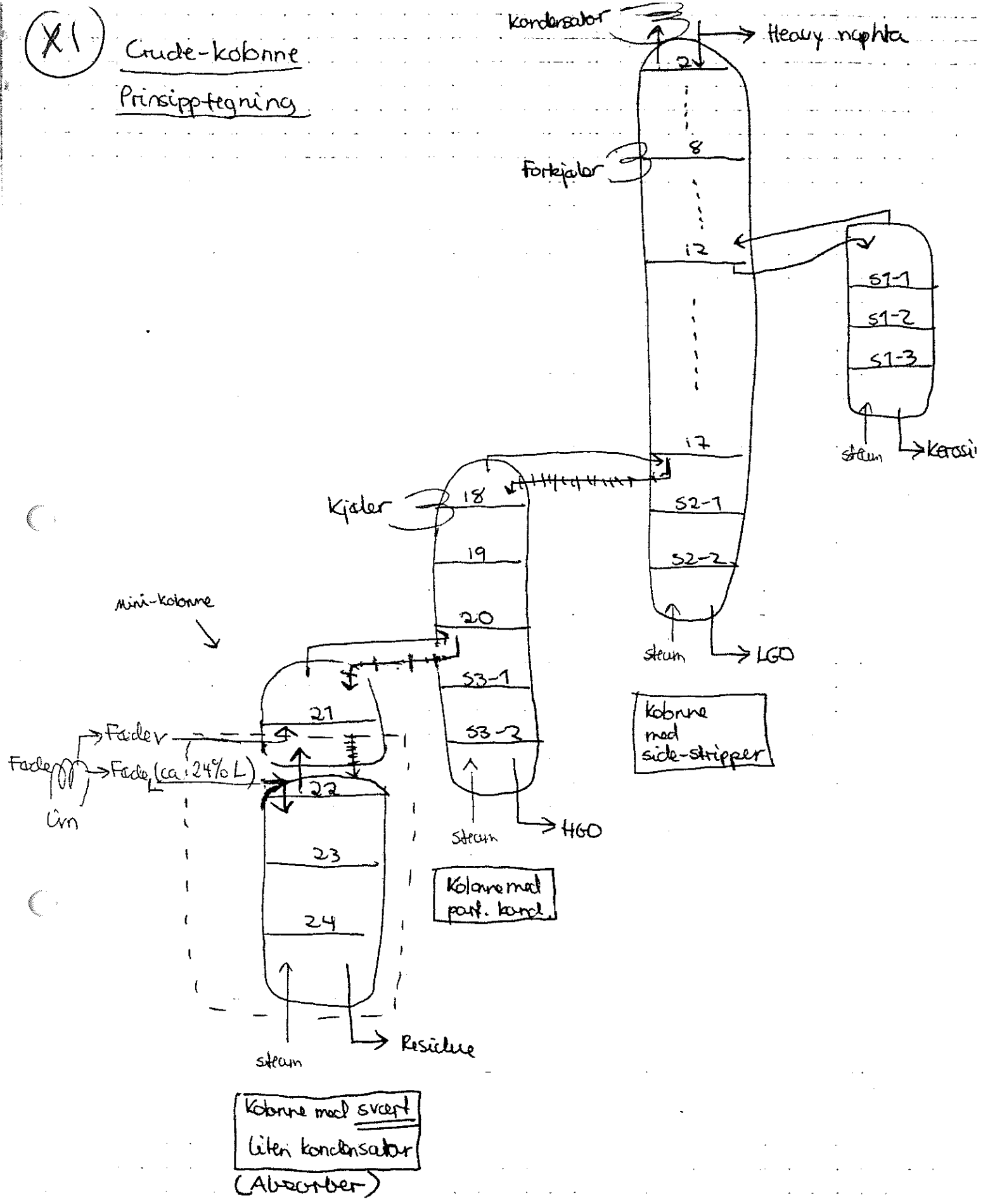


X1

# Crude-kolonne Prinsipp-tegning



||||| → liten væskestrøm  
 +++ → forholdsvis liten væskestrøm

Kolonne med svært liten kondensator (Absorber)

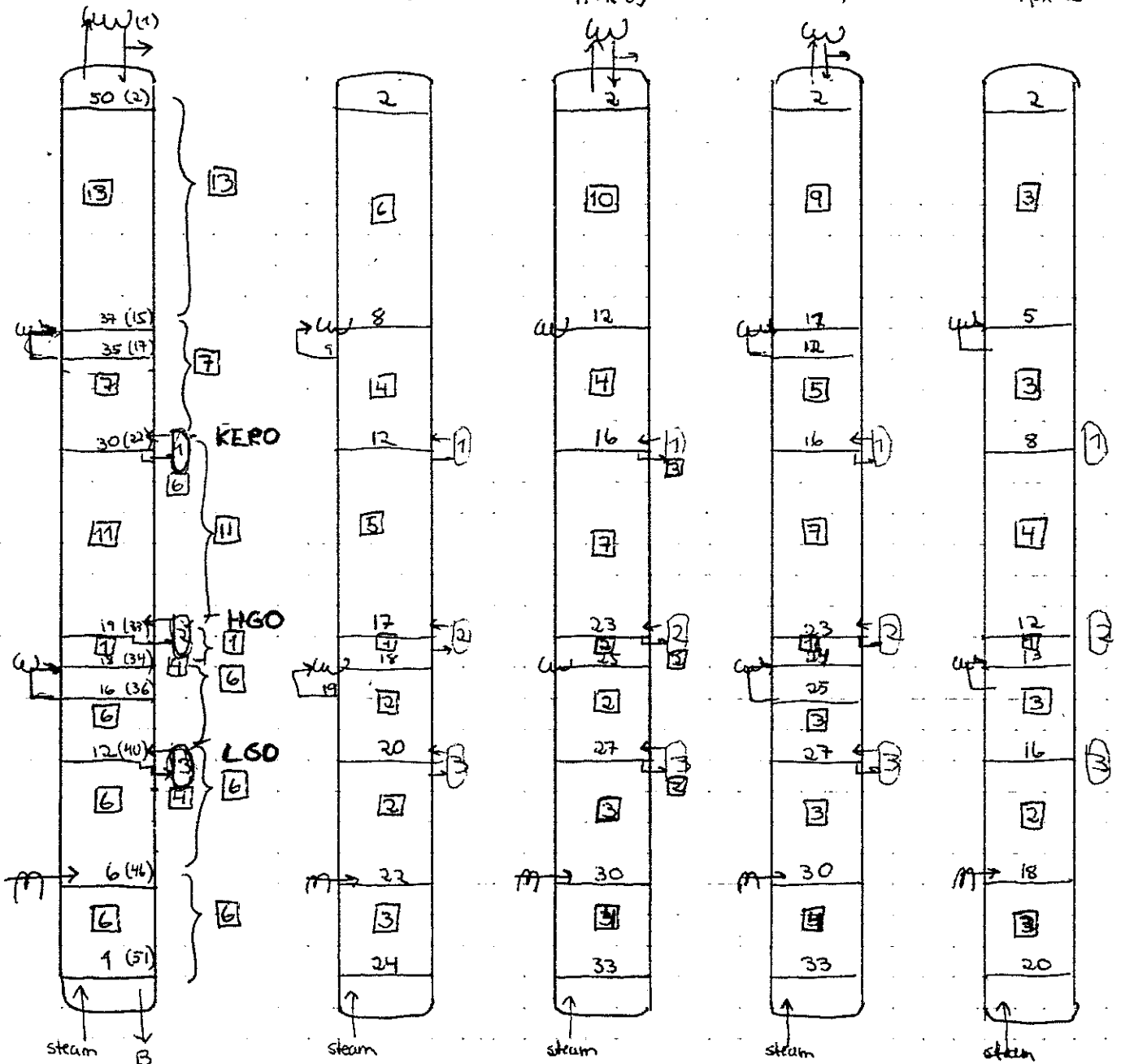
"vinkeligt"  
(ikke FN  
194-90)

"Kinetisk"  
et fra  
Process-  
vinkelgrader.

F-W  
simulering  
17 sep 81  
17:42:03

Fig-7  
(alene  
konv.)

stavn  
SSI  
27 jan 82



□ = antall fase-trin

Trin (Trinvektgrader) (Sikertippem: 50%)

Process	6	3 (50)	4 (67)	4 (67)	3 (50)	4 (67)
30-50 Stippedel	6	3 (50)	4 (67)	4 (67)	3 (50)	3 (50)
(30-40) Fade - HGO	6	2 (33)	3 (50)	3 (50)	2 (33)	2 (33)
40-50 HGO-LGO Tot.	7	3 (43)	4 (57)	4 (57)	4 (57)	4 (57)
derav (PA-HGO)	1	(1 (100))	(2 (200))	(1 (100))	(1 (100))	(1 (100))
(40-50) HGO-KERO	11	5 (45)	7 (64)	7 (64)	4 (36)	4 (36)
50-60 KERO-TOP Tot	20	10 (50)	14 (70)	14 (70)	6 (30)	6 (30)
(50-55) derav (PA-TOP)	13	(8 (57))	(10 (77))	(9 (61))	(3 (23))	(3 (23))
	50	23 (46)	32 (64)	32 (64)	19 (38)	
(parameter Bulletin #13)		23 (46)				

Revision

**PROBLEM R3**

**CRUDE OIL DISTILLATION SYSTEM**

A crude oil distillation system is shown in Figure R3-1. Total charge to the system is 25000 barrels/day of crude oil.

The crude oil data are as follows:

TBP Distillation		Light Ends, LV Percent on Crude	
LV Percent	°F		
3.83	98	Propane	.18
5	125	i-Butane	.30
10	167	n-Butane	.69
20	227		
30	291		
40	370		
50	460		
60	552		
70	643		
80	799		
90	1023		
100	1440		

API Gravity	
Average	°API
Mid LV Percent	°API
12	66.7
19	55.3
40	37.6
62	27
82	19

Desired Product Specifications are:

	ASTM D86		°API
	5 Percent	95 Percent	
Gasoline	—	200	—
Preflash Naphtha	205	370	—
Preflash Bottoms	—	—	25
Heavy Naphtha	—	375	—
Jet Fuel	380	525	—
Diesel Fuel	515	700	—
Topped Crude	—	—	16

It is desired to determine the following:

- The product yields
- The furnace duties for both columns
- The tray loadings for both columns
- The side cooling requirement for the crude unit, C-3, which results in  $L_9/V_{10}$  ratio of 0.35.

Desired column operating conditions are:

- 5 MMBtu/hr side cooling on the preflash column (C-1)
- 400 Bbl/day overflash on the preflash column (C-1)
- 5 LV% overflash on the crude unit (C-3)
- 100°F Condenser operation on both towers
- Preflash pumparound rate of 5200 Bbl/day
- Crude unit pumparound rate of 4700 Bbl/day

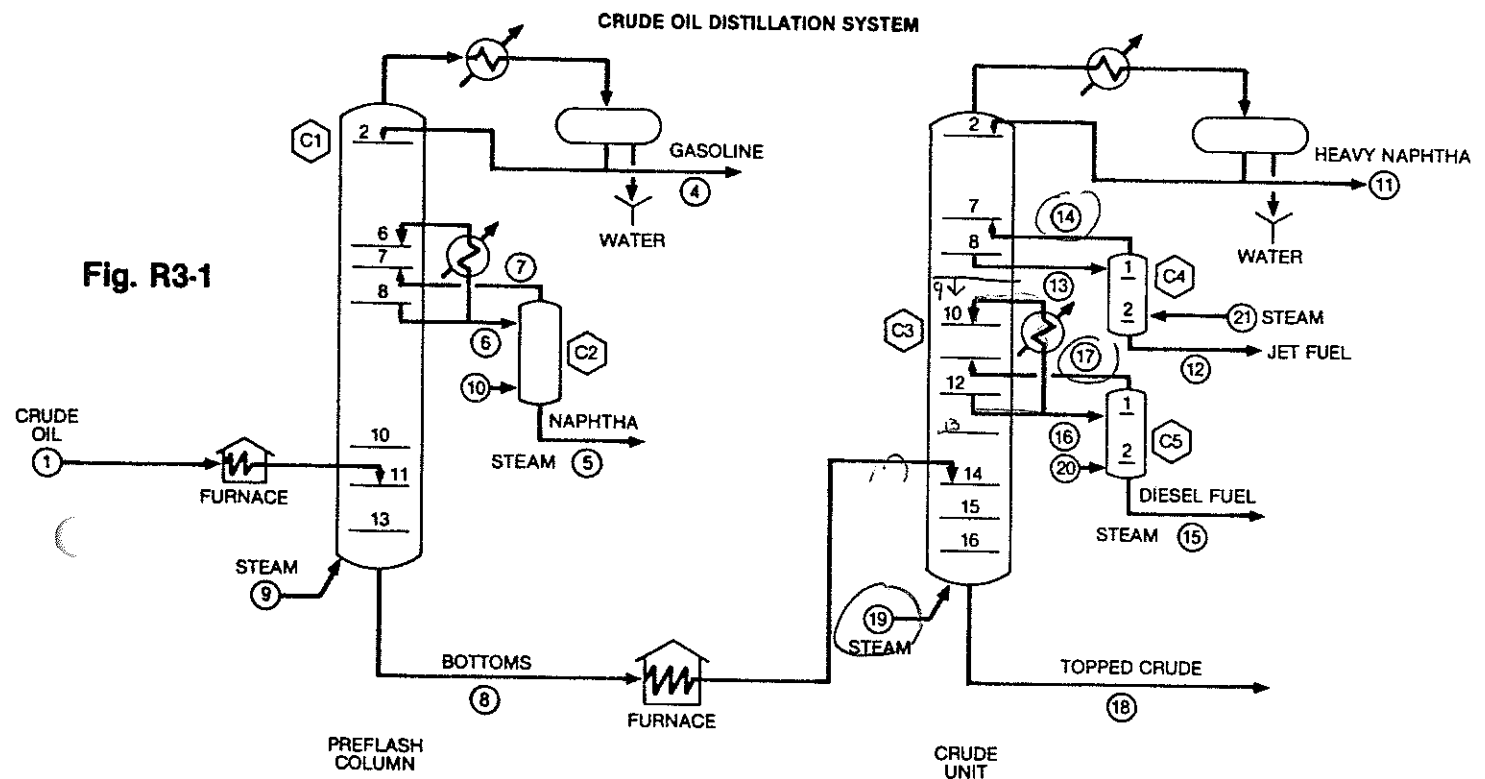
Column operating pressures are summarized below:

Column	Tray	PSIA
C-1	Condenser	48
C-1	2	53
C-1	13	55
C-3	Condenser	20
C-3	2	23
C-3	16	25

Estimated requirements of 115 psia stripping steam are:

Column	Lb/Hr
C-1	3000
C-2	900
C-3	1500
C-4	600
C-5	650

Fig. R3-1



**SIMULATION MODEL — SHORTCUT CALCULATION**

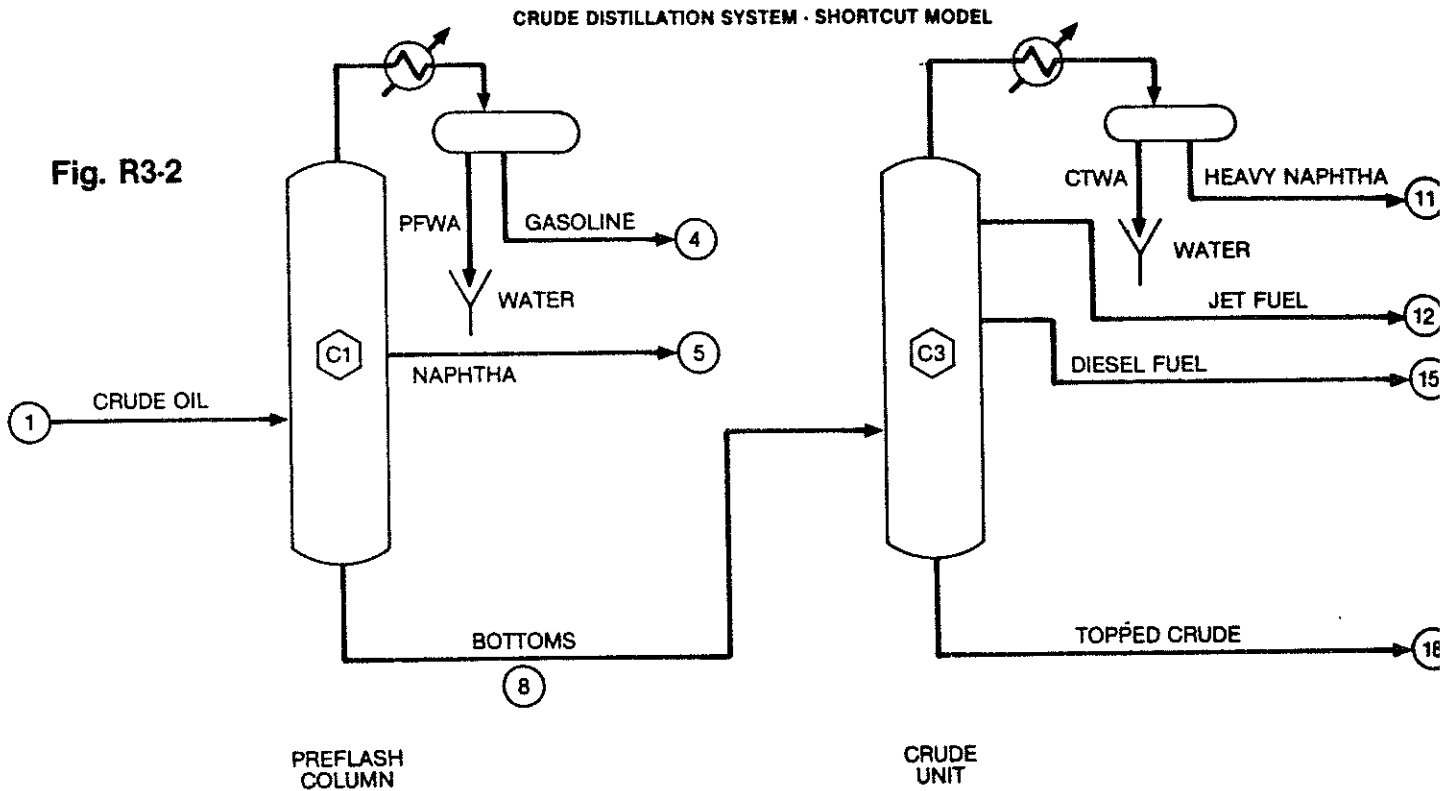
The multidraw shortcut column is first used to determine the product yields corresponding to the desired specifications. The required fractionation indices predicted by the shortcut calculations also give a qualitative check on the required tray configurations for the columns.

The crude oil assay analysis data are entered directly into the PROCESS stream data. The stripping steam flow rates are also entered to get an estimate of the water distribution in the products.

Figure R3-2 shows the flowsheet for the shortcut model of the system.

The Braun K-10 system is chosen for thermodynamic data.

Fig. R3-2



COMMENTS ON RESULTS — SHORTCUT CALCULATION

The product flow rates to satisfy the ASTM and gravity specifications are as follows:

	BBLS/Day	LB Moles/Day
C-1 Water	—	5200
Gasoline	2850	—
Naphtha	5420	13400
C-1 Bottoms	16800	22000
C-3 Water	—	3660
Heavy Naphtha	1915	—
Jet Fuel	3780	6700
Diesel Fuel	3765	4900
Topped Crude	7335	5930

The fractionation indices (which correspond to theoretical trays for the Fenske shortcut method) indicate that the theoretical trays assumed in Figure R3-1 are reasonable for the product separations specified in the shortcut.

SIMULATION MODEL — RIGOROUS CALCULATION

The Simulation Flowsheet — the rigorous simulation is identical to Figure R3-1 with two exceptions:

- The preflash furnace is simulated by placement of a heater on tray 11.
- The crude unit furnace is simulated with a heater on tray 14.

Both columns are simulated using a subcooled condenser, type 4, with the temperature set at 100°F.

**Feed Stream Data and Recycle Estimates** — The crude oil assay analysis data is entered directly the same as in the shortcut calculation. The side stripper vapor returns are estimated assuming only stripping steam as an initial guess.

**Performance Specifications and Variables** —

**Preflash Tower** — The bottoms rate is specified at 16800 BBL/day. The naphtha product is set at 5420 BBL/day on the side stripper. The overflash is set at 400 BBL/day. The preflash condenser duty and feed furnace duty are calculated to satisfy overflash and bottoms rate specifications. The naphtha draw from the preflash column is calculated to satisfy the naphtha product specification.

**Crude Unit** — The bottoms, diesel and jet fuel product rates are specified at 7335, 3765 and 3780 BBL/day respectively. The  $L_9/V_{10}$  ratio is set at 0.35 in the crude unit, and the overflash from tray 13 is set at 5 percent by volume of the feed. The crude tower condenser, side-cooler, and feed furnace duties are calculated to satisfy the bottom product, L/V and overflash specifications. The side stripper product specifications are satisfied by varying the draws from the crude unit to the side strippers.

**Initial Estimate Generator** — The initial tray temperature, vapor and liquid profiles were generated automatically by PROCESS.

**COMMENTS ON RESULTS — RIGOROUS CALCULATION**

The output includes the ASTM/TBP curves of all streams for both the rigorous and shortcut distillations. The ASTM curves are also shown graphically in Figure R3-3. All product ASTM curves are in very close agreement except the heavy end of the naphtha and heavy naphtha products. The heavy naphtha 95 percent point is 375°F for the shortcut and 343°F for the rigorous. (Correspondingly the naphtha product has an ASTM 95 percent of 370°F on the shortcut and 386°F on the rigorous). This suggests that more trays may be required between the preflash feed and the naphtha draw tray.

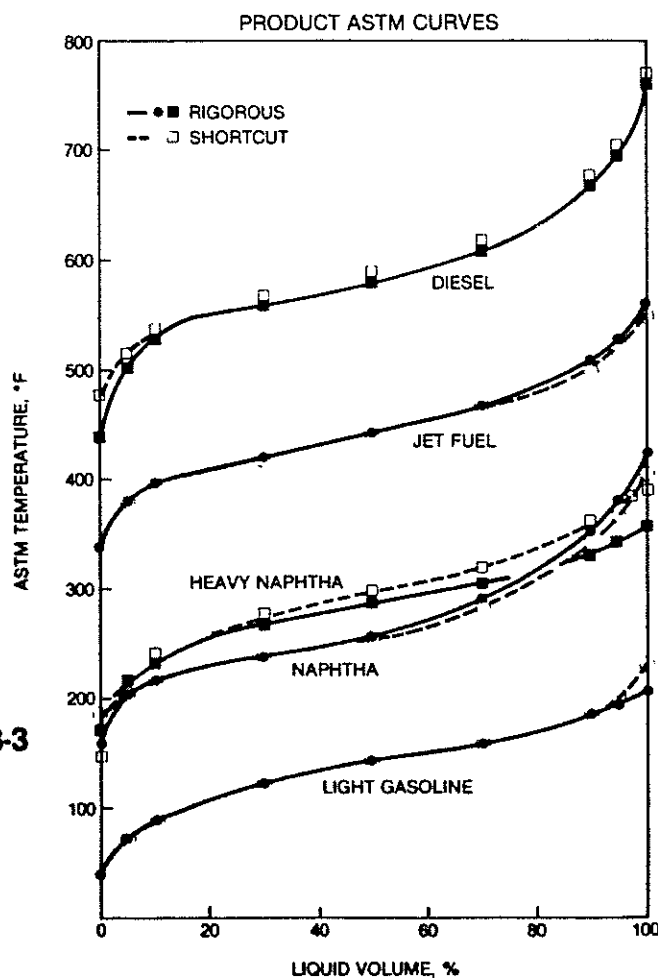


Fig. R3-3

## INPUT SHORTCUT

TITLE PROJ#R3,PROJECT=CRUDE UNIT,USER=SIMSCI STAFF,DATE=JAN 1979  
 DESC PREFLASH AND CRUDE UNIT SHORTCUT CALCULATIONS  
 PRINT TBP  
 DIMENSION ENGLISH,LIQVOL=BBL,TIME=DAY  
 COMPONENT DATA  
 LIQID 1,WATER/2,PROPANE/3,IBUTANE/4,BUTANE  
 TBP CUTS 50,150,4/550,16/750,4/1250,5  
 THERMODYNAMIC DATA  
 TYPE SYSTEM=BK10  
 STREAM DATA  
 PRUP STRM=1,TEMP=300,PRES=58,BASIS=V,RATE=25000  
 TMP DATA=1,83,98/5,125/10,167/20,227/30,291/40,370/50,460/60,552/70,643/  
 80,799/90,1023/100,1440,STRM=1  
 API STRM=1,AVG=35,DATA=12,66,7/19,55,3/40,37,6/62,27/42,19  
 LIGHT ENDS STRM=1,BASIS=V,PERCENT=1,17,COMP=2,0,18/3,0,3/4,0,69  
 PRUP STRM=9,PRES=115,COMP=1,100,BASIS=W,RATE=72000,PHASE=V  
 PRUP STRM=10,PRES=115,COMP=1,100,BASIS=W,RATE=21600,PHASE=V  
 PRUP STRM=19,PRES=115,PHASE=V,COMP=1,100,BASIS=W,RATE=36000  
 PRUP STRM=21,PRES=115,PHASE=V,COMP=1,100,BASIS=W,RATE=14400  
 PRUP STRM=20,PRES=115,PHASE=V,COMP=1,100,BASIS=W,RATE=15600  
 NAME 1,CRUDE/4,GASOLINE/5,LT NAPHTHA/8,PF BOTTOMS/11,HVY NAPHTHA/  
 12,JET FUEL/15,DIESEL/18,TOPPED CRUDE  
 UNIT OPERATIONS DATA  
 SHORTCUT UID=C-1,NAME=PREFLASH THR  
 FEED 1,10,9  
 PROD STRM=4,PRES=48,CUTP(V)=12  
 PROD STRM=5,PRES=54,CUTP(V)=36  
 PROD STRM=8,PRES=55  
 WATER PFWA  
 COND TYPE=4,TEMP=100  
 CALC MODEL=2  
 SPEC STRM=4,DB6(95)=200  
 SPEC STRM=5,DB6(5)=205  
 SPEC STRM=5,DB6(95)=370  
 SPEC STRM=8,API=25,DHY  
 SHORTCUT UID=C-3,NAME=CRUDE UNIT  
 FEED 8,19,20,21  
 WATER CTWA  
 COND TYPE=4,TEMP=100  
 CALC MODEL=2  
 PROD STRM=11,PRES=20,CUTP(V)=15  
 PROD STRM=12,PRES=23,CUTP(V)=50  
 PROD STRM=15,PRES=24,CUTP(V)=65  
 PROD STRM=18,PRES=25,CUTP(V)=100  
 SPEC STRM=11,DB6(95)=375  
 SPEC STRM=12,DB6(5)=380  
 SPEC STRM=12,DB6(95)=525  
 SPEC STRM=15,DB6(5)=515  
 SPEC STRM=15,DB6(95)=700  
 SPEC STRM=18,API=16,DHY

INPUT RIGOROUS

TITLE PRUB=R3,PROJECT=CRUDE UNIT,USER=SIMSCI STAFF,DATE=JAN 1979  
 DESC PREFLASH AND CRUDE RIGOROUS CALCULATIONS  
 PRINT TBP  
 DIMENSION ENGLISH,LIQVOL=BUL,TIME=DAY  
 COMPONENT DATA  
 LIQID 1,WATER/2,PROPANE/3,IBUTANE/4,BUTANE  
 TBP CUTS 50,150,4/550,16/750,4/1250,5  
 THERMODYNAMIC DATA  
 TYPE SYSTEM=HK10  
 STREAM DATA  
 PRUP STRM=1,TEMP=300,PRES=58,BASIS=V,RATE=25000  
 TBP DATA=3,83,98/5,125/10,167/20,227/30,291/40,370/50,460/60,552/70,643/80,799/90,1023/100,1440,STRM=1  
 API STRM=1,AVG=35,DATA=12,66,7/19,55,3/40,37,6/62,27/82,19  
 LIGHTENDS STRM=1,BASIS=V,PERCENT=1.17,COMP=2,0.18/3,0.3/4,0.69  
 PRUP STRM=9,PRES=115,COMP=1,100,BASIS=W,RATE=72000,PHASE=V  
 PRUP STRM=10,PRES=115,COMP=1,100,BASIS=W,RATE=21600,PHASE=V  
 PRUP STRM=19,PHES=115,PHASE=V,COMP=1,100,BASIS=W,RATE=36000  
 PRUP STRM=21,PRES=115,PHASE=V,COMP=1,100,BASIS=W,RATE=14400  
 PRUP STRM=20,PRES=115,PHASE=V,COMP=1,100,BASIS=W,RATE=15600  
 NAMF 1,CRUDE/4,GASOLINE/5,LT NAPHTHA/8,PF BOTTOMS/11,MVY NAPHTHA/12,JET FUEL/15,DIESEL/18,TOPPED CRUDE  
 UNIT OPERATIONS DATA  
 COLUMN UID=C-1,NAME=PREFLASH TWR  
 FEED 1,11,7,7,9,13  
 PROD QVHD=4,BTMS=8,22000,LDRAW=8,8,13400,WATER=PPFWA,1,5200  
 CUND TYPE=4,PRES=48,TEMP=100  
 HEAT 1,11/2,6,-120/3,1  
 PA FROM=8,TO=6,RATE=5200,BASIS=V  
 PRES 2,53/13,55  
 PARA TRAY=13  
 SPEC STRM=8,RATE(V)=16800  
 SPEC TRAY=10,PHASE=L,RATE(V)=400  
 VARI HEAT=1,3  
 ESTIMATE MODEL=2,CTEMP=100,RRATIO=0.7  
 SIDESTRIPPER UID=C-2,NAME=LT NAPHTHA SPLT  
 FEED 6,1/10,2  
 PROD QVHD=7,BTMS=5,13400  
 PARA TRAY=2  
 PSPEC TOP=54  
 SPEC STRM=5,RATE(V)=5420  
 VARI FEED=6  
 ESTIMATE MODEL=1  
 COLUMN UID=C-3,NAME=CRUDE UNIT  
 FEED 8,14,14,7,17,11,19,16  
 PROD QVHD=17,BTMS=18,5930,LDRAW=13,8,6700/16,12,4900,WATER=CTWA,1,3660  
 PARA TRAY=16  
 CUND TYPE=4,TEMP=100,PRES=20  
 HEAT 1,1/2,10/3,14  
 PA FROM=12,TO=10,RATE=4700,BASIS=V  
 PRES 2,23/16,25  
 ESTIMATE MODEL=2,CTEMP=100,RRATIO=0.6  
 SPEC STRM=18,RATE(V)=7335  
 SPEC TRAY=9,PHASE=L,REF=10,REFP=V,RATE=0.35  
 SPEC TRAY=13,PHASE=L,RATE(V)=0.05,REFS=8 *Boverflash*  
 VARI HEAT=1,2,3  
 SIDESTRIPPER UID=C-4,NAME=JET STRIP  
 FEED 13,1,21,2  
 PROD QVHD=14,BTMS=12,6700  
 PARA TRAY=2  
 PSPEC TOP=24  
 SPEC STRM=12,RATE(V)=3760  
 VARI FEED=13  
 ESTIMATE MODEL=1  
 SIDESTRIPPER UID=C-5,NAME=DIESEL STRIP  
 FEED 16,4,20,2  
 PROD QVHD=17,BTMS=15,4900  
 PARA TRAY=2  
 PSPEC TOP=24  
 SPEC STRM=15,RATE(V)=3765  
 VARI FEED=16  
 ESTIMATE MODEL=1





X3

# CRUDE COL STATFJORD

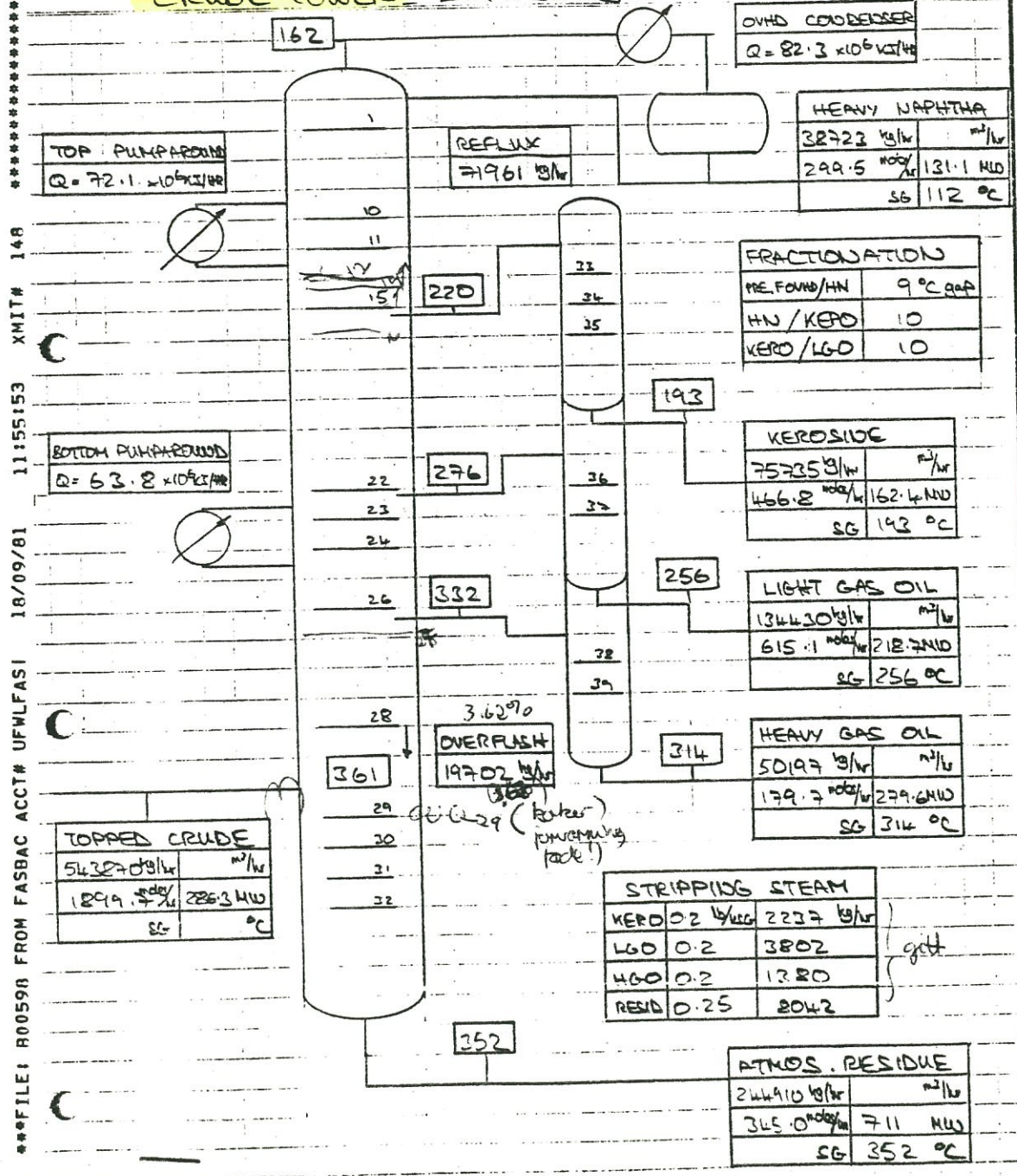
① Run meets  
all specs  
so no  
change.

A possible change  
however is steam  
stripping ratios  
to HGO  
& resid but  
leave as is for  
moment.

FOSTER WHEELER ENERGY LIMITED, F.W. HOUSE, STATION ROAD, READING, BERKSHIRE, RG1 1LX.

MADE BY ..... DATE ..... SUBJECT Norsk Hydro SHEET No. .... OF .....  
CHECKED BY ..... DATE ..... JOB No. 1-11-20950  
REV. 1 BY ..... DATE .....

## CRUDE TOWER STATFJORD. 0



\*\*\*FILE: R00598 FROM FASBAC ACCT# UFHLFASI 18/09/81 11:55:53 XMIT# 148 \*\*\*\*\*

GA 5-9.

9

get



ECHO PRINT OF INPUT DATA 17SEP81 17142103  
 \* RAFINOR CRUDE TOWER - STATFJORD - 1-11-20958  
 C- TOPPED CRUDE ASSAY TAKEN FROM PROGRAM AEA001, STATFJORD,  
 C- FINAL RUN - OUTPUT NAME H00560.

C- THERMODYNAMIC OPTIONS

DATA K KEY = 12

DATA H KEY = 9

C- FEED/DATA *DATA*

COM = 62,445,6778

FEE (KGM/HR) = 0, 0.0014, 0.00805, 0.0573, 0.3889, 1.6014,

0.0603, 2.358, 10.499, 91.077, 253.88, 1308.7,

4725.4, 13049., 17945., 16698., 16457., 16777., 19585., 18675.,

18800., 19351., 21775., 10176., 10177., 11718., 11717,

9391, 9390, 8771, 8771, 16914,

13157., 13814., 12012., 10213., 10238., 10262., 10287., 10312.,

20699., 20799., 20901., 21004., 21107., 21212., 21318., 21425.,

2575.6

CUT (F) = 121, 158, 182, 207, 232, 257, 282, 307, 332, 357, 382, 407, 432, 457,

482, 507, 532, 551, 563, 576, 588, 601, 613, 626, 638,

657, 682, 707, 745, 795, 845, 895, 945,

995, 1070, 1170, 1270, 1370, 1470, 1570, 1670, 1770, 1825,

FEE COM GRA (SPG) = .6143, .7002, .7372, .7509, .7625, .7706, .7786,

0.7893,

.7989, .8042, .8099, .8182, .8294, .8386, .846, .8527, .8619,

.8621, .8626, .8638, .8654, .8680, .8716, .8778, .8812,

.8831, .8919, .894, .8959, .898, .9002, .9023,

.9045, .9067, .91, .9144, .9189, .9234, .928, .9326, .9372, .9419,

.9446

FEE COM MOL = 88,36,90,11,93,18,99,09,105,5,112,65,120,17,127,64,

135,6,144,62,154,0,163,33,172,44,182,27,192,9,204,08,

215,06,225,6,232,4,239,6,246,2,252,8,259,2,265,6,

271,4,283,92,297,44,314,19,341,36,

380,66,423,45,469,88,520,48,574,12,662,44,793,4,938,01,

1093,31,1254,63,1415,62,1568,45,1704,24,1769,43

C- TOTAL FEED = 543870 KG/HR = 1899.5 KMOL/HR = 611.12 M3/HR (NTP)

C- COLUMN CONFIGURATION

C- TOTAL CONDENSER, 3 SIDESTREAM DRAWS, 2 PUMPAROUNDS

C- NOTE - TRAY NUMBERS IN ACTUAL TOWER ARE NUMBERED FROM BOTTOM TO

C- TOP, BUT REEINE NUMBERS TRAYS FROM TOP TO BOTTOM.

C- SEE SEPARATE SHEET FOR TRAY EFFICIENCIES USED.

TEM FEE(C)=381

PRE FEE(BAR)=2.55 *2.56*

LOC FEE=29

BUR=1

C- COLUMN SPECIFICATIONS

TEM PRO(C)=151, 158, 161, 162, 164, 165, 166, 167, 169, 168, 170, 188,

194, 200, 209, 220, 229, 236, 242, 248, 255, 268, 286, 313, 324,

333, 339, 341, 347, 344, 341, 199, 191, 182, 258, 248, 316, 306

TEM TOP(C)=151

TEM BOT(C)=341

TEM FLA ZON(C)=351

PRE TOP(BAR)=2.09

DEL(BAR)=0.517, 0.062, 0.041, 0.041

TOY

TEM CON(C)=112

PRE CON(BAR)=1.84

*0.5*  
*kg/h*

*Same som proce*

*try to put over side strip*

*ans. PRE BTR(BNR) = 2.09 + 0.517 = 2.607*



STA=32,3,2,2

C-STRIPPER DETAILS

LOC DRA STR=15,22,26  
LOC VAP STR=15,22,26

C-PRODUCT NAMES AND FLOWRATES

PRO GUE (KGMOL/HR)=0,378,41 } *rounded*  
PRO (KG/HR)=0,243957  
PRO NAM = HEAVY NAPHTHA, KEROSENE, LGO, HGO, RESIDUE  
PRO STR GUE (KGMOL/HR)=493,1,644,187.8 } *scattered*  
PRO STR (KG/HR)=75545, 134183, 50112  
DRY

C-PUMPAROUND DETAILS

C-LOC PUM=11,10,24,23  
C-HEA PUM (BTU/HR)=68,32E6, 72,98E6  
C-PRO PUM GUE (KGMOL/HR)=3018,0, 1618,8  
C-PRO PUM (KG/HR) = 44250, 406165

LOC HEA = 11  
HEA (BTU/HR) =-68,32E6,

C-STEAM CONDITIONS AND INJECTION RATES

C-STRIP RATES RESID 0.25 LB/GAL, OTHERS 0.2 LB/GAL  
LOC STE=33,36,38,40  
TEM STE(C)=4,368

PRE STE (BAR)=4,2,67

STE (KG/HR)=8042, 2237, 3802, 1380

C-FIX OVERFLASH AT ~~4.5~~ *3.62* PPM FEED

FIX LIQ (KGMOL/HR) 2,063,9,28,29  
FIX LIQ NET (KGMOL/HR) 1,50,23,24

C-PRINTOUT CONTROLS

REP=1  
PRO CUR=7\*0  
HEA CUR = 250,425  
EFV  
MET UNI OUT = BAR  
PRE UNI OUT = BAR  
ENT UNI OUT=KJ  
MAX MAT = 2  
END



F  
 (størst and like B  
 fra følgende benyning)

DETAILED FEED COMPONENT ANALYSIS OF FEED NO. 1

NO	COMPONENTS	K	WATSON	MOL WT.	API	KGML/HR
1	WATER	8.8	18.02	10.0	.00	.00
2	PROPANE	14.7	44.09	147.5	.00	.00
3	I-BUTANE	13.8	58.12	120.0	.00	.00
4	N-BUTANE	13.5	58.12	110.8	.00	.00
5	I-PENTANE	13.1	72.15	95.1	.01	.02
6	N-PENTANE	13.0	72.15	92.8	.00	.00
7	121 ABP	13.6	88.36	98.8	.00	.00
8	158 ABP	12.2	90.11	70.6	.03	.11
9	182 ABP	11.7	93.18	60.4	.11	.92
10	207 ABP	11.6	99.09	56.9	.92	2.41
11	232 ABP	11.6	105.50	54.1	11.62	11.62
12	257 ABP	11.6	112.65	52.1	39.32	39.32
13	282 ABP	11.6	120.17	50.2	102.23	102.23
14	307 ABP	11.6	127.64	47.8	132.34	132.34
15	332 ABP	11.6	135.60	45.6	115.46	115.46
16	357 ABP	11.6	144.62	44.5	106.86	106.86
17	382 ABP	11.7	154.00	43.2	102.72	102.72
18	407 ABP	11.7	163.33	41.4	113.58	113.58
19	432 ABP	11.6	172.44	39.1	102.46	102.46
20	457 ABP	11.6	182.27	37.2	97.46	97.46
21	482 ABP	11.6	192.90	35.8	94.82	94.82
22	507 ABP	11.6	204.08	34.4	101.25	101.25
23	532 ABP	11.6	215.06	32.7	45.11	45.11
24	551 ABP	11.6	225.60	32.6	43.79	43.79
25	563 ABP	11.7	232.40	32.5	48.91	48.91
26	576 ABP	11.7	239.60	32.3	47.59	47.59
27	588 ABP	11.7	246.20	32.0	37.15	37.15
28	601 ABP	11.7	252.80	31.5	36.23	36.23
29	613 ABP	11.7	259.20	30.8	33.02	33.02
30	626 ABP	11.7	265.60	29.7	32.32	32.32
31	638 ABP	11.7	271.40	29.1	59.57	59.57
32	657 ABP	11.7	283.92	28.7	44.23	44.23
33	682 ABP	11.7	297.44	27.2	43.97	43.97
34	707 ABP	11.8	314.19	26.8	35.19	35.19
35	745 ABP	11.9	341.36	26.4	26.83	26.83
36	795 ABP	12.0	380.66	26.1	24.18	24.18
37	845 ABP	12.1	423.45	25.7	21.84	21.84
38	895 ABP	12.3	469.88	25.3	19.78	19.78
39	945 ABP	12.4	520.08	24.9	17.96	17.96
40	995 ABP	12.5	574.12	24.6	31.25	31.25
41	1070 ABP	12.7	662.44	24.0	26.22	26.22
42	1170 ABP	12.9	793.40	23.2	22.28	22.28
43	1270 ABP	13.1	938.01	22.5	19.21	19.21
44	1370 ABP	13.2	1093.31	21.7	16.82	16.82
45	1470 ABP	13.4	1254.63	21.0	14.98	14.98
46	1570 ABP	13.6	1415.62	20.2	13.59	13.59
47	1670 ABP	13.7	1568.45	19.5	12.57	12.57
48	1770 ABP	13.9	1704.24	18.7		



49	1825 ARP	13.9	1769.43	18.3	1.46
		-----	-----	-----	-----
		12.2	286.30	30.2	1899.66
		-----	-----	-----	-----



SYSTEM DESIGN SPECIFICATIONS

-----  
 DISTILLATION WITH TOTAL CONDENSER  
 NUMBER OF THEORETICAL STAGES = 32 (~~31~~)      PROCESS: 33 (?)  
 CONDENSER PRESSURE = 1.84 BAR  
 TOP TOWER PRESSURE = 2.090 BAR  
 BOTTOM TOWER PRESSURE = 2.607 BAR  
 HEAT REMOVAL AT STAGE 11 = 72083+08 KJ/HR      (Top pumparound) reflow som højer, (11: gift)  
 BOTTOM STEAM RATE = 446.78 KGMOL/HR      (CIB som steam)  
 STEAM TEMPERATURE = 368.00 DEG C  
 STEAM PRESSURE = 2.6700 BAR  
 STEAM HEAT = 55863+07 KJ/HR  
 CONVERGENCE TOLERANCE = 10000-04  
 ADJUSTED RATE VARIABLE = VAPOR  
 \*\*\*\*\*  
 KEY SPECIFICATIONS  
 BOTTOM PRODUCT = 2440+06 KG/HR      Vari: QC  
 CONDENSER TEMPERATURE = 112.00 DEG C      (TD) undertryk  
 \*\*\*\*\*

AB: Reflux subtraheret

Specs:

- C011
- Steam til grunn

SIDE STRIPPER SPECIFICATIONS

-----  
 SIDE STRIPPER 1 - STEAM SIDE STRIPPER  
 NUMBER OF THEORETICAL STAGES = 3  
 INLET STREAM FROM STAGE 15 OF MAIN COLUMN  
 OUTLET STREAM INTO STAGE 15 OF MAIN COLUMN  
 LOCATION FEED FROM MAIN COLUMN = 1  
 \*\*\*\*\*  
 +---+ WARNING - TOP PRESSURE OF SIDE STRIPPER IS NOT GIVEN  
 IT HAS BEEN SET TO THE SIDE DRAW STAGE PRES.  
 \*\*\*\*\*  
 TOP TOWER PRESSURE = 2.323 BAR  
 BOTTOM TOWER PRESSURE = 2.385 BAR  
 TOP TOWER TEMPERATURE = 199.00 DEG C  
 BOTTOM TOWER TEMPERATURE = 182.00 DEG C  
 BOTTOM STEAM RATE = 124.28 KGMOL/HR  
 STEAM TEMPERATURE = 360.00 DEG C  
 STEAM PRESSURE = 2.6700 BAR  
 STEAM HEAT = 15539+07 KJ/HR  
 BOTTOM PRODUCT RATE = 75545. KG/HR  
 \*\*\*\*\*

!  
 H-specs



-----  
 SIDE STRIPPER SPECIFICATIONS  
 -----

SIDE STRIPPER 2 - STEAM SIDE STRIPPER  
 NUMBER OF THEORETICAL STAGES = 2  
 INLET STREAM FROM STAGE 22 OF MAIN COLUMN  
 OUTLET STREAM INTO STAGE 22 OF MAIN COLUMN  
 LOCATION FEED FROM MAIN COLUMN = 1  
 +\*\*\* WARNING - TOP PRESSURE OF SIDE STRIPPER IS NOT GIVEN  
 IT HAS BEEN SET TO THE SIDE DRAW STAGE PRES.  
 TOP TOWER PRESSURE = 2.440 BAR  
 BOTTOM TOWER PRESSURE = 2.481 BAR  
 TOP TOWER TEMPERATURE = 258.00 DEG C *210 deg C*  
 BOTTOM TOWER TEMPERATURE = 248.00 DEG C  
 BOTTOM STEAM RATE = 211.22 KGMOL/HR *210 kg/hr*  
 STEAM TEMPERATURE = 368.00 DEG C  
 STEAM PRESSURE = 2.6700 BAR *high steam*  
 STEAM HEAT = 26410.07 KJ/HR  
 BOTTOM PRODUCT RATE = .13418+06 KG/HR

SIDE STRIPPER 3 - STEAM SIDE STRIPPER  
 NUMBER OF THEORETICAL STAGES = 2  
 INLET STREAM FROM STAGE 26 OF MAIN COLUMN  
 OUTLET STREAM INTO STAGE 26 OF MAIN COLUMN  
 LOCATION FEED FROM MAIN COLUMN = 1  
 +\*\*\* WARNING - TOP PRESSURE OF SIDE STRIPPER IS NOT GIVEN  
 IT HAS BEEN SET TO THE SIDE DRAW STAGE PRES.  
 TOP TOWER PRESSURE = 2.507 BAR  
 BOTTOM TOWER PRESSURE = 2.548 BAR  
 TOP TOWER TEMPERATURE = 316.00 DEG C  
 BOTTOM TOWER TEMPERATURE = 306.00 DEG C  
 BOTTOM STEAM RATE = 76.667 KGMOL/HR *400 kg/hr*  
 STEAM TEMPERATURE = 368.00 DEG C  
 STEAM PRESSURE = 2.6700 BAR  
 STEAM HEAT = 95860.06 KJ/HR  
 BOTTOM PRODUCT RATE = 50112.

FIX CONDITIONS  
 -----

LOCATION	TYPE	FIXED	RATE	ITEMS VARIED
1	LIQUID		50.000	TRAY 24 DUTY
2	LIQUID		63.900	TRAY 29 DUTY

*Bottom pumparound*  
*2 nge specs + 2 nge rate*  
*029, 029*  
*Hotwater flow er eleven no figuren*

THE ABOVE FIX LIQUID RATE EXCLUDES LIQUID DRAWS

\*\*\* WARNING ----- THE 7TH COMPONENT GRAVITY IS GREATER THAN 90 ENTHALPY CALCULATION MIGHT BE FAULTY







CHEMSHARE REFINE      VERSION 8.3019(01APR81)      17SEP81      17:42:03  
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COLUMN PROFILES

SIDE STRIPPER 2

TRAY NO.	TEMP DEG C	LIQUID RATES KG/MOL/HR	KG/HR	VAPOR RATES KG/MOL/HR	KG/HR
1	266.04	726.67	.15581+06	429.48	44249.
2	256.34	615.12	.134+3.06 (gwt)	322.76 ↑ 211.22 steam	25193.

SIDE STRIPPER 3

TRAY NO.	TEMP DEG C	LIQUID RATES KG/MOL/HR	KG/HR	VAPOR RATES KG/MOL/HR	KG/HR
1	323.48	214.34	58617.	146.94	17464.
2	314.22	179.70	50197. (gwt)	111.30 76.657 steam	9801.3

SIDE STRIPPER FEEDS

SIDE STRIPPER	LOCATION	FEED RATE KG/MOL/HR	KG/HR	M3(NTP)/HR
1	16	642.24	.10239+06	122.98
2	23	833.38	.17487+06	201.14
3	27	249.97	66283.	74.215



TRAY LOADINGS AND TOWER DIAMETERS WITHIN COLUMNS

APPROXIMATE TOWER DIAMETER AT FLOOD FROM THE SMITH, DRESSER AND OHLWASGER CORRELATION. FOR REFERENCE, SEE PETROLEUM REFINER, MAY 1963, VOL. 40, NO. 5, PAGE 183. FEED RATES ARE ASSUMED TO BE ON A PER HOUR BASIS.

USER-PROVIDED INPUT DATA

TRAY SPACING M = .000  
 DOWNCOMER AREA M2 = .000  
 WEIR LENGTH M = .000  
 WEIR HEIGHT M = .000

SINCE NO USER-PROVIDED VALUE WAS ENTERED FOR DOWNCOMER AREA, IT WAS ASSUMED TO BE EQUAL TO 12 PERCENT OF THE TOWER AREA.

SETTLING HEIGHT IS CALCULATED FROM TRAY SPACING, WEIR LENGTH AND WEIR HEIGHT. SINCE USER-PROVIDED VALUES WERE NOT ENTERED FOR THESE QUANTITIES, A SETTLING HEIGHT OF 12 INCHES WAS ASSUMED.

MAIN COLUMN

TRAY NO.	DIA.FT	CONDENSER	LIQUID OFF GAL./MIN.	VAPOR OFF CU.FT./SEC.
0			441.44	.00000
1	12.738		623.16	280.65
2	13.589		649.99	308.70
3	13.691		655.16	310.72
4	13.693		656.98	309.17
5	13.679		657.72	307.13
6	13.660		657.84	304.97
7	13.638		657.45	302.75
8	13.613		656.50	300.50
9	13.585		654.66	298.22
10	13.553		652.52	295.86
11	14.786		2025.1	293.53
12	20.208		2322.3	535.54
13	20.964		2336.4	573.19
14	20.924		2304.1	569.08
15	20.042		2288.3	509.18
16	19.478		1588.7	500.21
17	19.380		1585.1	491.90
18	19.321		1575.5	486.00
19	19.226		1545.7	479.94
20	19.060		1486.1	472.10
21	18.775		1377.8	461.05
22	17.048		1255.8	369.51
23	15.706		76.717	352.17



24					
25	16.432	1126.2	347.79		
26	19.782	1182.4	483.47		
27	19.345	1072.6	456.68		
28	18.624	465.30	443.00		
29	17.941	131.94	426.16		
30	18.031	1821.1	400.04		
31	10.240	1673.6	121.77		
32	9.3136	1599.1	104.23		
	8.6274	1495.5	95.727		



TRAY LOADINGS AND TOWER DIAMETERS WITHIN COLUMNS (CONTINUED)

SIDE STRIPPER 1

TRAY NO.	DIA.FT	LIQUID OFF GAL./MIN.	VAPOR OFF CU.FT./SEC.
1	6.7581	609.24	48.887
2	5.9922	561.13	37.416
3	5.3154	485.41	29.979

SIDE STRIPPER 2

TRAY NO.	DIA.FT	LIQUID OFF GAL./MIN.	VAPOR OFF CU.FT./SEC.
1	8.4953	1018.3	74.868
2	7.2232	866.10	54.835

SIDE STRIPPER 3

TRAY NO.	DIA.FT	LIQUID OFF GAL./MIN.	VAPOR OFF CU.FT./SEC.
1	5.2564	387.69	27.635
2	4.4609	327.79	20.483

\* = LIQUID TO VAPOR RATIO NOT WITHIN CORRELATION LIMITS.



-----  
 \*\* THE FOLLOWING ITEMS WILL NOT APPEAR IN THE PICTURE, \*\*  
 \*\* IF THEY ARE APPLICABLE. \*\*  
 \*\* 1. RETURN LIQUID STREAM. \*\*  
 \*\* 2. FEED AT THE CONDENSER. \*\*  
 \*\*\*\*\*

UNITS  
 -----  
 TEMPERATURE IN DEG C PRESSURE IN BAR  
 HEAT DUTY IN KJ/HR FLOW RATE IN KGMOL/HR

```

XX=====XX 1708.5 QC= .82260+08
XX P = 2.09 XX----->>>P= 1.84 *
XX T = 161.67 XX 556.48 *T= 112.00 *
XX XX<<----->>>*****
XX=====XX D = 299.45
XX XX W = 852.54
XX XX HD= -.60124+07
XX XX HW= -.31205+08
XX Q= -.68320+08 XX
XX=====XX
XX XX
XX XX
XX XX
XX XX 299.76
XX=====XX<<----->>>
XX XX *T= 209.96 1
XX XX
XX XX
XX XX
XX=====XX 642.24 1
XX 1----->>>*****
XX 1----->>>*****
XX 1502.1 1----->>>*****
XX 1----->>>*****
XX XX *T= 220.07 *STRIPPER 1*
XX XX *****
XX XX STEAM PRODUCT
XX XX RATE 124.28 466.77
XX XX TEMP 368.00 193.31
XX XX PRES 2.67 2.39
XX XX H= .1554+07 .4608+07
XX XX
XX XX 429.48
XX=====XX<<----->>>
XX XX *T= 266.04 1
XX XX
XX XX
XX=====XX 833.38 1
XX 1----->>>*****
XX 1----->>>*****
XX 68.116 1----->>>*****
XX 1----->>>*****
XX XX *T= 275.77 *STRIPPER 2*
XX XX *****
XX XX STEAM PRODUCT
  
```

Refine's profile:  
 TRAY 15 : LIQRATE = 2144  
 => 1502 + 642 = 2144  
 NB

Var speak!

