

FRACTIONATION RESEARCH, INC.

TEST OF RASCHIG SUPER-PAK[®] 250

(Released to Raschig GmbH as They See Fit)

by

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June 15, 2009

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SUMMARY

Raschig Super-Pak[®] 250 (RSP 250) structured packing was tested at FRI's experimental distillation unit. The packing was tested in the 4-foot (1.22 m) section of the low-pressure column 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 1.43 psia (0.1 bar), or 75 mm Hg. The installation and portions of the tests were observed and approved by a Raschig GmbH representative.

INTRODUCTION

This test was originally conducted as FRI 2007 Category 3 Proprietary Test (proprietor-paid). The test was conducted under the Proprietary Device Test Procedure amended at the November, 2005, TAC meeting⁽¹⁾.

RSP 250 was 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), and the o/p xylene system at 1.43 psia (0.1 bar), or 75 mm Hg.

After the test, Raschig requested that the test be reclassified to a Category 2 test. The request was received within three months of the conclusion of operations and was approved by the Technical Committee.

DESCRIPTION OF EQUIPMENT

Packing --Raschig Super-Pak is a high-capacity vapor-liquid contacting device for use in distillation and other mass transfer columns. According to Raschig, the device is a hybrid of random/structured packing, with a highly open geometry, enhanced surfaces, and vertically-aligned packing sheets with regularly sequenced rows of sinusoidal waves above and below the plain of the metal sheet. The tested packing, shown in **Figure 1**, is segmented into six blocks in each layer for the 4-foot (1.22) diameter FRI column. The specific area and void fraction of RSP 250, provided by Raschig, were 77.7 ft²/ft³ (255 m²/m³) and 0.98, respectively. Measurements by FRI on the packing that was received were 79.6 ft²/ft³ (261 m²/m³) and 0.978. The nominal corrugation angle was 45° to the vertical, and the block height was 9.25 inches (235 mm). The packing used in the test was made of 304 stainless steel with a sheet thickness of 0.15 mm.

Liquid Distributors – Two DT-S liquid distributors, designed and supplied by Raschig, were used for this test. Each was a trough type distributor with a pre-distributor as shown in **Figure 2**. Both distributors were identical except for the sizes of the drip holes. There were total of 142 drip holes on each distributor, so the pour point density was 11.4 points/ft² (123 points/m²), for the FRI column with its 4-foot (1.22 m) diameter. One distributor had a drip hole diameter of 4.8 mm, and was used with the operations with the C₆/C₇ system at 4.5 psia (0.31 bar) and with the o/p xylene system at 1.43 psia (0.1 bar). The second one had holes with diameters of 6.9 mm and was used with the operations with the C₆/C₇ system at 23.5 psia (1.62 bar). This latter distributor was also used with the C₆/C₇ system at 4.5 psia (0.31 bar) operations, without using liquid collector. All 142 drip holes were located 1-9/16 inches (40 mm) above the bottoms of the distributor troughs. Those 142 drip holes fed liquid into vertical tubes that were attached to the troughs. Those tubes are clearly shown in Figure 2. Ultimately, liquid issued vertically from the bottoms of the tubes. Both liquid distributors were water tested outside the column after the completion of test. The water test results, in terms of the ratios of standard deviation to the mean flow, are shown in **Figures 3-6**.

Figures 3 and 4 provide water test results for the distributor with 4.8 mm drip holes. **Figure 3** shows the ratio of the standard deviation to the mean flow, C_v, in terms of the liquid head from the

bottom of the trough. **Figure 4** is plotted vs. the total liquid rate flowing through the distributor. Except at very low heads, or low liquid rates, the distributor performed very well, with Cv's below 5 percent, as shown in **Figures 3** and **4**. Similar water test results were obtained for the distributor 6.9 mm drip holes as shown in **Figures 5** and **6**. Also included in those figures are the water test results independently obtained by Raschig before the distributors were shipped to FRI. Raschig's results are very close to the FRI water test data.

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

Samplers – No in-bed sampler was used for this test. The below-bed sampler used for this test was FRI center-draw cross sampler. A description of the sampler and other details are given in Topical Report 129⁽²⁾.

Liquid Collector/Vapor Distributor -- The vapor distributor/liquid collector used in the tests was designed and manufactured by Raschig. It consisted of ten high rectangular risers. Each riser was fitted with an angled cap. The vapor distributor/liquid collector was fitted with two 8 inch (203 mm) downpipes. The liquid collector/vapor distributor was only used for the first phase of the test.

Gamma Ray Scanning Equipment - The gamma ray scanning equipment was the same as that described in the Topical Report 166⁽³⁾.

Confidential Information Withheld by Proprietor - Consistent with the past practice of many Proprietors, certain information regarding these structured packing tests was regarded by the Proprietor as "trade secrets" and is not included in this Report. FRI's listing of the excluded information is consistent with the verbiage of the Procedure for Conducting, Interpreting and Reporting Tests of Proprietary Contacting Devices, which was approved by the TAC on May 28, 2009. The list of excluded information follows:

- Details regarding the "enhanced surfaces", i.e., the texturing
- Details regarding the "sinusoidal waves", e.g., their locations, widths and depths
- Details regarding the designs and linkages of the distributor troughs
- Details regarding the support plates
- Details regarding the liquid collector/vapor distributor

An appreciable amount of information was provided by Raschig to FRI for this Topical Report.

INSTALLATION OF EQUIPMENT

Test with Liquid Collector/Vapor Distributor

The first phase of the program was conducted using the liquid collector/vapor distributor installed below the packing support plate. **Figure 7** is a sketch of the column configuration used for the first phase, locating the liquid collector/vapor distributor, packing support plate, samplers, packed bed, thermowells, taps for pressure drops, liquid distributor, and other equipment. The deck of the vapor distributor/liquid collector was located 112 inches (2.84 m) above the column head-seam. The two downpipes fitted with the collector were positioned at the north and south side of the column. To maximize the range of the gamma scanning and avoid the slightly out-of-roundness column section, the packing support plate was installed 149 inches (3.78 m) above column headseam. A cross sampler was installed below the packing support plate to withdraw samples of liquid exiting the bottom of the packed

bed. A thermowell was attached to the center of the cross sampler to measure the liquid temperature. Inside the packed bed, a thermowell was installed at interface of between layers 6 and 7; another one between layers 14 and 15. No mid-bed sampler was installed for this test. The bottom layer of packing was installed with the seams perpendicular to the beams of the support plate. Each layer of structured packing was rotated 90° from the previous layer. Fifteen layers of RSP 250 structured packing were installed to a total bed depth of 11.6 ft (3.53 m). 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 liquid distributor. Wall wipers were installed between the 4-foot (1.22) column section and the conical transition section to collect and guide vapor condensation to the distributor troughs. The bottom of the distributor trough was placed 4-1/3 inches (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 the distributor was obtained with 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 (0-68 inches; (0-1.73 m)), the second one for the top half of the bed (68-138.8 inches; (1.73-3.53 m)), and the third for the overall bed (0-138.8 inches; (0-3.53 m)). All distances are measured from the bottom of the support plate. Pressure drops were also measured across the liquid collector/vapor distributor and the liquid distributor. A bubbler connected to a pressure transmitter was installed inside the liquid distributor to measure liquid heads. 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 test, the packing and other equipment were removed from the column and inspected. The packing did not appear to have any damage and no anomalies were found for all of the equipment.

Tests Without Liquid Collector/Vapor Distributor

After finishing testing with the liquid collector/vapor distributor, the packed bed was left unchanged, and the liquid collector/vapor distributor was removed from the column via the bottom manway. During the removal process, everything above the liquid collector/vapor distributor was not disturbed. Some conditions at medium to high rates were repeated.

Gamma Ray - The calibration and operation were the same as those described in Topical Report 166⁽³⁾. Two vertical elevations were scanned. One was at the middle of layer 6, another was at the interface of layers 5 and 6. For each vertical position, the packed bed was scanned at three different horizontal locations, those being centerline and 10 and then 20 inches (254 and 508 mm) off the centerline.

EXPERIMENTAL PROCEDURE

A process flow diagram of the FRI low-pressure distillation column as configured for this test is shown in **Figure 8**.

FRI's standard operating procedure is to establish the flood point, decrease the operating loads to about 20 per cent of the flood point 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 unless it is mentioned otherwise. All run conditions were total reflux with efficiency, capacity, and pressure drop measurements.

Test sequences were as follows:

I. Test with liquid collector/vapor distributor:

1. Operation with the o/p xylene system at 1.43 psia (0.1 bar), or 75 mmHg, using DT-S with 4.8 mm drip holes
2. Operation with the C₆/C₇ system at 4.5 psia (0.31 bar) using the 4.8 mm drip hole distributor
3. Liquid distributor change-over (changed to distributor with 6.9 mm drip holes)
4. Operation with the C₆/C₇ system at 23.5 psia (1.62 bar) using the 6.9 mm drip hole distributor

II. Test without liquid collector/vapor distributor:

1. Removal of the liquid collector via the column bottom manway
2. Operation with the C₆/C₇ system at 23.5 psia (1.62 bar) using the 6.9 mm drip hole distributor
3. Operation with the C₆/C₇ system at 4.5 psia (0.31 bar) using the 6.9 mm drip hole distributor
4. Liquid distributor change-over (changed to distributor with 4.8 mm drip-holes)
5. Operation with the o/p xylene system at 1.43 psia (0.1 bar), or 75 mmHg, using DT-S 4.8 mm drip hole distributor

RESULTS

Summary of the Test Results

Experimental results for the RSP 250 structured packing are summarized in **Tables I to V**. **Tables I to III** provide test results with the liquid collector/vapor distributor. **Tables IV and V** provide the data collected without the liquid collector/vapor distributor in service.

A summary of run conditions for all test systems follows:

<u>Run No.</u>	<u>System</u>	<u>Pressure psia (bar)</u>	<u>Table No.</u>	<u>Run Type</u>	<u>Liquid Collector</u>
23598-23611 &23616-23621	o/p xylene	1.43 (0.1)	I	Total Reflux	Yes
23622-23623 &23628-23637 &23640-23647	C ₆ /C ₇	4.5 (0.31)	II	Total Reflux	Yes
23648-23673	C ₆ /C ₇	23.5 (1.62)	III	Total Reflux	Yes
23674-23687	C ₆ /C ₇	23.5 (1.62)	IV	Total Reflux	No
23688-23700 &23703-23707	C ₆ /C ₇	4.5 (0.31)	V	Total Reflux	No

In **Tables I to V**, the liquid hold up in the packed bed was measured at the column centerline. Gamma scan results at other locations are available to the membership upon request.

Notes on the Results

During the RSP 250 testing, for all 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. Capacity factors, C_s, are based on physical properties at the bottom of the packed bed, mid-bed, and top of the bed.

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)
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
FT	Total reflux flood runs
Mid	Middle bed
Pt	Points
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
Duties	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 Technical Advisory Committee Meeting, November, 2005
2. FRI Topical Report 129
3. FRI Topical Report 166

Figure 1. Raschig Super-Pak 250

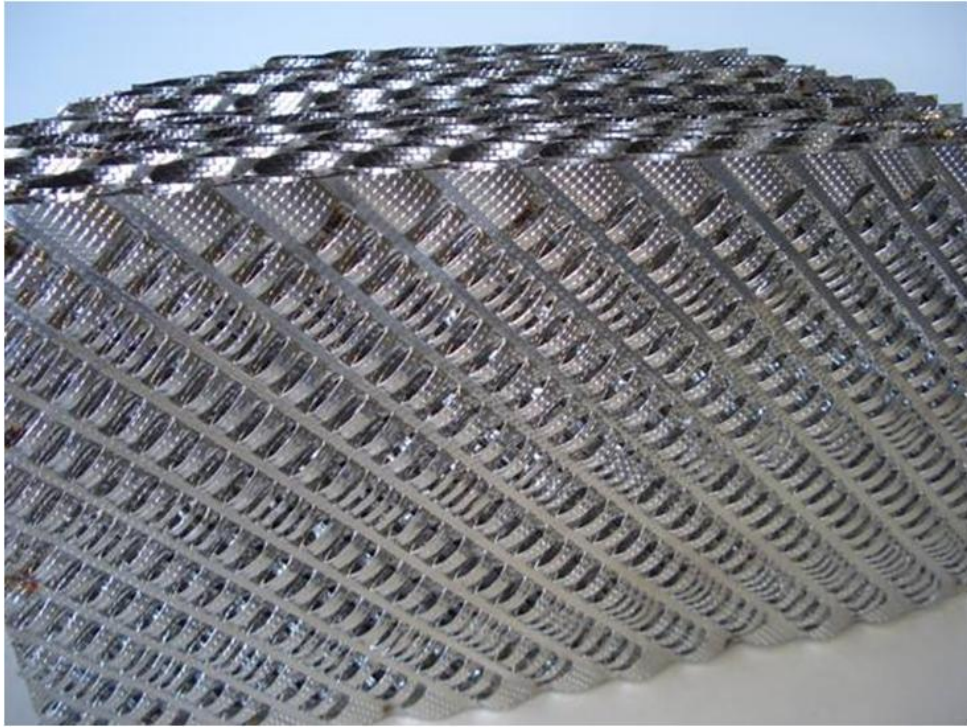


Figure 2. Raschig DT-S Liquid Distributor



Figure 3. Raschig Liquid Distributor 4.8 mm Water Test Results

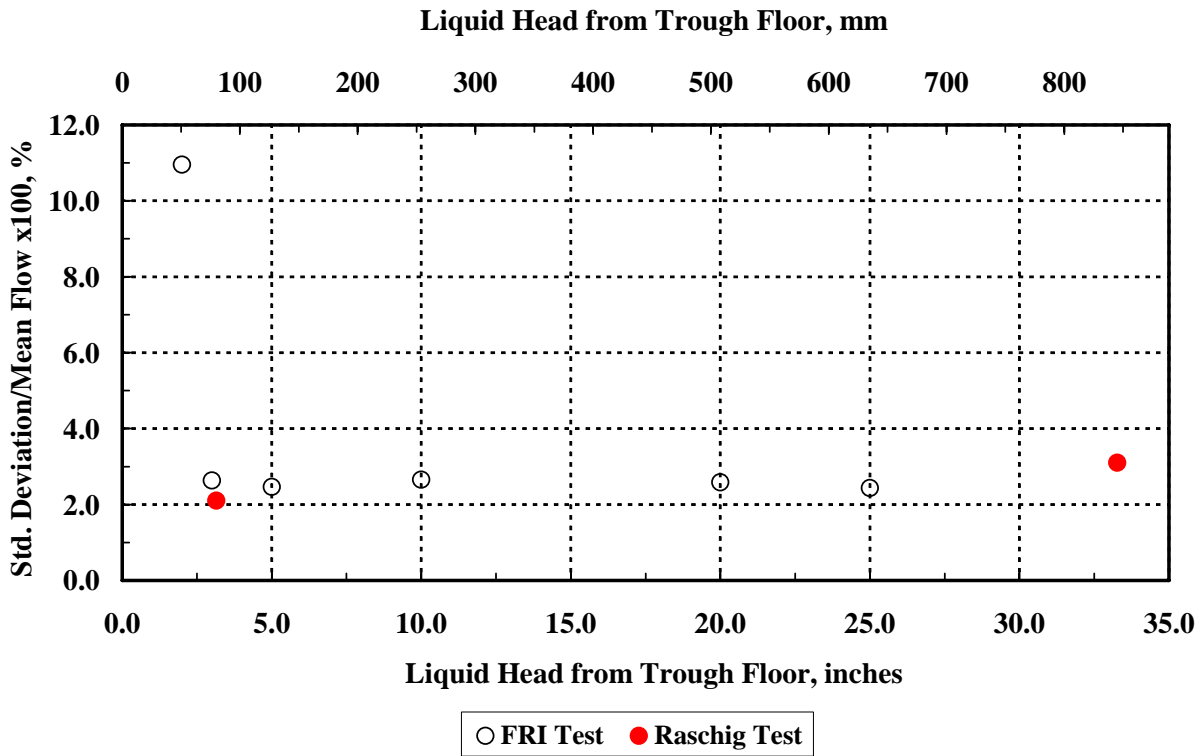


Figure 4. Raschig Liquid Distributor 4.8 mm Water Test Results

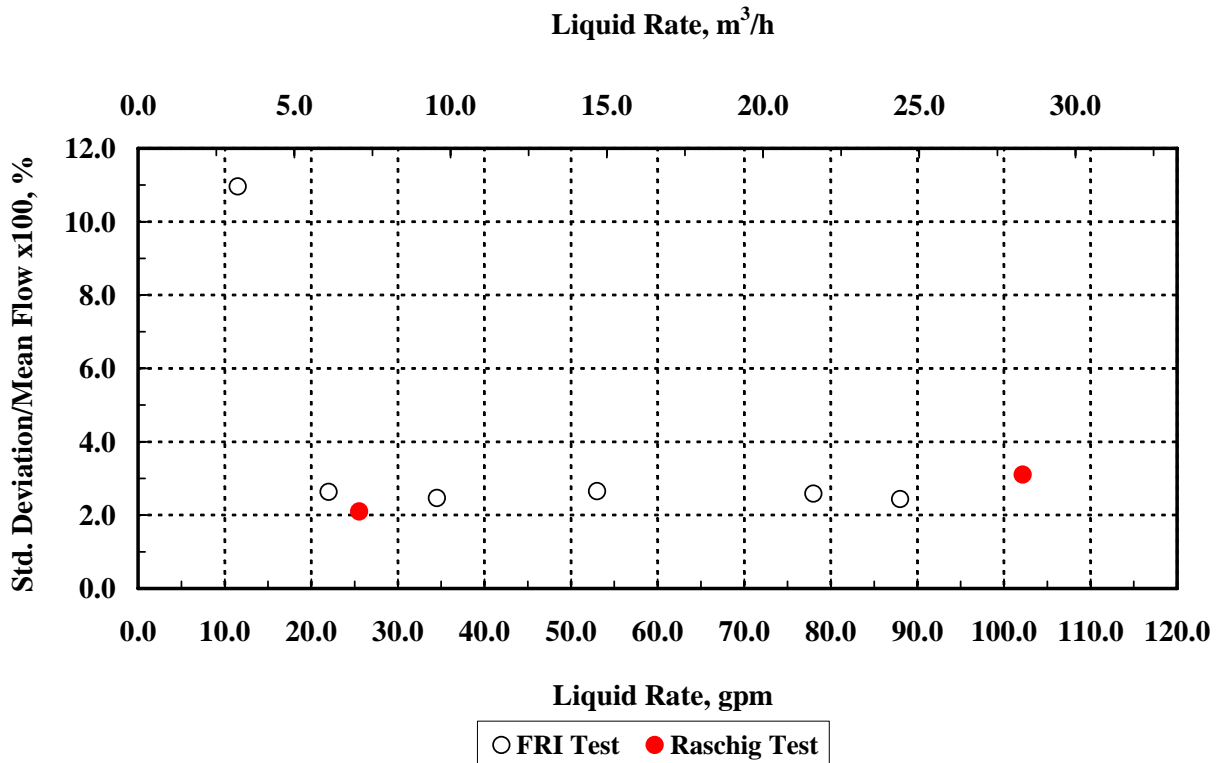


Figure 5. Raschig Liquid Distributor 6.9 mm Water Test Results

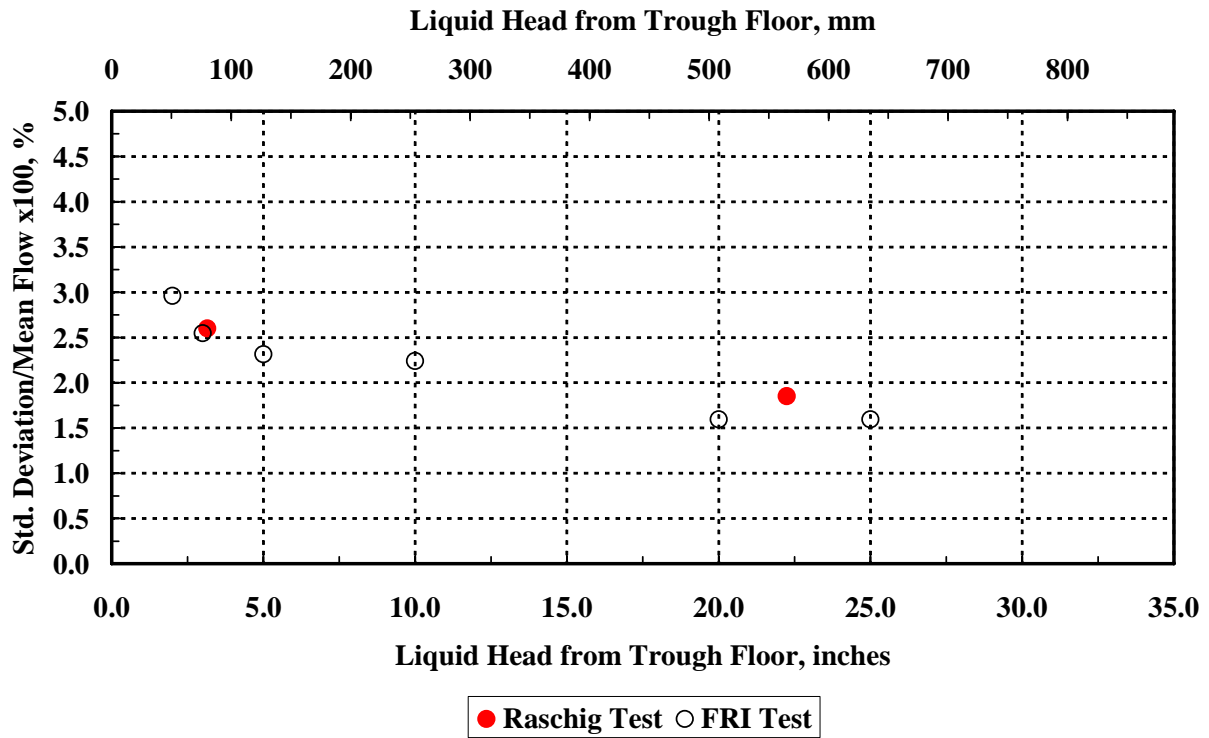


Figure 6. Raschig Liquid Distributor 6.9 mm Water Test Results

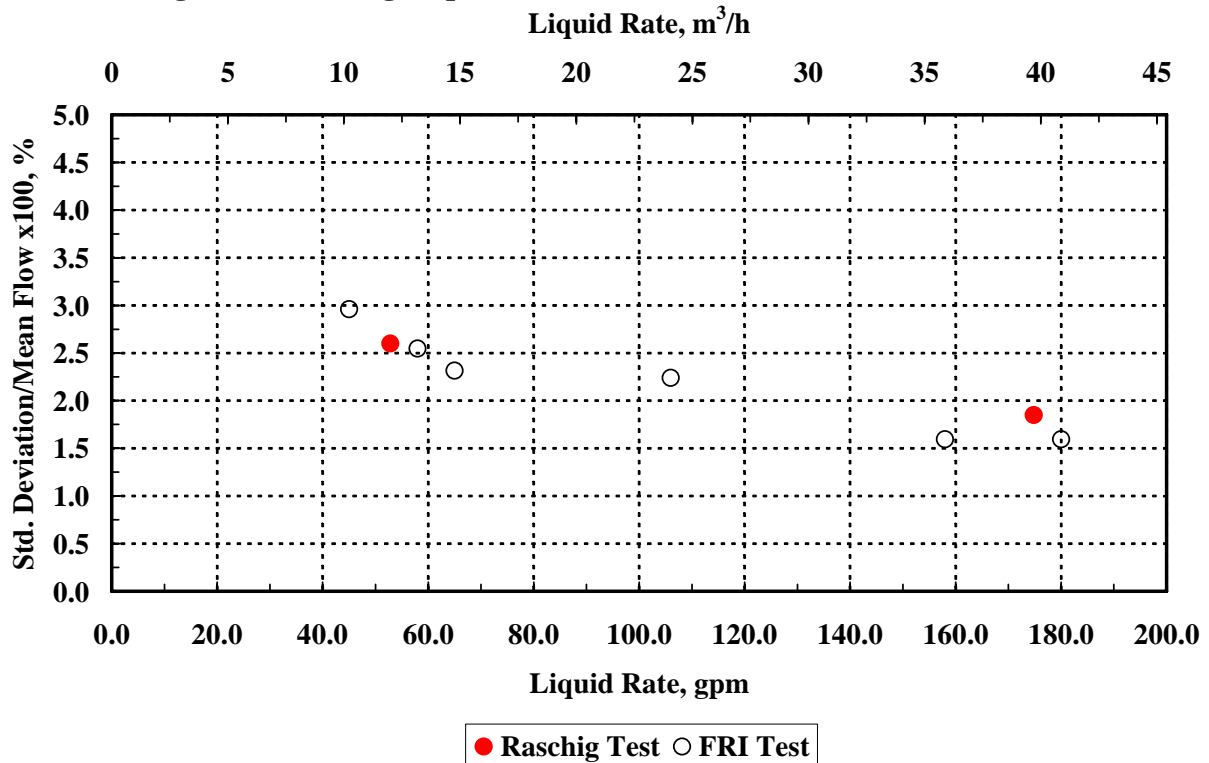


Figure 7. Column Configuration for the Raschig Super-Pak 250 Test

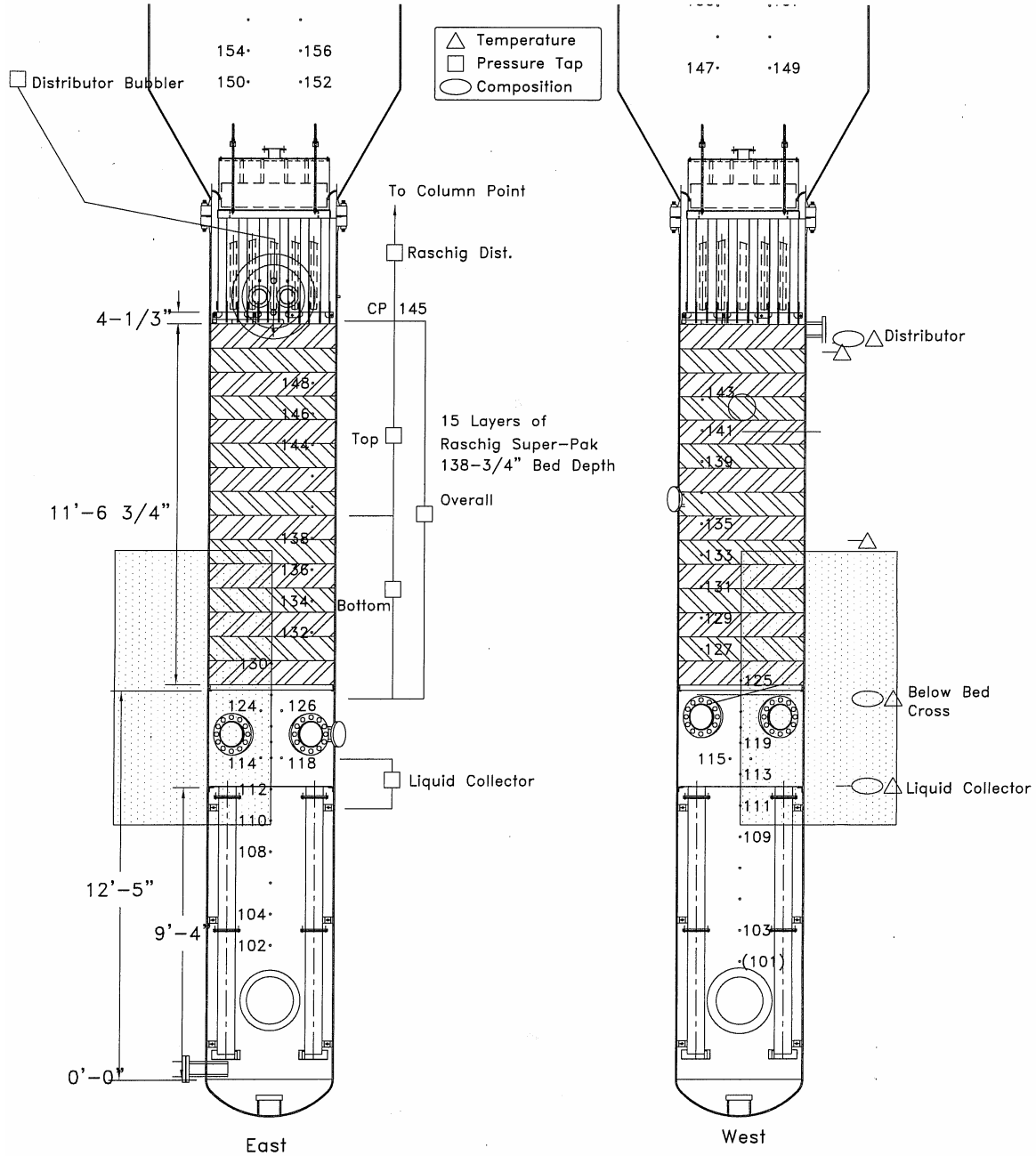


Figure 8. Process Flow Diagram for Raschig Super-Pak Test

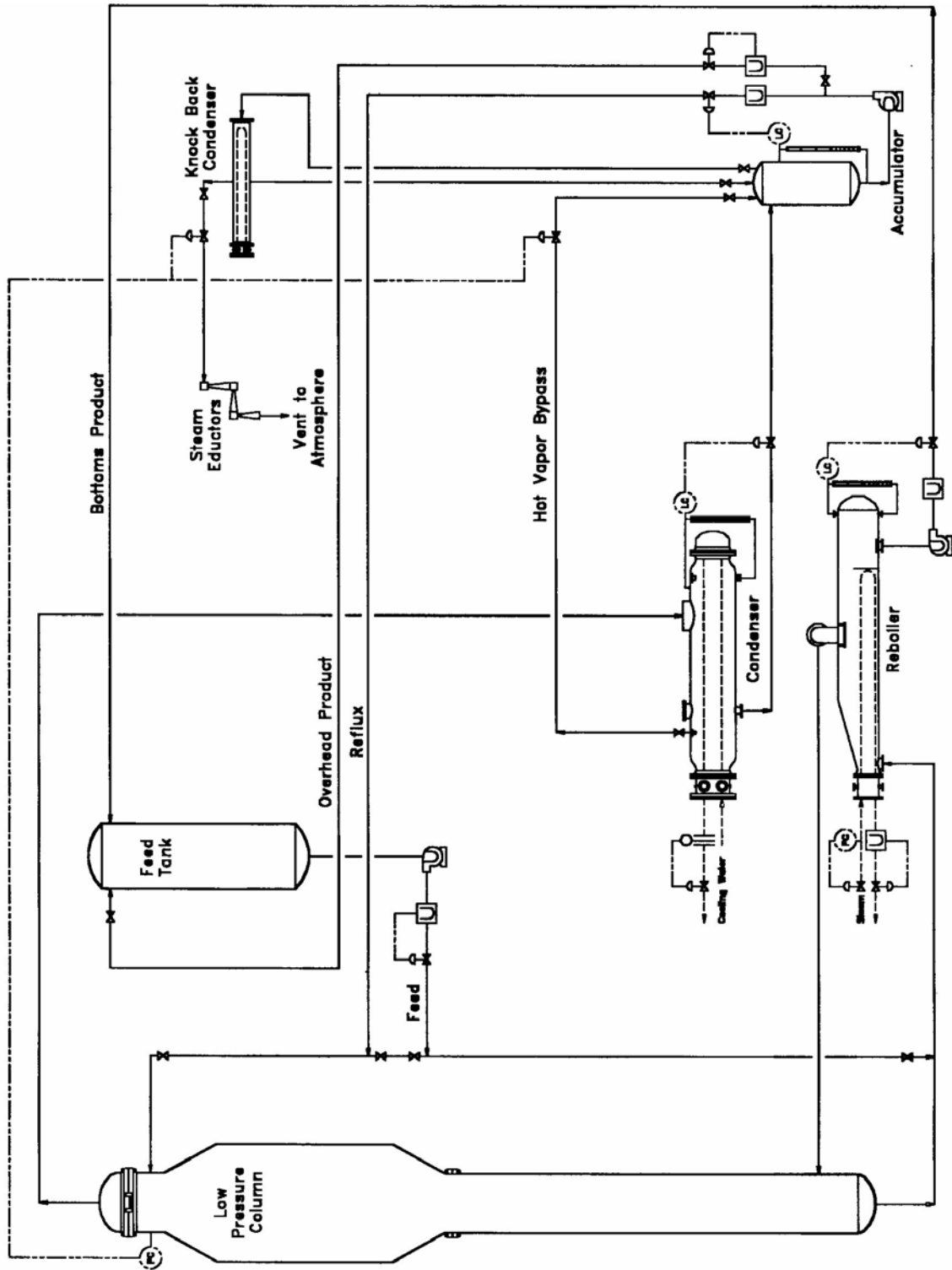


Table I (US Engineering Units)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
o/p xylene, 1.43 psia

Run Number		23598	23599	23600	23601	23602
Run Type		FT	FT	TR	TR	TR
Column Pressure:	psia	1.43	1.44	1.43	1.43	1.43
Reboiler Duty	M Btu/h	4.90	4.90	1.77	1.77	2.20
Condenser Duty	M Btu/h	4.54	4.57	1.44	1.42	2.01
Reflux Rate	k lb/h	25.3	25.5	8.7	8.2	11.7
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	29.9	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	2.20	2.19	0.12	0.11	0.21
Top Half	in H ₂ O / ft	2.41	2.40	0.10	0.09	0.18
Bottom Half	in H ₂ O / ft	1.99	1.99	0.13	0.12	0.21
Liquid Collector	in H ₂ O	10.4	10.5	2.2	2.0	3.6
Bubblers						
Distributor Head	inches Hot Liq					
Liquid Holdup						
Between Layers 5&6		0.12		0.04		0.04
Middle of Layer 6		0.14		0.04		0.04
Temperature Profiles						
	°F					
Reflux		113.9	114.9	131.1	127.3	127.4
Overhead Vapor		159.9	160.3	159.4	159.3	159.0
Distributor		129.4	130.2	146.5	145.5	142.3
Top Bed		170.8	171.0	158.8	158.7	158.5
Mid Bed		180.8	181.0	161.1	161.0	161.5
Below Bed		187.6	187.8	164.2	164.1	164.5
Liq Collector		190.9	190.9	166.0	165.0	167.5
Composition of Liquid						
	Mol % p-xylene					
Reflux		54.16	53.98	86.60	87.47	88.95
Distributor		54.24	53.99	86.05	87.34	87.07
Below Bed Cross		45.15	44.50	38.99	40.01	37.97
Collector		40.40	44.49	40.32	38.10	40.02
Bottoms		41.04	41.30	33.78	33.55	32.36
Feed		40.98	41.19	34.00	33.71	32.48
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % p-xylene	45.15	44.50	38.99	40.01	37.97
Temperature	°F	187.6	187.8	164.2	164.1	164.5
Liquid Density	lb/ft ³	50.8	50.8	51.6	51.6	51.6
Vapor Density	lb/ft ³	0.040	0.040	0.024	0.025	0.025
Vapor Rate	k lb/h	30.1	30.1	10.7	10.5	13.5
Liquid Rate	gpm	73.9	73.9	26.0	25.4	32.6
Fs	ft/s(lb/ft ³) ^{0.5}	3.374	3.372	1.533	1.502	1.922
Capacity Factor, Cs	ft/s	0.474	0.473	0.213	0.209	0.268
HETP 2 pt	inches					
DIST & below bed		79.8	76.4	13.3	12.9	12.6
DIST & bottoms		90.3	96.4	13.2	12.6	12.4
Relative Volatility		1.224	1.224	1.241	1.241	1.240
Cs Top	ft/s	0.543	0.542	0.212	0.208	0.267
Cs Mid	ft/s	0.507	0.506	0.213	0.209	0.267

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
 o/p xylene, **1.43 psia**

Run Number		23603	23604	23605	23606	23607
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	1.43	1.43	1.43	1.43	1.43
Reboiler Duty	M Btu/h	2.20	3.14	3.13	3.75	3.74
Condenser Duty	M Btu/h	2.03	2.78	2.74	3.10	3.02
Reflux Rate	k lb/h	11.8	15.7	15.8	18.1	18.1
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.21	0.41	0.41	0.62	0.61
Top Half	in H ₂ O / ft	0.18	0.39	0.39	0.59	0.59
Bottom Half	in H ₂ O / ft	0.21	0.40	0.40	0.62	0.61
Liquid Collector	in H ₂ O	3.6	6.1	6.2	7.8	7.7
Bubblers						
Distributor Head	inches Hot Liq				8.2	8.1
Liquid Holdup						
Between Layers 5&6			0.05		0.06	
Middle of Layer 6			0.05		0.05	
Temperature Profiles	°F					
Reflux		128.2	119.8	121.6	117.2	117.7
Overhead Vapor		159.0	157.2	159.3	157.2	159.4
Distributor		142.7	134.7	136.7	132.0	133.1
Top Bed		158.5	157.2	159.3	157.7	159.8
Mid Bed		161.5	161.2	163.4	162.7	164.8
Below Bed		165.0	165.7	168.0	168.1	170.3
Liq Collector		167.5	168.6	171.0	171.4	173.6
Composition of Liquid	Mol % p-xylene					
Reflux		89.17	86.30	86.33	84.71	84.80
Distributor		86.29	87.01	86.32	84.78	84.77
Below Bed Cross		37.92	37.46	37.34	37.39	37.20
Collector		37.16	35.64	34.64	35.20	34.06
Bottoms		32.33	31.54	31.50	31.68	31.70
Feed		32.40	31.65	31.51	31.74	31.73
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % p-xylene	37.92	37.46	37.34	37.39	37.20
Temperature	°F	165.0	165.7	168.0	168.1	170.3
Liquid Density	lb/ft ³	51.6	51.6	51.5	51.5	51.4
Vapor Density	lb/ft ³	0.025	0.025	0.026	0.026	0.028
Vapor Rate	k lb/h	13.5	19.0	18.9	22.3	22.2
Liquid Rate	gpm	32.6	45.8	45.9	53.9	53.8
Fs	ft/s(lb/ft ³) ^{0.5}	1.911	2.668	2.603	3.056	2.975
Capacity Factor, Cs	ft/s	0.266	0.372	0.363	0.426	0.415
HETP 2 pt	inches					
DIST & below bed		12.9	12.5	12.7	13.5	13.3
DIST & bottoms		12.7	12.3	12.5	13.2	13.2
Relative Volatility		1.240	1.239	1.238	1.238	1.236
Cs Top	ft/s	0.267	0.380	0.371	0.444	0.433
Cs Mid	ft/s	0.267	0.375	0.367	0.435	0.424

Table I (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
o/p xylene, 1.43 psia

Run Number		23608	23609	23610	23611	23616
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	1.43	1.43	1.43	1.43	1.42
Reboiler Duty	M Btu/h	4.05	4.04	4.20	4.21	4.58
Condenser Duty	M Btu/h	3.32	3.40	3.63	3.59	4.15
Reflux Rate	k lb/h	20.0	20.1	21.4	21.6	24.0
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.85	0.87	1.28	1.31	2.15
Top Half	in H ₂ O / ft	0.80	0.81	1.19	1.21	2.31
Bottom Half	in H ₂ O / ft	0.88	0.89	1.35	1.39	1.96
Liquid Collector	in H ₂ O	8.7	8.8	9.2	9.2	9.5
Bubblers						
Distributor Head	inches Hot Liq	9.4	9.4	17.8	18.5	36.8
Liquid Holdup						
Between Layers 5&6		0.08		0.08		0.13
Middle of Layer 6		0.05		0.06		0.13
Temperature Profiles						
	°F					
Reflux		118.5	120.2	120.2	118.6	115.3
Overhead Vapor		157.4	159.5	159.7	157.5	160.2
Distributor		131.7	133.5	133.2	131.3	129.6
Top Bed		158.0	160.2	163.1	161.0	168.3
Mid Bed		164.2	166.5	170.0	167.8	178.8
Below Bed		170.3	172.8	175.8	175.1	186.0
Liq Collector		174.3	176.5	179.3	178.3	189.3
Composition of Liquid						
	Mol % p-xylene					
Reflux		83.09	83.10	81.95	81.95	55.59
Distributor		83.09	83.10	81.95	81.95	55.39
Below Bed Cross		36.55	36.44	36.70	36.77	40.97
Collector		32.46	35.23	34.83	35.64	42.42
Bottoms		31.65	31.63	31.74	31.57	39.06
Feed		31.63	31.63	31.73	31.68	39.28
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % p-xylene	36.55	36.44	36.70	36.77	40.97
Temperature	°F	170.3	172.8	175.8	175.1	186.0
Liquid Density	lb/ft ³	51.4	51.3	51.2	51.3	50.9
Vapor Density	lb/ft ³	0.028	0.029	0.031	0.031	0.038
Vapor Rate	k lb/h	24.1	24.2	25.5	25.6	28.2
Liquid Rate	gpm	58.5	58.6	62.1	62.3	69.0
Fs	ft/s(lb/ft ³) ^{0.5}	3.242	3.163	3.243	3.273	3.219
Capacity Factor, Cs	ft/s	0.452	0.442	0.453	0.457	0.451
HETP 2 pt	inches					
DIST & below bed		14.0	13.8	14.4	14.5	50.2
DIST & bottoms		14.0	13.8	14.3	14.3	64.7
Relative Volatility		1.236	1.234	1.232	1.232	1.225
Cs Top	ft/s	0.480	0.470	0.483	0.494	0.519
Cs Mid	ft/s	0.465	0.455	0.467	0.475	0.483

Table I (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
o/p xylene, 1.43 psia

Run Number		23617	23618	23619	23620	23621
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	1.43	1.43	1.43	1.43	1.43
Reboiler Duty	M Btu/h	4.59	3.43	3.43	2.64	2.64
Condenser Duty	M Btu/h	4.14	3.01	3.00	2.26	2.25
Reflux Rate	k lb/h	24.1	17.7	17.5	13.3	13.3
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	2.12	0.53	0.53	0.28	0.27
Top Half	in H ₂ O / ft	2.27	0.52	0.51	0.25	0.25
Bottom Half	in H ₂ O / ft	1.95	0.53	0.52	0.28	0.27
Liquid Collector	in H ₂ O	9.6	7.1	7.1	4.5	4.4
Bubblers						
Distributor Head	inches Hot Liq	36.2	7.9	7.9	5.3	5.3
Liquid Holdup						
Between Layers 5&6			0.06		0.05	
Middle of Layer 6			0.05		0.04	
Temperature Profiles	°F					
Reflux		115.7	123.5	123.1	124.8	124.7
Overhead Vapor		160.6	159.8	159.7	159.2	159.3
Distributor		129.8	137.1	136.8	140.0	140.0
Top Bed		167.7	159.9	159.8	158.8	158.9
Mid Bed		178.3	164.4	164.3	162.0	162.1
Below Bed		185.6	169.5	169.4	165.5	165.8
Liq Collector		188.8	173.0	172.9	168.9	169.0
Composition of Liquid	Mol % p-xylene					
Reflux		55.37	83.26	83.81	88.24	88.32
Distributor		55.38	83.43	83.83	88.22	88.27
Below Bed Cross		41.54	37.68	37.23	35.78	36.44
Collector		42.32	39.67	34.58	34.19	34.88
Bottoms		39.60	31.80	31.91	30.95	30.81
Feed		39.45	32.29	32.07	30.92	30.88
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % p-xylene	41.54	37.68	37.23	35.78	36.44
Temperature	°F	185.6	169.5	169.4	165.5	165.8
Liquid Density	lb/ft ³	50.9	51.4	51.4	51.6	51.6
Vapor Density	lb/ft ³	0.038	0.027	0.027	0.025	0.025
Vapor Rate	k lb/h	28.2	20.9	20.9	16.0	16.0
Liquid Rate	gpm	69.2	50.8	50.7	38.8	38.8
Fs	ft/s(lb/ft ³) ^{0.5}	3.238	2.834	2.834	2.266	2.258
Capacity Factor, Cs	ft/s	0.454	0.395	0.395	0.316	0.315
HETP 2 pt	inches					
DIST & below bed		52.3	14.1	13.8	11.6	11.7
DIST & bottoms		68.2	13.8	13.7	11.6	11.5
Relative Volatility		1.225	1.237	1.237	1.240	1.239
Cs Top	ft/s	0.524	0.409	0.409	0.316	0.316
Cs Mid	ft/s	0.487	0.402	0.402	0.315	0.315

Table II (US Engineering Units)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
C₆/C₇ System, 4.5 psia

Run Number		23622	23623	23628	23629	23630
Run Type		FT	FT	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.5
Reboiler Duty	M Btu/h	5.30	5.29	3.21	3.22	3.85
Condenser Duty	M Btu/h	4.95	4.98	2.99	2.96	3.59
Reflux Rate	k lb/h	31.3	31.4	18.4	18.5	22.2
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	1.89	1.93	0.18	0.18	0.28
Top Half	in H ₂ O / ft	2.06	2.14	0.13	0.13	0.22
Bottom Half	in H ₂ O / ft	1.68	1.70	0.20	0.20	0.31
Liquid Collector	in H ₂ O	7.4	7.4	3.2	3.3	4.6
Bubblers						
Distributor Head	inches Hot Liq	35.1	35.2	9.3	9.3	12.7
Liquid Holdup						
Between Layers 5&6				0.05		0.06
Middle of Layer 6				0.05		0.06
Temperature Profiles	°F					
Reflux		108.1	108.4	105.2	103.7	103.8
Overhead Vapor		128.2	128.4	118.8	117.2	119.6
Distributor		111.5	111.8	108.7	107.2	107.4
Top Bed		128.9	129.3	117.6	116.0	118.3
Mid Bed		132.8	133.3	130.6	128.8	134.5
Below Bed		139.8	140.0	144.7	142.9	145.3
Liq Collector		145.0	145.1	146.2	144.2	147.0
Composition of Liquid	Mol % C ₆					
Reflux		66.04	66.47	92.76	92.76	90.95
Distributor		66.31	66.53	92.86	92.90	91.04
Below Bed Cross		33.62	33.36	3.51	3.55	2.30
Collector		28.43	31.31	5.05	2.81	1.88
Bottoms		23.29	22.44	1.31	1.31	0.53
Feed		23.35	22.92	1.31	1.30	0.49
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	33.62	33.36	3.51	3.55	2.30
Temperature	°F	139.8	140.0	144.7	142.9	145.3
Liquid Density	lb/ft ³	42.1	42.1	40.5	40.6	40.4
Vapor Density	lb/ft ³	0.079	0.079	0.073	0.070	0.073
Vapor Rate	k lb/h	35.1	35.1	21.8	21.8	26.2
Liquid Rate	gpm	104.0	103.9	67.2	67.1	80.7
Fs	ft/s(lb/ft ³) ^{0.5}	2.793	2.788	1.807	1.840	2.165
Capacity Factor, Cs	ft/s	0.431	0.430	0.284	0.289	0.341
HETP 2 pt	inches					
DIST & below bed		62.2	61.1	14.3	14.4	13.9
DIST & bottoms		66.9	63.9	13.4	13.5	12.1
Relative Volatility		1.844	1.844	1.866	1.874	1.866
Cs Top	ft/s	0.419	0.417	0.256	0.260	0.306
Cs Mid	ft/s	0.424	0.422	0.265	0.270	0.318

Table II (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
C₆/C₇ System, **4.5 psia**

Run Number		23631	23632	23633	23634	23635
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.5
Reboiler Duty	M Btu/h	3.85	4.17	4.17	4.48	4.48
Condenser Duty	M Btu/h	3.61	3.97	3.95	4.50	4.52
Reflux Rate	k lb/h	22.2	23.9	24.0	26.7	26.6
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.28	0.35	0.35	0.54	0.53
Top Half	in H ₂ O / ft	0.22	0.28	0.28	0.38	0.37
Bottom Half	in H ₂ O / ft	0.31	0.40	0.40	0.67	0.66
Liquid Collector	in H ₂ O	4.6	5.3	5.3	6.3	6.2
Bubblers						
Distributor Head	inches Hot Liq	12.7	14.8	14.8	18.3	18.2
Liquid Holdup						
Between Layers 5&6			0.06		0.07	
Middle of Layer 6			0.06		0.06	
Temperature Profiles	°F					
Reflux		103.9	105.7	106.3	110.8	110.8
Overhead Vapor		119.6	118.9	118.9	118.9	118.9
Distributor		107.5	108.6	109.1	112.3	112.3
Top Bed		118.4	118.0	118.1	118.3	118.3
Mid Bed		134.8	131.7	132.0	131.9	132.0
Below Bed		145.5	145.8	145.8	146.5	146.5
Liq Collector		147.0	147.2	147.2	148.0	148.0
Composition of Liquid	Mol % C ₆					
Reflux		90.94	91.99	91.97	91.55	91.54
Distributor		90.92	92.01	91.96	91.65	91.75
Below Bed Cross		2.37	3.09	3.00	3.26	3.23
Collector		1.43	1.68	1.71	1.69	1.78
Bottoms		0.52	0.96	0.91	0.88	0.87
Feed		0.48	0.96	0.92	0.90	0.89
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	2.37	3.09	3.00	3.26	3.23
Temperature	°F	145.5	145.8	145.8	146.5	146.5
Liquid Density	lb/ft ³	40.4	40.5	40.5	40.4	40.4
Vapor Density	lb/ft ³	0.073	0.074	0.074	0.075	0.075
Vapor Rate	k lb/h	26.2	28.4	28.4	30.5	30.5
Liquid Rate	gpm	80.9	87.5	87.5	94.1	94.1
Fs	ft/s(lb/ft ³) ^{0.5}	2.162	2.329	2.329	2.485	2.486
Capacity Factor, Cs	ft/s	0.340	0.367	0.366	0.391	0.391
HETP 2 pt	inches					
DIST & below bed		14.0	14.3	14.2	14.5	14.5
DIST & bottoms		12.1	13.0	12.9	12.9	12.9
Relative Volatility		1.864	1.862	1.862	1.859	1.859
Cs Top	ft/s	0.306	0.331	0.331	0.356	0.356
Cs Mid	ft/s	0.318	0.343	0.343	0.367	0.367

Table II (US Engineering Units) (cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
C₆/C₇ System, 4.5 psia

Run Number		23636	23637	23640	23641	23642
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.5
Reboiler Duty	M Btu/h	4.60	4.60	4.68	4.67	4.93
Condenser Duty	M Btu/h	4.44	4.46	4.40	4.38	4.61
Reflux Rate	k lb/h	27.3	27.3	27.4	27.3	29.0
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.70	0.71	0.78	0.78	1.47
Top Half	in H ₂ O / ft	0.41	0.41	0.42	0.42	1.28
Bottom Half	in H ₂ O / ft	0.98	0.99	1.12	1.11	1.63
Liquid Collector	in H ₂ O	6.5	6.5	6.5	6.5	6.7
Bubblers						
Distributor Head	inches Hot Liq	18.6	18.6	18.6	18.6	22.4
Liquid Holdup						
Between Layers 5&6		0.08		0.09		0.15
Middle of Layer 6		0.06		0.07		0.15
Temperature Profiles						
	°F					
Reflux		109.5	109.5	106.0	105.7	109.4
Overhead Vapor		119.2	119.2	117.9	117.9	126.9
Distributor		111.2	111.3	108.1	107.9	112.2
Top Bed		118.4	118.4	117.1	117.1	127.4
Mid Bed		132.7	132.7	132.6	132.6	137.3
Below Bed		147.2	147.2	145.6	145.5	145.9
Liq Collector		148.7	148.7	147.0	147.0	148.1
Composition of Liquid						
	Mol % C ₆					
Reflux		91.64	91.56	90.90	90.86	70.70
Distributor		91.60	91.66	91.04	90.97	70.70
Below Bed Cross		3.51	3.53	3.18	3.32	16.99
Collector		2.25	2.56	2.36	2.36	11.78
Bottoms		1.29	1.28	1.31	1.26	11.88
Feed		1.27	1.27	1.31	1.27	12.06
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	3.51	3.53	3.18	3.32	16.99
Temperature	°F	147.2	147.2	145.6	145.5	145.9
Liquid Density	lb/ft ³	40.4	40.4	40.5	40.5	41.1
Vapor Density	lb/ft ³	0.076	0.076	0.074	0.074	0.081
Vapor Rate	k lb/h	31.4	31.4	31.8	31.8	33.2
Liquid Rate	gpm	96.8	96.8	98.0	98.0	100.9
Fs	ft/s(lb/ft ³) ^{0.5}	2.536	2.536	2.614	2.614	2.612
Capacity Factor, Cs	ft/s	0.399	0.399	0.411	0.411	0.408
HETP 2 pt	inches					
DIST & below bed		14.7	14.7	14.7	14.8	34.1
DIST & bottoms		13.7	13.7	14.0	13.9	37.0
Relative Volatility		1.856	1.856	1.863	1.863	1.844
Cs Top	ft/s	0.365	0.365	0.376	0.376	0.388
Cs Mid	ft/s	0.376	0.376	0.387	0.387	0.396

Table II (US Engineering Units) (cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
C₆/C₇ System, 4.5 psia

Run Number		23643	23644	23645	23646	23647
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.5
Reboiler Duty	M Btu/h	4.93	1.61	1.61	2.58	2.58
Condenser Duty	M Btu/h	4.62	1.41	1.41	2.23	2.21
Reflux Rate	k lb/h	28.9	8.6	8.6	13.9	13.7
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	1.47	0.05	0.05	0.10	0.10
Top Half	in H ₂ O / ft	1.29	0.00	0.00	0.06	0.05
Bottom Half	in H ₂ O / ft	1.63	0.07	0.07	0.12	0.12
Liquid Collector	in H ₂ O	6.7	0.8	0.8	1.9	1.9
Bubblers						
Distributor Head	inches Hot Liq	22.4	3.1	3.1	6.0	5.9
Liquid Holdup						
Between Layers 5&6			0.04		0.05	
Middle of Layer 6			0.04		0.05	
Temperature Profiles	°F					
Reflux		109.4	109.8	109.9	106.6	106.0
Overhead Vapor		126.7	118.0	118.0	118.1	118.1
Distributor		112.2	113.0	113.0	110.3	109.9
Top Bed		127.4	116.9	116.9	116.9	116.9
Mid Bed		137.4	130.4	130.2	125.5	125.6
Below Bed		145.9	144.6	144.6	143.8	143.8
Liq Collector		148.3	144.7	145.0	145.2	145.2
Composition of Liquid	Mol % C ₆					
Reflux		70.98	94.59	94.72	95.68	95.67
Distributor		71.95	94.55	94.69	95.74	95.66
Below Bed Cross		18.45	3.15	3.09	5.68	5.79
Collector		16.06	4.46	2.85	4.37	5.09
Bottoms		11.20	1.67	1.53	2.58	2.57
Feed		11.53	1.78	1.61	2.60	2.58
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	18.45	3.15	3.09	5.68	5.79
Temperature	°F	145.9	144.6	144.6	143.8	143.8
Liquid Density	lb/ft ³	41.1	40.5	40.5	40.6	40.6
Vapor Density	lb/ft ³	0.082	0.072	0.072	0.072	0.073
Vapor Rate	k lb/h	33.2	10.9	10.9	17.1	17.0
Liquid Rate	gpm	100.6	33.5	33.5	52.3	52.2
Fs	ft/s(lb/ft ³) ^{0.5}	2.597	0.903	0.904	1.415	1.410
Capacity Factor, Cs	ft/s	0.405	0.142	0.142	0.222	0.221
HETP 2 pt	inches					
DIST & below bed		34.6	13.4	13.3	14.2	14.3
DIST & bottoms		34.9	13.3	13.1	13.7	13.7
Relative Volatility		1.842	1.868	1.868	1.868	1.867
Cs Top	ft/s	0.387	0.127	0.128	0.200	0.199
Cs Mid	ft/s	0.393	0.132	0.132	0.207	0.207

Table III (US Engineering Units)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, **23.5 psia**

Run Number		23648	23649	23650	23651	23652
Run Type		FT	FT	TR	TR	TR
Column Pressure:	psia	23.4	23.3	23.5	23.4	23.6
Reboiler Duty	M Btu/h	8.08	8.09	2.37	2.36	4.13
Condenser Duty	M Btu/h	7.49	7.41	1.90	1.89	3.56
Reflux Rate	k lb/h	45.9	45.6	10.8	10.8	21.2
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	29.9	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	2.00	2.03	0.02	0.02	0.06
Top Half	in H ₂ O / ft	2.49	2.52	0.02	0.02	0.06
Bottom Half	in H ₂ O / ft	1.51	1.52	0.02	0.02	0.07
Liquid Collector	in H ₂ O	5.0	5.0	0.3	0.3	1.2
Bubblers						
Distributor Head	inches Hot Liq	34.3	34.4	2.2	2.2	4.2
Liquid Holdup						
Between Layers 5&6		0.21		0.04		0.05
Middle of Layer 6		0.21		0.04		0.05
Temperature Profiles	°F					
Reflux		170.2	169.9	150.4	150.1	154.6
Overhead Vapor		218.4	217.9	211.8	211.6	213.6
Distributor		177.0	176.7	178.3	178.0	170.2
Top Bed		216.7	216.3	209.8	209.6	211.1
Mid Bed		223.1	223.9	227.4	227.1	228.8
Below Bed		232.7	232.8	236.8	236.7	237.1
Liq Collector		234.2	234.4	237.0	236.8	237.9
Composition of Liquid	Mol % C ₆					
Reflux		79.55	79.50	93.67	93.77	90.91
Distributor		79.81	81.03	93.64	93.76	90.90
Below Bed Cross		35.18	36.38	10.03	9.90	10.14
Collector		37.29	35.12	10.09	10.03	10.16
Bottoms		24.68	27.06	7.50	7.33	6.12
Feed		26.20	26.05	7.64	7.40	6.14
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	35.18	36.38	10.03	9.90	10.14
Temperature	°F	232.7	232.8	236.8	236.7	237.1
Liquid Density	lb/ft ³	39.0	39.0	37.7	37.7	37.7
Vapor Density	lb/ft ³	0.351	0.353	0.338	0.338	0.340
Vapor Rate	k lb/h	58.4	58.3	16.5	16.5	30.0
Liquid Rate	gpm	186.89	186.33	54.69	54.64	99.40
Fs	ft/s(lb/ft ³) ^{0.5}	2.203	2.194	0.634	0.634	1.150
Capacity Factor, Cs	ft/s	0.354	0.353	0.104	0.104	0.188
HETP 2 pt	inches					
DIST & below bed		30.9	30.5	12.6	12.5	13.7
DIST & bottoms		30.0	30.7	12.9	12.8	13.4
Relative Volatility		1.558	1.557	1.562	1.562	1.561
Cs Top	ft/s	0.337	0.336	0.093	0.093	0.168
Cs Mid	ft/s	0.345	0.344	0.097	0.097	0.177

Table III (US Engineering Units) (Cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, **23.5 psia**

Run Number		23653	23654	23655	23656	23657
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	23.6	23.5	23.5	23.6	23.6
Reboiler Duty	M Btu/h	4.12	5.29	5.30	6.17	6.17
Condenser Duty	M Btu/h	3.55	4.78	4.70	5.53	5.66
Reflux Rate	k lb/h	21.2	29.3	29.1	33.2	33.1
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.06	0.12	0.12	0.18	0.18
Top Half	in H ₂ O / ft	0.06	0.11	0.11	0.16	0.16
Bottom Half	in H ₂ O / ft	0.07	0.13	0.13	0.19	0.20
Liquid Collector	in H ₂ O	1.2	2.2	2.2	2.9	2.9
Bubblers						
Distributor Head	inches Hot Liq	4.2	6.3	6.2	7.7	7.7
Liquid Holdup						
Between Layers 5&6			0.06		0.06	
Middle of Layer 6			0.06		0.06	
Temperature Profiles	°F					
Reflux		154.4	169.0	168.4	162.3	160.0
Overhead Vapor		213.7	213.8	214.0	214.4	214.6
Distributor		170.1	177.5	177.1	171.3	169.7
Top Bed		211.2	211.3	211.5	212.0	212.1
Mid Bed		228.8	228.2	228.5	227.9	228.0
Below Bed		237.1	237.0	237.2	237.5	237.7
Liq Collector		237.9	237.9	238.1	238.6	238.7
Composition of Liquid	Mol % C ₆					
Reflux		90.90	89.96	89.93	89.36	89.24
Distributor		90.92	89.95	89.92	89.31	89.21
Below Bed Cross		10.17	9.56	9.50	9.63	9.46
Collector		10.34	9.38	8.90	8.40	8.34
Bottoms		6.13	4.91	4.91	4.27	4.22
Feed		6.12	4.91	4.90	4.31	4.25
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	10.17	9.56	9.50	9.63	9.46
Temperature	°F	237.1	237.0	237.2	237.5	237.7
Liquid Density	lb/ft ³	37.7	37.6	37.6	37.6	37.6
Vapor Density	lb/ft ³	0.340	0.339	0.340	0.341	0.342
Vapor Rate	k lb/h	30.0	39.0	38.9	45.4	45.4
Liquid Rate	gpm	99.29	129.19	129.06	150.32	150.47
Fs	ft/s(lb/ft ³) ^{0.5}	1.148	1.496	1.493	1.734	1.734
Capacity Factor, Cs	ft/s	0.188	0.245	0.244	0.284	0.284
HETP 2 pt	inches					
DIST & below bed		13.7	13.9	13.8	14.1	14.1
DIST & bottoms		13.4	13.1	13.1	12.8	12.8
Relative Volatility		1.561	1.561	1.561	1.560	1.560
Cs Top	ft/s	0.168	0.219	0.218	0.254	0.254
Cs Mid	ft/s	0.177	0.230	0.229	0.267	0.267

Table III (US Engineering Units) (Cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, **23.5 psia**

Run Number		23658	23659	23660	23661	23662
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	23.5	23.6	23.5	23.5	23.5
Reboiler Duty	M Btu/h	6.77	6.76	7.34	7.35	7.53
Condenser Duty	M Btu/h	6.17	6.21	6.76	6.74	6.73
Reflux Rate	k lb/h	37.3	37.1	41.4	41.4	42.1
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	29.9	29.9	30.1	30.1	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.24	0.24	0.38	0.39	0.44
Top Half	in H ₂ O / ft	0.21	0.21	0.30	0.30	0.32
Bottom Half	in H ₂ O / ft	0.27	0.27	0.47	0.49	0.56
Liquid Collector	in H ₂ O	3.6	3.6	4.3	4.3	4.5
Bubblers						
Distributor Head	inches Hot Liq	9.4	9.3	11.3	11.2	11.5
Liquid Holdup						
Between Layers 5&6		0.07		0.09		0.09
Middle of Layer 6		0.07		0.08		0.08
Temperature Profiles	°F					
Reflux		168.8	167.9	171.0	170.6	169.7
Overhead Vapor		214.3	214.4	215.2	215.3	215.9
Distributor		175.7	175.1	177.0	176.6	175.9
Top Bed		212.0	212.2	213.1	213.1	213.8
Mid Bed		226.6	226.8	226.4	226.4	227.2
Below Bed		237.3	237.4	237.6	237.6	237.6
Liq Collector		238.5	238.6	238.4	238.4	238.3
Composition of Liquid	Mol % C ₆					
Reflux		88.69	88.64	86.76	86.55	85.39
Distributor		88.67	88.64	86.71	86.62	85.41
Below Bed Cross		9.47	9.67	9.98	9.44	9.74
Collector		7.83	7.85	8.44	9.88	10.38
Bottoms		3.96	3.91	5.58	5.71	6.76
Feed		4.04	3.95	5.49	5.65	6.83
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	9.47	9.67	9.98	9.44	9.74
Temperature	°F	237.3	237.4	237.6	237.6	237.6
Liquid Density	lb/ft ³	37.6	37.6	37.6	37.6	37.6
Vapor Density	lb/ft ³	0.340	0.341	0.342	0.341	0.342
Vapor Rate	k lb/h	49.8	49.7	54.4	54.5	55.7
Liquid Rate	gpm	164.94	164.68	180.18	180.62	184.51
Fs	ft/s(lb/ft ³) ^{0.5}	1.907	1.901	2.076	2.083	2.127
Capacity Factor, Cs	ft/s	0.312	0.311	0.340	0.341	0.348
HETP 2 pt	inches					
DIST & below bed		14.3	14.3	15.1	14.9	15.4
DIST & bottoms		12.8	12.8	14.4	14.5	15.6
Relative Volatility		1.561	1.560	1.560	1.560	1.560
Cs Top	ft/s	0.279	0.278	0.305	0.305	0.312
Cs Mid	ft/s	0.293	0.293	0.320	0.321	0.328

Table III (US Engineering Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, **23.5 psia**

Run Number		23663	23664	23665	23666	23667
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	23.5	23.5	23.5	23.6	23.5
Reboiler Duty	M Btu/h	7.53	7.76	7.76	7.94	7.94
Condenser Duty	M Btu/h	6.77	7.06	7.07	7.27	7.19
Reflux Rate	k lb/h	42.1	44.4	44.4	46.2	45.8
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.44	1.07	1.10	1.97	1.96
Top Half	in H ₂ O / ft	0.33	0.73	0.79	2.46	2.42
Bottom Half	in H ₂ O / ft	0.56	1.42	1.42	1.48	1.48
Liquid Collector	in H ₂ O	4.5	4.8	4.8	4.8	4.8
Bubblers						
Distributor Head	inches Hot Liq	11.6	12.8	12.8	34.8	34.6
Liquid Holdup						
Between Layers 5&6			0.17		0.19	
Middle of Layer 6			0.16		0.17	
Temperature Profiles	°F					
Reflux		169.9	174.3	174.7	182.5	181.7
Overhead Vapor		215.9	217.7	217.6	223.5	223.2
Distributor		176.1	179.6	180.0	187.7	187.2
Top Bed		213.8	215.7	215.7	221.7	221.5
Mid Bed		227.3	229.9	229.7	229.1	229.7
Below Bed		237.6	237.0	237.2	236.8	236.6
Liq Collector		238.3	237.9	238.1	237.9	237.8
Composition of Liquid	Mol % C ₆					
Reflux		85.45	80.72	81.06	67.81	66.49
Distributor		85.43	80.86	81.20	67.28	66.30
Below Bed Cross		9.95	14.55	13.49	17.80	20.43
Collector		11.28	13.15	16.71	22.09	20.78
Bottoms		6.69	9.90	10.26	17.12	16.11
Feed		6.69	10.15	10.38	14.70	16.23
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	9.95	14.55	13.49	17.80	20.43
Temperature	°F	237.6	237.0	237.2	236.8	236.6
Liquid Density	lb/ft ³	37.6	37.9	37.8	38.0	38.1
Vapor Density	lb/ft ³	0.342	0.346	0.345	0.349	0.352
Vapor Rate	k lb/h	55.7	57.3	57.4	58.5	58.2
Liquid Rate	gpm	184.5	188.9	189.3	192.0	190.3
Fs	ft/s(lb/ft ³) ^{0.5}	2.126	2.178	2.183	2.213	2.192
Capacity Factor, Cs	ft/s	0.348	0.356	0.357	0.361	0.357
HETP 2 pt	inches					
DIST & below bed		15.5	19.1	18.5	27.3	30.2
DIST & bottoms		15.5	19.2	19.3	33.1	32.6
Relative Volatility		1.560	1.559	1.559	1.558	1.557
Cs Top	ft/s	0.312	0.324	0.323	0.334	0.334
Cs Mid	ft/s	0.328	0.338	0.338	0.346	0.345

Table III (US Engineering Units) (Cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, **23.5 psia**

Run Number		23668	23669	23670	23671	23672	23673
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure:	psia	23.5	23.5	23.5	23.5	23.5	23.5
Reboiler Duty	M Btu/h	7.65	7.65	7.05	7.05	3.24	3.25
Condenser Duty	M Btu/h	6.99	7.00	6.44	6.49	2.73	2.72
Reflux Rate	k lb/h	43.5	43.5	40.6	40.6	16.6	16.5
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.1	30.1	30.0	30.0
Pressure Drops:							
Overall	in H ₂ O / ft	0.50	0.51	0.30	0.31	0.04	0.04
Top Half	in H ₂ O / ft	0.36	0.36	0.25	0.25	0.04	0.04
Bottom Half	in H ₂ O / ft	0.66	0.68	0.36	0.36	0.04	0.04
Liquid Collector	in H ₂ O	4.6	4.6	4.0	4.0	0.7	0.7
Bubblers							
Distributor Head	inches Hot Liq	12.2	12.2	10.8	10.8	3.2	3.2
Liquid Holdup							
Between Layers 5&6		0.09		0.08		0.04	
Middle of Layer 6		0.08		0.07		0.05	
Temperature Profiles							
	°F						
Reflux		176.6	176.6	179.3	179.4	166.4	165.0
Overhead Vapor		216.1	216.1	215.5	215.6	214.0	214.0
Distributor		181.6	181.6	184.1	184.1	181.8	181.1
Top Bed		214.2	214.1	213.4	213.5	211.8	211.8
Mid Bed		228.1	228.0	227.6	227.7	231.6	231.5
Below Bed		237.3	237.3	237.7	237.8	237.6	237.5
Liq Collector		238.0	238.0	238.8	238.9	238.0	237.9
Composition of Liquid							
	Mol % C ₆						
Reflux		84.30	84.30	85.74	85.67	89.46	89.41
Distributor		84.20	84.41	85.71	85.56	89.46	89.45
Below Bed Cross		11.02	11.09	9.27	8.57	7.49	7.51
Collector		12.54	12.81	6.45	6.62	7.24	7.54
Bottoms		7.90	7.89	2.98	2.96	4.69	4.70
Feed		7.90	7.82	2.97	2.98	4.68	4.69
Conditions at Bottom (Based on Reboiler Duty)							
Composition	Mol % C ₆	11.02	11.09	9.27	8.57	7.49	7.51
Temperature	°F	237.3	237.3	237.7	237.8	237.6	237.5
Liquid Density	lb/ft ³	37.7	37.7	37.6	37.6	37.5	37.5
Vapor Density	lb/ft ³	0.342	0.342	0.342	0.341	0.338	0.338
Vapor Rate	k lb/h	56.4	56.4	52.2	52.2	23.5	23.5
Liquid Rate	gpm	186.5	186.6	173.0	173.3	77.9	78.0
Fs	ft/s(lb/ft ³) ^{0.5}	2.154	2.154	1.993	1.997	0.900	0.902
Capacity Factor, Cs	ft/s	0.352	0.352	0.327	0.327	0.148	0.148
HETP 2 pt	inches						
DIST & below bed		16.4	16.3	15.1	14.8	13.2	13.2
DIST & bottoms		16.7	16.6	12.7	12.7	13.1	13.1
Relative Volatility		1.560	1.560	1.560	1.560	1.561	1.561
Cs Top	ft/s	0.317	0.317	0.293	0.293	0.131	0.131
Cs Mid	ft/s	0.332	0.332	0.307	0.308	0.138	0.138

Table IV (US Engineering Units)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, **23.5 psia**

Run Number		23674	23675	23676	23677	23678
Run Type		FT	FT	TR	TR	TR
Column Pressure:	psia	23.4	23.5	23.5	23.5	23.5
Reboiler Duty	M Btu/h	8.11	8.08	4.13	4.13	5.30
Condenser Duty	M Btu/h	7.55	7.48	3.21	3.23	4.54
Reflux Rate	k lb/h	46.6	46.2	20.5	20.5	28.4
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	29.9	29.9	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	2.04	2.09	0.06	0.06	0.11
Top Half	in H ₂ O / ft	2.55	2.55	0.05	0.05	0.11
Bottom Half	in H ₂ O / ft	1.47	1.51	0.07	0.07	0.13
Liquid Collector	in H ₂ O	0.3	0.3	0.1	0.1	0.2
Bubblers						
Distributor Head	inches Hot Liq	34.4	34.5	4.1	4.1	6.3
Liquid Holdup						
Between Layers 5&6		0.16		0.05		0.06
Middle of Layer 6		0.17		0.05		0.06
Temperature Profiles	°F					
Reflux		174.0	173.7	173.5	171.9	172.8
Overhead Vapor		220.4	219.7	212.7	212.7	213.3
Distributor		180.3	180.1	183.9	182.8	180.7
Top Bed		218.7	218.2	210.6	210.5	211.1
Mid Bed		223.2	222.8	227.7	227.8	227.8
Below Bed		234.6	235.0	236.6	236.6	237.0
Composition of Liquid	Mol % C ₆					
Reflux		73.90	75.40	92.38	92.32	90.82
Distributor		73.70	75.93	92.40	92.30	90.88
Below Bed Cross		27.40	27.40	11.75	11.69	10.19
Bottoms		19.96	20.81	6.60	6.26	4.63
Feed		21.33	20.60	6.52	6.38	4.92
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	27.40	27.40	11.75	11.69	10.19
Temperature	°F	234.6	235.0	236.6	236.6	237.0
Liquid Density	lb/ft ³	38.5	38.5	37.7	37.7	37.7
Vapor Density	lb/ft ³	0.351	0.352	0.340	0.340	0.339
Vapor Rate	k lb/h	59.4	59.2	29.0	29.1	38.5
Liquid Rate	gpm	192.1	191.7	95.7	96.0	127.4
Fs	ft/s(lb/ft ³) ^{0.5}	2.239	2.228	1.110	1.113	1.475
Capacity Factor, Cs	ft/s	0.362	0.361	0.181	0.182	0.241
HETP 2 pt	inches					
DIST & below bed		30.7	28.9	13.6	13.7	13.8
DIST & bottoms		31.1	30.1	13.1	13.0	12.6
Relative Volatility		1.558	1.558	1.561	1.562	1.561
Cs Top	ft/s	0.341	0.339	0.162	0.163	0.216
Cs Mid	ft/s	0.351	0.349	0.171	0.171	0.227

Table IV (US Engineering Units) (Cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 23.5 psia

Run Number		23679	23680	23681	23682	23683
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	23.5	23.5	23.5	23.5	23.5
Reboiler Duty	M Btu/h	5.30	6.76	6.76	7.64	7.64
Condenser Duty	M Btu/h	4.61	6.36	6.47	6.94	6.96
Reflux Rate	k lb/h	28.6	38.1	38.2	42.9	42.9
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	29.9	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.12	0.26	0.26	0.49	0.50
Top Half	in H ₂ O / ft	0.11	0.22	0.23	0.37	0.37
Bottom Half	in H ₂ O / ft	0.13	0.29	0.30	0.63	0.63
Liquid Collector	in H ₂ O	0.2	0.2	0.2	0.2	0.2
Bubblers						
Distributor Head	inches Hot Liq	6.3	9.9	10.0	12.1	12.1
Liquid Holdup						
Between Layers 5&6			0.07		0.10	
Middle of Layer 6			0.07		0.08	
Temperature Profiles						
	°F					
Reflux		172.6	168.4	168.2	169.7	169.7
Overhead Vapor		213.3	214.1	214.1	216.1	216.1
Distributor		180.6	175.2	175.1	175.7	175.7
Top Bed		211.1	212.0	211.9	214.0	214.0
Mid Bed		227.9	225.9	225.8	228.6	228.7
Below Bed		237.1	237.4	237.3	237.3	237.3
Composition of Liquid						
	Mol % C ₆					
Reflux		90.79	88.93	88.78	84.87	84.81
Distributor		90.85	88.91	88.81	84.84	84.91
Below Bed Cross		10.37	9.65	9.35	11.48	11.77
Bottoms		4.81	3.12	3.52	7.18	7.19
Feed		4.85	3.55	3.55	7.20	7.22
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	10.37	9.65	9.35	11.48	11.77
Temperature	°F	237.1	237.4	237.3	237.3	237.3
Liquid Density	lb/ft ³	37.7	37.6	37.6	37.7	37.7
Vapor Density	lb/ft ³	0.340	0.340	0.340	0.343	0.343
Vapor Rate	k lb/h	38.6	50.4	50.4	56.7	56.7
Liquid Rate	gpm	127.6	166.9	167.1	187.6	187.5
Fs	ft/s(lb/ft ³) ^{0.5}	1.476	1.928	1.932	2.164	2.163
Capacity Factor, Cs	ft/s	0.242	0.316	0.316	0.354	0.354
HETP 2 pt						
	inches					
DIST & below bed		13.8	14.2	14.2	16.3	16.4
DIST & bottoms		12.7	12.1	12.5	16.0	16.0
Relative Volatility						
Cs Top	ft/s	0.216	0.282	0.283	0.319	0.319
Cs Mid	ft/s	0.227	0.297	0.297	0.334	0.334

Table IV (US Engineering Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, **23.5 psia**

Run Number		23684	23685	23686	23687
Run Type		TR	TR	TR	TR
Column Pressure:	psia	23.3	23.5	23.5	23.6
Reboiler Duty	M Btu/h	7.68	7.77	7.95	7.94
Condenser Duty	M Btu/h	6.93	7.06	7.26	7.27
Reflux Rate	k lb/h	42.6	43.3	44.7	44.6
Feed Location		Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	29.7	30.0	30.0	30.0
Pressure Drops:					
Overall	in H ₂ O / ft	0.55	0.59	1.13	1.17
Top Half	in H ₂ O / ft	0.40	0.42	0.93	0.99
Bottom Half	in H ₂ O / ft	0.70	0.77	1.33	1.35
Liquid Collector	in H ₂ O	0.2	0.2	0.3	0.3
Bubblers					
Distributor Head	inches Hot Liq	12.2	12.4	13.0	13.0
Liquid Holdup					
Between Layers 5&6		0.10		0.14	
Middle of Layer 6		0.08		0.17	
Temperature Profiles	°F				
Reflux		167.4	167.5	172.1	172.0
Overhead Vapor		217.2	217.2	218.2	218.8
Distributor		173.9	173.9	177.9	177.9
Top Bed		215.1	215.2	215.9	217.0
Mid Bed		230.3	230.7	230.1	230.0
Below Bed		237.3	237.1	237.2	236.9
Composition of Liquid	Mol % C ₆				
Reflux		82.41	82.39	80.53	79.29
Distributor		82.44	82.46	80.09	79.28
Below Bed Cross		11.95	11.46	16.97	16.97
Bottoms		7.80	7.79	7.89	10.39
Feed		7.83	7.78	8.21	9.69
Conditions at Bottom (Based on Reboiler Duty)					
Composition	Mol % C ₆	11.95	11.46	16.97	16.97
Temperature	°F	237.3	237.1	237.2	236.9
Liquid Density	lb/ft ³	37.7	37.7	38.0	38.0
Vapor Density	lb/ft ³	0.343	0.342	0.349	0.348
Vapor Rate	k lb/h	56.8	57.6	58.3	58.4
Liquid Rate	gpm	187.8	190.3	191.6	191.9
Fs	ft/s(lb/ft ³) ^{0.5}	2.167	2.198	2.204	2.210
Capacity Factor, Cs	ft/s	0.354	0.360	0.359	0.360
HETP 2 pt	inches				
DIST & below bed		17.4	17.1	20.6	21.0
DIST & bottoms		17.2	17.2	18.0	20.1
Relative Volatility		1.560	1.560	1.558	1.558
Cs Top	ft/s	0.320	0.324	0.330	0.330
Cs Mid	ft/s	0.335	0.339	0.343	0.343

Table V (US Engineering Units)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 4.5 psia

Run Number		23688	23689	23690	23691	23692
Run Type		FT	FT	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.5
Reboiler Duty	M Btu/h	5.23	5.18	3.21	3.22	4.17
Condenser Duty	M Btu/h	5.04	4.99	3.00	3.01	3.94
Reflux Rate	k lb/h	30.6	30.4	18.3	18.4	24.2
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	1.53	1.67	0.17	0.17	0.33
Top Half	in H ₂ O / ft	1.55	1.77	0.16	0.17	0.31
Bottom Half	in H ₂ O / ft	1.51	1.56	0.18	0.18	0.35
Liquid Collector	in H ₂ O	0.1	0.1	0.0	0.0	0.1
Bubblers						
Distributor Head	inches Hot Liq	6.6	8.4	3.3	3.3	4.6
Liquid Holdup						
Between Layers 5&6		0.16		0.05		0.07
Middle of Layer 6		0.15		0.05		0.06
Temperature Profiles	°F					
Reflux		108.0	108.2	108.9	109.1	109.4
Overhead Vapor		121.4	122.3	118.7	118.7	119.0
Distributor		110.7	110.9	111.6	111.7	111.6
Top Bed		126.9	124.6	117.6	117.6	118.1
Mid Bed		136.0	137.8	130.9	130.9	131.5
Below Bed		144.1	145.2	144.6	144.6	145.5
Composition of Liquid	Mol % C ₆					
Reflux		85.63	85.61	93.79	93.71	92.64
Distributor		85.61	85.68	93.80	93.77	92.72
Below Bed Cross		17.80	16.76	3.88	4.11	4.00
Bottoms		8.95	8.53	1.37	1.33	1.03
Feed		8.87	8.92	1.39	1.36	1.03
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	17.80	16.76	3.88	4.11	4.00
Temperature	°F	144.1	145.2	144.6	144.6	145.5
Liquid Density	lb/ft ³	41.2	41.1	40.5	40.5	40.5
Vapor Density	lb/ft ³	0.078	0.080	0.073	0.073	0.074
Vapor Rate	k lb/h	35.2	34.9	21.8	21.9	28.4
Liquid Rate	gpm	106.6	106.0	67.2	67.3	87.4
Fs	ft/s(lb/ft ³) ^{0.5}	2.806	2.764	1.809	1.811	2.329
Capacity Factor, Cs	ft/s	0.438	0.432	0.284	0.285	0.366
HETP 2 pt	inches					
DIST & below bed		25.3	24.7	14.2	14.3	14.7
DIST & bottoms		24.0	23.5	13.2	13.1	12.9
Relative Volatility		1.850	1.847	1.867	1.866	1.862
Cs Top	ft/s	0.394	0.398	0.255	0.256	0.331
Cs Mid	ft/s	0.412	0.411	0.265	0.265	0.343

Table V (US Engineering Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 4.5 psia

Run Number		23693	23694	23695	23696	23697
Run Type		TR	TR	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.5	4.5	4.5
Reboiler Duty	M Btu/h	4.17	4.49	4.49	4.69	4.69
Condenser Duty	M Btu/h	3.93	4.34	4.32	4.45	4.41
Reflux Rate	k lb/h	24.2	26.1	25.9	26.7	26.6
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0	30.0
Pressure Drops:						
Overall	in H ₂ O / ft	0.33	0.42	0.41	0.49	0.48
Top Half	in H ₂ O / ft	0.31	0.38	0.38	0.43	0.42
Bottom Half	in H ₂ O / ft	0.35	0.45	0.45	0.54	0.53
Liquid Collector	in H ₂ O	0.1	0.1	0.1	0.1	0.1
Bubblers						
Distributor Head	inches Hot Liq	4.7	5.2	5.1	5.3	5.3
Liquid Holdup						
Between Layers 5&6			0.07		0.08	
Middle of Layer 6			0.06		0.06	
Temperature Profiles	°F					
Reflux		109.6	109.7	109.5	108.4	108.0
Overhead Vapor		119.0	119.0	119.0	119.6	119.6
Distributor		111.8	111.7	111.5	110.9	110.6
Top Bed		118.2	118.3	118.4	118.9	119.0
Mid Bed		131.5	131.1	131.2	133.8	133.9
Below Bed		145.5	145.9	145.9	146.5	146.6
Composition of Liquid	Mol % C ₆					
Reflux		92.70	92.35	92.45	90.61	90.68
Distributor		92.71	92.35	92.39	90.59	90.68
Below Bed Cross		4.01	3.06	3.12	2.13	2.12
Bottoms		1.04	0.96	0.98	0.67	0.66
Feed		1.05	0.97	0.97	0.70	0.69
Conditions at Bottom (Based on Reboiler Duty)						
Composition	Mol % C ₆	4.01	3.06	3.12	2.13	2.12
Temperature	°F	145.5	145.9	145.9	146.5	146.6
Liquid Density	lb/ft ³	40.5	40.5	40.5	40.4	40.4
Vapor Density	lb/ft ³	0.074	0.074	0.074	0.075	0.075
Vapor Rate	k lb/h	28.4	30.6	30.6	31.7	31.7
Liquid Rate	gpm	87.4	94.3	94.2	98.0	97.8
Fs	ft/s(lb/ft ³) ^{0.5}	2.329	2.508	2.505	2.594	2.589
Capacity Factor, Cs	ft/s	0.366	0.395	0.394	0.409	0.408
HETP 2 pt	inches					
DIST & below bed		14.7	14.1	14.2	13.8	13.8
DIST & bottoms		12.9	12.9	12.9	12.6	12.6
Relative Volatility		1.862	1.862	1.862	1.860	1.860
Cs Top	ft/s	0.331	0.356	0.356	0.369	0.368
Cs Mid	ft/s	0.343	0.369	0.368	0.382	0.381

Table V (US Engineering Units) (Cont'd)
FRI Distillation Unit Experimental Data
4.0 ft. Diameter Low Pressure Column
Raschig RSP 250 Test, **11.6 ft** Packing Depth
Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 4.5 psia

Run Number		23698	23699	23700	23703
Run Type		TR	TR	TR	TR
Column Pressure:	psia	4.5	4.4	4.5	4.5
Reboiler Duty	M Btu/h	4.82	4.82	4.93	4.37
Condenser Duty	M Btu/h	4.26	4.25	4.48	4.12
Reflux Rate	k lb/h	27.4	27.5	29.0	26.3
Feed Location		Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0
Pressure Drops:					
Overall	in H ₂ O / ft	0.55	0.56	0.99	0.39
Top Half	in H ₂ O / ft	0.46	0.46	0.56	0.36
Bottom Half	in H ₂ O / ft	0.64	0.66	1.43	0.41
Liquid Collector	in H ₂ O	0.1	0.1	0.1	0.1
Bubblers					
Distributor Head	inches Hot Liq	5.4	5.4	6.0	5.1
Liquid Holdup					
Between Layers 5&6		0.09		0.15	0.07
Middle of Layer 6		0.07		0.15	0.06
Temperature Profiles					
	°F				
Reflux		109.6	109.9	113.3	115.6
Overhead Vapor		119.1	118.6	121.7	120.7
Distributor		111.5	111.7	115.0	116.6
Top Bed		118.3	117.9	121.8	120.2
Mid Bed		132.3	132.1	143.1	138.0
Below Bed		146.3	146.1	148.3	146.6
Composition of Liquid					
	Mol % C ₆				
Reflux		91.30	91.52	84.71	89.77
Distributor		91.32	91.51	84.81	89.80
Below Bed Cross		2.49	2.44	5.29	1.35
Bottoms		0.72	0.74	1.26	1.00
Feed		0.73	0.74	1.25	1.00
Conditions at Bottom (Based on Reboiler Duty)					
Composition	Mol % C ₆	2.49	2.44	5.29	1.35
Temperature	°F	146.3	146.1	148.3	146.6
Liquid Density	lb/ft ³	40.4	40.4	40.5	40.4
Vapor Density	lb/ft ³	0.075	0.074	0.079	0.074
Vapor Rate	k lb/h	32.3	32.4	33.5	29.8
Liquid Rate	gpm	99.8	99.9	103.1	92.0
Fs	ft/s(lb/ft ³) ^{0.5}	2.644	2.654	2.662	2.439
Capacity Factor, Cs	ft/s	0.416	0.418	0.419	0.384
HETP 2 pt	inches				
DIST & below bed		14.0	13.9	18.2	13.0
DIST & bottoms		12.6	12.6	15.3	13.6
Relative Volatility		1.861	1.862	1.849	1.861
Cs Top	ft/s	0.377	0.379	0.387	0.343
Cs Mid	ft/s	0.390	0.391	0.397	0.357

Table V (US Engineering Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 4.0 ft. Diameter Low Pressure Column
 Raschig RSP 250 Test, **11.6 ft** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 4.5 psia

Run Number		23704	23705	23706	23707
Run Type		TR	TR	TR	TR
Column Pressure:	psia	4.5	4.5	4.5	4.5
Reboiler Duty	M Btu/h	4.36	4.37	3.86	3.86
Condenser Duty	M Btu/h	4.10	4.07	3.57	3.57
Reflux Rate	k lb/h	25.8	25.7	22.4	22.4
Feed Location		Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	k lb/h	30.0	30.0	30.0	30.0
Pressure Drops:					
Overall	in H ₂ O / ft	0.38	0.38	0.26	0.26
Top Half	in H ₂ O / ft	0.35	0.35	0.25	0.24
Bottom Half	in H ₂ O / ft	0.41	0.41	0.27	0.27
Liquid Collector	in H ₂ O	0.1	0.1	0.1	0.1
Bubblers					
Distributor Head	inches Hot Liq	5.0	5.0	4.2	4.2
Liquid Holdup					
Between Layers 5&6				0.06	
Middle of Layer 6				0.06	
Temperature Profiles					
	°F				
Reflux		113.9	113.8	113.8	113.9
Overhead Vapor		119.3	119.4	119.1	119.3
Distributor		114.9	115.0	114.9	115.0
Top Bed		118.6	118.7	118.1	118.3
Mid Bed		132.8	133.1	133.5	134.0
Below Bed		145.9	146.0	145.4	145.5
Composition of Liquid					
	Mol % C ₆				
Reflux		91.76	91.71	92.37	92.27
Distributor		91.75	91.84	92.34	92.24
Below Bed Cross		2.23	2.27	2.32	2.19
Bottoms		0.81	0.80	0.93	0.93
Feed		0.81	0.81	0.95	0.94
Conditions at Bottom (Based on Reboiler Duty)					
Composition	Mol % C ₆	2.23	2.27	2.32	2.19
Temperature	°F	145.9	146.0	145.4	145.5
Liquid Density	lb/ft ³	40.4	40.4	40.4	40.4
Vapor Density	lb/ft ³	0.074	0.074	0.073	0.073
Vapor Rate	k lb/h	29.7	29.7	26.2	26.2
Liquid Rate	gpm	91.7	91.8	80.8	80.8
Fs	ft/s(lb/ft ³) ^{0.5}	2.443	2.441	2.165	2.161
Capacity Factor, Cs	ft/s	0.385	0.384	0.341	0.340
HETP 2 pt					
	inches				
DIST & below bed		13.6	13.6	13.5	13.4
DIST & bottoms		12.7	12.7	12.8	12.9
Relative Volatility		1.863	1.862	1.865	1.865
Cs Top	ft/s	0.346	0.345	0.305	0.305
Cs Mid	ft/s	0.359	0.358	0.317	0.317

Table I (SI Units)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
o/p xylene, 0.1 bara

Run Number		23598	23599	23600	23601	23602
Run Type		FT	FT	TR	TR	TR
Column Pressure	bar	0.10	0.10	0.10	0.10	0.10
Reboiler Duty	MW	1.44	1.43	0.52	0.52	0.64
Condenser Duty	MW	1.33	1.34	0.42	0.42	0.59
Reflux Rate	kg/s	3.19	3.22	1.10	1.03	1.48
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.77	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	18.0	17.9	1.0	0.9	1.7
Top Half	mbar/m	19.6	19.6	0.8	0.7	1.5
Bottom Half	mbar/m	16.3	16.3	1.0	1.0	1.7
Liquid Collector	mbar	26.0	26.0	5.4	5.1	8.9
Distributor	mbar					
Bubblers						
Distributor Head	mm Hot Liq					
Liquid Holdup						
Between Layers 5&6		0.12		0.04		0.04
Middle of Layer 6		0.14		0.04		0.04
Temperature Profiles	°C					
Reflux		45.5	46.0	55.1	53.0	53.0
Overhead Vapor		71.1	71.3	70.8	70.7	70.6
Distributor		54.1	54.6	63.6	63.0	61.3
Top Bed		77.1	77.2	70.5	70.4	70.3
Mid Bed		82.7	82.8	71.7	71.7	71.9
Below Bed		86.4	86.5	73.4	73.4	73.6
Liq Collector		88.3	88.3	74.4	73.9	75.3
Composition of Liquid	mol % p-xylene					
Reflux		54.16	53.98	86.60	87.47	88.95
Distributor		54.24	53.99	86.05	87.34	87.07
Below Bed Cross		45.15	44.50	38.99	40.01	37.97
Collector		40.40	44.49	40.32	38.10	40.02
Bottoms		41.04	41.30	33.78	33.55	32.36
Feed		40.98	41.19	34.00	33.71	32.48
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % p-xylene	45.15	44.50	38.99	40.01	37.97
Temperature	°C	86.4	86.5	73.4	73.4	73.6
Liquid Density	kg/m ³	813.1	813.2	826.3	826.1	826.4
Vapor Density	kg/m ³	0.635	0.636	0.392	0.393	0.393
Vapor Rate	kg/s	3.79	3.79	1.35	1.33	1.70
Liquid Rate	m ³ /h	16.78	16.79	5.90	5.78	7.41
Fs	m/s (kg/m ³) ^{0.5}	4.116	4.113	1.870	1.832	2.345
Capacity Factor, Cs	m/s	0.144	0.144	0.065	0.064	0.082
HETP 2 pt	%					
DIST & below bed		2028	1941	337	327	319
DIST & bottoms		2293	2448	336	319	315
Relative Volatility		1.224	1.224	1.241	1.241	1.240
Cs Top	m/s	0.166	0.165	0.065	0.063	0.081
Cs mid	m/s	0.154	0.154	0.065	0.064	0.081

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
 o/p xylene, **0.1** bara

Run Number		23603	23604	23605	23606	23607
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	0.10	0.10	0.10	0.10	0.10
Reboiler Duty	MW	0.64	0.92	0.92	1.10	1.10
Condenser Duty	MW	0.59	0.81	0.80	0.91	0.88
Reflux Rate	kg/s	1.49	1.98	1.99	2.28	2.28
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	1.7	3.3	3.3	5.0	5.0
Top Half	mbar/m	1.5	3.2	3.2	4.8	4.8
Bottom Half	mbar/m	1.7	3.3	3.3	5.0	5.0
Liquid Collector	mbar	8.9	15.3	15.3	19.3	19.2
Distributor	mbar					
Bubblers						
Distributor Head	mm Hot Liq				207	206
Liquid Holdup						
Between Layers 5&6			0.05		0.06	
Middle of Layer 6			0.05		0.05	
Temperature Profiles	°C					
Reflux		53.4	48.8	49.8	47.3	47.6
Overhead Vapor		70.5	69.5	70.7	69.6	70.8
Distributor		61.5	57.1	58.2	55.6	56.2
Top Bed		70.3	69.5	70.7	69.8	71.0
Mid Bed		71.9	71.8	73.0	72.6	73.8
Below Bed		73.9	74.3	75.5	75.6	76.8
Liq Collector		75.3	75.9	77.2	77.4	78.7
Composition of Liquid	mol % p-xylene					
Reflux		89.17	86.30	86.33	84.71	84.80
Distributor		86.29	87.01	86.32	84.78	84.77
Below Bed Cross		37.92	37.46	37.34	37.39	37.20
Collector		37.16	35.64	34.64	35.20	34.06
Bottoms		32.33	31.54	31.50	31.68	31.70
Feed		32.40	31.65	31.51	31.74	31.73
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % p-xylene	37.92	37.46	37.34	37.39	37.20
Temperature	°C	73.9	74.3	75.5	75.6	76.8
Liquid Density	kg/m ³	826.1	825.9	824.8	824.7	823.6
Vapor Density	kg/m ³	0.398	0.403	0.423	0.424	0.444
Vapor Rate	kg/s	1.70	2.39	2.39	2.81	2.79
Liquid Rate	m ³ /h	7.41	10.41	10.41	12.25	12.21
Fs	m/s (kg/m ³) ^{0.5}	2.332	3.255	3.176	3.728	3.630
Capacity Factor, Cs	m/s	0.081	0.113	0.111	0.130	0.127
HETP 2 pt	%					
DIST & below bed		328	317	322	342	338
DIST & bottoms		324	311	317	336	334
Relative Volatility		1.240	1.239	1.238	1.238	1.236
Cs Top	m/s	0.081	0.116	0.113	0.135	0.132
Cs mid	m/s	0.081	0.114	0.112	0.133	0.129

Table I (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.22 m. Diameter Low Pressure Column
Raschig RSP 250 Test, **3.53 m** Packing Depth
Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
o/p xylene, 0.1 bara

Run Number		23608	23609	23610	23611	23616
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	0.10	0.10	0.10	0.10	0.10
Reboiler Duty	MW	1.19	1.18	1.23	1.23	1.34
Condenser Duty	MW	0.97	1.00	1.06	1.05	1.22
Reflux Rate	kg/s	2.52	2.54	2.70	2.72	3.03
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	7.0	7.1	10.4	10.7	17.5
Top Half	mbar/m	6.6	6.6	9.7	9.9	18.8
Bottom Half	mbar/m	7.2	7.3	11.0	11.4	16.0
Liquid Collector	mbar	21.7	21.8	22.9	22.8	23.7
Distributor	mbar					
Bubblers						
Distributor Head	mm Hot Liq	239	240	452	471	934
Liquid Holdup						
Between Layers 5&6		0.08		0.08		0.13
Middle of Layer 6		0.05		0.06		0.13
Temperature Profiles	°C					
Reflux		48.1	49.0	49.0	48.1	46.3
Overhead Vapor		69.6	70.8	70.9	69.7	71.2
Distributor		55.4	56.4	56.2	55.2	54.2
Top Bed		70.0	71.2	72.9	71.6	75.7
Mid Bed		73.4	74.7	76.7	75.4	81.6
Below Bed		76.8	78.2	79.9	79.5	85.6
Liq Collector		79.1	80.3	81.8	81.3	87.4
Composition of Liquid	mol % p-xylene					
Reflux		83.09	83.10	81.95	81.95	55.59
Distributor		83.09	83.10	81.95	81.95	55.39
Below Bed Cross		36.55	36.44	36.70	36.77	40.97
Collector		32.46	35.23	34.83	35.64	42.42
Bottoms		31.65	31.63	31.74	31.57	39.06
Feed		31.63	31.63	31.73	31.68	39.28
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % p-xylene	36.55	36.44	36.70	36.77	40.97
Temperature	°C	76.8	78.2	79.9	79.5	85.6
Liquid Density	kg/m ³	823.8	822.5	820.9	821.3	814.8
Vapor Density	kg/m ³	0.442	0.466	0.495	0.489	0.611
Vapor Rate	kg/s	3.04	3.04	3.22	3.23	3.55
Liquid Rate	m ³ /h	13.29	13.32	14.11	14.14	15.67
Fs	m/s (kg/m ³) ^{0.5}	3.955	3.859	3.957	3.993	3.926
Capacity Factor, Cs	m/s	0.138	0.135	0.138	0.139	0.138
HETP 2 pt	%					
DIST & below bed		355	352	365	367	1275
DIST & bottoms		354	352	364	364	1644
Relative Volatility		1.236	1.234	1.232	1.232	1.225
Cs Top	m/s	0.146	0.143	0.147	0.151	0.158
Cs mid	m/s	0.142	0.139	0.142	0.145	0.147

Table I (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
 o/p xylene, **0.1** bara

Run Number		23617	23618	23619	23620	23621
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	0.10	0.10	0.10	0.10	0.10
Reboiler Duty	MW	1.34	1.01	1.00	0.77	0.77
Condenser Duty	MW	1.21	0.88	0.88	0.66	0.66
Reflux Rate	kg/s	3.03	2.22	2.21	1.67	1.67
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	17.3	4.4	4.3	2.3	2.2
Top Half	mbar/m	18.5	4.2	4.2	2.1	2.0
Bottom Half	mbar/m	16.0	4.3	4.3	2.3	2.2
Liquid Collector	mbar	23.9	17.8	17.7	11.1	11.0
Distributor	mbar					
Bubblers						
Distributor Head	mm Hot Liq	920	201	200	135	134
Liquid Holdup						
Between Layers 5&6			0.06		0.05	
Middle of Layer 6			0.05		0.04	
Temperature Profiles	°C					
Reflux		46.5	50.9	50.6	51.5	51.5
Overhead Vapor		71.5	71.0	71.0	70.7	70.7
Distributor		54.3	58.4	58.2	60.0	60.0
Top Bed		75.4	71.0	71.0	70.4	70.5
Mid Bed		81.3	73.6	73.5	72.2	72.3
Below Bed		85.3	76.4	76.3	74.2	74.3
Liq Collector		87.1	78.3	78.3	76.0	76.1
Composition of Liquid	mol % p-xylene					
Reflux		55.37	83.26	83.81	88.24	88.32
Distributor		55.38	83.43	83.83	88.22	88.27
Below Bed Cross		41.54	37.68	37.23	35.78	36.44
Collector		42.32	39.67	34.58	34.19	34.88
Bottoms		39.60	31.80	31.91	30.95	30.81
Feed		39.45	32.29	32.07	30.92	30.88
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % p-xylene	41.54	37.68	37.23	35.78	36.44
Temperature	°C	85.3	76.4	76.3	74.2	74.3
Liquid Density	kg/m ³	814.9	824.0	824.1	826.3	826.1
Vapor Density	kg/m ³	0.607	0.436	0.435	0.400	0.403
Vapor Rate	kg/s	3.56	2.64	2.64	2.02	2.02
Liquid Rate	m ³ /h	15.71	11.53	11.51	8.81	8.81
Fs	m/s (kg/m ³) ^{0.5}	3.950	3.458	3.457	2.764	2.755
Capacity Factor, Cs	m/s	0.138	0.120	0.120	0.096	0.096
HETP 2 pt	%					
DIST & below bed		1329	358	350	294	296
DIST & bottoms		1732	351	347	294	292
Relative Volatility		1.225	1.237	1.237	1.240	1.239
Cs Top	m/s	0.160	0.125	0.125	0.096	0.096
Cs mid	m/s	0.148	0.123	0.122	0.096	0.096

Table II (SI Units)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
C₆/C₇ System, 0.31 bara

Run Number		23622	23623	23628	23629	23630
Run Type		FT	FT	TR	TR	TR
Column Pressure	bar	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	1.55	1.55	0.94	0.94	1.13
Condenser Duty	MW	1.45	1.46	0.87	0.87	1.05
Reflux Rate	kg/s	3.94	3.95	2.32	2.33	2.80
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	15.4	15.8	1.5	1.5	2.3
Top Half	mbar/m	16.8	17.4	1.1	1.1	1.8
Bottom Half	mbar/m	13.7	13.9	1.6	1.6	2.5
Liquid Collector	mbar	18.4	18.4	8.1	8.1	11.5
Distributor	mbar	2.82	3.41			
Bubblers						
Distributor Head	mm Hot Liq	891	893	236	236	321
Liquid Holdup						
Between Layers 5&6				0.05		0.06
Middle of Layer 6				0.05		0.06
Temperature Profiles	°C					
Reflux		42.3	42.5	40.7	39.8	39.9
Overhead Vapor		53.5	53.6	48.2	47.3	48.7
Distributor		44.2	44.3	42.6	41.8	41.9
Top Bed		53.8	54.0	47.6	46.7	48.0
Mid Bed		56.0	56.3	54.8	53.8	57.0
Below Bed		59.9	60.0	62.6	61.6	62.9
Liq Collector		62.8	62.8	63.4	62.3	63.9
Composition of Liquid	mol % C ₆					
Reflux		66.04	66.47	92.76	92.76	90.95
Distributor		66.31	66.53	92.86	92.90	91.04
Below Bed Cross		33.62	33.36	3.51	3.55	2.30
Collector		28.43	31.31	5.05	2.81	1.88
Bottoms		23.29	22.44	1.31	1.31	0.53
Feed		23.35	22.92	1.31	1.30	0.49
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	33.62	33.36	3.51	3.55	2.30
Temperature	°C	59.9	60.0	62.6	61.6	62.9
Liquid Density	kg/m ³	674.0	673.7	648.9	649.8	647.8
Vapor Density	kg/m ³	1.261	1.263	1.166	1.126	1.168
Vapor Rate	kg/s	4.42	4.42	2.75	2.75	3.30
Liquid Rate	m ³ /h	23.62	23.60	15.26	15.25	18.34
Fs	m/s (kg/m ³) ^{0.5}	3.407	3.401	2.204	2.244	2.641
Capacity Factor, Cs	m/s	0.131	0.131	0.087	0.088	0.104
HETP 2 pt	%					
DIST & below bed		1579	1553	364	366	353
DIST & bottoms		1699	1622	341	342	308
Relative Volatility		1.844	1.844	1.866	1.874	1.866
Cs Top	m/s	0.128	0.127	0.078	0.079	0.093
Cs mid	m/s	0.129	0.129	0.081	0.082	0.097

Table II (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
C₆/C₇ System, 0.31 bara

Run Number		23631	23632	23633	23634	23635
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	1.13	1.22	1.22	1.31	1.31
Condenser Duty	MW	1.06	1.16	1.16	1.32	1.32
Reflux Rate	kg/s	2.80	3.01	3.03	3.37	3.35
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	2.3	2.9	2.9	4.4	4.3
Top Half	mbar/m	1.8	2.3	2.3	3.1	3.0
Bottom Half	mbar/m	2.5	3.2	3.3	5.5	5.4
Liquid Collector	mbar	11.5	13.2	13.3	15.6	15.5
Distributor	mbar					
Bubblers						
Distributor Head	mm Hot Liq	322	375	377	464	462
Liquid Holdup						
Between Layers 5&6			0.06		0.07	
Middle of Layer 6			0.06		0.06	
Temperature Profiles	°C					
Reflux		40.0	40.9	41.3	43.8	43.8
Overhead Vapor		48.7	48.3	48.3	48.3	48.3
Distributor		41.9	42.5	42.8	44.6	44.6
Top Bed		48.0	47.8	47.8	48.0	48.0
Mid Bed		57.1	55.4	55.5	55.5	55.6
Below Bed		63.1	63.2	63.2	63.6	63.6
Liq Collector		63.9	64.0	64.0	64.5	64.4
Composition of Liquid	mol % C ₆					
Reflux		90.94	91.99	91.97	91.55	91.54
Distributor		90.92	92.01	91.96	91.65	91.75
Below Bed Cross		2.37	3.09	3.00	3.26	3.23
Collector		1.43	1.68	1.71	1.69	1.78
Bottoms		0.52	0.96	0.91	0.88	0.87
Feed		0.48	0.96	0.92	0.90	0.89
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	2.37	3.09	3.00	3.26	3.23
Temperature	°C	63.1	63.2	63.2	63.6	63.6
Liquid Density	kg/m ³	647.7	648.1	648.0	647.8	647.8
Vapor Density	kg/m ³	1.175	1.186	1.187	1.204	1.203
Vapor Rate	kg/s	3.30	3.58	3.58	3.84	3.84
Liquid Rate	m ³ /h	18.37	19.87	19.87	21.37	21.37
Fs	m/s (kg/m ³) ^{0.5}	2.638	2.842	2.841	3.032	3.033
Capacity Factor, Cs	m/s	0.104	0.112	0.112	0.119	0.119
HETP 2 pt	%					
DIST & below bed		355	363	361	369	367
DIST & bottoms		307	330	327	328	327
Relative Volatility		1.864	1.862	1.862	1.859	1.859
Cs Top	m/s	0.093	0.101	0.101	0.108	0.108
Cs mid	m/s	0.097	0.105	0.104	0.112	0.112

Table II (SI Units) (cont'd)
FRI Distillation Unit Experimental Data
1.22 m. Diameter Low Pressure Column
Raschig RSP 250 Test, **3.53 m** Packing Depth
Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
C₆/C₇ System, 0.31 bara

Run Number		23636	23637	23640	23641	23642
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	1.35	1.35	1.37	1.37	1.44
Condenser Duty	MW	1.30	1.31	1.29	1.28	1.35
Reflux Rate	kg/s	3.44	3.44	3.45	3.44	3.65
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	5.8	5.8	6.4	6.3	12.0
Top Half	mbar/m	3.3	3.3	3.5	3.4	10.5
Bottom Half	mbar/m	8.0	8.1	9.1	9.1	13.3
Liquid Collector	mbar	16.1	16.1	16.2	16.2	16.7
Distributor	mbar					
Bubblers						
Distributor Head	mm Hot Liq	472	472	473	472	569
Liquid Holdup						
Between Layers 5&6		0.08		0.09		0.15
Middle of Layer 6		0.06		0.07		0.15
Temperature Profiles	°C					
Reflux		43.1	43.1	41.1	41.0	43.0
Overhead Vapor		48.4	48.4	47.7	47.7	52.7
Distributor		44.0	44.0	42.3	42.2	44.5
Top Bed		48.0	48.0	47.3	47.3	53.0
Mid Bed		56.0	56.0	55.9	55.9	58.5
Below Bed		64.0	64.0	63.1	63.1	63.3
Liq Collector		64.8	64.8	63.9	63.9	64.5
Composition of Liquid	mol % C ₆					
Reflux		91.64	91.56	90.90	90.86	70.70
Distributor		91.60	91.66	91.04	90.97	70.70
Below Bed Cross		3.51	3.53	3.18	3.32	16.99
Collector		2.25	2.56	2.36	2.36	11.78
Bottoms		1.29	1.28	1.31	1.26	11.88
Feed		1.27	1.27	1.31	1.27	12.06
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	3.51	3.53	3.18	3.32	16.99
Temperature	°C	64.0	64.0	63.1	63.1	63.3
Liquid Density	kg/m ³	647.6	647.6	648.2	648.4	657.9
Vapor Density	kg/m ³	1.223	1.223	1.183	1.183	1.293
Vapor Rate	kg/s	3.95	3.95	4.01	4.01	4.19
Liquid Rate	m ³ /h	21.98	21.97	22.27	22.25	22.92
Fs	m/s (kg/m ³) ^{0.5}	3.094	3.093	3.189	3.188	3.186
Capacity Factor, Cs	m/s	0.122	0.122	0.125	0.125	0.124
HETP 2 pt	%					
DIST & below bed		373	373	374	377	867
DIST & bottoms		348	347	355	353	939
Relative Volatility		1.856	1.856	1.863	1.863	1.844
Cs Top	m/s	0.111	0.111	0.115	0.115	0.118
Cs mid	m/s	0.115	0.114	0.118	0.118	0.121

Table II (SI Units) (cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 4.8 mm with Liquid Collector
C₆/C₇ System, 0.31 bara

Run Number		23643	23644	23645	23646	23647
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	1.44	0.47	0.47	0.76	0.76
Condenser Duty	MW	1.35	0.41	0.41	0.65	0.65
Reflux Rate	kg/s	3.65	1.08	1.08	1.75	1.72
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	12.0	0.4	0.4	0.9	0.8
Top Half	mbar/m	10.5	0.0	0.0	0.5	0.4
Bottom Half	mbar/m	13.3	0.5	0.5	1.0	1.0
Liquid Collector	mbar	16.7	2.0	2.0	4.8	4.7
Distributor	mbar					
Bubblers						
Distributor Head	mm Hot Liq	568	80	80	152	150
Liquid Holdup						
Between Layers 5&6			0.04		0.05	
Middle of Layer 6			0.04		0.05	
Temperature Profiles	°C					
Reflux		43.0	43.2	43.3	41.4	41.1
Overhead Vapor		52.6	47.8	47.8	47.8	47.8
Distributor		44.5	45.0	45.0	43.5	43.3
Top Bed		53.0	47.2	47.1	47.2	47.2
Mid Bed		58.5	54.7	54.5	52.0	52.0
Below Bed		63.3	62.5	62.5	62.1	62.1
Liq Collector		64.6	62.6	62.8	62.9	62.9
Composition of Liquid	mol % C ₆					
Reflux		70.98	94.59	94.72	95.68	95.67
Distributor		71.95	94.55	94.69	95.74	95.66
Below Bed Cross		18.45	3.15	3.09	5.68	5.79
Collector		16.06	4.46	2.85	4.37	5.09
Bottoms		11.20	1.67	1.53	2.58	2.57
Feed		11.53	1.78	1.61	2.60	2.58
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	18.45	3.15	3.09	5.68	5.79
Temperature	°C	63.3	62.5	62.5	62.1	62.1
Liquid Density	kg/m ³	659.0	648.7	648.7	650.9	650.9
Vapor Density	kg/m ³	1.306	1.159	1.159	1.161	1.163
Vapor Rate	kg/s	4.18	1.37	1.37	2.15	2.14
Liquid Rate	m ³ /h	22.85	7.61	7.62	11.89	11.85
Fs	m/s (kg/m ³) ^{0.5}	3.168	1.102	1.103	1.726	1.720
Capacity Factor, Cs	m/s	0.124	0.043	0.043	0.068	0.067
HETP 2 pt	%					
DIST & below bed		879	340	338	360	363
DIST & bottoms		887	338	332	348	349
Relative Volatility		1.842	1.868	1.868	1.868	1.867
Cs Top	m/s	0.118	0.039	0.039	0.061	0.061
Cs mid	m/s	0.120	0.040	0.040	0.063	0.063

Table III (SI Units)
FRI Distillation Unit Experimental Data
1.22 m. Diameter Low Pressure Column
Raschig RSP 250 Test, **3.53 m** Packing Depth
Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, 1.62 bara

Run Number		23648	23649	23650	23651	23652
Run Type		FT	FT	TR	TR	TR
Column Pressure	bar	1.61	1.61	1.62	1.62	1.63
Reboiler Duty	MW	2.37	2.37	0.69	0.69	1.21
Condenser Duty	MW	2.19	2.17	0.56	0.55	1.04
Reflux Rate	kg/s	5.78	5.75	1.37	1.36	2.67
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.76	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	16.4	16.6	0.2	0.2	0.5
Top Half	mbar/m	20.3	20.6	0.2	0.2	0.5
Bottom Half	mbar/m	12.3	12.4	0.2	0.2	0.6
Liquid Collector	mbar	12.5	12.4	0.8	0.8	3.1
Distributor	mbar	10.65	11.08	0.69	0.69	0.80
Bubblers						
Distributor Head	mm Hot Liq	872	873	57	56	106
Liquid Holdup						
Between Layers 5&6		0.21		0.04		0.05
Middle of Layer 6		0.21		0.04		0.05
Temperature Profiles	°C					
Reflux		76.8	76.6	65.8	65.6	68.1
Overhead Vapor		103.6	103.3	99.9	99.8	100.9
Distributor		80.5	80.4	81.3	81.1	76.8
Top Bed		102.6	102.4	98.8	98.6	99.5
Mid Bed		106.2	106.6	108.5	108.4	109.3
Below Bed		111.5	111.5	113.8	113.7	113.9
Liq Collector		112.3	112.4	113.9	113.8	114.4
Composition of Liquid	mol % C ₆					
Reflux		79.55	79.50	93.67	93.77	90.91
Distributor		79.81	81.03	93.64	93.76	90.90
Below Bed Cross		35.18	36.38	10.03	9.90	10.14
Collector		37.29	35.12	10.09	10.03	10.16
Bottoms		24.68	27.06	7.50	7.33	6.12
Feed		26.20	26.05	7.64	7.40	6.14
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	35.18	36.38	10.03	9.90	10.14
Temperature	°C	111.5	111.5	113.8	113.7	113.9
Liquid Density	kg/m ³	624.4	625.3	603.3	603.3	603.3
Vapor Density	kg/m ³	5.618	5.649	5.421	5.407	5.441
Vapor Rate	kg/s	7.36	7.35	2.08	2.08	3.78
Liquid Rate	m ³ /h	42.45	42.32	12.42	12.41	22.58
Fs	m/s (kg/m ³) ^{0.5}	2.688	2.676	0.774	0.774	1.403
Capacity Factor, Cs	m/s	0.108	0.108	0.032	0.032	0.057
HETP 2 pt	%					
DIST & below bed		786	775	320	318	348
DIST & bottoms		762	779	329	326	340
Relative Volatility		1.558	1.557	1.562	1.562	1.561
Cs Top	m/s	0.103	0.102	0.028	0.028	0.051
Cs mid	m/s	0.105	0.105	0.030	0.030	0.054

Table III (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, 1.62 bara

Run Number		23653	23654	23655	23656	23657
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	1.63	1.62	1.62	1.63	1.63
Reboiler Duty	MW	1.21	1.55	1.55	1.81	1.81
Condenser Duty	MW	1.04	1.40	1.38	1.62	1.66
Reflux Rate	kg/s	2.67	3.70	3.67	4.19	4.17
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	0.5	1.0	1.0	1.4	1.4
Top Half	mbar/m	0.5	0.9	0.9	1.3	1.3
Bottom Half	mbar/m	0.6	1.1	1.0	1.6	1.6
Liquid Collector	mbar	3.1	5.4	5.4	7.3	7.3
Distributor	mbar	0.80	0.73	0.73	0.81	0.83
Bubblers						
Distributor Head	mm Hot Liq	106	159	158	196	195
Liquid Holdup						
Between Layers 5&6			0.06		0.06	
Middle of Layer 6			0.06		0.06	
Temperature Profiles	°C					
Reflux		68.0	76.1	75.8	72.4	71.1
Overhead Vapor		100.9	101.0	101.1	101.3	101.4
Distributor		76.7	80.9	80.6	77.4	76.5
Top Bed		99.6	99.6	99.7	100.0	100.1
Mid Bed		109.3	109.0	109.2	108.8	108.9
Below Bed		114.0	113.9	114.0	114.2	114.3
Liq Collector		114.4	114.4	114.5	114.8	114.8
Composition of Liquid	mol % C ₆					
Reflux		90.90	89.96	89.93	89.36	89.24
Distributor		90.92	89.95	89.92	89.31	89.21
Below Bed Cross		10.17	9.56	9.50	9.63	9.46
Collector		10.34	9.38	8.90	8.40	8.34
Bottoms		6.13	4.91	4.91	4.27	4.22
Feed		6.12	4.91	4.90	4.31	4.25
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	10.17	9.56	9.50	9.63	9.46
Temperature	°C	114.0	113.9	114.0	114.2	114.3
Liquid Density	kg/m ³	603.2	602.9	602.7	602.6	602.4
Vapor Density	kg/m ³	5.446	5.426	5.439	5.464	5.471
Vapor Rate	kg/s	3.78	4.91	4.91	5.72	5.72
Liquid Rate	m ³ /h	22.55	29.34	29.31	34.14	34.18
Fs	m/s (kg/m ³) ^{0.5}	1.401	1.825	1.821	2.116	2.116
Capacity Factor, Cs	m/s	0.057	0.075	0.075	0.087	0.087
HETP 2 pt	%					
DIST & below bed		348	352	352	358	357
DIST & bottoms		340	332	332	326	326
Relative Volatility		1.561	1.561	1.561	1.560	1.560
Cs Top	m/s	0.051	0.067	0.067	0.077	0.077
Cs mid	m/s	0.054	0.070	0.070	0.081	0.081

Table III (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, 1.62 bara

Run Number		23658	23659	23660	23661	23662
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	1.62	1.62	1.62	1.62	1.62
Reboiler Duty	MW	1.98	1.98	2.15	2.15	2.21
Condenser Duty	MW	1.81	1.82	1.98	1.97	1.97
Reflux Rate	kg/s	4.70	4.68	5.22	5.22	5.30
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.77	3.77	3.80	3.80	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	2.0	2.0	3.1	3.2	3.6
Top Half	mbar/m	1.7	1.7	2.4	2.4	2.7
Bottom Half	mbar/m	2.2	2.2	3.9	4.0	4.6
Liquid Collector	mbar	8.9	8.9	10.7	10.8	11.1
Distributor	mbar	0.72	0.73	0.73	0.71	0.76
Bubblers						
Distributor Head	mm Hot Liq	239	237	286	285	293
Liquid Holdup						
Between Layers 5&6		0.07		0.09		0.09
Middle of Layer 6		0.07		0.08		0.08
Temperature Profiles	°C					
Reflux		76.0	75.5	77.2	77.0	76.5
Overhead Vapor		101.3	101.4	101.8	101.8	102.2
Distributor		79.8	79.5	80.5	80.3	80.0
Top Bed		100.0	100.1	100.6	100.6	101.0
Mid Bed		108.1	108.2	108.0	108.0	108.4
Below Bed		114.0	114.1	114.2	114.2	114.2
Liq Collector		114.7	114.8	114.7	114.6	114.6
Composition of Liquid	mol % C ₆					
Reflux		88.69	88.64	86.76	86.55	85.39
Distributor		88.67	88.64	86.71	86.62	85.41
Below Bed Cross		9.47	9.67	9.98	9.44	9.74
Collector		7.83	7.85	8.44	9.88	10.38
Bottoms		3.96	3.91	5.58	5.71	6.76
Feed		4.04	3.95	5.49	5.65	6.83
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	9.47	9.67	9.98	9.44	9.74
Temperature	°C	114.0	114.1	114.2	114.2	114.2
Liquid Density	kg/m ³	602.7	602.7	602.8	602.5	602.7
Vapor Density	kg/m ³	5.443	5.458	5.481	5.466	5.472
Vapor Rate	kg/s	6.27	6.26	6.85	6.87	7.02
Liquid Rate	m ³ /h	37.46	37.40	40.92	41.0	41.9
Fs	m/s (kg/m ³) ^{0.5}	2.326	2.319	2.532	2.541	2.595
Capacity Factor, Cs	m/s	0.095	0.095	0.104	0.104	0.106
HETP 2 pt	%					
DIST & below bed		362	364	383	378	391
DIST & bottoms		325	325	366	369	396
Relative Volatility		1.561	1.560	1.560	1.560	1.560
Cs Top	m/s	0.085	0.085	0.093	0.093	0.095
Cs mid	m/s	0.089	0.089	0.098	0.098	0.100

Table III (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, 1.62 bara

Run Number		23663	23664	23665	23666	23667
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	1.62	1.62	1.62	1.62	1.62
Reboiler Duty	MW	2.20	2.27	2.27	2.33	2.33
Condenser Duty	MW	1.98	2.07	2.07	2.13	2.11
Reflux Rate	kg/s	5.31	5.59	5.60	5.83	5.78
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	3.6	8.7	9.0	16.1	16.0
Top Half	mbar/m	2.7	6.0	6.4	20.1	19.8
Bottom Half	mbar/m	4.6	11.6	11.6	12.1	12.1
Liquid Collector	mbar	11.1	11.9	11.9	12.0	12.0
Distributor	mbar	0.76	0.77	0.77	11.53	10.46
Bubblers						
Distributor Head	mm Hot Liq	294	325	325	885	880
Liquid Holdup						
Between Layers 5&6			0.17		0.19	
Middle of Layer 6			0.16		0.17	
Temperature Profiles	°C					
Reflux		76.6	79.1	79.3	83.6	83.2
Overhead Vapor		102.2	103.2	103.1	106.4	106.2
Distributor		80.1	82.0	82.2	86.5	86.2
Top Bed		101.0	102.1	102.1	105.4	105.3
Mid Bed		108.5	110.0	109.9	109.5	109.8
Below Bed		114.2	113.9	114.0	113.8	113.7
Liq Collector		114.6	114.4	114.5	114.4	114.3
Composition of Liquid	mol % C ₆					
Reflux		85.45	80.72	81.06	67.81	66.49
Distributor		85.43	80.86	81.20	67.28	66.30
Below Bed Cross		9.95	14.55	13.49	17.80	20.43
Collector		11.28	13.15	16.71	22.09	20.78
Bottoms		6.69	9.90	10.26	17.12	16.11
Feed		6.69	10.15	10.38	14.70	16.23
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	9.95	14.55	13.49	17.80	20.43
Temperature	°C	114.2	113.9	114.0	113.8	113.7
Liquid Density	kg/m ³	602.8	606.4	605.5	608.8	610.8
Vapor Density	kg/m ³	5.480	5.536	5.525	5.585	5.631
Vapor Rate	kg/s	7.02	7.22	7.23	7.37	7.33
Liquid Rate	m ³ /h	41.9	42.9	43.0	43.6	43.2
Fs	m/s (kg/m ³) ^{0.5}	2.593	2.657	2.662	2.700	2.674
Capacity Factor, Cs	m/s	0.106	0.108	0.109	0.110	0.109
HETP 2 pt	%					
DIST & below bed		393	486	470	693	766
DIST & bottoms		394	487	490	841	829
Relative Volatility		1.560	1.559	1.559	1.558	1.557
Cs Top	m/s	0.095	0.099	0.099	0.102	0.102
Cs mid	m/s	0.100	0.103	0.103	0.106	0.105

Table III (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm with Liquid Collector
C₆/C₇ System, 1.62 bara

Run Number		23668	23669	23670	23671	23672	23673
Run Type		TR	TR	TR	TR	TR	TR
Column Pressure	bar	1.62	1.62	1.62	1.62	1.62	1.62
Reboiler Duty	MW	2.24	2.24	2.07	2.06	0.95	0.95
Condenser Duty	MW	2.05	2.05	1.89	1.90	0.80	0.80
Reflux Rate	kg/s	5.48	5.49	5.11	5.12	2.09	2.07
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.79	3.79	3.78	3.78
Pressure Drops:	inches Hot Liq						
Overall	mbar/m	4.1	4.2	2.5	2.5	0.3	0.3
Top Half	mbar/m	2.9	2.9	2.1	2.1	0.3	0.3
Bottom Half	mbar/m	5.4	5.5	2.9	2.9	0.4	0.4
Liquid Collector	mbar	11.5	11.5	9.9	9.9	1.8	1.8
Distributor	mbar	0.71	0.72	0.67	0.66	0.59	0.61
Bubblers							
Distributor Head	mm Hot Liq	310	310	274	274	81	81
Liquid Holdup							
Between Layers 5&6		0.09		0.08		0.04	
Middle of Layer 6		0.08		0.07		0.05	
Temperature Profiles	°C						
Reflux		80.3	80.3	81.9	81.9	74.7	73.9
Overhead Vapor		102.3	102.3	102.0	102.0	101.1	101.1
Distributor		83.1	83.1	84.5	84.5	83.2	82.8
Top Bed		101.2	101.2	100.8	100.8	99.9	99.9
Mid Bed		108.9	108.9	108.7	108.7	110.9	110.8
Below Bed		114.0	114.0	114.3	114.3	114.2	114.2
Liq Collector		114.5	114.4	114.9	114.9	114.4	114.4
Composition of Liquid	mol % C ₆						
Reflux		84.30	84.30	85.74	85.67	89.46	89.41
Distributor		84.20	84.41	85.71	85.56	89.46	89.45
Below Bed Cross		11.02	11.09	9.27	8.57	7.49	7.51
Collector		12.54	12.81	6.45	6.62	7.24	7.54
Bottoms		7.90	7.89	2.98	2.96	4.69	4.70
Feed		7.90	7.82	2.97	2.98	4.68	4.69
Conditions at Bottom (Based on Reboiler Duty)							
Composition	mol % C ₆	11.02	11.09	9.27	8.57	7.49	7.51
Temperature	°C	114.0	114.0	114.3	114.3	114.2	114.2
Liquid Density	kg/m ³	603.7	603.8	602.3	601.7	601.1	601.2
Vapor Density	kg/m ³	5.477	5.478	5.470	5.461	5.420	5.417
Vapor Rate	kg/s	7.11	7.11	6.57	6.58	2.96	2.96
Liquid Rate	m ³ /h	42.4	42.4	39.3	39.4	17.7	17.7
Fs	m/s (kg/m ³) ^{0.5}	2.627	2.627	2.432	2.436	1.098	1.100
Capacity Factor, Cs	m/s	0.107	0.107	0.100	0.100	0.045	0.045
HETP 2 pt	%						
DIST & below bed		416	414	384	377	336	336
DIST & bottoms		424	422	323	324	332	332
Relative Volatility		1.560	1.560	1.560	1.560	1.561	1.561
Cs Top	m/s	0.097	0.097	0.089	0.089	0.040	0.040
Cs mid	m/s	0.101	0.101	0.094	0.094	0.042	0.042

Table IV (SI Units)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 1.62 bara

Run Number		23674	23675	23676	23677	23678
Run Type		FT	FT	TR	TR	TR
Column Pressure	bar	1.62	1.62	1.62	1.62	1.62
Reboiler Duty	MW	2.38	2.37	1.21	1.21	1.55
Condenser Duty	MW	2.21	2.19	0.94	0.95	1.33
Reflux Rate	kg/s	5.87	5.82	2.58	2.58	3.57
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.77	3.76	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	16.6	17.0	0.5	0.5	0.9
Top Half	mbar/m	20.8	20.8	0.4	0.4	0.9
Bottom Half	mbar/m	12.0	12.3	0.5	0.5	1.0
Liquid Collector	mbar	0.7	0.7	0.4	0.4	0.5
Distributor	mbar	10.61	11.28	0.81	0.82	0.89
Bubblers						
Distributor Head	mm Hot Liq	875	875	104	104	159
Liquid Holdup						
Between Layers 5&6		0.16		0.05		0.06
Middle of Layer 6		0.17		0.05		0.06
Temperature Profiles	°C					
Reflux		78.9	78.7	78.6	77.7	78.2
Overhead Vapor		104.7	104.3	100.4	100.4	100.7
Distributor		82.4	82.3	84.4	83.8	82.6
Top Bed		103.7	103.5	99.2	99.2	99.5
Mid Bed		106.2	106.0	108.7	108.8	108.8
Below Bed		112.6	112.8	113.7	113.7	113.9
Composition of Liquid	mol % C ₆					
Reflux		73.90	75.40	92.38	92.32	90.82
Distributor		73.70	75.93	92.40	92.30	90.88
Below Bed Cross		27.40	27.40	11.75	11.69	10.19
Collector		45.70	45.58	45.61	45.62	45.43
Bottoms		19.96	20.81	6.60	6.26	4.63
Feed		21.33	20.60	6.52	6.38	4.92
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	27.40	27.40	11.75	11.69	10.19
Temperature	°C	112.6	112.8	113.7	113.7	113.9
Liquid Density	kg/m ³	617.2	617.0	604.6	604.6	603.3
Vapor Density	kg/m ³	5.619	5.646	5.445	5.444	5.438
Vapor Rate	kg/s	7.48	7.46	3.65	3.66	4.85
Liquid Rate	m ³ /h	43.6	43.5	21.7	21.8	28.9
Fs	m/s (kg/m ³) ^{0.5}	2.731	2.718	1.354	1.358	1.800
Capacity Factor, Cs	m/s	0.110	0.110	0.055	0.055	0.074
HETP 2 pt	%					
DIST & below bed		779	735	346	347	349
DIST & bottoms		790	764	332	329	320
Relative Volatility		1.558	1.558	1.561	1.562	1.561
Cs Top	m/s	0.104	0.103	0.050	0.050	0.066
Cs mid	m/s	0.107	0.106	0.052	0.052	0.069

Table IV (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 1.62 bara

Run Number		23679	23680	23681	23682	23683
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	1.62	1.62	1.62	1.62	1.62
Reboiler Duty	MW	1.55	1.98	1.98	2.24	2.24
Condenser Duty	MW	1.35	1.86	1.89	2.03	2.04
Reflux Rate	kg/s	3.60	4.81	4.81	5.40	5.41
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.77	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	1.0	2.1	2.1	4.0	4.1
Top Half	mbar/m	0.9	1.8	1.8	3.0	3.0
Bottom Half	mbar/m	1.1	2.4	2.4	5.1	5.2
Liquid Collector	mbar	0.5	0.6	0.6	0.6	0.6
Distributor	mbar	0.90	1.02	1.01	1.01	1.01
Bubblers						
Distributor Head	mm Hot Liq	160	252	253	308	308
Liquid Holdup						
Between Layers 5&6			0.07		0.10	
Middle of Layer 6			0.07		0.08	
Temperature Profiles	°C					
Reflux		78.1	75.8	75.7	76.5	76.5
Overhead Vapor		100.7	101.2	101.1	102.3	102.3
Distributor		82.5	79.6	79.5	79.8	79.8
Top Bed		99.5	100.0	99.9	101.1	101.1
Mid Bed		108.8	107.7	107.7	109.2	109.3
Below Bed		113.9	114.1	114.0	114.1	114.0
Composition of Liquid	mol % C ₆					
Reflux		90.79	88.93	88.78	84.87	84.81
Distributor		90.85	88.91	88.81	84.84	84.91
Below Bed Cross		10.37	9.65	9.35	11.48	11.77
Collector		45.49	45.42	45.49	45.58	45.55
Bottoms		4.81	3.12	3.52	7.18	7.19
Feed		4.85	3.55	3.55	7.20	7.22
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	10.37	9.65	9.35	11.48	11.77
Temperature	°C	113.9	114.1	114.0	114.1	114.0
Liquid Density	kg/m ³	603.4	602.7	602.6	604.0	604.3
Vapor Density	kg/m ³	5.447	5.454	5.439	5.489	5.494
Vapor Rate	kg/s	4.86	6.35	6.35	7.15	7.15
Liquid Rate	m ³ /h	29.0	37.9	38.0	42.6	42.6
Fs	m/s (kg/m ³) ^{0.5}	1.801	2.352	2.357	2.640	2.639
Capacity Factor, Cs	m/s	0.074	0.096	0.096	0.108	0.108
HETP 2 pt	%					
DIST & below bed		351	362	360	415	417
DIST & bottoms		323	308	317	407	407
Relative Volatility		1.561	1.561	1.561	1.560	1.560
Cs Top	m/s	0.066	0.086	0.086	0.097	0.097
Cs mid	m/s	0.069	0.090	0.091	0.102	0.102

Table IV (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 1.62 bara

Run Number		23684	23685	23686	23687
Run Type		TR	TR	TR	TR
Column Pressure	bar	1.60	1.62	1.62	1.62
Reboiler Duty	MW	2.25	2.27	2.33	2.33
Condenser Duty	MW	2.03	2.07	2.13	2.13
Reflux Rate	kg/s	5.36	5.45	5.63	5.62
Feed Location		Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.74	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq				
Overall	mbar/m	4.5	4.8	9.2	9.5
Top Half	mbar/m	3.3	3.4	7.6	8.1
Bottom Half	mbar/m	5.7	6.3	10.9	11.1
Liquid Collector	mbar	0.6	0.6	0.7	0.7
Distributor	mbar	1.01	1.03	1.03	1.04
Bubblers					
Distributor Head	mm Hot Liq	309	315	329	329
Liquid Holdup					
Between Layers 5&6		0.10		0.14	
Middle of Layer 6		0.08		0.17	
Temperature Profiles	°C				
Reflux		75.2	75.3	77.8	77.8
Overhead Vapor		102.9	102.9	103.5	103.8
Distributor		78.8	78.8	81.1	81.1
Top Bed		101.7	101.8	102.2	102.8
Mid Bed		110.2	110.4	110.0	110.0
Below Bed		114.0	114.0	114.0	113.8
Composition of Liquid	mol % C ₆				
Reflux		82.41	82.39	80.53	79.29
Distributor		82.44	82.46	80.09	79.28
Below Bed Cross		11.95	11.46	16.97	16.97
Collector		45.50	45.50	45.13	45.06
Bottoms		7.80	7.79	7.89	10.39
Feed		7.83	7.78	8.21	9.69
Conditions at Bottom (Based on Reboiler Duty)					
Composition	mol % C ₆	11.95	11.46	16.97	16.97
Temperature	°C	114.0	114.0	114.0	113.8
Liquid Density	kg/m ³	604.4	604.1	608.0	608.1
Vapor Density	kg/m ³	5.496	5.477	5.598	5.580
Vapor Rate	kg/s	7.16	7.25	7.35	7.36
Liquid Rate	m ³ /h	42.7	43.2	43.5	43.6
Fs	m/s (kg/m ³) ^{0.5}	2.643	2.681	2.688	2.696
Capacity Factor, Cs	m/s	0.108	0.110	0.110	0.110
HETP 2 pt	%				
DIST & below bed		441	435	523	532
DIST & bottoms		437	437	458	511
Relative Volatility		1.560	1.560	1.558	1.558
Cs Top	m/s	0.097	0.099	0.101	0.101
Cs mid	m/s	0.102	0.103	0.105	0.105

Table V (SI Units)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 0.31 bara

Run Number		23688	23689	23690	23691	23692
Run Type		FT	FT	TR	TR	TR
Column Pressure	bar	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	1.53	1.52	0.94	0.94	1.22
Condenser Duty	MW	1.48	1.46	0.88	0.88	1.15
Reflux Rate	kg/s	3.85	3.83	2.31	2.32	3.04
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	12.5	13.6	1.4	1.4	2.7
Top Half	mbar/m	12.7	14.5	1.3	1.3	2.5
Bottom Half	mbar/m	12.3	12.7	1.4	1.4	2.8
Liquid Collector	mbar	0.3	0.2	0.1	0.1	0.2
Distributor	mbar	0.40	0.68	0.23	0.23	0.30
Bubblers						
Distributor Head	mm Hot Liq	167	213	84	85	118
Liquid Holdup						
Between Layers 5&6		0.16		0.05		0.07
Middle of Layer 6		0.15		0.05		0.06
Temperature Profiles	°C					
Reflux		42.2	42.3	42.7	42.8	43.0
Overhead Vapor		49.7	50.2	48.1	48.1	48.3
Distributor		43.7	43.8	44.2	44.3	44.2
Top Bed		52.7	51.4	47.5	47.5	47.8
Mid Bed		57.8	58.8	54.9	54.9	55.3
Below Bed		62.3	62.9	62.5	62.5	63.1
Composition of Liquid	mol % C ₆					
Reflux		85.63	85.61	93.79	93.71	92.64
Distributor		85.61	85.68	93.80	93.77	92.72
Below Bed Cross		17.80	16.76	3.88	4.11	4.00
Bottoms		8.95	8.53	1.37	1.33	1.03
Feed		8.87	8.92	1.39	1.36	1.03
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	17.80	16.76	3.88	4.11	4.00
Temperature	°C	62.3	62.9	62.5	62.5	63.1
Liquid Density	kg/m ³	659.5	658.1	649.2	649.4	648.8
Vapor Density	kg/m ³	1.257	1.276	1.165	1.167	1.187
Vapor Rate	kg/s	4.43	4.40	2.75	2.76	3.58
Liquid Rate	m ³ /h	24.2	24.1	15.3	15.3	19.8
Fs	m/s (kg/m ³) ^{0.5}	3.422	3.371	2.206	2.209	2.841
Capacity Factor, Cs	m/s	0.133	0.132	0.087	0.087	0.112
HETP 2 pt	%					
DIST & below bed		643	626	361	364	373
DIST & bottoms		609	597	335	333	328
Relative Volatility		1.850	1.847	1.867	1.866	1.862
Cs Top	m/s	0.120	0.121	0.078	0.078	0.101
Cs mid	m/s	0.126	0.125	0.081	0.081	0.104

Table V (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 0.31 bara

Run Number		23693	23694	23695	23696	23697
Run Type		TR	TR	TR	TR	TR
Column Pressure	bar	0.31	0.31	0.31	0.31	0.31
Reboiler Duty	MW	1.22	1.32	1.32	1.37	1.37
Condenser Duty	MW	1.15	1.27	1.27	1.30	1.29
Reflux Rate	kg/s	3.05	3.29	3.27	3.37	3.36
Feed Location		Bottom	Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq					
Overall	mbar/m	2.7	3.4	3.4	4.0	3.9
Top Half	mbar/m	2.5	3.1	3.1	3.5	3.4
Bottom Half	mbar/m	2.8	3.7	3.6	4.4	4.4
Liquid Collector	mbar	0.2	0.2	0.2	0.2	0.2
Distributor	mbar	0.30	0.35	0.35	0.35	0.34
Bubblers						
Distributor Head	mm Hot Liq	119	131	130	135	135
Liquid Holdup						
Between Layers 5&6			0.07		0.08	
Middle of Layer 6			0.06		0.06	
Temperature Profiles	°C					
Reflux		43.1	43.2	43.0	42.4	42.2
Overhead Vapor		48.3	48.4	48.4	48.7	48.7
Distributor		44.3	44.3	44.2	43.8	43.7
Top Bed		47.9	48.0	48.0	48.3	48.3
Mid Bed		55.3	55.1	55.1	56.6	56.6
Below Bed		63.1	63.3	63.3	63.6	63.6
Composition of Liquid	mol % C ₆					
Reflux		92.70	92.35	92.45	90.61	90.68
Distributor		92.71	92.35	92.39	90.59	90.68
Below Bed Cross		4.01	3.06	3.12	2.13	2.12
Bottoms		1.04	0.96	0.98	0.67	0.66
Feed		1.05	0.97	0.97	0.70	0.69
Conditions at Bottom (Based on Reboiler Duty)						
Composition	mol % C ₆	4.01	3.06	3.12	2.13	2.12
Temperature	°C	63.1	63.3	63.3	63.6	63.6
Liquid Density	kg/m ³	648.8	648.0	648.0	647.0	647.0
Vapor Density	kg/m ³	1.188	1.189	1.190	1.196	1.197
Vapor Rate	kg/s	3.58	3.86	3.85	4.00	3.99
Liquid Rate	m ³ /h	19.9	21.4	21.4	22.3	22.2
Fs	m/s (kg/m ³) ^{0.5}	2.841	3.059	3.056	3.164	3.158
Capacity Factor, Cs	m/s	0.112	0.120	0.120	0.125	0.124
HETP 2 pt	%					
DIST & below bed		373	359	360	350	349
DIST & bottoms		328	327	328	321	320
Relative Volatility		1.862	1.862	1.862	1.860	1.860
Cs Top	m/s	0.101	0.109	0.108	0.112	0.112
Cs mid	m/s	0.104	0.112	0.112	0.116	0.116

Table V (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 0.31 bara

Run Number		23698	23699	23700	23703
Run Type		TR	TR	TR	TR
Column Pressure	bar	0.31	0.30	0.31	0.31
Reboiler Duty	MW	1.41	1.41	1.44	1.28
Condenser Duty	MW	1.25	1.25	1.31	1.21
Reflux Rate	kg/s	3.46	3.47	3.65	3.32
Feed Location		Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq				
Overall	mbar/m	4.5	4.6	8.1	3.1
Top Half	mbar/m	3.7	3.8	4.6	2.9
Bottom Half	mbar/m	5.3	5.4	11.6	3.4
Liquid Collector	mbar	0.2	0.2	0.2	0.2
Distributor	mbar	0.31	0.31	0.36	0.36
Bubblers					
Distributor Head	mm Hot Liq	138	138	151	129
Liquid Holdup					
Between Layers 5&6		0.09		0.15	0.07
Middle of Layer 6		0.07		0.15	0.06
Temperature Profiles	°C				
Reflux		43.1	43.3	45.2	46.4
Overhead Vapor		48.4	48.1	49.8	49.3
Distributor		44.2	44.3	46.1	47.0
Top Bed		47.9	47.7	49.9	49.0
Mid Bed		55.7	55.6	61.7	58.9
Below Bed		63.5	63.4	64.6	63.7
Composition of Liquid	mol % C ₆				
Reflux		91.30	91.52	84.71	89.77
Distributor		91.32	91.51	84.81	89.80
Below Bed Cross		2.49	2.44	5.29	1.35
Bottoms		0.72	0.74	1.26	1.00
Feed		0.73	0.74	1.25	1.00
Conditions at Bottom (Based on Reboiler Duty)					
Composition	mol % C ₆	2.49	2.44	5.29	1.35
Temperature	°C	63.5	63.4	64.6	63.7
Liquid Density	kg/m ³	647.4	647.5	648.3	646.5
Vapor Density	kg/m ³	1.195	1.188	1.264	1.192
Vapor Rate	kg/s	4.08	4.08	4.22	3.75
Liquid Rate	m ³ /h	22.7	22.7	23.4	20.9
Fs	m/s (kg/m ³) ^{0.5}	3.226	3.238	3.247	2.976
Capacity Factor, Cs	m/s	0.127	0.127	0.128	0.117
HETP 2 pt	%				
DIST & below bed		355	352	463	330
DIST & bottoms		320	321	389	346
Relative Volatility		1.861	1.862	1.849	1.861
Cs Top	m/s	0.115	0.115	0.118	0.105
Cs mid	m/s	0.119	0.119	0.121	0.109

Table V (SI Units) (Cont'd)
 FRI Distillation Unit Experimental Data
 1.22 m. Diameter Low Pressure Column
 Raschig RSP 250 Test, **3.53 m** Packing Depth
 Raschig **DT-S** Distributor 6.9 mm without Liquid Collector
C₆/C₇ System, 0.31 bara

Run Number		23704	23705	23706	23707
Run Type		TR	TR	TR	TR
Column Pressure	bar	0.31	0.31	0.31	0.31
Reboiler Duty	MW	1.28	1.28	1.13	1.13
Condenser Duty	MW	1.20	1.19	1.05	1.05
Reflux Rate	kg/s	3.25	3.24	2.82	2.82
Feed Location		Bottom	Bottom	Bottom	Bottom
Mass Feed Flow Rate	kg/s	3.78	3.78	3.78	3.78
Pressure Drops:	inches Hot Liq				
Overall	mbar/m	3.1	3.1	2.1	2.1
Top Half	mbar/m	2.9	2.8	2.0	2.0
Bottom Half	mbar/m	3.3	3.3	2.2	2.2
Liquid Collector	mbar	0.2	0.2	0.1	0.1
Distributor	mbar	0.32	0.32	0.29	0.29
Bubblers					
Distributor Head	mm Hot Liq	127	127	107	107
Liquid Holdup					
Between Layers 5&6				0.06	
Middle of Layer 6				0.06	
Temperature Profiles	°C				
Reflux		45.5	45.5	45.5	45.5
Overhead Vapor		48.5	48.5	48.4	48.5
Distributor		46.1	46.1	46.0	46.1
Top Bed		48.1	48.2	47.9	48.0
Mid Bed		56.0	56.1	56.4	56.7
Below Bed		63.3	63.4	63.0	63.1
Composition of Liquid	mol % C ₆				
Reflux		91.76	91.71	92.37	92.27
Distributor		91.75	91.84	92.34	92.24
Below Bed Cross		2.23	2.27	2.32	2.19
Bottoms		0.81	0.80	0.93	0.93
Feed		0.81	0.81	0.95	0.94
Conditions at Bottom (Based on Reboiler Duty)					
Composition	mol % C ₆	2.23	2.27	2.32	2.19
Temperature	°C	63.3	63.4	63.0	63.1
Liquid Density	kg/m ³	647.4	647.4	647.8	647.6
Vapor Density	kg/m ³	1.183	1.186	1.171	1.174
Vapor Rate	kg/s	3.75	3.75	3.30	3.30
Liquid Rate	m ³ /h	20.8	20.8	18.4	18.4
Fs	m/s (kg/m ³) ^{0.5}	2.980	2.978	2.641	2.636
Capacity Factor, Cs	m/s	0.117	0.117	0.104	0.104
HETP 2 pt	%				
DIST & below bed		345	345	343	340
DIST & bottoms		323	322	326	327
Relative Volatility		1.863	1.862	1.865	1.865
Cs Top	m/s	0.105	0.105	0.093	0.093
Cs mid	m/s	0.109	0.109	0.097	0.097