

## Crude Oil Assays

Gippsland Blend	Whole crude	Butane & Lighter	Light Naphtha	Heavy Naphtha	Kerosene	Diesel	Vacuum Gas Oil	Vacuum Residue
Distillation Range, F	-200 to 1499	-200 to 60	60 to 165	165 to 330	330 to 480	480 to 650	650 to 1000	1000 to 1499
Cut volume, %	100.00	0.44	6.32	35.80	27.68	20.07	9.19	0.49
API Gravity,	49.00	117.28	79.57	60.34	47.73	35.53	25.39	-0.08
Specific Gravity (60/60F),	0.7839	0.5688	0.6704	0.7376	0.7895	0.8472	0.9019	1.0767
Carbon, wt %		82.56	83.66	84.73	85.50	86.56	87.27	
Hydrogen, wt %		17.44	16.34	15.27	14.50	13.42	12.59	
Pour point, F	-65.00				-55.00	13.00	88.00	109.00
Neutralization number (TAN), MG/GM	0.0500					0.0540	0.0510	0.1060
Sulfur, wt%	0.0140			0.0000	0.0006	0.0185	0.1054	0.4991
Viscosity at 20C/68F, cSt	1.65	0.35	0.41	0.73	2.01	6.82	76.33	2.18E+08
Viscosity at 40C/104F, cSt	1.30	0.30	0.35	0.60	1.45	3.90	27.33	3.18E+06
Viscosity at 50C/122F, cSt	1.17	0.28	0.32	0.55	1.26	3.12	18.20	5.96E+05
Mercaptan sulfur, ppm	0.00			0.10	0.70			
Nitrogen, ppm	57.00	0.00	0.00	0.00	0.20	9.70	331.40	4,108.00
CCR, wt%	0.22					0.00	0.06	33.63
N-Heptane Insolubles (C7 Asphaltenes), wt%								7.60
Nickel, ppm	2.10					0.00	0.30	76.50
Vanadium, ppm	0.10	0.00	0.00	0.00	0.00	0.00	0.00	12.00
Calcium, ppm	1.00							
Reid Vapor Pressure (RVP) Whole Crude, psi	2.10							
Heat of Combustion (Gross), BTU/lb	20,308							
Heat of Combustion (Net), BTU/lb	18,724	19,775	19,197	18,924	18,743			
Hydrogen Sulfide (dissolved), ppm	0.00							
Salt content, ptb	7.10							
Paraffins, vol %		100.00	93.79	64.88	54.56	50.75	37.36	
Naphthenes, vol %		0.00	6.20	34.12	38.28	28.46	29.25	
Aromatics (FIA), vol %				1.00	6.28			
Distillation type, D-	1160	86	86	86	86	86	1160	1160
ASTM IBP, F	118.1	-73.9	106.2	207.1	363.4	501.0	685.4	1,036.4
5 vol%, F	173.8	-24.5	112.0	213.7	367.4	504.7	690.5	1,041.4
10 vol%, F	207.4	19.0	114.8	218.7	368.9	506.6	692.2	1,044.8
20 vol%, F	241.1	26.5	120.6	224.4	373.2	510.9	698.1	1,054.7
30 vol%, F	277.7	28.9	128.2	229.5	379.2	516.5	705.5	1,066.6
40 vol%, F	323.4	28.8	131.3	235.6	386.9	521.5	717.2	1,083.1
50 vol%, F	371.7	30.6	133.3	242.7	394.8	527.4	732.4	1,106.6
60 vol%, F	426.4	34.9	138.1	252.0	403.8	535.5	754.0	1,146.2
70 vol%, F	476.4	39.0	142.5	263.2	412.7	546.4	778.1	1,196.9
80 vol%, F	532.9	42.9	146.5	275.9	422.3	561.3	807.6	1,261.9
90 vol%, F	613.9	42.9	146.7	289.1	432.6	579.4	840.2	1,340.9
95 vol%, F	692.6	44.0	147.9	296.3	438.9	589.8	875.3	1,392.7
ASTM EP, F	958.2	45.9	149.7	307.6	449.5	603.3	960.4	1,453.4
Freeze point, F				-39.10	27.10			
Smoke point, mm				29.40				
Naphthalenes (D1840), vol%				0.90				
Viscosity at 100C/212F, cSt	0.77	0.21	0.24	0.38	0.74	1.42	4.58	2,274.89
Viscosity at 150C/302F, cSt	0.57	0.17	0.19	0.28	0.50	0.86	2.09	122.19
Cetane Index 1990 (D4737),	46.90	122.50	45.40	38.40	53.60	55.60	57.40	16.50
Cloud point, F				-46.00	20.00			
Aniline pt, F				158.00	165.90	188.20		

Source: ExxonMobil Refining & Supply. "Crude Oil Information: Crudes by American Petroleum Institute Gravity." ExxonMobil Refining & Supply website. Web. 13 June 2013.  
[http://www.exxonmobil.com/crudeoil/about\\_crudes\\_api.aspx](http://www.exxonmobil.com/crudeoil/about_crudes_api.aspx)

Brent Blend	Whole crude	Butane & Lighter	Light Naphtha	Heavy Naphtha	Kerosene	Diesel	Vacuum Gas Oil	Vacuum Residue
Distillation Range, F	-200 to 1499	-200 to 60	60 to 165	165 to 330	330 to 480	480 to 650	650 to 1000	1000 to 1499
Cut volume, %	100.00	2.55	8.95	19.39	14.97	17.20	25.48	11.00
API Gravity,	38.50	118.54	82.04	56.07	42.88	34.80	24.86	10.00
Specific Gravity (60/60F),	0.8324	0.5659	0.6626	0.7544	0.8115	0.8508	0.9050	0.9900
Carbon, wt %	85.99	82.50	83.90	85.83	86.18	86.38	86.46	
Hydrogen, wt %	13.53	17.50	16.10	14.17	13.81	13.33	12.81	
Pour point, F	32.00				-69.00	10.00	100.00	97.00
Neutralization number (TAN), MG/GM	0.0900					0.1340	0.1150	0.1600
Sulfur, wt%	0.4060			0.0024	0.0327	0.2585	0.6079	1.3600
Viscosity at 20C/68F, cSt	4.89	0.35	0.41	0.74	1.87	7.06	125.57	1.91E+
Viscosity at 40C/104F, cSt	3.15	0.30	0.35	0.61	1.36	4.01	41.57	9.89E+
Viscosity at 50C/122F, cSt	2.63	0.28	0.32	0.56	1.19	3.20	26.81	3.01E+
Mercaptan sulfur, ppm	20.00				7.70	3.50		
Nitrogen, ppm	970.00	0.00	0.00	0.00	0.20	54.20	899.40	5,202.00
CCR, wt%	2.18					0.00	0.23	15.00
N-Heptane Insolubles (C7 Asphaltenes), wt%								2.00
Nickel, ppm	1.30					0.00	0.00	9.00
Vanadium, ppm	5.90	0.00	0.00	0.00	0.00	0.00	0.00	43.00
Calcium, ppm	0.50							
Reid Vapor Pressure (RVP) Whole Crude, psi	9.20							
Heat of Combustion (Gross), BTU/lb	19,688							
Heat of Combustion (Net), BTU/lb	18,459	19,266	18,869	18,653	18,584			
Hydrogen Sulfide (dissolved), ppm	0.00							
Salt content, ptb	2.30							
Paraffins, vol %		100.00	85.61	47.08	41.03	40.38	23.55	
Naphthenes, vol %		0.00	12.87	38.46	42.44	37.18	39.69	
Aromatics (FIA), vol %				14.46	14.92			
Distillation type, D-	1160	86	86	86	86	86	1160	1160
ASTM IBP, F	9.0	-92.6	94.1	205.7	363.5	505.7	689.9	1,038.0
5 vol%, F	102.0	-50.4	99.0	210.3	367.8	510.5	694.3	1,042.0
10 vol%, F	157.4	-2.9	102.8	212.4	369.8	512.7	705.1	1,052.0
20 vol%, F	232.6	29.2	106.9	216.8	374.6	518.6	727.2	1,071.0
30 vol%, F	316.3	36.0	111.0	222.8	380.6	525.8	752.4	1,095.0
40 vol%, F	411.1	38.0	113.6	230.6	388.0	534.3	779.7	1,123.0
50 vol%, F	508.4	37.3	117.9	239.3	395.4	542.5	808.7	1,155.0
60 vol%, F	609.5	41.5	125.7	249.9	404.2	552.2	837.7	1,198.0
70 vol%, F	716.7	45.6	131.6	261.5	413.4	562.7	865.8	1,248.0
80 vol%, F	830.8	48.5	137.4	274.5	423.5	574.4	895.6	1,306.0
90 vol%, F	970.3	47.0	140.7	288.1	433.9	586.8	926.7	1,373.0
95 vol%, F	1,107.3	46.7	143.6	295.6	439.7	593.8	946.5	1,415.0
ASTM EP, F	1,389.2	47.6	146.3	307.3	444.4	604.8	970.0	1,457.0
Freeze point, F					-48.00	27.40		
Smoke point, mm					20.70			
Naphthalenes (D1840), vol%					3.60			
Viscosity at 100C/212F, cSt	1.36	0.21	0.23	0.38	0.71	1.44	6.03	52.40
Viscosity at 150C/302F, cSt	0.88	0.17	0.18	0.28	0.48	0.87	2.59	56.00
Cetane Index 1990 (D4737),	37.50	134.90	45.00	29.00	43.20	55.80	57.20	40.00
Cloud point, F					-57.00	20.00		
Aniline pt, F					142.90	163.30	191.30	

Alaskan North Slope	Whole crude	Butane & Lighter	Light Naphtha	Heavy Naphtha	Kerosene	Diesel	Vacuum Gas Oil	Vacuum Resid
Distillation Range, F	-200 to 1499	-200 to 60	60 to 165	165 to 330	330 to 480	480 to 650	650 to 1000	1000 to 14
Cut volume, %	100.00	2.53	7.98	14.08	14.06	16.01	27.07	18.
API Gravity,	31.40	113.65	83.77	55.02	41.10	31.39	21.24	6.
Specific Gravity (60/60F),	0.8686	0.5772	0.6573	0.7586	0.8198	0.8687	0.9264	1.02
Carbon, wt %		82.64	83.88	85.84	86.18	86.60	86.34	
Hydrogen, wt %		17.36	16.12	14.16	13.74	12.86	12.30	
Pour point, F	-3.00				-69.00	-2.00	88.00	121.
Neutralization number (TAN), MG/GM	0.2000					0.1330	0.3400	0.18
Sulfur, wt%	0.9580			0.0107	0.0929	0.5304	1.2117	2.34
Viscosity at 20C/68F, cSt	12.22	0.35	0.39	0.71	1.81	7.57	285.61	5.40E+
Viscosity at 40C/104F, cSt	6.88	0.30	0.34	0.59	1.33	4.25	75.53	7.21E+
Viscosity at 50C/122F, cSt	5.43	0.28	0.31	0.54	1.16	3.37	44.80	1.30E+
Mercaptan sulfur, ppm	13.00				7.80	8.90		
Nitrogen, ppm	1,800.00	0.00	0.00	0.00	1.10	74.70	1,307.20	6,321.
CCR, wt%	4.86					0.00	0.52	21.
N-Heptane Insolubles (C7 Asphaltenes), wt%								7.
Nickel, ppm	11.00					0.00	0.00	51.
Vanadium, ppm	24.80					0.00	0.00	118.
Calcium, ppm	0.50							
Reid Vapor Pressure (RVP) Whole Crude, psi	6.30							
Heat of Combustion (Gross), BTU/lb	19,249							
Heat of Combustion (Net), BTU/lb	18,071	19,168	18,855	18,599	18,491			
Hydrogen Sulfide (dissolved), ppm	0.00							
Salt content, ptb								
Paraffins, vol %	100.00	84.67	43.29	36.76	31.56	19.11		
Naphthenes, vol %	0.00	14.26	43.00	46.56	37.47	34.78		
Aromatics (FIA), vol %			13.71	21.24				
Distillation type, D-	1160	86	86	86	86	86	1160	11
ASTM IBP, F	32.0	-2.1	94.6	207.6	363.9	505.9	690.3	1,035
5 vol%, F	98.8	24.9	99.0	212.7	368.4	510.6	694.9	1,043
10 vol%, F	158.3	31.2	102.7	215.1	370.6	512.6	706.4	1,055
20 vol%, F	274.2	32.4	107.3	221.6	375.8	518.5	729.5	1,080
30 vol%, F	377.8	34.9	112.3	229.5	382.1	525.8	755.5	1,105
40 vol%, F	477.2	37.4	116.0	238.9	389.5	534.6	783.5	1,142
50 vol%, F	582.1	39.5	119.1	247.6	396.7	543.1	813.8	1,175
60 vol%, F	699.2	43.2	123.1	257.7	405.3	553.1	844.8	1,225
70 vol%, F	814.4	46.5	128.4	268.3	414.2	563.9	875.3	1,270
80 vol%, F	939.6	49.1	135.1	279.4	424.0	575.5	905.9	1,330
90 vol%, F	1,085.9	47.8	139.5	290.9	434.1	587.6	934.0	1,387
95 vol%, F	1,216.2	47.5	143.2	297.3	439.8	594.3	950.4	1,420
ASTM EP, F	1,398.6	48.6	146.5	302.5	444.5	605.0	969.8	1,457
Freeze point, F					-52.10	13.80		
Smoke point, mm					21.50			
Naphthalenes (D1840), vol%					2.40			
Viscosity at 100C/212F, cSt	2.32	0.21	0.23	0.37	0.70	1.50	7.84	4,081
Viscosity at 150C/302F, cSt	1.37	0.17	0.18	0.27	0.48	0.90	3.01	189.
Cetane Index 1990 (D4737),	29.70	113.30	50.60	29.30	39.80	48.10	48.10	28.
Cloud point, F					-60.00	7.00		
Aniline pt, F					130.30	148.30	173.60	

Hungo Blend	Whole crude	Butane & Lighter	Light Naphtha	Heavy Naphtha	Kerosene	Diesel	Vacuum Gas Oil	Vacuum Resid
Distillation Range, F	-200 to 1499	-200 to 60	60 to 165	165 to 330	330 to 480	480 to 650	650 to 1000	1000 to 14
Cut volume, %	100.00	1.33	4.24	12.29	13.11	15.96	31.23	21.
API Gravity,	28.30	121.03	79.73	55.05	41.02	32.65	21.20	7.
Specific Gravity (60/60F),	0.8855	0.5603	0.6699	0.7585	0.8202	0.8620	0.9266	1.01
Carbon, wt %		82.44	83.83	85.44	86.39	86.47	86.79	
Hydrogen, wt %	12.93	17.56	16.17	14.55	13.53	13.21	12.31	
Pour point, F	-19.00				-75.00	4.00	89.00	108.
Neutralization number (TAN), MG/GM	0.4700					0.6340	0.7490	0.35
Sulfur, wt%	0.6410			0.0138	0.0781	0.3126	0.7550	1.33
Viscosity at 20C/68F, cSt	32.96	0.29	0.34	0.70	1.83	7.64	299.32	7.55E+
Viscosity at 40C/104F, cSt	14.41	0.25	0.29	0.56	1.30	4.22	78.38	9.58E+
Viscosity at 50C/122F, cSt	10.34	0.24	0.27	0.50	1.12	3.33	46.32	1.68E+
Mercaptan sulfur, ppm	6.00			1.50	0.90			
Nitrogen, ppm	2,640.00	0.10	0.10	1.40	15.00	92.80	1,438.80	8,567.
CCR, wt%	5.64					0.00	0.47	21.
N-Heptane Insolubles (C7 Asphaltenes), wt%								3.
Nickel, ppm	18.00					0.00	0.10	71.
Vanadium, ppm	15.00					0.00	0.00	59.
Calcium, ppm	0.50							
Reid Vapor Pressure (RVP) Whole Crude, psi	5.40							
Heat of Combustion (Gross), BTU/lb	19,116							
Heat of Combustion (Net), BTU/lb	17,944	19,334	18,871	18,635	18,509			
Hydrogen Sulfide (dissolved), ppm	0.00							
Salt content, ptb	20.00							
Paraffins, vol %		100.00	83.91	42.53	34.71	30.40	16.35	
Naphthenes, vol %		0.00	15.86	49.81	42.67	42.85	30.80	
Aromatics (FIA), vol %				7.65	15.53			
Distillation type, D-	1160	86	86	86	86	86	1160	11
ASTM IBP, F	17.8	-114.3	95.3	208.4	364.4	506.1	691.3	1,03
5 vol%, F	151.5	-78.0	100.0	214.4	369.1	511.0	696.3	1,04
10 vol%, F	228.2	-34.6	103.2	218.2	371.6	513.2	709.2	1,05
20 vol%, F	351.5	15.0	106.0	225.7	377.3	519.3	734.7	1,080
30 vol%, F	457.3	28.3	110.3	233.5	384.0	526.8	762.2	1,110
40 vol%, F	558.1	32.4	113.8	241.8	391.5	535.8	790.6	1,14
50 vol%, F	666.5	32.3	118.9	249.6	398.7	544.3	820.1	1,184
60 vol%, F	780.0	36.2	126.7	258.9	407.1	554.3	849.1	1,23
70 vol%, F	882.1	41.0	132.3	268.9	415.6	564.9	877.9	1,283
80 vol%, F	996.4	44.9	137.8	279.8	425.1	576.3	907.5	1,335
90 vol%, F	1,135.7	44.3	141.0	291.1	434.7	588.0	935.1	1,395
95 vol%, F	1,258.2	44.9	143.8	297.4	440.2	594.5	951.5	1,43
ASTM EP, F	1,414.4	46.3	146.4	302.6	444.8	605.1	970.5	1,45
Freeze point, F					-58.90	18.80		
Smoke point, mm					24.00			
Naphthalenes (D1840), vol%					1.90			
Viscosity at 100C/212F, cSt	3.28	0.18	0.20	0.32	0.64	1.46	8.01	4,878.
Viscosity at 150C/302F, cSt	1.69	0.14	0.16	0.23	0.43	0.87	3.05	214.
Cetane Index 1990 (D4737),	26.60	146.30	39.20	29.80	40.00	51.00	48.20	30.
Cloud point, F					-67.00	12.00		
Aniline pt, F					134.10	150.60	168.50	

Cold Lake Blend	Whole crude	Butane & Lighter	Light Naphtha	Heavy Naphtha	Kerosene	Diesel	Vacuum Gas Oil	Vacuum Resid
Distillation Range, F	-200 to 1499	-200 to 60	60 to 165	165 to 330	330 to 480	480 to 650	650 to 1000	1000 to 14
Cut volume, %	100.00	0.65	11.19	6.91	5.92	11.02	28.66	35.
API Gravity,	19.71	113.01	89.21	57.80	37.88	26.07	15.27	1.
Specific Gravity (60/60F),	0.9358	0.5787	0.6411	0.7475	0.8354	0.8980	0.9641	1.06
Carbon, wt %		82.65	83.54	85.56	86.16	85.78	85.07	
Hydrogen, wt %		17.35	16.46	14.44	13.30	12.24	11.40	
Pour point, F	-37.00				-115.00	-51.00	34.00	124.
Neutralization number (TAN), MG/GM	1.0180					0.6670	1.6550	0.99
Sulfur, wt%	3.8177			0.0860	0.6814	1.9316	3.2888	6.08
Viscosity at 20C/68F, cSt		0.31	0.35	0.70	2.12	11.00	1,311.68	7.82E+
Viscosity at 40C/104F, cSt		0.27	0.30	0.57	1.50	5.56	224.04	1.31E+
Viscosity at 50C/122F, cSt		0.25	0.28	0.52	1.29	4.24	113.11	1.03E+
Mercaptan sulfur, ppm	80.90			119.90	19.10			
Nitrogen, ppm		0.00	0.00	0.50	18.40	97.30	1,521.50	7,854.
CCR, wt%	11.69					0.00	0.85	27.
N-Heptane Insolubles (C7 Asphaltenes), wt%								19.
Nickel, ppm	61.90					0.00	0.10	155.
Vanadium, ppm	157.70					0.00	0.40	384.
Calcium, ppm	1.60							
Reid Vapor Pressure (RVP) Whole Crude, psi	5.80							
Heat of Combustion (Gross), BTU/lb	18,211							
Heat of Combustion (Net), BTU/lb	17,150	19,316	19,029	18,674	18,358			
Hydrogen Sulfide (dissolved), ppm	0.00							
Salt content, ptb	10.60							
Paraffins, vol %		100.00	93.80	52.93	21.39	12.19	7.21	
Naphthenes, vol %		0.00	5.90	35.55	56.48	50.02	27.26	
Aromatics (FIA), vol %				11.51	12.87			
Distillation type, D-	1160	86	86	86	86	86	1160	11
ASTM IBP, F		21.7	86.8	204.1	365.8	508.1	691.7	1,040.
5 vol%, F		28.0	91.1	207.8	370.8	514.1	696.9	1,040.
10 vol%, F		33.5	94.7	209.0	373.2	517.8	711.8	1,065.
20 vol%, F		33.4	94.6	212.5	379.9	526.3	742.1	1,104.
30 vol%, F		36.9	96.1	217.9	387.9	535.4	773.9	1,145.
40 vol%, F		39.4	99.2	225.5	396.7	545.2	806.1	1,185.
50 vol%, F		41.4	102.5	234.5	404.1	553.3	837.4	1,235.
60 vol%, F		45.0	105.8	246.1	412.4	562.3	865.8	1,280.
70 vol%, F		48.1	110.8	259.1	420.2	571.4	892.8	1,333.
80 vol%, F		50.4	119.6	273.1	428.7	581.0	919.0	1,378.
90 vol%, F		48.9	129.8	287.3	436.8	590.6	941.6	1,415.
95 vol%, F		48.4	137.2	295.2	441.6	596.0	955.3	1,437.
ASTM EP, F		49.3	149.0	307.2	445.5	600.5	971.5	1,460.
Freeze point, F					-96.90	-33.40		
Smoke point, mm					20.10			
Naphthalenes (D1840), vol%					0.70			
Viscosity at 100C/212F, cSt		0.19	0.21	0.35	0.74	1.68	12.32	205,965.
Viscosity at 150C/302F, cSt		0.15	0.17	0.26	0.50	0.96	3.86	2,227.
Cetane Index 1990 (D4737),		111.90	58.30	30.90	34.80	37.80	33.70	10.
Cloud point, F					-105.00	-42.00		
Aniline pt, F					129.40	127.50	141.00	

**57 oxygenated compounds used for analysis**

DIMETHYL ETHER  
METHYL ETHYL ETHER  
ACETALDEHYDE  
METHYL FORMATE  
DIETHYL ETHER  
N-PROPIALDEHYDE  
ACROLEIN  
ETHYL FORMATE  
METHYL-TERT-BUTYL ETHER  
ACETONE  
METHYL ACETATE  
METHANOL  
TETRAMYOROFURAN  
METHACROLEIN  
VINYL ACETATE  
N-BUTYRALDEHYDE  
ETHYL ACETATE  
ETHANOL  
METHYL ETHYL KETONE  
N-PROPYL FORMATE  
ISOPROPANOL  
TERT-BUTANOL  
ISOPROPYL ACETATE  
N-PROPANOL  
SEC-BUTANOL  
FORMIC ACID  
N-PROPYL ACETATE  
DIETHYL KETONE  
2-METHYL-2-BUTANOL  
METHYL-N-PROPYL KETONE

METHYL N-BUTYRATE  
TRANS-CROTONALDEHYDE  
ISOBUTANOL  
3-METHYL-2-BUTANOL  
METHYL ISOBUTYL KETONE  
N-BUTANOL  
ACETIC ACID  
2-PENTANOL  
N-BUTYL ACETATE  
METHYL-N-BUTYL KETONE  
2-METHYL-1-BUTANOL  
4-METHYL-2-PENTANOL  
1-PENTANOL  
PROPIONIC ACID  
N-PENTYL ACETATE  
2-METHYLPROPIONIC ACID  
FURFURAL  
N-BUTYRIC ACID  
3-METHYLBUTYRIC ACID  
PHENOL  
N-PENTANOIC ACID  
1,2-PROPYLENE GLYCOL  
O-CRESOL  
P-CRESOL  
M-CRESOL  
N-HEXANOIC ACID  
DIETHYLENE GLYCOL  
TETRAETHYLENE GLYCOL