.87	0.53		
Capacity Factor, Top	m/s	0.087	0.096	0.099	0.079		
Capacity Factor, Mid	m/s	0.081	0.089	0.093	0.082		

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **0.31 bar**

Run Number		23366	23364	23363	23362	23342	23367
Run Type		TF	TF	TF	TF	FL TF	TF
Column Pressure:	bar	0.31	0.31	0.31	0.31	0.30	0.31
Reboiler Duty	MW	0.39	0.76	0.86	0.95	1.02	0.37
Condenser Duty	MW	0.37	0.72	0.83	0.91	1.00	0.35
Reflux Rate	kg/s	1.0	1.9	2.2	2.4	2.6	1.0
Feed Location		TOP	TOP	TOP	TOP	TOP	TOP
Mass Feed Flow Rate	kg/s	2.5	1.5	1.3	1.0	0.6	2.9
Pressure Drops:							
Overall	mbar/m	1.67	5.64	7.83	11.17	19.26	1.75
Top	mbar/m	1.22	5.46	7.75	11.14	22.62	1.30
Bottom	mbar/m	1.10	4.80	6.88	10.18	15.22	1.16
Dist. Pressure Drop	mbar	0.68	0.71	0.73	0.76	0.58	0.68
Dist Bubbler	mm Hot Liq	755	717	710	675	649	878
Liquid Holdup	Vol. Fraction	0.11	0.13	0.14	0.17	0.19	0.11
Temperature Profiles	°C						
Reflux		55.7	51.7	50.9	48.6	50.6	55.8
Overhead Vapor		55.9	53.8	53.0	51.8	51.8	56.0
Distributor		55.4	52.0	51.2	49.3	50.8	55.5
Top Bed		55.5	53.6	52.7	51.6	54.5	55.7
Mid Bed		55.6	54.1	53.5	52.7	57.6	55.8
Below Bed		56.0	57.0	57.6	58.7	60.4	56.1
Composition of Liquid	Mol% C ₆						
Reflux		52.77	64.28	68.76	74.86	70.73	51.82
Distributor		37.10	48.07	53.47	61.20	63.21	36.07
Below Bed		35.24	34.36	33.29	30.39	32.31	34.73
Bottoms		29.90	25.16	23.05	20.22	22.53	30.33
Feed		29.85	24.40	22.11	19.18	19.56	30.24
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	35.24	34.36	33.29	30.39	32.31	34.73
Temperature	°C	56.0	57.0	57.6	58.7	60.4	56.1
Liquid Density	kg/m ³	678.9	677.3	675.8	672.5	672.4	678.3
Vapor Density	kg/m ³	1.107	1.162	1.199	1.259	1.157	1.108
Vapor Rate	kg/s	1.024	2.104	2.379	2.676	2.880	0.995
Liquid Rate	m ³ /h	18.64	19.20	19.37	19.67	18.45	20.76
Capacity Factor, Cs	m/s	0.032	0.065	0.072	0.080	0.089	0.031
L/V		3.43	1.72	1.53	1.37	1.20	3.93
Capacity Factor, Top	m/s	0.032	0.067	0.075	0.085	0.082	0.031
Capacity Factor, Mid	m/s	0.032	0.066	0.074	0.082	0.086	0.031

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **0.31 bar**

Run Number		23368	23369	23370	23371	23343	
Run Type		TF	TF	TF	TF	FL TF	
Column Pressure:	bar	0.31	0.31	0.31	0.31	0.30	
Reboiler Duty	MW	0.57	0.67	0.76	0.86	1.01	
Condenser Duty	MW	0.56	0.64	0.77	0.87	1.01	
Reflux Rate	kg/s	1.6	1.7	2.0	2.2	2.7	
Feed Location		TOP	TOP	TOP	TOP	TOP	
Mass Feed Flow Rate	kg/s	2.4	2.2	1.9	1.7	0.9	
Pressure Drops:							
Overall	mbar/m	3.68	4.30	5.97	8.57	20.65	
Top	mbar/m	3.37	4.02	5.77	8.52	24.90	
Bottom	mbar/m	2.97	3.56	5.12	7.59	15.77	
Dist. Pressure Drop	mbar	0.70	0.72	0.76	0.79	1.27	
Dist Bubbler	mm Hot Liq	879	878	877	876	853	
Liquid Holdup	Vol. Fraction	0.12	0.12	0.13	0.15	0.19	
Temperature Profiles	°C						
Reflux		53.9	54.1	54.0	53.1	53.2	
Overhead Vapor		55.3	54.9	54.4	53.8	52.7	
Distributor		54.0	54.1	53.9	53.0	52.8	
Top Bed		55.0	54.7	54.2	53.6	54.2	
Mid Bed		55.2	55.0	54.6	54.3	57.2	
Below Bed		56.4	56.5	56.8	57.5	60.0	
Composition of Liquid	Mol% C ₆						
Reflux		55.90	57.50	60.15	63.57	64.57	
Distributor		39.70	41.13	44.00	47.83	55.22	
Below Bed		35.36	35.03	34.49	33.87	33.46	
Bottoms		28.21	27.33	25.89	24.04	23.62	
Feed		28.32	27.26	25.90	24.03	22.77	
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	35.36	35.03	34.49	33.87	33.46	
Temperature	°C	56.4	56.5	56.8	57.5	60.0	
Liquid Density	kg/m ³	678.6	678.3	677.5	676.4	673.7	
Vapor Density	kg/m ³	1.125	1.129	1.146	1.178	1.317	
Vapor Rate	kg/s	1.562	1.826	2.094	2.366	2.819	
Liquid Rate	m ³ /h	21.14	21.29	21.44	21.61	20.12	
Capacity Factor, Cs	m/s	0.049	0.057	0.065	0.073	0.082	
L/V		2.55	2.20	1.93	1.72	1.34	
Capacity Factor, Top	m/s	0.049	0.057	0.066	0.074	0.087	
Capacity Factor, Mid	m/s	0.049	0.057	0.065	0.073	0.084	

Table II (SI Units)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **1.62 bar**

Run Number		23374	23375	23397	23396	23377	23376
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	0.43	0.44	0.44	0.44	0.52	0.53
Condenser Duty	MW	0.33	0.33	0.41	0.41	0.37	0.37
Reflux Rate	kg/s	0.83	0.89	1.06	1.07	0.96	0.99
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	0.94	0.96	1.07	1.08	1.04	1.05
Top	mbar/m	0.60	0.63	0.74	0.75	0.72	0.73
Bottom	mbar/m	0.31	0.33	0.45	0.45	0.40	0.40
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	36	37	43	43	41	42
Liquid Holdup	Vol. Fraction	0.07			0.07		0.07
Temperature Profiles	°C						
Reflux		73.7	74.0	73.8	74.0	70.1	70.1
Overhead Vapor		99.7	99.6	101.0	100.8	100.5	100.5
Distributor		90.3	90.3	89.4	89.3	88.8	88.8
Top Bed		98.5	98.4	99.7	99.5	99.2	99.2
Mid Bed		102.1	101.8	102.7	102.4	102.3	102.1
Below Bed		112.2	112.0	113.3	113.0	113.0	112.9
Composition of Liquid	Mol% C ₆						
Reflux		88.72	89.17	86.91	86.69	88.65	88.66
Distributor		88.40	89.16	86.86	86.30	88.62	88.68
Below Bed		13.29	12.52	11.83	12.56	12.67	13.94
Bottoms		7.28	7.18	6.52	6.55	6.66	6.60
Feed		7.34	7.37	6.71	6.68	6.64	6.68
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	13.29	12.52	11.83	12.56	12.67	13.94
Temperature	°C	112.2	112.0	113.3	113.0	113.0	112.9
Liquid Density	kg/m ³	607.3	606.9	605.1	605.9	606.0	607.0
Vapor Density	kg/m ³	5.276	5.240	5.389	5.369	5.367	5.387
Vapor Rate	kg/s	1.229	1.271	1.301	1.310	1.505	1.531
Liquid Rate	m ³ /h	7.29	7.54	7.74	7.78	8.94	9.08
Capacity Factor, Cs	m/s	0.019	0.020	0.020	0.020	0.023	0.023
HEP 2pt	mm						
DIST & below bed		279	270	279	288	273	280
DIST & bottoms		264	259	264	268	256	255
Relative Volatility		1.567	1.569	1.563	1.564	1.564	1.564
Capacity Factor, Top	m/s	0.019	0.019	0.020	0.020	0.023	0.023
Capacity Factor, Mid	m/s	0.019	0.019	0.020	0.020	0.023	0.023

Table II (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **1.62 bar**

Run Number		23398	23399	23378	23379	23381	23380
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	0.52	0.52	0.69	0.69	0.87	0.87
Condenser Duty	MW	0.46	0.49	0.60	0.60	0.75	0.75
Reflux Rate	kg/s	1.16	1.22	1.51	1.52	1.91	1.93
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.74	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	1.20	1.23	1.52	1.54	1.98	2.00
Top	mbar/m	0.88	0.91	1.23	1.25	1.70	1.72
Bottom	mbar/m	0.55	0.58	0.85	0.86	1.30	1.32
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	49	52	70	70	94	95
Liquid Holdup	Vol. Fraction	0.08		0.08			0.09
Temperature Profiles	°C						
Reflux		70.2	70.8	69.5	69.4	72.3	72.2
Overhead Vapor		101.0	100.6	101.0	100.9	100.8	100.7
Distributor		87.1	86.8	85.0	84.9	84.9	84.8
Top Bed		99.5	99.1	99.5	99.4	99.2	99.1
Mid Bed		102.0	101.3	101.7	101.6	101.6	101.5
Below Bed		113.1	112.6	113.1	113.1	113.0	112.9
Composition of Liquid	Mol% C ₆						
Reflux		86.49	86.39	86.59	86.60	86.11	86.10
Distributor		86.47	86.42	86.43	86.56	86.13	86.06
Below Bed		11.53	11.92	11.66	11.12	11.17	10.76
Bottoms		6.31	6.23	5.97	5.93	5.36	5.37
Feed		6.33	6.30	6.07	5.96	5.42	5.37
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	11.53	11.92	11.66	11.12	11.17	10.76
Temperature	°C	113.1	112.6	113.1	113.1	113.0	112.9
Liquid Density	kg/m ³	605.1	605.8	605.1	604.8	604.9	604.8
Vapor Density	kg/m ³	5.363	5.306	5.369	5.349	5.340	5.312
Vapor Rate	kg/s	1.574	1.579	2.140	2.164	2.737	2.742
Liquid Rate	m ³ /h	9.37	9.38	12.73	12.88	16.29	16.32
Capacity Factor, Cs	m/s	0.024	0.024	0.033	0.033	0.042	0.042
HEP 2pt	mm						
DIST & below bed		279	283	280	276	279	277
DIST & bottoms		265	265	261	260	256	257
Relative Volatility		1.564	1.566	1.564	1.564	1.565	1.566
Capacity Factor, Top	m/s	0.025	0.025	0.034	0.035	0.044	0.044
Capacity Factor, Mid	m/s	0.024	0.024	0.033	0.033	0.042	0.043

Table II (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **1.62 bar**

Run Number		23382	23383	23385	23384	23387	23386
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	1.04	1.04	1.22	1.21	1.30	1.30
Condenser Duty	MW	0.91	0.92	1.08	1.09	1.22	1.21
Reflux Rate	kg/s	2.33	2.33	2.66	2.68	2.94	2.95
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	2.70	2.70	3.69	3.70	4.41	4.45
Top	mbar/m	2.43	2.43	3.39	3.40	4.08	4.11
Bottom	mbar/m	2.01	2.01	3.01	3.03	3.79	3.83
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	125	124	154	155	179	180
Liquid Holdup	Vol. Fraction	0.10			0.11		0.12
Temperature Profiles	°C						
Reflux		71.4	71.3	67.6	68.0	70.2	70.4
Overhead Vapor		101.3	101.4	101.1	101.2	100.4	100.2
Distributor		83.1	83.0	79.1	79.3	79.7	79.7
Top Bed		99.7	99.7	99.6	99.7	99.1	99.0
Mid Bed		102.4	102.5	102.5	102.6	101.5	101.3
Below Bed		113.3	113.4	113.3	113.4	112.8	112.6
Composition of Liquid	Mol% C ₆						
Reflux		85.41	85.46	85.70	85.72	89.53	89.43
Distributor		85.43	85.36	85.78	85.88	89.59	89.42
Below Bed		10.51	9.87	9.43	8.88	12.32	12.66
Bottoms		5.25	5.22	5.07	5.03	7.44	7.44
Feed		5.27	5.30	5.15	5.09	7.60	7.52
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	10.51	9.87	9.43	8.88	12.32	12.66
Temperature	°C	113.3	113.4	113.3	113.4	112.8	112.6
Liquid Density	kg/m ³	604.1	603.6	603.4	603.0	605.9	606.4
Vapor Density	kg/m ³	5.371	5.361	5.341	5.340	5.339	5.316
Vapor Rate	kg/s	3.275	3.275	3.820	3.829	4.110	4.114
Liquid Rate	m ³ /h	19.52	19.53	22.79	22.86	24.42	24.42
Capacity Factor, Cs	m/s	0.050	0.050	0.058	0.059	0.063	0.063
HEP 2pt	mm						
DIST & below bed		278	273	268	263	264	268
DIST & bottoms		258	258	254	253	257	259
Relative Volatility		1.564	1.564	1.564	1.564	1.565	1.566
Capacity Factor, Top	m/s	0.054	0.054	0.065	0.065	0.069	0.069
Capacity Factor, Mid	m/s	0.051	0.051	0.061	0.061	0.065	0.065

Table II (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **1.62 bar**

Run Number		23389	23388	23390	23391	23392	23372
Run Type		TR	TR	TR	TR	TR	FT
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	1.47	1.47	1.56	1.56	1.61	1.65
Condenser Duty	MW	1.35	1.34	1.43	1.43	1.47	1.49
Reflux Rate	kg/s	3.33	3.33	3.73	3.73	3.84	3.86
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	6.63	6.70	8.43	8.42	12.78	15.11
Top	mbar/m	5.94	5.99	7.27	7.27	11.39	16.33
Bottom	mbar/m	6.38	6.47	8.63	8.62	13.22	12.99
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	220	220	259	258	277	299
Liquid Holdup	Vol. Fraction		0.14	0.15		0.25	0.23
Temperature Profiles							
	°C						
Reflux		67.8	67.7	75.8	75.9	77.3	74.2
Overhead Vapor		100.2	100.1	99.3	99.3	100.4	102.4
Distributor		77.2	77.1	81.8	81.9	82.9	81.0
Top Bed		99.0	98.9	98.2	98.2	99.4	101.6
Mid Bed		101.3	101.2	99.8	99.8	109.7	110.2
Below Bed		113.3	113.2	112.4	112.4	113.1	111.1
Composition of Liquid							
	Mol% C ₆						
Reflux		89.88	89.86	93.97	93.94	89.39	80.28
Distributor		89.90	89.91	93.74	93.93	89.58	79.01
Below Bed		10.06	9.99	14.78	14.49	14.50	23.88
Bottoms		5.99	5.97	8.98	9.01	11.95	19.47
Feed		6.11	6.02	8.96	9.05	11.99	19.65
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	10.06	9.99	14.78	14.49	14.50	23.88
Temperature	°C	113.3	113.2	112.4	112.4	113.1	111.1
Liquid Density	kg/m ³	603.9	603.9	608.1	607.9	607.2	616.1
Vapor Density	kg/m ³	5.351	5.337	5.335	5.326	5.422	5.345
Vapor Rate	kg/s	4.676	4.685	4.947	4.949	5.081	5.156
Liquid Rate	m ³ /h	27.87	27.93	29.29	29.31	30.12	30.12
Capacity Factor, Cs	m/s	0.071	0.072	0.075	0.076	0.077	0.078
HEP 2pt	mm						
DIST & below bed		248	248	244	241	276	439
DIST & bottoms		242	242	237	236	293	475
Relative Volatility		1.564	1.565	1.566	1.566	1.563	1.57
Capacity Factor, Top	m/s	0.081	0.081	0.081	0.081	0.083	0.090
Capacity Factor, Mid	m/s	0.075	0.075	0.077	0.077	0.079	0.083

Table II (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **1.62 bar**

Run Number		23395	23393	23373	23394		
Run Type		FT	TR	FT	FT		
Column Pressure:	bar	1.6	1.6	1.6	1.6		
Reboiler Duty	MW	1.68	1.61	1.66	1.67		
Condenser Duty	MW	1.52	1.49	1.52	1.55		
Reflux Rate	kg/s	3.89	3.84	3.89	3.92		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78		
Pressure Drops:							
Overall	mbar/m	16.49	12.77	15.44	17.11		
Top	mbar/m	18.87	11.35	16.86	19.48		
Bottom	mbar/m	13.25	13.25	13.15	13.90		
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	276	277	299	280		
Liquid Holdup	Vol. Fraction				0.22		
Temperature Profiles	°C						
Reflux		71.6	76.9	74.2	73.5		
Overhead Vapor		102.8	100.4	102.4	104.6		
Distributor		78.6	82.6	80.9	80.4		
Top Bed		102.8	99.4	101.8	104.5		
Mid Bed		107.4	109.6	110.1	108.0		
Below Bed		108.3	113.2	111.0	110.1		
Composition of Liquid	Mol% C₆						
Reflux		68.28	89.84	81.06	69.85		
Distributor		68.82	89.84	80.51	69.49		
Below Bed		27.21	13.83	23.62	26.92		
Bottoms		22.28	11.57	18.66	22.20		
Feed		22.26	11.57	19.38	22.06		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C₆	27.21	13.83	23.62	26.92		
Temperature	°C	108.3	113.2	111.0	110.1		
Liquid Density	kg/m³	621.5	606.6	616.0	619.5		
Vapor Density	kg/m³	5.049	5.421	5.332	5.272		
Vapor Rate	kg/s	5.202	5.086	5.183	5.215		
Liquid Rate	m³/h	30.13	30.18	30.29	30.31		
Capacity Factor, Cs	m/s	0.081	0.077	0.079	0.079		
HEP 2pt	mm						
DIST & below bed		622	270.5	420	600		
DIST & bottoms		696	287.8	446	671		
Relative Volatility		1.577	1.563	1.567	1.570		
Capacity Factor, Top	m/s	0.097	0.083	0.090	0.094		
Capacity Factor, Mid	m/s	0.088	0.079	0.083	0.086		

Table II (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **1.62 bar**

Run Number		23428	23427	23426	23424	23417	23418
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	1.05	1.41	1.76	2.13	1.31	1.49
Condenser Duty	MW	0.94	1.27	1.60	1.88	1.20	1.36
Reflux Rate	kg/s	1.41	1.22	1.07	0.67	1.60	1.46
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	7.56	7.56	3.78	3.78
Pressure Drops:							
Overall	mbar/m	2.41	3.59	5.45	7.03	3.50	4.32
Top	mbar/m	2.18	3.44	5.44	7.16	3.39	4.20
Bottom	mbar/m	1.67	2.76	4.48	5.92	2.75	3.45
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	69	58	49	35	83	74
Liquid Holdup	Vol. Fraction		0.11				
Temperature Profiles	°C						
Reflux		73.3	74.7	73.1	66.0	76.8	77.0
Overhead Vapor		107.9	109.1	109.2	108.1	108.9	109.4
Distributor		90.4	92.8	93.6	96.8	91.7	92.8
Top Bed		107.3	108.8	108.8	107.5	108.5	109.1
Mid Bed		109.5	109.5	109.1	107.7	110.1	110.0
Below Bed		109.8	109.7	109.3	107.9	110.3	110.1
Composition of Liquid	Mol% C ₆						
Reflux		51.30	45.31	42.69	40.67	46.20	42.81
Distributor		51.31	45.36	42.22	40.59	46.02	42.97
Below Bed		26.85	28.32	28.80	28.77	25.01	25.89
Bottoms		27.25	28.31	28.25	28.33	24.37	25.25
Feed		30.67	33.20	34.63	35.63	34.20	36.03
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	26.85	28.32	28.80	28.77	25.01	25.89
Temperature	°C	109.8	109.7	109.3	107.9	110.3	110.1
Liquid Density	kg/m ³	619.7	621.0	621.7	623.2	617.8	618.6
Vapor Density	kg/m ³	5.543	5.481	5.406	5.198	5.542	5.500
Vapor Rate	kg/s	3.3	4.4	5.5	6.6	4.1	4.7
Liquid Rate	m ³ /h	13.4	13.5	13.7	13.8	15.0	14.9
Capacity Factor, Cs	m/s	0.049	0.065	0.083	0.101	0.061	0.070
L/V		0.70	0.53	0.43	0.36	0.63	0.55
OHP Flow	kg/s	0.98	2.07	3.13	4.26	1.54	2.12
<i>Capacity Factor, Top</i>	m/s	0.060	0.081	0.102	0.118	0.076	0.087
<i>Capacity Factor, Mid</i>	m/s	0.054	0.073	0.092	0.110	0.068	0.077

Table II (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **1.62 bar**

Run Number		23419	23420	23421	23423	23422	23416
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	1.68	1.94	2.12	2.30	2.39	1.13
Condenser Duty	MW	1.47	1.76	1.95	2.11	2.23	1.03
Reflux Rate	kg/s	1.28	1.22	1.04	0.60	0.62	2.00
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	6.05	6.05	6.05	7.56	7.56	3.78
Pressure Drops:							
Overall	mbar/m	5.10	7.22	8.40	8.32	9.33	2.96
Top	mbar/m	5.05	7.32	8.62	8.57	9.66	2.80
Bottom	mbar/m	4.18	6.13	7.20	7.09	8.02	2.30
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	63	59	50	33	34	107
Liquid Holdup	Vol. Fraction	0.22				0.10	0.10
Temperature Profiles	°C						
Reflux		75.2	76.7	74.5	67.3	69.3	75.4
Overhead Vapor		107.7	109.7	110.2	110.0	110.2	106.2
Distributor		92.6	94.9	95.2	100.1	100.6	88.0
Top Bed		108.1	109.3	109.6	109.4	109.6	105.2
Mid Bed		108.9	109.7	110.0	109.6	109.8	109.7
Below Bed		109.1	109.9	110.2	109.8	110.0	111.3
Composition of Liquid	Mol% C₆						
Reflux		43.25	41.43	40.24	39.96	39.65	62.60
Distributor		43.23	41.37	40.43	39.89	39.64	62.87
Below Bed		27.73	27.79	27.73	28.70	28.49	20.16
Bottoms		27.17	27.29	27.02	28.22	28.00	18.98
Feed		34.84	36.11	36.49	36.08	36.27	26.70
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C₆	27.73	27.79	27.73	28.70	28.49	20.16
Temperature	°C	109.1	109.9	110.2	109.8	110.0	111.3
Liquid Density	kg/m³	621.1	620.3	619.9	621.1	620.7	613.1
Vapor Density	kg/m³	5.374	5.472	5.497	5.449	5.472	5.807
Vapor Rate	kg/s	5.2	6.1	6.6	7.2	7.5	3.6
Liquid Rate	m³/h	14.7	15.0	15.1	14.0	14.2	17.1
Capacity Factor, Cs	m/s	0.078	0.090	0.099	0.108	0.112	0.052
L/V		0.49	0.43	0.39	0.33	0.33	0.82
OHP Flow	kg/s	2.68	3.48	4.04	4.80	5.05	0.65
Capacity Factor, Top	m/s	0.097	0.111	0.122	0.124	0.128	0.064
Capacity Factor, Mid	m/s	0.087	0.100	0.110	0.115	0.119	0.057

Table II (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **1.62 bar**

Run Number		23425	23403	23402	23415	23414	23413
Run Type		OHP	FL OHP	FL OHP	OHP	OHP	OHP
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	1.94	2.53	2.33	1.13	1.22	1.40
Condenser Duty	MW	1.79	2.35	2.17	0.99	1.07	1.22
Reflux Rate	kg/s	1.41	1.04	1.35	2.27	2.28	2.36
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	7.56	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	7.45	19.34	18.57	2.98	3.36	4.49
Top	mbar/m	7.56	22.90	21.91	2.80	3.20	4.39
Bottom	mbar/m	6.36	14.88	14.29	2.35	2.70	3.80
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	72	65	78	127	130	139
Liquid Holdup	Vol. Fraction	0.12	0.10		0.14		
Temperature Profiles	°C						
Reflux		70.5	71.1	74.3	73.4	72.6	72.0
Overhead Vapor		109.3	110.0	109.9	104.0	105.4	106.8
Distributor		89.9	95.9	93.8	84.7	84.8	84.7
Top Bed		108.8	109.7	109.7	102.5	104.2	105.8
Mid Bed		109.5	110.2	110.2	106.6	108.4	109.7
Below Bed		109.7	110.7	110.7	111.7	111.3	111.0
Composition of Liquid	Mol% C ₆						
Reflux		43.18	39.19	40.08	70.71	62.84	56.77
Distributor		42.64	38.90	39.98	71.20	63.11	56.90
Below Bed		28.15	27.07	26.86	18.13	20.15	21.20
Bottoms		27.66	26.74	26.78	17.14	19.74	20.76
Feed		34.69	35.34	34.73	22.26	26.21	29.68
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	28.15	27.07	26.86	18.13	20.15	21.20
Temperature	°C	109.7	110.7	110.7	111.7	111.3	111.0
Liquid Density	kg/m ³	620.8	619.0	618.8	611.2	613.1	614.2
Vapor Density	kg/m ³	5.464	5.541	5.554	5.897	5.790	5.712
Vapor Rate	kg/s	6.1	7.9	7.3	3.6	3.9	4.4
Liquid Rate	m ³ /h	17.0	17.2	17.8	19.6	20.1	21.1
Capacity Factor, Cs	m/s	0.090	0.118	0.108	0.052	0.056	0.065
L/V		0.48	0.37	0.42	0.93	0.89	0.82
OHP Flow	kg/s	3.13	4.97	4.24	0.27	0.44	0.80
Capacity Factor, Top	m/s	0.118	0.145	0.136	0.065	0.071	0.084
Capacity Factor, Mid	m/s	0.103	0.130	0.121	0.058	0.063	0.073

Table II (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **1.62 bar**

Run Number		23401	23412	23411	23410	23409	23408
Run Type		FL OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	2.09	1.57	1.75	1.92	1.39	1.48
Condenser Duty	MW	1.89	1.43	1.62	1.78	1.22	1.32
Reflux Rate	kg/s	1.96	2.47	2.61	2.75	2.97	2.93
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.48	3.78	3.78	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	17.05	6.20	9.22	18.84	5.04	6.17
Top	mbar/m	19.97	6.13	9.04	22.66	4.64	5.80
Bottom	mbar/m	13.19	5.47	8.42	13.98	4.49	5.61
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	112	151	165	184	185	191
Liquid Holdup	Vol. Fraction		0.16		0.13	0.22	0.19
Temperature Profiles	°C						
Reflux		72.9	73.1	75.5	77.8	71.3	67.8
Overhead Vapor		109.5	107.8	108.5	109.2	101.8	104.8
Distributor		90.0	85.3	86.7	88.3	80.5	80.3
Top Bed		109.8	107.1	107.6	109.4	100.3	103.4
Mid Bed		110.3	110.3	110.6	110.8	104.1	108.4
Below Bed		110.7	111.0	111.1	111.3	112.5	112.9
Composition of Liquid	Mol% C ₆						
Reflux		42.67	51.85	48.21	44.84	82.02	68.35
Distributor		42.72	51.62	48.58	44.69	80.92	68.37
Below Bed		26.34	22.40	22.58	25.45	13.48	13.33
Bottoms		26.01	22.11	22.68	23.54	10.86	12.80
Feed		33.10	32.54	34.19	35.35	15.01	19.08
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	26.34	22.40	22.58	25.45	13.48	13.33
Temperature	°C	110.7	111.0	111.1	111.3	112.5	112.9
Liquid Density	kg/m ³	618.3	615.1	615.1	617.1	607.1	606.5
Vapor Density	kg/m ³	5.582	5.668	5.661	5.662	6.060	6.006
Vapor Rate	kg/s	6.5	4.9	5.5	6.0	4.5	4.7
Liquid Rate	m ³ /h	20.8	22.1	23.2	24.2	25.5	26.1
Capacity Factor, Cs	m/s	0.097	0.073	0.081	0.089	0.064	0.068
L/V		0.55	0.76	0.72	0.69	0.96	0.93
OHP Flow	kg/s	2.95	1.17	1.53	1.89	0.16	0.33
Capacity Factor, Top	m/s	0.126	0.096	0.106	0.116	0.081	0.090
Capacity Factor, Mid	m/s	0.110	0.083	0.092	0.101	0.071	0.077

Table II (SI Units (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
C₆/C₇ System **1.62 bar**

Run Number		23407	23406	23405	23400		
Run Type		OHP	OHP	OHP	FL OHP		
Column Pressure:	bar	1.6	1.6	1.6	1.6		
Reboiler Duty	MW	1.57	1.75	1.78	1.91		
Condenser Duty	MW	1.43	1.58	1.63	1.73		
Reflux Rate	kg/s	2.97	3.11	2.99	2.75		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78		
Pressure Drops:							
Overall	mbar/m	7.61	15.51	15.69	18.34		
Top	mbar/m	7.19	17.41	17.68	21.98		
Bottom	mbar/m	7.09	12.77	12.86	13.75		
Dist. Pressure Drop	mbar						
Dist Bubbler	mm Hot Liq	199	223	212	182		
Liquid Holdup	Vol. Fraction	0.16	0.20	0.17			
Temperature Profiles	°C						
Reflux		68.1	71.1	71.1	72.0		
Overhead Vapor		105.8	107.3	107.9	109.2		
Distributor		80.7	82.9	83.6	85.3		
Top Bed		104.4	106.8	107.6	110.1		
Mid Bed		109.5	111.1	111.3	111.0		
Below Bed		112.5	111.8	111.9	111.4		
Composition of Liquid	Mol% C ₆						
Reflux		62.70	54.09	51.99	45.06		
Distributor		62.79	54.14	50.68	45.18		
Below Bed		15.60	19.90	20.64	23.48		
Bottoms		15.34	19.04	19.75	22.14		
Feed		23.13	28.34	29.85	33.10		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	15.60	19.90	20.64	23.48		
Temperature	°C	112.5	111.8	111.9	111.4		
Liquid Density	kg/m ³	608.6	612.4	612.8	615.5		
Vapor Density	kg/m ³	5.913	5.779	5.772	5.666		
Vapor Rate	kg/s	5.0	5.5	5.6	6.0		
Liquid Rate	m ³ /h	26.4	27.3	26.8	25.4		
Capacity Factor, Cs	m/s	0.072	0.081	0.082	0.088		
L/V		0.90	0.84	0.81	0.72		
OHP Flow	kg/s	0.52	0.88	1.06	1.66		
Capacity Factor, Top	m/s	0.097	0.108	0.110	0.119		
Capacity Factor, Mid	m/s	0.083	0.092	0.094	0.102		

Table II (SI Units (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 C₆/C₇ System **1.62 bar**

Run Number		23433	23432	23431	23430	23429	23404
Run Type		TF	TF	TF	TF	TF	FL TF
Column Pressure:	bar	1.6	1.6	1.6	1.6	1.6	1.6
Reboiler Duty	MW	0.70	0.88	1.05	1.22	1.39	1.53
Condenser Duty	MW	0.60	0.77	0.94	1.12	1.26	1.40
Reflux Rate	kg/s	1.57	1.96	2.39	2.90	3.33	3.41
Feed Location		TOP	TOP	TOP	TOP	TOP	TOP
Mass Feed Flow Rate	kg/s	3.59	2.91	2.23	1.59	0.79	1.43
Pressure Drops:							
Overall	mbar/m	1.80	2.43	3.25	4.40	6.20	16.95
Top	mbar/m	1.50	2.18	3.05	4.22	5.73	20.23
Bottom	mbar/m	1.12	1.71	2.48	3.61	5.70	12.77
Dist. Pressure Drop	mbar						0.42
Dist Bubbler	mm Hot Liq	460	413	387	371	318	364
Liquid Holdup	Vol. Fraction						0.24
Temperature Profiles	°C						
Reflux		97.8	93.4	89.4	86.9	81.0	78.6
Overhead Vapor		108.4	107.9	107.2	105.8	103.7	106.7
Distributor		99.2	95.6	92.5	90.3	85.5	84.0
Top Bed		107.8	107.3	106.5	105.1	102.7	106.1
Mid Bed		107.8	107.3	106.5	105.2	103.8	107.8
Below Bed		108.2	108.2	108.4	108.6	112.0	110.5
Composition of Liquid	Mol% C ₆						
Reflux		48.56	51.43	56.27	64.23	71.67	58.74
Distributor		36.07	38.36	43.28	50.96	66.72	48.33
Below Bed		35.03	35.06	34.80	32.76	16.60	26.04
Bottoms		30.00	29.07	27.20	25.94	12.87	21.55
Feed		30.21	28.69	26.38	22.09	26.74	21.04
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% C ₆	35.03	35.06	34.80	32.76	16.60	26.04
Temperature	°C	108.2	108.2	108.4	108.6	112.0	110.5
Liquid Density	kg/m ³	627.7	627.8	627.4	625.5	609.9	618.3
Vapor Density	kg/m ³	5.187	5.194	5.242	5.318	5.778	5.496
Vapor Rate	kg/s	2.1	2.7	3.2	3.8	4.5	4.8
Liquid Rate	m ³ /h	32.8	32.1	31.4	31.1	31.0	36.5
Capacity Factor, Cs	m/s	0.033	0.041	0.049	0.057	0.065	0.072
L/V		2.68	2.08	1.69	1.42	1.18	1.29
<i>Capacity Factor, Top</i>	m/s	0.031	0.041	0.052	0.063	0.075	0.086
<i>Capacity Factor, Mid</i>	m/s	0.032	0.041	0.050	0.060	0.070	0.078

Table III (SI Units)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System 1.0 bar

Run Number		23436	23437	23438	23439	23441	23440
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	0.33	0.33	0.50	0.50	0.66	0.66
Condenser Duty	MW	0.22	0.22	0.36	0.36	0.52	0.53
Reflux Rate	kg/s	0.55	0.57	0.90	0.90	1.27	1.27
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	0.90	0.90	1.15	1.15	1.59	1.60
Top	mbar/m	0.53	0.53	0.80	0.80	1.27	1.28
Bottom	mbar/m	0.27	0.27	0.50	0.50	0.90	0.91
Dist Bubbler	mm Hot Liq	30.9	30.9	38.8	38.8	52.2	52.6
Liquid Holdup	Vol. Fraction	0.06	0.06	0.07	0.07	0.08	0.08
Temperature Profiles	°C						
Reflux		104.0	103.6	102.4	102.1	96.6	96.9
Overhead Vapor		141.4	141.3	141.2	141.1	141.1	141.1
Distributor		133.5	133.5	129.5	129.5	124.3	124.4
Top Bed		141.0	140.9	140.1	140.1	139.9	140.0
Mid Bed		141.7	141.6	140.7	140.7	140.4	140.5
Below Bed		142.1	142.1	142.2	142.2	142.2	142.2
Composition of Liquid	Mol% p-xylene						
Reflux		69.18	69.18	72.67	73.51	74.30	74.27
Distributor		66.17	66.17	68.74	71.09	73.21	73.02
Below Bed		36.69	36.60	36.24	36.16	36.33	36.03
Bottoms		32.42	32.42	30.87	30.74	30.07	30.08
Feed		32.58	32.51	30.93	30.83	30.08	30.09
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	36.69	36.60	36.24	36.16	36.33	36.03
Temperature	°C	142.1	142.1	142.2	142.2	142.2	142.2
Liquid Density	kg/m ³	761.1	761.1	761.1	761.1	761.1	761.1
Vapor Density	kg/m ³	3.120	3.119	3.123	3.121	3.124	3.124
Vapor Rate	kg/s	0.873	0.873	1.367	1.366	1.851	1.855
Liquid Rate	m ³ /h	4.13	4.13	6.46	6.46	8.76	8.77
Capacity Factor, Cs	m/s	0.016	0.016	0.024	0.024	0.033	0.033
HETP 2pt	mm						
DIST & below bed		304	303	273	252	236	236
DIST & bottoms		295	295	256	237	218	219
Relative Volatility		1.163	1.163	1.163	1.163	1.163	1.163
Capacity Factor, Top	m/s	0.015	0.015	0.024	0.024	0.032	0.032
Capacity Factor, Mid	m/s	0.015	0.015	0.024	0.024	0.033	0.033

Table III (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System 1.0 bar

Run Number		23443	23442	23444	23445	23446	23447
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	0.74	0.74	0.91	0.91	1.07	1.07
Condenser Duty	MW	0.59	0.59	0.76	0.77	0.90	0.90
Reflux Rate	kg/s	1.38	1.40	1.74	1.73	2.01	2.02
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	1.84	1.85	2.58	2.59	3.42	3.41
Top	mbar/m	1.53	1.55	2.32	2.33	3.20	3.19
Bottom	mbar/m	1.13	1.14	1.84	1.85	2.64	2.63
Dist Bubbler	mm Hot Liq	60.7	61.0	80.7	80.8	97.9	97.7
Liquid Holdup	Vol. Fraction	0.08	0.08	0.09	0.09	0.10	0.10
Temperature Profiles	°C						
Reflux		92.6	92.7	87.4	87.4	84.6	84.5
Overhead Vapor		141.3	141.2	141.2	141.1	141.1	141.1
Distributor		121.0	120.9	115.4	115.4	112.0	112.0
Top Bed		140.1	140.0	140.0	140.0	140.0	140.0
Mid Bed		140.5	140.5	140.5	140.5	140.5	140.5
Below Bed		142.4	142.3	142.4	142.3	142.4	142.4
Composition of Liquid	Mol% p-xylene						
Reflux		74.37	74.35	74.57	74.58	74.37	74.38
Distributor		73.44	73.32	74.38	74.46	74.19	74.18
Below Bed		36.29	36.28	36.40	36.17	35.88	35.59
Bottoms		29.83	29.83	29.42	29.39	29.12	29.08
Feed		29.82	29.90	29.39	29.47	29.12	29.10
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	36.29	36.28	36.40	36.17	35.88	35.59
Temperature	°C	142.4	142.3	142.4	142.3	142.4	142.4
Liquid Density	kg/m ³	760.9	761.0	760.9	760.9	761.0	761.0
Vapor Density	kg/m ³	3.135	3.130	3.138	3.134	3.135	3.134
Vapor Rate	kg/s	2.083	2.085	2.572	2.577	3.024	3.024
Liquid Rate	m ³ /h	9.85	9.86	12.17	12.19	14.30	14.30
Capacity Factor, Cs	m/s	0.037	0.037	0.046	0.046	0.054	0.054
HETP 2pt	mm						
DIST & below bed		234	235	228	226	226	224
DIST & bottoms		215	216	207	206	206	206
Relative Volatility		1.163	1.163	1.163	1.163	1.163	1.163
Capacity Factor, Top	m/s	0.036	0.036	0.045	0.045	0.052	0.052
Capacity Factor, Mid	m/s	0.036	0.037	0.045	0.045	0.053	0.053

Table III (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System 1.0 bar

Run Number		23449	23448	23450	23451	23453	23452
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	1.24	1.24	1.40	1.40	1.48	1.48
Condenser Duty	MW	1.04	1.05	1.19	1.19	1.24	1.32
Reflux Rate	kg/s	2.34	2.35	2.67	2.66	2.79	2.87
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.77	3.78	3.78	3.77
Pressure Drops:							
Overall	mbar/m	4.61	4.64	6.42	6.45	7.68	8.15
Top	mbar/m	4.47	4.49	6.39	6.41	7.72	8.21
Bottom	mbar/m	3.76	3.78	5.47	5.49	6.64	7.08
Dist Bubbler	mm Hot Liq	117.4	118.1	139.7	139.5	150.0	155.8
Liquid Holdup	Vol. Fraction	0.11	0.11	0.12	0.12	0.14	0.14
Temperature Profiles	°C						
Reflux		82.1	82.3	80.3	80.4	79.2	80.7
Overhead Vapor		141.2	141.2	141.2	141.2	141.1	141.0
Distributor		108.4	108.4	106.1	106.2	105.2	105.9
Top Bed		140.0	140.0	140.0	140.0	139.8	139.8
Mid Bed		140.7	140.7	140.8	140.8	140.7	140.7
Below Bed		142.5	142.5	142.7	142.7	142.7	142.7
Composition of Liquid	Mol% p-xylene						
Reflux		74.05	73.88	74.45	74.52	75.48	75.46
Distributor		73.86	73.87	74.26	74.27	75.34	75.08
Below Bed		35.49	35.04	34.27	34.01	33.37	33.31
Bottoms		28.78	28.77	27.89	27.90	27.24	27.11
Feed		28.76	28.83	27.95	27.93	27.20	27.18
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	35.49	35.04	34.27	34.01	33.37	33.31
Temperature	°C	142.5	142.5	142.7	142.7	142.7	142.7
Liquid Density	kg/m ³	760.9	761.0	761.0	761.1	761.2	761.2
Vapor Density	kg/m ³	3.143	3.141	3.154	3.151	3.146	3.149
Vapor Rate	kg/s	3.502	3.506	3.978	3.978	4.206	4.248
Liquid Rate	m ³ /h	16.57	16.59	18.82	18.82	19.89	20.09
Capacity Factor, Cs	m/s	0.062	0.062	0.070	0.070	0.075	0.075
HETP 2pt	mm						
DIST & below bed		226	223	216	214	204	206
DIST & bottoms		206	206	199	199	190	190
Relative Volatility		1.163	1.163	1.163	1.163	1.163	1.163
Capacity Factor, Top	m/s	0.061	0.061	0.069	0.069	0.073	0.073
Capacity Factor, Mid	m/s	0.061	0.061	0.070	0.070	0.074	0.074

Table III (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System 1.0 bar

Run Number		23455	23454	23457	23456	23435	23434
Run Type		TR	TR	TR	TR	FT	FT
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	1.56	1.56	1.61	1.61	1.65	1.65
Condenser Duty	MW	1.32	1.31	1.34	1.35	1.51	1.50
Reflux Rate	kg/s	3.00	2.98	3.02	3.02	3.35	3.35
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.79	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	9.62	9.57	10.43	10.60	20.29	20.30
Top	mbar/m	9.77	9.71	10.64	10.81	24.07	24.07
Bottom	mbar/m	8.46	8.41	9.22	9.40	15.58	15.58
Dist Bubbler	mm Hot Liq	164.1	164.3	166.9	168.4	196.5	197.3
Liquid Holdup	Vol. Fraction	0.15	0.15	0.17	0.17	0.23	0.23
Temperature Profiles °C							
Reflux		80.4	80.2	78.6	79.0	87.1	87.5
Overhead Vapor		141.2	141.2	141.1	141.2	142.1	141.9
Distributor		105.6	105.5	104.8	104.9	107.8	108.1
Top Bed		139.9	139.9	139.9	139.9	141.1	141.0
Mid Bed		140.9	140.9	140.9	140.9	142.3	142.1
Below Bed		143.0	143.0	143.1	143.2	144.0	143.8
Composition of Liquid Mol% p-xylene							
Reflux		76.14	75.92	76.82	76.80	61.23	62.10
Distributor		75.84	75.87	76.47	76.59	61.21	52.95
Below Bed		32.86	32.52	32.52	32.33	37.73	38.10
Bottoms		26.70	26.75	26.35	26.34	32.00	31.56
Feed		26.68	26.76	26.35	26.35	31.87	31.62
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	32.86	32.52	32.52	32.33	37.73	38.10
Temperature	°C	143.0	143.0	143.1	143.2	144.0	143.8
Liquid Density	kg/m ³	759.0	761.1	761.0	760.9	758.9	759.0
Vapor Density	kg/m ³	3.259	3.165	3.176	3.180	3.265	3.259
Vapor Rate	kg/s	4.470	4.419	4.530	4.539	4.741	4.741
Liquid Rate	m ³ /h	21.20	20.90	21.43	21.47	22.49	22.49
Capacity Factor, Cs	m/s	0.078	0.078	0.080	0.080	0.083	0.083
HETP 2pt mm							
DIST & below bed		198	197	193	192	384	609
DIST & bottoms		183	184	180	179	347	495
Relative Volatility		1.162	1.163	1.162	1.162	1.16	1.16
Capacity Factor, Top	m/s	0.078	0.076	0.078	0.078	0.082	0.083
Capacity Factor, Mid	m/s	0.078	0.077	0.079	0.079	0.082	0.083

Table III (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **1.0 bar**

Run Number		23458	23459				
Run Type		FT	FT				
Column Pressure:	bar	1.0	1.0				
Reboiler Duty	MW	1.70	1.70				
Condenser Duty	MW	1.44	1.44				
Reflux Rate	kg/s	3.21	3.21				
Feed Location		Bottom	Bottom				
Mass Feed Flow Rate	kg/s	3.78	3.78				
Pressure Drops:							
Overall	mbar/m	20.63	20.84				
Top	mbar/m	24.73	25.04				
Bottom	mbar/m	15.55	15.65				
Dist Bubbler	mm Hot Liq	164.9	162.2				
Liquid Holdup	Vol. Fraction	0.22	0.22				
Temperature Profiles	°C						
Reflux		79.3	79.5				
Overhead Vapor		142.1	142.1				
Distributor		104.4	104.5				
Top Bed		141.0	141.1				
Mid Bed		142.2	142.4				
Below Bed		143.8	143.8				
Composition of Liquid	Mol% p-xylene						
Reflux		61.85	59.68				
Distributor		61.40	59.33				
Below Bed		36.14	36.18				
Bottoms		30.32	31.08				
Feed		29.82	30.53				
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	36.14	36.18				
Temperature	°C	143.8	143.8				
Liquid Density	kg/m³	759.5	759.5				
Vapor Density	kg/m³	3.244	3.243				
Vapor Rate	kg/s	4.800	4.803				
Liquid Rate	m³/h	22.75	22.77				
Capacity Factor, Cs	m/s	0.084	0.084				
HETP 2pt	mm						
DIST & below bed		355	389				
DIST & bottoms		321	359				
Relative Volatility		1.162	1.162				
Capacity Factor, Top	m/s	0.083	0.083				
Capacity Factor, Mid	m/s	0.083	0.084				

Table III (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System 1.0 bar

Run Number		23488	23489	23490	23491	23487	23486
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	0.83	1.16	1.50	1.66	1.24	1.41
Condenser Duty	MW	0.60	0.94	1.29	1.49	1.09	1.23
Reflux Rate	kg/s	0.94	0.66	0.45	0.43	1.65	1.47
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	7.56	7.56	7.56	7.56
Pressure Drops:							
Overall	mbar/m	1.78	2.75	3.97	4.87	3.86	4.53
Top	mbar/m	1.48	2.52	3.84	4.80	3.69	4.41
Bottom	mbar/m	1.09	2.00	3.13	3.96	3.06	3.68
Dist Bubbler	mm Hot Liq	44.6	36.7	32.6	31.9	75.2	66.6
Liquid Holdup	Vol. Fraction	0.07	0.07	0.07	0.07		0.09
Temperature Profiles	°C						
Reflux		85.3	76.7	76.3	78.5	82.8	81.6
Overhead Vapor		142.4	141.9	143.2	143.2	142.6	142.8
Distributor		126.1	129.1	135.0	135.7	114.3	115.7
Top Bed		141.2	140.7	142.0	142.1	141.5	141.7
Mid Bed		141.6	140.8	142.1	142.2	142.0	142.1
Below Bed		141.9	141.0	142.3	142.4	142.3	142.3
Composition of Liquid	Mol% p-xylene						
Reflux		49.66	45.02	43.53	43.09	49.54	46.71
Distributor		49.81	45.24	43.73	43.51	48.54	46.42
Below Bed		37.51	38.16	38.68	38.63	37.24	37.70
Bottoms		36.19	37.29	37.28	37.10	35.66	36.45
Feed		37.20	38.91	39.44	39.63	37.26	38.32
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	37.51	38.16	38.68	38.63	37.24	37.70
Temperature	°C	141.9	141.0	142.3	142.4	142.3	142.3
Liquid Density	kg/m³	761.1	761.9	760.4	760.3	760.7	760.6
Vapor Density	kg/m³	3.103	3.041	3.145	3.152	3.137	3.141
Vapor Rate	kg/s	2.428	3.413	4.401	4.889	3.634	4.128
Liquid Rate	m³/h	9.07	9.11	9.03	9.12	13.62	13.63
Capacity Factor, Cs	m/s	0.043	0.061	0.078	0.087	0.064	0.073
L/V		0.79	0.57	0.43	0.39	0.79	0.70
OHP Flow	kg/s	0.51	1.48	2.49	2.96	0.76	1.25
Capacity Factor, Top	m/s	0.043	0.060	0.077	0.085	0.064	0.072
Capacity Factor, Mid	m/s	0.043	0.061	0.077	0.086	0.064	0.073

Table III (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System 1.0 bar

Run Number		23485	23484	23492	23483	23482	23481
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	1.58	1.75	2.00	2.09	2.43	2.69
Condenser Duty	MW	1.42	1.60	1.80	1.92	2.26	2.51
Reflux Rate	kg/s	1.32	1.16	0.77	0.86	0.72	0.58
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.55	7.56	7.56	7.56	7.57	7.56
Pressure Drops:							
Overall	mbar/m	5.37	6.24	7.95	8.61	11.85	14.44
Top	mbar/m	5.32	6.28	8.13	8.87	12.42	15.19
Bottom	mbar/m	4.45	5.27	6.78	7.43	10.36	12.76
Dist Bubbler	mm Hot Liq	58.8	51.6	39.3	43.3	41.0	38.3
Liquid Holdup	Vol. Fraction	0.09	0.10	0.09	0.10	0.09	0.10
Temperature Profiles	°C						
Reflux		80.7	79.9	84.4	77.8	78.2	77.5
Overhead Vapor		142.9	142.9	143.2	143.0	143.1	143.1
Distributor		117.3	119.2	130.0	125.8	129.7	133.0
Top Bed		141.8	141.8	142.0	141.9	142.0	142.1
Mid Bed		142.1	142.1	142.3	142.3	142.5	142.6
Below Bed		142.4	142.4	142.7	142.7	143.0	143.3
Composition of Liquid	Mol% p-xylene						
Reflux		45.35	44.31	43.13	43.20	42.56	42.10
Distributor		45.39	44.36	43.45	43.33	42.81	42.90
Below Bed		38.02	38.19	38.30	38.38	38.24	38.10
Bottoms		36.62	36.83	36.68	36.73	36.56	36.53
Feed		38.87	39.28	39.77	39.82	40.18	40.45
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	38.02	38.19	38.30	38.38	38.24	38.10
Temperature	°C	142.4	142.4	142.7	142.7	143.0	143.3
Liquid Density	kg/m ³	760.5	760.4	760.1	760.1	759.8	759.6
Vapor Density	kg/m ³	3.145	3.152	3.172	3.171	3.195	3.214
Vapor Rate	kg/s	4.625	5.127	5.865	6.136	7.141	7.880
Liquid Rate	m ³ /h	13.50	13.45	11.67	13.21	13.57	13.60
Capacity Factor, Cs	m/s	0.082	0.091	0.104	0.108	0.126	0.138
L/V		0.62	0.55	0.42	0.45	0.40	0.36
OHP Flow	kg/s	1.77	2.29	3.40	3.35	4.28	5.01
<i>Capacity Factor, Top</i>	m/s	0.081	0.090	0.102	0.107	0.125	0.138
<i>Capacity Factor, Mid</i>	m/s	0.081	0.090	0.103	0.108	0.125	0.138

Table III (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
o/p xylene System 1.0 bar

Run Number		23467	23475	23476	23477	23478	23479
Run Type		FL OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	3.00	1.32	1.49	1.66	2.00	2.17
Condenser Duty	MW	2.78	1.13	1.29	1.43	1.80	1.98
Reflux Rate	kg/s	0.38	2.02	1.88	1.72	1.51	1.38
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	4.91	4.91	4.92	5.29	5.29
Pressure Drops:							
Overall	mbar/m	22.45	4.76	5.70	6.76	9.93	11.89
Top	mbar/m	25.76	4.65	5.64	6.80	10.23	12.36
Bottom	mbar/m	18.19	3.91	4.78	5.76	8.67	10.47
Dist Bubbler	mm Hot Liq	41.3	95.5	88.4	81.3	70.3	65.5
Liquid Holdup	Vol. Fraction	0.14	0.03	0.03	0.11	0.12	0.12
Temperature Profiles	°C						
Reflux		74.1	80.4	80.3	80.8	80.8	80.3
Overhead Vapor		143.2	142.2	142.7	142.9	143.0	143.0
Distributor		136.0	110.3	111.6	112.9	115.8	117.6
Top Bed		142.2	141.0	141.5	141.7	141.9	141.9
Mid Bed		143.1	141.7	142.2	142.2	142.3	142.4
Below Bed		144.0	142.5	142.6	142.6	142.8	143.0
Composition of Liquid	Mol% p-xylene						
Reflux		41.80	57.15	50.21	46.55	44.18	43.46
Distributor		41.99	57.17	52.98	46.92	45.77	44.08
Below Bed		37.95	34.53	35.16	36.83	37.32	37.95
Bottoms		36.34	32.22	33.96	34.96	35.49	35.42
Feed		40.89	34.85	37.45	38.79	39.84	40.25
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	37.95	34.53	35.16	36.83	37.32	37.95
Temperature	°C	144.0	142.5	142.6	142.6	142.8	143.0
Liquid Density	kg/m³	758.9	761.2	760.9	760.6	760.2	759.9
Vapor Density	kg/m³	3.270	3.136	3.146	3.155	3.176	3.193
Vapor Rate	kg/s	8.780	3.876	4.373	4.872	5.872	6.375
Liquid Rate	m³/h	13.50	15.95	15.95	15.93	15.97	15.97
Capacity Factor, Cs	m/s	0.153	0.069	0.077	0.086	0.104	0.112
L/V		0.32	0.87	0.77	0.69	0.57	0.53
OHP Flow	kg/s	5.94	0.50	1.00	1.51	2.50	3.00
Capacity Factor, Top	m/s	0.154	0.067	0.076	0.085	0.103	0.112
Capacity Factor, Mid	m/s	0.154	0.068	0.077	0.086	0.103	0.112

Table III (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System 1.0 bar

Run Number		23480	23463	23466	23462	23474	23473
Run Type		OHP	FL OHP	FL OHP	FL OHP	OHP	OHP
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	2.26	2.40	2.64	2.24	1.48	1.65
Condenser Duty	MW	2.07	2.14	2.40	1.99	1.28	1.43
Reflux Rate	kg/s	1.31	1.30	0.94	1.67	2.59	2.43
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	6.04	7.56	7.56	6.05	4.92	4.92
Pressure Drops:							
Overall	mbar/m	12.67	20.61	22.84	20.46	7.12	8.77
Top	mbar/m	13.20	23.73	26.52	23.72	7.14	8.91
Bottom	mbar/m	11.19	16.53	18.21	16.23	6.14	7.67
Dist Bubbler	mm Hot Liq	61.4	63.4	54.6	81.1	130.1	120.0
Liquid Holdup	Vol. Fraction	0.13	0.18	0.17	0.19	0.04	0.14
Temperature Profiles	°C						
Reflux		80.3	90.5	81.4	91.8	81.1	80.6
Overhead Vapor		143.0	143.1	143.1	143.0	142.1	142.5
Distributor		119.1	123.1	125.7	120.1	107.4	107.8
Top Bed		141.9	142.1	142.1	142.1	140.9	141.3
Mid Bed		142.4	142.9	143.0	142.9	141.7	142.1
Below Bed		143.1	143.8	144.0	143.8	142.8	142.9
Composition of Liquid	Mol% p-xylene						
Reflux		43.31	43.10	42.58	43.69	58.55	52.44
Distributor		43.84	43.67	42.78	44.49	58.70	52.60
Below Bed		37.71	37.77	38.01	37.36	34.68	35.20
Bottoms		35.84	36.34	40.43	35.61	31.93	33.29
Feed		40.19	39.97	36.53	39.98	33.96	36.64
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	37.71	37.77	38.01	37.36	34.68	35.20
Temperature	°C	143.1	143.8	144.0	143.8	142.8	142.9
Liquid Density	kg/m ³	759.9	759.1	758.9	759.2	760.9	760.6
Vapor Density	kg/m ³	3.196	3.251	3.268	3.249	3.158	3.169
Vapor Rate	kg/s	6.622	7.048	7.738	6.577	4.353	4.847
Liquid Rate	m ³ /h	15.86	15.50	15.19	16.86	19.23	19.29
Capacity Factor, Cs	m/s	0.117	0.123	0.135	0.115	0.077	0.086
L/V		0.51	0.46	0.41	0.54	0.93	0.84
OHP Flow	kg/s	3.27	3.78	4.53	3.02	0.29	0.77
Capacity Factor, Top	m/s	0.116	0.123	0.136	0.115	0.076	0.084
Capacity Factor, Mid	m/s	0.116	0.123	0.135	0.115	0.076	0.085

Table III (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **1.0 bar**

Run Number		23472	23471	23470	23461		
Run Type		OHP	OHP	OHP	FL OHP		
Column Pressure:	bar	1.0	1.0	1.0	1.0		
Reboiler Duty	MW	1.74	1.82	1.99	2.08		
Condenser Duty	MW	1.51	1.60	1.77	1.83		
Reflux Rate	kg/s	2.34	2.29	2.18	2.23		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	kg/s	5.29	5.29	5.30	4.54		
Pressure Drops:							
Overall	mbar/m	9.64	10.90	14.88	21.28		
Top	mbar/m	9.84	11.19	15.48	25.23		
Bottom	mbar/m	8.47	9.65	13.33	16.37		
Dist Bubbler	mm Hot Liq	114.2	110.1	102.8	109.0		
Liquid Holdup	Vol. Fraction	0.14	0.15	0.20	0.21		
Temperature Profiles	°C						
Reflux		80.3	80.6	80.3	90.2		
Overhead Vapor		142.7	142.7	142.9	142.8		
Distributor		108.1	108.7	109.6	114.7		
Top Bed		141.5	141.6	141.7	142.0		
Mid Bed		142.3	142.4	142.6	142.9		
Below Bed		142.9	143.0	143.3	143.7		
Composition of Liquid	Mol% p-xylene						
Reflux		49.99	48.30	46.75	45.04		
Distributor		50.22	48.53	47.01	46.82		
Below Bed		35.80	36.19	36.45	36.96		
Bottoms		34.11	34.53	34.67	34.34		
Feed		37.57	38.24	38.98	39.68		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	35.80	36.19	36.45	36.96		
Temperature	°C	142.9	143.0	143.3	143.7		
Liquid Density	kg/m³	760.5	760.3	759.9	759.4		
Vapor Density	kg/m³	3.175	3.184	3.210	3.244		
Vapor Rate	kg/s	5.094	5.338	5.833	6.092		
Liquid Rate	m³/h	19.29	19.28	19.31	19.21		
Capacity Factor, Cs	m/s	0.090	0.094	0.102	0.106		
L/V		0.80	0.76	0.70	0.67		
OHP Flow	kg/s	1.02	1.27	1.76	2.04		
Capacity Factor, Top	m/s	0.089	0.093	0.102	0.107		
Capacity Factor, Mid	m/s	0.089	0.094	0.102	0.107		

Table III (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System 1.0 bar

Run Number		23469	23468	23460			
Run Type		OHP	OHP	FL OHP			
Column Pressure:	bar	1.0	1.0	1.0			
Reboiler Duty	MW	1.68	1.78	1.85			
Condenser Duty	MW	1.48	1.57	1.61			
Reflux Rate	kg/s	2.89	2.77	2.75			
Feed Location		Bottom	Bottom	Bottom			
Mass Feed Flow Rate	kg/s	4.91	4.91	3.78			
Pressure Drops:							
Overall	mbar/m	11.88	14.23	19.75			
Top	mbar/m	12.19	14.73	22.73			
Bottom	mbar/m	10.62	12.79	15.81			
Dist Bubbler	mm Hot Liq	153.6	143.8	145.2			
Liquid Holdup	Vol. Fraction	0.18	0.21	0.22			
Temperature Profiles	°C						
Reflux		80.9	80.8	89.1			
Overhead Vapor		142.0	142.3	142.6			
Distributor		106.0	106.8	111.3			
Top Bed		140.8	141.1	141.6			
Mid Bed		141.9	142.3	142.7			
Below Bed		143.2	143.3	143.7			
Composition of Liquid	Mol% p-xylene						
Reflux		58.86	54.48	49.55			
Distributor		63.39	54.62	55.61			
Below Bed		33.73	34.33	35.50			
Bottoms		31.31	32.53	32.93			
Feed		34.04	36.13	37.71			
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	33.73	34.33	35.50			
Temperature	°C	143.2	143.3	143.7			
Liquid Density	kg/m ³	760.7	760.4	759.7			
Vapor Density	kg/m ³	3.183	3.199	3.235			
Vapor Rate	kg/s	4.935	5.228	5.433			
Liquid Rate	m ³ /h	21.57	21.36	21.09			
Capacity Factor, Cs	m/s	0.087	0.092	0.095			
L/V		0.92	0.86	0.82			
OHP Flow	kg/s	0.38	0.72	0.98			
<i>Capacity Factor, Top</i>	m/s	0.085	0.091	0.094			
<i>Capacity Factor, Mid</i>	m/s	0.086	0.092	0.095			

Table III (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **1.0 bar**

Run Number		23498	23497	23496	23495		
Run Type		TF	TF	TF	TF		
Column Pressure:	bar	1.0	1.0	1.0	1.0		
Reboiler Duty	MW	0.58	0.66	0.82	0.99		
Condenser Duty	MW	0.42	0.50	0.67	0.82		
Reflux Rate	kg/s	1.02	1.19	1.55	1.84		
Feed Location		TOP	TOP	TOP	TOP		
Mass Feed Flow Rate	kg/s	4.63	4.39	3.85	3.40		
Pressure Drops:							
Overall	mbar/m	1.55	1.83	2.58	3.58		
Top	mbar/m	1.21	1.51	2.28	3.33		
Bottom	mbar/m	0.90	1.16	1.89	2.84		
Dist Bubbler	mm Hot Liq	401.6	388.8	365.8	347.4		
Liquid Holdup	Vol. Fraction	0.04	0.04	0.04	0.13		
Temperature Profiles	°C						
Reflux		131.4	129.1	124.5	118.9		
Overhead Vapor		143.2	143.2	143.1	143.1		
Distributor		133.3	131.5	128.0	123.8		
Top Bed		142.0	142.0	141.9	141.9		
Mid Bed		142.1	142.1	142.1	142.1		
Below Bed		142.1	142.1	142.2	142.2		
Composition of Liquid	Mol% p-xylene						
Reflux		44.57	44.74	44.52	46.14		
Distributor		40.32	40.63	41.16	41.50		
Below Bed		40.35	40.61	40.87	41.00		
Bottoms		38.56	38.47	38.25	38.12		
Feed		38.55	38.44	38.24	37.87		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	40.35	40.61	40.87	41.00		
Temperature	°C	142.1	142.1	142.2	142.2		
Liquid Density	kg/m³	760.2	760.1	760.0	760.0		
Vapor Density	kg/m³	3.137	3.141	3.145	3.149		
Vapor Rate	kg/s	1.776	2.020	2.501	2.994		
Liquid Rate	m³/h	30.34	30.37	30.10	30.30		
Capacity Factor, Cs	m/s	0.032	0.036	0.044	0.053		
L/V		3.61	3.17	2.54	2.14		
Capacity Factor, Top	m/s	0.030	0.034	0.042	0.051		
Capacity Factor, Mid	m/s	0.030	0.034	0.043	0.051		

Table III (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System 1.0 bar

Run Number		23494	23493	23464	23499	23500	23501
Run Type		TF	TF	FL TF	TF	TF	TF
Column Pressure:	bar	1.0	1.0	1.0	1.0	1.0	1.0
Reboiler Duty	MW	1.23	1.40	1.51	0.50	0.66	0.82
Condenser Duty	MW	1.06	1.21	1.29	0.33	0.49	0.65
Reflux Rate	kg/s	2.37	2.73	2.97	0.86	1.22	1.54
Feed Location		TOP	TOP	TOP	TOP	TOP	TOP
Mass Feed Flow Rate	kg/s	2.68	2.16	1.82	6.53	6.06	5.60
Pressure Drops:							
Overall	mbar/m	6.08	9.65	20.02	1.35	1.91	2.72
Top	mbar/m	5.90	9.48	23.60	0.99	1.58	2.42
Bottom	mbar/m	5.25	8.82	15.49	0.72	1.25	2.04
Dist Bubbler	mm Hot Liq	323.2	316.3	291.8	606.1	603.1	556.3
Liquid Holdup	Vol. Fraction	0.15	0.18	0.26	0.13	0.13	0.14
Temperature Profiles	°C						
Reflux		111.5	106.2	104.4	135.4	132.9	129.2
Overhead Vapor		143.0	142.8	142.6	143.3	143.2	143.2
Distributor		118.4	114.7	113.8	135.9	133.9	131.0
Top Bed		141.8	141.7	141.6	142.1	142.0	142.0
Mid Bed		142.1	142.1	142.5	142.1	142.1	142.1
Below Bed		142.4	142.7	143.5	142.1	142.2	142.2
Composition of Liquid	Mol% p-xylene						
Reflux		47.89	49.45	49.86	44.19	44.27	44.63
Distributor		42.84	44.44	45.04	40.06	40.19	40.37
Below Bed		41.26	40.93	40.01	40.17	40.36	40.53
Bottoms		37.78	37.05	36.04	38.74	38.62	38.51
Feed		37.12	36.65	35.94	38.73	38.60	38.45
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	41.26	40.93	40.01	40.17	40.36	40.53
Temperature	°C	142.4	142.7	143.5	142.1	142.2	142.2
Liquid Density	kg/m ³	759.7	759.5	758.9	760.3	760.2	760.1
Vapor Density	kg/m ³	3.166	3.186	3.239	3.137	3.141	3.146
Vapor Rate	kg/s	3.726	4.223	4.580	1.537	2.008	2.491
Liquid Rate	m ³ /h	30.36	30.24	30.38	38.21	38.21	38.32
Capacity Factor, Cs	m/s	0.066	0.074	0.080	0.027	0.036	0.044
L/V		1.72	1.51	1.40	5.25	4.02	3.25
Capacity Factor, Top	m/s	0.063	0.072	0.078	0.025	0.034	0.042
Capacity Factor, Mid	m/s	0.064	0.072	0.078	0.026	0.034	0.043

Table III (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 o/p xylene System **1.0 bar**

Run Number		23502	23503	23504	23465		
Run Type		TF	TF	TF	FL TF		
Column Pressure:	bar	1.0	1.0	1.0	1.0		
Reboiler Duty	MW	0.99	1.15	1.31	1.42		
Condenser Duty	MW	0.80	0.96	1.12	1.18		
Reflux Rate	kg/s	1.87	2.20	2.55	2.63		
Feed Location		TOP	TOP	TOP	TOP		
Mass Feed Flow Rate	kg/s	5.12	4.64	4.17	3.93		
Pressure Drops:							
Overall	mbar/m	3.86	5.67	9.47	21.82		
Top	mbar/m	3.59	5.43	9.14	27.21		
Bottom	mbar/m	3.15	4.92	8.80	15.47		
Dist Bubbler	mm Hot Liq	519.1	493.3	472.6	453.1		
Liquid Holdup	Vol. Fraction	0.14	0.31	0.19	0.29		
Temperature Profiles	°C						
Reflux		125.3	121.5	118.1	114.4		
Overhead Vapor		143.1	143.1	143.1	143.0		
Distributor		127.8	124.8	122.3	119.3		
Top Bed		142.0	141.9	141.9	141.9		
Mid Bed		142.1	142.2	142.3	142.9		
Below Bed		142.3	142.5	142.8	143.7		
Composition of Liquid	Mol% p-xylene						
Reflux		45.02	45.50	46.01	46.01		
Distributor		40.60	40.95	41.32	43.18		
Below Bed		40.69	40.90	40.87	40.75		
Bottoms		38.29	38.05	37.77	37.59		
Feed		38.29	38.06	37.76	37.58		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% p-xylene	40.69	40.90	40.87	40.75		
Temperature	°C	142.3	142.5	142.8	143.7		
Liquid Density	kg/m³	760.0	759.7	759.5	758.5		
Vapor Density	kg/m³	3.153	3.166	3.189	3.264		
Vapor Rate	kg/s	2.974	3.451	3.938	4.329		
Liquid Rate	m³/h	38.36	38.35	38.44	39.21		
Capacity Factor, Cs	m/s	0.053	0.061	0.069	0.075		
L/V		2.72	2.35	2.06	1.91		
Capacity Factor, Top	m/s	0.051	0.059	0.068	0.073		
Capacity Factor, Mid	m/s	0.051	0.059	0.068	0.073		

Table IV (SI Units)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System **11.4 bar**

Run Number		23507	23508	23510	23509	23512	23511
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	11.4	11.4	11.4	11.4	11.3	11.4
Reboiler Duty	MW	0.74	0.74	0.92	0.92	1.10	1.10
Condenser Duty	MW	0.65	0.65	0.81	0.81	1.01	1.01
Reflux Rate	kg/s	2.00	2.01	2.52	2.52	3.13	3.15
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	3.78	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	1.16	1.16	1.35	1.35	1.65	1.66
Top	mbar/m	0.84	0.85	1.05	1.05	1.36	1.37
Bottom	mbar/m	0.49	0.49	0.68	0.69	0.97	0.98
Dist Bubbler	mm Hot Liq	62	63	102	102	159	160
Liquid Holdup	Vol. Fraction	0.08	0.08	0.09	0.09	0.09	0.09
Temperature Profiles	°C						
Reflux		48.5	48.7	49.6	49.4	50.5	50.6
Overhead Vapor		72.7	72.7	72.9	72.8	73.0	73.0
Distributor		56.4	56.5	56.0	55.9	55.8	55.8
Top Bed		73.1	73.1	73.1	73.1	73.1	73.2
Mid Bed		74.6	74.5	74.7	74.7	74.6	74.7
Below Bed		80.4	80.4	80.4	80.4	80.4	80.5
Composition of Liquid	Mol% iC ₄						
Reflux		83.66	82.35	84.07	82.30	82.93	82.88
Distributor		83.59	82.66	83.16	83.06	83.08	82.47
Below Bed		34.64	34.97	33.93	33.55	34.24	34.04
Bottoms		28.25	28.03	27.02	26.90	27.11	27.69
Feed		27.64	28.37	27.23	28.04	27.91	27.69
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	34.64	34.97	33.93	33.55	34.24	34.04
Temperature	°C	80.4	80.4	80.4	80.4	80.4	80.5
Liquid Density	kg/m ³	488.2	488.0	488.4	488.5	488.3	488.3
Vapor Density	kg/m ³	28.523	28.586	28.477	28.436	28.500	28.508
Vapor Rate	kg/s	2.587	2.597	3.267	3.268	3.931	3.940
Liquid Rate	m ³ /h	19.08	19.15	24.08	24.08	28.98	29.05
Capacity Factor, Cs	m/s	0.020	0.020	0.025	0.025	0.030	0.030
HETP 2pt	mm						
DIST & below bed		201	203	202	200	209	210
DIST & bottoms		194	196	194	194	200	203
Relative Volatility		1.232	1.232	1.232	1.232	1.232	1.232
Capacity Factor, Top	m/s	0.020	0.020	0.025	0.025	0.030	0.030
Capacity Factor, Mid	m/s	0.020	0.020	0.025	0.025	0.030	0.030

Table IV (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 11.4 bar

Run Number		23513	23514	23516	23515	23517	23518
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	11.4	11.4	11.4	11.4	11.4	11.4
Reboiler Duty	MW	1.19	1.19	1.38	1.38	1.65	1.65
Condenser Duty	MW	1.08	1.08	1.22	1.24	1.53	1.52
Reflux Rate	kg/s	3.41	3.39	3.83	3.87	4.69	4.69
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.79	3.78	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	1.83	1.82	2.19	2.22	3.43	3.43
Top	mbar/m	1.56	1.52	1.92	1.95	3.24	3.25
Bottom	mbar/m	1.14	1.13	1.49	1.52	2.66	2.68
Dist Bubbler	mm Hot Liq	185	182	233	237	328	329
Liquid Holdup	Vol. Fraction	0.10	0.10	0.11	0.11	0.13	0.13
Temperature Profiles							
Reflux	°C	51.3	51.4	51.8	51.8	51.0	51.0
Overhead Vapor		73.1	73.1	73.2	73.2	73.3	73.3
Distributor		56.0	56.1	56.0	55.9	54.5	54.5
Top Bed		73.2	73.2	73.2	73.2	73.2	73.2
Mid Bed		74.7	74.7	74.8	74.7	74.8	74.8
Below Bed		80.6	80.6	80.7	80.7	80.9	80.9
Composition of Liquid							
Reflux	Mol% iC ₄	82.65	82.56	82.22	81.92	81.46	80.98
Distributor		81.28	82.68	82.17	82.10	81.21	81.21
Below Bed		33.88	32.06	31.39	31.10	29.26	30.27
Bottoms		26.69	27.37	25.01	24.95	24.12	24.02
Feed		27.57	27.02	25.16	25.27	24.24	24.19
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	33.88	32.06	31.39	31.10	29.26	30.27
Temperature	°C	80.6	80.6	80.7	80.7	80.9	80.9
Liquid Density	kg/m ³	488.2	488.8	488.7	488.9	489.2	488.9
Vapor Density	kg/m ³	28.546	28.376	28.403	28.355	28.288	28.385
Vapor Rate	kg/s	4.258	4.250	4.883	4.887	5.868	5.879
Liquid Rate	m ³ /h	31.39	31.30	35.97	35.99	43.19	43.29
Capacity Factor, Cs	m/s	0.032	0.032	0.037	0.037	0.044	0.044
HETP 2pt	mm						
DIST & below bed		216	205	206	206	204	210
DIST & bottoms		204	204	198	198	200	201
Relative Volatility		1.232	1.232	1.232	1.232	1.232	1.232
Capacity Factor, Top	m/s	0.033	0.033	0.038	0.038	0.046	0.046
Capacity Factor, Mid	m/s	0.033	0.033	0.037	0.037	0.045	0.045

Table IV (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System 11.4 bar

Run Number		23595	23594	23520	23519	23522	23521
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	11.4	11.4	11.4	11.4	11.4	11.4
Reboiler Duty	MW	1.73	1.73	1.93	1.93	2.11	2.11
Condenser Duty	MW	1.57	1.58	1.82	1.81	1.91	1.90
Reflux Rate	kg/s	4.69	4.70	5.52	5.51	5.92	5.90
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	3.79	3.77	3.78	3.78
Pressure Drops:							
Overall	mbar/m	3.92	3.95	6.20	6.16	9.17	9.05
Top	mbar/m	3.76	3.79	6.28	6.23	9.60	9.44
Bottom	mbar/m	3.12	3.15	5.16	5.12	7.77	7.68
Dist Bubbler	mm Hot Liq	322	324	433	431	495	492
Liquid Holdup	Vol. Fraction	0.14	0.14	0.18	0.18	0.26	0.26
Temperature Profiles	°C						
Reflux		44.5	44.4	49.2	49.2	49.3	49.2
Overhead Vapor		74.4	74.4	73.4	73.3	73.5	73.5
Distributor		49.5	49.4	52.5	52.5	52.3	52.2
Top Bed		74.0	74.0	73.1	73.0	73.3	73.3
Mid Bed		75.6	75.6	75.2	75.2	76.4	76.3
Below Bed		81.7	81.8	81.4	81.3	81.7	81.7
Composition of Liquid	Mol% iC ₄						
Reflux		77.08	77.05	80.04	81.84	80.46	80.53
Distributor		76.71	76.64	79.82	80.16	80.38	80.18
Below Bed		22.09	22.24	27.47	27.56	24.76	24.50
Bottoms		17.86	17.90	23.07	22.77	20.63	20.58
Feed		17.96	17.91	22.16	24.77	20.67	20.55
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	22.09	22.24	27.47	27.56	24.76	24.50
Temperature	°C	81.7	81.8	81.4	81.3	81.7	81.7
Liquid Density	kg/m ³	490.2	490.1	489.0	489.1	489.3	489.4
Vapor Density	kg/m ³	28.098	28.135	28.412	28.365	28.350	28.324
Vapor Rate	kg/s	6.097	6.109	6.856	6.853	7.493	7.490
Liquid Rate	m ³ /h	44.78	44.88	50.48	50.44	55.12	55.10
Capacity Factor, Cs	m/s	0.046	0.046	0.052	0.052	0.057	0.057
HETP 2pt	mm						
DIST & below bed		204	205	195	196	193	192
DIST & bottoms		200	200	193	192	191	191
Relative Volatility		1.233	1.232	1.232	1.232	1.232	1.232
Capacity Factor, Top	m/s	0.047	0.047	0.053	0.053	0.058	0.058
Capacity Factor, Mid	m/s	0.047	0.047	0.053	0.053	0.057	0.057

Table IV (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
iC₄/nC₄ System 11.4 bar

Run Number		23596	23597	23524	23523	23526	23525
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	11.4	11.4	11.4	11.4	11.4	11.4
Reboiler Duty	MW	2.16	2.16	2.21	2.21	2.27	2.27
Condenser Duty	MW	2.03	2.05	2.01	2.00	2.08	2.07
Reflux Rate	kg/s	5.79	5.81	6.26	6.26	6.55	6.53
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.57	7.56	3.78	3.78	5.67	5.68
Pressure Drops:							
Overall	mbar/m	14.53	14.55	15.21	15.21	16.20	16.36
Top	mbar/m	17.99	18.06	19.30	19.29	20.18	20.40
Bottom	mbar/m	10.12	10.10	10.15	10.17	11.30	11.42
Dist Bubbler	mm Hot Liq	458	459	548	547	601	609
Liquid Holdup	Vol. Fraction	0.15	0.15	0.30	0.30	0.35	0.35
Temperature Profiles	°C						
Reflux		46.6	46.9	55.5	55.4	58.0	57.7
Overhead Vapor		76.7	77.0	76.9	76.9	77.4	77.4
Distributor		50.9	51.1	57.9	57.8	60.0	59.7
Top Bed		76.3	76.4	75.8	75.7	76.9	76.3
Mid Bed		77.6	77.6	77.5	77.5	77.7	77.3
Below Bed		81.0	80.8	79.7	79.7	79.4	79.4
Composition of Liquid	Mol% iC ₄						
Reflux		60.60	60.40	57.93	57.65	54.62	56.34
Distributor		60.39	60.32	57.95	57.54	54.45	56.10
Below Bed		28.67	28.65	39.03	37.44	40.55	40.35
Bottoms		26.59	26.97	34.59	34.83	36.74	34.18
Feed		25.77	27.82	34.56	34.95	36.62	35.34
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	28.67	28.65	39.03	37.44	40.55	40.35
Temperature	°C	81.0	80.8	79.7	79.7	79.4	79.4
Liquid Density	kg/m ³	489.2	489.5	488.0	488.5	487.9	488.0
Vapor Density	kg/m ³	28.288	28.172	28.522	28.334	28.511	28.457
Vapor Rate	kg/s	7.649	7.663	7.914	7.896	8.112	8.107
Liquid Rate	m ³ /h	56.29	56.36	58.38	58.19	59.85	59.80
Capacity Factor, Cs	m/s	0.058	0.058	0.060	0.060	0.061	0.061
HETP 2pt	mm						
DIST & below bed		374	375	623	587	838	759
DIST & bottoms		405	413	637	661	888	717
Relative Volatility		1.232	1.233	1.232	1.233	1.233	1.233
Capacity Factor, Top	m/s	0.059	0.059	0.060	0.060	0.062	0.062
Capacity Factor, Mid	m/s	0.058	0.059	0.060	0.060	0.062	0.062

Table IV (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System **11.4 bar**

Run Number		23505	23506	23528	23527		
Run Type		FT	FT	FT	FT		
Column Pressure:	bar	11.4	11.4	11.4	11.4		
Reboiler Duty	MW	2.30	2.30	2.32	2.32		
Condenser Duty	MW	2.16	2.16	2.14	2.13		
Reflux Rate	kg/s	6.72	6.73	6.68	6.68		
Feed Location		Bottom	Bottom	Bottom	Bottom		
Mass Feed Flow Rate	kg/s	7.56	7.57	5.67	5.67		
Pressure Drops:							
Overall	mbar/m	17.35	17.24	16.26	17.11		
Top	mbar/m	22.14	21.93	20.28	21.78		
Bottom	mbar/m	11.64	11.61	11.29	11.51		
Dist Bubbler	mm Hot Liq	639	641	620	622		
Liquid Holdup	Vol. Fraction	0.42	0.42	0.34	0.34		
Temperature Profiles	°C						
Reflux		58.4	58.6	57.5	57.7		
Overhead Vapor		77.2	77.2	77.6	77.7		
Distributor		60.2	60.5	59.5	59.7		
Top Bed		76.2	76.2	77.3	77.1		
Mid Bed		77.0	77.0	77.7	77.4		
Below Bed		78.9	79.0	79.4	79.3		
Composition of Liquid	Mol% iC ₄						
Reflux		56.10	56.05	53.81	53.70		
Distributor		54.48	55.91	53.61	53.09		
Below Bed		44.20	44.38	41.49	41.69		
Bottoms		40.19	39.86	37.46	37.25		
Feed		40.22	40.18	37.31	37.07		
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	44.20	44.38	41.49	41.69		
Temperature	°C	78.9	79.0	79.4	79.3		
Liquid Density	kg/m ³	487.6	487.4	487.6	487.8		
Vapor Density	kg/m ³	28.549	28.600	28.603	28.536		
Vapor Rate	kg/s	8.231	8.254	8.324	8.322		
Liquid Rate	m ³ /h	60.77	60.96	61.45	61.42		
Capacity Factor, Cs	m/s	0.062	0.062	0.063	0.063		
HETP 2pt	mm						
DIST & below bed		1107	974	953	1016		
DIST & bottoms		1226	1021	1014	1037		
Relative Volatility		1.233	1.233	1.232	1.233		
Capacity Factor, Top	m/s	0.063	0.063	0.063	0.063		
Capacity Factor, Mid	m/s	0.062	0.063	0.063	0.063		

Table IV (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
iC₄/nC₄ System **11.4 bar**

Run Number		23581	23582	23583	23584	23586	23587
Run Type		OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	bar	11.4	11.4	11.4	11.4	11.4	11.4
Reboiler Duty	MW	1.29	1.47	1.84	2.21	2.77	3.15
Condenser Duty	MW	1.18	1.36	1.74	2.09	2.61	2.98
Reflux Rate	kg/s	1.92	1.89	1.77	1.60	1.22	1.01
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.57	7.56	7.56	7.56	9.07	9.82
Pressure Drops:							
Overall	mbar/m	1.49	1.68	2.14	2.73	3.86	4.93
Top	mbar/m	1.14	1.35	1.84	2.46	3.67	4.83
Bottom	mbar/m	0.88	1.06	1.49	2.04	3.07	4.06
Dist Bubbler	mm Hot Liq	61	56	46	35	16	7
Liquid Holdup	Vol. Fraction	0.08	0.08	0.08	0.08	0.08	
Temperature Profiles °C							
Reflux		48.2	51.7	53.9	56.0	55.0	54.5
Overhead Vapor		78.4	78.8	79.1	79.3	79.4	79.5
Distributor		58.9	61.3	63.1	64.9	66.1	67.2
Top Bed		78.7	78.9	79.1	79.2	79.1	79.1
Mid Bed		79.5	79.3	79.2	79.2	79.1	79.1
Below Bed		79.6	79.4	79.3	79.3	79.1	79.1
Composition of Liquid Mol% iC ₄							
Reflux		50.47	48.54	46.79	46.43	45.71	45.42
Distributor		50.16	48.82	47.14	46.17	45.58	45.36
Below Bed		37.04	38.60	39.05	39.05	39.47	39.56
Bottoms		37.20	37.79	38.27	38.33	38.56	38.53
Feed		39.99	41.29	42.49	43.59	44.08	44.31
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	37.04	38.60	39.05	39.05	39.47	39.56
Temperature	°C	79.6	79.4	79.3	79.3	79.1	79.1
Liquid Density	kg/m ³	488.7	488.5	488.6	488.7	488.8	488.8
Vapor Density	kg/m ³	28.260	28.297	28.257	28.240	28.186	28.181
Vapor Rate	kg/s	4.605	5.277	6.615	7.964	9.988	11.336
Liquid Rate	m ³ /h	22.79	23.01	23.44	23.36	23.27	23.40
Capacity Factor, Cs	m/s	0.035	0.040	0.050	0.060	0.076	0.086
L/V		0.67	0.59	0.48	0.40	0.32	0.28
OHP Flow	kg/s	1.51	2.15	3.43	4.79	6.83	8.16
Capacity Factor, Top	m/s	0.035	0.040	0.050	0.060	0.076	0.086
Capacity Factor, Mid	m/s	0.035	0.040	0.050	0.060	0.076	0.086

Table IV (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System **11.4 bar**

Run Number		23568	23593	23592	23591	23585	23590
Run Type		FL OHP	OHP	OHP	OHP	OHP	OHP
Column Pressure:	bar	11.4	11.3	11.4	11.4	11.4	11.4
Reboiler Duty	MW	4.06	1.37	1.84	2.31	2.58	2.68
Condenser Duty	MW	3.87	1.22	1.67	2.13	2.44	2.48
Reflux Rate	kg/s	0.91	2.91	2.53	2.20	1.92	2.03
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	15.12	7.55	9.82	9.82	7.56	9.83
Pressure Drops:							
Overall	mbar/m	13.04	1.88	2.42	3.19	4.06	4.23
Top	mbar/m	15.52	1.55	2.11	2.93	3.86	4.04
Bottom	mbar/m	9.58	1.24	1.76	2.49	3.29	3.46
Dist Bubbler	mm Hot Liq	9	149	114	84	51	70
Liquid Holdup	Vol. Fraction	0.18	0.10	0.10	0.10	0.10	0.11
Temperature Profiles	°C						
Reflux		57.4	43.9	44.7	45.5	57.0	48.0
Overhead Vapor		79.5	77.1	78.5	79.0	79.5	79.2
Distributor		69.5	53.0	54.9	56.6	64.6	58.8
Top Bed		79.0	77.3	78.7	78.9	79.3	79.0
Mid Bed		79.1	79.0	79.4	79.2	79.4	79.2
Below Bed		79.2	80.4	79.5	79.3	79.4	79.2
Composition of Liquid	Mol% iC ₄						
Reflux		45.76	57.68	49.48	47.31	46.00	46.81
Distributor		45.46	58.02	49.41	47.56	45.93	46.67
Below Bed		40.32	32.38	37.45	38.75	38.92	39.07
Bottoms		39.13	31.94	37.26	38.26	38.06	38.51
Feed		44.24	34.38	40.23	42.23	44.15	43.07
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	40.32	32.38	37.45	38.75	38.92	39.07
Temperature	°C	79.2	80.4	79.5	79.3	79.4	79.2
Liquid Density	kg/m ³	488.4	489.0	488.7	488.7	488.5	488.7
Vapor Density	kg/m ³	28.303	28.278	28.260	28.229	28.312	28.212
Vapor Rate	kg/s	14.635	4.907	6.587	8.272	9.298	9.625
Liquid Rate	m ³ /h	24.24	31.64	32.01	32.14	27.12	32.26
Capacity Factor, Cs	m/s	0.111	0.037	0.050	0.063	0.070	0.073
L/V		0.2	0.88	0.66	0.53	0.40	0.45
OHP Flow	kg/s	11.3	0.61	2.24	3.91	5.62	5.25
Capacity Factor, Top	m/s	0.110	0.038	0.050	0.063	0.070	0.073
Capacity Factor, Mid	m/s	0.111	0.037	0.050	0.063	0.070	0.073

Table IV (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
iC₄/nC₄ System **11.4 bar**

Run Number		23589	23588	23567	23580	23579	23578
Run Type		OHP	OHP	FL OHP	OHP	OHP	OHP
Column Pressure:	bar	11.4	11.4	11.4	11.4	11.4	11.4
Reboiler Duty	MW	2.96	3.23	3.74	1.83	2.30	2.49
Condenser Duty	MW	2.75	3.04	3.56	1.70	2.14	2.31
Reflux Rate	kg/s	1.96	1.99	2.18	3.59	3.25	3.20
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	9.83	9.83	11.34	7.56	7.57	7.57
Pressure Drops:							
Overall	mbar/m	5.44	7.60	15.16	3.13	4.44	5.28
Top	mbar/m	5.33	7.63	17.84	2.85	4.20	5.13
Bottom	mbar/m	4.58	6.60	11.50	2.44	3.70	4.47
Dist Bubbler	mm Hot Liq	62	61	79	209	176	169
Liquid Holdup	Vol. Fraction	0.12	0.15	0.26	0.11	0.13	0.14
Temperature Profiles	°C						
Reflux		50.4	53.6	60.0	46.7	48.1	49.6
Overhead Vapor		79.4	79.4	79.4	77.8	78.7	79.0
Distributor		60.6	62.4	66.0	53.8	55.7	56.9
Top Bed		79.2	79.1	79.1	77.7	78.7	78.8
Mid Bed		79.3	79.2	79.2	79.4	79.5	79.5
Below Bed		79.3	79.3	79.3	80.2	79.7	79.6
Composition of Liquid	Mol% iC ₄						
Reflux		46.34	46.00	45.54	54.51	48.47	48.34
Distributor		46.26	45.91	45.81	54.42	48.37	48.10
Below Bed		39.29	38.98	39.41	33.97	27.79	37.85
Bottoms		38.49	38.31	38.36	33.61	36.63	37.02
Feed		43.64	44.12	44.32	37.57	41.85	42.66
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	39.29	38.98	39.41	33.97	27.79	37.85
Temperature	°C	79.3	79.3	79.3	80.2	79.7	79.6
Liquid Density	kg/m ³	488.5	488.7	488.5	488.8	491.7	488.4
Vapor Density	kg/m ³	28.294	28.229	28.312	28.314	27.356	28.357
Vapor Rate	kg/s	10.639	11.631	13.451	6.552	8.138	8.919
Liquid Rate	m ³ /h	32.34	32.38	32.27	38.63	37.89	39.05
Capacity Factor, Cs	m/s	0.081	0.088	0.102	0.050	0.062	0.068
L/V		0.41	0.38	0.33	0.80	0.64	0.59
OHP Flow	kg/s	6.25	7.23	9.07	1.31	2.96	3.62
Capacity Factor, Top	m/s	0.081	0.088	0.102	0.050	0.063	0.068
Capacity Factor, Mid	m/s	0.081	0.088	0.102	0.050	0.063	0.068

Table IV (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System **11.4 bar**

Run Number		23577	23576	23566	23571	23572	23573
Run Type		OHP	OHP	FL OHP	OHP	OHP	OHP
Column Pressure:	bar	11.4	11.4	11.4	11.4	11.4	11.4
Reboiler Duty	MW	2.76	2.95	3.14	1.92	2.11	2.29
Condenser Duty	MW	2.60	2.78	2.97	1.77	1.94	2.15
Reflux Rate	kg/s	3.18	3.17	3.09	4.45	4.49	4.54
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	11.34	3.78	3.78	3.78
Pressure Drops:							
Overall	mbar/m	7.28	9.78	14.91	4.29	5.28	6.57
Top	mbar/m	7.29	9.90	18.49	4.11	5.15	6.51
Bottom	mbar/m	6.32	8.70	10.37	3.49	4.44	5.67
Dist Bubbler	mm Hot Liq	163	161	162	295	300	305
Liquid Holdup	Vol. Fraction	0.17	0.22	0.24	0.14	0.15	0.17
Temperature Profiles	°C						
Reflux		52.9	54.9	57.2	48.3	51.6	56.4
Overhead Vapor		79.2	79.3	79.1	77.2	78.0	78.7
Distributor		59.3	60.8	62.6	53.4	56.2	60.0
Top Bed		79.0	79.2	79.0	76.8	77.6	78.4
Mid Bed		79.5	79.5	79.2	79.0	79.7	80.0
Below Bed		79.4	79.6	79.4	81.2	80.7	80.4
Composition of Liquid	Mol% iC ₄						
Reflux		47.39	46.90	47.18	60.50	55.20	51.08
Distributor		47.34	46.98	47.07	60.42	54.78	50.69
Below Bed		48.11	38.15	38.84	29.01	31.43	33.59
Bottoms		37.28	37.52	38.49	27.70	29.97	32.74
Feed		43.67	44.27	43.37	34.84	39.62	43.10
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	48.11	38.15	38.84	29.01	31.43	33.59
Temperature	°C	79.4	79.6	79.4	81.2	80.7	80.4
Liquid Density	kg/m ³	485.5	488.4	488.6	488.8	488.7	488.6
Vapor Density	kg/m ³	29.318	28.365	28.288	28.455	28.408	28.418
Vapor Rate	kg/s	10.04	10.59	11.29	6.85	7.52	8.19
Liquid Rate	m ³ /h	40.11	39.09	38.65	44.88	45.40	45.41
Capacity Factor, Cs	m/s	0.075	0.080	0.086	0.052	0.057	0.062
L/V		0.54	0.50	0.46	0.89	0.82	0.75
OHP Flow	kg/s	4.63	5.28	6.05	0.76	1.36	2.03
Capacity Factor, Top	m/s	0.075	0.080	0.086	0.053	0.058	0.063
Capacity Factor, Mid	m/s	0.075	0.080	0.086	0.052	0.057	0.062

Table IV (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
iC₄/nC₄ System **11.4 bar**

Run Number		23574	23575	23565	23570	23569	23564
Run Type		OHP	OHP	FL OHP	OHP	OHP	FL OHP
Column Pressure:	bar	11.4	11.4	11.4	11.4	11.4	11.4
Reboiler Duty	MW	2.38	2.57	2.83	2.10	2.29	2.42
Condenser Duty	MW	2.24	2.41	2.67	1.96	2.14	2.25
Reflux Rate	kg/s	4.55	4.37	4.39	5.16	5.24	5.26
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	7.56	3.78	3.78	7.56
Pressure Drops:							
Overall	mbar/m	7.46	9.59	15.39	6.89	9.46	15.07
Top	mbar/m	7.46	9.70	19.04	6.96	9.73	18.80
Bottom	mbar/m	6.50	8.54	10.79	5.86	8.23	10.40
Dist Bubbler	mm Hot Liq	306	285	293	378	391	396
Liquid Holdup	Vol. Fraction	0.19	0.24	0.34	0.19	0.23	0.30
Temperature Profiles	°C						
Reflux		57.9	56.8	57.0	46.2	50.0	53.3
Overhead Vapor		78.9	79.1	78.9	76.3	77.5	78.3
Distributor		61.2	60.7	60.8	50.9	54.2	57.0
Top Bed		78.6	78.9	78.7	75.8	77.2	77.8
Mid Bed		80.0	80.1	78.9	78.2	79.8	78.8
Below Bed		80.4	80.3	79.6	81.5	81.1	80.1
Composition of Liquid	Mol% iC ₄						
Reflux		49.56	48.29	48.32	64.87	57.57	52.82
Distributor		49.97	48.35	48.37	65.28	57.67	52.29
Below Bed		34.11	34.88	37.12	26.10	29.47	35.71
Bottoms		33.24	33.99	37.17	24.82	28.67	34.54
Feed		44.13	45.80	42.57	30.81	37.81	38.42
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	34.11	34.88	37.12	26.10	29.47	35.71
Temperature	°C	80.4	80.3	79.6	81.5	81.1	80.1
Liquid Density	kg/m ³	488.5	488.3	488.7	489.3	488.8	488.3
Vapor Density	kg/m ³	28.445	28.473	28.262	28.336	28.422	28.449
Vapor Rate	kg/s	8.53	9.21	10.13	7.49	8.16	8.66
Liquid Rate	m ³ /h	45.43	45.57	46.78	51.41	52.12	52.68
Capacity Factor, Cs	m/s	0.065	0.070	0.077	0.057	0.062	0.066
L/V		0.72	0.67	0.63	0.93	0.87	0.83
OHP Flow	kg/s	2.37	3.02	3.78	0.50	1.08	1.51
Capacity Factor, Top	m/s	0.065	0.070	0.077	0.058	0.063	0.066
Capacity Factor, Mid	m/s	0.065	0.070	0.077	0.057	0.062	0.066

Table V (SI Units)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System **6.9 bar**

Run Number		23532	23531	23534	23533	23536	23535
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	6.9	6.9	6.9	6.9	6.9	6.9
Reboiler Duty	MW	0.67	0.67	0.76	0.76	0.95	0.95
Condenser Duty	MW	0.61	0.62	0.71	0.70	0.89	0.90
Reflux Rate	kg/s	1.94	1.96	2.24	2.23	2.80	2.80
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	7.56	7.56	7.56	7.56
Pressure Drops:							
Overall	mbar/m	0.93	0.92	1.05	1.04	1.27	1.28
Top	mbar/m	0.58	0.57	0.72	0.72	0.96	0.96
Bottom	mbar/m	0.27	0.26	0.38	0.37	0.59	0.60
Dist Bubbler	mm Hot Liq	43	44	62	62	107	108
Liquid Holdup	Vol. Fraction	0.08	0.08	0.08	0.08	0.09	0.09
Temperature Profiles							
	°C						
Reflux		41.6	41.9	40.7	40.6	40.7	40.6
Overhead Vapor		51.0	51.1	51.1	51.0	51.3	51.3
Distributor		44.3	44.5	43.4	43.4	43.0	43.0
Top Bed		50.9	50.9	50.9	50.9	51.1	51.1
Mid Bed		52.3	52.3	52.3	52.3	52.6	52.6
Below Bed		58.7	58.8	58.8	58.8	59.0	59.0
Composition of Liquid							
	Mol% iC ₄						
Reflux		84.96	84.39	82.28	82.17	85.20	85.08
Distributor		84.67	87.05	81.47	80.22	85.67	85.08
Below Bed		28.06	28.81	27.62	28.86	28.91	28.91
Bottoms		21.95	22.15	22.01	22.21	23.02	24.63
Feed		20.97	21.36	20.80	20.89	24.13	24.63
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	28.06	28.81	27.62	28.86	28.91	28.91
Temperature	°C	58.7	58.8	58.8	58.8	59.0	59.0
Liquid Density	kg/m ³	526.6	526.3	526.6	526.3	525.9	525.9
Vapor Density	kg/m ³	16.794	16.860	16.798	16.865	16.959	16.963
Vapor Rate	kg/s	2.129	2.134	2.434	2.439	3.049	3.049
Liquid Rate	m ³ /h	14.56	14.60	16.64	16.68	20.87	20.87
Capacity Factor, Cs	m/s	0.020	0.020	0.023	0.023	0.028	0.028
HETP 2pt							
	mm						
DIST & below bed		214	219	214	219	224	223
DIST & bottoms		210	213	217	215	220	226
Relative Volatility		1.296	1.296	1.296	1.296	1.295	1.295
Capacity Factor, Top	m/s	0.021	0.021	0.024	0.024	0.029	0.029
Capacity Factor, Mid	m/s	0.020	0.020	0.023	0.023	0.029	0.029

Table V (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System **6.9 bar**

Run Number		23538	23537	23539	23540	23558	23557
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	6.9	6.9	6.9	6.9	6.9	6.9
Reboiler Duty	MW	1.14	1.14	1.33	1.33	1.52	1.52
Condenser Duty	MW	1.07	1.08	1.28	1.29	1.45	1.44
Reflux Rate	kg/s	3.34	3.35	3.92	3.94	4.84	4.83
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	7.56	7.56	7.56	7.56
Pressure Drops:							
Overall	mbar/m	1.62	1.63	2.11	2.12	2.80	2.80
Top	mbar/m	1.33	1.34	1.83	1.85	2.58	2.58
Bottom	mbar/m	0.93	0.93	1.39	1.41	2.01	2.02
Dist Bubbler	mm Hot Liq	160	161	226	226	348	347
Liquid Holdup	Vol. Fraction	0.10	0.10	0.10	0.10	0.11	0.11
Temperature Profiles							
Reflux	°C	40.0	39.9	40.7	40.8	49.6	49.5
Overhead Vapor		51.3	51.3	51.3	51.3	52.0	52.0
Distributor		42.2	42.1	42.5	42.6	49.9	49.9
Top Bed		51.0	51.1	51.1	51.1	51.6	51.6
Mid Bed		52.7	52.7	52.8	52.8	53.5	53.5
Below Bed		58.9	58.9	59.0	59.0	59.7	59.7
Composition of Liquid							
	Mol% iC ₄						
Reflux		84.87	84.65	85.08	85.08	85.03	85.14
Distributor		85.51	86.17	85.00	85.01	84.90	84.29
Below Bed		28.00	27.89	24.86	25.17	25.00	25.08
Bottoms		20.87	21.79	19.19	19.13	16.77	16.82
Feed		20.87	19.90	19.19	19.34	16.85	16.78
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	28.00	27.89	24.86	25.17	25.00	25.08
Temperature	°C	58.9	58.9	59.0	59.0	59.7	59.7
Liquid Density	kg/m ³	526.3	526.3	527.1	527.0	526.1	526.1
Vapor Density	kg/m ³	16.884	16.873	16.755	16.764	17.030	17.025
Vapor Rate	kg/s	3.652	3.653	4.246	4.249	4.866	4.868
Liquid Rate	m ³ /h	24.98	24.98	29.00	29.03	33.29	33.31
Capacity Factor, Cs	m/s	0.034	0.034	0.040	0.040	0.045	0.045
HETP 2pt	mm						
DIST & below bed		219	218	218	219	228	233
DIST & bottoms		210	217	213	213	210	214
Relative Volatility		1.296	1.296	1.296	1.296	1.294	1.294
Capacity Factor, Top	m/s	0.035	0.035	0.041	0.041	0.047	0.047
Capacity Factor, Mid	m/s	0.035	0.035	0.040	0.040	0.046	0.046

Table V (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System **6.9 bar**

Run Number		23541	23542	23544	23543	23545	23546
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	6.9	6.9	6.9	6.9	6.9	6.9
Reboiler Duty	MW	1.71	1.71	1.90	1.90	1.99	2.00
Condenser Duty	MW	1.66	1.65	1.82	1.82	1.90	1.89
Reflux Rate	kg/s	5.12	5.12	5.76	5.76	6.06	6.05
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	7.56	7.56	7.56	7.56
Pressure Drops:							
Overall	mbar/m	4.04	4.02	6.18	6.19	7.99	7.86
Top	mbar/m	3.93	3.91	6.31	6.32	8.37	8.22
Bottom	mbar/m	3.20	3.15	5.05	5.06	6.62	6.51
Dist Bubbler	mm Hot Liq	375	374	469	468	520	518
Liquid Holdup	Vol. Fraction	0.13	0.13	0.17	0.17	0.20	0.20
Temperature Profiles	°C						
Reflux		41.8	41.7	43.4	43.3	44.3	44.3
Overhead Vapor		51.5	51.4	51.7	51.6	51.9	51.9
Distributor		43.1	43.0	44.4	44.2	45.1	45.1
Top Bed		51.2	51.1	51.4	51.3	51.6	51.6
Mid Bed		53.1	53.0	53.6	53.5	54.2	54.1
Below Bed		59.3	59.3	59.8	59.7	60.0	59.9
Composition of Liquid	Mol% iC ₄						
Reflux		84.64	84.36	84.03	84.02	83.95	83.91
Distributor		84.09	84.36	83.86	83.75	82.80	83.91
Below Bed		22.76	24.81	25.42	25.42	25.99	25.33
Bottoms		17.82	17.91	16.85	16.86	16.63	16.53
Feed		17.82	17.91	16.88	16.94	16.63	16.53
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	22.76	24.81	25.42	25.42	25.99	25.33
Temperature	°C	59.3	59.3	59.8	59.7	60.0	59.9
Liquid Density	kg/m ³	527.2	526.8	525.9	526.0	525.5	525.7
Vapor Density	kg/m ³	16.769	16.846	17.090	17.066	17.197	17.143
Vapor Rate	kg/s	5.452	5.463	6.085	6.084	6.398	6.393
Liquid Rate	m ³ /h	37.22	37.34	41.66	41.64	43.83	43.78
Capacity Factor, Cs	m/s	0.051	0.051	0.056	0.056	0.059	0.059
HETP 2pt	mm						
DIST & below bed		215	224	228	228	237	226
DIST & bottoms		213	212	209	209	213	206
Relative Volatility		1.296	1.295	1.293	1.294	1.293	1.293
Capacity Factor, Top	m/s	0.053	0.053	0.058	0.058	0.061	0.061
Capacity Factor, Mid	m/s	0.052	0.052	0.057	0.058	0.060	0.060

Table V (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
 iC₄/nC₄ System **6.9 bar**

Run Number		23556	23555	23547	23548	23551	23552
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	bar	6.9	6.9	6.9	6.9	6.9	6.9
Reboiler Duty	MW	2.03	2.03	2.09	2.09	2.09	2.09
Condenser Duty	MW	1.94	1.95	1.97	1.98	1.98	1.98
Reflux Rate	kg/s	6.46	6.47	6.45	6.49	6.58	6.59
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	7.56	7.56	7.56	7.56
Pressure Drops:							
Overall	mbar/m	9.01	9.13	12.20	13.59	14.32	14.41
Top	mbar/m	9.57	9.71	14.23	16.67	17.83	17.99
Bottom	mbar/m	7.47	7.58	9.27	9.54	9.84	9.85
Dist Bubbler	mm Hot Liq	612	614	601	609	637	637
Liquid Holdup	Vol. Fraction	0.21	0.21	0.26	0.26	0.24	0.24
Temperature Profiles							
Reflux	°C	50.1	50.2	48.0	48.4	51.5	51.8
Overhead Vapor		52.4	52.4	52.5	53.0	53.9	54.2
Distributor		50.5	50.6	48.5	48.8	51.9	52.2
Top Bed		52.3	52.3	52.7	52.8	53.4	53.6
Mid Bed		55.5	55.7	57.1	56.3	56.1	56.4
Below Bed		60.1	60.0	60.0	59.8	59.4	59.3
Composition of Liquid							
	Mol% iC ₄						
Reflux		81.75	81.80	80.36	81.50	67.93	67.93
Distributor		81.39	81.78	80.15	80.35	69.63	69.63
Below Bed		30.10	30.10	28.46	28.46	27.05	27.05
Bottoms		16.53	16.76	22.77	22.77	23.36	23.36
Feed		16.66	16.56	24.76	22.46	24.59	24.59
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	30.10	30.10	28.46	28.46	27.05	27.05
Temperature	°C	60.1	60.0	60.0	59.8	59.4	59.3
Liquid Density	kg/m ³	524.1	524.2	524.7	525.0	525.9	526.0
Vapor Density	kg/m ³	17.463	17.439	17.342	17.241	17.032	16.985
Vapor Rate	kg/s	6.555	6.553	6.724	6.721	6.704	6.702
Liquid Rate	m ³ /h	45.02	45.00	46.13	46.08	45.89	45.87
Capacity Factor, Cs	m/s	0.060	0.060	0.062	0.062	0.062	0.062
HETP 2pt	mm						
DIST & below bed		277	274	268	269	342	341
DIST & bottoms		227	226	264	265	354	354
Relative Volatility		1.291	1.292	1.292	1.293	1.294	1.295
Capacity Factor, Top	m/s	0.062	0.062	0.064	0.064	0.064	0.064
Capacity Factor, Mid	m/s	0.061	0.061	0.063	0.063	0.063	0.063

Table V (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.21 m Diameter Low Pressure Column
 Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
 Raschig **DT-S** Distributor
iC₄/nC₄ System **6.9 bar**

Run Number		23550	23549	23529	23530	23553	23554
Run Type		TR	TR	FT	FT	FT	FT
Column Pressure:	bar	6.9	6.9	6.9	6.9	6.9	6.9
Reboiler Duty	MW	2.14	2.14	2.16	2.17	2.19	2.19
Condenser Duty	MW	2.03	2.05	2.08	2.09	2.06	2.07
Reflux Rate	kg/s	6.61	6.66	6.70	6.72	6.80	6.81
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	7.56	7.56	7.56	7.56	7.56	7.56
Pressure Drops:							
Overall	mbar/m	15.25	15.63	16.94	17.05	16.94	17.23
Top	mbar/m	19.29	20.10	22.57	22.79	21.71	22.34
Bottom	mbar/m	10.32	10.30	10.43	10.43	11.20	11.14
Dist Bubbler	mm Hot Liq	636	645	816	820	675	676
Liquid Holdup	Vol. Fraction	0.29	0.29	0.29	0.29	0.32	0.32
Temperature Profiles	°C						
Reflux		52.7	52.9	51.7	51.8	53.5	53.5
Overhead Vapor		55.4	55.6	55.5	55.5	56.1	56.1
Distributor		53.0	53.2	52.1	52.1	53.9	53.9
Top Bed		55.3	54.9	54.6	54.6	56.3	56.1
Mid Bed		56.0	56.0	56.0	56.1	55.7	55.6
Below Bed		58.2	58.1	57.8	57.8	58.1	58.0
Composition of Liquid	Mol% iC ₄						
Reflux		57.02	56.43	56.37	56.32	55.53	54.65
Distributor		57.00	59.90	56.03	55.94	58.18	55.39
Below Bed		34.13	34.62	35.50	35.88	35.78	35.78
Bottoms		30.82	31.18	32.58	32.64	31.76	31.84
Feed		31.03	31.42	32.74	32.67	31.85	31.83
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC ₄	34.13	34.62	35.50	35.88	35.78	35.78
Temperature	°C	58.2	58.1	57.8	57.8	58.1	58.0
Liquid Density	kg/m ³	525.5	525.6	525.7	525.6	525.1	525.3
Vapor Density	kg/m ³	16.947	16.919	16.862	16.895	17.024	16.971
Vapor Rate	kg/s	6.864	6.863	6.952	6.969	7.058	7.054
Liquid Rate	m ³ /h	47.02	47.01	47.60	47.74	48.38	48.34
Capacity Factor, Cs	m/s	0.064	0.064	0.065	0.065	0.066	0.066
HETP 2pt	mm						
DIST & below bed		655	593	726	741	695	795
DIST & bottoms		738	657	854	858	763	889
Relative Volatility		1.297	1.297	1.298	1.298	1.297	1.297
Capacity Factor, Top	m/s	0.065	0.065	0.066	0.066	0.066	0.066
Capacity Factor, Mid	m/s	0.064	0.064	0.065	0.065	0.066	0.066

Table V (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.21 m Diameter Low Pressure Column
Raschig Super Rings No. 0.3 Test, **2.44 m** Packing Depth
Raschig **DT-S** Distributor
iC₄/nC₄ System **6.9 bar**

Run Number		23563	23562	23561	23560	23559	
Run Type		OHP FL	OHP FL	OHP FL	OHP FL	OHP FL	
Column Pressure:	bar	6.9	6.9	6.8	6.9	6.8	
Reboiler Duty	MW	3.27	3.06	2.89	2.60	2.41	
Condenser Duty	MW	3.05	2.85	2.67	2.40	2.24	
Reflux Rate	kg/s	1.18	2.70	2.90	4.23	5.18	
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	
Mass Feed Flow Rate	kg/s	11.34	11.34	11.34	7.56	7.56	
Pressure Drops:							
Overall	mbar/m	14.31	18.61	16.95	18.32	16.66	
Top	mbar/m	16.93	24.48	20.60	23.76	21.97	
Bottom	mbar/m	10.71	11.78	12.31	11.98	10.46	
Dist Bubbler	mm Hot Liq	19	351	133	288	409	
Liquid Holdup	Vol. Fraction	0.17	0.26	0.24	0.28	0.25	
Temperature Profiles	°C						
Reflux		53.1	54.6	54.5	54.6	54.3	
Overhead Vapor		57.9	57.5	57.3	57.2	56.9	
Distributor		55.4	55.3	55.2	55.1	54.7	
Top Bed		57.5	56.8	56.9	56.3	55.9	
Mid Bed		57.6	57.5	57.3	57.4	57.4	
Below Bed		57.7	57.7	57.5	57.8	57.9	
Composition of Liquid	Mol% iC₄						
Reflux		45.86	47.03	47.55	48.80	50.18	
Distributor		45.81	46.92	47.53	52.13	59.97	
Below Bed		38.87	38.60	38.50	38.50	36.14	
Bottoms		38.67	38.52	38.54	37.00	35.13	
Feed		44.62	43.81	43.44	43.10	39.83	
Conditions Below Bed (Based on Reboiler Duty)							
Composition	Mol% iC₄	38.87	38.60	38.50	38.50	36.14	
Temperature	°C	57.7	57.7	57.5	57.8	57.9	
Liquid Density	kg/m³	524.9	525.0	525.2	524.9	525.4	
Vapor Density	kg/m³	17.029	16.998	16.935	17.035	16.943	
Vapor Rate	kg/s	10.55	9.85	9.29	8.37	7.74	
Liquid Rate	m³/h	10.14	20.85	22.24	31.45	37.49	
Capacity Factor, Cs	m/s	0.098	0.092	0.087	0.078	0.072	
L/V		0.14	0.31	0.35	0.55	0.71	
OHP Flow		9.07	6.81	6.05	3.78	2.27	
Capacity Factor, Top	m/s	0.098	0.092	0.087	0.078	0.072	
Capacity Factor, Mid	m/s	0.098	0.092	0.087	0.078	0.072	

Table VI
Propane/Iso-butane/N-Butane
Liquid Compositions in Mole Percent
Analysis by Gas Chromatography

Run Number		23505	23506	23507	23508	23509	23510	23511	23512
	Mol % C ₃								
Reflux		2.66	2.57	4.20	5.69	5.29	3.21	3.39	3.17
Distributor		2.20	2.61	4.28	5.15	4.45	4.12	3.66	3.31
Below Bed		0.00	0.00	0.80	0.00	0.71	0.00	0.00	0.00
Bottoms		0.00	0.00	0.00	1.11	2.08	0.96	0.00	1.26
Feed		0.00	0.00	2.80	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		56.10	56.05	83.66	82.35	82.30	84.07	82.88	82.93
Distributor		54.48	55.91	83.59	82.66	83.06	83.16	82.47	83.08
Below Bed		44.20	44.38	34.64	34.97	33.55	33.93	34.04	34.24
Bottoms		40.19	39.86	28.25	28.03	26.90	27.02	27.69	27.11
Feed		40.22	40.18	27.64	28.37	28.04	27.23	27.69	27.91

Run Number		23513	23514	23515	23516	23517	23518	23519	23520
	Mol % C ₃								
Reflux		3.05	3.07	3.13	2.87	2.88	3.06	2.72	4.84
Distributor		4.32	2.99	2.94	2.92	2.89	2.65	4.74	5.13
Below Bed		1.06	0.00	0.00	0.00	0.00	0.00	1.02	0.55
Bottoms		1.34	0.00	0.00	0.00	0.00	0.00	0.85	0.00
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		82.65	82.56	81.92	82.22	81.46	80.98	81.84	80.04
Distributor		81.28	82.68	82.10	82.17	81.21	81.21	80.16	79.82
Below Bed		33.88	32.06	31.10	31.39	29.26	30.27	27.56	27.47
Bottoms		26.69	27.37	24.95	25.01	24.12	24.02	22.77	23.07
Feed		27.57	27.02	25.27	25.16	24.24	24.19	24.77	22.16

Run Number		23521	23522	23523	23524	23525	23526	23527	23528
	Mol % C ₃								
Reflux		2.62	2.56	2.43	2.28	2.25	3.43	2.90	2.89
Distributor		2.63	2.49	2.22	2.19	2.28	3.22	3.29	2.94
Below Bed		0.00	0.00	0.00	0.00	0.98	1.45	1.68	1.06
Bottoms		0.00	0.00	0.00	0.00	2.07	0.65	0.99	0.61
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		80.53	80.46	57.65	57.93	56.34	54.62	53.70	53.81
Distributor		80.18	80.38	57.54	57.95	56.10	54.45	53.09	53.61
Below Bed		24.50	24.76	37.44	39.03	40.35	40.55	41.69	41.49
Bottoms		20.58	20.63	34.83	34.59	34.18	36.74	37.25	37.46
Feed		20.55	20.67	34.95	34.56	35.34	36.62	37.07	37.31

Table VI (cont'd)
Propane/Iso-butane/N-Butane
Liquid Compositions in Mole Percent
Analysis by Gas Chromatography

Run Number		23529	23530	23531	23532	23533	23534	23535	23536
	Mol % C ₃								
Reflux		1.91	1.94	5.64	5.08	8.03	7.66	3.58	3.18
Distributor		1.82	1.92	2.08	5.25	10.17	8.59	3.58	2.91
Below Bed		0.00	0.00	0.77	1.57	3.40	1.32	0.00	0.88
Bottoms		0.00	0.00	1.12	1.68	5.75	6.98	0.00	0.88
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		56.37	56.32	84.39	84.96	82.17	82.28	85.08	85.20
Distributor		56.03	55.94	87.05	84.67	80.22	81.47	85.08	85.67
Below Bed		35.50	35.88	28.81	28.06	28.86	27.62	28.91	28.91
Bottoms		32.58	32.64	22.15	21.95	22.21	22.01	24.63	23.02
Feed		32.74	32.67	21.36	20.97	20.89	20.80	24.63	24.13

Run Number		23537	23538	23539	23540	23541	23542	23543	23544
	Mol % C ₃								
Reflux		3.61	3.15	2.04	2.04	1.99	1.98	1.85	1.86
Distributor		2.54	3.22	2.05	2.01	1.87	1.82	1.80	1.72
Below Bed		0.00	0.00	0.00	0.00	0.00	1.82	0.00	0.00
Bottoms		3.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		84.65	84.87	85.08	85.08	84.64	84.36	84.02	84.03
Distributor		86.17	85.51	85.00	85.01	84.09	84.36	83.75	83.86
Below Bed		27.89	28.00	24.86	25.17	22.76	24.81	25.42	25.42
Bottoms		21.79	20.87	19.19	19.13	17.82	17.91	16.86	16.85
Feed		19.90	20.87	19.19	19.34	17.82	17.91	16.94	16.88

Run Number		23545	23546	23547	23548	23549	23550	23551	23552
	Mol % C ₃								
Reflux		1.68	1.86	1.50	1.00	1.64	1.76	1.64	1.64
Distributor		1.68	1.86	1.50	1.00	1.57	1.57	1.50	1.50
Below Bed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottoms		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		83.95	83.91	80.36	81.50	56.43	57.02	67.93	67.93
Distributor		82.80	83.91	80.15	80.35	59.90	57.00	69.63	69.63
Below Bed		25.99	25.33	28.46	28.46	34.62	34.13	27.05	27.05
Bottoms		16.63	16.53	22.77	22.77	31.18	30.82	23.36	23.36
Feed		16.63	16.53	24.76	22.46	31.42	31.03	24.59	24.59

Table VI (cont'd)
Propane/Iso-butane/N-Butane
Liquid Compositions in Mole Percent
Analysis by Gas Chromatography

Run Number		23553	23554	23555	23556	23557	23558	23559	23560
	Mol % C ₃								
Reflux		0.00	1.66	0.00	0.00	0.00	0.00	0.00	0.00
Distributor		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Below Bed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottoms		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		55.53	54.65	81.80	81.75	85.14	85.03	50.18	48.80
Distributor		58.18	55.39	81.78	81.39	84.29	84.90	59.97	52.13
Below Bed		35.78	35.78	30.10	30.10	25.08	25.00	36.14	38.50
Bottoms		31.76	31.84	16.76	16.53	16.82	16.77	35.13	37.00
Feed		31.85	31.83	16.56	16.66	16.78	16.85	39.83	43.10

Run Number		23561	23562	23563	23564	23565	23566	23567	23568
	Mol % C ₃								
Reflux		0.00	0.00	0.00	0.00	0.00	0.00	0.87	0.00
Distributor		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Below Bed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottoms		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		47.55	47.03	45.86	52.82	48.32	47.18	45.54	45.76
Distributor		47.53	46.92	45.81	52.29	48.37	47.07	45.81	45.46
Below Bed		38.50	38.60	38.87	35.71	37.12	38.84	39.41	40.32
Bottoms		38.54	38.52	38.67	34.54	37.17	38.49	38.36	39.13
Feed		43.44	43.81	44.62	38.42	42.57	43.37	44.32	44.24

Run Number		23569	23570	23571	23572	23573	23574	23575	23576
	Mol % C ₃								
Reflux		1.05	1.35	1.11	1.04	0.00	0.87	0.00	0.00
Distributor		1.01	1.30	1.08	0.98	0.00	0.00	0.00	0.00
Below Bed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottoms		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		57.57	64.87	60.50	55.20	51.08	49.56	48.29	46.90
Distributor		57.67	65.28	60.42	54.78	50.69	49.97	48.35	46.98
Below Bed		29.47	26.10	29.01	31.43	33.59	34.11	34.88	38.15
Bottoms		28.67	24.82	27.70	29.97	32.74	33.24	33.99	37.52
Feed		37.81	30.81	34.84	39.62	43.10	44.13	45.80	44.27

Table VI (cont'd)
 Propane/Iso-butane/N-Butane
 Liquid Compositions in Mole Percent
 Analysis by Gas Chromatography

Run Number		23577	23578	23579	23580	23581	23582	23583	23584
	Mol % C ₃								
Reflux		0.00	0.00	2.03	1.02	1.31	0.92	1.11	0.00
Distributor		0.00	0.00	0.00	1.09	1.05	0.00	0.00	0.00
Below Bed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottoms		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		47.39	48.34	48.47	54.51	50.47	48.54	46.79	46.43
Distributor		47.34	48.10	48.37	54.42	50.16	48.82	47.14	46.17
Below Bed		48.11	37.85	27.79	33.97	37.04	38.60	39.05	39.05
Bottoms		37.28	37.02	36.63	33.61	37.20	37.79	38.27	38.33
Feed		43.67	42.66	41.85	37.57	39.99	41.29	42.49	43.59

Run Number		23585	23586	23587	23588	23589	23590	23591	23592
	Mol % C ₃								
Reflux		0.00	0.00	0.00	0.00	0.00	0.00	0.90	1.14
Distributor		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85
Below Bed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bottoms		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Feed		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Mol % iC ₄								
Reflux		46.00	45.71	45.42	46.00	46.34	46.81	47.31	49.48
Distributor		45.93	45.58	45.36	45.91	46.26	46.67	47.56	49.41
Below Bed		38.92	39.47	39.56	38.98	39.29	39.07	38.75	37.45
Bottoms		38.06	38.56	38.53	38.31	38.49	38.51	38.26	37.26
Feed		44.15	44.08	44.31	44.12	43.64	43.07	42.23	40.23

Run Number		23593	23594	23595	23596	23597			
	Mol % C ₃								
Reflux		1.20	1.35	1.28	1.35	1.36			
Distributor		1.07	1.34	1.29	1.33	1.19			
Below Bed		0.00	0.00	0.00	0.00	0.00			
Bottoms		0.00	0.00	0.00	0.00	0.00			
Feed		0.00	0.00	0.00	0.00	0.00			
	Mol % iC ₄								
Reflux		57.68	77.05	77.08	60.60	60.40			
Distributor		58.02	76.64	76.71	60.39	60.32			
Below Bed		32.38	22.24	22.09	28.67	28.65			
Bottoms		31.94	17.90	17.86	26.59	26.97			
Feed		34.38	17.91	17.96	25.77	27.82			