USED OIL REFINERY STORED IN CALIFORNIA (USA) AT 18 YEARS OLD

FOR SALE WITHOUT TANK FARM AND BOILER

DESIGN BASIS

1. The Crude Unit is designed to handle 25,000 BPSD ranging from 20-34.2° API gravity. Two design cases were used to size equipment at the 10,000 BPSD rate reflecting the extremes in this gravity range.

2. Fractionation is provided to produce light naphtha, heavy naphtha, kerosene, diesel, atmospheric gas oil and residual fuel products.

3. Following is a summary of the product yields for each design case:

COMPONENTS		LIGHT CRUDE (1)		HEAVY CRUDE (2)
		(34° API)		(20°API)
C3, liquid Volume %		0.2		0
C4's		0.6		0
Light Naphtha		17.1		1.1
Heavy Naphtha		16.0		10.2
Kerosene		9.9		7.7
Diesel		15.4		15.0
Atmos, Gal Oil		9.1		0
Residual Fuel		31.7		66.0
		100.00		100.00

Notes:

(1) Developed from 34.2 API Voulomne Crude Oil analysis by Mohawk Petroleum Corporation, Inc., dated 6/8/68.

(2) (2) Developed as a 20° API blend from 34.2° API Voulomne Crude and 13.7° API South Belridge Crude (from crude assay data dated 1/12/79 accompanying True Boiling Point data, undated.)

(3) (3) The estimated properties of the various distillate products are as follows:

	LIGHT NAPHTHA	HEAVY NAPHTHA	KEROSENE	DIESEL	ATMOS. GAS OIL
Gravity, °API	65.0	54.5	38.9	31.0	23.9
Distillation (D-86)					
IBP, °F		112	327	465	587
10	147	218	400	525	670
50	211	286	435	570	715
90	277	348	480	647	800
EP	329	376	512	696	862
RVP. psi	9.0	2.0			
Flash Point, F° (Min)			125	150	250

4. **Product stripping is based on the following steam rates:**

Product	LBS. Steam/Gal. Product
Kerosene	0.25
Diesel	0.17
Atmos. Gas Oil	0.17
Residuum	0.35

5. **The Naphtha Stabilizer is designed to stabilize the light naphtha product (Preflash Tower Overhead) to 9# RVP (max.).**

6. **The Crude Unit is designed to be able to reprocess 1500 BPSD of out-side off-spec naphtha in addition to and concurrent with the 10,000 BPSD crude fractionation. Provisions are included to handle off-spec conditions either (1) for too high a vapor pressure or (2) with too high an end point. Alternate feed locations are to the Main Fractionator for conditions (1) or to the Naphtha Stabilizer for condition (2).**

7. **Items of major equipment are designed on the following basis:**

Design Temperatures

Air Temperatures

Dry Bulb (max), F°	100
Wet Bulb (max), °F	75

Process Temperatures

Crude Charge, °F	100
Naphtha Product (max), °F	100
Kerosene Product (max). °F	125
Diesel Product (max). °F	150
Atmos. Gas Oil (max). °F	175
Resid. Fuel Oil, °F	200-300

Equipment Design Capacity Factors

Column Sizing Basis	87% of Flood (max)
Heat Exchanger Fouling Factors	TEMA
Pump Design Flow Rates (1)	
Column Reflux Services	120% (min)
All Other Services	110% (min)
Fired Heater Design Duty (1)	

Notes: **(1)** Relative to calculated values.

Table 1 Material Balance Light Crude Case

	Crude	Preflash Tower	Preflash Tower	Crude Heater	Fract. Tower	Fract. Tower	Kerosene	Diesel	Gas Oil	Residuum	Feed To	Stabilizer	Stabilized	Stabilized
Components	Charge	Reflux	OVHD. Naphtha	Charge	Reflux	OVHD. Naphtha	Product	Product	Product	Product	Stabilizer	Reflux	Vent Gas	Naphtha
C3 - C4's	3.3	1.5	3.3								3.3	35.9	3.3	
Lt. Naphtha	71.2	32.6	71.2								71.2			71.2
Hvy. Naphtha	66.7			66.7	300	66.7								
Kerosene	41.4			41.4			41.4							
Diesel	64.3			64.3				64.3						
Gas Oil	37.7			37.7					37.7					
Residuum	132.1	_____	_____	132.1	_____	_____	_____	_____	_____	132.1	_____	_____	_____	_____
Total, BPH	416.7	34.1	74.5	342.2	300	66.7	41.4	64.3	37.7	132.1	74.5	35.9	3.2	71.2
Gravity, API	34.2	67.1	67.1	28.5	54.5	54.5	38.9	31.0	23.9	15.6	67.56	-	-	65
Lbs/Hr	124,500	8,500	18,600	105,900	71,760	17,770	12,030	19,620	12.01	44,470	18,600	7,100	650	17,950

NOTE:

Design includes capability for rerunning up to 62.5 BPH (1,500 BPSD) of off-spec

Naphtha either to the Crude Fractionator or to the Naphtha Stabilizer.

This allowance is not included in the above material balance.

Table 2 Material Balance Heavy Crude Case

	Crude	Preflash Tower	Preflash Tower	Crude Heater	Fract. Tower	Fract. Tower	Kerosene	Diesel	Gas Oil	Residuum	Feed To	Stabilizer	Stabilized	Stabilized
Components	Charge	Reflux	OVHD. Naphtha	Charge	Reflux	OVHD. Naphtha	Product	Product	Product	Product	Stabilizer	Reflux	Vent Gas	Naphtha
C3 - C4's	0	0	0								-	-	-	
Lt. Naphtha	4.6	20.4	4.6								4.6	-	-	4.6
Hvy. Naphtha	42.5			42.5	255.7	42.5								
Kerosene	32.1			32.1			32.1							
Diesel	62.5			62.5				62.5						
Gas Oil	0			0					0					
Residuum	275.0	_____	_____	275.0	_____	_____	_____	_____	_	275.0	_____	_	_	_____
Total, BPH	416.7	20.4	4.6	412.1	255.7	42.5	32.1	62.5	0	275.0	4.6	-	-	4.6
Gravity, API	20.0	70.0	70.0	19.6	51.0	51.0	36.0	26.5	-	12.5	70.0	-	-	70.0
Lbs/Hr	136,300	5,020	1,130	135,170	69,300	11,520	9,490	19,600	0	94,560	1,130	-	-	1,130

NOTE:

Design includes capability for rerunning up to 62.5 BPH (1,500 BPSD) of off-spec

Naphtha either to the Crude Fractionator or to the Naphtha Stabilizer.

This allowance is not included in the above material balance

Table 3 Process Steam Requirements

SERVICE	LIGT CRUDE CASE Lbs/Hr	HEAVY CRUDE CASE Lbs/Hr
Kerosene Stripper	440	350
Diesel Stripper	460	450
Gas Oil Stripper	280	0
Resid Stripper	2,000	4,000
Stabilizer Reboiler	2,500	0
Totals, Lbs/Hr	5,680	4,800

Equipment List

Heat Exchangers

Item No.	Service
E-2, 3, 4, 5	Cold Resid/Crude Exchangers
E-6, 7, 8, 9	Hot Resid/Crude Exchangers
E-11B	Diesel Cooler (initial)
E-12	Diesel Cooler (final)
E148	Diesel/Rude Exchanger
E-14C	Gas Oil/Crude Exchanger
E-14D	Gas Oil/Crude Exchanger
E-15	Diesel/BFW Exchanger
E-20	Pre Flash Condenser
E-21	Fractionator Overhead/Crude Exchanger
E-22	Fractionator Overhead Condenser
E-24	Gas Oil Cooler
E-25	Stabilizer Feed/Bottoms Exchanger
E-26	Stabilizer Reboiler
E-27	Stabilizer Condenser
E-28	Naphtha Product Cooler
E-29	Kerosene Cooler

Vessels

Item No.	Service
D-1	Pre Flash Tower
D-4	Caustic Treater (Fract. Naphtha)
D-6	Caustic Treater (Pre Flash Naphtha)
D-7	Vent Gas Knockout Drum
D-9	Salt Drier (Diesel Product)
D-20	Crude Fractionator
D-21, A, B, C	Product Stripper
D-21A	Kerosene Stripper
D-21B	Diesel Stripper
D-21C	Gas Oil Stripper
D-22	Pre Flash Overhead Accumulator
D-23	Fractionator Overhead Accumulator
D-24	Naphtha Stabilizer
D-25 (Ex. D-2)	Stabilizer Overhead Accumulator
D-26	Vent Gas Knockout Drum
D-27	Pre Flash Accumulator Boot
D-28	Fractionator Accumulator
D-29	Stabilizer Accumulator Boot

Miscellaneous Equipment

Item No.	Service
DA-20	Deaerator
MX-20	Static Mixer For D-6
MX-21	Static Mixer For D-4

Pumps

Pumps	Type	Service
P-1A	(M)	Crude Charge
P-1B, C	(S)	Crude Charge (Spares)
P-2A	(M)	Heater Charge
P-2B	(T)	Heater Charge (Spare)
P-4	(M)	Vent Gas Drops
P-5	(M)	Stabilizer Reflux
P-6	(M)	Stabilizer Reflux (Spare)
P-9	(G)	Vent Gas Drips
P-12A	(G)	Fuel Oil Circulation
P-12B	(G)	Fuel Oil Circulation (Spare)
P-20A	(M)	Light Naphtha Product
P-20B	(M)	Light Naphtha Product (Spare)
P-22A	(M)	Fractionator Overhead
P-22B	(M)	Fractionator Overhead (Spare)
P-23	(M)	Kerosene Product
P-24	(M)	Diesel Product
P-25	(M)	Gas Oil Product
P-25B	(M)	Gas Oil Product (Spare)
P-26A	(M)	Resid Product
P-27A	(M)	Deaerator Charge
P-27B	(M)	Deaerator Charge (Spare)
*P-7B	(S)	Temporary Substitute For P-268
P-28A	(M)	Pump Seal C.W.
P-28B	(M)	Pump Seal C.W. (Spare)

P-29A	(M)	Sump Pump (South Pump)
P-29B	(M)	Sump Pump (North Pump)
E-20-P-1A	(M)	Preflash Cond. Water Circ. Pump
E-20-P-1B	(M)	Preflash Cond. Water Circ. Pump (Spare)
E-27-P-1A	(M)	Stabilizer Cond. Water Circ. Pump
E-27-P-1B	(M)	Stabilizer Cond. Water Circ. Pump (Spare)

Legend

M=Centrifugal Pump w/Electric Motor Drive

S=Reciprocating Pump w/Steam Drive

G=Gear Pump w/Electric Motor Drive

T=Centrifugal Pump w/Steam Turbine Drive