

APPENDIX B

DETAILED DATA OBTAINED WITH DEVELOPMENTAL CATALYST SG-A-1

TABLE B1

CATALYST SG-A-1 WITH SYNTHESIS GAS CHARGE  
H<sub>2</sub>/CO/CO<sub>2</sub> OF 1/1/0

Run CT-143	57-2	57-1	57-4
Catalyst SG-	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub> /	1/1/0	1/1/0	1/1/0
Temp., Inlet, °F	599	600	617
Avg., °F	604	603	616
Max., °F	635	634	635
Outlet, °F	585	587	604
Pressure, PSIG	200	200	200
GHSV	5216	3905	2633
WHSV	2.9	2.2	1.5
Contact Time, sec.	5.5	7.3	10.8
Material Balance, %	103	95	98
CO Conv., % wt	86	96	98
to HC, % wt	59	58	57
H <sub>2</sub> Conv., % wt	58	72	74
to HC % wt	91	83	82
Total Conv., % wt	84	94	96
G HC/m <sup>3</sup> CO	270	321	317
HC Selectivity, % wt			
C <sub>1</sub>	19	17	19
C <sub>2</sub>	9	8	8
C <sub>3</sub>	12	6	6
C <sub>4</sub>	14	13	10
C <sub>5</sub>	12	13	11
C <sub>6</sub> <sup>+</sup>	34	43	46
Olefin Selectivity, % wt			
C <sub>2</sub>	38	36	12
C <sub>3</sub>	74	51	32
C <sub>4</sub>	75	79	60
C <sub>5</sub>	84	85	73
C <sub>5</sub> Olefin Selectivity, % wt			
1-pentene	5	3	3
2-pentene	36	25	19
Methylbutenes	59	72	78
C <sub>6</sub> <sup>+</sup> Aromatics, % wt	10	11	12
90% OH, °F	394	384	373

TABLE B2

EFFECT OF TEMPERATURE ON PERFORMANCE OF  
CATALYST SG-A-1 WHILE PROCESSING 2H<sub>2</sub>/CO AT 200 PSIG

Run CT-143	53-1	53-2	53-3	54-2	54-3
Catalyst SG-	A-1	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	2/1/0	2/1/0	2/1/0	2/1/0	2/1/0
Temp., Inlet °F	601	497	675	562	588
Avg °F	594	496	671	551	575
Max °F	637	503	704	577	600
Outlet °F	576	491	653	540	563
Pressure, PSIG	200	200	200	200	200
GHSV	3937	3937	3937	3910	3910
WHSV	1.5	1.5	1.5	1.5	1.5
Contact Time, sec.	7.3	7.3	7.3	7.3	7.3
Material Balance, %	103	102	102	101	101
CO Conv. % Wt	99	13	97	91	93
to HC % Wt	68	96	69	66	66
H <sub>2</sub> Conv. % Wt	56	14	62	50	52
to HC % Wt	71	79	74	77	77
Total Conv. % Wt	93	13	92	85	86
GHC/m <sup>3</sup> CO	394	55	402	348	362
HC Selectivity, % Wt					
C <sub>1</sub>	20	12	27	17	20
C <sub>2</sub>	8	7	6	9	9
C <sub>3</sub>	5	19	6	12	7
C <sub>4</sub>	11	15	12	13	11
C <sub>5</sub> <sup>+</sup>	13	6	9	11	12
C <sub>6</sub> <sup>+</sup>	43	41	40	38	41
Olefin Selectivity, % Wt					
C <sub>2</sub>	38	67	11	27	30
C <sub>3</sub>	42	63	37	63	35
C <sub>4</sub>	72	89	39	77	73
C <sub>5</sub>	80	81	44	78	79
C <sub>5</sub> Olefin Selectivity, % Wt					
1-pentene	3	5	3	5	3
2-pentene	18	60	20	42	21
Methylbutenes	79	35	77	53	76
C <sub>6</sub> <sup>+</sup> , Aromatics, % Wt	10	7	32	9	7
90% OH, °F	367	NA	367	394	365

TABLE B3

## EFFECT OF TEMPERATURE ON CATALYST PERFORMANCE

Run CT-158	89-1	89-2	89-3	89-4
Catalyst SG-	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	3/1/2	3/1/2	3/1/2	3/1/2
Temp., Inlet °F	607	496	661	598
Avg °F	609	496	663	600
Max °F	638	503	700	634
Outlet °F	594	490	641	581
Pressure, PSIG	400	400	400	400
GHSV	7414	7414	7414	7414
WHSV	6.0	6.0	6.0	6.0
Contact Time, sec.	6.7	7.4	6.3	6.7
Material Balance, %	99	98	97	96
CO Conv. % Wt	58	15	75	64
to HC % Wt	-	92	94	89
H <sub>2</sub> Conv. % Wt	42	8	48	36
to HC % Wt	55	43	53	51
Total Conv. % Wt	55	13	70	60
GHC/m <sup>3</sup> CO	367	62	404	322
HC Selectivity, % Wt				
C <sub>1</sub>	15	17	18	17
C <sub>2</sub>	5	17	6	7
C <sub>3</sub>	4	25	6	5
C <sub>4</sub>	18	17	19	17
C <sub>5</sub>	17	4	13	15
C <sub>6</sub> <sup>+</sup>	41	20	38	39
Olefin Selectivity, % Wt				
C <sub>2</sub>	50	50	33	40
C <sub>3</sub>	33	67	50	50
C <sub>4</sub>	55	50	41	56
C <sub>5</sub>	74	58	60	69
C <sub>5</sub> Olefin Selectivity, % Wt				
1-pentene	3	3	3	3
2-pentene	18	18	20	17
Methylbutenes	79	79	77	80
C <sub>6</sub> <sup>+</sup> , Aromatics, % Wt	15	-	27	11
90% OH, °F	363	305	365	349

TABLE B4

EFFECT OF PRESSURE AT CONSTANT SPACE VELOCITY FOR  
CATALYST SG-A-1 WITH 2/1 H<sub>2</sub>/CO

Run CT-143	51-2	55-2	51-3	51-4	51-5
Catalyst SG-	A-1	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	2/1/0	2/1/0	2/1/0	2/1/0	2/1/0
Temp., Inlet °F	598	590	632	610	618
Avg °F	575	576	636	611	613
Max °F	632	634	638	637	634
Outlet °F	558	556	627	589	627
Pressure, PSIG	400	400	50	200	100
GHSV	3575	5911	3575	3575	3575
WHSV	1.6	2.3	1.6	1.6	1.6
Contact Time, sec.	14.0	10.5	2.2	7.3	3.9
Material Balance, %	103	97	99	102	102
CO Conv. % Wt	97	82	10	99	93
to HC % Wt	71	74	95	72	64
H <sub>2</sub> Conv. % Wt	60	49	6	63	45
to HC % Wt	71	71	96	69	78
Total Conv. % Wt	91	78	10	93	86
GHC/m <sup>3</sup> CO	400	337	43	423	342
HC Selectivity, % Wt					
C <sub>1</sub>	18	17	59	20	21
C <sub>2</sub>	9	9	10	7	7
C <sub>3</sub>	7	9	13	5	6
C <sub>4</sub>	9	12	17	11	14
C <sub>5</sub>	9	11	<1	12	14
C <sub>6</sub> <sup>+</sup>	49	42	2	45	38
Olefin Selectivity, % Wt					
C <sub>2</sub>	33	24	67	23	31
C <sub>3</sub>	55	50	75	40	54
C <sub>4</sub>	67	69	80	57	62
C <sub>5</sub>	74	72	NA	69	72
C <sub>5</sub> Olefin Selectivity, % Wt					
1-pentene	4	5	NA	3	3
2-pentene	28	38	NA	19	19
Methylbutenes	68	57	NA	78	78
C <sub>6</sub> <sup>+</sup> , Aromatics, % Wt	13	10	NA	13	13
90% OH, °F	380	388	NA	402	376

TABLE B5

PRESSURE EFFECTS AT CONSTANT CONTACT TIME  
(VARYING SPACE VELOCITY)

Run CT-143	52-1	52-2	52-3	52-4
Catalyst SG-	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	2/1/0	2/1/0	2/1/0	2/1/0
Temp., Inlet °F	604	578	627	632
Avg °F	594	549	624	631
Max °F	634	631	633	635
Outlet °F	576	530	619	628
Pressure, PSIG	200	400	100	50
GHSV	3530	6630	1863	1075
WHSV	1.5	2.8	0.8	0.5
Contact Time, sec.	7.3	7.3	7.3	7.3
Material Balance, %	102	101	105	101
CO Conv. % Wt	99	72	92	42
to HC % Wt	68	77	65	82
H <sub>2</sub> Conv. % Wt	58	39	44	19
to HC % Wt	73	71	73	87
Total Conv. % Wt	93	60	85	38
GHC/m <sup>3</sup> CO	402	296	312	155
HC Selectivity, % Wt				
C <sub>1</sub>	20	21	25	43
C <sub>2</sub>	9	10	5	6
C <sub>3</sub>	5	13	6	4
C <sub>4</sub>	10	13	12	11
C <sub>5</sub>	13	10	11	5
C <sub>6</sub> <sup>+</sup>	43	33	41	31
Olefin Selectivity, % Wt				
C <sub>2</sub>	37	25	33	86
C <sub>3</sub>	37	64	61	80
C <sub>4</sub>	69	73	50	62
C <sub>5</sub>	80	75	59	70
C <sub>5</sub> Olefin Selectivity, % Wt				
1-pentene	3	7	2	2
2-pentene	18	56	20	20
Methylbutenes	79	37	77	78
C <sub>6</sub> <sup>+</sup> , Aromatics, % Wt	9	10	23	28
90% OH, °F	399	433	357	318

TABLE B6

## PRESSURE EFFECTS AT CONSTANT SPACE VELOCITY

Run CT-158	87-1	87-3	87-4	87-5
Catalyst SG-	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	3/1/2	3/1/2	3/1/2	3/1/2
Temp., Inlet °F	624	633	627	629
Avg °F	625	631	632	629
Max °F	636	633	638	634
Outlet °F	613	624	620	621
Pressure, PSIG	200	50	200	100
GHSV	6560	6593	6626	6571
WHSV	5.9	5.9	6.0	5.9
Contact Time, sec.	3.8	1.1	3.8	2.0
Material Balance, %	100	103	99	100
CO Conv. % Wt	74	1	78	16
to HC % Wt	99	-	98	89
H <sub>2</sub> Conv. % Wt	50	8	52	16
to HC % Wt	57	71	57	65
Total Conv. % Wt	69	2	73	16
GHC/m <sup>3</sup> CO	431	22	460	80
HC Selectivity, % Wt				
C <sub>1</sub>	16	50	17	39
C <sub>2</sub>	6	25	8	20
C <sub>3</sub>	7	25	6	13
C <sub>4</sub>	21	-	20	13
C <sub>5</sub>	16	-	16	3
C <sub>6</sub> <sup>+</sup>	34	-	33	12
Olefin Selectivity, % Wt				
C <sub>2</sub>	50	100	50	67
C <sub>3</sub>	67	100	60	100
C <sub>4</sub>	58	-	64	100
C <sub>5</sub>	77	-	76	86
C <sub>5</sub> Olefin Selectivity, % Wt				
1-pentene	3	-	3	2
2-pentene	18	-	18	18
Methylbutenes	79	-	79	80
C <sub>6</sub> <sup>+</sup> , Aromatics, % Wt	21	-	-	-
90% OH, °F	401	-	350	351

TABLE B7

EFFECT OF PRESSURE AT CONSTANT CONTACT TIME FOR  
FOR CATALYST SG-A-1 WITH 3/1/2 H<sub>2</sub>/CO/CO<sub>2</sub>

Run CT-	158-88-1	159-127-2	159-127-3	159-127-4	159-127-5
Catalyst SG-	A-1	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	3/1/2	3/1/2	3/1/2	3/1/2	3/1/2
Temp., Inlet °F	608	611	633	642	617
Avg °F	614	585	633	627	620
Max °F	639	634	636	644	627
Outlet °F	595	560	628	613	609
Pressure, PSIG	200	400	50	200	100
GHSV	6673	13158	1620	6658	3279
WHSV	6.0	11.7	1.4	5.9	2.9
Contact Time, sec.	3.8	3.8	4.7	3.8	4.1
Material Balance, %	100	100	102	105	97
CO Conv. % Wt	78	51	25	79	34
to HC % Wt	89	94	92	81	94
H <sub>2</sub> Conv. % Wt	51	31	18	44	20
to HC % Wt	60	56	59	63	53
Total Conv. % Wt	73	47	23	72	31
GHC/m <sup>3</sup> CO	389	279	120	365	179
HC Selectivity, % Wt					
C <sub>1</sub>	16	13	37	20	27
C <sub>2</sub>	7	8	16	10	11
C <sub>3</sub>	4	4	16	7	11
C <sub>4</sub>	20	19	16	21	19
C <sub>5</sub>	18	20	4	14	9
C <sub>6</sub> <sup>+</sup>	35	36	11	29	24
Olefin Selectivity, % Wt					
C <sub>2</sub>	57	60	75	50	75
C <sub>3</sub>	50	50	75	60	75
C <sub>4</sub>	67	67	75	64	67
C <sub>5</sub>	81	82	88	75	79
C <sub>5</sub> Olefin Selectivity, % Wt					
1-pentene	3	3	2	3	3
2-pentene	18	21	20	18	21
Methylbutenes	79	76	78	79	76
C <sub>6</sub> <sup>+</sup> , Aromatics, % Wt	16	-	-	-	-
90% OH, °F	357	389	-	351	-



TABLE B8

EFFECT OF CONTACT TIME AT 200 PSIG FOR  
CATALYST SG-A-1 WITH 3/1/2 H<sub>2</sub>/CO/CO<sub>2</sub>

Run CT-158	91-1	91-2	91-3	91-4	91-5
Catalyst SG-	A-1	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	3/1/2	3/1/2	3/1/2	3/1/2	3/1/2
Temp., Inlet °F	606	608	620	607	608
Avg °F	614	610	620	610	612
Max °F	640	634	636	634	631
Outlet °F	593	596	609	596	598
Pressure, PSIG	200	200	200	200	200
GHSV	7540	3719	1847	10921	7343
WHSV	6.1	3.0	1.5	8.9	6.0
Contact Time, sec.	3.4	6.9	13.7	2.3	3.5
Material Balance, %	98	99	99	98	99
CO Conv. % Wt	77	83	89	38	54
to HC % Wt	91	93	92	88	89
H <sub>2</sub> Conv. % Wt	47	52	58	20	30
to HC % Wt	55	52	52	50	55
Total Conv. % Wt	72	78	84	35	50
GHC/m <sup>3</sup> CO	416	441	418	186	284
HC Selectivity, % Wt					
C <sub>1</sub>	16	17	20	22	20
C <sub>2</sub>	7	6	5	10	8
C <sub>3</sub>	4	5	7	2	10
C <sub>4</sub>	20	17	14	25	20
C <sub>5</sub>	18	16	10	22	13
C <sub>6</sub> <sup>+</sup>	35	39	44	19	29
Olefin Selectivity, % Wt					
C <sub>2</sub>	57	43	20	75	60
C <sub>3</sub>	50	40	29	60	67
C <sub>4</sub>	67	50	33	67	67
C <sub>5</sub>	83	70	49	84	80
C <sub>5</sub> Olefin Selectivity, % Wt					
1-pentene	3	2	2	2	3
2-pentene	18	19	20	19	19
Methylbutenes	79	79	80	79	78
C <sub>6</sub> <sup>+</sup> , Aromatics, % Wt	15	19	32	15	15
90% OH, °F	365	358	395	330	366

TABLE B9

EFFECT OF CONTACT TIME AT 300 PSIG

Run	CT-158	92-1	92-2	92-3	92-4	93-1	93-2	93-3	93-4
Catalyst	SG-	A-1	A-1	A-1	A-1	A-1	A-1	A-1	A-1
Charge (mole)	H <sub>2</sub> /CO/CO <sub>2</sub> /	3/1/2	3/1/2	3/1/2	3/1/2	3/1/2	3/1/2	3/1/2	3/1/2
Temp., Inlet, °F		606	607	610	611	606	608	617	617
Avg., °F		611	605	615	612	606	608	614	614
Max., °F		640	632	634	637	634	634	635	634
Outlet, °F		591	592	604	597	589	591	602	601
Pressure, PSIG		300	300	300	300	300	300	300	300
GHSV		7252	3655	1858	7329	7133	11058	3720	7218
WHSV		5.9	3.0	1.5	6.0	5.8	9.1	3.0	5.9
Contact Time, sec.		5.2	10.3	20.0	5.1	5.3	3.4	10.0	5.2
Material Balance, %		98	100	99	99	98	101	98	101
CO Conv., % wt		65	79	88	52	58	41	76	50
to HC & wt		99	94	95	91	99	98	94	94
H <sub>2</sub> Conv., % wt		43	49	55	31	36	29	43	32
to HC, % wt		53	52	50	49	48	54	46	53
Total Conv., % wt		61	74	82	48	54	38	70	46
G HC/m <sup>3</sup> CO		381	410	430	267	321	224	369	254
HC Selectivity, % wt		15	17	16	22	12	17	15	18
C1		7	5	5	7	6	8	6	9
C2		5	5	5	7	7	2	5	6
C3		19	15	13	19	20	27	17	20
C4		19	14	13	14	15	23	15	16
C5		36	44	48	31	40	23	43	31
C6+		50	40	20	50	50	50	40	60
Olefin Selectivity, % wt		50	40	40	50	58	16	25	32
C2		62	51	35	60	68	67	54	59
C3		74	62	45	74	79	81	62	73
C4		3	2	2	2	3	2	3	3
C5		18	16	16	17	17	17	17	18
C5 Olefin Selectivity, % wt		79	82	82	81	80	81	80	79
1-pentene		17	20	30	15	15	17	22	16
2-pentene		366	373	393	358	370	367	369	353
Methylbenzenes									
C6+ Aromatics, % wt									
90% OH, °F									

TABLE B10

EFFECT OF CONTACT TIME AT 400 PSIG FOR  
CATALYST SG-A-1 WITH 3/1/2 H<sub>2</sub>/CO/CO<sub>2</sub>

Run CT-158	90-1	90-2	90-3	90-4	90-5
Catalyst SG-	A-1	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	3/1/2	3/1/2	3/1/2	3/1/2	3/1/2
Temp., Inlet °F	599	598	614	592	596
Avg °F	609	594	610	594	596
Max °F	647	630	634	635	634
Outlet °F	578	577	598	577	578
Pressure, PSIG	400	400	400	400	400
GHSV	7272	3627	1829	11079	7360
WHSV	5.9	3.0	1.5	8.9	6.0
Contact Time, sec.	6.8	13.8	27.0	4.5	6.8
Material Balance, %	97	98	98	98	100
CO Conv. % Wt	64	75	88	36	48
to HC % Wt	94	94	92	91	92
H <sub>2</sub> Conv. % Wt	40	46	55	22	30
to HC % Wt	51	50	47	51	53
Total Conv. % Wt	60	70	82	34	44
GHC/m <sup>3</sup> CO	346	394	370	175	244
HC Selectivity, % Wt					
C <sub>1</sub>	18	18	18	24	22
C <sub>2</sub>	5	6	6	8	7
C <sub>3</sub>	4	3	5	2	7
C <sub>4</sub>	16	14	12	22	14
C <sub>5</sub>	17	15	11	19	13
C <sub>6</sub> <sup>+</sup>	40	44	48	25	37
Olefin Selectivity, % Wt					
C <sub>2</sub>	50	33	17	67	50
C <sub>3</sub>	33	0	67	0	50
C <sub>4</sub>	50	45	30	62	50
C <sub>5</sub>	76	65	45	79	75
C <sub>5</sub> Olefin Selectivity, % Wt					
1-pentene	2	2	2	2	2
2-pentene	18	18	19	18	18
Methylbutenes	80	80	79	80	80
C <sub>6</sub> <sup>+</sup> , Aromatics, % Wt	15	17	29	16	12
90% OH, °F	363	367	381	369	348

TABLE III  
 ACTING OF SO A-1 WITH  $H_2/CO/CO_2$  AT 200 PSIG AND 633°F

Run	Conv. % Catalyst Days on-stream	Temp., °F	Pressure, PSIG	CO Conv. to Methanol, %	CO <sub>2</sub> Conv. to Methanol, %	CO Conv. to HC & H <sub>2</sub> , %	CO <sub>2</sub> Conv. to HC & H <sub>2</sub> , %	Total Conv., C <sub>2</sub> H <sub>5</sub> /M <sub>2</sub> CO	HC Selectivity, %	C <sub>2</sub> Selectivity, %	C <sub>3</sub> Selectivity, %	C <sub>4</sub> Selectivity, %	C <sub>5</sub> Selectivity, %	Methanol Production, lb/M	Hydrocarbons Production, lb/M	Hydrogen Accumulation, lb/M	CO <sub>2</sub> Accu., lb/M	111-1	111-2	111-3	111-4	111-5	111-6	111-7	111-8	111-9	111-10	111-11	111-12	111-13	111-14	111-15	111-16	111-17
70	182	625	200	5.1	5.1	5.1	5.1	15.4	7.4	1.2	1.8	3.0	4.6	33	17	3	1	111-1																
15	15	625	200	10.2	10.2	10.2	10.2	30.8	14.8	2.4	3.6	6.0	9.2	66	34	6	2	111-2																
7	7	625	200	15.3	15.3	15.3	15.3	46.2	22.2	3.6	5.4	9.0	13.6	100	52	9	3	111-3																
6	6	625	200	20.4	20.4	20.4	20.4	61.6	33.2	4.8	7.2	12.0	18.0	133	69	12	4	111-4																
17	17	625	200	25.5	25.5	25.5	25.5	77.0	41.2	6.0	9.0	15.0	22.0	166	88	15	5	111-5																
36	36	625	200	30.6	30.6	30.6	30.6	92.4	50.8	7.2	10.8	18.0	27.0	199	104	18	6	111-6																
51	51	625	200	35.7	35.7	35.7	35.7	107.8	60.4	8.4	12.6	21.0	32.0	232	123	21	7	111-7																
66	66	625	200	40.8	40.8	40.8	40.8	123.2	69.0	9.6	14.4	24.0	36.0	265	139	24	8	111-8																
81	81	625	200	45.9	45.9	45.9	45.9	138.6	77.6	10.8	16.2	27.0	40.0	298	155	27	9	111-9																
96	96	625	200	51.0	51.0	51.0	51.0	154.0	86.2	12.0	18.0	30.0	44.0	331	171	30	10	111-10																
111	111	625	200	56.1	56.1	56.1	56.1	169.4	94.8	13.2	19.8	33.0	48.0	364	187	33	11	111-11																
126	126	625	200	61.2	61.2	61.2	61.2	184.8	103.4	14.4	21.6	36.0	52.0	397	203	36	12	111-12																
141	141	625	200	66.3	66.3	66.3	66.3	200.2	112.0	15.6	23.4	39.0	56.0	430	219	39	13	111-13																
156	156	625	200	71.4	71.4	71.4	71.4	215.6	120.6	16.8	25.2	42.0	60.0	463	235	42	14	111-14																
171	171	625	200	76.5	76.5	76.5	76.5	231.0	129.2	18.0	27.0	45.0	64.0	496	251	45	15	111-15																
186	186	625	200	81.6	81.6	81.6	81.6	246.4	137.8	19.2	28.8	48.0	68.0	529	267	48	16	111-16																
191	191	625	200	86.7	86.7	86.7	86.7	261.8	146.4	20.4	30.6	51.0	72.0	562	283	51	17	111-17																

A. Hydrogen introduced 16 hours at 95°F and 200 psig before starting the 111 series.  
 B. Hydrogen introduced 16 hours at 95°F and 200 psig before starting the 112 series.

TABLE B12

AGING OF SG-A-1 WITH 3/1/2 H<sub>2</sub>/CO/CO<sub>2</sub> AT 350 PSIG AND 625°F

Run	CT-158-Catalyst	SG-Charge (mole)	H <sub>2</sub> /CO/CO <sub>2</sub>	Days on-Stream	Temp., Inlet °F	Temp., Avg. °F	Max. °F	Outlet °F	Pressure, PSIG	GESV	WHSV	Contact Time, sec.	Material Balance, %	CO Conv. %	H <sub>2</sub> Conv. to HC %	H <sub>2</sub> Conv. to HC %	Total Conv. %	G HC/m <sup>3</sup> CO	HC selectivity	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>6</sub> <sup>+</sup>	Olefin Selectivity, %	C <sub>5</sub> Olefin Selectivity, %	1-pentene	2-pentene	Methylbutenes	C <sub>6</sub> <sup>+</sup> Aromatics, %	90% OH, °F
95-1	A-1	3/1/2	1.0	599	603	628	586	350	7300	6.0	94	82	93	49	52	76	440	16	7	6	14	16	41	43	50	63	70	2	17	81	14	356	
95-2	A-1	3/1/2	2.0	596	596	624	583	350	7300	6.0	97	77	90	44	54	18	401	8	8	5	16	15	37	43	40	61	72	2	17	81	14	342	
95-3	A-1	3/1/2	3.0	598	599	626	585	350	7300	6.0	97	72	90	42	53	20	369	8	5	15	15	37	43	50	60	73	3	17	80	12	324		
95-4	A-1	3/1/2	3.9	600	602	625	586	350	7300	6.0	99	70	90	41	54	21	358	9	5	15	14	36	43	50	65	73	2	17	81	12	321		
95-5	A-1	3/1/2	6.0	601	602	625	591	350	7300	6.0	98	64	92	42	58	21	342	9	3	13	15	39	43	50	74	74	2	17	81	11	317		
95-6	A-1	3/1/2	7.0	602	603	624	591	350	7300	6.0	100	61	93	41	59	20	332	10	6	16	15	33	43	50	75	75	2	17	81	11	316		
95-7	A-1	3/1/2	8.0	601	603	624	591	350	7300	6.0	100	60	92	41	58	22	317	9	6	16	15	32	43	50	76	76	2	17	81	11	345		
95-8	A-1	3/1/2	9.0	604	604	625	593	350	7300	6.0	99	61	91	36	54	23	316	10	7	17	12	31	43	60	76	76	2	17	81	10	337		
96-1	A-1	3/1/2	0.9	599	601	626	587	350	7300	6.0	95	76	93	46	53	18	408	7	6	15	16	38	13	60	70	70	2	17	91	12	-		
96-2	A-1	3/1/2	3.0	599	601	627	588	350	7300	6.0	95	74	92	42	52	20	395	9	5	14	15	38	13	60	73	73	2	17	81	11	405		
96-3	A-1	3/1/2	4.0	601	603	627	590	350	7300	6.0	97	72	90	41	54	21	360	10	7	14	13	35	38	65	75	75	3	16	81	11	333		
96-4	A-1	3/1/2	5.0	602	603	627	590	350	7300	6.0	98	70	90	41	58	23	356	10	8	15	12	32	38	68	75	75	3	16	81	10	328		
96-5	A-1	3/1/3	6.0	601	603	627	590	350	7300	6.0	97	70	90	42	61	18	371	9	6	16	16	35	37	71	76	76	3	16	81	10	330		
96-6	A-1	3/1/2	7.0	600	602	623	590	350	7300	6.0	97	65	85	42	60	22	317	9	7	16	13	33	43	70	78	78	3	16	81	9	325		

Hydrogen regenerated 16 hours at 950°F and 350 psig

TABLE B13

AGING OF SG-A-1 WITH 2/1 H<sub>2</sub>/CO AT 200 PSIG AND 635°F

Run CT-158	97-1	97-2	97-4	97-5	97-6	97-7
Catalyst SG-	A-1	A-1	A-1	A-1	A-1	A-1
Charge (mole) H <sub>2</sub> /CO/CO <sub>2</sub>	2/1/0	2/1/0	2/1/0	2/1/0	2/1/0	2/1/0
Days On-Stream	0.9	2.9	5.8	6.9	8.8	9.8
Temp., Inlet °F	593	591	594	605	603	605
Avg. °F	590	587	588	598	598	600
Max. °F	637	632	627	636	636	636
Outlet °F	574	570	577	585	585	585
Pressure, PSIG	200	200	200	200	200	200
GHSV	3160	3160	3160	3160	3160	3160
WHSV	1.4	1.4	1.4	1.4	1.4	1.4
Contact Time, sec.	8.9	8.9	8.9	8.9	8.9	8.9
Material Balance, %	99	100	102	95	106	104
CO Conv. % Wt.	98	98	98	96	93	92
to HC % Wt.	69	69	70	67	64	64
H <sub>2</sub> Conv. % Wt.	56	55	56	54	50	49
to HC % Wt.	68	70	70	71	75	71
Total Conv. % Wt.	93	92	92	90	87	86
G HC/m <sup>3</sup> CO	397	397	412	385	357	327
HC Selectivity, % Wt.						
C <sub>1</sub>	23	24	22	24	24	25
C <sub>1</sub>	7	8	7	7	8	9
C <sub>2</sub>	5	5	5	4	6	6
C <sub>3</sub>	13	8	12	13	14	15
C <sub>4</sub>	13	13	14	15	14	13
C <sub>5</sub> <sup>+</sup>	39	43	40	38	35	32
Olefin Selectivity, % Wt.						
C <sub>2</sub>	29	25	25	30	27	28
C <sub>2</sub>	33	35	34	33	37	40
C <sub>3</sub>	61	61	63	63	63	66
C <sub>4</sub>	69	68	69	68	68	72
C <sub>5</sub> Olefin Selectivity, % Wt.						
1-pentene	2	2	2	3	2	2
2-pentene	17	17	17	17	18	18
Methylbutenes	81	81	81	80	80	80
C <sub>6</sub> <sup>+</sup> Aromatics, % Wt.	12	11	9	11	13	12
90% OH, °F	362	360	352	-	-	-

TABLE B14

## AGING OF HYDROGEN REGENERATED SG-A-1 FOLLOWING RUN 158-97

Run	CT-158-	98-1	98-2	98-3	98-4	98-5	98-6
Catalyst	SG-	A-1	A-1	A-1	A-1	A-1	A-1
Charge (mole)	H <sub>2</sub> /CO/CO <sub>2</sub> /	2/1/0	2/1/0	2/1/0	2/1/0	2/1/0	2/1/0
Days On-Stream		1.9	3.0	4.0	5.9	7.9	8.9
Temp., Inlet	°F	595	596	598	600	600	600
	Avg. °F	589	589	591	593	593	595
	Max. °F	636	634	635	636	633	632
	Outlet °F	573	573	575	577	578	580
Pressure	PSIG	204	210	210	210	204	208
	GHSV	3160	3160	3160	3160	3160	3160
	WHSV	1.4	1.4	1.4	1.4	1.4	1.4
Contact Time, sec.		8.9	8.9	8.9	8.9	8.9	8.9
Material Balance, % Wt.		98	105	106	97	98	102
CO Conv. % Wt.		98	99	97	98	97	97
	to HC % Wt.	71	69	68	68	69	70
H <sub>2</sub> Conv. % Wt.		62	60	62	58	58	60
	to HC % Wt.	71	72	72	71	71	68
Total Conv. % Wt.		93	93	92	93	92	92
G HC/m <sup>3</sup> CO		444	409	399	408	414	411
HC Selectivity, % Wt.							
	C <sub>1</sub>	19	23	23	23	21	21
	C <sub>2</sub>	7	9	9	9	9	8
	C <sub>3</sub>	4	5	6	5	5	5
	C <sub>4</sub>	11	9	9	10	12	12
	C <sub>5</sub>	14	12	11	12	13	14
	C <sub>6</sub> <sup>+</sup>	45	42	42	41	40	40
Olefin Selectivity, % Wt.							
	C <sub>2</sub>	23	22	22	22	24	27
	C <sub>3</sub>	29	41	30	30	32	34
	C <sub>4</sub>	63	65	63	63	66	68
	C <sub>5</sub>	73	75	75	75	76	78
C <sub>5</sub> Olefin Selectivity, % Wt.							
	1-pentene	2	2	2	2	2	2
	2-pentene	18	18	18	18	18	18
	Methylbutenes	80	80	80	80	80	80
C <sub>6</sub> <sup>+</sup> Aromatics, % Wt.		11	9	11	11	12	10
	90% OH, °F	357	356	370	367	349	345

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TABLE R15

MATERIAL BALANCES FROM FLUID BENCH-SCALE UNIT WITH CATALYST SG-A-1

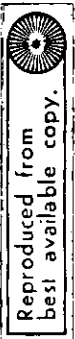
	10-1	10-2	10-3	10-4	10-5	10-6	10-7	10-8	10-9	10-10	10-11	10-12
RUN NUMBER 225-												
RUN DAYS-ON-STREAM	1.1	2.1	3.1	4.1	7.2	7.6	8.5	9.3	9.5	10.5	11.5	12.5
CUM. DAYS-ON-STREAM	1.1	2.1	3.1	4.1	7.2	7.6	8.5	9.3	9.5	10.5	11.5	12.5
FRESH FEED H <sub>2</sub> /CO RATIO	2.8	3.2	3.2	3.0	3.2	3.2	3.9	2.0	1.9	1.9	1.9	2.0
GHSV, HR <sup>-1</sup> (CAG BASIS)	3574	3574	3553	3551	3534	3500	3466	3591	3495	3534	3479	3444
RECYCLE RATIO	8.39	8.49	8.67	9.30	8.86	8.85	9.68	9.54	10.04	9.18	9.11	9.80
REACT. PRESS., PSIG	300	300	300	300	300	300	300	300	300	300	300	300
REACT. INLET TEMP., °F	481	482	482	485	480	481	477	475	473	473	473	456
HEAT. TRANS., °F	605	607	603	611	609	608	593	583	575	580	583	602
CONVERSIONS, MOL %												
H <sub>2</sub>	73.8	76.9	77.9	75.2	71.3	73.7	55.0	63.3	55.6	55.3	55.2	49.0
CO	93.7	96.3	95.9	95.9	93.9	93.8	78.0	75.5	69.6	72.8	72.8	61.8
H <sub>2</sub> +CO	79.0	81.5	82.2	81.2	76.6	73.5	69.4	67.3	60.4	61.3	61.2	52.5
HYDROGEN	4.4	4.3	4.1	4.2	5.4	5.0	4.3	4.7	5.4	5.5	5.5	6.7
WATER	45.0	49.4	47.6	49.8	41.1	40.1	26.2	27.3	22.2	24.1	24.1	13.0
CO	5.2	3.0	3.3	3.4	4.9	5.0	39.3	21.4	26.7	23.9	23.8	33.3
CO <sub>2</sub>	8.4	4.3	4.5	5.0	4.9	5.4	21.8	21.5	24.2	22.5	22.5	22.7
TOTAL HYDROCARBON	37.0	43.1	44.5	42.2	49.5	40.3	33.5	28.8	21.6	24.0	27.2	21.0
HC SELECTIVITY, WT %												
METHANE	21.3	21.5	18.2	20.2	21.6	26.3	8.3	12.4	17.0	17.0	16.2	16.9
ETHANE	0.9	0.6	0.6	0.6	0.7	0.9	1.3	1.4	1.9	1.7	1.5	2.0
ETHANE	10.2	11.0	10.0	10.3	7.3	9.2	4.2	5.5	7.4	7.5	6.8	6.9
PROPENE	1.2	1.0	1.0	1.0	1.2	1.2	1.9	2.5	3.6	3.1	4.2	4.2
PROPANE	5.5	6.2	5.8	5.5	4.3	5.1	2.5	3.5	4.1	4.0	3.5	3.9
BUTENES	3.1	2.5	3.1	2.5	2.5	2.9	4.2	5.0	7.1	6.3	5.6	7.4
I-BUTANE	2.3	2.6	2.8	2.4	2.2	2.7	1.8	1.6	1.9	1.7	1.5	1.5
N-BUTANE	3.4	3.9	4.6	3.4	2.7	3.1	1.8	2.3	2.9	2.5	2.3	2.5
TOTAL C <sub>4</sub> -	47.9	49.3	46.0	46.0	42.9	51.5	25.0	35.2	45.9	43.8	39.9	45.2
C <sub>5</sub> + PARAFFINS	44.5	15.5	18.8	16.3	14.9	13.9	15.2	16.0	39.9	43.8	14.3	12.6
OLEFINS	5.0	12.3	13.8	13.5	12.9	11.8	21.8	19.4	9.2	8.3	18.9	18.1
NAPHTHENES	0.0	1.0	1.1	1.9	3.2	2.2	4.1	3.2	0.1	0.1	2.6	1.2
AROMATICS	0.0	3.3	2.7	0.9	0.7	1.2	2.2	1.8	0.0	0.0	1.2	0.4
OTHERS	2.6	18.5	17.6	21.4	25.4	19.5	29.7	24.4	4.9	4.0	23.2	22.4
TOTAL C <sub>5</sub> +	52.1	50.7	54.0	54.0	57.1	48.5	74.0	64.8	54.1	56.2	60.1	54.8
YIELDS, G/SEC CONV CO <sub>2</sub> H <sub>2</sub>	183	176	180	177	206	169	198	177	173	189	191	173
TOTAL HC	95	80	88	86	106	73	138	105	94	106	105	88
C <sub>2</sub>	7.7	5.1	5.5	5.7	8.4	8.5	23.0	17.5	20.5	18.6	18.6	22.0
C <sub>3</sub>	18.4	14.1	14.5	15.8	19.7	19.7	42.7	41.9	46.6	43.9	43.3	51.6
C <sub>4</sub>	34.8	28.1	29.4	29.9	33.9	33.4	53.6	55.6	59.9	59.4	59.3	64.9
C <sub>5</sub>	47.4	39.0	38.6	41.3	44.2	43.6	61.5	62.9	64.3	65.6	65.4	67.7
90 PCT OH, RAW PROD., °F	420	393	383	390	411	393	389	395	421	412	398	400
OCTANE NO. ON RAW PROD.	84.1	82.2	83.1	83.9	84.9	85.2	89.1	85.9	88.9	85.1	85.3	-
R+3	95.1	95.9	96.5	95.6	95.9	96.6	97.1	97.0	96.7	96.0	96.7	-
OXYGENATES, WT %	-	-	-	-	0.2	-	-	0.2	-	-	-	0.2



TABLE B15 (Continued)

MATERIAL BALANCES FROM FLUID BENCH-SCALE UNIT WITH CATALYST SG-A-1

	10-13	10-14	10-15	10-16	10-17	10-18	10-19	10-20	10-21	10-22	10-23
RUN NUMBER 225-											
RUN DAYS-ON-STREAK	13.1	13.5	15.8	16.5	18.0	18.5	20.2	21.9	22.5	23.5	24.1
CUM. DAYS-ON-STREAK	13.1	13.5	15.8	16.5	18.0	18.5	20.2	21.9	22.5	23.5	24.1
FRESH FEED H <sub>2</sub> /CO RATIO	2.1	2.1	2.1	2.2	2.2	2.2	2.2	2.1	2.2	2.2	2.1
GHSV, HR <sup>-1</sup> (CHG BASIS)	3512	3500	2334	2351	2339	2345	2458	1490	1490	3478	3478
RECYCLE RATIO	9.37	9.57	9.75	9.86	9.58	9.45	9.10	10.35	10.38	9.39	9.12
REACT. PRESS., PSIG	300	300	300	300	300	300	300	300	300	300	300
REACT. INLET TEMP., °F	457	455	462	459	461	463	461	462	461	462	465
NOX. REACT. TEMP., °F	600	596	618	607	619	616	619	633	640	614	616
CONVERSIONS, MOL %/o											
H <sub>2</sub>	45.8	43.5	53.4	52.7	60.4	63.0	54.3	80.9	81.0	44.3	39.9
CO	61.2	58.2	75.4	70.3	72.1	75.7	70.1	89.6	89.3	57.5	52.0
H <sub>2</sub> +CO	50.7	48.2	60.5	58.2	64.1	66.9	59.3	83.7	83.6	48.5	43.8
YIELDS, WT %/o											
HYDROGEN	7.2	7.5	6.1	6.4	5.4	5.1	6.2	2.6	2.6	7.6	8.0
WATER	19.0	17.4	33.3	22.5	24.1	28.1	24.5	38.2	39.3	17.7	15.5
CO	33.6	36.3	21.3	25.7	24.2	21.0	26.0	9.0	9.2	36.7	41.6
CO <sub>2</sub>	21.8	21.6	18.9	22.0	21.4	20.0	19.5	16.3	16.1	19.1	18.8
TOTAL HYDROCARBON	18.4	17.2	20.3	23.5	25.0	25.8	23.9	33.9	32.8	18.0	16.1
HC SELECTIVITY, WT %/o											
METHANE	22.2	21.4	30.8	24.2	15.5	17.7	15.7	15.4	13.6	20.0	21.1
ETHANE	2.1	2.3	2.1	1.9	1.7	1.6	1.7	0.8	0.3	2.3	2.7
ETHANE	8.4	8.3	10.0	9.3	7.7	8.4	7.7	7.6	7.7	8.3	8.3
PROPANE	4.7	5.4	3.7	3.7	2.8	2.5	2.9	1.0	1.1	4.4	5.4
PROPANE	4.0	4.9	5.6	4.9	4.1	4.6	4.2	3.8	3.9	4.7	4.9
BUTENES	8.1	8.0	7.4	7.0	6.0	5.7	6.2	3.2	3.3	8.2	9.4
I-BUTANE	1.4	1.4	1.8	1.5	1.7	1.8	1.4	2.0	2.1	1.4	1.2
N-BUTANE	3.0	3.1	3.5	3.2	3.0	3.0	2.7	2.5	2.7	3.0	3.0
TOTAL C <sub>4</sub> -	54.7	55.5	65.5	55.6	42.5	45.3	42.6	36.3	35.2	52.2	56.4
C <sub>5</sub> + PARAFFINS	29.2	27.7	21.7	31.5	45.7	43.4	45.0	56.4	58.3	31.4	25.1
OLEFINS	10.2	10.5	9.3	9.2	8.7	8.0	8.6	5.8	6.0	9.9	10.9
NAPHTHENES	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
AROMATICS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHERS	5.9	6.3	3.3	3.5	3.0	3.1	3.7	1.4	0.5	6.3	7.5
TOTAL C <sub>5</sub> +	45.3	44.5	34.5	44.4	57.5	54.7	57.4	63.7	64.8	47.8	43.6
YIELDS, G/SEC CONV CO+H <sub>2</sub>											
TOTAL HC	166	165	155	183	177	173	183	186	176	177	168
C <sub>5</sub> +	75	74	54	81	102	95	105	118	114	85	74
OLEFINS, WT %/o BY C NO.											
C <sub>2</sub>	19.8	21.4	16.8	16.9	18.0	15.9	18.2	9.8	10.0	21.7	23.3
C <sub>3</sub>	40.3	52.5	39.7	42.7	40.4	35.1	41.1	20.6	22.3	48.4	52.0
C <sub>4</sub>	64.7	56.6	58.5	60.0	56.4	54.2	60.4	48.0	40.9	65.4	69.1
C <sub>5</sub>	68.0	69.1	65.1	65.1	63.5	63.0	67.3	51.0	56.4	68.6	71.5
90 PCT OH, RAW PROD., °F	420	393	383	390	411	393	389	395	421	412	393
OCTANE NO. ON RAW PROD.											
R+0	83.6	82.9	83.7	81.7	83.0	-	88.0	86.8	87.0	83.3	85.6
M+3	96.3	96.9	94.5	94.8	95.5	95.4	97.0	96.6	97.2	96.2	96.5
OXYGENATES, WT %/o	-	-	-	0.2	0.1	0.1	0.2	-	0.2	0.4	0.3



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