Lube oil consumption is same as Section 6-11.

Engine Oil	14,400 liter
NaOH Production	60,739 ton
Unit Lube Oil Consumption	0.237 lit/ton

Lube Oil Consumption in 1983 and 1993

(Unit: kl)

	1983	1993
Engine Oil	0	13

CONCLUSION OF "7" NEW PROJECT

LUBRICATING OIL CONSUMPTION (2)
NEW PROJECT

		1993 Consumption Date	Lubricating Oil Consumption (kl) Engine Oil	Industrial Oil	Grease	Total	Production
7-1	Gas Separation	Nov. 1984	82.0	58.46	0.13	140.59	C_2 358,000 ton, C_3 223,000 ton, LPG 250,000 ton, NGL 83,000 ton
7-2	Fertilizer	Oct. 1986	13.0	381.0	6.0	400.0	Ammonia 267,300 ton, Urea 297,000 ton, Sulfuric acid 647,460 ton Phosphoric acid 213,840 ton, Ammonium phosphate and Compound fertilizer 632,610 ton
7-3	Rock Salt	July 1985	106.0	398.0	27.0	531.0	Rock salt 1,800,000 ton
7-4	Soda Ash	July 1985	28.0	111.0	0.7	139.7	Soda ash 400,000 ton
7-5	Petro-chemical	1987	-	236.0	0.64	236.64	Ethylene 300,000 ton, Propylene 73,000 ton, LDPE 73,500 ton, HDPE 110,000 ton, VCM 80,000 ton, EG 50,000 ton, PP 70,000 ton
7-6	Caustic Soda	1987	13.0	-	-	13.0	Caustic soda 55,000 ton
	Total		242.0	1,184.46	34.47	1,460.93	

OVERALL LUBRICATING OIL CONSUMPTION FOR INDUSTRY

LUBRICATING OIL CONSUMPTION INDUSTRY

	Item	Lube Oil Consumption (kl)							
		1983				1993			
		Engine Oil	Industrial Oil	Grease	Total	Engine Oil	Industrial Oil	Grease	Total
1									
2	Transportation	1,829.5	504.6	0.32	2,334.4	3,273.0	442.2	0.18	3,715.4
3	Agriculture, Fishery, Forest, Cold Storage	12,873.1	6,660.0	-	19,533.1	20,447.1	11,871.0	-	32,318.1
4	Construction	403.0	1,210.0	-	1,613.0	793.0	2,380.0	-	3,173.0
5	Electric Power Generation	257.0	298.0	-	555.0	257.0	550.0	-	807.0
6	Manufacturing	531.1	3,124.2	300.6	3,955.9	841.2	5,281.7	547.7	6,670.6
7	New Project	0	0	0	0	242.0	1,184.46	34.47	1,460.93
	Lube Oil	15,893.7	11,796.8	300.92	27,991.4	25,853.3	21,709.4	582.3	48,145.0
	as Base Oil	14,622	10,853	238	25,713	23,785	19,973	461	44,219

Table AII-1-1 DATA OF VEHICLES

Table AII-1-1(1) Passenger Car

a) Past registered number of passenger car

(unit: 1,000)

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
221.8	235.0	240.1	250.9	270.5	290.4	298.4	331.3	362.4	387.3	393.0

1981	1982
429.0	440.5

b) Regression equation of number of passenger car

30.0665 + 0.00126575 x GDPR

c) Estimation of number of passenger car

(unit: 1,000)

	1986	1991	1993	1996	2001
Estimated number	549.5	741.0	819.6	937.4	1,188.1

d) Average km per year (km/veh/year)

16,000 km/veh/year

e) Kilometer per liter fuel (km/lit.)

Gasoline	8.0 km/l
Diesel	9.2 km/l

f) Sales record of passenger car (Including Taxi)

1975	1976	1977	1978	1979	1980	1981	1982	1983
12,692	14,458	25,767	23,125	21,785	26,739	27,088	29,352	32,966

g) Interval of oil exchange: 5,000km in 1983 and 7,000km in 1993

Table AII-1-1(2) Truck

a) Past registered number of Truck

(unit: 1,000)

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
135.7	147.2	159.1	179.4	232.4	238.1	285.2	345.5	368.4	417.2	365.8

1981	1982
413.1	466.7

b) Regression equation of number of truck

$-135.5579 + 0.0018571 \times GDPR$

c) Estimation of number of truck

(unit: 1,000)

	1986	1991	1993	1996	2001
Total	626.5	907.4	1,022.7	1,195.6	1,563.4
Heavy	81.4	118.0	133.0	155.4	203.2
Small	545.1	789.4	889.7	1,040.2	1,360.2

d) Average km per year (km/veh/year)

Heavy truck 80,000
Small truck 18,000

Small truck is used as small bus in Thailand, therefore consultant estimates 100,000 km/veh/year instead of 18,000.

e) Kilometer per liter fuel (km/lit.)

Heavy truck
Diesel 3.2 km/l

Small truck
Gasoline 6.14 km/l
Diesel 7.7 km/l

f) Sales record of truck

	1975	1976	1977	1978	1979	1980	1981	1982	1983
Heavy	4,462	7,277	10,147	7,696	7,297	5,262	6,425	5,355	7,057
Medium	2,241	2,978	4,372	4,042	3,899	3,034	3,535	2,826	4,118
Small	40,206	45,856	58,857	52,525	54,889	51,991	51,287	54,813	73,529
Total	46,909	56,111	13,376	64,263	66,045	60,267	61,247	62,994	84,704

Table AII-1-1(3) Motor Cycle

a) Past registered number of motor cycle

(unit: 1,000)

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
337.6	363.6	376.2	408.2	458.6	479.5	511.5	645.7	714.1	793.3	915.8

1981	1982
1,136.7	1,047.4

b) Regression equation of number of motor cycle

-355.4303 + 0.00432586 x GDPR

c) Estimation of number of motor cycle

(unit: 1,000)

	1986	1991	1993	1996	2001
Estimated number	1,419.9	2,074.2	2,342.7	2,745.5	3,602.2

d) Average km per year (km/veh/year)

12,000 km/veh/year

e) Kilometer per liter fuel (km/lit.)

Gasoline 31.0 km/l

Table AII-1-1(4) Bus

a) Past registered number of buses

(unit: 1,000)

1970	1971	1972	1973	1974	1975	1976	1977	1978
18,715	18,302	20,153	21,573	22,050	22,717	19,603	27,425	28,127
1979	1980	1981						
28,424	29,913	31,402						

Source: Police Registration Department

b) Estimation of number of buses

Number of bus will not be increased in future and Consultant estimates number of buses in 1993 as 30,000 which is the same one in 1981.

c) Average km per year (km/veh/year)

65,000 km

Table AII-1-1(5) Taxi

a) Past registered number of Taxi

1975	1976	1977	1978	1979	1980	1981
15,724	20,902	20,247	18,430	19,191	18,682	N.A.

Include interurban serviced cars and non exceed 7 person commercial cars.

b) Historical data shows that number of Taxi will be constant in future.

c) Estimate of number of Taxis will be constant and 19,000 by 2001.

d) Average km per year (km/veh/year) 120,000 km/veh/year

Table AII-1-1(6) Tricycle

a) Past registered number of Tricycle

1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
6,984	2,889	9,960	8,043	8,016	6,419	8,124	8,556	8,635	9,014

1980	1981
9,066	8,679

b) Historical data shows that number of Tri-cycle will be constant in future.

c) Estimated number of Tri-cycle number of Tri-cycle will be constant and 9000 by 2001.

d) Average km per year (km/veh/year) 80,000 km/veh/year.

Table AII-1-2 CRUDE OIL IMPORT SOURCE FOR THAILAND

	1) 1982	2) 1983	3) 1993
Saudi Arabia	5,609	6,058	8,974
Qatar	686	741	1,098
Dubai	103	111	165
Oman	105	113	168
UAE	65	70	104
Malaysia	1,412	1,525	2,259
Brunei	447	483	715
China	116	125	186
	8,543	9,226	13,669

Notes: 1) Source: OIL AND THAILAND 1982
2) After 1983, import crude oil is corresponding to CRUDE OIL TOPPING CAPACITY (Sources: NEA's Base Data and EMP - scenario 1 which are collectively referred as NEA.)
3) CRUDE OIL TOPPING CAPACITY (Source: EMP) has no data for after 1992, thus it is assumed that crude oil import in and after 1993 is as same as in 1992.

Table AII-1-3 ESTIMATED LUBE OIL CONSUMPTION FOR TRANSPORTATION OF IMPORTED CRUDE OIL IN 1982

Export Country	Imported Crude Volume ('000kl) 1)	Tanker Size (DWt)	Specific Gravity of crude	Cargo Capacity (kl)	Engine capacity (ps)	Sailing Speed (kn/hr)	Distance (nm)	Lube Oil Consumption (cc/HP.hr)	Sailing Time for Round trip (hr/voyage)	Number of Voyage per year	Lube Oil Consumption 3) (kl/y)
Saudi Arabia	5,609.4	90,000	0.87	93,100	21,600	13	4,509	0.16	693.7	60.2	144
Qatar	685.8	90,000	0.84	96,400	21,600	13	4,509	0.16	693.7	7.1	17
Dubai	103.0	90,000	0.87	93,100	21,600	13	4,293	0.16	660.0	1.1	3
Oman	105.2	90,000	0.84	96,400	21,600	13	4,186	0.16	644.0	1.1	3
UAE	65.2	90,000	0.82	97,600	21,600	13	4,368	0.16	697.0	0.7	2
Malaysia	1,411.7	60,000	0.78	62,000	13,200	13	824	0.16	126.8	23.0	6
Brunei	447.0	60,000	0.90	60,000	13,200	13	1,072	0.16	165.0	7.5	3
(China	115.5) 2)										
Total	8,427.3 (8,542.8)										178

Notes: 1) Source: OIL AND THAILAND 1982
2) Lube oil requirement for crude oil import from China is assumed to be supplied by China.
3) As of 1982, lube oil requirements except China have been fulfilled by Thailand, but after 1993, it is assumed that all of lube oil requirements in Middle East will be supplied by Saudi Arabia.

Table AII-1-4 ESTIMATED LUBE OIL CONSUMPTION FOR TRANSPORTATION OF IMPORTED PETROLEUM PRODUCTS IN 1982

Export Country	Imported Fuel 1) ('000kl)	Imported Lube Oil & Base Oil 2) ('000kl)	Total ('000kl)	Tanker Size (DWt)	Cargo Capacity (kl)	Engine Capacity (ps)	Sailing Speed (kn/hr)	Distance (nm)	Lube Oil Consumption (cc/HP.hr)	Sailing Time for Round Trip (hr/voyage)	Number of Voyage Per Year	Lube Oil consumption (kl/y)
Singapore	1,509	93	1,602	24,000	24,400	17,600	13	844	0.16	130.0	62.0	22.7
				2,000 3)	2,000	2,000	13	844	0.16	130.0	47.0	2.0
Middle East	301	-	301	25,000	24,400	17,600	13	4,509	0.16	693.7	12.8	24.0
Japan	94	8	102	2,000	2,000	2,000	13	3,015	0.16	464.0	15.0	7.6
China	162	26	188									
Philippines	40	-	40	2,000	2,000	2,000	13	633	0.16	97.3	20.0	0.6
Australia	40	14	54	2,000	2,000	2,000	13	5,084	0.16	782.0	27.0	13.2
USA	56	3	59	2,000	2,000	2,000	13	8,967	0.16	1,380.0	30.0	6.8
Netherland	-	9	9	2,000	2,000	2,000	13	5,920	0.16			1.3
Total	2,040	127	2,167									78.2
	2,202	153	2,355	(Including China)						(Lube Oil supply by Thailand		51.1) 4)

Notes: 1) Source: *OIL AND THAILAND*. Fuel includes LPG, gasoline, jet fuel, kerosene, diesel oil and fuel oil.
Small imports are omitted, actual total import in 1982 was 2,999,000 kl.
2) Source: Thai Customs
Small lube oil and base oil import sources are omitted, actual total import in 1982 was 162,000 kl.
3) Tanker size for lube oil and base oil from Singapore.
4) Lube oil supply share by Thailand in 1982. (For transportation of imported petro-products for Thailand.)

Origin of cargo	share (%)
From Middle East	100
From China	0
From other countries	50

Table AII-1-5 ESTIMATED LUBE OIL SUPPLY BY THAILAND REQUIRED FOR TRANSPORTATION OF PETRO-PRODUCTS IMPORTED TO THAILAND FROM 1982 THROUGH 1993

(Unit: 1000kl)

	Fuel Oil				Lube Oil & Base Oil		
	Demand (A)	Domestic Production (B)	Import (1) (C)	Import (2) (D)	Import (1) (E)	Import (2) (F)	Total Import
	1)	2)	3)	4)	5)	6)	7)
1982	11.136	8.822	2.314	1.241	162	68	1.309
1983	11.289	8.822	2.467	1.323	178	75	1.398
1984	11.443	8.822	2.621	1.350	166	70	1.420
1985	11.600	9.501	2.099	1.096	169	71	1.167
	1)						
1986	11.759	10.187	1.572	843	171	72	915
1987	12.357	10.802	1.555	834	180	76	910
1988	12.985	10.802	2.183	1.171	189	79	1.250
1989	13.645	10.802	2.843	1.525	198	83	1.608
1990	14.339	13.023	1.316	706	209	88	794
	1)						
1991	15.068	13.023	2.045	1.097	219	92	1.189
1992	16.426	13.023	3.403	1.825	0	0	1.825
1993	17.906	13.023	4.883	2.619	0	0	2.619

Notes: 1) Source: Demand for petroleum products derived from EMP

2) Source: OIL AND THAILAND 1982
After 1983, estimated domestic production of fuel is corresponded to crude oil topping capacity (Source: NEA).

3) (A)-(B).
Actual fuel import was 2,299,000 kl in 1982 (Source: OIL AND THAILAND 1982).

4) The fuel import for which required lube oil is supplied by Thailand.
Middle East 100%, China 0%, other countries 50%.
(2,314 (Total)-331 (Middle East)-162 (China))/2+331=1,241 kl (In 1982)
After 1983, it is assumed to correspond to fuel import 1).

5) Lube oil and base oil imports in 1982 are based on the Customs data, and after 1983, it is assumed to correspond to fuel oil demand.

6) The lube oil and base oil import for which required lube oil is supplied by Thailand.

7) (D)+(F).
Total volume of fuel and lube oil (including base oil) import for which required lube oil is assumed to be supplied by Thailand.

Table AII-1-G AGRICULTURAL MACHINERIES IN USE AND GROWTH RATES

Description	1976	1977	1978	1979	1980	Average Annual Growth Rate (%)	Adjusted Average Annual Growth Rate (%)	
Power tillers	90,001	113,286	151,504	192,002	230,591	26.5	26.5	*
Mini-tractors	14,575	16,427	23,942	26,984	378,389	125.7	26.9	*
Large tractors	13,338	17,569	22,826	28,987	33,285	25.7	25.7	*
Motor rollers	9,882	9,000	8,700	8,200	8,000	-5.2	6.0	
Surveyors	1,310,464	1,379,436	1,452,038	1,528,461	1,604,884	5.2	5.2	
Diesel engines	56,891	68,219	81,923	89,775	107,730	17.3	17.3	*
Water pumps	251,288	277,084	317,328	359,306	473,975	17.2	17.2	*
Cleaning machines	42,342	47,423	53,114	59,488	66,806	12.1	12.1	
Corn threshing machines	5,721	6,407	7,175	8,036	9,000	12.0	12.0	*
Rice threshing machines	3,955	4,430	4,962	5,557	6,224	12.0	12.0	*
Feed mixing machines	374	419	469	525	588	12.0	12.0	
Windmills	1,937	2,169	2,429	2,721	3,047	12.0	12.0	
Sugar cane cutters	-	-	-	-	5	19.0	19.0	
Rice milling machinery	24,658	24,912	25,170	25,426	25,682	1.0	1.0	*

Source: Office of Agricultural Economics (OAE), Ministry of Agriculture & Co-operatives.

Notes: 1. Since the number of mini-tractors in 1980 is doubtfully corrected to 37,838.9 units. Growth rate after such adjustment is 26.9%.

2. The average growth rate of the motor rollers is minus 5.2%, however it is assumed to be 6% as per GDP growth rate in Thailand.

3. The average growth rates of total agriculture machinerie is assumed to be 5% till 1983, due to machinerization programe which is completed in 1983. Annual growth rate of agricultural production is 3% during Fourth Year Plan, but agricultural machinerie growth rate is expected to be more than 3%. Thus it is assumed to be 5%.

4. Water pump, corn threshing, rice threshing and rice milling machineries are assumed to use gasoline engines. Total units of such items in 1980 are 514,881 and weighted average annual growth rate is 16.3%.

5. By similar experience in Japan, major lube oil demand for agricultural equipment is caused by the items marked "*". Share of the other items, therefore, is assumed to be 20% in the total demand.

Table AII-1-7 ESTIMATED NUMBER OF AGRICULTURAL MACHINERIES FROM 1983 TO 1993

	Power Tillers		Mini-Tractor		Large-Tractor		Diesel Engine		Gasoline Engine	
	Growth Rate (%)	Number of Units	Growth Rate (%)	Number of Units	Growth Rate (%)	Number of Units	Growth Rate (%)	Number of Units	Growth Rate (%)	Number of Units
1983	26.5	466.782	26.9	77.326	25.7	66.108	17.3	173.872	16.3	810.872
1984	22.5	571.808	22.9	95.034	21.7	80.453	13.3	196.997	12.3	910.609
1985	18.5	677.592	18.9	112.995	17.7	94.694	9.1	214.924	8.3	986.190
1986	13.5	769.067	13.9	128.701	12.7	106.720	5.0	225.670	5.0	1.035.499
1987	8.5	834.438	8.9	140.156	7.7	114.937	5.0	236.954	5.0	1.087.274
1988	5.0	876.160	5.0	147.164	5.0	120.684	5.0	248.801	5.0	1.141.638
1989	5.0	919.968	5.0	154.522	5.0	126.718	5.0	261.241	5.0	1.198.720
1990	5.0	965.966	5.0	162.248	5.0	133.054	5.0	274.303	5.0	1.258.656
1991	5.0	1.014.265	5.0	170.361	5.0	139.707	5.0	288.018	5.0	1.321.588
1992	5.0	1.064.978	5.0	178.879	5.0	146.692	5.0	302.419	5.0	1.387.668
1993	5.0	1.118.227	5.0	187.823	5.0	154.027	5.0	317.540	5.0	1.457.051

Notes: Number of units for machineries are estimated from Table AII-1-5.

Table AII-1-8 ESTIMATED LUBE OIL CONSUMPTION BY AGRICULTURAL MACHINERIES IN 1983 AND 1993

	Machinery Units in 1983	Unit Lube Oil Consumption lit/Unit 3)		Lube Oil Consumption in 1983 (kl)		Machineries Units in 1993	Lube Oil Consumption in 1993 (kl)	
		Engine Oil	Gear Oil 1)	Engine Oil	Gear Oil 1)		Engine Oil	Gear Oil 1)
Power Tillers	466,782	4.2	2.8	1,960	1,307	1,118,227	4,697	3,131
Mini-Tractor	77,326	16.1	12.8	1,245	990	187,823	3,024	2,404
Large-Tractor	66,108	12.0	15.0	793	992	154,027	1,848	2,310
Diesel engine	173,872	1.6	-	278	-	317,540	508	-
Water Pump	810,872	1.6	-	1,297	-	1,457,051	2,331	-
Sub-total				5,573	3,289		12,408	7,845
				8,862			20,253	
Total 2)				6,688	3,947		14,890	9,114
				10,635			24,304	

Notes: 1) Industrial Oil
2) Added 20% of the sub-total as the consumption for other item of machines.
3) Source: The experience of Japan, but adjust to meet Thai condition.

Table AII-1-9 NUMBER OF TEXTILE MACHINES

	Number of Spinning Machine	Number of Weaving Machine	Number of Knitting Machine
1971	538,958	32,332	5,222
1972	637,720	34,589	6,929
1973	773,404	39,503	9,373
1974	838,060	46,140	15,533
1975	1,094,652	48,836	21,700
1976	1,112,248	51,020	29,512
1977	1,129,144	52,168	30,417
1978	1,168,596	54,008	31,617
1979	1,300,844	57,567	34,190
1980	1,298,368	57,511	29,907
1981	1,541,684	58,180	31,555
1982	1,512,748	51,338	32,531

Source: Japan Spinning and Weaving Association

Table AII-1-10 UNIT LUBE OIL CONSUMPTION OF SPINNING AND WEAVING

	Spinning lit/100,000 units		Weaving lit/1,000 units
Engine Oil	-		132
M.S spindle Oil	1,500		
		} 3,500	2,841
Industrial Oil	2,000		
Grease	700		27
Total	4,200		3,000

Source: Japanese company

ANNEX II-2

[redacted] AND PROJECTION FOR
[redacted] OIL, PETROLEUM PRODUCTS
[redacted] THE DERIVATIVES
[redacted] USED OIL

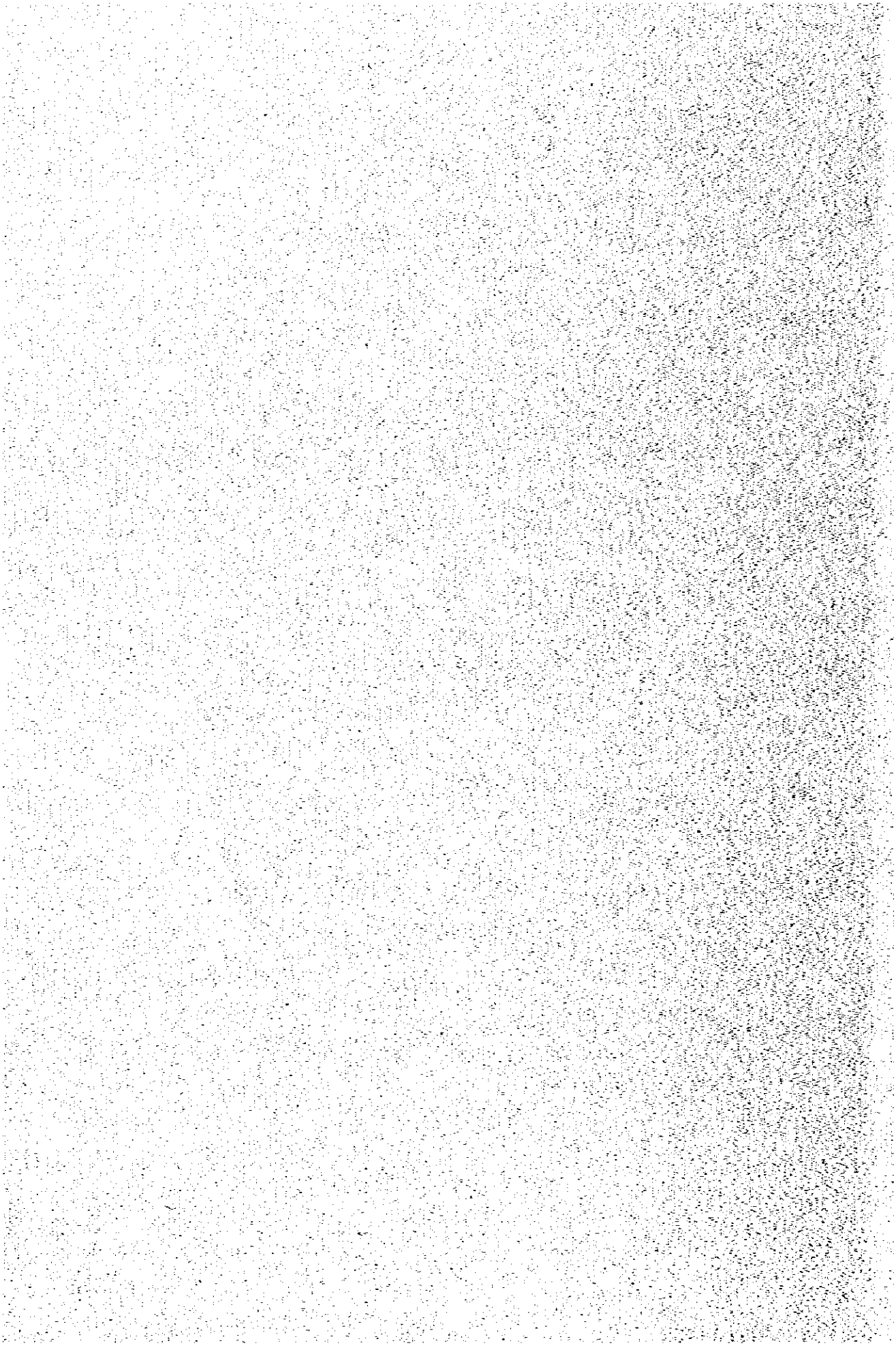


Table AII-2-1 ARABIAN LIGHT-34 FOB RAS TANURA PRICE (1975 - 1983)

Year	US$/BBL	US$/kl
1975	11.32	71.20
1976	11.51	72.39
1977	12.40	77.99
1978	12.70	79.88
1979	17.26	108.56
1980	28.68	180.39
1981	32.50	204.42
1982	34.00	213.85
1983	29.81	187.50

Table AII-2-2 PROJECTED ARABIAN LIGHT-34 FOB RAS TANURA PRICE (1984 - 2010)

Year	US$/BBL	US$/kl
1984	29.00	182.40
1985	29.00	182.40
1986	29.00	182.40
1987	31.47	197.94
1988	34.14	214.73
1989	37.04	232.97
1990	40.19	252.78
1991	43.61	274.29
1992	47.31	297.57
1993	51.33	322.85
1994	55.70	350.34
1995	60.43	380.09
1996	65.57	412.42
1997	71.14	447.45
1998	77.19	485.50
1999	83.75	526.76
2000	90.87	571.55
2001	98.59	620.10
2002	106.97	672.81
2003	116.07	730.05
2004	125.93	792.06
2005	136.64	859.42
2006	148.25	932.45
2007	160.85	1011.70
2008	174.52	1097.68
2009	189.36	1191.02
2010	205.45	1292.22

Assumptions:

	(Unit: % per annum) 1983-1986	1986-2010
Crude Oil:		
Real:	-5.0	2.5
Current:	0	8.5
Inflation:	5.0	6.0

Table AII-2-3 PETROLEUM PRODUCT CIF THAILAND PRICES (1979 - 1982)

(Unit: US$/kl)

Year	Premium Gasoline	Regular Gasoline	Kerosene	HSD	LSD	Fuel Oil
1979	115.84	115.84	112.13	104.94	104.94	75.79
1980	272.37	272.37	262.60	266.54	266.54	180.86
1981	270.37	270.37	283.34	266.33	266.33	204.77
1982	405.86	405.86	293.58	279.78	279.78	186.33

Source: Oil and Thailand 1982

Table AII-2-4 PETROLEUM PRODUCT FOB SINGAPORE PRICES (1975 - 1983)

(Unit: US$/kl)

Year	Premium Gasoline	Regular Gasoline	Kerosene	HSD	LSD	Fuel Oil	Bitumen
1975	112.67	112.67	91.70	82.79	82.79	72.82	91.78
1976	121.69	121.69	97.63	94.06	94.06	73.78	88.52
1977	132.89	132.89	106.07	103.12	103.12	81.63	94.34
1978	138.12	138.12	115.90	110.38	110.38	85.52	108.80
1979	164.47	152.12	144.45	140.70	140.70	103.35	135.18
1980	259.33	237.14	241.61	234.54	234.54	172.92	210.30
1981	290.15	271.08	285.35	266.59	266.59	213.51	255.58
1982	269.84	249.86	269.16	256.05	256.05	201.89	238.22
1983	256.30	230.84	243.80	234.74	234.74	187.85	212.75

Source: Singapore Trade Statistics

Table AII-2-5 PETROLEUM PRODUCT THAI EX-REFINERY PRICES (1975 - 1983) (1)

(Unit: Baht/lit.)

Year	Date	Arab Light (US$/BBL)	Premium Gasoline	Regular Gasoline	JP4	JP1	Kerosene	HSD	LSD	FO600"	FO1200"	FO1500"	FO2000"	FO2500"	Bitumen (Baht/kg)
1975	Jan. 1	10.463	2.1159	1.8744	1.7651	1.9613	1.8821	1.7587	1.6591	1.3964	1.3564	1.3433	-	-	1.1964
1975	Oct. 1	11.510	2.1159	1.8744	1.7651	1.9613	1.8821	1.7587	1.6591	1.3964	1.3564	1.3433	-	-	1.1964
1975	Dec. 1	11.510	2.2802	2.0378	1.9080	2.0941	2.0302	1.9495	1.8471	1.5237	1.4765	1.4610	-	-	1.1964
1977	Jan. 1	12.090	2.2802	2.0378	1.9080	2.0941	2.0302	1.9495	1.8471	1.5237	1.4765	1.4610	-	-	1.1964
1977	Mar. 2	12.090	2.3833	2.1305	1.9878	2.1207	2.0702	2.0322	1.9272	1.5813	1.5418	1.5289	-	-	1.1964
1977	Jul. 1	12.704	2.3833	2.1305	1.9878	2.1207	2.0702	2.0322	1.9272	1.5813	1.5418	1.5289	-	-	1.1964
1977	Sep. 1	12.704	2.4275	2.1877	2.0433	2.2006	2.1516	2.1085	2.0681	1.6712	1.6304	1.6174	-	-	1.1964
1979	Jan. 1	13.339	2.4275	2.1877	2.0433	2.2006	2.1516	2.1085	2.0681	1.6712	1.6304	1.6174	-	-	1.1964
1979	Feb. 1	13.339	2.6407	2.3977	-	-	2.3118	2.2264	2.2074	1.6956	1.6346	1.6147	-	-	1.1964
1979	Apr. 1	14.546	2.6407	2.3977	-	-	2.3118	2.2264	2.2074	1.6956	1.6346	1.6147	-	-	1.1964
1979	May 1	14.546	3.1528	2.9047	-	-	2.9284	2.7845	2.7547	2.0798	1.9975	1.9707	-	-	1.7485
1979	Jun. 1	18.000	3.1528	2.9047	-	-	2.9284	2.7845	2.7547	2.0798	1.9975	1.9707	-	-	1.7485
1979	Jul.14	18.000	3.7286	3.5564	-	-	3.5699	3.4282	3.3795	2.6584	2.5684	2.5387	-	-	2.2731
1979	Nov. 1	24.000	3.7286	3.5564	-	-	3.5699	3.4282	3.3795	2.6584	2.5684	2.5387	-	-	2.2731
1980	Jan. 1	26.000	3.7286	3.5564	-	-	3.5699	3.4282	3.3795	2.6584	2.5684	2.5387	-	-	2.2731
1980	Feb. 9	26.000	4.8475	4.5932	-	-	4.9121	4.7037	4.6417	3.3780	3.2562	3.2156	-	-	2.5488
1980	Mar.19	26.000	4.8475	4.5932	-	-	4.9121	4.7037	4.6417	3.3780	3.2562	3.2156	-	-	2.5488
1980	Apr. 1	28.000	4.8475	4.5932	-	-	4.9121	4.7037	4.6417	3.3780	3.2562	3.2156	-	-	2.5488
1980	May 23	28.000	5.0797	4.6698	-	-	5.3843	5.0227	4.8491	3.5150	3.3383	3.2813	-	-	2.5488
1980	Jun.16	28.000	5.2890	4.8785	-	-	5.3862	5.1369	5.0419	3.5126	3.3383	3.2825	-	-	2.5488
1980	Jul.21	28.000	5.3096	5.0564	-	-	5.6720	5.2502	5.2053	3.5706	3.3846	3.3245	-	-	2.5488
1980	Aug. 1	30.000	5.3096	5.0564	-	-	5.6720	5.2502	5.2053	3.5706	3.3846	3.3245	-	-	2.5488
1980	Aug. 6	30.000	5.4483	5.1912	-	-	5.6773	5.3966	5.2820	3.5974	3.4064	3.3437	-	-	2.7945
1980	Nov. 1	32.000	5.4483	5.1912	-	-	5.6773	5.3966	5.2820	3.5974	3.4064	3.3437	-	-	2.7945
1980	Nov. 7	32.000	5.5194	5.2164	-	-	5.7049	5.4363	5.3205	3.9233	3.7648	3.7134	-	-	3.3120
1980	Dec. 2	32.000	5.5606	5.2215	-	-	5.7105	5.4616	5.3449	4.1868	4.0552	4.0128	-	-	3.7278
1981	Jan.21	32.000	5.5606	5.2215	-	-	5.7105	5.4616	5.3449	4.1868	4.0552	4.0128	3.9695	3.9235	3.7278
1981	Feb. 5	32.000	5.8802	5.5199	-	-	6.2458	5.8439	5.7193	4.6876	4.5706	4.5323	4.4932	4.4536	4.3022
1981	Apr.30	32.000	5.9079	5.5258	-	-	6.1662	5.8591	5.7486	4.6882	4.5667	4.5278	4.4880	4.4465	4.2896
1981	Jun.30	32.000	5.8795	5.5296	-	-	6.0612	5.8522	5.7372	4.6420	4.5179	4.4773	4.4357	4.3925	4.2258
1981	Jul.31	32.000	6.4395	6.0246	-	-	6.6371	6.3841	6.2811	5.0342	4.8911	4.8457	4.7983	4.7495	4.5520
1981	Sep.16	32.000	6.4361	6.0180	-	-	6.6300	6.3766	6.2743	5.0230	4.8801	4.8347	4.7873	4.7372	4.5400
1981	Oct. 1	34.000	6.4361	6.0180	-	-	6.6300	6.3766	6.2743	5.0230	4.8801	4.8347	4.7873	4.7372	4.5400
1981	Nov.26	34.000	6.4367	6.0156	-	-	6.6300	6.3772	6.2737	4.7792	4.6091	4.5536	4.4962	4.4374	4.1367
1981	Dec. 2	34.000	6.4738	6.0156	-	-	6.6900	6.4073	6.2737	4.7377	4.5632	4.5063	4.4475	4.3872	4.0614
1982	Feb.18	34.000	6.2904	5.8352	-	-	6.6900	6.4073	6.2743	4.6015	4.4112	4.3496	4.2868	4.2209	3.8342
1982	Apr.30	34.000	6.0685	5.6010	-	-	6.4711	6.1691	6.0951	4.4495	4.2606	4.2008	4.1377	4.0732	3.7234
1982	Jul. 7	34.000	6.1134	5.6010	-	-	6.4711	6.1691	6.0951	4.4495	4.2606	4.2008	4.1377	4.0732	3.7234
1982	Aug. 1	34.000	6.0581	5.5918	-	-	6.4684	6.1660	6.0921	4.4472	4.2595	4.1991	4.1364	4.0717	3.7204
1983	Mar.14	29.000	6.0581	5.5918	-	-	6.4684	6.1660	6.0921	4.4472	4.2595	4.1991	4.1364	4.0717	3.7204
1983	Apr.11	29.000	5.3220	4.8587	-	-	5.6003	5.2288	5.1113	3.9304	3.7955	3.7518	3.7071	3.6606	3.5085

Source: Oil and Thailand 1982

Table AII-2-5. PETROLEUM PRODUCT THAI EX-REFINERY PRICES (1975 - 1983) (2)

(Unit: US$/kl)

Year	Date	Exchange Rate (Baht/US$)	Arab Light (US$/BBL)	Premium Gasoline	Regular Gasoline	JP4	JP1	Kerosene	HSD	LSD	FO600"	FO1200"	FO1500"	FO2000"	FO2500"	Bitumen (US$/MT)
1975	Jan. 1	20.355	10.463	103.9	92.1	86.7	96.4	92.5	86.4	81.5	68.6	66.6	66.0	-	-	58.8
1975	Oct. 1	20.355	11.510	103.9	92.1	86.7	96.4	92.5	86.4	81.5	68.6	66.6	66.0	-	-	58.8
1975	Dec. 1	20.355	11.510	112.0	100.1	93.7	102.9	99.7	95.8	90.7	74.9	72.5	71.8	-	-	58.8
1977	Jan. 1	20.375	12.090	111.9	100.0	93.6	102.8	99.6	95.7	90.7	74.8	72.5	71.7	-	-	58.7
1977	Mar. 2	20.375	12.090	117.0	104.6	97.6	104.1	101.6	99.7	94.6	77.6	75.7	75.0	-	-	58.7
1977	Jul. 1	20.375	12.704	117.0	104.6	97.6	104.1	101.6	99.7	94.6	77.6	75.7	75.0	-	-	58.7
1977	Sep. 1	20.375	12.704	119.1	107.4	100.3	108.0	105.6	103.5	101.5	82.0	80.0	79.4	-	-	58.5
1979	Jan. 1	20.45	13.339	118.7	107.0	99.9	107.6	105.2	103.1	101.1	81.7	79.7	79.1	-	-	58.5
1979	Feb. 1	20.45	13.339	129.1	117.2	-	-	113.0	108.9	107.9	82.9	79.9	79.0	-	-	58.5
1979	Apr. 1	20.45	14.546	129.1	117.2	-	-	113.0	108.9	107.9	82.9	79.9	79.0	-	-	85.5
1979	May 1	20.45	14.546	154.2	142.0	-	-	143.2	136.2	134.7	101.7	97.7	96.4	-	-	85.5
1979	Jun. 1	20.45	18.000	154.2	142.0	-	-	143.2	136.2	134.7	101.7	97.7	96.4	-	-	111.2
1979	Jul.14	20.45	18.000	182.3	173.9	-	-	174.6	167.6	165.3	130.0	125.6	124.1	-	-	111.2
1979	Nov. 1	20.45	24.000	182.3	173.9	-	-	174.6	167.6	165.3	130.0	125.6	124.1	-	-	110.4
1980	Jan. 1	20.59	26.000	181.1	172.7	-	-	173.4	166.5	164.1	129.1	124.7	123.3	-	-	123.8
1980	Feb. 9	20.59	26.000	217.9	223.1	-	-	238.6	228.4	225.4	164.1	158.1	156.2	-	-	123.8
1980	Mar.19	20.59	26.000	235.4	223.1	-	-	238.6	228.4	225.4	164.1	158.1	156.2	-	-	123.8
1980	Apr. 1	20.59	28.000	235.4	223.1	-	-	261.5	243.9	235.5	170.7	162.1	159.4	-	-	123.8
1980	May 23	20.59	28.000	246.7	226.8	-	-	261.6	249.5	244.9	170.6	162.1	159.4	-	-	123.8
1980	Jun.16	20.59	28.000	256.9	236.9	-	-	275.5	255.0	252.8	173.4	164.4	161.5	-	-	123.8
1980	Jul.21	20.59	28.000	257.9	245.6	-	-	275.5	255.0	252.8	173.4	164.4	161.5	-	-	123.8
1980	Aug. 1	20.59	30.000	257.9	245.6	-	-	275.7	262.1	256.5	174.7	165.4	162.4	-	-	135.7
1980	Aug. 6	20.59	30.000	264.6	252.1	-	-	275.7	262.1	256.5	174.7	165.4	162.4	-	-	135.7
1980	Nov. 1	20.59	32.000	264.6	252.1	-	-	277.1	264.0	258.4	190.5	182.8	180.3	-	-	160.9
1980	Nov. 7	20.59	32.000	268.1	253.3	-	-	277.3	265.3	259.6	203.3	196.9	194.9	-	-	181.0
1980	Dec. 2	20.59	32.000	270.1	253.6	-	-	247.7	236.9	231.9	181.6	175.9	174.1	172.2	170.2	161.7
1981	Jan.21	23.05	32.000	241.2	226.5	-	-	271.0	253.5	248.1	203.4	198.3	196.6	194.9	193.2	186.6
1981	Feb. 5	23.05	32.000	255.1	239.5	-	-	267.5	254.2	249.4	203.4	198.1	196.4	194.7	192.9	186.1
1981	Apr.30	23.05	32.000	256.3	239.7	-	-	263.0	253.9	248.9	201.4	196.0	194.2	192.4	190.6	183.3
1981	Jun.30	23.05	32.000	255.1	239.9	-	-	287.9	277.0	272.5	218.4	212.2	210.2	208.2	206.1	197.5
1981	Jul.31	23.05	32.000	279.4	261.4	-	-	287.6	276.6	272.2	217.9	211.7	209.7	207.7	205.5	197.0
1981	Sep.16	23.05	32.000	279.2	261.1	-	-	287.6	276.6	272.2	217.9	211.7	209.7	207.7	205.5	197.0
1981	Oct. 1	23.05	34.000	279.2	261.1	-	-	287.6	276.7	272.2	207.3	200.0	197.6	195.1	192.5	179.5
1981	Nov.26	23.05	34.000	279.2	261.0	-	-	290.2	278.0	272.2	205.5	198.0	195.5	193.0	190.3	176.2
1981	Dec. 2	23.05	34.000	280.9	261.0	-	-	290.2	278.0	272.2	199.6	191.4	188.7	186.0	183.1	166.3
1982	Feb.18	23.05	34.000	272.9	253.2	-	-	280.7	267.6	264.4	193.0	184.8	182.2	179.5	176.7	161.5
1982	Apr.30	23.05	34.000	263.3	243.0	-	-	280.7	267.6	264.4	193.0	184.8	182.2	179.5	176.7	161.5
1982	Jul. 7	23.05	34.000	265.2	243.0	-	-	280.6	267.5	264.3	192.9	184.8	182.2	179.5	176.6	161.4
1982	Aug. 1	23.05	34.000	262.8	242.6	-	-	280.6	267.5	264.3	192.9	184.8	182.2	179.5	176.6	161.4
1983	Mar.14	23.05	29.000	262.8	242.6	-	-	243.0	226.8	221.7	170.5	164.7	162.8	160.8	158.8	152.2
1983	Apr.11	23.05	29.000	230.9	210.8	-	-									

Source: Table AII-2-5 (1)

Table AII-2-6 LUBRICATING OIL AND BASE OIL PRICES/CIF THAILAND AND FOB SINGAPORE (1975 - 1983)

	Exchange Rate (Baht/US$)	CIF Thailand								FOB Singapore
		Lubricating Oil				Base Oil				
		kl	1,000 Baht	1,000 US$	US$/kl	kl	1,000 Baht	1,000 US$	US$/kl	Lubricating Oil (US$/kl)
1975	20.355	62.885	335.525	16.484	262.1	0	0	0	-	195.51
1976	20.375	78.393	433.562	21.279	271.4	0	0	0	-	219.16
1977	20.375	64.757	431.486	21.177	327.0	96.894	416.030	20.419	210.7	247.66
1978	20.315	64.045	366.045	18.019	281.3	71.696	309.784	15.249	212.7	268.77
1979	20.450	54.514	352.464	17.235	316.2	106.797	586.681	28.689	268.6	302.53
1980	20.590	29.190	292.492	14.206	486.7	132.029	1.074.607	52.191	395.3	492.81
1981	23.050	31.508	309.670	13.435	426.4	127.883	1.286.997	55.835	436.6	569.27
1982	23.050	52.060	615.196	26.690	512.7	78.480	849.603	36.859	469.7	527.60
1983										491.77

Sources: Oil and Thailand 1982. Singapore Trade Statistics

Table AII-2-7 BASE OIL PRICES BY TYPE/FOB SINGAPORE (1979 - 1984)

Year	Date	Arab Light (US$/BBL)	US Cent/gallon			US$/kl		
			150N	500N	150BS	150N	500N	150BS
1979	Jan.1	13.339	71.75	75.75	89.25	189.6	200.1	235.8
1979	Apr.1	14.546	76.75	81.25	95.00	202.8	214.7	251.0
1979	Jul.1	18.000	86.25	91.25	104.75	227.9	241.1	276.8
1979	Oct.1	18.000	106.00	111.50	124.50	280.1	294.6	328.9
1980	Jan.1	26.000	112.75	118.50	133.00	297.9	313.1	351.4
1980	Apr.1	28.000	129.50	143.50	161.50	342.1	379.1	426.7
1980	Jul.1	28.000	134.00	150.00	169.00	354.0	396.3	446.5
1980	Oct.1	30.000	134.00	150.00	169.00	354.0	396.3	446.5
1981	Jan.1	32.000	141.00	158.25	179.00	372.5	418.1	472.9
1981	Apr.1	32.000	154.50	173.25	195.50	408.2	457.7	516.5
1981	Jul.1	32.000	148.50	167.75	191.25	392.3	443.2	505.3
1981	Oct.1	34.000	148.50	167.75	191.25	392.3	443.2	505.3
1982	Jan.1	34.000	142.50	162.25	186.25	376.5	428.7	492.1
1982	Apr.1	34.000	142.50	162.25	186.25	376.5	428.7	492.1
1982	Jul.1	34.000	136.00	155.75	179.50	359.3	411.5	474.2
1982	Oct.1	34.000	133.50	152.25	176.00	352.7	402.2	465.0
1983	Jan.1	34.000	133.50	152.25	176.00	352.7	402.2	465.0
1983	Apr.1	29.000	129.00	147.75	171.50	340.8	390.4	453.1
1983	Jul.1	29.000	129.00	147.75	171.50	340.8	390.4	453.1
1983	Oct.1	29.000	129.00	147.75	171.50	340.8	390.4	453.1
1984	Jan.1	29.000	129.00	147.75	171.50	340.8	390.4	453.1

Source: Platt's Oilgram Price Report

Table AII-2-8 RELATION BETWEEN PETROLEUM PRODUCT PRICES AND CRUDE OIL PRICE

Regression Formula: $y = a + b x$

Where: y = Petroleum Product Thai Ex-refinery Price or FOB Singapore Price

x = Arab Light-34 FOB Ras Tanura Price

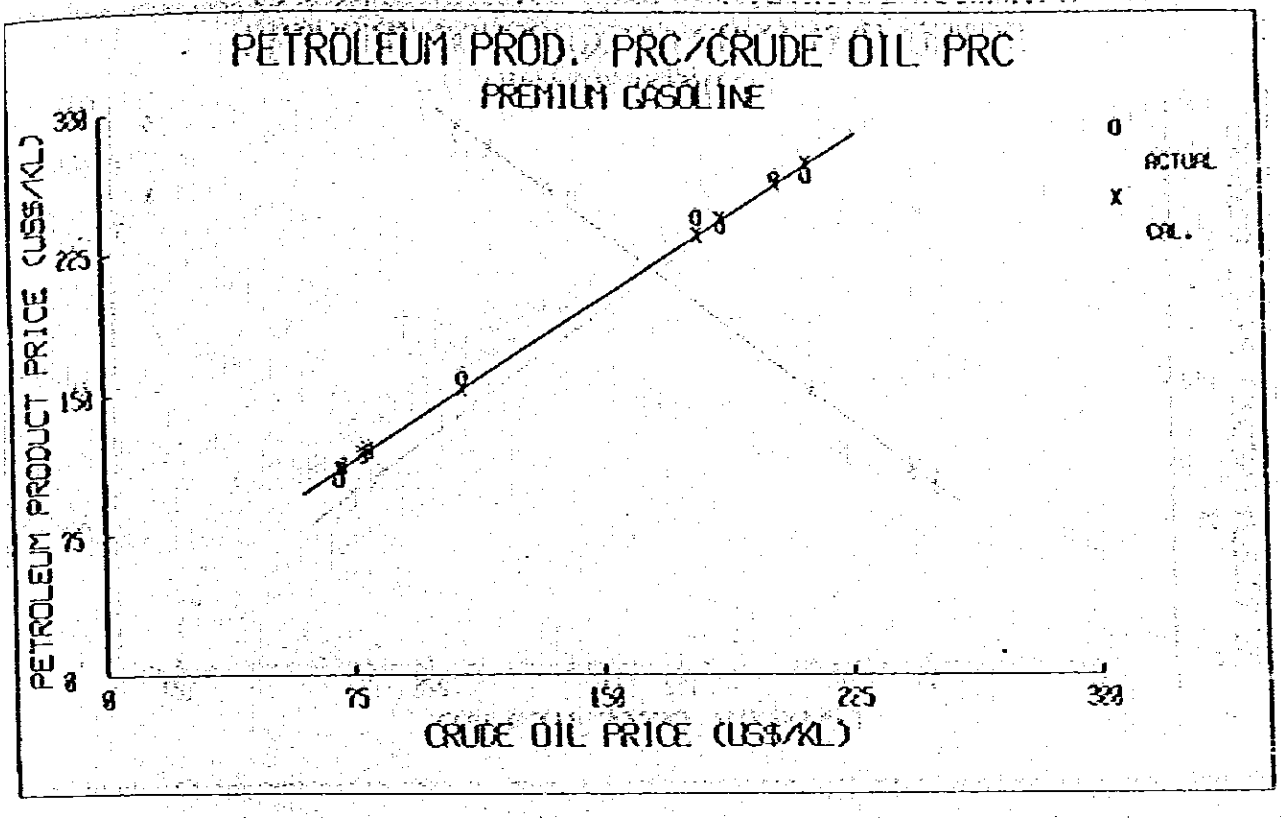
rr, r = Correlation Factor

	a	b	rr	r
Thai Ex-refinery Price				
Premium Gasoline	27.63160	1.152100	0.995441	0.997718
Regular Gasoline	20.10320	1.102650	0.989346	0.994659
Kerosene	-1.62640	1.360530	0.997914	0.998956
High Speed Diesel	0.41000	1.283850	0.997623	0.998811
Low Speed Diesel	-2.86441	1.278470	0.997243	0.998621
Fuel Oil 600"	7.29460	0.915455	0.991692	0.995837
Fuel Oil 1200"	8.00183	0.876861	0.989137	0.994554
Fuel Oil 1500"	8.30884	0.863767	0.988217	0.994091
Bitumen	-4.29613	0.915636	0.968501	0.984125
Bitumen *1	5.79817	0.876861	-	-
FOB Singapore Price				
Base Oil 150N	72.64960	1.441770	0.921062	0.959720
Base Oil 500N	48.35320	1.800550	0.923277	0.960873
Base Oil 150BS	59.52410	2.041200	0.923220	0.960844

Notes: 1. Thai Ex-refinery Price: See Table II-10.
FOB Singapore Price: See Table II-13.
Crude Oil Price (Arab Light-34 FOB Ras Tanura): See Tables II-10, Table AII-2-1.

*1 Adjusted by using equation of Fuel Oil 1200" and Bitumen price in 1975.

Figure AII-2-1 RELATION BETWEEN PETROLEUM PRODUCT EX-REFINERY PRICE AND CRUDE OIL PRICE (1)



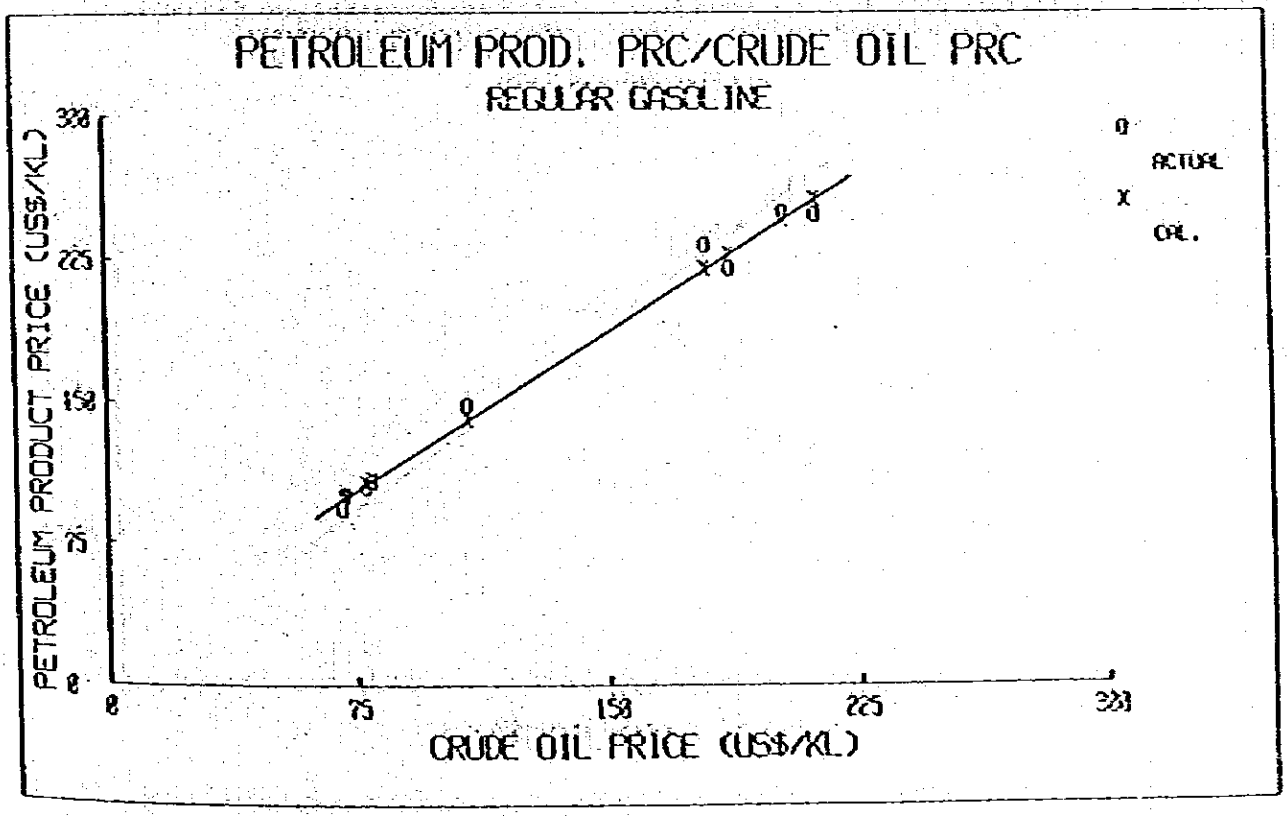


Figure AII-2-1 RELATION BETWEEN PETROLEUM PRODUCT EX-REFINERY PRICE AND CRUDE OIL PRICE (2)

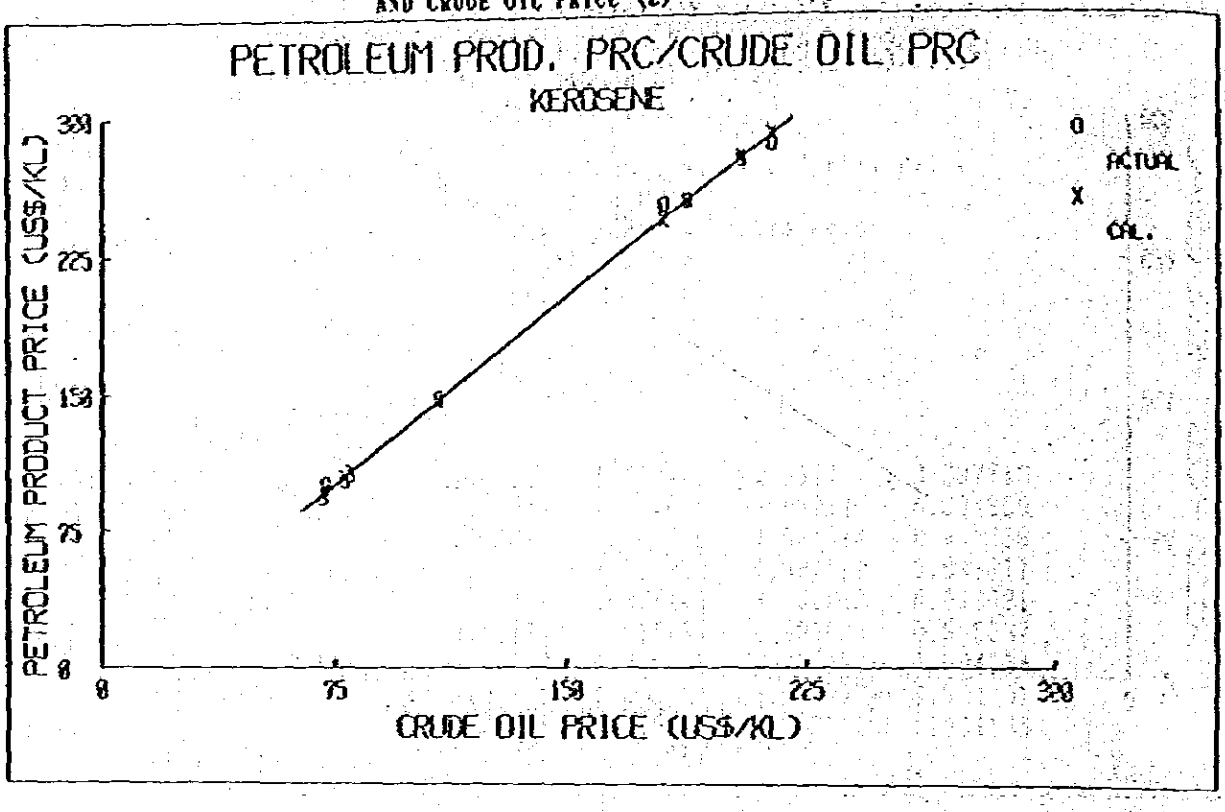
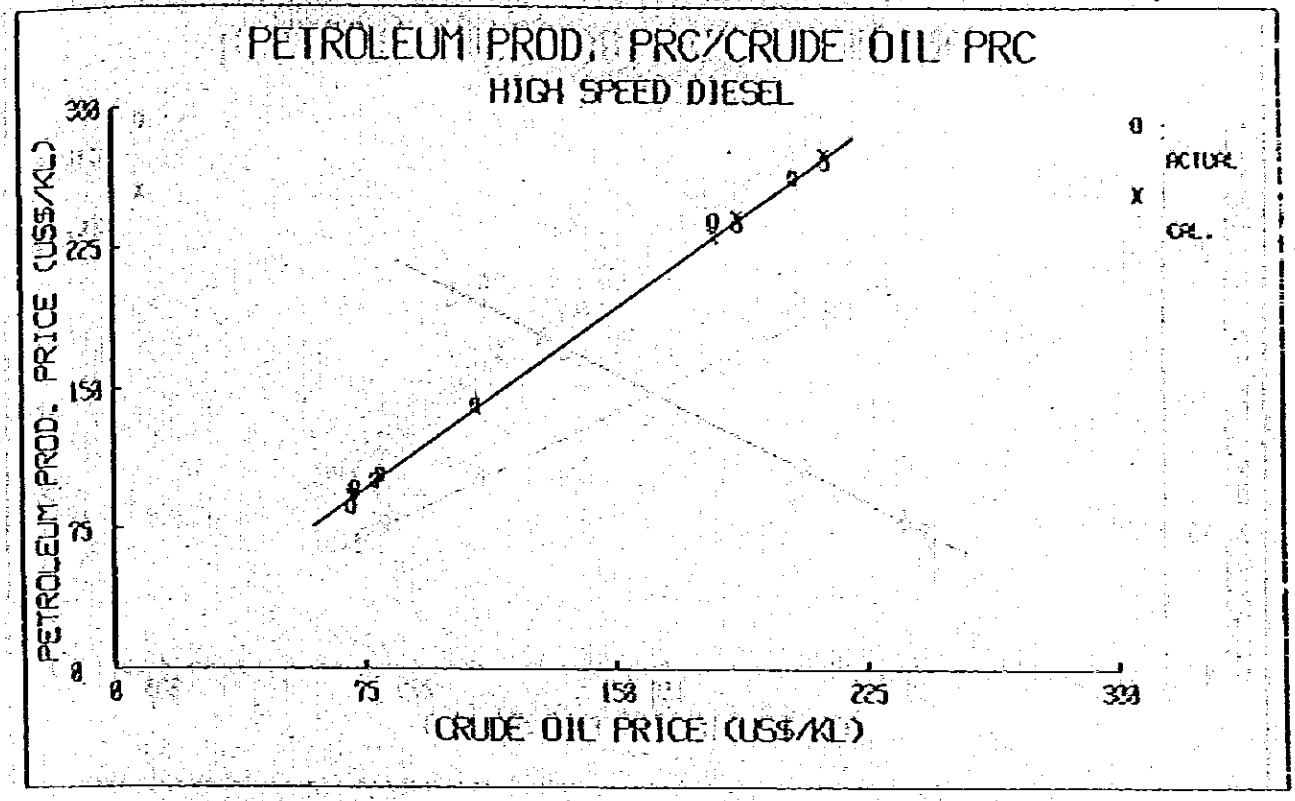


Figure AII-2-1 RELATION BETWEEN PETROLEUM PRODUCT EX-REFINERY PRICE AND CRUDE OIL PRICE (3)



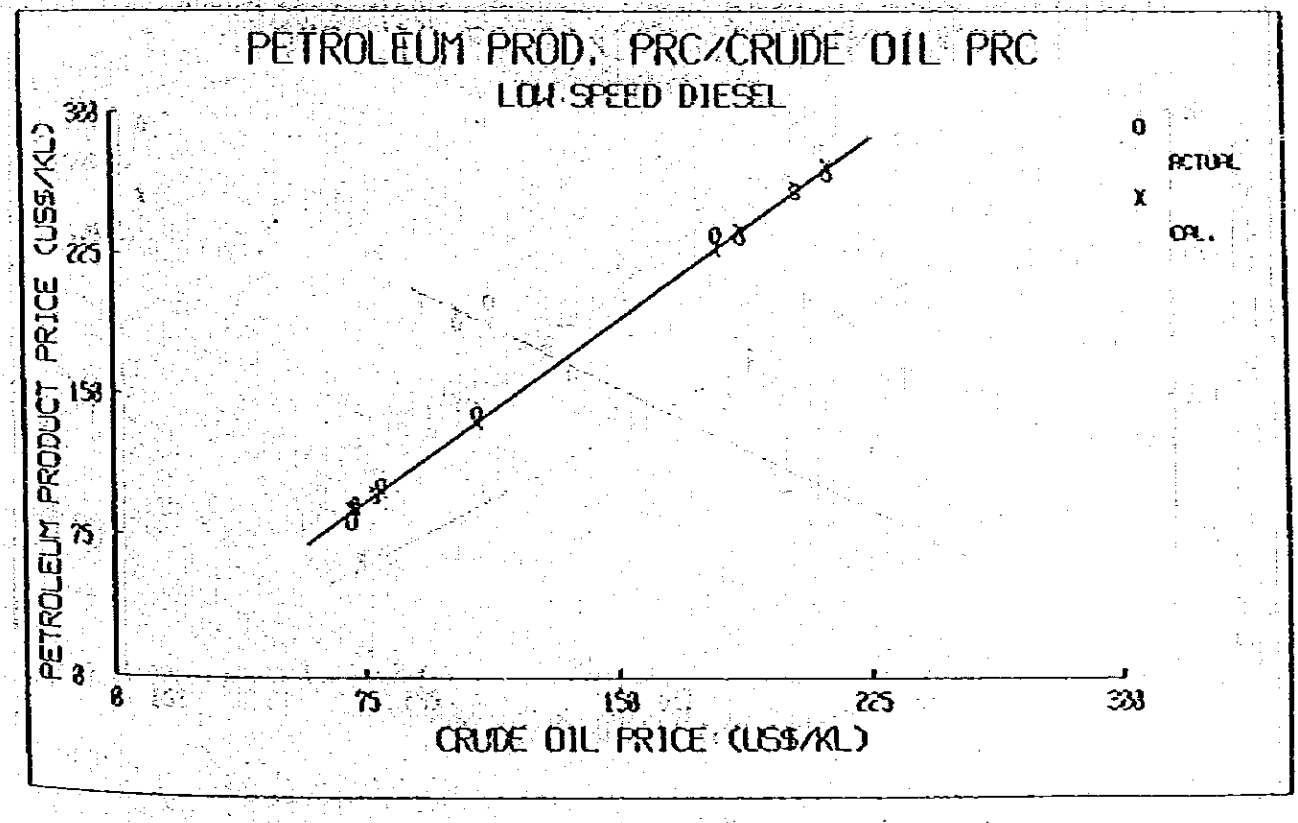
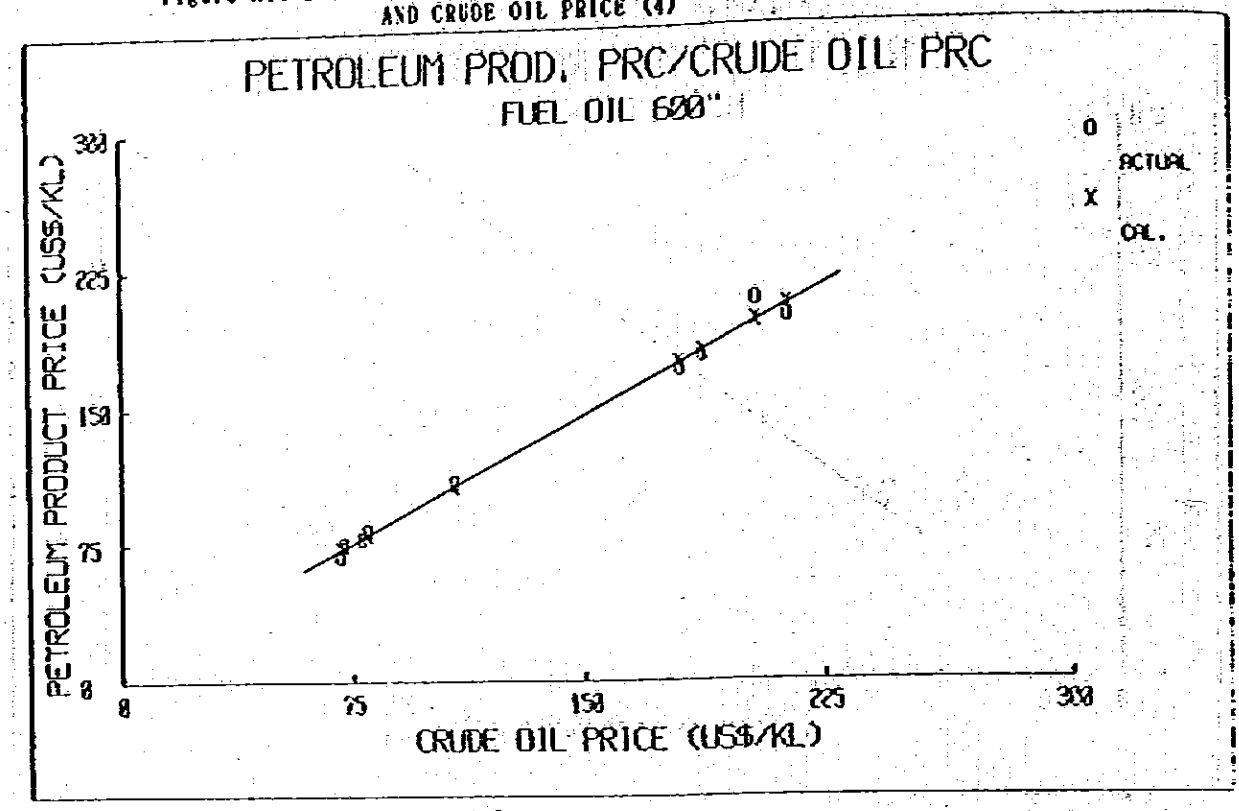


Figure AII-2-1 RELATION BETWEEN PETROLEUM PRODUCT EX-REFINERY PRICE AND CRUDE OIL PRICE (4)



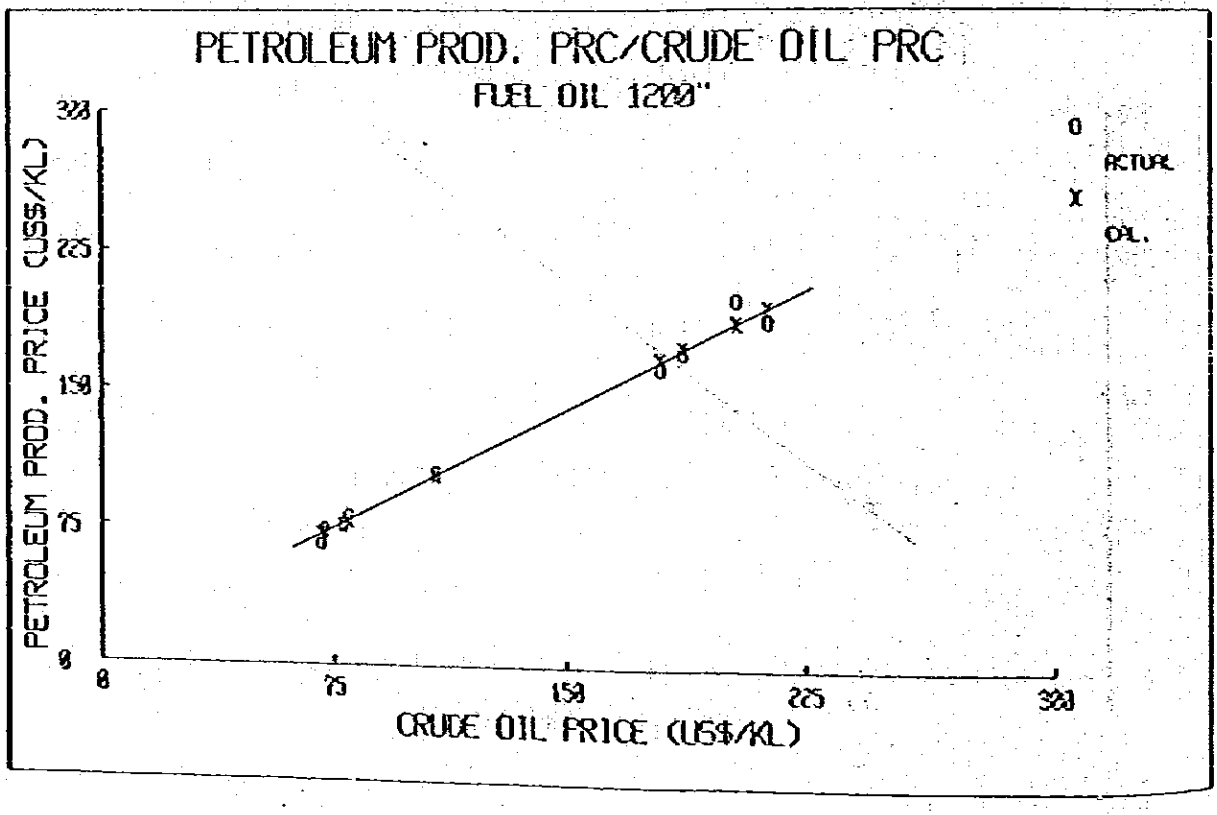
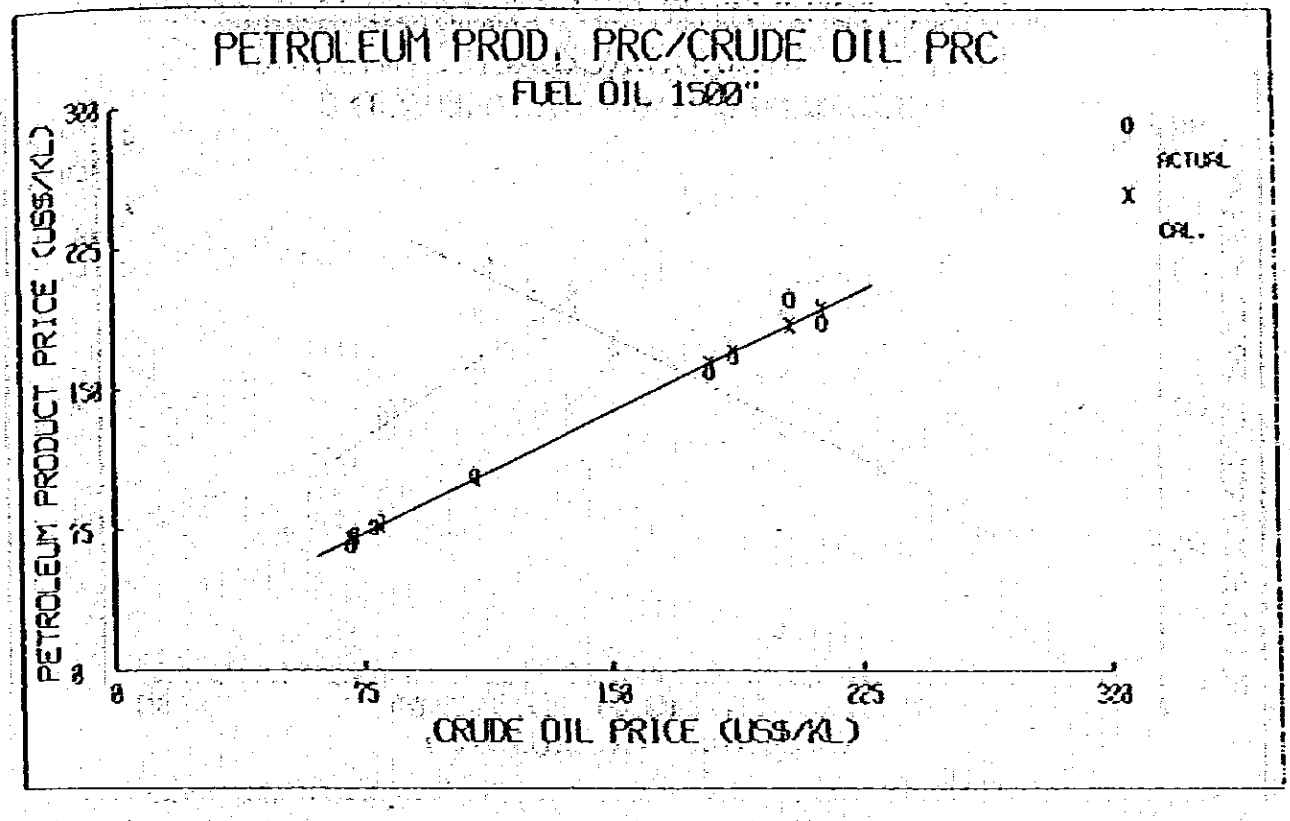


Figure AII-2-1 RELATION BETWEEN PETROLEUM PRODUCT EX-REFINERY PRICE AND CRUDE OIL PRICE (5)



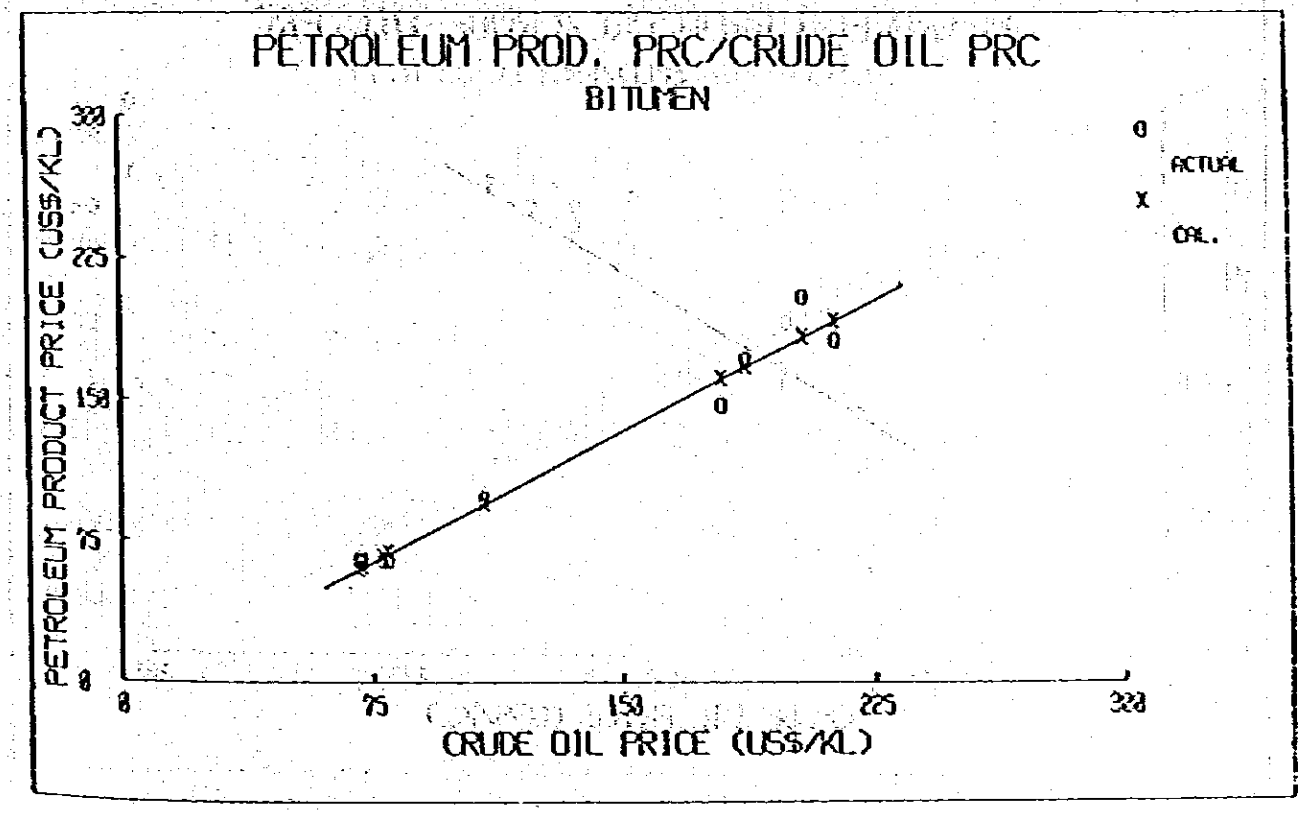
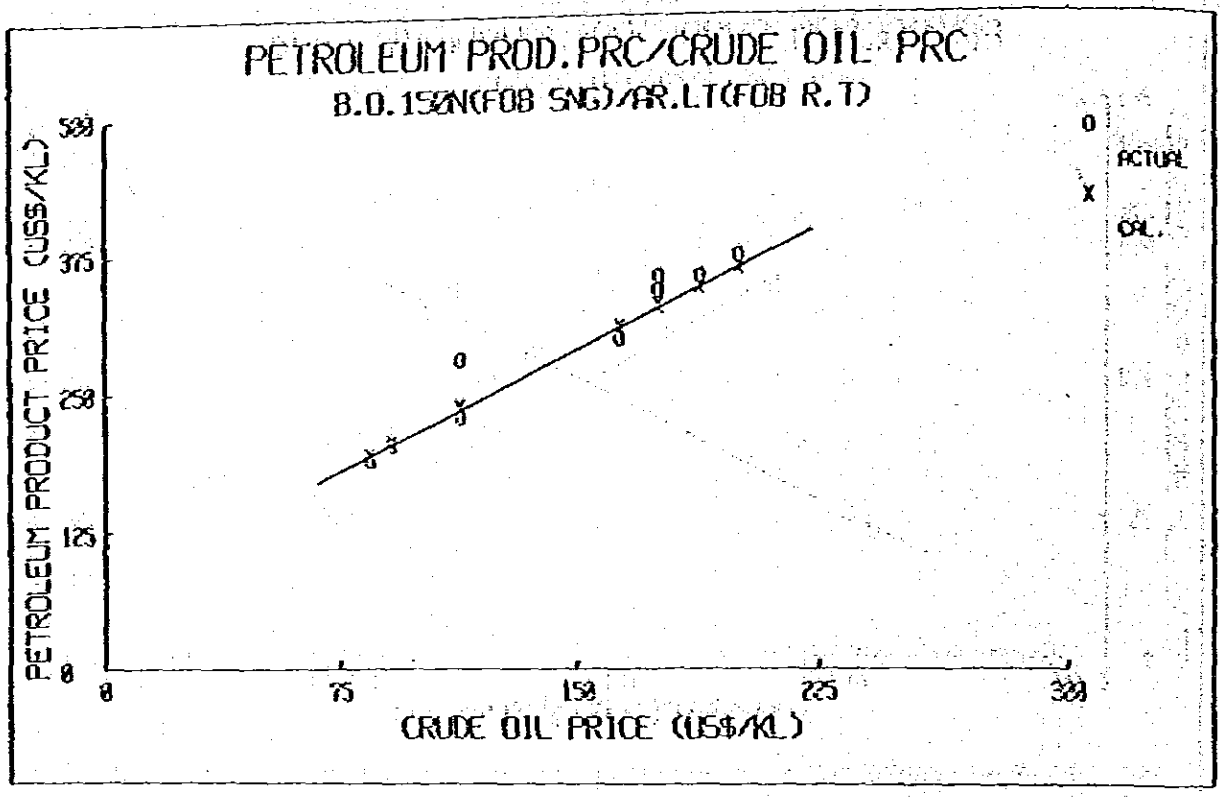


Figure AII-2-2 RELATION BETWEEN PETROLEUM PRODUCT FOB SINGAPORE AND CRUDE OIL PRICE (1)



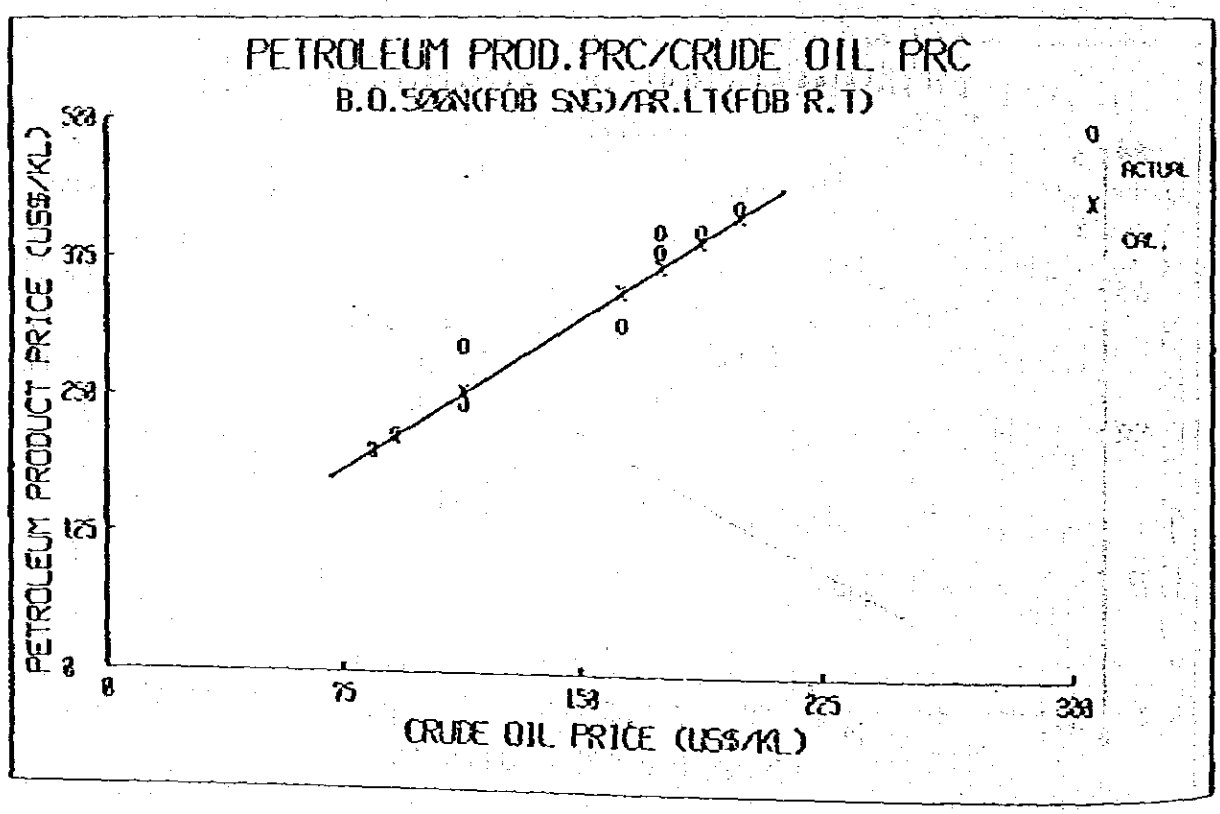


Figure AII-2-2 RELATION BETWEEN PETROLEUM PRODUCT FOB SINGAPORE AND CRUDE OIL PRICE (2)

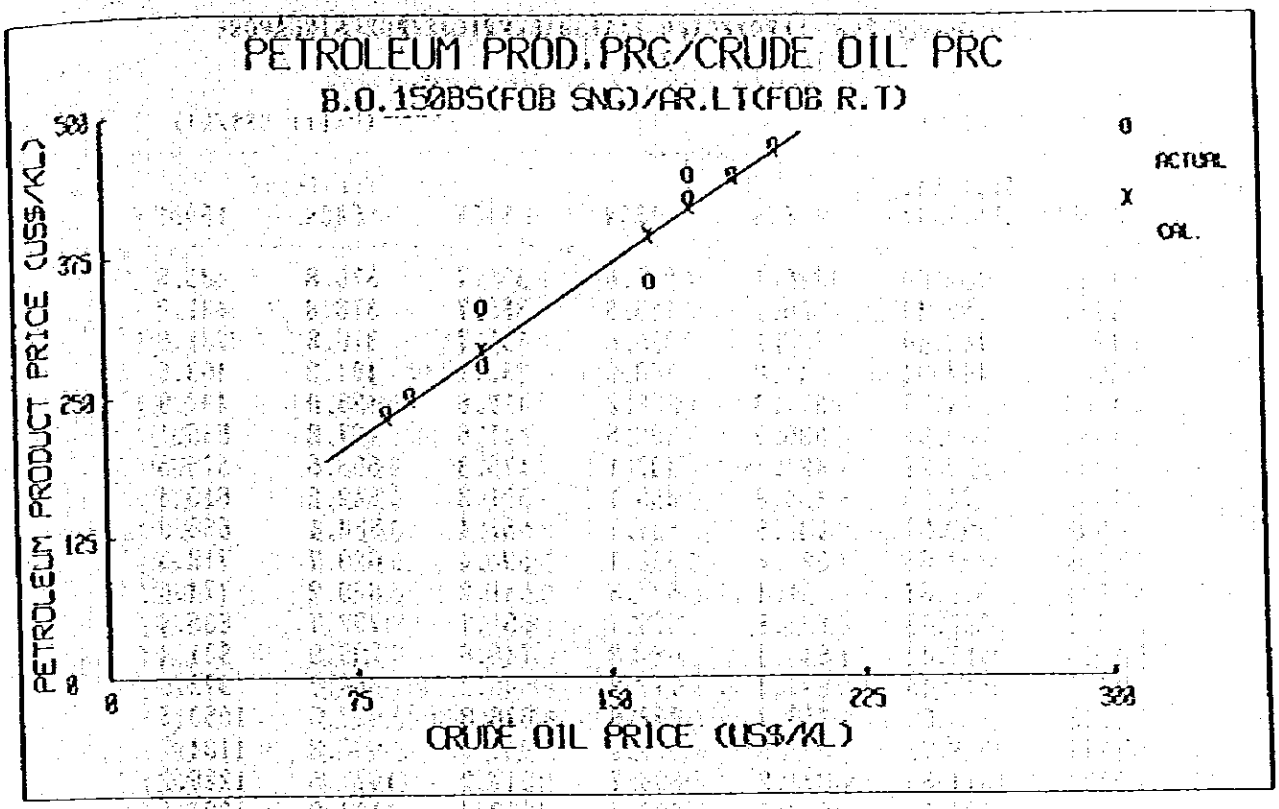


Table AII-2-9 PROJECTED BASE OIL PRICES/FOB SINGAPORE
(1984 - 2010)

(Unit: US$/kl)

Year	Arab Lt. (US$/kl)	60S	150N	300N	500N	150BS
1984	182.40	326.1	335.6	355.7	376.8	431.8
1985	182.40	326.1	335.6	355.7	376.8	431.8
1986	182.40	326.1	335.6	355.7	376.8	431.8
1987	197.94	347.8	358.0	382.1	404.8	463.6
1988	214.73	371.3	382.2	410.6	435.0	497.8
1989	232.97	396.9	408.5	441.6	467.8	535.1
1990	252.78	424.7	437.1	475.3	503.5	575.5
1991	274.29	454.8	468.1	511.8	542.2	619.4
1992	297.57	487.5	501.7	551.4	584.1	666.9
1993	322.85	522.8	538.1	594.4	629.7	718.5
1994	350.34	561.4	577.8	641.2	679.2	774.6
1995	380.09	603.1	620.7	691.7	732.7	835.4
1996	412.42	648.3	667.3	746.6	790.9	901.4
1997	447.45	697.4	717.8	806.2	854.0	972.9
1998	485.50	750.7	772.6	870.8	922.5	1050.5
1999	526.76	808.5	832.1	941.0	996.8	1134.7
2000	571.55	871.2	896.7	1017.2	1077.5	1226.2
2001	620.10	939.2	966.7	1099.7	1164.9	1325.3
2002	672.81	1013.1	1042.7	1189.3	1259.8	1432.9
2003	730.05	1093.2	1125.2	1286.5	1362.8	1549.7
2004	792.06	1180.1	1214.6	1391.9	1474.5	1676.3
2005	859.42	1274.4	1311.7	1506.4	1595.8	1813.8
2006	932.45	1376.8	1417.0	1630.6	1727.3	1962.8
2007	1011.70	1487.8	1531.3	1765.3	1870.0	2124.6
2008	1097.68	1608.3	1655.3	1911.4	2024.8	2300.1
2009	1191.02	1739.0	1789.8	2070.0	2192.8	2490.6
2010	1292.22	1880.7	1935.7	2242.1	2375.1	2697.2

Table AII-2-10 PROJECTED FREIGHT RATE OF BASE OIL, SINGAPORE - THAILAND (1984 - 2010)

(Unit: US$/kl)

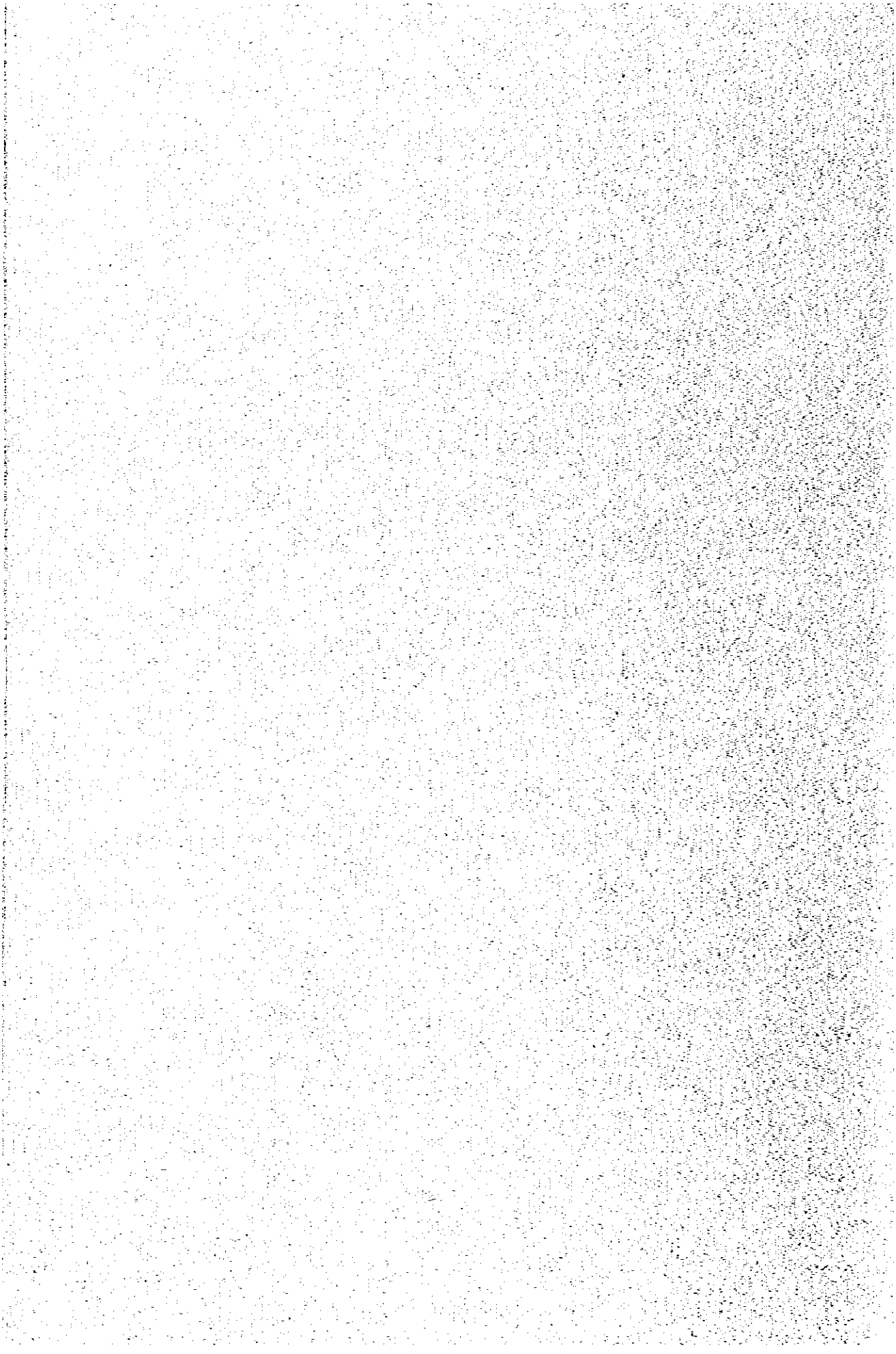
Year	Escalation Rate	60S	150N	300N	500N	150BS
1983 *1		15.00	15.00	15.00	15.00	15.00
S.G. *2		0.864	0.865	0.879	0.885	0.900
1983 *3		12.96	12.98	13.19	13.28	13.50
1984	1.0000	12.96	12.98	13.19	13.28	13.50
1985	1.0000	12.96	12.98	13.19	13.28	13.50
1986	1.0000	12.96	12.98	13.19	13.28	13.50
1987	1.0600	13.74	13.76	13.98	14.08	14.31
1988	1.1236	14.56	14.58	14.82	14.92	15.17
1989	1.1910	15.44	15.46	15.71	15.82	16.08
1990	1.2625	16.36	16.39	16.65	16.77	17.04
1991	1.3383	17.34	17.37	17.65	17.77	18.07
1992	1.4186	18.39	18.41	18.71	18.84	19.15
1993	1.5037	19.49	19.52	19.83	19.97	20.30
1994	1.5939	20.66	20.69	21.02	21.17	21.52
1995	1.6895	21.90	21.93	22.28	22.44	22.81
1996	1.7909	23.21	23.25	23.62	23.78	24.18
1997	1.8984	24.60	24.64	25.04	25.21	25.63
1998	2.0123	26.08	26.12	26.54	26.72	27.17
1999	2.1330	27.64	27.69	28.13	28.33	28.80
2000	2.2610	29.30	29.35	29.82	30.03	30.52
2001	2.3967	31.06	31.11	31.61	31.83	32.36
2002	2.5405	32.92	32.98	33.51	33.74	34.30
2003	2.6929	34.90	34.95	35.52	35.76	36.35
2004	2.8545	36.99	37.05	37.65	37.91	38.54
2005	3.0258	39.21	39.27	39.91	40.18	40.85
2006	3.2073	41.57	41.63	42.30	42.59	43.30
2007	3.3997	44.06	44.13	44.84	45.15	45.90
2008	3.6037	46.70	46.78	47.53	47.86	48.65
2009	3.8199	49.51	49.58	50.38	50.73	51.57
2010	4.0491	52.48	52.56	53.41	53.77	54.66

Notes: *1 US$/MT
*2 Specific Gravity
*3 US$/kl

ANNEX III

ANNEX III-1

PROCESS FLOW SCHEME



(1) Vacuum Distillation Unit (Figure III-1-1)

The feed atmospheric residue is heated in the furnace and flow into the flash zone of the column. The steam is injected to the coil in the furnace to assist the vaporization of oil. A vacuum is maintained in the flash zone by a vacuum system connected to the top of the column. By reducing the pressure, materials boiling up to 550°C at atmospheric pressure can be vaporized without thermal cracking. At various points in the column, special trays (draw off trays) are installed which collect the distillate and remove from the column. To remove the low boiling materials, the distillate is charged to a side stripper where steam is introduced to strip out the low boiling materials. The flash point of distillate is adjusted by removing these low boiling components. The vacuum residue is also steam stripped in a stripping section below the flash zone.

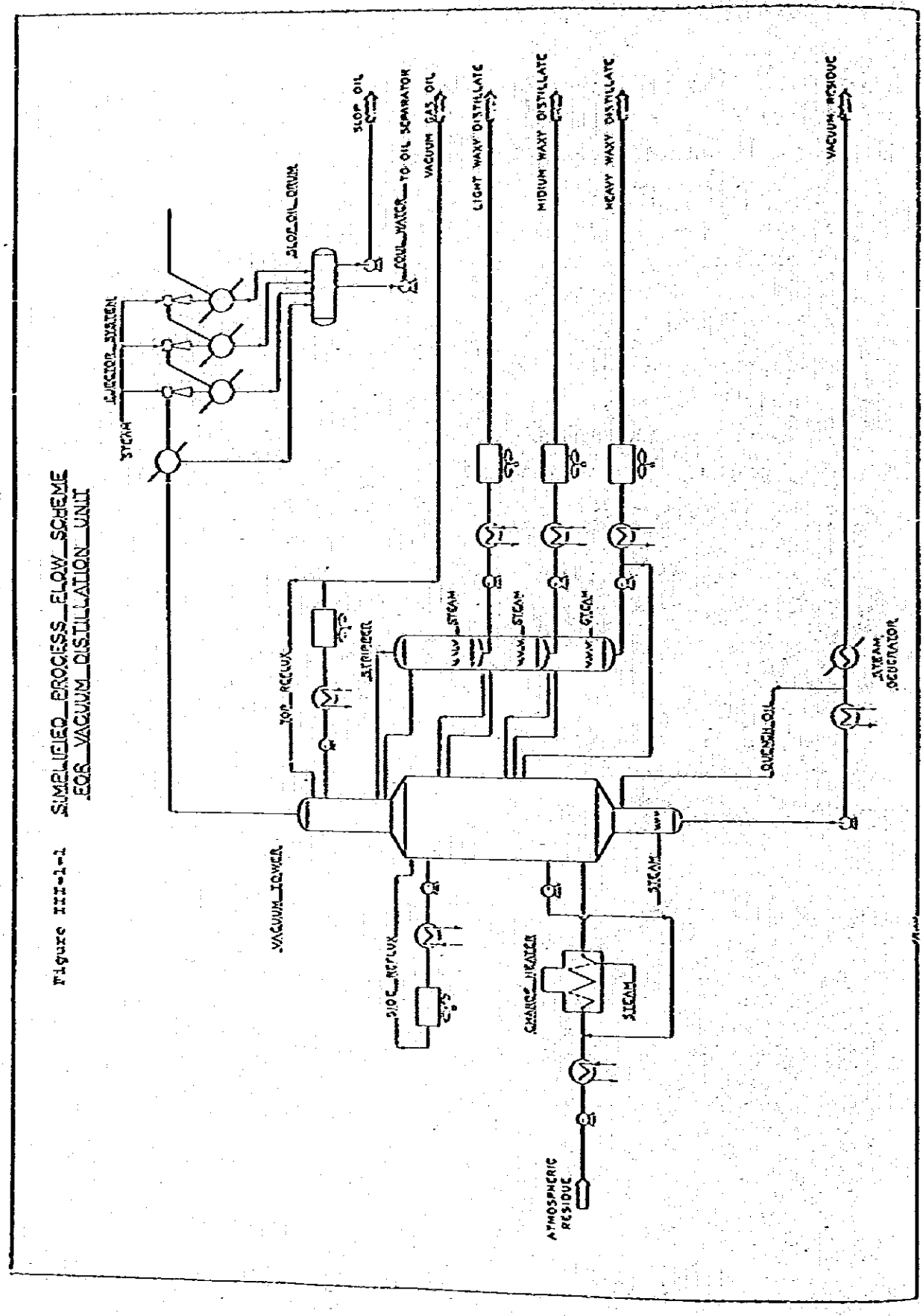
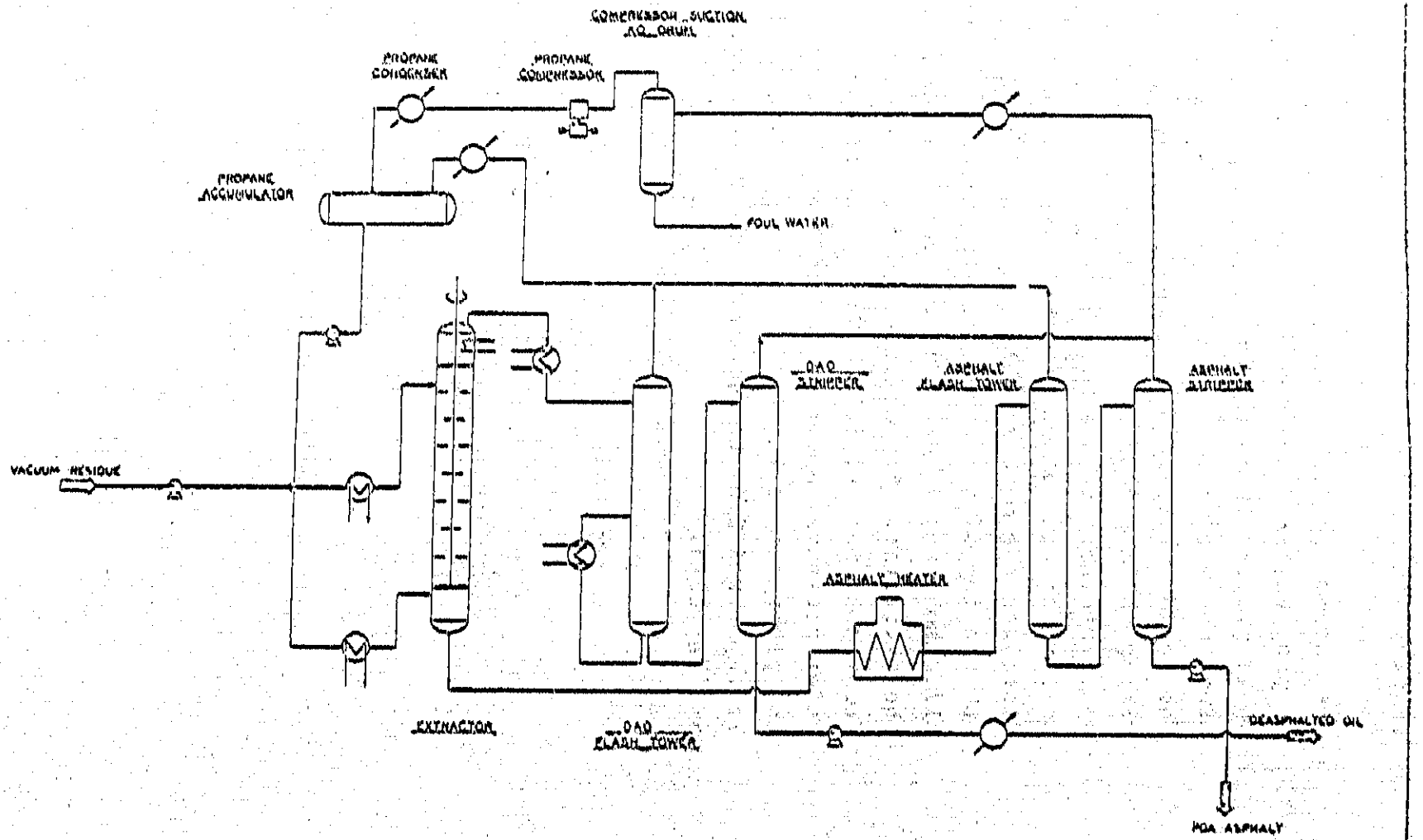


Figure III-1-1

(2) Propane Deasphalting Unit (Figure III-1-2)

The vacuum residue, usually diluted with a small amount of propane, is charged to the middle of the extractor, while propane is charged to the bottom of the extractor. Since the vacuum residue is more dense than the propane, the residue will flow down the extractor, the propane rising up in a counter flow. The mixing is provided by some internals in the extractor, either baffle plates or a rotor with discs attached. The rising propane dissolves the more soluble components which are carried out the top of the extractor with propane. The insoluble, asphaltic material is removed from the bottom of the extractor. Temperatures used in the extractor range from about 50°C to 80°C. The extractor must be operated under pressure (about 35 kg/cm^2G) in order to maintain the propane as a liquid at the temperature used. Propane is vaporized from the products and is then recovered and recycled.

Figure III-1-2 SIMPLIFIED PROCESS FLOW SCHEME FOR PROPANE DEASPHALTING UNIT

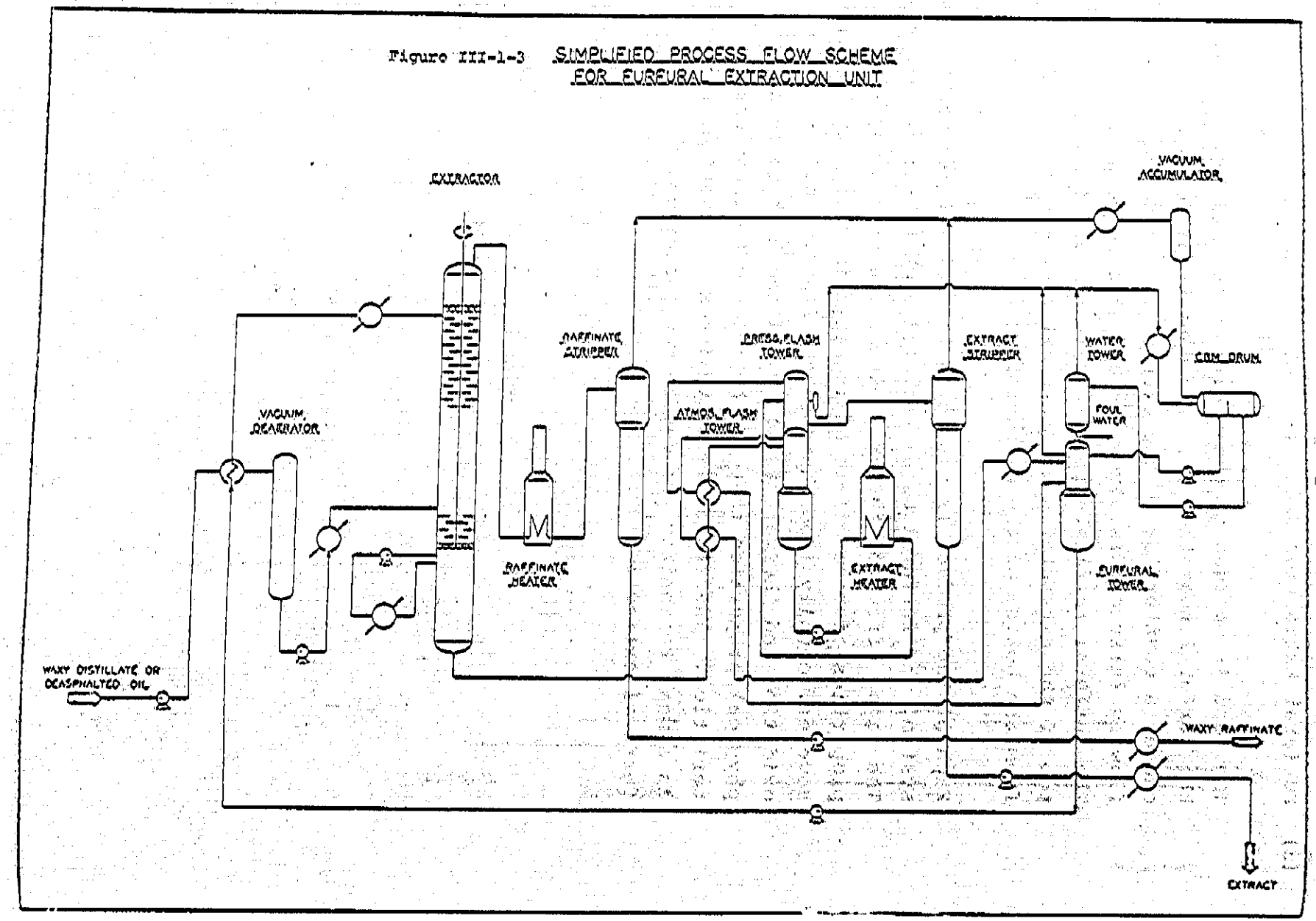


(3) Furfural Extraction Unit (Figure III-1-3)

The feed is charged to the middle of the extractor, the furfural near the top. The density difference causes a counterflow in the extractor; the downward flowing furfural dissolves the aromatic compounds. The furfural raffinate rises and is removed from the top of the extractor. The furfural extract is removed from the bottom of the extractor.

Each of the product is passes to its solvent recovery system, the furfural being recycled back to the extractor. The major effect of furfural extraction on the physical properties of base oil is an increase in viscosity index. However, equally important are the improvements of oxidation and thermal stability, although there is no physical properties that can be related to these characteristics. Therefore viscosity index is sometimes used as a meas to monitor the day to day operations of a furfural extraction unit.

Figure III-1-3 SIMPLIFIED PROCESS FLOW SCHEME FOR FURFURAL EXTRACTION UNIT



(4) Hydrofinishing Unit (Figure III-1-4)

The feed oil and recycle gas are combined and preheated, and the mixture is passed through the reactor. The reactor effluent is separated into hydrofinished oil and a gas stream, consisting mostly of unreacted hydrogen which is recycled back to the reactor. The hydrofinished oil is stripped of light hydrocarbons, distillate, and hydrogen sulfide and pumped to storage or further processing. Make-up hydrogen is constantly added to compensate that reacted with the oil and solution loss.

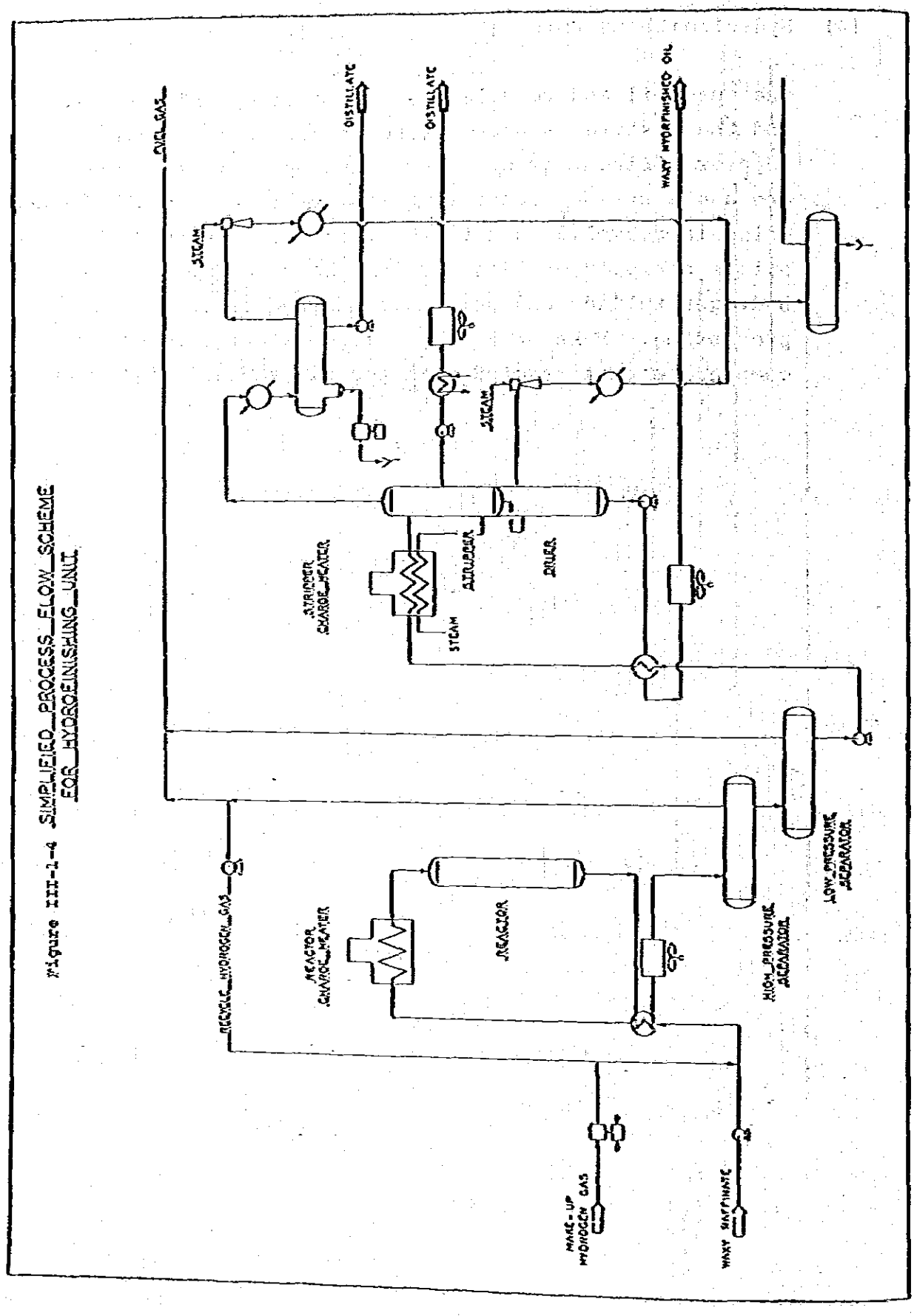


Figure III-1-4 SIMPLIFIED PROCESS FLOW SCHEME FOR HYDROFINISHING UNIT

(5) MEK Dewaxing Unit (Figure III-1-5)

The waxy feed, hydrofinished oil is mixed with solvent and heated to a temperature high enough to dissolve all waxes. The purpose of this step is to dissolve all the crystals that are in the oil so that the crystals that will be separated at the filter are formed under carefully controlled conditions. The solution is then cooled, first with cooling water, then by heat exchange with cold filtrate and finally by a refrigerant. In some cases additional solvent is added at various points in the step of chilling process. Scraped surface exchangers are used for this cooling.

The cooled slurry is passed to a filter feed surge drum and them to the filter where the actual separation is accomplished. The oil and solvent are filtrated continuously with the filter and then pumped to a solvent recovery system. After removal of solvent for recycle, the base oil is ready for use in many applications.

As the wax from the filter contains certain amount of oil, usually it is again mixed with solvent and filtrated for the recovery of solvent before pumping to a solvent recovery section. This operation called a repulping.

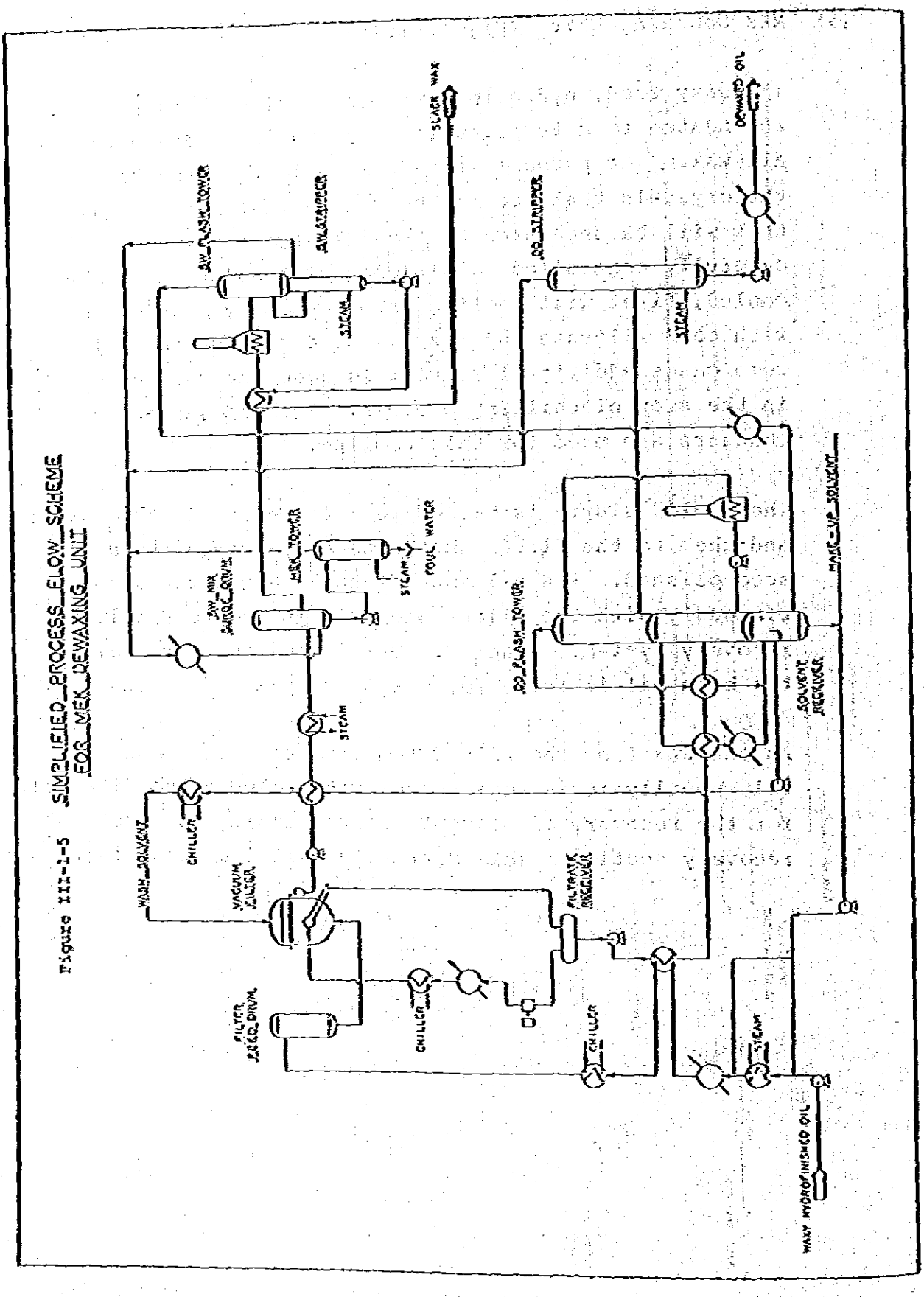


Figure III-1-5 SIMPLIFIED PROCESS FLOW SCHEME FOR MEK DEWAXING UNIT

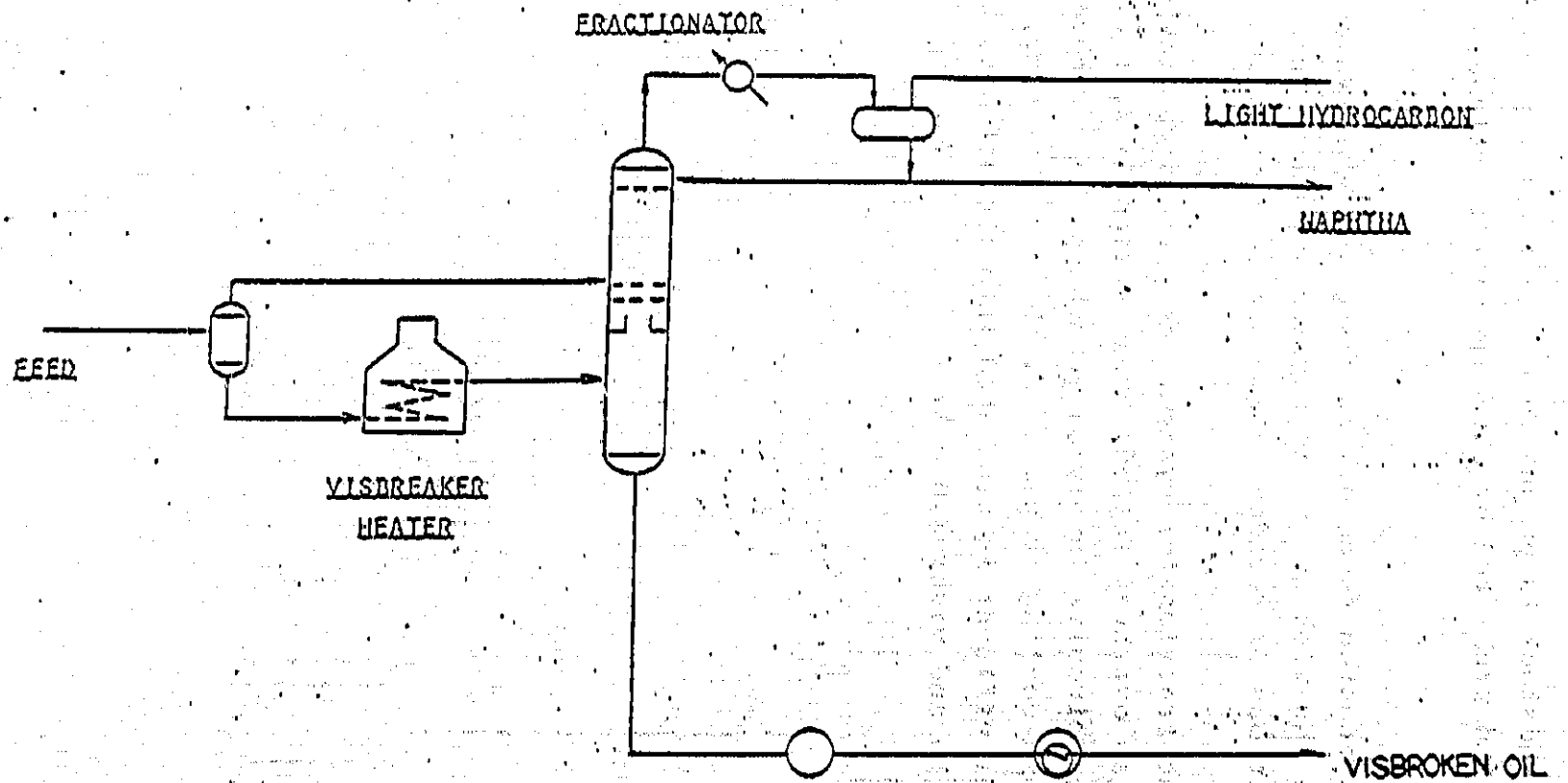
(6) Visbreaking Unit (Figure III-1-6)

The feedstock is pumped by the Visbreaker Heater Charge Pump and preheated by exchange with fractionator bottom product.

The preheated feedstock is charged to Visbreaker Heater where the visbreaking is carried out under specified conditions or residence time and temperature.

In the fractionator system, there are some provisions such as overhead reflux, steam stripping system and bottom circuits involving quenching, heat recovery and rundown cooling systems. By the above systems, the heater effluent is separated into the off gas, cracked naphtha and visbroken oil.

FIGURE III-1-6 SIMPLIFIED PROCESS FLOW SCHEME OF VISBREAKING PROCESS



(7) Asphalt Blowing Unit (Figure III-1-7)

The mixed feed asphalt is charged to the oxidizer after being heated up to the specified reaction temperature via heat exchanger and charge heater. Air required for reaction is introduced into the oxidizer under flow rate control. The product asphalt is drawn from the bottom of the oxidizer and run down to the tankage after being heat recovered and cooled down. The overhead vapor from the oxidizer is sent to the oil scrubber for recovery of oil fraction contained. The recovered oil is cooled down, a part of it is used as a scrubbing oil, and sent to the storage.

The oil scrubber overhead vapor consisting of combustible gases, steam and unused air is burned in the fume incinerator.

FIGURE III-1-7 SIMPLIFIED PROCESS FLOW SCHEME FOR ASPHALT BLOWING UNIT