APPENDIX B

EXPERIMENTAL DATA AND METHOD OF ANALYSIS

The experimental tests completed during this work are listed in this appendix. For each run (e.g., 200), there are three sets of tables: the first lists the operating conditions, the bed height, and bed expansion; the second provides the holdup of the various phases in the bed; and the third shows the holdups in the dilute phase.

The volume fraction of catalyst is calculated from measurement of the bed height and mass of catalyst in the reactor:

$$\epsilon_c = \frac{M}{\rho_c A H}$$

where: M = mass of dry catalyst added to the reactor.
ρ_c = density of a dry catalyst particle.
A = cross-sectional area of the reactor.
H = catalyst bed height

The volume fraction of liquid can then be calculated using either gamma-ray scan or pressure drop measurements.

For liquid/catalyst tests, the following equations should be used:

For gamma-ray scan data:

$$\epsilon_l = \frac{\frac{\ln \frac{I_l}{I_m}}{d} - \mu_c \rho_c + \mu_l \rho_l}{\mu_l \rho_l - \mu_c \rho_c + \frac{\omega_f \rho_l (\mu_f \rho_f - \mu_c \rho_c)}{\rho_f (100 - \omega_f)}}$$

For pressure drop measurements:

$$\epsilon_l = \frac{\frac{\Delta P}{HD} - \rho_c}{\rho_l - \rho_c + \frac{\rho_l \omega_f}{100 - \omega_f} \left(1 - \frac{\rho_c}{\rho_f}\right)}$$

When three phases are in the reactor, gas/liquid/catalyst, these equations should be used:

Gamma-ray:

$$\frac{\frac{\ln \frac{I_l}{I_m}}{d} - \mu_c \rho_c \epsilon_c + \mu_l \rho_l}{\mu_l \rho_l + \frac{\mu_f \omega_f \rho_l}{(100 - \omega_f)}}$$

Pressure drop:

$$\epsilon_l = \frac{\frac{\Delta P}{HD} - \rho_c \epsilon_c}{\rho_l + \frac{\omega_f \rho_l}{100 - \omega_f}}$$

In either case:

$$\epsilon_f = \frac{\epsilon_l \rho_l \omega_f}{\rho_f (100 - \omega_f)}$$

$$\therefore \epsilon_g = 1 - \epsilon_l - \epsilon_c - \epsilon_f$$

In the dilute phase above the catalyst bed, ϵ_c is set to 0.0 and the same equations are solved.

HD = height between pressure taps
I_l = gamma-ray intensity through liquid
I_m = gamma-ray intensity at test conditions
ΔP = pressure drop

ϵ_c = volume fraction catalyst
ϵ_f = volume fraction fines
ϵ_g = volume fraction gas
ϵ_l = volume fraction liquid
ρ_c = catalyst density
ρ_f = fines density
ρ_l = liquid density
μ_c = catalyst mass absorption coefficient
μ_f = fines mass absorption coefficient
μ_l = liquid mass absorption coefficient
ω_f = wt% fines

Based on the tables presented in this appendix, the figures in the main text of this report were prepared. Additional plots are included in this appendix for reference.

p

% BED EXPANSION FOR RUN 200

M80-21
-118

CATALYST : NONE $\epsilon_M = 0$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
200-00	0.0	0.0	0.	0.
-01	31.3	0.05	0.	0.
-02	31.3	0.10	0.	0.
-03	31.3	0.15	0.	0.
-04	31.3	0.20	0.	0.
-05	31.3	0.25	0.	0.

CALCULATED HOLDUPS, RUN 200: DENSE PHASE

CATALYST : NONE
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
200-00	0.0	0.0	0.0	1.00	0.0	0.0	0.0
-01	31.3	0.05	0.0	0.91	0.97	0.09	11.9
-02	31.3	0.10	0.0	0.84	0.81	0.16	21.9
-03	31.3	0.15	0.0	0.77	0.79	0.23	30.1
-04	31.3	0.20	0.0	0.80	0.81	0.20	44.8
-05	31.3	0.25	0.0	0.78	0.81	0.22	54.9

CALCULATED HOLDUPS, RUN 200--DILUTE PHASE

CATALYST : NONE
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGD
200-00	0.0	0.0	1.00	0.0	0.0
-01	31.3	0.05	0.90	1.01	0.10
-02	31.3	0.10	0.79	0.81	0.21
-03	31.3	0.15	0.70	0.81	0.30
-04	31.3	0.20	0.73	0.79	0.27
-05	31.3	0.25	0.71	0.75	0.29

p

% BED EXPANSION FOR RUN 201

M80-21
-119

CATALYST : HDS-2A $d/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
201-00	0.0	0.0	64.	0.
-01	0.0	0.0	66.	0.
-02	31.4	0.0	68.	3.
-03	38.0	0.0	69.	5.
-04	44.9	0.0	73.	11.
-05	51.5	0.0	78.	18.
-06	60.6	0.0	87.	32.
-07	67.3	0.0	98.	48.
-08	74.9	0.0	103.	56.
-09	81.7	0.0	108.	64.
-10	89.6	0.0	120.	82.
-11	100.1	0.0	133.	102.
-12	22.4	0.00	73.	11.
-13	22.4	0.03	72.	9.
-14	22.4	0.04	77.	17.
-15	22.4	0.04	74.	16.
-16	22.4	0.08	78.	22.
-17	22.4	0.10	79.	23.
-18	22.4	0.15	79.	23.
-19	22.4	0.20	78.	22.
-20	22.4	0.25	77.	20.
-21	31.4	0.03	73.	14.
-22	31.4	0.04	74.	16.
-23	31.4	0.04	77.	20.
-24	31.4	0.05	79.	23.
-25	31.4	0.08	79.	23.
-26	31.4	0.10	82.	28.
-27	31.4	0.15	87.	36.
-28	31.4	0.20	88.	38.
-29	31.4	0.25	89.	39.
-30	44.8	0.03	82.	28.
-31	44.8	0.04	83.	30.
-32	44.8	0.04	86.	34.
-33	44.8	0.05	87.	36.
-34	44.8	0.08	88.	38.
-35	43.8	0.10	93.	45.
-36	43.8	0.15	104.	63.
-37	43.0	0.20	107.	67.
-38	78.4	0.03	117.	83.
-39	79.3	0.04	118.	69.
-40	78.3	0.04	119.	70.
-41	78.3	0.05	122.	74.
-42	76.7	0.08	127.	81.
-43	71.3	0.10	128.	83.
-44	70.5	0.15	128.	83.
-45	44.9	0.25	97.	39.

CALCULATED HOLDUPS, RUN 201: DENSE PHASE

M80-21
-120

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Hm/Sec)
201-00	0.0	0.0	0.49	0.62	1.84	0.0	0.0
-01	0.0	0.0	0.49	0.54	0.58	0.0	0.0
-02	31.4	0.0	0.48	0.54	0.56	0.0	0.0
-03	38.0	0.0	0.47	0.55	0.56	0.0	0.0
-04	44.9	0.0	0.44	0.55	0.65	0.0	0.0
-05	51.5	0.0	0.41	0.60	0.68	0.0	0.0
-06	60.6	0.0	0.37	0.62	0.70	0.0	0.0
-07	67.3	0.0	0.33	0.65	0.70	0.0	0.0
-08	74.9	0.0	0.31	0.67	0.73	0.0	0.0
-09	81.7	0.0	0.30	0.73	0.64	0.0	0.0
-10	89.6	0.0	0.27	0.69	0.77	0.0	0.0
-11	100.1	0.0	0.24	0.73	0.80	0.0	0.0
-12	22.4	0.05	0.44	0.45	0.37	0.11	10.4
-13	22.4	0.03	0.45	0.47	0.41	0.08	4.9
-14	22.4	0.04	0.42	0.48	0.44	0.10	6.9
-15	22.4	0.04	0.42	0.48	0.41	0.10	9.4
-16	22.4	0.08	0.40	0.47	0.56	0.13	17.0
-17	22.4	0.10	0.40	0.46	0.33	0.15	21.9
-18	22.4	0.15	0.40	0.45	0.31	0.16	34.2
-19	22.4	0.20	0.40	0.42	0.32	0.18	44.5
-20	22.4	0.25	0.41	0.37	0.30	0.22	52.6
-21	31.4	0.03	0.43	0.55	0.42	0.02	6.9
-22	31.4	0.04	0.42	0.55	0.41	0.03	9.2
-23	31.4	0.04	0.41	0.54	-0.89	0.05	10.9
-24	31.4	0.05	0.40	0.55	0.42	0.05	12.7
-25	31.4	0.08	0.40	0.49	0.35	0.12	16.1
-26	31.4	0.10	0.38	0.46	0.40	0.16	19.7
-27	31.4	0.15	0.36	0.46	0.39	0.18	30.6
-28	31.4	0.20	0.36	0.44	0.37	0.21	40.4
-29	31.4	0.25	0.35	0.43	0.36	0.22	51.5
-30	44.8	0.03	0.38	0.60	0.50	0.02	7.1
-31	44.8	0.04	0.38	0.59	0.49	0.03	8.6
-32	44.8	0.04	0.36	0.60	0.50	0.04	11.2
-33	44.8	0.05	0.36	0.59	0.50	0.05	12.0
-34	44.8	0.08	0.36	0.56	0.46	0.09	17.8
-35	43.8	0.10	0.34	0.53	0.46	0.13	20.3
-36	43.8	0.15	0.30	0.53	0.43	0.17	29.8
-37	43.0	0.20	0.29	0.48	0.39	0.23	36.7
-38	78.4	0.03	0.27	0.74	0.68	-0.00	8.3
-39	79.3	0.04	0.29	0.66	0.60	0.05	6.7
-40	78.3	0.04	0.29	0.65	0.58	0.07	7.5
-41	78.3	0.05	0.28	0.65	0.58	0.07	9.1
-42	76.7	0.08	0.27	0.61	0.50	0.12	11.4
-43	71.3	0.10	0.27	0.56	0.50	0.17	12.7
-44	70.5	0.15	0.27	0.50	0.45	0.23	18.6
-45	44.9	0.25	0.35	0.38	0.36	0.27	40.3

CALCULATED HOLDUPS, RUN 201--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EBG
201-00	0.0	0.0	0.99	1.84	0.0
-01	0.0	0.0	0.98	0.96	0.0
-02	31.4	0.0	0.98	0.96	0.0
-03	38.0	0.0	0.97	0.96	0.0
-04	44.9	0.0	0.99	0.99	0.0
-05	51.5	0.0	0.97	0.98	0.0
-06	60.6	0.0	0.08	0.98	0.0
-07	67.3	0.0	0.99	0.98	0.0
-08	74.9	0.0	0.98	0.97	0.0
-09	81.7	0.0	0.94	1.14	0.0
-10	89.6	0.0	0.98	0.89	0.0
-11	100.1	0.0	0.97	0.85	0.0
-12	22.4	0.05	0.96	0.97	0.04
-13	22.4	0.03	0.97	1.00	0.03
-14	22.4	0.04	0.97	0.98	0.03
-15	22.4	0.04	0.95	0.99	0.05
-16	22.4	0.08	0.90	0.92	0.10
-17	22.4	0.10	0.85	0.0	0.15
-18	22.4	0.15	0.82	0.0	0.18
-19	22.4	0.20	0.77	0.0	0.23
-20	22.4	0.25	0.76	0.0	0.24
-21	31.4	0.03	0.98	0.98	0.02
-22	31.4	0.04	0.96	0.91	0.04
-23	31.4	0.04	0.95	0.0	0.05
-24	31.4	0.05	0.94	0.93	0.06
-25	31.4	0.08	0.89	0.89	0.11
-26	31.4	0.10	0.84	0.85	0.16
-27	31.4	0.15	0.77	0.79	0.23
-28	31.4	0.20	0.75	0.78	0.25
-29	31.4	0.25	0.73	0.77	0.27
-30	44.8	0.03	0.97	0.98	0.03
-31	44.8	0.04	0.95	0.97	0.05
-32	44.8	0.04	0.93	0.95	0.07
-33	44.8	0.05	0.91	0.94	0.09
-34	44.8	0.08	0.86	0.88	0.14
-35	43.8	0.10	0.81	0.83	0.19
-36	43.8	0.15	0.74	0.75	0.26
-37	43.0	0.20	0.69	0.71	0.31
-38	78.4	0.03	0.96	0.98	0.04
-39	79.3	0.04	0.94	0.96	0.06
-40	78.3	0.04	0.92	0.94	0.08
-41	78.3	0.05	0.89	0.92	0.11
-42	76.7	0.08	0.83	0.85	0.17
-43	71.3	0.10	0.74	0.77	0.26
-44	70.5	0.15	0.66	0.69	0.34
-45	44.9	0.25	0.72	0.0	0.28

M80-21
-122

% BED EXPANSION FOR RUN 203

CATALYST : NDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 1.0 VOL %
TEMPERATURE : 68. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
203-01	22.3	0.0	69.	0.
-02	44.7	0.0	79.	14.
-03	67.0	0.0	101.	46.
-04	89.4	0.0	118.	71.
-05	26.1	0.05	77.	12.
-06	26.1	0.20	82.	19.
-07	44.7	0.05	84.	28.
-08	44.7	0.15	97.	45.
-09	67.0	0.05	105.	57.
-10	67.0	0.10	119.	78.
-11	89.4	0.05	124.	85.

CALCULATED HOLDUPS, RUN 203: DENSE PHASE

CATALYST : NDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 1.0 VOL %
TEMPERATURE : 68. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
203-01	22.3	0.0	0.49	0.50	1.83	0.0	0.0
-02	44.7	0.0	0.43	0.56	0.62	0.0	0.0
-03	67.0	0.0	0.33	0.65	0.69	0.0	0.0
-04	89.4	0.0	0.29	0.70	0.77	0.0	0.0
-05	26.1	0.05	0.44	0.48	0.39	0.08	11.5
-06	26.1	0.20	0.41	0.39	0.34	0.19	42.2
-07	44.7	0.05	0.38	0.55	0.49	0.06	11.3
-08	44.7	0.15	0.34	0.46	0.40	0.20	26.1
-09	67.0	0.05	0.31	0.61	0.55	0.07	9.5
-10	67.0	0.10	0.28	0.57	0.50	0.15	15.6
-11	89.4	0.05	0.26	0.68	0.61	0.05	10.1

CALCULATED HOLDUPS, RUN 203--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 1.0 VOL %
TEMPERATURE : 68. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL6	ELBP	E6G
203-01	22.3	0.0	0.93	0.87	0.0
-02	44.7	0.0	0.95	0.86	0.0
-03	67.0	0.0	0.95	0.86	0.0
-04	89.4	0.0	0.95	0.86	0.0
-05	26.1	0.05	0.93	1.07	0.06
-06	26.1	0.20	0.77	0.92	0.22
-07	44.7	0.05	0.92	1.05	0.07
-08	44.7	0.15	0.74	0.87	0.25
-09	67.0	0.05	0.90	1.03	0.09
-10	67.0	0.10	0.76	0.91	0.24
-11	89.4	0.05	0.90	1.04	0.09

% BED EXPANSION FOR RUN 204

CATALYST : NDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 5.1 VOL %
TEMPERATURE : 70. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
204-01	30.8	0.0	74.	7.
-02	44.0	0.0	87.	26.
-03	59.3	0.0	101.	46.
-04	65.9	0.0	106.	54.
-05	74.7	0.0	120.	74.
-6	87.8	0.0	135.	96.
-7	30.5	0.05	79.	14.
)	30.5	0.03	75.	9.
-09	30.5	0.04	76.	10.
-10	30.5	0.04	77.	12.
-11	31.6	0.10	90.	30.
-12	31.6	0.15	89.	29.
-14	44.2	0.04	96.	39.
-15	44.2	0.04	97.	41.
-16	44.2	0.05	107.	55.
-17	44.2	0.10	115.	67.
-18	65.9	0.03	125.	81.
-19	65.9	0.04	127.	84.
-20	65.9	0.04	128.	86.
-21	65.9	0.05	130.	88.
-22	79.9	0.03	140.	103.
-23	79.9	0.04	142.	106.
-24	79.9	0.04	138.	100.
-25	30.5	0.10	86.	24.
-26	30.5	0.03	77.	11.
-27	43.6	0.10	96.	39.

CALCULATED HOLDUPS, RUN 204: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 5.1 VOL %
TEMPERATURE : 70. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EBB	Vcd (Mm/Sec)
204-01	30.8	0.0	0.46	0.51	0.42	0.0	0.0
-02	44.0	0.0	0.39	0.58	0.47	0.0	0.0
-03	59.3	0.0	0.33	0.62	0.51	0.0	0.0
-04	65.9	0.0	0.32	0.63	0.54	0.0	0.0
-05	74.7	0.0	0.28	0.67	0.57	0.0	0.0
-06	87.8	0.0	0.25	0.69	0.60	0.0	0.0
-07	30.5	0.05	0.43	0.49	0.57	0.05	12.4
-08	30.5	0.03	0.45	0.50	0.57	0.02	7.0
-09	30.5	0.04	0.44	0.49	0.57	0.04	8.6
-10	30.5	0.04	0.44	0.47	0.56	0.07	9.9
-11	31.6	0.10	0.38	0.52	0.64	0.08	25.1
-12	31.6	0.15	0.38	0.44	0.36	0.15	32.8
-14	44.2	0.04	0.35	0.57	0.43	0.05	7.8
-15	44.2	0.04	0.35	0.57	0.48	0.05	10.1
-16	44.2	0.05	0.32	0.60	0.51	0.05	12.3
-17	44.2	0.10	0.29	0.52	0.44	0.16	18.3
-18	65.9	0.03	0.27	0.69	0.60	0.00	7.6
-19	65.9	0.04	0.27	0.67	0.58	0.02	8.9
-20	65.9	0.04	0.26	0.66	0.56	0.04	10.3
-21	65.9	0.05	0.26	0.64	0.55	0.06	10.5
-22	79.9	0.03	0.24	0.71	0.63	0.01	7.4
-23	79.9	0.04	0.24	0.69	0.60	0.03	8.1
-24	79.9	0.04	0.24	0.68	0.57	0.04	9.7
-25	30.5	0.10	0.40	0.47	0.36	0.11	22.8
-26	30.5	0.03	0.44	0.51	0.40	0.02	6.9
-27	43.6	0.10	0.35	0.48	0.38	0.14	18.9

CALCULATED HOLDUPS, RUN 205: DENSE PHASE

M80-21
-128

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 10.4 VOL %
TEMPERATURE : 67. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
205-01	36.3	0.0	0.42	0.51	0.57	0.0	0.0
-02	42.7	0.0	0.39	0.55	0.58	0.0	0.0
-03	49.1	0.0	0.37	0.56	0.60	0.0	0.0
-04	57.6	0.0	0.32	0.59	0.64	0.0	0.0
-05	72.7	0.0	0.26	0.62	0.68	0.0	0.0
-06	64.4	0.0	0.31	0.60	0.65	0.0	0.0
-07	79.1	0.0	0.24	0.66	0.71	0.0	0.0
-08	85.4	0.0	0.23	0.67	0.72	0.0	0.0
-09	36.3	0.03	0.44	0.45	0.36	0.06	4.7
-10	36.3	0.04	0.41	0.49	0.40	0.04	8.7
-11	36.3	0.04	0.39	0.51	0.42	0.04	11.2
-12	36.3	0.05	0.39	0.48	0.40	0.07	11.3
-13	36.3	0.08	0.40	0.44	0.35	0.11	16.1
-14	36.3	0.10	0.37	0.45	0.42	0.13	21.2
-15	36.3	0.15	0.38	0.43	0.41	0.14	32.8
-16	36.3	0.20	0.39	0.42	0.39	0.14	45.7
-17	36.3	0.25	0.40	0.41	0.37	0.14	58.7
-18	42.8	0.03	0.37	0.56	0.45	-0.00	8.0
-19	42.8	0.04	0.37	0.53	0.47	0.04	8.6
-20	42.8	0.04	0.38	0.50	0.43	0.06	9.8
-21	42.8	0.05	0.37	0.51	0.44	0.06	11.5
-22	42.8	0.08	0.37	0.48	0.40	0.10	16.4
-23	42.8	0.10	0.34	0.49	0.40	0.11	21.6
-24	42.8	0.15	0.36	0.43	0.37	0.16	30.5
-25	42.8	0.20	0.37	0.46	0.39	0.11	48.3
-26	42.8	0.25	0.39	0.41	0.35	0.15	56.7
-27	64.0	0.03	0.29	0.64	0.57	-0.00	8.2
-28	64.0	0.04	0.28	0.64	0.59	0.00	10.5
-29	64.0	0.04	0.28	0.61	0.56	0.03	10.8
-30	64.0	0.05	0.28	0.61	0.54	0.04	11.8
-31	64.0	0.08	0.27	0.56	0.41	0.11	14.0
-32	85.9	0.04	0.22	0.69	0.64	0.01	9.8
-33	85.9	0.04	0.22	0.68	0.62	0.02	11.6
-34	85.9	0.05	0.22	0.66	0.60	0.05	10.9
-35	94.4	0.0	0.22	0.65	0.70	0.0	0.0
-36	94.9	0.05	0.22	0.66	0.64	0.04	10.9

CALCULATED HOLDUPS, RUN 205--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 10.4 VOL %
TEMPERATURE : 67. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EBG
205-01	36.3	0.0	0.91	0.72	0.0
-02	42.7	0.0	0.91	0.72	0.0
-03	49.1	0.0	0.91	0.73	0.0
-04	57.6	0.0	0.91	0.72	0.0
-05	72.7	0.0	0.92	0.72	0.0
-06	64.4	0.0	0.91	0.73	0.0
-07	79.1	0.0	0.64	0.68	0.0
-08	85.4	0.0	0.66	0.66	0.0
-09	36.3	0.03	0.88	1.03	0.02
-10	36.3	0.04	0.86	1.02	0.04
-11	36.3	0.04	0.85	1.01	0.05
-12	36.3	0.05	0.83	0.99	0.07
-13	36.3	0.08	0.79	0.96	0.12
-14	36.3	0.10	0.77	0.94	0.14
-15	36.3	0.15	0.75	0.92	0.16
-16	36.3	0.20	0.74	0.91	0.18
-17	36.3	0.25	0.72	0.87	0.20
-18	42.8	0.03	0.89	0.94	0.00
-19	42.8	0.04	0.86	1.02	0.04
-20	42.8	0.04	0.86	1.00	0.04
-21	42.8	0.05	0.85	0.99	0.06
-22	42.8	0.08	0.81	0.95	0.10
-23	42.8	0.10	0.77	0.91	0.14
-24	42.8	0.15	0.76	0.92	0.15
-25	42.8	0.20	0.76	0.92	0.16
-26	42.8	0.25	0.72	0.90	0.20
-27	64.0	0.03	0.89	1.07	0.00
-28	64.0	0.04	0.87	1.02	0.03
-29	64.0	0.04	0.85	1.00	0.05
-30	64.0	0.05	0.83	0.98	0.08
-31	64.0	0.08	0.76	0.0	0.16
-32	85.9	0.04	0.68	1.10	0.24
-33	85.9	0.04	0.65	1.08	0.27
-34	85.9	0.05	0.64	1.06	0.29
-35	94.4	0.0	0.66	0.64	0.0
-36	94.9	0.05	0.64	1.10	0.29

% BED EXPANSION FOR RUN 206

CATALYST : HDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 85. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
206- 1	30.0	0.0	44.	10.
- 2	36.2	0.0	48.	20.
- 3	42.3	0.0	50.	25.
- 4	48.6	0.0	61.	53.
- 5	56.4	0.0	73.	83.
- 6	63.2	0.0	78.	95.
- 7	71.5	0.0	87.	118.
- 8	77.9	0.0	92.	130.
- 9	87.1	0.0	107.	168.
-10	29.8	0.07	47.	18.
-11	30.0	0.08	52.	30.
-12	30.0	0.08	54.	35.
-13	30.1	0.09	54.	35.
-14	30.0	0.12	54.	35.
-15	30.0	0.14	58.	45.
-16	30.0	0.19	60.	50.
-17	30.0	0.24	62.	55.
-18	30.0	0.29	65.	63.
-19	36.7	0.08	53.	33.

% BED EXPANSION FOR RUN 206

CATALYST : HDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 85. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
206-20	36.4	0.09	55.	38.
-21	36.7	0.12	55.	38.
-22	36.3	0.14	54.	35.
-23	36.2	0.19	55.	38.
-24	36.3	0.24	60.	50.
-25	36.7	0.29	51.	28.
-26	42.9	0.08	65.	63.
-27	43.0	0.03	62.	55.
-28	42.9	0.05	63.	58.
-29	30.0	0.14	48.	20.
-30	36.5	0.14	54.	35.
-31	43.0	0.08	62.	55.
-32	42.9	0.12	63.	58.
-33	43.3	0.15	63.	58.
-34	42.9	0.20	63.	58.
-35	42.9	0.25	64.	60.
-36	63.5	0.03	77.	93.
-37	63.7	0.05	79.	98.
-38	64.0	0.09	82.	105.
-39	30.0	0.07	53.	33.
-40	30.0	0.14	49.	23.
-41	36.7	0.14	55.	38.
-42	36.7	0.08	52.	30.
-43	63.7	0.15	78.	95.
-44	63.7	0.20	74.	85.
-45	63.7	0.34	69.	73.
-46	84.5	0.04	106.	165.
-47	84.3	0.04	112.	180.
-48	84.4	0.05	110.	175.
-49	36.1	0.04	53.	33.
-50	36.8	0.05	54.	35.
-51	36.7	0.04	54.	35.
-52	30.5	0.04	48.	20.
-53	30.5	0.15	50.	25.
-54	30.5	0.17	49.	23.
-55	30.5	0.20	47.	18.
-56	42.9	0.0	60.	50.

CALCULATED HOLDUPS, RUN 206: DENSE PHASE

CATALYST : MDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 85. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Hm/Sec)
206- 1	30.0	0.0	0.44	0.43	1.73	0.0	0.0
- 2	36.2	0.0	0.41	0.47	1.73	0.0	0.0
- 3	42.3	0.0	0.39	0.49	1.73	0.0	0.0
- 4	48.6	0.0	0.32	0.56	1.73	0.0	0.0
- 5	56.4	0.0	0.27	0.60	1.73	0.0	0.0
- 6	63.2	0.0	0.25	0.61	1.73	0.0	0.0
- 7	71.5	0.0	0.23	0.64	1.73	0.0	0.0
- 8	77.9	0.0	0.21	0.64	1.73	0.0	0.0
- 9	87.1	0.0	0.18	0.66	1.73	0.0	0.0
-10	29.8	0.07	0.42	0.48	-0.77	0.01	19.6
-11	30.0	0.08	0.38	0.51	-0.71	0.02	21.9
-12	30.0	0.08	0.36	0.51	-0.68	0.03	24.0
-13	30.1	0.09	0.36	0.51	-0.68	0.04	25.6
-14	30.0	0.12	0.36	0.48	-0.68	0.06	31.5
-15	30.0	0.14	0.34	0.52	-0.64	0.05	39.3
-16	30.0	0.19	0.33	0.52	-0.62	0.06	52.9
-17	30.0	0.24	0.32	0.53	-0.60	0.06	67.7
-18	30.0	0.29	0.30	0.53	-0.57	0.07	80.4
-19	36.7	0.08	0.37	0.51	-0.69	0.03	21.3
-20	36.4	0.09	0.36	0.50	-0.67	0.05	24.5
-21	36.7	0.12	0.36	0.49	-0.67	0.07	31.0
-22	36.3	0.14	0.36	0.47	-0.68	0.08	36.0
-23	36.2	0.19	0.36	0.47	-0.67	0.09	49.6
-24	36.3	0.24	0.33	0.50	-0.62	0.08	64.4
-25	36.7	0.29	0.38	0.42	-0.72	0.12	73.2
-26	42.9	0.08	0.30	0.58	-0.58	0.01	22.5
-27	43.0	0.03	0.32	0.57	0.49	0.00	9.8
-28	42.9	0.05	0.31	0.56	0.51	0.02	14.0
-29	30.0	0.14	0.41	0.43	0.27	0.09	35.8
-30	36.5	0.14	0.36	0.47	0.37	0.08	36.3

CALCULATED HOLDUPS, RUN 206: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 85. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (hm/Sec)
206-31	43.0	0.08	0.32	0.52	0.44	0.07	18.8
-32	42.9	0.12	0.31	0.53	0.44	0.07	32.3
-33	43.3	0.15	0.31	0.52	1.98	0.07	39.0
-34	42.9	0.20	0.31	0.51	0.44	0.09	51.7
-35	42.9	0.25	0.31	0.51	1.84	0.09	64.7
-36	63.5	0.03	0.25	0.63	2.11	0.01	10.1
-37	63.7	0.05	0.25	0.60	2.07	0.04	12.3
-38	64.0	0.09	0.24	0.58	0.50	0.07	20.8
-39	30.0	0.07	0.37	0.49	0.15	0.06	18.8
-40	30.0	0.14	0.40	0.43	0.31	0.09	35.4
-41	36.7	0.14	0.36	0.48	0.37	0.07	36.6
-42	36.7	0.08	0.38	0.46	0.37	0.08	19.5
-43	63.7	0.15	0.25	0.53	0.44	0.12	32.7
-44	63.7	0.20	0.26	0.50	0.42	0.14	43.9
-45	63.7	0.34	0.28	0.47	0.74	0.16	75.4
-46	84.5	0.04	0.18	0.69	0.85	0.00	10.6
-47	84.3	0.04	0.17	0.69	0.82	0.01	12.3
-48	84.4	0.05	0.18	0.66	0.80	0.04	11.8
-49	36.1	0.04	0.37	0.49	0.59	0.05	10.5
-50	36.8	0.05	0.36	0.49	0.59	0.06	12.1
-51	36.7	0.04	0.36	0.51	0.39	0.04	8.7
-52	30.5	0.04	0.41	0.45	0.31	0.06	10.0
-53	30.5	0.15	0.39	0.43	0.31	0.10	37.7
-54	30.5	0.17	0.40	0.41	0.32	0.11	42.9
-55	30.5	0.20	0.42	0.37	0.27	0.14	47.0
-56	42.9	0.0	0.33	0.54	0.61	0.0	0.0

CALCULATED HOLDUPS, RUN 206--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 85. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EGG
206- 1	30.0	0.0	0.85	0.50	0.0
- 2	36.2	0.0	0.86	0.50	0.0
- 3	42.3	0.0	0.86	0.50	0.0
- 4	48.6	0.0	0.86	0.50	0.0
- 5	56.4	0.0	0.86	0.50	0.0
- 6	63.2	0.0	0.86	0.50	0.0
- 7	71.5	0.0	0.86	0.47	0.0
- 8	77.9	0.0	0.85	0.47	0.0
- 9	87.1	0.0	0.86	0.47	0.0
-10	29.8	0.07	0.82	1.19	0.03
-11	30.0	0.08	0.81	1.19	0.04
-12	30.0	0.08	0.81	1.19	0.04
-13	30.1	0.09	0.80	1.18	0.06
-14	30.0	0.12	0.78	1.16	0.08
-15	30.0	0.14	0.77	1.14	0.09
-16	30.0	0.19	0.75	1.25	0.11
-17	30.0	0.24	0.73	1.22	0.13
-18	30.0	0.29	0.71	1.21	0.16
-19	36.7	0.08	0.81	1.30	0.04
-20	36.4	0.09	0.80	1.29	0.06
-21	36.7	0.12	0.78	1.27	0.08
-22	36.3	0.14	0.77	1.26	0.09
-23	36.2	0.19	0.74	1.34	0.12

CALCULATED HOLDUPS, RUN 206--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 85. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EGG
206-24	36.3	0.24	0.73	1.33	0.14
-25	36.7	0.29	0.71	1.31	0.16
-26	42.9	0.08	0.81	1.41	0.04
-27	43.0	0.03	0.84	1.04	0.00
-28	42.9	0.05	0.81	1.02	0.04
-29	30.0	0.14	0.77	0.98	0.09
-30	36.5	0.14	0.77	0.97	0.09
-31	43.0	0.08	0.79	0.98	0.06
-32	42.9	0.12	0.78	0.97	0.08
-33	43.3	0.15	0.75	0.97	0.11
-34	42.9	0.20	0.74	0.96	0.13
-35	42.9	0.25	0.72	0.95	0.15
-36	63.5	0.03	0.83	1.04	0.02
-37	63.7	0.05	0.80	1.00	0.05
-38	64.0	0.09	0.75	0.95	0.11
-39	30.0	0.07	0.81	1.01	0.04
-40	30.0	0.14	0.77	0.97	0.09
-41	36.7	0.14	0.77	0.97	0.09
-42	36.7	0.08	0.80	1.00	0.06
-43	63.7	0.15	0.73	0.93	0.14
-44	63.7	0.20	0.71	0.93	0.16
-45	63.7	0.34	0.68	0.90	0.20
-46	84.5	0.04	0.83	1.04	0.01
-47	84.3	0.04	0.81	1.01	0.04
-48	84.4	0.05	0.79	1.00	0.06
-49	36.1	0.04	0.83	1.00	0.01
-50	36.8	0.05	0.82	1.03	0.03
-51	36.7	0.04	0.85	0.93	-0.00
-52	30.5	0.04	0.84	0.91	0.00
-53	30.5	0.15	0.76	0.97	0.10
-54	30.5	0.17	0.74	0.96	0.13
-55	30.5	0.20	0.71	0.94	0.16
-56	42.9	0.0	0.89	0.61	0.0

M80-21
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% BED EXPANSION FOR RUN 207

CATALYST : HDS-2A $\ell/d = 3$
GAS : FREON-12
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 81. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
207- 1	37.0	0.03	48.	37.
- 2	38.2	0.05	52.	49.
- 3	38.1	0.07	53.	52.
- 4	43.3	0.03	57.	63.
- 5	43.4	0.05	55.	57.
- 6	43.2	0.07	58.	66.
- 7	62.4	0.03	69.	97.
- 8	63.0	0.05	68.	95.
- 9	62.9	0.07	67.	92.
-10	83.3	0.03	95.	172.
-11	82.9	0.05	98.	180.
-12	83.3	0.07	104.	198.
-13	82.6	0.09	105.	200.
-14	63.7	0.09	77.	120.
-15	42.5	0.09	61.	75.
-16	36.0	0.09	54.	54.
-17	35.8	0.05	49.	40.
-18	62.1	0.07	71.	103.
-19	36.2	0.17	61.	60.
-20	36.7	0.20	63.	65.
-21	36.3	0.25	65.	70.
-22	62.9	0.17	76.	99.
-23	62.9	0.20	71.	86.
-24	63.0	0.25	69.	81.
-25	70.5	0.17	82.	115.
-26	42.6	0.17	65.	70.
-27	42.4	0.25	67.	75.
-28	42.3	0.30	70.	89.
-29	37.2	0.30	68.	82.
-30	62.6	0.10	83.	124.
-31	83.4	0.05	109.	195.
-32	83.5	0.06	110.	197.
-33	63.2	0.05	78.	111.
-34	43.1	0.06	62.	68.

CALCULATED HOLDUPS, RUN 207: DENSE PHASE

CATALYST : HDS-2A
GAS : FREON-12
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 81. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
207- 1	37.0	0.03	0.36	0.53	0.43	0.02	8.5
- 2	38.2	0.05	0.33	0.54	0.47	0.03	13.7
- 3	38.1	0.07	0.32	0.54	0.48	0.04	18.9
- 4	43.3	0.03	0.30	0.62	0.58	-0.03	11.1
- 5	43.4	0.05	0.31	0.60	0.55	-0.02	16.3
- 6	43.2	0.07	0.30	0.59	0.58	0.01	20.7
- 7	62.4	0.03	0.25	0.70	0.56	-0.08	14.7
- 8	63.0	0.05	0.25	0.69	0.55	-0.07	20.2
- 9	62.9	0.07	0.26	0.67	0.64	-0.04	24.7
-10	83.3	0.03	0.18	0.77	0.73	-0.09	16.7
-11	82.9	0.05	0.17	0.78	0.77	-0.10	23.1
-12	83.3	0.07	0.16	0.75	0.76	-0.06	26.3
-13	82.6	0.09	0.16	0.72	0.71	-0.01	28.8
-14	63.7	0.09	0.22	0.67	0.67	-0.01	28.6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
-16	36.0	0.09	0.32	0.58	0.55	-0.00	27.7
-17	35.8	0.05	0.35	0.59	0.50	-0.05	17.8
-18	62.1	0.07	0.24	0.67	0.62	-0.03	23.6
-19	36.2	0.17	0.31	0.53	0.48	0.07	45.9
-20	36.7	0.20	0.30	0.53	0.49	0.08	53.2
-21	36.3	0.25	0.29	0.53	0.54	0.08	67.0
-22	62.9	0.17	0.25	0.55	0.54	0.11	39.8
-23	62.9	0.20	0.26	0.51	0.51	0.13	44.5
-24	63.0	0.25	0.27	0.50	0.50	0.14	56.6
-25	70.5	0.17	0.23	0.54	0.53	0.13	36.2
-26	42.6	0.17	0.29	0.55	0.54	0.06	46.0
-27	42.4	0.25	0.28	0.55	0.55	0.07	67.8
-28	42.3	0.30	0.26	0.54	0.54	0.10	78.6
-29	37.2	0.30	0.27	0.55	0.53	0.09	80.6
-30	62.6	0.10	0.22	0.57	0.53	0.11	21.0
-31	83.4	0.05	0.17	0.67	0.63	0.04	11.6
-32	83.5	0.06	0.16	0.65	0.61	0.06	14.3
-33	63.2	0.05	0.23	0.63	0.60	0.02	13.8
-34	43.1	0.06	0.29	0.57	0.53	0.03	18.1

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CALCULATED HOLDUPS, RUN 207--DILUTE PHASE

CATALYST : HDS-2A
GAS : FREON-12
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 81. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EGG
207- 1	37.0	0.03	0.83	0.83	0.01
- 2	38.2	0.05	0.81	0.81	0.04
- 3	38.1	0.07	0.78	0.78	0.07
- 4	43.3	0.03	0.86	0.87	-0.02
- 5	43.4	0.05	0.84	0.85	0.01
- 6	43.2	0.07	0.78	0.80	0.07
- 7	62.4	0.03	0.90	0.86	-0.07
- 8	63.0	0.05	0.88	0.86	-0.04
- 9	62.9	0.07	0.86	0.0	-0.01
-10	83.3	0.03	0.91	0.0	-0.08
-11	82.9	0.05	0.89	0.0	-0.06
-12	83.3	0.07	0.83	0.0	0.02
-13	82.6	0.09	0.75	0.0	0.11
-14	63.7	0.09	0.79	0.0	0.07
-15	42.5	0.09	0.80	0.0	0.05
-16	36.0	0.09	0.81	0.01	0.04
-17	35.8	0.05	0.86	0.0	-0.02
-18	62.1	0.07	0.80	0.0	0.05
-19	36.2	0.17	0.71	0.71	0.17
-20	36.7	0.20	0.69	0.70	0.18
-21	36.3	0.25	0.67	0.69	0.20
-22	62.9	0.17	0.69	0.71	0.18
-23	62.9	0.20	0.69	0.71	0.18
-24	63.0	0.25	0.68	0.69	0.20
-25	70.5	0.17	0.69	0.71	0.18
-26	42.6	0.17	0.73	0.74	0.13
-27	42.4	0.25	0.69	0.71	0.18
-28	42.3	0.30	0.65	0.67	0.23
-29	37.2	0.30	0.66	0.68	0.22
-30	62.6	0.10	0.70	0.71	0.17
-31	83.4	0.05	0.73	0.73	0.13
-32	83.5	0.06	0.71	0.70	0.16
-33	63.2	0.05	0.78	0.78	0.08
-34	43.1	0.06	0.78	0.78	0.07

% BED EXPANSION FOR RUN 208

CATALYST : HDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.2 VOL %
TEMPERATURE : 148. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
208- 1	36.2	0.0	44.	26.
- 2	42.8	0.0	46.	31.
- 3	58.8	0.0	59.	59.
- 4	65.0	0.0	61.	65.
- 5	79.4	0.0	75.	103.
- 6	86.2	0.0	78.	111.
- 8	37.4	0.05	47.	27.
- 9	37.6	0.10	49.	32.
-10	37.0	0.15	52.	44.
-11	37.3	0.20	50.	39.
-12	36.5	0.25	55.	53.
-13	42.9	0.05	54.	50.
-14	42.8	0.10	60.	67.
-15	42.6	0.15	62.	72.
-16	43.5	0.20	60.	67.
-17	43.5	0.25	57.	58.
-18	63.7	0.05	63.	75.
-19	64.0	0.10	70.	94.
-20	64.1	0.15	76.	111.
-21	63.6	0.20	70.	94.
-22	63.9	0.25	68.	89.
-23	85.1	0.05	85.	136.
-24	86.3	0.10	82.	128.
-25	79.1	0.15	93.	158.
-26	85.8	0.0	78.	117.
-27	37.8	0.0	44.	22.
-28	63.7	0.0	63.	75.
-29	64.1	0.20	69.	92.
-30	43.3	0.10	58.	61.
-31	43.1	0.15	62.	72.

CALCULATED HOLDUPS, RUN 208: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.2 VOL %
TEMPERATURE : 148. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
208- 1	36.2	0.0	0.39	0.48	1.64	0.0	0.0
- 2	42.8	0.0	0.37	0.50	1.64	0.0	0.0
- 3	58.8	0.0	0.31	0.58	0.60	0.0	0.0
- 4	65.0	0.0	0.30	0.59	0.61	0.0	0.0
- 5	79.4	0.0	0.24	0.62	0.61	0.0	0.0
- 6	86.2	0.0	0.23	0.63	0.63	0.0	0.0
- 8	37.4	0.05	0.39	0.47	-1.49	0.06	11.9
- 9	37.6	0.10	0.37	0.45	-1.46	0.10	23.3
-10	37.0	0.15	0.34	0.48	-0.58	0.10	37.3
-11	37.3	0.20	0.35	0.46	-0.60	0.11	50.0
-12	36.5	0.25	0.32	0.48	-0.55	0.11	63.1
-13	42.9	0.05	0.33	0.55	-0.56	0.02	14.0
-14	42.8	0.10	0.29	0.53	-0.50	0.08	24.3
-15	42.6	0.15	0.28	0.53	-0.48	0.09	37.9
-16	43.5	0.20	0.29	0.51	-0.50	0.10	50.5
-17	43.5	0.25	0.31	0.49	-0.53	0.11	62.9
-18	63.7	0.05	0.28	0.56	-0.48	0.06	10.6
-19	64.0	0.10	0.25	0.54	-0.43	0.11	20.5
-20	64.1	0.15	0.23	0.52	-0.39	0.16	29.2
-21	63.6	0.20	0.25	0.50	-0.43	0.16	41.4
-22	63.9	0.25	0.26	0.50	-0.44	0.16	54.5
-23	85.1	0.05	0.21	0.67	-0.35	0.01	14.6
-24	86.3	0.10	0.22	0.59	-0.36	0.09	20.8
-25	79.1	0.15	0.19	0.58	-0.32	0.13	30.7
-26	85.8	0.0	0.23	0.62	1.63	0.0	0.0
-27	37.8	0.0	0.40	0.49	1.63	0.0	0.0
-28	63.7	0.0	0.28	0.59	1.63	0.0	0.0
-29	64.1	0.20	0.26	0.51	-0.43	0.14	43.9
-30	43.3	0.10	0.30	0.52	0.47	0.08	24.2
-31	43.1	0.15	0.28	0.53	0.49	0.09	37.4

CALCULATED HOLDUPS, RUN 208--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.2 VOL %
TEMPERATURE : 140. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL G	EL DP	EGG
208- 1	36.2	0.0	0.88	1.60	0.0
- 2	42.8	0.0	0.86	1.60	0.0
- 3	58.8	0.0	0.87	0.80	0.0
- 4	65.0	0.0	0.87	0.80	0.0
- 5	79.4	0.0	0.87	0.80	0.0
- 6	86.2	0.0	0.87	0.80	0.0
- 8	37.4	0.05	0.83	0.85	0.02
- 9	37.6	0.10	0.76	0.79	0.11
-10	37.0	0.15	0.74	0.77	0.12
-11	37.3	0.20	0.72	0.75	0.15
-12	36.5	0.25	0.70	0.74	0.18
-13	42.9	0.05	0.82	0.85	0.03
-14	42.8	0.10	0.76	0.78	0.11
-15	42.6	0.15	0.75	0.77	0.12
-16	43.5	0.20	0.72	0.76	0.15
-17	43.5	0.25	0.70	0.74	0.18
-18	63.7	0.05	0.81	0.85	0.04
-19	64.0	0.10	0.74	0.78	0.12
-20	64.1	0.15	0.69	0.73	0.19
-21	63.6	0.20	0.69	0.74	0.18
-22	63.9	0.25	0.69	0.73	0.19
-23	85.1	0.05	0.82	0.85	0.03
-24	86.3	0.10	0.77	0.78	0.09
-25	79.1	0.15	0.70	0.72	0.17
-26	85.8	0.0	0.88	0.80	0.0
-27	37.8	0.0	0.87	0.80	0.0
-28	63.7	0.0	0.87	0.80	0.0
-29	64.1	0.20	0.72	0.74	0.15
-30	43.3	0.10	0.77	0.79	0.10
-31	43.1	0.15	0.74	0.78	0.12

% BED EXPANSION FOR RUN 209

CATALYST : HDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 97. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
209- 1	36.0	0.0	48.	33.
- 2	42.5	0.0	52.	44.
- 3	62.8	0.0	72.	100.
- 4	83.7	0.0	100.	178.
- 5	36.3	0.05	52.	44.
- 6	36.5	0.10	58.	61.
- 7	36.1	0.20	62.	72.
- 8	36.3	0.15	52.	41.
- 9	36.6	0.15	56.	51.
-10	35.8	0.24	63.	70.
-11	42.2	0.05	62.	68.
-12	42.6	0.10	64.	73.
-13	42.4	0.15	65.	76.
-14	42.9	0.20	64.	73.
-15	42.1	0.25	65.	76.
-16	63.3	0.05	78.	111.
-17	63.2	0.10	84.	127.
-18	62.4	0.15	90.	143.
-19	62.6	0.20	78.	111.
-20	63.1	0.26	78.	111.
-21	82.9	0.05	99.	168.
-22	83.5	0.10	107.	189.
-23	83.8	0.15	105.	184.
-24	83.1	0.0	94.	154.
-25	63.3	0.0	70.	89.
-26	63.0	0.15	79.	114.
-27	62.5	0.15	85.	130.
-28	37.0	0.15	61.	65.
-29	83.1	0.05	106.	187.
-30	42.0	0.10	64.	73.

CALCULATED HOLDUPS, RUN 209: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 97. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
209- 1	36.0	0.0	0.37	0.56	0.49	0.0	0.0
- 2	42.5	0.0	0.34	0.58	0.46	0.0	0.0
- 3	62.8	0.0	0.24	0.68	0.50	0.0	0.0
- 4	83.7	0.0	0.18	0.72	0.55	0.0	0.0
- 5	36.3	0.05	0.34	0.47	0.61	0.10	9.5
- 6	36.5	0.10	0.30	0.46	0.62	0.15	20.2
- 7	36.1	0.20	0.28	0.49	0.56	0.14	47.3
- 8	36.3	0.15	0.35	0.41	0.64	0.16	31.7
- 9	36.6	0.15	0.32	0.46	0.68	0.13	34.5
-10	35.8	0.24	0.29	0.48	0.57	0.14	56.1
-11	42.2	0.05	0.29	0.52	0.59	0.10	9.7
-12	42.6	0.10	0.28	0.47	0.55	0.16	18.4
-13	42.4	0.15	0.28	0.47	0.48	0.17	30.7
-14	42.9	0.20	0.28	0.48	0.51	0.15	44.9
-15	42.1	0.25	0.28	0.47	0.51	0.17	55.3
-16	63.3	0.05	0.23	0.57	0.59	0.09	8.5
-17	63.2	0.10	0.22	0.52	0.54	0.17	15.6
-18	62.4	0.15	0.20	0.50	0.51	0.21	24.2
-19	62.6	0.20	0.23	0.47	0.49	0.22	34.8
-20	63.1	0.26	0.23	0.47	0.51	0.22	48.7
-21	82.9	0.05	0.18	0.62	0.61	0.08	8.3
-22	83.5	0.10	0.17	0.55	0.54	0.18	12.4
-23	83.8	0.15	0.17	0.51	0.50	0.22	19.1
-24	83.1	0.0	0.19	0.72	0.71	0.0	0.0
-25	63.3	0.0	0.26	0.67	0.67	0.0	0.0
-26	63.0	0.15	0.23	0.48	0.46	0.21	23.7
-27	62.5	0.15	0.21	0.48	0.48	0.21	23.6
-28	37.0	0.15	0.30	0.48	0.46	0.13	34.4
-29	83.1	0.05	0.17	0.63	0.62	0.08	8.5
-30	42.0	0.10	0.28	0.47	0.47	0.16	19.0

CALCULATED HOLDUPS, RUN 214: DENSE PHASE

CALCULATED HOLDUPS, RUN 209--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 97. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EGD
209- 1	36.0	0.0	0.83	0.89	0.0
- 2	42.5	0.0	0.83	0.81	0.0
- 3	62.8	0.0	0.83	0.80	0.0
- 4	83.7	0.0	0.83	0.80	0.0
- 5	36.3	0.05	0.76	0.82	0.11
- 6	36.5	0.10	0.70	0.76	0.17
- 7	36.1	0.20	0.66	0.73	0.22
- 8	36.3	0.15	0.69	0.76	0.18
- 9	36.6	0.15	0.69	0.76	0.18
-10	35.8	0.24	0.65	0.73	0.24
-11	42.2	0.05	0.75	0.82	0.11
-12	42.6	0.10	0.69	0.75	0.18
-13	42.4	0.15	0.67	0.74	0.20
-14	42.9	0.20	0.65	0.72	0.23
-15	42.1	0.25	0.64	0.72	0.24
-16	63.3	0.05	0.74	0.80	0.12
-17	63.2	0.10	0.67	0.72	0.20
-18	62.4	0.15	0.64	0.68	0.24
-19	62.6	0.20	0.65	0.70	0.23
-20	63.1	0.26	0.64	0.69	0.25
-21	82.9	0.05	0.76	0.81	0.10
-22	83.5	0.10	0.66	0.71	0.22
-23	83.8	0.15	0.60	0.65	0.29
-24	83.1	0.0	0.82	0.81	0.0
-25	63.3	0.0	0.82	0.81	0.0
-26	63.0	0.15	0.64	0.70	0.24
-27	62.5	0.15	0.64	0.70	0.24
-28	37.0	0.15	0.68	0.75	0.20
-29	83.1	0.05	0.75	0.80	0.12
-30	42.0	0.10	0.69	0.74	0.18

% BED EXPANSION FOR RUN 210

CATALYST : HDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 11.9 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
210-01	36.4	0.0	63.	26.
-02	36.0	0.05	70.	40.
-03	37.7	0.10	74.	48.
-04	37.9	0.15	72.	44.
-05	37.7	0.20	70.	40.
-06	38.2	0.24	70.	40.
-07	43.2	0.0	69.	38.
-08	43.6	0.05	74.	48.
-09	43.5	0.10	77.	54.
-10	43.9	0.15	75.	50.
-11	42.5	0.20	72.	44.
-12	44.7	0.24	72.	44.
-13	63.8	0.0	92.	84.
-14	63.8	0.05	98.	96.
-15	63.9	0.10	105.	110.
-16	63.2	0.15	100.	100.
-17	63.9	0.20	99.	98.
-18	64.6	0.24	95.	90.
-19	84.0	0.0	128.	156.
-20	84.5	0.05	129.	158.
-21	84.9	0.10	135.	170.
-22	64.0	0.20	95.	90.
-23	44.9	0.10	78.	56.
-24	44.4	0.15	76.	52.
-25	44.5	0.10	77.	54.
-26	43.6	0.15	75.	50.
-27	44.7	0.10	77.	54.
-28	44.9	0.15	76.	52.

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CALCULATED HOLDUPS, RUN 210: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 11.9 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
210-01	36.4	0.0	0.39	0.56	0.59	0.0	0.0
-02	36.0	0.05	0.35	0.51	0.49	0.07	11.6
-03	37.7	0.10	0.33	0.49	0.48	0.11	22.5
-04	37.9	0.15	0.34	0.48	0.48	0.11	36.1
-05	37.7	0.20	0.35	0.50	0.51	0.09	52.2
-06	38.2	0.24	0.35	0.50	0.53	0.08	62.4
-07	43.2	0.0	0.36	0.52	0.54	0.0	0.0
-08	43.6	0.05	0.33	0.53	0.57	0.07	11.3
-09	43.5	0.10	0.32	0.50	0.53	0.12	21.3
-10	43.9	0.15	0.33	0.48	0.51	0.13	33.5
-11	42.5	0.20	0.34	0.46	0.51	0.13	46.5
-12	44.7	0.24	0.34	0.46	0.34	0.13	55.3
-13	63.8	0.0	0.27	0.66	0.64	0.0	0.0
-14	63.8	0.05	0.25	0.61	0.62	0.06	10.8
-15	63.9	0.10	0.23	0.55	0.54	0.15	17.2
-16	63.2	0.15	0.24	0.51	0.52	0.18	26.4
-17	63.9	0.20	0.25	0.53	0.54	0.16	41.9
-18	64.6	0.24	0.26	0.52	0.54	0.16	50.5
-19	84.0	0.0	0.19	0.71	0.70	0.0	0.0
-20	84.5	0.05	0.19	0.65	0.67	0.07	9.3
-21	84.9	0.10	0.18	0.59	0.59	0.15	14.8
-22	64.0	0.20	0.26	0.51	0.51	0.17	40.4
-23	44.9	0.10	0.31	0.51	0.07	0.10	22.4
-24	44.4	0.15	0.32	0.49	0.51	0.12	34.8
-25	44.5	0.10	0.32	0.51	0.55	0.11	22.1
-26	43.6	0.15	0.33	0.49	0.52	0.12	34.9
-27	44.7	0.10	0.32	0.51	0.52	0.11	22.3
-28	44.9	0.15	0.32	0.49	0.53	0.12	34.8

CALCULATED HOLDUPS, RUN 210--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 11.9 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
210-01	36.4	0.0	0.88	0.86	0.0
-02	36.0	0.05	0.81	0.87	0.08
-03	37.7	0.10	0.76	0.82	0.14
-04	37.9	0.15	0.74	0.80	0.16
-05	37.7	0.20	0.71	0.78	0.20
-06	38.2	0.24	0.69	0.76	0.21
-07	43.2	0.0	0.88	0.86	0.0
-08	43.6	0.05	0.81	0.86	0.09
-09	43.5	0.10	0.75	0.81	0.15
-10	43.9	0.15	0.73	0.79	0.18
-11	42.5	0.20	0.70	0.77	0.21
-12	44.7	0.24	0.69	0.70	0.22
-13	63.8	0.0	0.89	0.86	0.0
-14	63.8	0.05	0.79	0.84	0.10
-15	63.9	0.10	0.67	0.73	0.24
-16	63.2	0.15	0.69	0.74	0.22
-17	63.9	0.20	0.68	0.74	0.23
-18	64.6	0.24	0.67	0.74	0.24
-19	84.0	0.0	0.89	0.86	0.0
-20	84.5	0.05	0.79	0.85	0.11
-21	84.9	0.10	0.67	0.75	0.24
-22	64.0	0.20	0.68	0.75	0.23
-23	44.9	0.10	0.76	0.87	0.14
-24	44.4	0.15	0.74	0.79	0.16
-25	44.5	0.10	0.76	0.81	0.14
-26	43.6	0.15	0.74	0.79	0.16
-27	44.7	0.10	0.77	0.80	0.13
-28	44.9	0.15	0.74	0.79	0.16

M80-21
-148

% BED EXPANSION FOR RUN 211

CATALYST : HDS-2A l/d:3
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 17.8 VOL %
TEMPERATURE : 80. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
211-01	36.1	0.0	51.	38.
-02	35.8	0.05	54.	46.
-03	36.7	0.10	57.	54.
-04	37.2	0.15	60.	62.
-05	36.0	0.20	62.	68.
-06	36.5	0.24	57.	54.
-07	42.3	0.0	57.	54.
-08	41.1	0.05	64.	73.
-09	42.5	0.10	65.	76.
-10	42.8	0.15	66.	78.
-11	43.0	0.20	64.	73.
-12	42.2	0.24	63.	70.
-13	42.0	0.0	79.	114.
-14	42.8	0.05	83.	124.
-15	43.9	0.10	89.	141.
-16	41.8	0.15	80.	116.
-17	42.9	0.20	80.	116.
-18	42.7	0.25	78.	111.

CALCULATED HOLDUPS, RUN 211: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 17.8 VOL %
TEMPERATURE : 80. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
211-01	36.1	0.0	0.36	0.57	0.53	0.0	0.0
-02	35.8	0.05	0.34	0.47	0.55	0.10	10.0
-03	36.7	0.10	0.32	0.46	0.52	0.12	22.3
-04	37.2	0.15	0.30	0.49	0.53	0.10	37.0
-05	36.0	0.20	0.29	0.49	0.54	0.11	49.8
-06	36.5	0.24	0.32	0.44	0.50	0.15	55.5
-07	42.3	0.0	0.32	0.61	0.54	0.0	0.0
-08	41.1	0.05	0.28	0.52	0.59	0.08	10.6
-09	42.5	0.10	0.28	0.48	0.55	0.13	20.9
-10	42.8	0.15	0.27	0.50	0.56	0.12	35.1
-11	43.0	0.20	0.28	0.48	0.55	0.14	46.5
-12	42.2	0.24	0.29	0.47	0.54	0.14	55.1
-13	62.0	0.0	0.23	0.66	0.61	0.0	0.0
-14	62.8	0.05	0.22	0.56	0.62	0.10	8.1
-15	63.9	0.10	0.20	0.52	0.57	0.17	15.6
-16	61.8	0.15	0.23	0.49	0.54	0.18	27.2
-17	62.9	0.20	0.23	0.48	0.56	0.18	38.8
-18	62.7	0.25	0.23	0.48	0.56	0.19	50.9

M80-21
-150

CALCULATED HOLDUPS, RUN 211--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 17.8 VOL %
TEMPERATURE : 80. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
211-01	36.1	0.0	0.81	0.76	0.0
-02	35.8	0.05	0.74	0.80	0.10
-03	36.7	0.10	0.70	0.76	0.15
-04	37.2	0.15	0.67	0.74	0.19
-05	36.0	0.20	0.66	0.73	0.20
-06	36.5	0.24	0.65	0.73	0.21
-07	42.3	0.0	0.81	0.75	0.0
-08	41.1	0.05	0.73	0.80	0.11
-09	42.5	0.10	0.70	0.76	0.14
-10	42.8	0.15	0.68	0.74	0.18
-11	43.0	0.20	0.67	0.73	0.19
-12	42.2	0.24	0.66	0.73	0.20
-13	62.0	0.0	0.81	0.75	0.0
-14	62.8	0.05	0.72	0.78	0.13
-15	63.9	0.10	0.64	0.70	0.22
-16	61.8	0.15	0.66	0.72	0.20
-17	62.9	0.20	0.65	0.71	0.21
-18	62.7	0.25	0.63	0.71	0.24

% BED EXPANSION FOR RUN 212

CATALYST : HDS-2A $\ell/d=3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
212- 1	30.8	0.0	57.	14.
- 2	31.7	0.10	67.	34.
- 3	45.0	0.0	65.	30.
- 4	44.6	0.04	70.	40.
- 5	44.0	0.10	77.	54.
- 6	44.7	0.14	81.	62.
- 7	66.8	0.0	84.	68.
- 8	66.4	0.11	95.	90.
- 9	66.5	0.16	102.	104.
-10	88.7	0.0	109.	118.
-11	88.4	0.12	119.	138.
-12	45.2	0.19	82.	64.
-13	66.5	0.21	111.	122.
-14	88.3	0.23	134.	168.
-15	87.8	0.16	127.	154.

CALCULATED HOLDUPS, RUN 212: DENSE PHASE

M80-21
-152

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
212- 1	30.8	0.0	0.43	0.59	0.43	0.0	0.0
- 2	31.7	0.10	0.37	0.47	0.46	0.17	18.4
- 3	45.0	0.0	0.38	0.66	0.64	0.0	0.0
- 4	44.6	0.04	0.35	0.55	0.55	0.10	7.3
- 5	44.0	0.10	0.32	0.49	0.50	0.19	15.4
- 6	44.7	0.14	0.30	0.46	0.47	0.24	21.9
- 7	66.8	0.0	0.29	0.72	0.72	0.0	0.0
- 8	66.4	0.11	0.26	0.57	0.58	0.17	16.8
- 9	66.5	0.16	0.24	0.54	0.54	0.22	23.2
-10	88.7	0.0	0.22	0.80	0.77	0.0	0.0
-11	88.4	0.12	0.21	0.65	0.65	0.15	19.5
-12	45.2	0.19	0.30	0.42	0.45	0.28	27.8
-13	66.5	0.21	0.22	0.51	0.53	0.27	28.9
-14	88.3	0.23	0.18	0.57	0.58	0.25	32.3
-15	87.8	0.16	0.19	0.63	0.64	0.17	27.7

CALCULATED HOLDUPS, RUN 212--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGD
212- 1	30.8	0.0	0.97	0.94	0.0
- 2	31.7	0.10	0.79	0.87	0.21
- 3	45.0	0.0	0.98	0.94	0.0
- 4	44.6	0.04	0.88	0.96	0.12
- 5	44.0	0.10	0.76	0.85	0.24
- 6	44.7	0.14	0.69	0.78	0.31
- 7	66.8	0.0	0.99	0.94	0.0
- 8	66.4	0.11	0.77	0.86	0.23
- 9	66.5	0.16	0.71	0.79	0.29
-10	88.7	0.0	0.97	0.94	0.0
-11	88.4	0.12	0.79	0.88	0.21
-12	45.2	0.19	0.68	0.76	0.32
-13	66.5	0.21	0.65	0.73	0.35
-14	88.3	0.23	0.67	0.80	0.33
-15	87.8	0.16	0.75	0.83	0.25

% BED EXPANSION FOR RUN 213

CATALYST : HDS-2A $\ell/d = 3$
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 70. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
213- 1	30.4	0.0	63.	26.
- 2	37.3	0.05	64.	28.
- 3	37.4	0.10	68.	36.
- 4	37.4	0.15	71.	42.
- 5	44.3	0.05	69.	38.
- 6	60.4	0.05	86.	79.
- 7	89.1	0.05	109.	127.
- 8	45.0	0.10	70.	46.
- 9	36.7	0.20	69.	44.
-10	44.4	0.20	76.	58.
-11	66.4	0.20	93.	94.
-12	37.5	0.25	69.	44.
-13	44.0	0.25	75.	56.
-14	66.5	0.25	99.	106.
-15	88.1	0.25	125.	160.
-16	88.4	0.20	120.	150.
-17	88.7	0.10	111.	131.
-18	88.7	0.15	117.	144.
-19	44.4	0.15	76.	58.
-20	66.6	0.15	96.	100.
-21	66.7	0.10	91.	90.
-22	109.5	0.05	135.	181.

CALCULATED HOLDUPS, RUN 213: DENSE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 70. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELOD	ELDPD	EGD	Vcd (Mm/Sec)
213- 1	38.4	0.0	0.39	0.63	0.62	0.0	0.0
- 2	37.3	0.05	0.38	0.54	0.55	0.07	10.9
- 3	37.4	0.10	0.36	0.52	0.53	0.12	21.5
- 4	37.4	0.15	0.35	0.48	0.50	0.17	30.3
- 5	44.3	0.05	0.36	0.54	0.58	0.09	9.7
- 6	68.4	0.05	0.27	0.69	0.68	0.04	12.0
- 7	89.1	0.05	0.22	0.75	0.76	0.04	11.8
- 8	45.0	0.10	0.34	0.58	0.56	0.09	23.5
- 9	36.7	0.20	0.34	0.55	0.54	0.11	49.8
-10	44.4	0.20	0.31	0.57	0.56	0.12	47.6
-11	66.4	0.20	0.25	0.60	0.62	0.15	42.2
-12	37.5	0.25	0.34	0.50	0.52	0.16	57.1
-13	44.0	0.25	0.31	0.49	0.53	0.20	51.4
-14	66.5	0.25	0.24	0.59	0.60	0.17	52.0
-15	88.1	0.25	0.19	0.64	0.66	0.17	49.9
-16	88.4	0.20	0.20	0.65	0.67	0.16	39.4
-17	88.7	0.10	0.21	0.70	0.73	0.08	21.3
-18	88.7	0.15	0.20	0.67	0.68	0.13	29.8
-19	44.4	0.15	0.31	0.56	0.55	0.13	33.8
-20	66.6	0.15	0.24	0.60	0.61	0.16	28.7
-21	66.7	0.10	0.26	0.63	0.64	0.12	19.5
-22	109.5	0.05	0.17	0.79	0.80	0.03	11.6

CALCULATED HOLDUPS, RUN 213--DILUTE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 70. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EGG
213- 1	38.4	0.0	0.97	0.94	0.0
- 2	37.3	0.05	0.94	1.01	0.06
- 3	37.4	0.10	0.88	0.95	0.12
- 4	37.4	0.15	0.80	0.89	0.20
- 5	44.3	0.05	0.90	0.97	0.10
- 6	60.4	0.05	0.93	0.98	0.07
- 7	89.1	0.05	0.91	1.03	0.09
- 8	45.0	0.10	0.88	0.93	0.12
- 9	36.7	0.20	0.80	0.93	0.20
-10	44.4	0.20	0.78	0.91	0.22
-11	66.4	0.20	0.76	0.89	0.24
-12	37.5	0.25	0.78	0.91	0.22
-13	44.0	0.25	0.76	0.89	0.24
-14	66.5	0.25	0.72	0.85	0.28
-15	88.1	0.25	0.73	0.86	0.27
-16	88.4	0.20	0.76	0.89	0.24
-17	88.7	0.10	0.84	0.98	0.16
-18	88.7	0.15	0.78	0.91	0.22
-19	44.4	0.15	0.77	0.90	0.23
-20	66.6	0.15	0.76	0.89	0.24
-21	66.7	0.10	0.81	0.95	0.19
-22	109.5	0.05	0.90	1.07	0.10

% BED EXPANSION FOR RUN 214

CATALYST : HDS-2A $l/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
214- 1	45.8	0.0	74.	40.
- 2	43.4	0.0	69.	30.
- 3	39.3	0.0	63.	19.
- 4	31.2	0.0	58.	9.
- 5	53.9	0.0	81.	53.
- 6	60.3	0.0	86.	62.
- 7	70.0	0.0	99.	70.
- 8	71.4	0.0	96.	81.
- 9	79.7	0.0	105.	98.
-10	71.3	0.0	106.	112.
-11	88.3	0.0	128.	156.
-12	47.1	0.10	78.	56.
-13	46.0	0.14	74.	48.

CALCULATED HOLDUPS, RUN 214: DENSE PHASE

M80-21
-157

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
214- 1	45.8	0.0	0.35	0.63	0.63	0.0	0.0
- 2	43.4	0.0	0.38	0.63	0.62	0.0	0.0
- 3	39.3	0.0	0.41	0.58	0.59	0.0	0.0
- 4	31.2	0.0	0.45	0.56	0.59	0.0	0.0
- 5	53.9	0.0	0.32	0.65	0.64	0.0	0.0
- 6	60.3	0.0	0.30	0.67	0.65	0.0	0.0
- 7	70.0	0.0	0.29	0.68	0.66	0.0	0.0
- 8	71.4	0.0	0.27	0.69	0.68	0.0	0.0
- 9	79.7	0.0	0.25	0.70	0.69	0.0	0.0
-10	71.3	0.0	0.23	0.71	0.66	0.0	0.0
-11	88.3	0.0	0.19	0.72	0.67	0.0	0.0
-12	47.1	0.10	0.31	0.41	0.41	0.20	12.4
-13	46.0	0.14	0.33	0.41	0.41	0.19	24.6

CALCULATED HOLDUPS, RUN 214--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
214- 1	45.8	0.0	0.81	0.76	0.0
- 2	43.4	0.0	0.81	0.76	0.0
- 3	39.3	0.0	0.82	0.76	0.0
- 4	31.2	0.0	0.81	0.76	0.0
- 5	53.9	0.0	0.82	0.76	0.0
- 6	60.3	0.0	0.81	0.76	0.0
- 7	70.0	0.0	0.82	0.75	0.0
- 8	71.4	0.0	0.81	0.75	0.0
- 9	79.7	0.0	0.82	0.75	0.0
-10	71.3	0.0	0.82	0.80	0.0
-11	88.3	0.0	0.84	0.76	0.0
-12	47.1	0.10	0.70	0.78	0.17
-13	46.0	0.14	0.69	0.78	0.18

% BED EXPANSION FOR RUN 215

M80-21
-158

CATALYST : HDS-2A $L/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
215- 1	40.4	0.05	84.	110.
- 2	43.5	0.09	85.	113.
- 3	44.1	0.14	83.	108.
- 4	67.3	0.04	128.	220.
- 5	67.8	0.10	139.	248.
- 6	68.1	0.14	158.	295.

CALCULATED HOLDUPS, RUN 215: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
215- 1	40.4	0.05	0.23	0.58	0.64	0.08	11.3
- 2	43.5	0.09	0.23	0.54	0.59	0.13	19.4
- 3	44.1	0.14	0.24	0.52	0.59	0.15	29.3
- 4	67.3	0.04	0.15	0.64	0.71	0.09	7.7
- 5	67.8	0.10	0.14	0.59	0.64	0.16	17.1
- 6	68.1	0.14	0.12	0.63	0.69	0.13	31.6

CALCULATED HOLDUPS, RUN 215--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 71. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
215- 1	40.4	0.05	0.75	0.84	0.11
- 2	43.5	0.09	0.71	0.81	0.16
- 3	44.1	0.14	0.69	0.78	0.18
- 4	67.3	0.04	0.74	0.81	0.12
- 5	67.8	0.10	0.65	0.75	0.23
- 6	68.1	0.14	0.51	0.77	0.40

% BED EXPANSION FOR RUN 216

CATALYST : HDS-2A
GAS : HELIUM $\ell/d = 3$
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 73. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
216- 1	44.5	0.10	85.	57.
- 4	39.6	0.10	77.	43.
- 5	39.9	0.05	75.	39.
- 6	47.3	0.05	86.	59.
- 7	47.6	0.15	79.	46.
- 8	67.4	0.15	124.	130.
- 9	66.8	0.10	123.	128.
-10	38.1	0.20	82.	52.
-11	37.7	0.25	75.	39.
-12	46.0	0.25	84.	56.
-13	46.2	0.20	92.	70.
-14	67.9	0.20	131.	143.
-15	69.5	0.25	127.	135.
-16	39.8	0.15	71.	32.

CALCULATED HOLDUPS, RUN 216: DENSE PHASE

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CATALYST : HDS-2A
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 73. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
216- 1	44.5	0.10	0.31	0.47	0.56	0.13	20.7
- 4	39.6	0.10	0.34	0.46	0.53	0.12	21.7
- 5	39.9	0.05	0.35	0.45	0.52	0.11	8.5
- 6	47.3	0.05	0.31	0.50	0.57	0.10	9.1
- 7	47.6	0.15	0.33	0.44	0.53	0.15	31.0
- 8	67.4	0.15	0.21	0.54	0.64	0.15	30.1
- 9	66.8	0.10	0.22	0.58	0.66	0.10	21.1
-10	38.1	0.20	0.32	0.46	0.49	0.13	48.0
-11	37.7	0.25	0.35	0.42	0.45	0.15	58.6
-12	46.0	0.25	0.31	0.46	0.48	0.14	58.6
-13	46.2	0.20	0.29	0.51	0.52	0.11	48.9
-14	67.9	0.20	0.20	0.56	0.47	0.14	44.2
-15	69.5	0.25	0.21	0.53	0.72	0.16	53.7
-16	39.8	0.15	0.37	0.41	0.49	0.14	32.6

CALCULATED HOLDUPS, RUN 216--DILUTE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 73. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
216- 1	44.5	0.10	0.76	0.85	0.09
- 4	39.6	0.10	0.77	0.85	0.09
- 5	39.9	0.05	0.78	0.87	0.07
- 6	47.3	0.05	0.77	0.86	0.08
- 7	47.6	0.15	0.76	0.83	0.10
- 8	67.4	0.15	0.73	0.81	0.14
- 9	66.8	0.10	0.74	0.81	0.13
-10	38.1	0.20	0.75	0.83	0.11
-11	37.7	0.25	0.73	0.83	0.13
-12	46.0	0.25	0.74	0.82	0.12
-13	46.2	0.20	0.74	0.83	0.13
-14	67.9	0.20	0.73	0.93	0.13
-15	69.5	0.25	0.72	0.82	0.14
-16	39.8	0.15	0.74	0.84	0.12

% BED EXPANSION FOR RUN 217

CATALYST : NDS-2A $\ell/d=3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 73. DEG F

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Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
217- 1	44.2	0.05	93.	72.
- 2	46.0	0.10	91.	69.
- 3	44.2	0.14	88.	63.
- 4	67.3	0.05	131.	143.
- 5	68.4	0.10	138.	156.
- 6	67.9	0.15	127.	135.

CALCULATED HOLDUPS, RUN 217: DENSE PHASE

CATALYST : NDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 73. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
217- 1	44.2	0.05	0.28	0.52	0.54	0.10	8.4
- 2	46.0	0.10	0.29	0.48	0.51	0.14	19.3
- 3	44.2	0.14	0.30	0.48	0.51	0.13	31.1
- 4	67.3	0.05	0.20	0.61	0.66	0.08	8.0
- 5	68.4	0.10	0.19	0.55	0.59	0.16	16.4
- 6	67.9	0.15	0.21	0.53	0.56	0.16	27.2

CALCULATED HOLDUPS, RUN 217--DILUTE PHASE

CATALYST : NDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 15.5 VOL %
TEMPERATURE : 73. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
217- 1	44.2	0.05	0.75	0.83	0.11
- 2	46.0	0.10	0.74	0.82	0.12
- 3	44.2	0.14	0.72	0.80	0.15
- 4	67.3	0.05	0.75	0.84	0.12
- 5	68.4	0.10	0.69	0.78	0.18
- 6	67.9	0.15	0.71	0.81	0.16

CALCULATED HOLDUPS, RUN 300: DENSE PHASE

CATALYST : NONE $\ell/d=0$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 84. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Ft/Sec)
300- 1	22.4	0.05	0.0	0.95	0.98	0.05	13.7
- 2	22.3	0.10	0.0	0.88	0.92	0.12	25.2
- 3	22.3	0.15	0.0	0.86	0.89	0.14	37.0
- 4	22.4	0.20	0.0	0.82	0.88	0.18	47.0
- 5	22.4	0.25	0.0	0.79	0.87	0.21	56.8
- 6	44.9	0.05	0.0	0.92	0.96	0.08	11.5
- 7	44.6	0.10	0.0	0.84	0.85	0.16	20.7
- 8	44.9	0.15	0.0	0.79	0.87	0.21	29.7
- 9	44.5	0.20	0.0	0.70	0.73	0.30	33.7
-10	45.2	0.23	0.0	0.68	0.73	0.32	38.1
-11	66.6	0.05	0.0	0.91	0.93	0.09	9.4
-12	66.9	0.10	0.0	0.79	0.80	0.21	14.8
-13	67.3	0.15	0.0	0.73	0.74	0.27	21.4
-14	66.6	0.21	0.0	0.68	0.70	0.32	29.7
-15	66.7	0.25	0.0	0.67	0.69	0.33	36.7
-16	88.7	0.05	0.0	0.93	0.94	0.07	10.1
-17	88.9	0.11	0.0	0.84	0.84	0.16	18.9
-18	89.7	0.16	0.0	0.78	0.81	0.22	25.8
-19	89.8	0.23	0.0	0.73	0.74	0.27	33.8
-20	112.3	0.05	0.0	0.95	0.98	0.05	9.8

CALCULATED HOLDUPS, RUN 300--DILUTE PHASE

CATALYST : NONE
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 84. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL G	EL DP	E GB
300- 1	22.4	0.05	0.94	0.96	0.06
- 2	22.3	0.10	0.85	0.89	0.15
- 3	22.3	0.15	0.79	0.84	0.21
- 4	22.4	0.20	0.77	0.79	0.23
- 5	22.4	0.25	0.73	0.78	0.27
- 6	44.9	0.05	0.91	0.94	0.09
- 7	44.6	0.10	0.82	0.86	0.18
- 8	44.9	0.15	0.73	0.76	0.27
- 9	44.5	0.20	0.64	0.70	0.36
-10	45.2	0.23	0.64	0.70	0.36
-11	66.6	0.05	0.89	0.95	0.11
-12	66.9	0.10	0.76	0.82	0.24
-13	67.3	0.15	0.71	0.77	0.29
-14	66.6	0.21	0.67	0.72	0.33
-15	66.7	0.25	0.64	0.70	0.36
-16	88.7	0.05	0.91	0.97	0.09
-17	88.9	0.11	0.82	0.88	0.18
-18	89.7	0.16	0.76	0.85	0.24
-19	89.8	0.23	0.70	0.77	0.30
-20	112.3	0.05	0.94	1.00	0.06

% BED EXPANSION FOR RUN 301

CATALYST : HDS-2A 2/d-6
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 74. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
301- 1	37.6	0.0	47.	7.
- 2	44.0	0.0	49.	11.
- 3	50.9	0.0	51.	16.
- 4	66.0	0.0	51.	16.
- 5	76.4	0.0	55.	25.
- 6	88.0	0.0	63.	43.
- 7	119.0	0.0	97.	121.
- 8	36.4	0.04	50.	22.
- 9	37.9	0.09	51.	24.
-10	40.4	0.14	51.	24.
-11	44.6	0.10	54.	32.
-12	44.2	0.14	55.	34.
-13	67.4	0.10	67.	63.
-14	66.6	0.15	71.	73.
-15	88.4	0.11	83.	102.
-16	88.3	0.16	93.	127.

CALCULATED HOLDUPS, RUN 301: DENSE PHASE

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CATALYST : MDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 74. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
301- 1	37.6	0.0	0.42	0.59	0.74	0.0	0.0
- 2	44.0	0.0	0.41	0.59	0.72	0.0	0.0
- 3	58.9	0.0	0.39	0.60	0.72	0.0	0.0
- 4	66.0	0.0	0.39	0.61	0.72	0.0	0.0
- 5	76.4	0.0	0.36	0.63	0.71	0.0	0.0
- 6	88.0	0.0	0.32	0.67	0.70	0.0	0.0
- 7	119.0	0.0	0.21	0.79	0.78	0.0	0.0
- 8	38.4	0.04	0.37	0.57	0.46	0.06	8.9
- 9	37.9	0.09	0.36	0.59	0.41	0.04	25.3
-10	40.4	0.14	0.36	0.56	0.38	0.08	34.4
-11	44.6	0.10	0.34	0.65	0.45	0.01	28.7
-12	44.2	0.14	0.34	0.65	0.42	0.01	40.8
-13	67.4	0.10	0.28	0.60	0.58	0.13	19.4
-14	66.6	0.15	0.26	0.54	0.55	0.20	23.4
-15	88.4	0.11	0.22	0.65	0.67	0.12	20.2
-16	88.3	0.16	0.20	0.63	0.65	0.17	27.6

CALCULATED HOLDUPS, RUN 301--DILUTE PHASE

CATALYST : MDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 74. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
301- 1	37.6	0.0	0.97	0.97	0.0
- 2	44.0	0.0	0.99	0.96	0.0
- 3	58.9	0.0	0.97	0.96	0.0
- 4	66.0	0.0	0.98	0.96	0.0
- 5	76.4	0.0	0.97	0.96	0.0
- 6	88.0	0.0	0.98	0.96	0.0
- 7	119.0	0.0	0.98	0.96	0.0
- 8	38.4	0.04	0.87	0.93	0.13
- 9	37.9	0.09	0.76	0.81	0.24
-10	40.4	0.14	0.70	0.76	0.30
-11	44.6	0.10	0.74	0.80	0.26
-12	44.2	0.14	0.67	0.72	0.33
-13	67.4	0.10	0.75	0.80	0.25
-14	66.6	0.15	0.71	0.76	0.29
-15	88.4	0.11	0.81	0.86	0.19
-16	88.3	0.16	0.76	0.81	0.24

% BED EXPANSION FOR RUN 310

CATALYST : HDS-2A $l/d = 3$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
310- 1	40.0	0.0	44.	19.
- 2	44.6	0.0	45.	22.
- 3	37.2	0.14	51.	38.
- 4	88.5	0.0	71.	92.
- 5	114.1	0.0	91.	146.
- 6	128.2	0.0	115.	211.
- 7	38.4	0.04	47.	27.
- 8	38.8	0.09	50.	35.
- 9	43.8	0.04	44.	19.
-10	44.7	0.10	57.	54.
-11	44.0	0.05	63.	70.
-12	44.1	0.10	70.	89.
-13	44.8	0.0	59.	59.
-14	39.3	0.18	51.	38.
-15	38.5	0.21	49.	32.
-16	44.7	0.14	57.	54.
-17	44.5	0.19	55.	49.
-18	44.2	0.24	50.	35.
-19	67.0	0.15	70.	89.
-20	66.8	0.20	70.	89.

CALCULATED HOLDUPS, RUN 310: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELBB	ELDPB	EGB	Vcd (Mm/Sec)
310- 1	40.0	0.0	0.47	0.41	0.59	0.0	0.0
- 2	44.6	0.0	0.46	0.43	0.60	0.0	0.0
- 3	37.2	0.14	0.40	0.47	0.37	0.13	29.8
- 4	88.5	0.0	0.29	0.66	0.65	0.0	0.0
- 5	114.1	0.0	0.23	0.73	0.71	0.0	0.0
- 6	128.2	0.0	0.18	0.77	0.81	0.0	0.0
- 7	38.6	0.04	0.44	0.56	0.40	0.00	12.6
- 8	38.9	0.09	0.41	0.61	0.37	-0.02	30.0
- 9	43.8	0.04	0.47	0.54	0.32	-0.01	13.8
-10	44.7	0.10	0.36	0.56	0.44	0.08	22.5
-11	66.0	0.05	0.33	0.62	0.60	0.05	10.3
-12	66.1	0.10	0.29	0.55	0.51	0.15	16.3
-13	66.8	0.0	0.35	0.59	0.60	0.0	0.0
-14	39.3	0.18	0.40	0.45	0.35	0.15	40.4
-15	38.5	0.21	0.42	0.43	0.31	0.15	47.4
-16	44.7	0.14	0.36	0.48	0.48	0.16	27.2
-17	44.5	0.19	0.37	0.45	0.44	0.18	37.3
-18	44.2	0.24	0.41	0.41	0.36	0.18	48.3
-19	67.0	0.15	0.29	0.56	0.62	0.15	28.7
-20	66.8	0.20	0.29	0.49	0.49	0.22	32.1

CALCULATED HOLDUPS, RUN 310--DILUTE PHASE

CATALYST : NDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 72. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EBG
310- 1	40.0	0.0	0.98	0.97	0.0
- 2	44.6	0.0	0.98	0.97	0.0
- 3	37.2	0.14	0.74	0.78	0.26
- 4	88.5	0.0	0.98	0.96	0.0
- 5	114.1	0.0	0.98	0.96	0.0
- 6	128.2	0.0	0.98	0.98	0.0
- 7	38.6	0.04	0.88	0.93	0.12
- 8	38.8	0.09	0.77	0.82	0.23
- 9	43.8	0.04	0.88	0.91	0.12
-10	44.7	0.10	0.74	0.77	0.26
-11	66.0	0.05	0.84	0.88	0.16
-12	66.1	0.10	0.70	0.73	0.30
-13	66.8	0.0	0.98	0.96	0.0
-14	39.3	0.18	0.72	0.76	0.28
-15	38.5	0.21	0.70	0.76	0.30
-16	44.7	0.14	0.71	0.77	0.29
-17	44.5	0.19	0.69	0.76	0.31
-18	44.2	0.24	0.67	0.75	0.33
-19	67.0	0.15	0.70	0.82	0.30
-20	66.8	0.20	0.66	0.72	0.34

% BED EXPANSION FOR RUN 311

CATALYST : HDS-2A $\ell/d = 3$
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 77. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
311- 1	37.6	0.20	50.	33.
- 2	44.7	0.20	55.	49.
- 3	67.5	0.20	64.	73.
- 4	90.2	0.20	81.	119.
- 5	37.9	0.25	48.	30.
- 6	44.5	0.25	56.	51.
- 7	64.1	0.25	70.	89.
- 8	37.4	0.15	50.	35.
- 9	44.7	0.15	54.	46.
-10	67.0	0.15	65.	76.
-11	88.5	0.15	80.	116.
-12	37.9	0.05	47.	27.
-13	38.1	0.10	46.	24.
-14	44.8	0.10	51.	38.
-15	44.3	0.05	46.	24.
-16	67.9	0.05	59.	59.
-17	67.5	0.10	63.	70.
-18	89.9	0.10	76.	105.
-19	88.5	0.05	71.	92.

CALCULATED HOLDUPS, RUN 311: DENSE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 77. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
311- 1	37.6	0.20	0.41	0.54	0.39	0.05	55.3
- 2	44.7	0.20	0.37	0.55	0.46	0.08	52.1
- 3	67.5	0.20	0.32	0.56	0.54	0.12	45.4
- 4	90.2	0.20	0.25	0.66	0.68	0.09	48.0
- 5	37.9	0.25	0.43	0.56	0.36	0.02	74.2
- 6	44.5	0.25	0.37	0.51	0.47	0.13	60.2
- 7	64.1	0.25	0.29	0.55	0.56	0.16	53.2
- 8	37.4	0.15	0.41	0.57	0.41	0.02	44.2
- 9	44.7	0.15	0.38	0.51	0.46	0.11	35.3
-10	67.0	0.15	0.32	0.57	0.55	0.12	31.9
-11	88.5	0.15	0.26	0.62	0.62	0.12	30.2
-12	37.9	0.05	0.44	0.57	0.45	-0.01	15.6
-13	38.1	0.10	0.45	0.52	0.39	0.03	28.0
-14	44.8	0.10	0.40	0.59	0.47	0.01	29.6
-15	44.3	0.05	0.45	0.54	0.44	0.01	14.4
-16	67.9	0.05	0.35	0.65	0.66	0.00	15.0
-17	67.5	0.10	0.33	0.63	0.67	0.04	26.4
-18	89.9	0.10	0.27	0.68	0.72	0.05	24.8
-19	88.5	0.05	0.29	0.70	0.73	0.01	14.3

CALCULATED HOLDUPS, RUN 311--DILUTE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 77. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGB
311- 1	37.6	0.20	0.80	0.87	0.20
- 2	44.7	0.20	0.77	0.84	0.23
- 3	67.5	0.20	0.76	0.83	0.24
- 4	90.2	0.20	0.79	0.86	0.21
- 5	37.9	0.25	0.76	0.84	0.24
- 6	44.5	0.25	0.75	0.82	0.25
- 7	64.1	0.25	0.71	0.78	0.29
- 8	37.4	0.15	0.80	0.87	0.20
- 9	44.7	0.15	0.78	0.84	0.22
-10	67.0	0.15	0.77	0.83	0.23
-11	88.5	0.15	0.77	0.84	0.23
-12	37.9	0.05	0.91	0.97	0.09
-13	38.1	0.10	0.86	0.92	0.14
-14	44.8	0.10	0.85	0.91	0.15
-15	44.3	0.05	0.91	0.97	0.09
-16	67.9	0.05	0.92	0.98	0.08
-17	67.5	0.10	0.85	0.92	0.15
-18	89.9	0.10	0.86	0.93	0.14
-19	88.5	0.05	0.92	0.98	0.08

% BED EXPANSION FOR RUN 320

CATALYST : HDS-2A $\ell/d = 2$
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 75. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
320- 1	38.2	0.0	63.	37.
- 2	47.0	0.0	65.	41.
- 3	69.1	0.0	86.	87.
- 4	89.7	0.0	106.	141.
- 5	109.3	0.0	141.	207.
- 6	38.1	0.20	67.	46.
- 7	44.9	0.20	71.	54.
- 8	67.3	0.20	94.	104.
- 9	89.0	0.20	124.	170.
-10	89.1	0.25	126.	174.
-11	67.1	0.25	101.	120.
-12	44.6	0.25	70.	52.
-13	38.1	0.25	66.	44.
-14	38.2	0.05	62.	38.
-15	38.3	0.10	66.	47.
-16	38.2	0.15	66.	47.
-17	43.0	0.05	65.	44.
-18	44.6	0.10	71.	58.
-19	42.9	0.15	75.	67.
-20	68.0	0.05	92.	104.
-21	66.2	0.10	95.	111.
-22	66.7	0.15	96.	113.
-23	89.7	0.05	111.	152.
-24	88.5	0.10	114.	153.
-25	89.1	0.15	121.	169.

CALCULATED HOLDUPS, RUN 320: DENSE PHASE

CATALYST : NDS-2A
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 75. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
320- 1	38.2	0.0	0.36	0.66	1.84	0.0	0.0
- 2	47.0	0.0	0.35	0.68	1.84	0.0	0.0
- 3	69.1	0.0	0.26	0.77	1.84	0.0	0.0
- 4	89.7	0.0	0.20	0.81	0.81	0.0	0.0
- 5	109.3	0.0	0.16	0.86	1.84	0.0	0.0
- 6	38.1	0.20	0.34	0.49	0.39	0.17	43.2
- 7	44.9	0.20	0.32	0.50	0.40	0.18	40.6
- 8	67.3	0.20	0.24	0.59	0.50	0.17	40.0
- 9	89.0	0.20	0.18	0.67	0.58	0.15	40.8
-10	89.1	0.25	0.18	0.64	0.53	0.18	48.0
-11	67.1	0.25	0.22	0.55	0.47	0.23	44.4
-12	44.6	0.25	0.32	0.47	0.38	0.21	49.7
-13	38.1	0.25	0.34	0.48	0.39	0.18	54.9
-14	38.2	0.05	0.36	0.57	0.55	0.08	10.8
-15	38.3	0.10	0.33	0.56	0.53	0.11	22.9
-16	38.2	0.15	0.33	0.50	0.46	0.17	30.6
-17	43.0	0.05	0.34	0.57	0.53	0.09	9.7
-18	44.6	0.10	0.31	0.55	0.52	0.14	19.7
-19	42.9	0.15	0.29	0.54	0.49	0.16	31.1
-20	68.0	0.05	0.24	0.68	0.65	0.08	8.6
-21	66.2	0.10	0.23	0.63	0.59	0.14	17.3
-22	66.7	0.15	0.23	0.60	0.56	0.17	27.1
-23	89.7	0.05	0.19	0.77	0.75	0.04	11.8
-24	88.5	0.10	0.19	0.72	0.71	0.09	21.3
-25	89.1	0.15	0.18	0.70	0.68	0.11	31.8

CALCULATED HOLDUPS, RUN 320--DILUTE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 75. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EGG
320- 1	38.2	0.0	0.98	1.84	0.0
- 2	47.0	0.0	0.98	1.84	0.0
- 3	69.1	0.0	0.98	1.84	0.0
- 4	89.7	0.0	0.98	1.00	0.0
- 5	109.3	0.0	0.97	1.84	0.0
- 6	38.1	0.20	0.83	0.85	0.17
- 7	44.9	0.20	0.82	0.84	0.18
- 8	67.3	0.20	0.79	0.84	0.21
- 9	89.0	0.20	0.82	0.86	0.18
-10	89.1	0.25	0.76	0.82	0.24
-11	67.1	0.25	0.73	0.78	0.27
-12	44.6	0.25	0.76	0.83	0.24
-13	38.1	0.25	0.78	0.85	0.22
-14	38.2	0.05	0.94	0.94	0.06
-15	38.3	0.10	0.88	0.89	0.12
-16	38.2	0.15	0.83	0.84	0.17
-17	43.0	0.05	0.92	0.93	0.08
-18	44.6	0.10	0.86	0.87	0.14
-19	42.9	0.15	0.80	0.81	0.20
-20	68.0	0.05	0.90	0.92	0.10
-21	66.2	0.10	0.82	0.83	0.18
-22	66.7	0.15	0.78	0.81	0.22
-23	89.7	0.05	0.95	0.96	0.05
-24	88.5	0.10	0.89	0.92	0.11
-25	89.1	0.15	0.84	0.87	0.16

% BED EXPANSION FOR RUN 321

CATALYST : HDS-2A $\ell/d = 2$
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 77. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
321- 1	36.9	0.04	66.	47.
- 2	39.4	0.09	71.	58.
- 3	42.9	0.05	70.	56.
- 4	43.2	0.10	76.	69.
- 5	67.6	0.05	91.	102.
- 6	38.4	0.14	66.	47.
- 7	38.1	0.19	67.	49.
- 8	38.9	0.24	66.	47.
- 9	44.7	0.14	76.	69.
-10	45.0	0.20	72.	60.
-11	44.4	0.26	71.	58.
-12	67.0	0.16	98.	118.
-13	67.5	0.11	91.	102.
-14	67.0	0.21	107.	138.
-15	67.3	0.27	109.	142.
-16	88.4	0.06	111.	147.
-17	88.5	0.12	123.	173.

CALCULATED HOLDUPS, RUN 321: DENSE PHASE

M80-21
-176

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 77. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELDB	ELDPB	EBD	Vcd (Ma/Sec)
321- 1	36.9	0.04	0.33	0.56	0.54	0.11	7.5
- 2	39.4	0.09	0.31	0.51	0.49	0.18	15.2
- 3	42.9	0.05	0.31	0.57	0.54	0.11	8.1
- 4	43.2	0.10	0.29	0.50	0.49	0.21	13.7
- 5	67.6	0.05	0.24	0.63	0.62	0.13	6.2
- 6	38.4	0.14	0.33	0.45	0.45	0.22	23.2
- 7	38.1	0.19	0.33	0.45	0.45	0.22	34.7
- 8	38.9	0.24	0.33	0.45	0.45	0.21	48.3
- 9	44.7	0.14	0.29	0.49	0.47	0.22	23.3
-10	45.0	0.20	0.31	0.45	0.44	0.24	32.5
-11	44.4	0.26	0.31	0.47	0.46	0.22	49.6
-12	67.0	0.16	0.22	0.54	0.59	0.23	22.3
-13	67.5	0.11	0.24	0.59	0.59	0.17	16.5
-14	67.0	0.21	0.21	0.54	0.52	0.25	33.0
-15	67.3	0.27	0.20	0.51	0.50	0.29	38.7
-16	88.4	0.06	0.20	0.73	0.74	0.07	10.1
-17	88.5	0.12	0.18	0.69	0.69	0.13	20.2

CALCULATED HOLDUPS, RUN 321--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : KEROSENE
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 77. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELD	ELDP	EBD
321- 1	36.9	0.04	0.87	0.91	0.13
- 2	39.4	0.09	0.77	0.81	0.23
- 3	42.9	0.05	0.87	0.89	0.13
- 4	43.2	0.10	0.76	0.79	0.24
- 5	67.6	0.05	0.84	0.88	0.16
- 6	38.4	0.14	0.76	0.80	0.24
- 7	38.1	0.19	0.75	0.72	0.25
- 8	38.9	0.24	0.71	0.75	0.29
- 9	44.7	0.14	0.73	0.76	0.27
-10	45.0	0.20	0.72	0.75	0.28
-11	44.4	0.26	0.70	0.74	0.30
-12	67.0	0.16	0.73	0.80	0.27
-13	67.5	0.11	0.79	0.83	0.21
-14	67.0	0.21	0.67	0.70	0.33
-15	67.3	0.27	0.62	0.66	0.38
-16	88.4	0.06	0.92	0.93	0.08
-17	88.5	0.12	0.82	0.85	0.18

% BED EXPANSION FOR RUN 400

CATALYST : NONE $\ell/d = 0$
GAS : NITROGEN
LIQUID : NIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 100. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
400- 1	36.1	0.05	0.	0.
- 2	38.9	0.10	0.	0.
- 3	38.2	0.15	0.	0.
- 4	37.9	0.20	0.	0.
- 5	42.5	0.05	0.	0.
- 6	42.5	0.10	0.	0.
- 7	44.5	0.15	0.	0.
- 8	45.3	0.21	0.	0.
- 9	45.5	0.24	0.	0.
-10	38.2	0.24	0.	0.
-11	67.0	0.06	0.	0.
-12	72.1	0.12	0.	0.
-13	67.3	0.17	0.	0.

CALCULATED HOLDUPS, RUN 400: DENSE PHASE

M80-21
-178

CATALYST : NONE
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 100. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
400- 1	36.1	0.05	0.0	0.92	0.95	0.08	11.7
- 2	38.9	0.10	0.0	0.90	0.95	0.10	24.2
- 3	38.2	0.15	0.0	0.90	0.93	0.10	37.2
- 4	37.9	0.20	0.0	0.87	0.92	0.13	48.9
- 5	42.5	0.05	0.0	0.93	0.95	0.07	11.8
- 6	42.5	0.10	0.0	0.90	0.93	0.10	23.8
- 7	44.5	0.15	0.0	0.88	0.92	0.12	37.9
- 8	45.3	0.21	0.0	0.86	0.91	0.14	51.7
- 9	45.5	0.24	0.0	0.86	0.91	0.14	60.0
-10	38.2	0.24	0.0	0.86	0.91	0.14	58.6
-11	67.0	0.06	0.0	0.93	0.97	0.07	12.5
-12	72.1	0.12	0.0	0.87	0.92	0.13	24.5
-13	67.3	0.17	0.0	0.85	0.89	0.15	36.5

CALCULATED HOLDUPS, RUN 400--DILUTE PHASE

CATALYST : NONE
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 100. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGD
400- 1	36.1	0.05	0.91	0.89	0.09
- 2	38.9	0.10	0.90	0.88	0.10
- 3	38.2	0.15	0.90	0.88	0.10
- 4	37.9	0.20	0.86	0.86	0.14
- 5	42.5	0.05	0.90	0.88	0.10
- 6	42.5	0.10	0.89	0.88	0.11
- 7	44.5	0.15	0.88	0.87	0.12
- 8	45.3	0.21	0.86	0.86	0.14
- 9	45.5	0.24	0.86	0.85	0.14
-10	38.2	0.24	0.85	0.86	0.15
-11	67.0	0.06	0.91	0.88	0.09
-12	72.1	0.12	0.86	0.84	0.14
-13	67.3	0.17	0.86	0.84	0.14

% BED EXPANSION FOR RUN 401

CATALYST : NONE $\ell/d = 0$
GAS : NITROGEN
LIQUID : NIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
401- 1	38.4	0.05	0.	0.
- 2	36.7	0.10	0.	0.
- 3	44.0	0.05	0.	0.
- 4	44.0	0.10	0.	0.
- 5	38.9	0.14	0.	0.
- 6	38.4	0.20	0.	0.
- 7	39.1	0.24	0.	0.
- 8	44.9	0.15	0.	0.
- 9	44.9	0.20	0.	0.
-10	44.7	0.25	0.	0.
-11	82.0	0.06	0.	0.
-12	78.4	0.11	0.	0.
-13	74.8	0.17	0.	0.

CALCULATED HOLDUPS, RUN 401: DENSE PHASE

M80-21
-180

CATALYST : NONE
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Ma/Sec)
401- 1	38.4	0.05	0.0	0.89	0.96	0.11	10.7
- 2	36.7	0.10	0.0	0.87	0.94	0.13	22.5
- 3	44.0	0.05	0.0	0.89	0.80	0.11	9.9
- 4	44.0	0.10	0.0	0.84	0.92	0.16	20.7
- 5	38.9	0.14	0.0	0.85	0.79	0.15	33.5
- 6	38.4	0.20	0.0	0.84	0.78	0.16	45.9
- 7	39.1	0.24	0.0	0.82	0.78	0.18	55.8
- 8	44.9	0.15	0.0	0.84	0.78	0.16	33.3
- 9	44.9	0.20	0.0	0.82	0.76	0.18	44.9
-10	44.7	0.25	0.0	0.81	0.75	0.19	55.5
-11	82.0	0.06	0.0	0.92	0.82	0.08	11.7
-12	78.4	0.11	0.0	0.83	0.73	0.17	20.3
-13	74.8	0.17	0.0	0.80	0.76	0.20	30.2

CALCULATED HOLDUPS, RUN 401--DILUTE PHASE

CATALYST : NONE
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
401- 1	38.4	0.05	0.88	0.85	0.12
- 2	36.7	0.10	0.87	0.84	0.13
- 3	44.0	0.05	0.86	0.81	0.14
- 4	44.0	0.10	0.84	0.82	0.16
- 5	38.9	0.14	0.85	0.81	0.15
- 6	38.4	0.20	0.82	0.82	0.18
- 7	39.1	0.24	0.81	0.80	0.19
- 8	44.9	0.15	0.85	0.82	0.15
- 9	44.9	0.20	0.81	0.79	0.19
-10	44.7	0.25	0.82	0.79	0.18
-11	82.0	0.06	0.90	0.86	0.10
-12	78.4	0.11	0.81	0.77	0.19
-13	74.8	0.17	0.79	0.75	0.21

% BED EXPANSION FOR RUN 410

CATALYST : NONE $\ell/d = 0$
GAS : HELIUM
LIQUID : NIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
410- 1	38.5	0.20	0.	0.
- 2	38.4	0.25	0.	0.
- 3	45.1	0.25	0.	0.
- 4	44.8	0.20	0.	0.
- 5	71.3	0.20	0.	0.
- 6	71.2	0.25	0.	0.
- 7	38.8	0.05	0.	0.
- 8	39.0	0.10	0.	0.
- 9	38.2	0.15	0.	0.
-10	43.5	0.15	0.	0.
-11	44.3	0.10	0.	0.
-12	44.4	0.05	0.	0.
-13	71.2	0.05	0.	0.
-14	71.2	0.10	0.	0.
-15	70.5	0.15	0.	0.
-16	90.0	0.05	0.	0.
-17	90.1	0.10	0.	0.

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CALCULATED HOLDUPS, RUN 410: DENSE PHASE

M80-21
-182

CATALYST : NONE
GAS : HELIUM
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
410- 1	38.5	0.20	0.0	0.89	0.85	0.11	51.0
- 2	38.4	0.25	0.0	0.87	0.83	0.13	62.4
- 3	45.1	0.25	0.0	0.86	0.82	0.14	61.2
- 4	44.8	0.20	0.0	0.87	0.82	0.13	49.2
- 5	71.3	0.20	0.0	0.86	0.79	0.14	45.6
- 6	71.2	0.25	0.0	0.83	0.78	0.17	54.9
- 7	38.8	0.05	0.0	0.95	0.89	0.05	13.3
- 8	39.0	0.10	0.0	0.91	0.85	0.09	25.5
- 9	38.2	0.15	0.0	0.99	0.83	0.10	38.3
-10	43.5	0.15	0.0	0.87	0.84	0.13	36.3
-11	44.3	0.10	0.0	0.89	0.83	0.11	24.8
-12	44.4	0.05	0.0	0.92	0.86	0.08	11.4
-13	71.2	0.05	0.0	0.94	0.87	0.06	11.1
-14	71.2	0.10	0.0	0.89	0.84	0.11	21.5
-15	70.5	0.15	0.0	0.86	0.81	0.14	32.6
-16	90.0	0.05	0.0	0.95	0.90	0.05	11.7
-17	90.1	0.10	0.0	0.91	0.84	0.09	21.9

CALCULATED HOLDUPS, RUN 410--DILUTE PHASE

CATALYST : NONE
GAS : HELIUM
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELD	ELDP	EGD
410- 1	38.5	0.20	0.88	0.84	0.12
- 2	38.4	0.25	0.88	0.84	0.12
- 3	45.1	0.25	0.86	0.83	0.14
- 4	44.8	0.20	0.86	0.83	0.14
- 5	71.3	0.20	0.81	0.79	0.19
- 6	71.2	0.25	0.82	0.80	0.18
- 7	38.8	0.05	0.94	0.91	0.06
- 8	39.0	0.10	0.88	0.85	0.12
- 9	38.2	0.15	0.85	0.84	0.15
-10	43.5	0.15	0.88	0.85	0.12
-11	44.3	0.10	0.88	0.84	0.12
-12	44.4	0.05	0.90	0.86	0.10
-13	71.2	0.05	0.91	0.88	0.09
-14	71.2	0.10	0.86	0.82	0.14
-15	70.5	0.15	0.83	0.79	0.17
-16	90.0	0.05	0.93	0.90	0.07
-17	90.1	0.10	0.86	0.84	0.14

% BED EXPANSION FOR RUN 420

CATALYST : HDS-2A $\ell/d = 2$
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 100. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
420- 1	22.0	0.0	46.	31.
- 2	39.4	0.0	71.	103.
- 3	41.3	0.0	87.	149.
- 4	11.5	0.0	39.	22.
- 5	9.3	0.0	36.	13.
- 6	53.3	0.0	108.	238.

CALCULATED HOLDUPS, RUN 420: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 100. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Rm/Sec)
420- 1	22.0	0.0	0.42	0.63	0.64	0.0	0.0
- 2	39.4	0.0	0.27	0.74	0.67	0.0	0.0
- 3	41.3	0.0	0.22	0.77	0.69	0.0	0.0
- 4	11.5	0.0	0.45	0.55	0.76	0.0	0.0
- 5	9.3	0.0	0.49	0.49	0.70	0.0	0.0
- 6	53.3	0.0	0.16	0.81	2.18	0.0	0.0

CALCULATED HOLDUPS, RUN 420--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 100. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGD
420- 1	22.0	0.0	0.98	1.05	0.0
- 2	39.4	0.0	0.99	1.05	0.0
- 3	41.3	0.0	0.99	1.05	0.0
- 4	11.5	0.0	1.00	1.04	0.0
- 5	9.3	0.0	1.00	1.05	0.0
- 6	53.3	0.0	0.99	0.05	0.0

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% BED EXPANSION FOR RUN 421

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CATALYST : NDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
421- 1	10.3	0.0	37.	16.
- 2	22.6	0.0	45.	41.
- 3	38.9	0.0	63.	97.
- 4	44.1	0.0	69.	116.
- 5	71.2	0.0	119.	272.
- 6	11.4	0.05	36.	13.

CALCULATED HOLDUPS, RUN 421: DENSE PHASE

CATALYST : NDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
421- 1	10.3	0.0	0.48	0.49	0.67	0.0	0.0
- 2	22.6	0.0	0.39	0.61	0.64	0.0	0.0
- 3	38.9	0.0	0.28	0.71	0.64	0.0	0.0
- 4	44.1	0.0	0.26	0.73	0.67	0.0	0.0
- 5	71.2	0.0	0.15	0.83	0.76	0.0	0.0
- 6	11.4	0.05	0.49	0.46	0.32	0.04	13.5

CALCULATED HOLDUPS, RUN 421--DILUTE PHASE

CATALYST : NDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 125. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
421- 1	10.3	0.0	0.99	1.06	0.0
- 2	22.6	0.0	0.98	1.06	0.0
- 3	38.9	0.0	0.99	1.05	0.0
- 4	44.1	0.0	0.99	1.05	0.0
- 5	71.2	0.0	0.96	1.05	0.0
- 6	11.4	0.05	0.93	0.99	0.07

% BED EXPANSION FOR RUN 422

CATALYST : HDS-2A $L/d = 3$
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
422- 1	13.3	0.0	37.	16.
- 2	23.9	0.0	41.	28.
- 3	37.6	0.0	51.	59.
- 4	44.5	0.0	56.	75.
- 5	66.6	0.0	85.	166.
- 6	87.2	0.0	136.	325.
- 7	38.1	0.05	57.	78.
- 8	38.1	0.10	55.	72.
- 9	37.4	0.15	56.	75.
-10	41.8	0.05	63.	97.
-11	44.3	0.10	65.	103.
-12	44.6	0.15	68.	113.
-13	44.8	0.20	70.	119.
-14	69.1	0.06	92.	188.
-15	69.1	0.11	96.	200.
-16	69.1	0.16	104.	225.
-17	38.7	0.20	60.	88.
-18	38.9	0.0	49.	58.
-19	45.2	0.0	56.	81.
-20	24.3	0.0	36.	16.
-21	67.7	0.0	76.	145.
-22	89.4	0.0	120.	287.

CALCULATED HOLDUPS, RUN 422: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
422- 1	13.3	0.0	0.48	0.51	0.69	0.0	0.0
- 2	23.9	0.0	0.43	0.58	0.68	0.0	0.0
- 3	37.6	0.0	0.35	0.68	0.71	0.0	0.0
- 4	44.5	0.0	0.32	0.70	0.78	0.0	0.0
- 5	66.6	0.0	0.21	0.80	0.87	0.0	0.0
- 6	87.2	0.0	0.13	0.88	0.96	0.0	0.0
- 7	38.1	0.05	0.31	0.60	0.50	0.09	10.5
- 8	38.1	0.10	0.32	0.52	0.44	0.15	19.9
- 9	37.4	0.15	0.32	0.53	0.44	0.16	31.1
-10	43.8	0.05	0.28	0.62	0.54	0.10	9.6
-11	44.3	0.10	0.27	0.58	0.50	0.15	20.4
-12	44.6	0.15	0.26	0.59	0.52	0.14	32.7
-13	44.8	0.20	0.25	0.61	0.54	0.14	48.0
-14	69.1	0.06	0.19	0.72	0.62	0.09	9.9
-15	69.1	0.11	0.18	0.65	0.56	0.16	19.0
-16	69.1	0.16	0.17	0.64	0.54	0.19	28.5
-17	38.7	0.20	0.29	0.57	0.47	0.13	47.6
-18	38.9	0.0	0.35	0.67	0.76	0.0	0.0
-19	45.2	0.0	0.31	0.71	0.76	0.0	0.0
-20	24.3	0.0	0.48	0.51	0.79	0.0	0.0
-21	67.7	0.0	0.23	0.79	0.83	0.0	0.0
-22	89.4	0.0	0.14	0.84	0.91	0.0	0.0

CALCULATED HOLDUPS, RUN 422--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EG0
422- 1	13.3	0.0	0.98	1.07	0.0
- 2	23.9	0.0	0.98	1.07	0.0
- 3	37.6	0.0	0.98	1.07	0.0
- 4	44.5	0.0	0.99	1.07	0.0
- 5	66.6	0.0	0.99	1.06	0.0
- 6	87.2	0.0	0.99	1.04	0.0
- 7	38.1	0.05	0.87	0.83	0.13
- 8	38.1	0.10	0.82	0.79	0.18
- 9	37.4	0.15	0.82	0.78	0.18
-10	43.8	0.05	0.86	0.82	0.14
-11	44.3	0.10	0.79	0.78	0.21
-12	44.6	0.15	0.79	0.78	0.21
-13	44.8	0.20	0.79	0.78	0.21
-14	69.1	0.06	0.86	0.83	0.14
-15	69.1	0.11	0.76	0.74	0.24
-16	69.1	0.16	0.71	0.69	0.29
-17	38.7	0.20	0.78	0.78	0.22
-18	38.9	0.0	0.98	1.07	0.0
-19	45.2	0.0	0.99	1.06	0.0
-20	24.3	0.0	0.99	1.07	0.0
-21	67.7	0.0	0.98	1.07	0.0
-22	89.4	0.0	0.98	1.07	0.0

% BED EXPANSION FOR RUN 423

CATALYST : HDS-2A $l/d = 3$
GAS : NITROGEN
LIQUID : SIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 175. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
423- 1	38.0	0.0	44.	38.
- 2	44.9	0.0	50.	56.
- 3	67.0	0.0	66.	106.
- 4	89.5	0.0	100.	213.
- 5	23.6	0.0	36.	13.
- 6	23.9	0.05	40.	25.
- 7	38.4	0.05	51.	59.
- 8	38.5	0.10	51.	59.
- 9	38.4	0.15	50.	56.
-10	38.4	0.20	52.	63.
-11	45.0	0.05	56.	75.
-12	44.9	0.10	56.	75.
-13	45.1	0.15	55.	72.
-14	45.4	0.20	57.	78.
-15	45.2	0.25	50.	56.
-16	67.3	0.05	72.	125.
-17	67.7	0.11	81.	153.
-18	67.3	0.16	80.	150.
-19	67.8	0.22	77.	141.
-20	67.1	0.26	75.	134.
-21	89.5	0.05	102.	219.
-22	89.0	0.11	114.	256.
-23	38.7	0.23	50.	56.

CALCULATED HOLDUPS, RUN 423: DENSE PHASE

CATALYST : NDS-2A
GAS : NITROGEN
LIQUID : NIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 175. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
423- 1	38.0	0.0	0.40	0.64	0.75	0.0	0.0
- 2	44.9	0.0	0.35	0.69	0.75	0.0	0.0
- 3	47.0	0.0	0.27	0.78	0.78	0.0	0.0
- 4	89.5	0.0	0.18	0.84	0.87	0.0	0.0
- 5	23.6	0.0	0.49	0.52	0.77	0.0	0.0
- 6	23.9	0.05	0.44	0.46	0.30	0.10	10.0
- 7	38.4	0.05	0.35	0.54	0.46	0.11	8.8
- 8	38.5	0.10	0.35	0.49	0.41	0.16	18.3
- 9	38.4	0.15	0.35	0.46	0.39	0.19	27.4
-10	38.4	0.20	0.34	0.47	0.42	0.19	40.4
-11	45.0	0.05	0.32	0.57	0.51	0.12	8.6
-12	44.9	0.10	0.32	0.50	0.44	0.19	16.0
-13	45.1	0.15	0.32	0.48	0.44	0.20	25.9
-14	45.4	0.20	0.31	0.51	0.45	0.18	40.6
-15	45.2	0.25	0.35	0.43	0.38	0.22	46.8
-16	67.3	0.05	0.25	0.65	0.62	0.11	7.3
-17	67.7	0.11	0.22	0.60	0.58	0.18	16.0
-18	67.3	0.16	0.22	0.54	0.51	0.23	22.6
-19	67.8	0.22	0.23	0.53	0.49	0.24	34.4
-20	67.1	0.26	0.24	0.53	0.49	0.23	45.3
-21	89.5	0.05	0.17	0.75	0.69	0.07	7.8
-22	89.0	0.11	0.16	0.69	0.64	0.15	17.6
-23	38.7	0.23	0.35	0.45	0.38	0.19	47.7

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CALCULATED HOLDUPS, RUN 423--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : NIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 175. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELB	ELDP	EGB
423- 1	38.0	0.0	0.98	1.08	0.0
- 2	44.9	0.0	0.97	1.08	0.0
- 3	67.0	0.0	0.97	1.07	0.0
- 4	89.5	0.0	0.98	1.07	0.0
- 5	23.6	0.0	0.98	1.07	0.0
- 6	23.9	0.05	0.88	0.85	0.12
- 7	38.4	0.05	0.85	0.82	0.15
- 8	38.5	0.10	0.79	0.77	0.21
- 9	38.4	0.15	0.78	0.76	0.22
-10	38.4	0.20	0.76	0.74	0.24
-11	45.0	0.05	0.85	0.81	0.15
-12	44.9	0.10	0.78	0.74	0.22
-13	45.1	0.15	0.76	0.74	0.24
-14	45.4	0.20	0.75	0.74	0.25
-15	45.2	0.25	0.73	0.73	0.27
-16	67.3	0.05	0.85	0.82	0.15
-17	67.7	0.11	0.75	0.73	0.25
-18	67.3	0.16	0.70	0.66	0.30
-19	67.8	0.22	0.71	0.69	0.29
-20	67.1	0.26	0.71	0.71	0.29
-21	89.5	0.05	0.88	0.85	0.12
-22	89.0	0.11	0.79	0.76	0.21
-23	38.7	0.23	0.74	0.74	0.26

% BED EXPANSION FOR RUN 424

CATALYST : HDS-2A $\ell/d = 3$
GAS : HELIUM
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 177. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
424- 1	38.2	0.20	51.	65.
- 2	38.3	0.25	52.	68.
- 3	45.0	0.25	56.	81.
- 4	45.0	0.20	57.	84.
- 5	66.9	0.20	79.	155.
- 6	67.4	0.25	81.	161.
- 7	87.8	0.25	116.	274.
- 8	88.1	0.20	117.	277.
- 9	38.4	0.05	49.	58.
-10	38.6	0.10	50.	61.
-11	38.0	0.15	51.	65.
-12	45.1	0.05	53.	71.
-13	45.2	0.10	55.	77.
-14	44.7	0.15	56.	81.
-15	66.4	0.05	70.	126.
-16	67.6	0.10	75.	142.
-17	66.9	0.15	78.	152.
-18	89.7	0.05	101.	226.
-19	89.4	0.10	108.	248.
-20	89.7	0.15	116.	274.

CALCULATED HOLDUPS, RUN 424: DENSE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 177. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELOD	ELDPD	EGD	Vcd (Mm/Sec)
424- 1	38.2	0.20	0.34	0.52	0.43	0.14	46.3
- 2	38.3	0.25	0.33	0.51	0.43	0.16	57.4
- 3	45.0	0.25	0.31	0.53	0.45	0.17	55.6
- 4	45.0	0.20	0.30	0.54	0.47	0.16	43.2
- 5	66.9	0.20	0.22	0.60	0.55	0.18	38.4
- 6	67.4	0.25	0.21	0.58	0.53	0.21	47.6
- 7	87.8	0.25	0.15	0.65	0.60	0.20	46.7
- 8	88.1	0.20	0.15	0.67	0.61	0.18	36.5
- 9	38.4	0.05	0.35	0.37	0.46	0.08	10.8
-10	38.6	0.10	0.34	0.54	0.43	0.11	22.1
-11	38.0	0.15	0.34	0.53	0.43	0.13	34.1
-12	45.1	0.05	0.32	0.61	0.52	0.07	10.9
-13	45.2	0.10	0.31	0.57	0.49	0.12	21.4
-14	44.7	0.15	0.31	0.54	0.47	0.15	31.6
-15	66.4	0.05	0.24	0.69	0.63	0.07	10.0
-16	67.6	0.10	0.23	0.65	0.60	0.12	19.3
-17	66.9	0.15	0.22	0.61	0.56	0.17	27.6
-18	89.7	0.05	0.17	0.76	0.71	0.07	9.1
-19	89.4	0.10	0.16	0.72	0.67	0.12	18.9
-20	89.7	0.15	0.15	0.67	0.63	0.18	24.3

CALCULATED HOLDUPS, RUN 424--DILUTE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : MIN-OIL
COAL CHAR CONC: 9.0 VOL %
TEMPERATURE : 177. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EG0
424- 1	38.2	0.20	0.80	0.78	0.20
- 2	38.3	0.25	0.81	0.78	0.19
- 3	45.0	0.25	0.78	0.76	0.22
- 4	45.0	0.20	0.79	0.76	0.21
- 5	66.9	0.20	0.76	0.72	0.24
- 6	67.4	0.25	0.73	0.70	0.27
- 7	87.8	0.25	0.73	0.70	0.27
- 8	88.1	0.20	0.75	0.72	0.25
- 9	38.4	0.05	0.90	0.86	0.10
-10	38.6	0.10	0.84	0.80	0.16
-11	38.0	0.15	0.83	0.79	0.17
-12	45.1	0.05	0.91	0.86	0.09
-13	45.2	0.10	0.84	0.80	0.16
-14	44.7	0.15	0.81	0.77	0.19
-15	66.4	0.05	0.91	0.87	0.09
-16	67.6	0.10	0.83	0.80	0.17
-17	66.9	0.15	0.78	0.74	0.22
-18	89.7	0.05	0.91	0.86	0.09
-19	89.4	0.10	0.83	0.79	0.17
-20	89.7	0.15	0.77	0.74	0.23

CALCULATED HOLDUPS, RUN 431: DENSE PHASE

% BED EXPANSION FOR RUN 425

CATALYST : HDS-2A $\ell/d = 3$
GAS : HELIUM
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
425- 1	38.4	0.05	54.	74.
- 2	38.4	0.10	55.	77.
- 3	39.0	0.15	56.	81.
- 4	45.4	0.05	57.	84.
- 5	45.4	0.10	63.	103.
- 6	44.6	0.15	61.	97.
- 7	67.3	0.05	81.	161.
- 8	66.8	0.10	91.	194.
- 9	67.4	0.15	91.	194.
-10	89.4	0.05	125.	303.
-11	89.5	0.10	129.	316.
-12	89.0	0.15	135.	336.
-13	39.7	0.20	51.	65.
-14	39.3	0.25	53.	71.
-15	45.9	0.25	53.	71.
-16	45.2	0.20	60.	94.
-17	67.7	0.20	91.	194.
-18	67.0	0.25	81.	161.

CALCULATED HOLDUPS, RUN 425: DENSE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
425- 1	38.4	0.05	0.32	0.61	0.52	0.07	11.3
- 2	38.4	0.10	0.31	0.59	0.50	0.10	23.4
- 3	39.0	0.15	0.31	0.58	0.50	0.12	35.8
- 4	45.4	0.05	0.30	0.63	0.55	0.07	10.7
- 5	45.4	0.10	0.27	0.62	0.56	0.11	22.5
- 6	44.6	0.15	0.28	0.59	0.53	0.13	33.8
- 7	67.3	0.05	0.21	0.71	0.65	0.08	9.6
- 8	66.8	0.10	0.19	0.68	0.63	0.13	19.0
- 9	67.4	0.15	0.19	0.67	0.61	0.14	30.9
-10	89.4	0.05	0.14	0.82	0.75	0.04	11.4
-11	89.5	0.10	0.13	0.76	0.69	0.10	20.1
-12	89.0	0.15	0.13	0.73	0.66	0.14	28.9
-13	39.7	0.20	0.34	0.54	0.45	0.12	48.2
-14	39.3	0.25	0.32	0.55	0.47	0.13	60.7
-15	45.9	0.25	0.32	0.53	0.45	0.14	58.1
-16	45.2	0.20	0.29	0.58	0.52	0.14	46.3
-17	67.7	0.20	0.19	0.66	0.64	0.16	42.2
-18	67.0	0.25	0.21	0.61	0.56	0.18	51.9

CALCULATED HOLDUPS, RUN 425--DILUTE PHASE

CATALYST : HDS-2A
GAS : HELIUM
LIQUID : NIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 150. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EG0
425- 1	38.4	0.05	0.91	0.87	0.09
- 2	38.4	0.10	0.86	0.83	0.14
- 3	39.0	0.15	0.85	0.83	0.15
- 4	45.4	0.05	0.90	0.86	0.10
- 5	45.4	0.10	0.84	0.81	0.16
- 6	44.6	0.15	0.84	0.81	0.16
- 7	67.3	0.05	0.89	0.85	0.11
- 8	66.8	0.10	0.81	0.78	0.19
- 9	67.4	0.15	0.80	0.76	0.20
-10	89.4	0.05	0.93	0.89	0.07
-11	89.5	0.10	0.86	0.84	0.14
-12	89.0	0.15	0.80	0.79	0.20
-13	39.7	0.20	0.84	0.81	0.16
-14	39.3	0.25	0.83	0.81	0.17
-15	45.9	0.25	0.83	0.80	0.17
-16	45.2	0.20	0.83	0.80	0.17
-17	67.7	0.20	0.78	0.74	0.22
-18	67.0	0.25	0.76	0.73	0.24

% BED EXPANSION FOR RUN 426

CATALYST : HDS-2A $\ell/d = 3$
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 154. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
426- 1	13.7	0.0	32.	3.
- 2	20.9	0.0	36.	16.
- 3	26.6	0.0	41.	32.
- 4	38.3	0.0	49.	63.
- 5	45.0	0.0	56.	87.
- 6	67.2	0.0	76.	153.
- 7	87.6	0.0	111.	270.
- 8	39.0	0.05	54.	80.
- 9	38.7	0.10	56.	87.
-10	38.7	0.15	54.	80.
-11	39.0	0.20	53.	77.
-12	44.8	0.05	60.	100.
-13	45.4	0.10	62.	107.
-14	44.7	0.15	61.	103.
-15	44.9	0.20	60.	100.
-16	67.4	0.05	82.	173.
-17	67.6	0.11	91.	203.
-18	67.4	0.16	92.	207.
-19	67.2	0.22	82.	173.

CALCULATED HOLDUPS, RUN 426: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 154. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELD2	ELDPB	EGB	Vcd (Mm/Sec)
426- 1	13.7	0.0	0.54	0.51	0.77	0.0	0.0
- 2	20.9	0.0	0.48	0.51	0.76	0.0	0.0
- 3	26.6	0.0	0.42	0.59	0.75	0.0	0.0
- 4	38.3	0.0	0.34	0.65	0.83	0.0	0.0
- 5	45.0	0.0	0.30	0.70	0.84	0.0	0.0
- 6	67.2	0.0	0.22	0.79	0.89	0.0	0.0
- 7	87.6	0.0	0.15	0.83	0.97	0.0	0.0
- 8	39.0	0.05	0.31	0.61	0.47	0.08	10.0
- 9	38.7	0.10	0.30	0.58	0.45	0.12	21.9
-10	38.7	0.15	0.31	0.57	0.44	0.12	34.0
-11	39.0	0.20	0.31	0.54	0.42	0.15	45.1
-12	44.8	0.05	0.28	0.63	0.52	0.09	9.7
-13	45.4	0.10	0.27	0.60	0.51	0.13	20.5
-14	44.7	0.15	0.27	0.59	0.50	0.14	32.0
-15	44.9	0.20	0.28	0.59	0.50	0.14	46.2
-16	67.4	0.05	0.20	0.71	0.63	0.09	9.2
-17	67.6	0.11	0.18	0.67	0.59	0.15	19.6
-18	67.4	0.16	0.18	0.62	0.55	0.20	27.1
-19	67.2	0.22	0.20	0.59	0.52	0.21	39.5

CALCULATED HOLDUPS, RUN 426--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 154. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EGB
426- 1	13.7	0.0	0.98	1.04	0.0
- 2	20.9	0.0	0.98	1.04	0.0
- 3	26.6	0.0	0.99	1.04	0.0
- 4	38.3	0.0	0.98	1.06	0.0
- 5	45.0	0.0	0.98	1.06	0.0
- 6	67.2	0.0	0.98	1.06	0.0
- 7	87.6	0.0	0.99	1.06	0.0
- 8	39.0	0.05	0.87	0.84	0.13
- 9	38.7	0.10	0.82	0.80	0.18
-10	38.7	0.15	0.81	0.79	0.19
-11	39.0	0.20	0.80	0.79	0.20
-12	44.8	0.05	0.86	0.83	0.14
-13	45.4	0.10	0.81	0.77	0.19
-14	44.7	0.15	0.81	0.78	0.19
-15	44.9	0.20	0.80	0.77	0.20
-16	67.4	0.05	0.87	0.83	0.13
-17	67.6	0.11	0.78	0.74	0.22
-18	67.4	0.16	0.73	0.70	0.27
-19	67.2	0.22	0.75	0.72	0.25

M80-21
-200

% BED EXPANSION FOR RUN 427

CATALYST : HDS-2A $l/d = 3$
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 99. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
427- 1	12.8	0.0	36.	20.
- 2	22.4	0.0	47.	57.
- 3	30.6	0.0	61.	103.
- 4	41.4	0.0	76.	153.
- 5	37.3	0.0	71.	137.
- 6	56.5	0.0	115.	283.
- 7	23.7	0.0	47.	57.
- 8	37.1	0.0	70.	133.
- 9	56.1	0.0	113.	277.

CALCULATED HOLDUPS, RUN 427: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 99. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
427- 1	12.8	0.0	0.46	0.50	0.84	0.0	0.0
- 2	22.4	0.0	0.35	0.59	0.82	0.0	0.0
- 3	30.6	0.0	0.27	0.70	0.82	0.0	0.0
- 4	41.4	0.0	0.22	0.76	0.86	0.0	0.0
- 5	37.3	0.0	0.23	0.73	0.85	0.0	0.0
- 6	56.5	0.0	0.14	0.82	0.92	0.0	0.0
- 7	23.7	0.0	0.35	0.61	0.74	0.0	0.0
- 8	37.1	0.0	0.24	0.74	0.76	0.0	0.0
- 9	56.1	0.0	0.15	0.81	0.84	0.0	0.0

CALCULATED HOLDUPS, RUN 427--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 99. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGD
427- 1	12.8	0.0	0.99	1.04	0.0
- 2	22.4	0.0	1.00	1.04	0.0
- 3	30.6	0.0	0.99	1.04	0.0
- 4	41.4	0.0	0.99	1.04	0.0
- 5	37.3	0.0	0.99	1.03	0.0
- 6	56.5	0.0	0.99	1.03	0.0
- 7	23.7	0.0	0.99	1.04	0.0
- 8	37.1	0.0	1.00	1.04	0.0
- 9	56.1	0.0	0.99	1.04	0.0

% BED EXPANSION FOR RUN 428

M80-21
-202

CATALYST : HDS-2A L/d = 3
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 127. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
428- 1	10.2	0.0	32.	7.
- 2	22.9	0.0	40.	33.
- 3	35.3	0.0	52.	73.
- 4	44.6	0.0	63.	110.
- 5	72.3	0.0	106.	253.
- 6	13.1	0.05	33.	10.

CALCULATED HOLDUPS, RUN 428: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 127. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELDD	ELDPD	EBD	Vcd (Mm/Sec)
428- 1	10.2	0.0	0.52	0.49	0.86	0.0	0.0
- 2	22.9	0.0	0.41	0.54	0.79	0.0	0.0
- 3	35.3	0.0	0.32	0.60	0.77	0.0	0.0
- 4	44.6	0.0	0.26	0.72	0.78	0.0	0.0
- 5	72.3	0.0	0.16	0.83	0.87	0.0	0.0
- 6	13.1	0.05	0.50	0.44	0.20	0.05	12.8

CALCULATED HOLDUPS, RUN 428--DILUTE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 127. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELD	ELDP	EBD
428- 1	10.2	0.0	0.99	1.05	0.0
- 2	22.9	0.0	0.98	1.05	0.0
- 3	35.3	0.0	0.99	1.05	0.0
- 4	44.6	0.0	0.99	1.05	0.0
- 5	72.3	0.0	0.99	1.05	0.0
- 6	13.1	0.05	0.93	0.89	0.07

% BED EXPANSION FOR RUN 429

M80-21
-203

CATALYST : HDS-2A $l/d = 3$
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 176. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
429- 1	45.7	0.0	50.	67.
- 2	45.8	0.06	55.	83.
- 3	44.9	0.10	57.	88.
- 4	45.0	0.15	55.	83.
- 5	45.1	0.20	54.	80.
- 6	44.0	0.26	54.	80.
- 7	67.8	0.0	69.	130.
- 8	66.9	0.05	72.	140.
- 9	68.1	0.10	81.	170.
-10	67.4	0.15	86.	187.
-11	67.3	0.22	84.	180.
-12	67.5	0.25	78.	160.

CALCULATED HOLDUPS, RUN 429: DENSE PHASE

CATALYST : HDS-2A
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 176. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
429- 1	45.7	0.0	0.33	0.67	0.83	0.0	0.0
- 2	45.8	0.06	0.30	0.60	0.49	0.10	12.9
- 3	44.9	0.10	0.29	0.54	0.45	0.17	18.0
- 4	45.0	0.15	0.30	0.51	0.43	0.19	27.9
- 5	45.1	0.20	0.31	0.51	0.42	0.18	41.3
- 6	44.0	0.26	0.31	0.50	0.42	0.19	55.2
- 7	67.8	0.0	0.24	0.77	0.85	0.0	0.0
- 8	66.9	0.05	0.23	0.67	0.61	0.10	7.9
- 9	68.1	0.10	0.20	0.64	0.56	0.16	15.9
-10	67.4	0.15	0.19	0.59	0.52	0.21	24.2
-11	67.3	0.22	0.20	0.55	0.49	0.25	34.0
-12	67.5	0.25	0.21	0.54	0.49	0.24	41.6

CALCULATED HOLDUPS, RUN 429--DILUTE PHASE

CATALYST : NDS-2A
GAS : NITROGEN
LIQUID : NIH-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 176. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	EL0	ELDP	EGG
429- 1	45.7	0.0	0.98	1.07	0.0
- 2	45.8	0.06	0.84	0.82	0.16
- 3	44.9	0.10	0.76	0.73	0.24
- 4	45.0	0.15	0.76	0.74	0.24
- 5	45.1	0.20	0.75	0.74	0.25
- 6	44.0	0.26	0.73	0.72	0.27
- 7	67.8	0.0	0.98	1.07	0.0
- 8	66.9	0.05	0.87	0.84	0.13
- 9	68.1	0.10	0.77	0.74	0.23
-10	67.4	0.15	0.71	0.68	0.29
-11	67.3	0.22	0.69	0.67	0.31
-12	67.5	0.25	0.71	0.69	0.29

CALCULATED HOLDUPS, RUN 430: DENSE PHASE

M80-21
-205

CATALYST : NONE C/W = C
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 170. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECD	ELGD	ELDPD	EGD	Vcd (Mm/Sec)
430- 1	45.3	0.10	0.0	0.80	0.74	0.20	18.5
- 2	38.3	0.10	0.0	0.82	0.76	0.18	20.1
- 3	66.5	0.10	0.0	0.80	0.72	0.20	15.3
- 4	66.9	0.05	0.0	0.89	0.81	0.11	8.6
- 5	45.4	0.05	0.0	0.88	0.81	0.12	9.6
- 6	38.6	0.05	0.0	0.88	0.82	0.12	10.3
- 7	38.3	0.15	0.0	0.79	0.73	0.21	30.8
- 8	45.4	0.15	0.0	0.79	0.72	0.21	29.4
- 9	66.6	0.16	0.0	0.74	0.67	0.26	23.8
-10	38.5	0.19	0.0	0.77	0.72	0.23	39.0
-11	45.0	0.20	0.0	0.76	0.71	0.24	37.9
-12	66.0	0.22	0.0	0.72	0.66	0.28	34.7
-13	66.5	0.25	0.0	0.71	0.65	0.29	40.4
-14	45.3	0.23	0.0	0.74	0.70	0.26	42.8
-15	38.5	0.23	0.0	0.75	0.71	0.25	46.7
-16	88.0	0.06	0.0	0.91	0.81	0.09	9.9
-17	88.0	0.12	0.0	0.81	0.73	0.19	17.7

CALCULATED HOLDUPS, RUN 430--DILUTE PHASE

CATALYST : NONE
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 170. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELD	ELDP	EGG
430- 1	45.3	0.10	0.77	0.75	0.23
- 2	38.3	0.10	0.80	0.77	0.20
- 3	66.5	0.10	0.77	0.74	0.23
- 4	66.9	0.05	0.87	0.84	0.13
- 5	45.4	0.05	0.86	0.83	0.14
- 6	38.6	0.05	0.86	0.84	0.14
- 7	38.3	0.15	0.76	0.74	0.24
- 8	45.4	0.15	0.75	0.73	0.25
- 9	66.6	0.16	0.72	0.69	0.28
-10	38.5	0.19	0.75	0.73	0.25
-11	45.0	0.20	0.74	0.73	0.26
-12	66.0	0.22	0.69	0.68	0.31
-13	66.5	0.25	0.70	0.68	0.30
-14	45.3	0.23	0.73	0.71	0.27
-15	38.5	0.23	0.73	0.72	0.27
-16	88.0	0.06	0.89	0.86	0.11
-17	88.0	0.12	0.81	0.77	0.19

M80-21
-206

% BED EXPANSION FOR RUN 431

CATALYST : NONE /d = C
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 149. DEG F

Run No.	Liquid Flow Rate, GPM/Ft2	Gas Flow Rate Ft/Sec	Catalyst Bed Height (In.)	% Bed Expansion
431- 1	38.9	0.05	0.	0.
- 2	39.0	0.10	0.	0.
- 3	38.9	0.14	0.	0.
- 4	39.2	0.20	0.	0.
- 5	45.3	0.05	0.	0.
- 6	45.0	0.10	0.	0.
- 7	45.3	0.15	0.	0.
- 8	45.7	0.20	0.	0.
- 9	45.0	0.24	0.	0.
-10	38.5	0.24	0.	0.
-11	67.5	0.05	0.	0.
-12	67.8	0.11	0.	0.
-13	67.6	0.16	0.	0.
-14	66.1	0.22	0.	0.
-15	69.3	0.25	0.	0.
-16	90.0	0.06	0.	0.

CALCULATED HOLDUPS, RUN 431: DENSE PHASE

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CATALYST : NONE
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 149. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ECB	ELGB	ELDPB	EGB	Vcd (Mm/Sec)
431- 1	38.9	0.05	0.0	0.89	0.86	0.11	9.7
- 2	39.0	0.10	0.0	0.85	0.81	0.15	20.8
- 3	38.9	0.14	0.0	0.82	0.80	0.18	31.2
- 4	39.2	0.20	0.0	0.79	0.78	0.21	41.5
- 5	45.3	0.05	0.0	0.89	0.86	0.11	10.2
- 6	45.0	0.10	0.0	0.82	0.80	0.18	18.1
- 7	45.3	0.15	0.0	0.80	0.79	0.20	30.4
- 8	45.7	0.20	0.0	0.78	0.77	0.22	41.6
- 9	45.0	0.24	0.0	0.77	0.76	0.23	48.6
-10	38.5	0.24	0.0	0.78	0.77	0.22	51.2
-11	67.5	0.05	0.0	0.89	0.86	0.11	9.7
-12	67.8	0.11	0.0	0.81	0.78	0.19	18.5
-13	67.6	0.16	0.0	0.77	0.74	0.23	27.3
-14	66.1	0.22	0.0	0.75	0.73	0.25	39.3
-15	69.3	0.25	0.0	0.74	0.72	0.26	44.1
-16	90.0	0.06	0.0	0.91	0.87	0.09	9.9

CALCULATED HOLDUPS, RUN 431--DILUTE PHASE

CATALYST : NONE
GAS : NITROGEN
LIQUID : MIN-OIL
COAL CHAR CONC: 0.0 VOL %
TEMPERATURE : 149. DEG F

Run No.	Liquid Flow Rate, Gpm/Ft2	Gas Flow Rate, Ft/Sec	ELG	ELDP	EGG
431- 1	38.9	0.05	0.88	0.89	0.12
- 2	39.0	0.10	0.82	0.84	0.18
- 3	38.9	0.14	0.79	0.83	0.21
- 4	39.2	0.20	0.78	0.81	0.22
- 5	45.3	0.05	0.86	0.87	0.14
- 6	45.0	0.10	0.79	0.81	0.21
- 7	45.3	0.15	0.78	0.79	0.22
- 8	45.7	0.20	0.77	0.79	0.23
- 9	45.0	0.24	0.77	0.77	0.23
-10	38.5	0.24	0.77	0.76	0.23
-11	67.5	0.05	0.87	0.84	0.13
-12	67.8	0.11	0.78	0.75	0.22
-13	67.6	0.16	0.75	0.72	0.25
-14	66.1	0.22	0.74	0.72	0.26
-15	69.3	0.25	0.73	0.73	0.27
-16	90.0	0.06	0.90	0.87	0.10

Figure B.1

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Effect of Operating conditions on Catalyst holdup

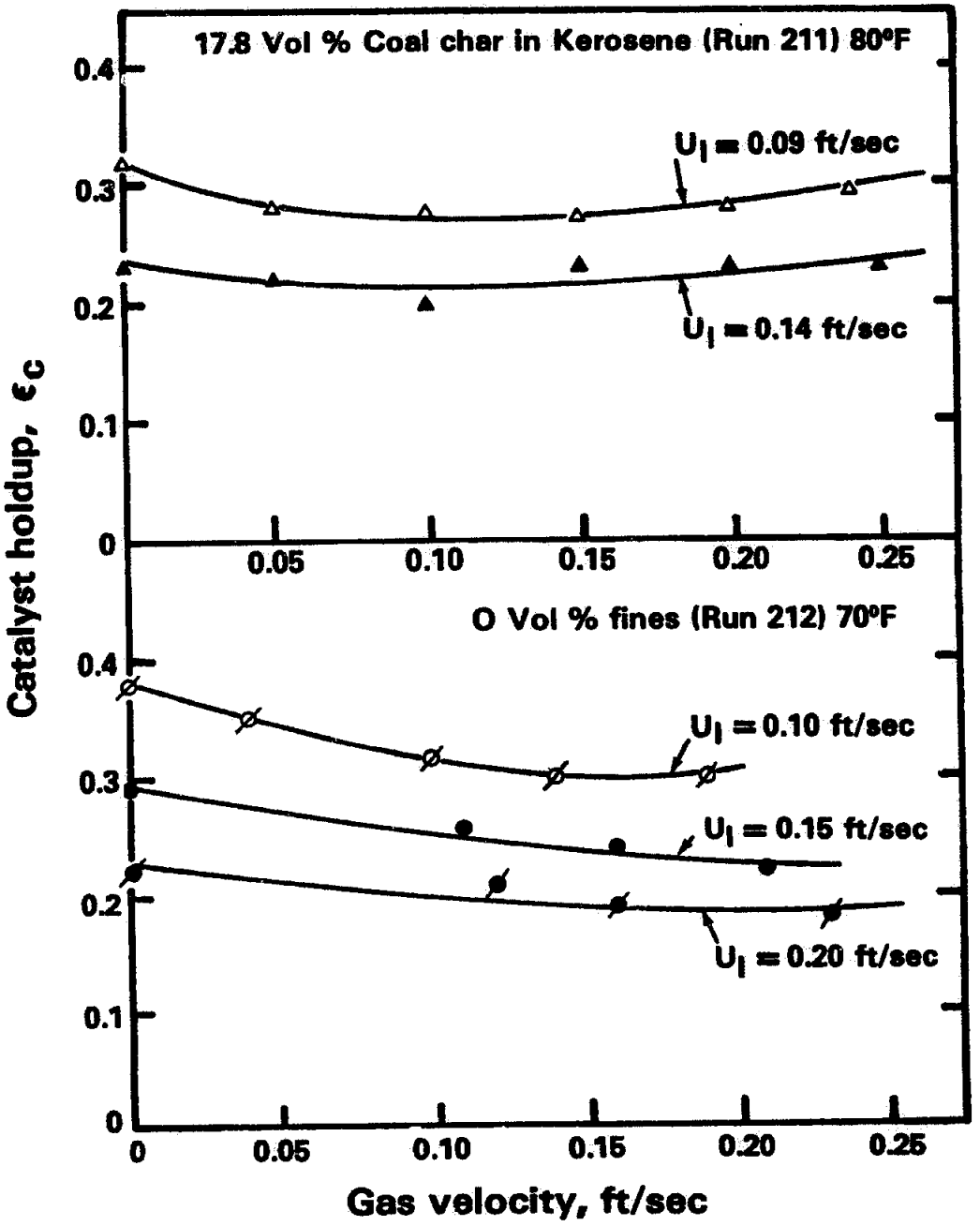

Figure B.2

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Effect of Temperature on Catalyst holdup

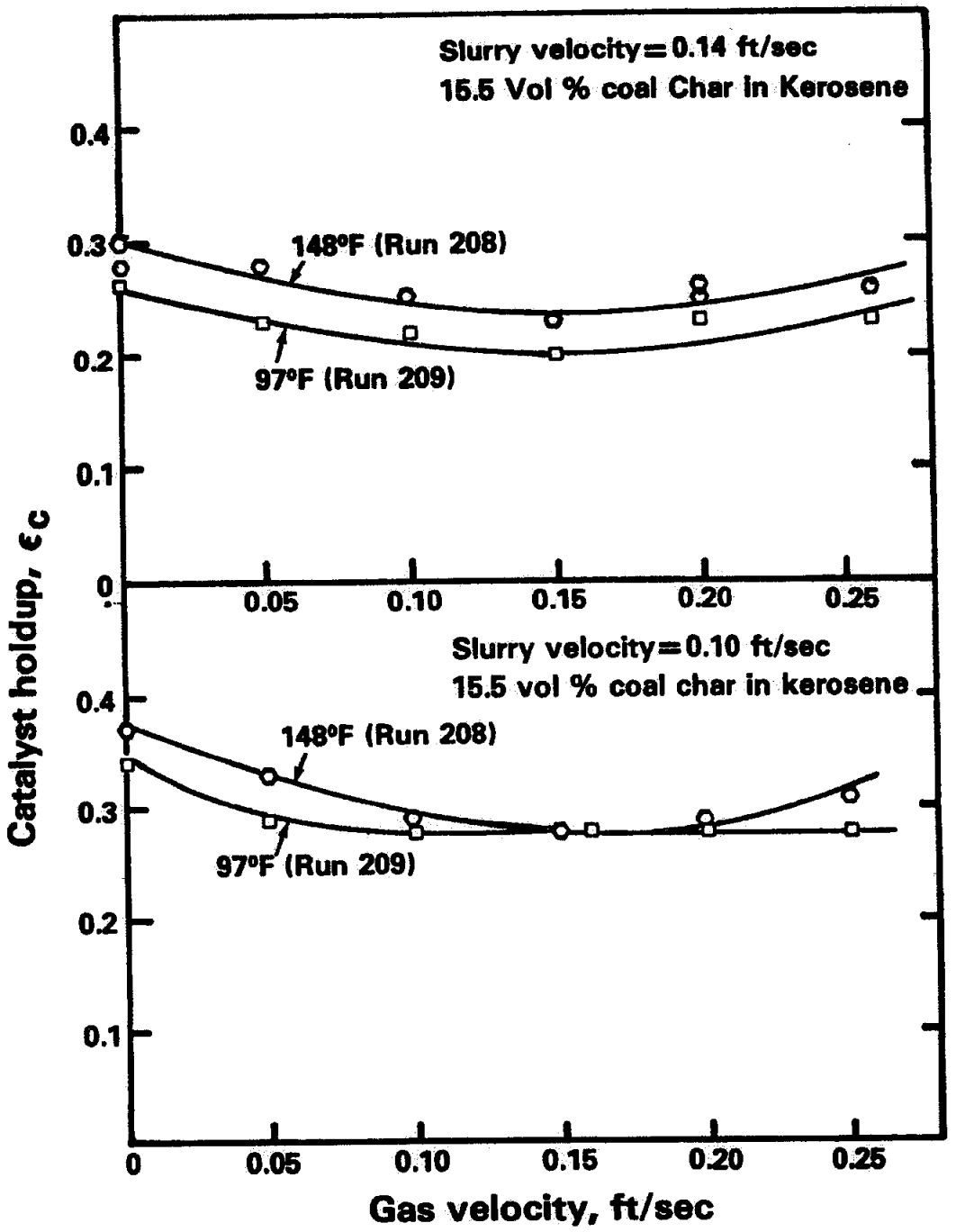

Figure B.3

Effect of Viscosity on Catalyst holdup

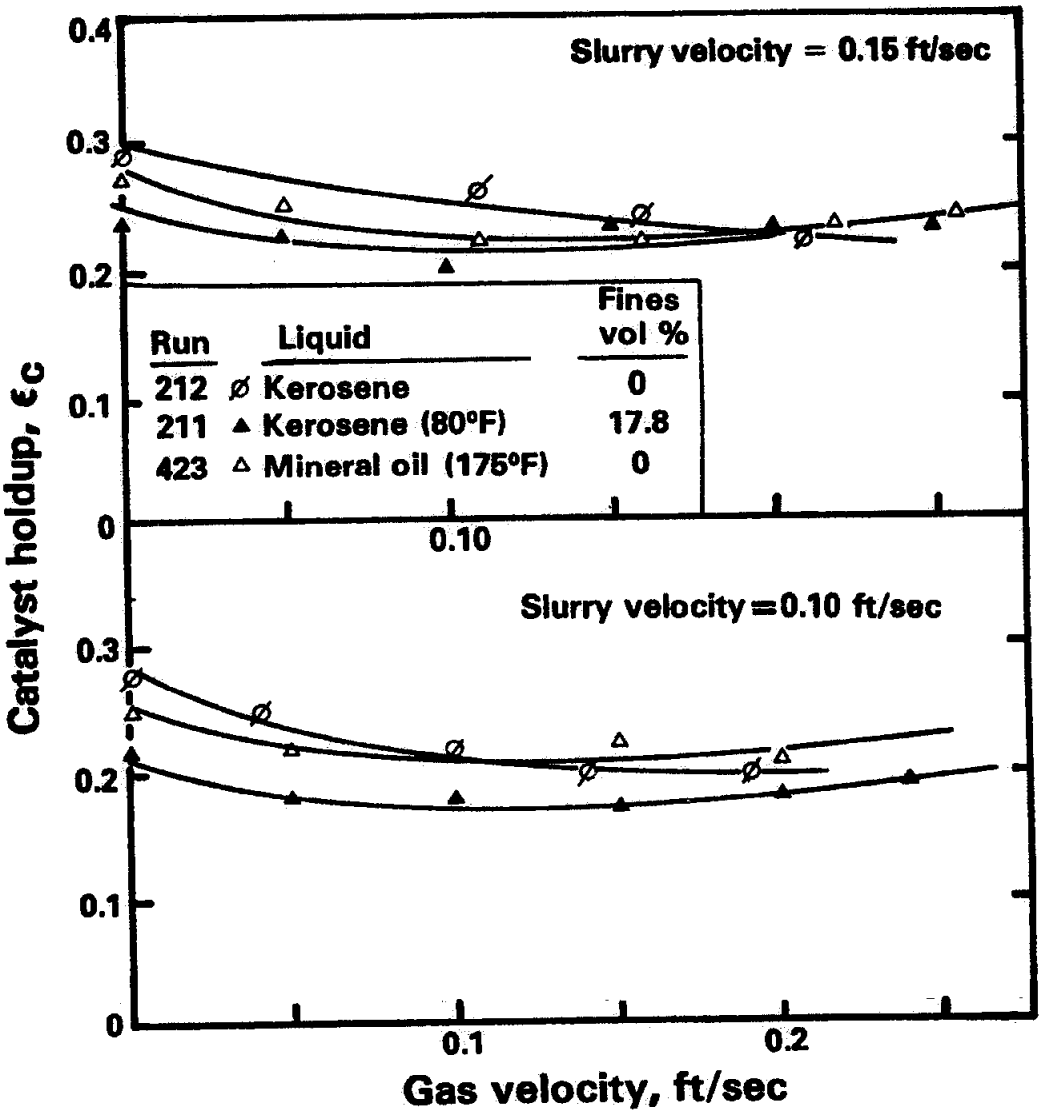

Figure B.4

Effect of Particle size on Catalyst holdup

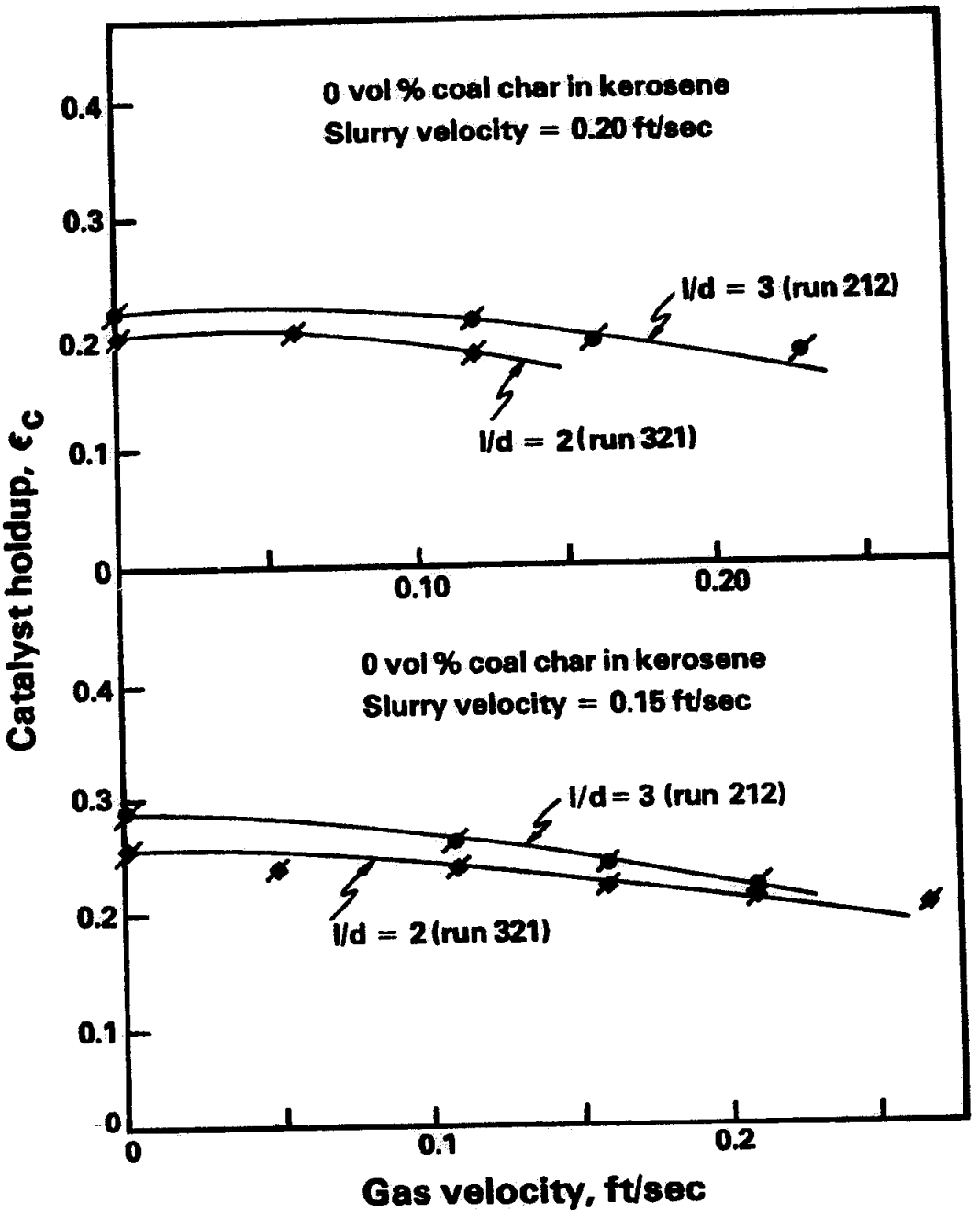

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Figure B.5

Effect of Gas type on Catalyst holdup

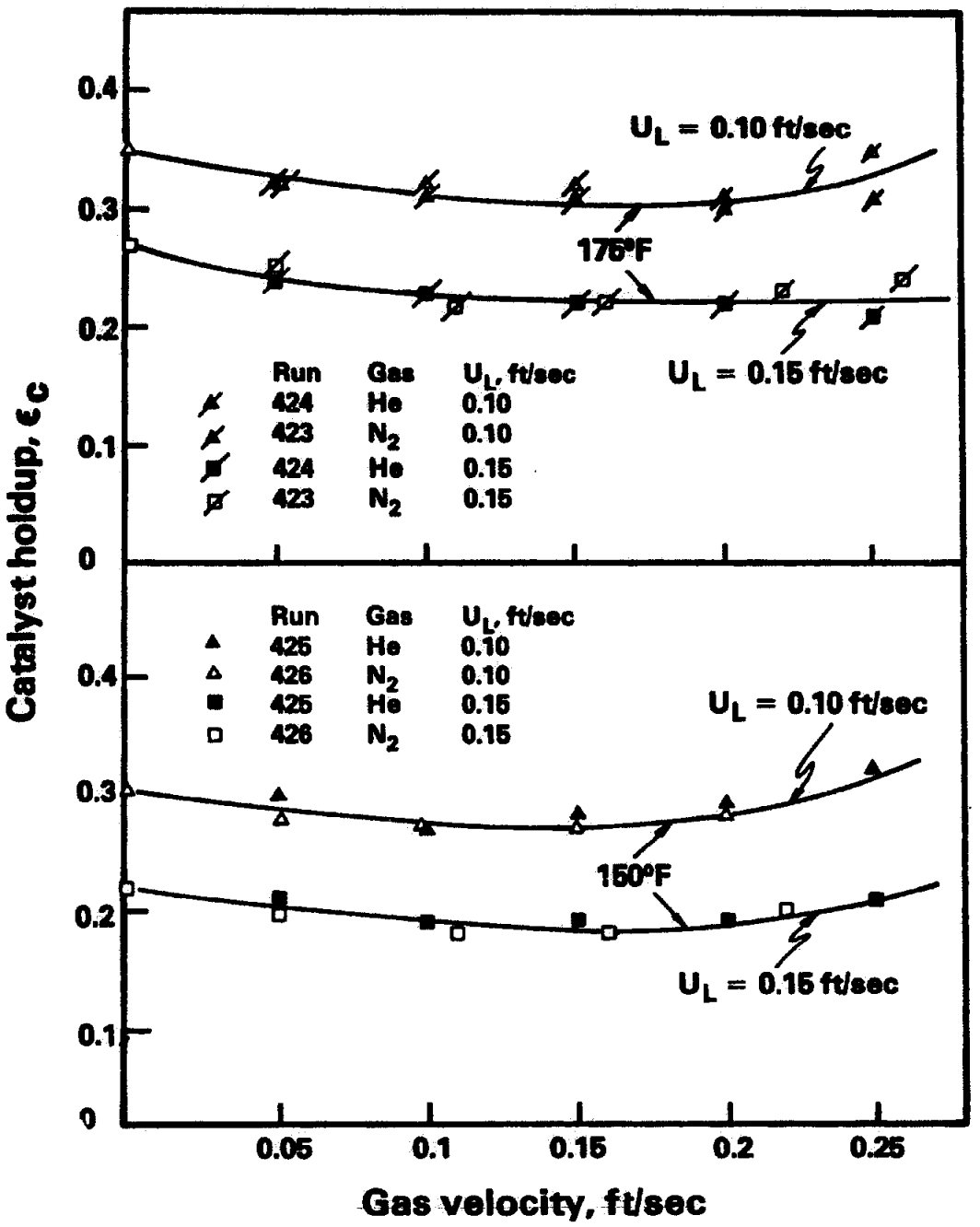

Figure B.6

Effect of Particle size on Gas holdup

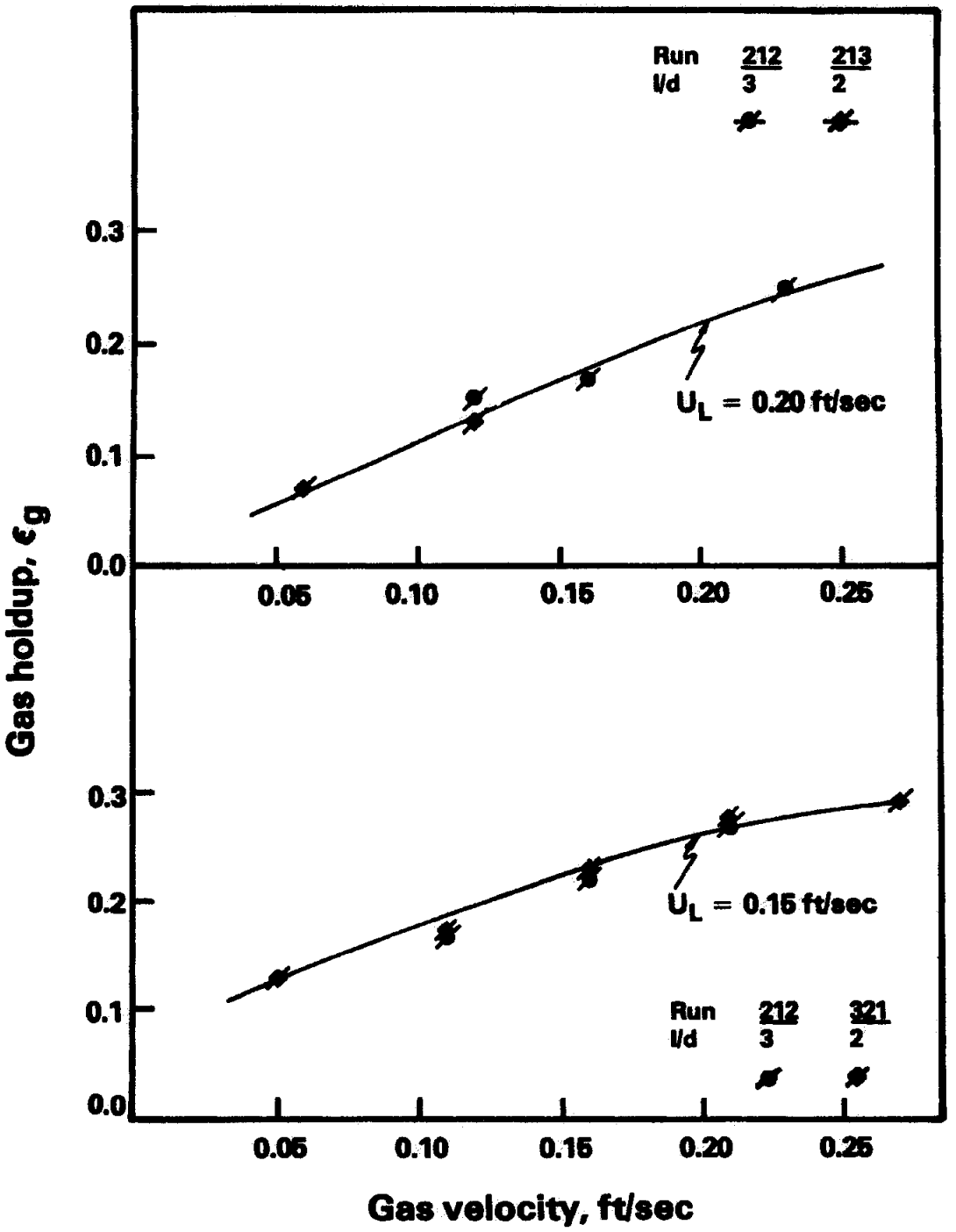

Figure B.7

Effect of Temperature on Gas holdup