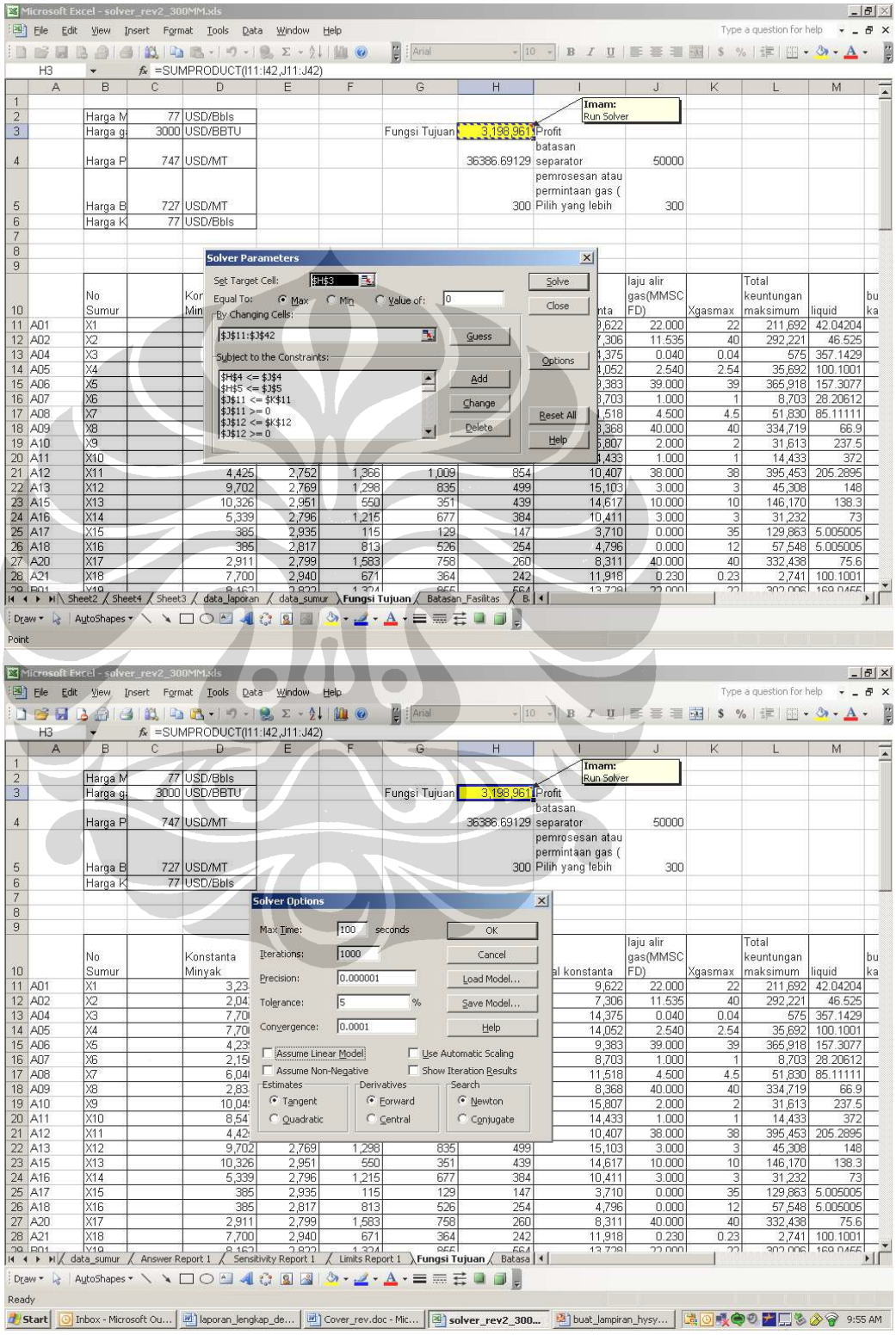
LAMPIRAN

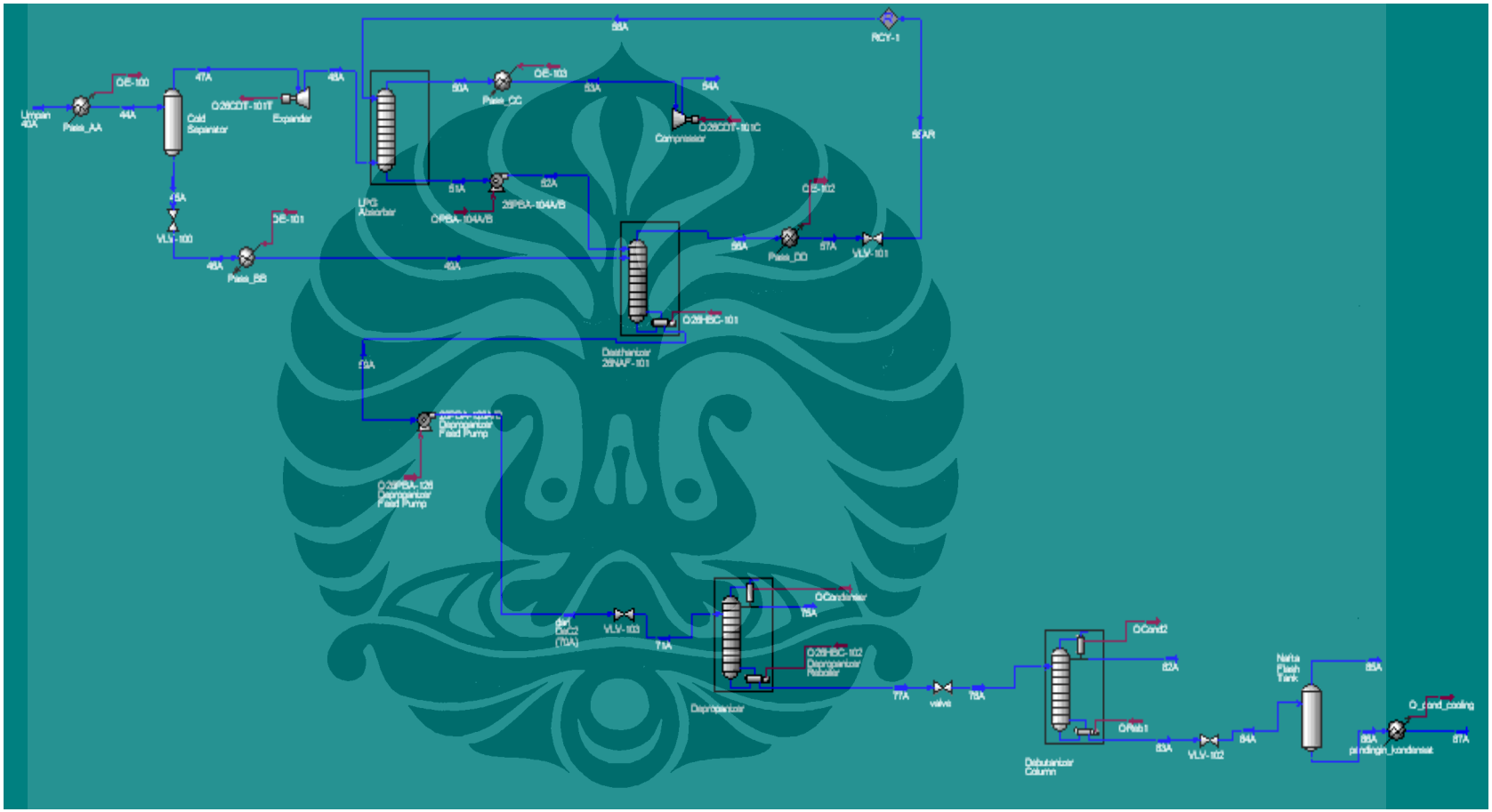
Lampiran 1 Data Hasil Optimasi pada Microsoft Excel

	Fungsi Tujuan (USD)	3,198,961	Harga Minyak	77	USD/Bbls
	batasan cairan (BBLS)	50,000	Harga gas pipa	3000	USD/BBTU
	batasan gas (MMSCF)	300	Harga Propana	747	USD/MT
	cairan yang diproses (BBLS)	36,386	Harga Butana	727	USD/MT
	gas yang diproses (MMSCF)	300	Harga Kondensat	77	USD/Bbls
No Sumur	laju alir gas (MMSCFD)	Xgasmax	bukaan katup (%)	laju alir minyak(bbls/d)	laju alir air(bbls/d)
X1	22.000	22	100	924.0	0.9
X2	11.535	40	29	306.0	230.7
X3	0.040	0.04	100	4.0	10.3
X4	2.540	2.54	100	254.0	0.3
X5	39.000	39	100	2147.0	3988.0
X6	1.000	1	100	28.0	0.2
X7	4.500	4.5	100	353.0	30.0
X8	40.000	40	100	1472.0	1204.0
X9	2.000	2	100	261.0	214.0
X10	1.000	1	100	111.0	261.0
X11	38.000	38	100	2184.0	5617.0
X12	3.000	3	100	378.0	66.0
X13	10.000	10	100	1341.0	42.0
X14	3.000	3	100	208.0	11.0
X15	0.000	35	0	0.0	0.0
X16	0.000	12	0	0.0	0.0
X17	40.000	40	100	1512.0	1512.0
X18	0.230	0.23	100	23.0	0.0
X19	22.000	22	100	2332.0	1387.0
X20	1.000	1	100	106.4	959.3
X21	0.045	0.045	100	2.3	0.0
X22	2.950	2.95	100	295.0	0.0
X23	0.030	0.03	100	3.0	10.4
X24	0.000	0.5	0	0.0	0.0
X25	16.000	16	100	1269.0	355.0
X26	19.000	19	100	1723.0	114.0
X27	0.000	0.8	0	0.0	0.0
X28	0.000	0.5	0	0.0	0.0
X29	11.000	11	100	1824.0	135.0
X30	0.000	3	0	0.0	0.0
X31	0.130	0.13	100	13.0	0.0
X32	10.000	10	100	602.0	563.0

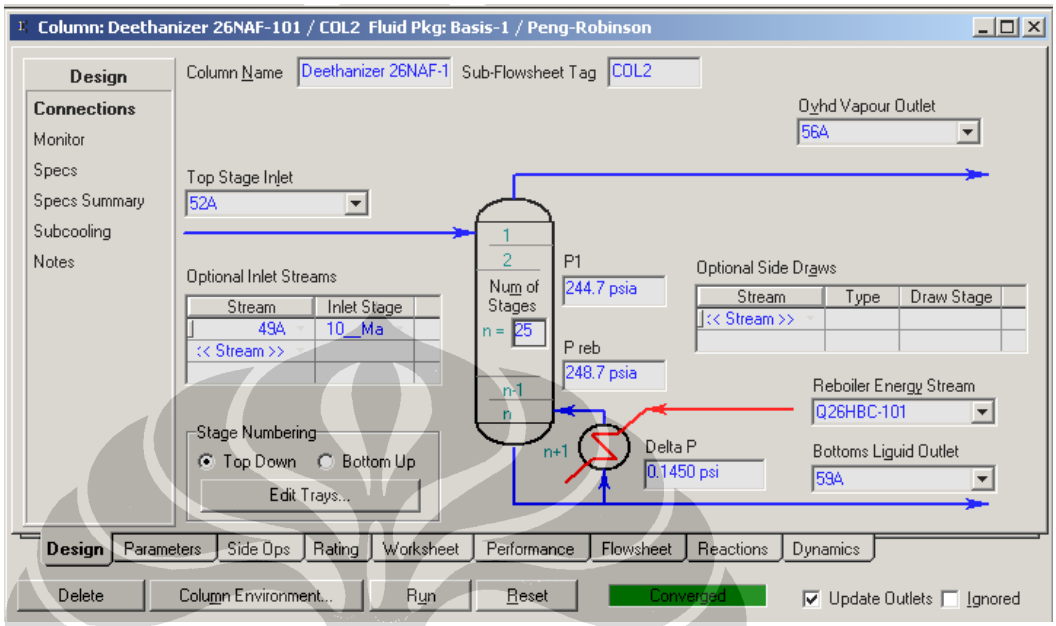
Lampiran 2 Solver yang digunakan pada Microsoft Excel

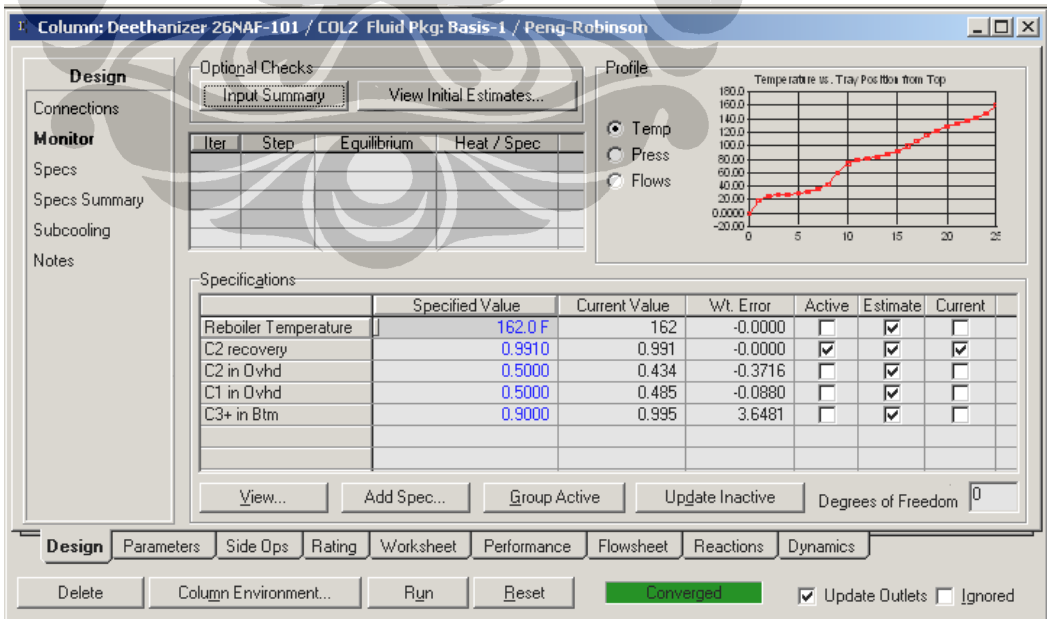


Lampiran 3 Diagram laju alir pada Simulasi Hysys

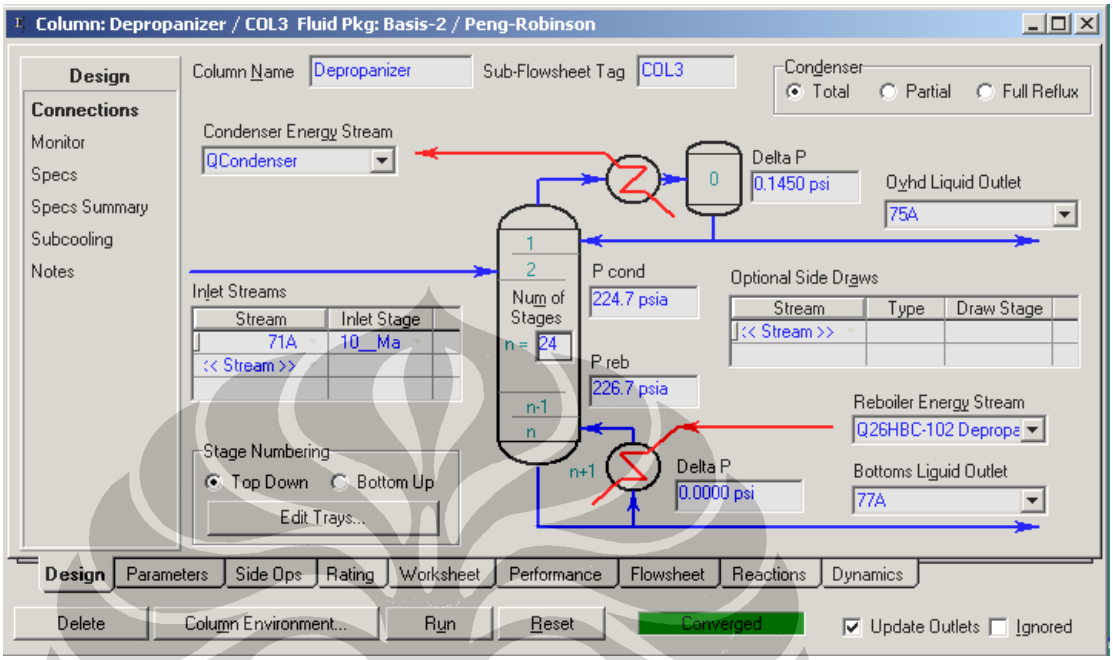


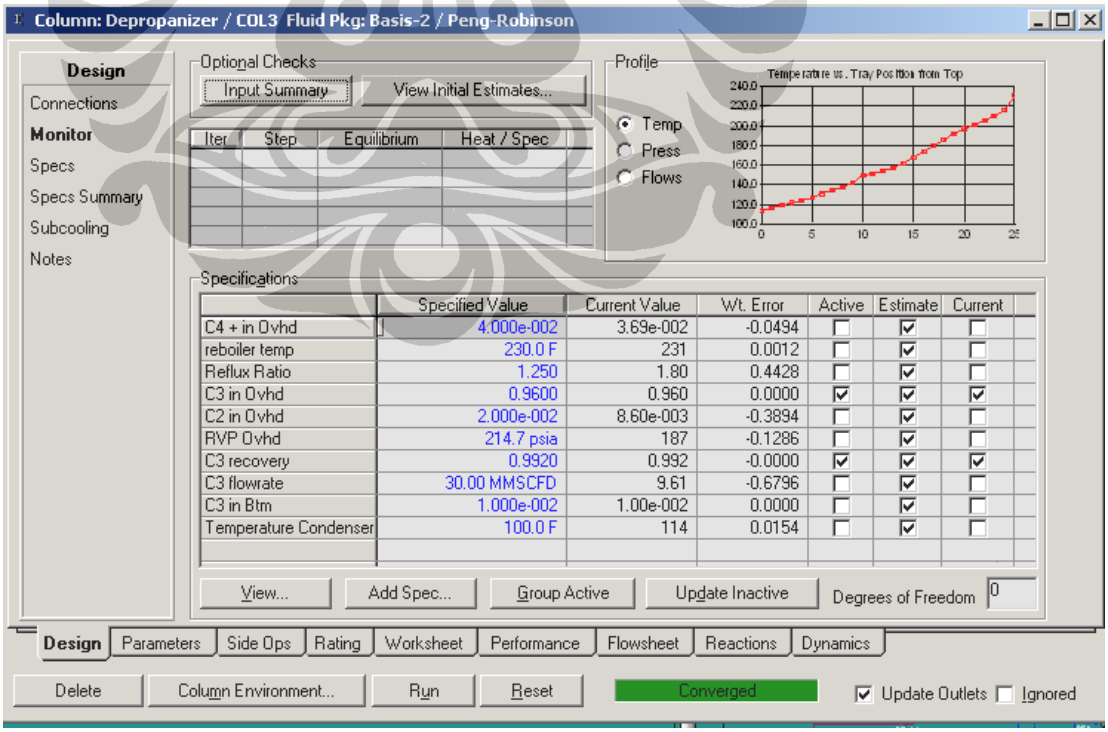
Lampiran 4 Konfigurasi Kolom Deethanizer pada Simulasi Hysys



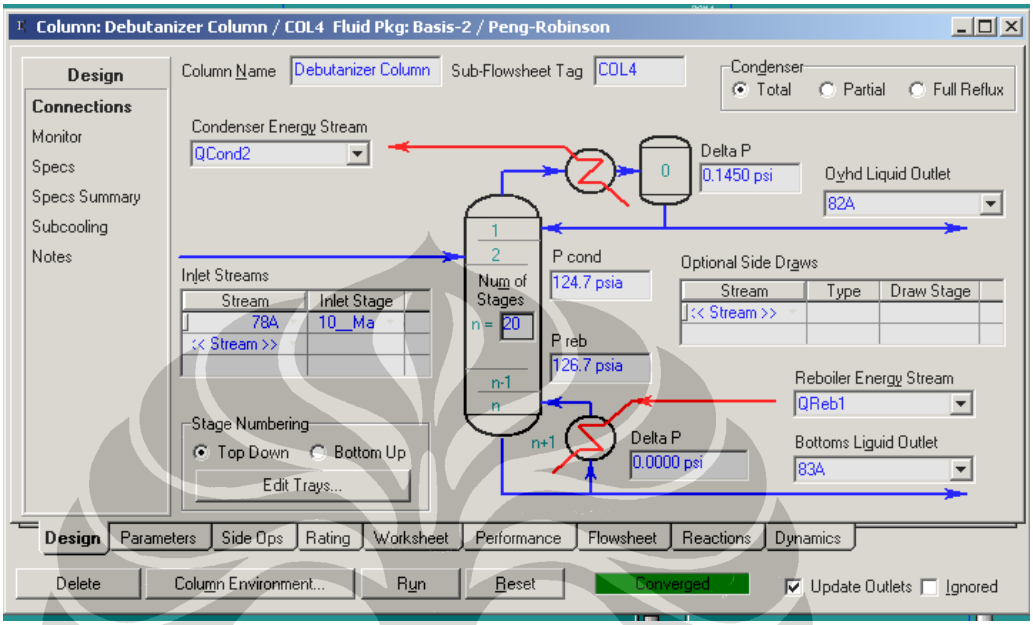


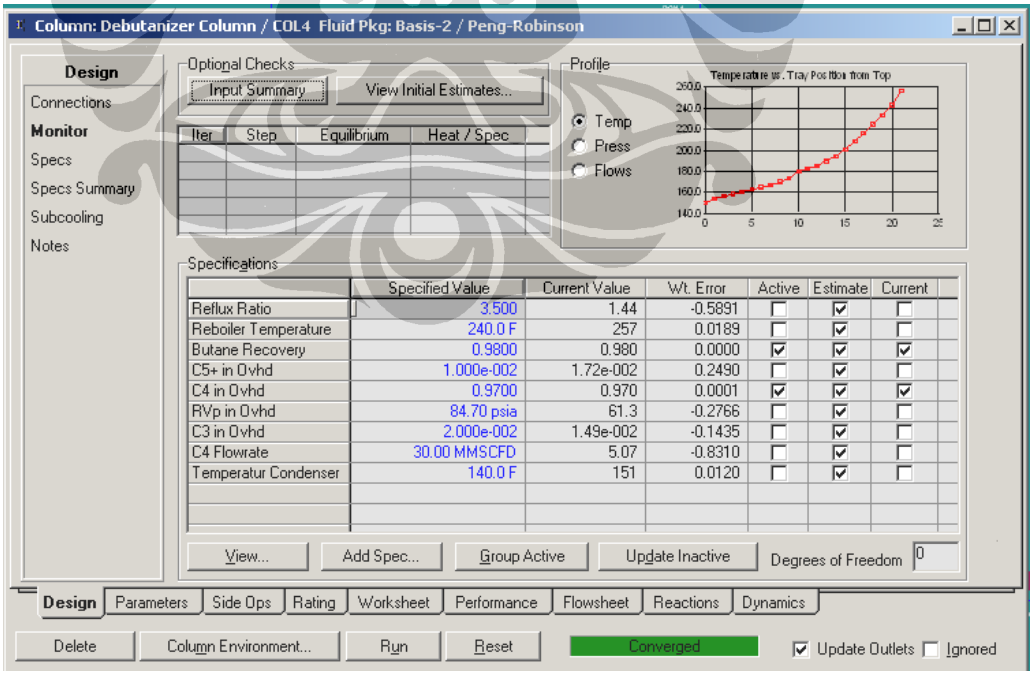
Lampiran 5 Konfigurasi Kolom Depropanizer pada Simulasi Hysys





Lampiran 6 Konfigurasi Kolom Debutanizer pada Simulasi Hysys





Lampiran 7 Spesifikasi LPG Propana Saudi Aramco

SAUDI ARAMCO PRODUCT SPECIFICATION

NUMBER: A-140
ISSUE DATE: 10/14/98
REPLACES: 03/10/98
PAGE NO.: 1 OF 1

REFRIGERATED PROPANE LPG (a)

TEST	GUARANTEE	METHOD
Composition, liquid volume % Ethane Propane Butanes Pentanes and heavier Total Olefins	 Max 2.0 Min 95.0 Max 4.0 Nil Max 0.1	ASTM D-2163
Corrosive Compounds, Copper strip	Max No 1b	ASTM D-1838
Hydrogen Sulfide, ppm (wt) (Note b)	Max 5	Lead acetate paper per Exxon Lab. Inspection Circular 200.14 UOP-212
Specific Gravity 60°F/60°F	To be reported	ASTM D-2598
Sulfur (Total), ppm (wt) (µg/g)	Max 30	ASTM D-2784 or ASTM D-4045 modified (Note d)
Vapor Pressure @ 100°F, psig (kPa(g))	Max 200 (1380)	ASTM D-2598 or ASTM D-1267
Water Content , ppm (wt)	Max 10 (Note c)	ASTM E-700

Notes:
a. Odorant not required in refrigerated propane LPG.
b. Hydrogen sulfide test required only when volatile sulfur test exceeds 5 ppm. Passing test of hydrogen sulfide shall be reported as "Not more than 5 ppm".
c. Product shall contain no free water.
d. ASTM D-4045 as modified by Saudi Aramco can also be used as an alternative method of testing.

Lampiran 8 Spesifikasi LPG Butana Saudi Aramco

SAUDI ARAMCO PRODUCT SPECIFICATION

NUMBER: A-160
ISSUE DATE: 10/14/98
REPLACES: 03/10/98
PAGE NO.: 1 OF 1

REFRIGERATED BUTANE LPG (a)

TEST	GUARANTEE	METHOD
Composition, liquid volume % Propane Iso-butane N-butane Isopentane and heavier Olefins	 Max 2.0 Max 29.0 Min 68.0 Max 1.0 Max 0.1	ASTM D-2163
Corrosive Compounds, Copper strip	Max No. 1b	ASTM D-1838
Hydrogen Sulfide, ppm (wt) (Note b)	Max 5	Exxon Laboratory Inspection Circular 200.14 or UOP-212
Specific Gravity, 60 °F/60 °F	To be reported	ASTM D-2598
Total Sulfur, ppm (wt) (µg/g)	Max 30	ASTM-D-2784 or ASTM D-4045 modified (Note d)
Vapor Pressure @ 100°F, psig (kPa(g))	Max 70 (483)	ASTM D-2598 or ASTM D-1267
Water Content, ppm (wt)	Max 10 (Note c)	ASTM E-700

Notes:
a) Odorant not required in refrigerated butane LPG.
b) Hydrogen sulfide test required only when volatile sulfur test exceeds 5 ppm. Passing test of hydrogen sulfide shall be reported as "Not more than 5 ppm".
c) Product shall contain no free water.
d) ASTM D-4045 as modified by Saudi Aramco can also be used as an alternative method of testing.

Lampiran 9 Hasil Simulasi Unit Deethanizer

Unit Deethanizer	Kondisi proses	keterangan
T_masuk Heat Exchanger Pass_AA (F)	88.5	ditentukan
T_keluar Heat Exchanger Pass_AA (F)	0.0	ditentukan
T_masuk Heat Exchanger Pass_BB (F)	-29.1	dihitung
T_keluar Heat Exchanger Pass_BB (F)	82.5	ditentukan
T_masuk Heat Exchanger Pass_CC (F)	-97.5	dihitung
T_keluar Heat Exchanger Pass_CC (F)	83.5	ditentukan
T_masuk Heat Exchanger Pass_DD (F)	-0.7	dihitung
T_keluar Heat Exchanger Pass_DD (F)	-91.3	ditentukan
Tekanan_masuk Expander (psia)	718	ditentukan
Tekanan_keluar Expander (psi)	215	ditentukan
Recovery C3+	0.9	dihitung
Recovery C2	0.99	ditentukan
Tekanan Umpan kolom /Reboiler (psia)	248.7	ditentukan
Tekanan LPG Absorber (psia)	244.7	ditentukan
Jumlah tahap	21	ditentukan
Lokasi umpan	10	ditentukan
Temperatur reboiler kolom deethanizer (F)	162	dihitung
Fraksi C3+ di bawah kolom	0.995	dihitung
Laju alir C3 + di bagian bawah kolom DeC2 (MMSCFD)	17.7	dihitung
Dewpoint gas menuju pipa pada 700 psia	-64 F	dihitung (spesifikasi maksimum 55 F)
Fraksi Methana pada gas menuju pipa	0.89	dihitung (spesifikasi maksimum 0.8)

Lampiran 10 Hasil Simulasi Unit Depropanizer

Kolom Depropanizer	Kondisi Proses	Spesifikasi Penjualan	Keterangan
Recovery C3	0.99		ditentukan
Fraksi C3 di atas	0.96	Min 0.95	ditentukan
Tekanan umpan /reboiler (psia)	227		ditentukan
Hilang tekan antara kolom bagian bawah dan atas (psia)	2		ditentukan
Jumlah tahap	25		ditentukan
Lokasi umpan	10		ditentukan
Temperatur Reboiler (F)	231		dihitung
Rasio Refluks	1.8		dihitung
Temperatur Kondenser (F)	114		dihitung
Fraksi C4+ di atas kolom	0.037	Maks 0.04	dihitung
Fraksi C2 di atas kolom	0.009	Maks 0.02	dihitung
RVP di atas kolom (psia)	187	Maks 200	dihitung

Lampiran 11 Hasil Simulasi Kolom Debutanizer

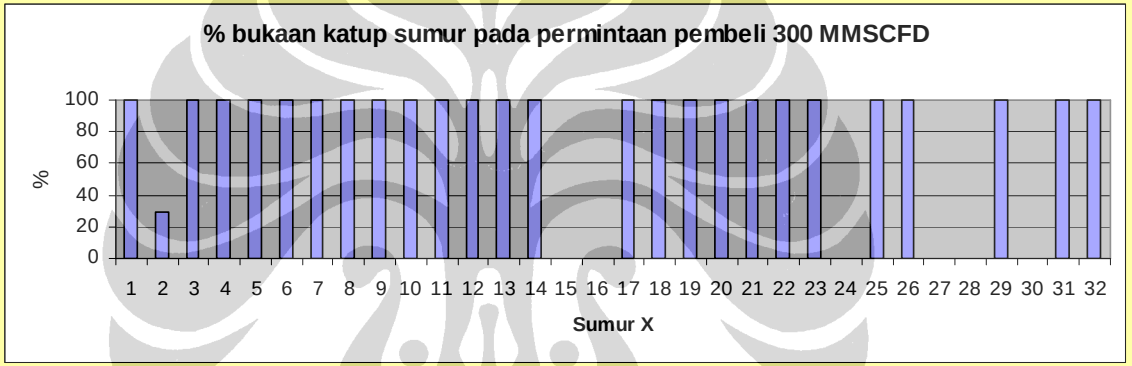
Kolom Debutanizer	Kondisi Proses	Spesifikasi Penjualan	Keterangan
C4 Recovery	0.98		ditentukan
Fraksi C4 di atas	0.97	Min 0.97	ditentukan
Jumlah tahap	21		ditentukan
Lokasi umpan	10		ditentukan
Tekanan umpan/reboiler (psi)	127		ditentukan
Hilang tekan antara kolom bagian bawah dan atas (psia)	2		ditentukan
Temperatur Reboiler (F)	257		dihitung
Rasio Refluks	1.4		dihitung
Temperatur Kondenser	151		dihitung
Fraksi C5+ di atas kolom	0.017	Maks 0.02	dihitung
Fraksi C3 di atas kolom	0.015	Maks 0.02	dihitung
RVP di atas kolom	61.3	Maks 70	dihitung

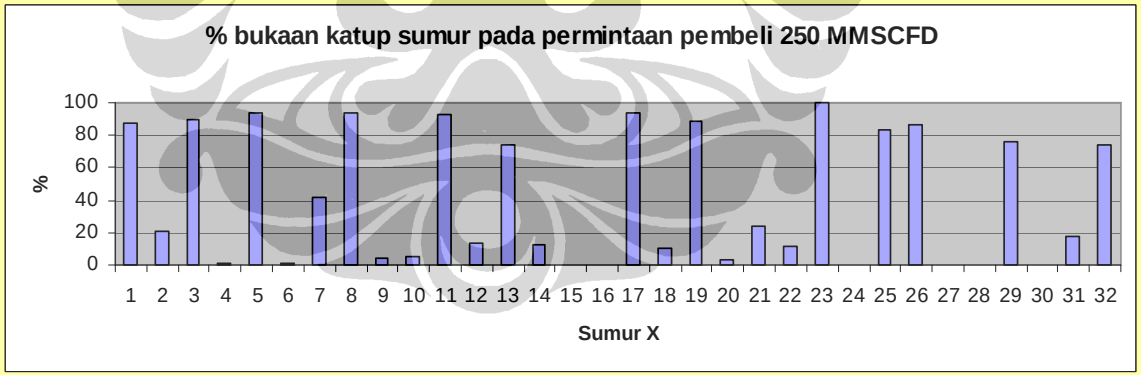
Lampiran 12 Hasil Simulasi Tangki Stabilisasi Kondensat

Tangki Stabilisasi Kondensat	Kondisi Proses	Spesifikasi Penjualan	Keterangan
Tekanan_umpan (psi)	26.7		ditentukan
T_keluar pendingin (F)	80		ditentukan
Laju Alir Produk (MMSCFD)	1.278		dihitung
RVP Kondensat (Psia)	11.5	< 13 psia	dihitung
SG	0.6405	0.64-0.74	dihitung
Fraksi Uap Kondensat	0		dihitung

Lampiran 13 Hasil Optimasi Sumur

Hasil Optimasi Sumur





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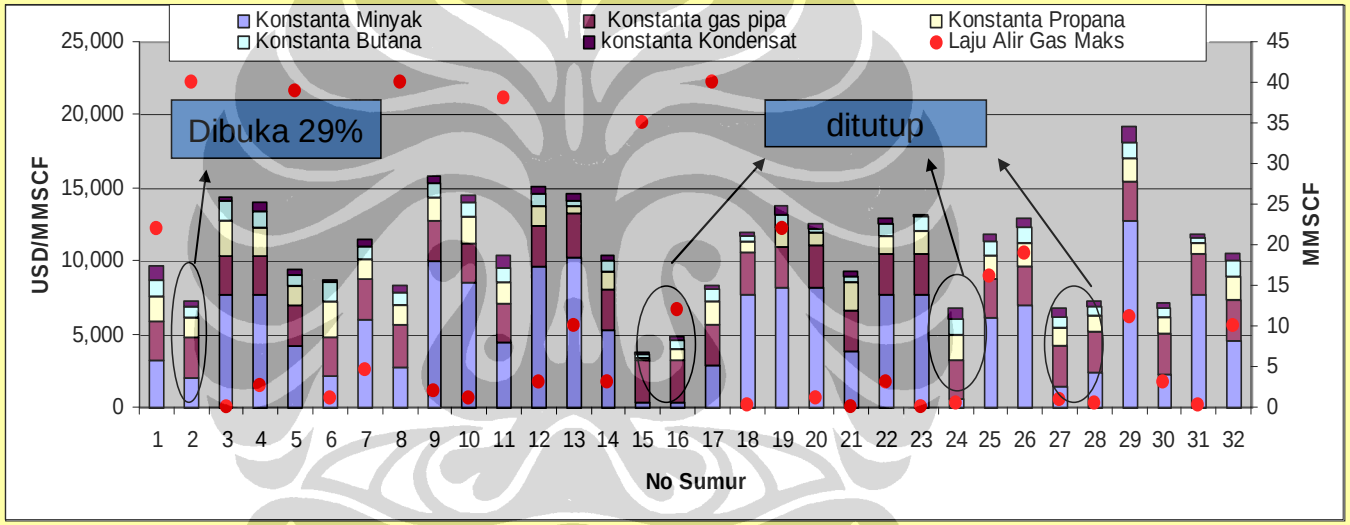
Kontribusi Konstanta Masing-Masing Produk dari Setiap Sumur pada persaman tujuan



- Konstanta minyak = $\frac{\text{harga minyak}}{\text{GOR}}$
- Konstanta gas pipa = $(1{,}01x\%C_1 + 1{,}769x\%C_2)x$ harga gas pipa
- Konstanta propana = $(52{,}7x\%C_3)x$ harga propana
- Konstanta butana = $(69{,}5x\%NC_4 + 74{,}2x\%IC_4)$ x harga butana
- Konstanta kondensat = $(869\ x\%\ IC_5 + 860\ x\%\ NC_5 + 977\ x\%\ C_6 + 1096\ x\%\ C_7)$ x harga kondensat

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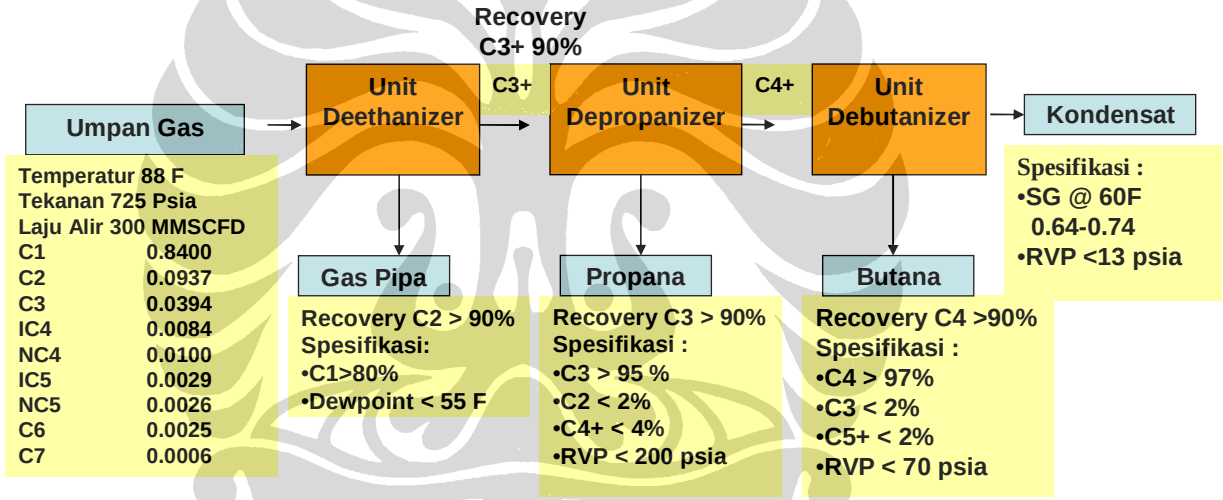
Simulasi Hysys pada Unit Fraksinasi Gas



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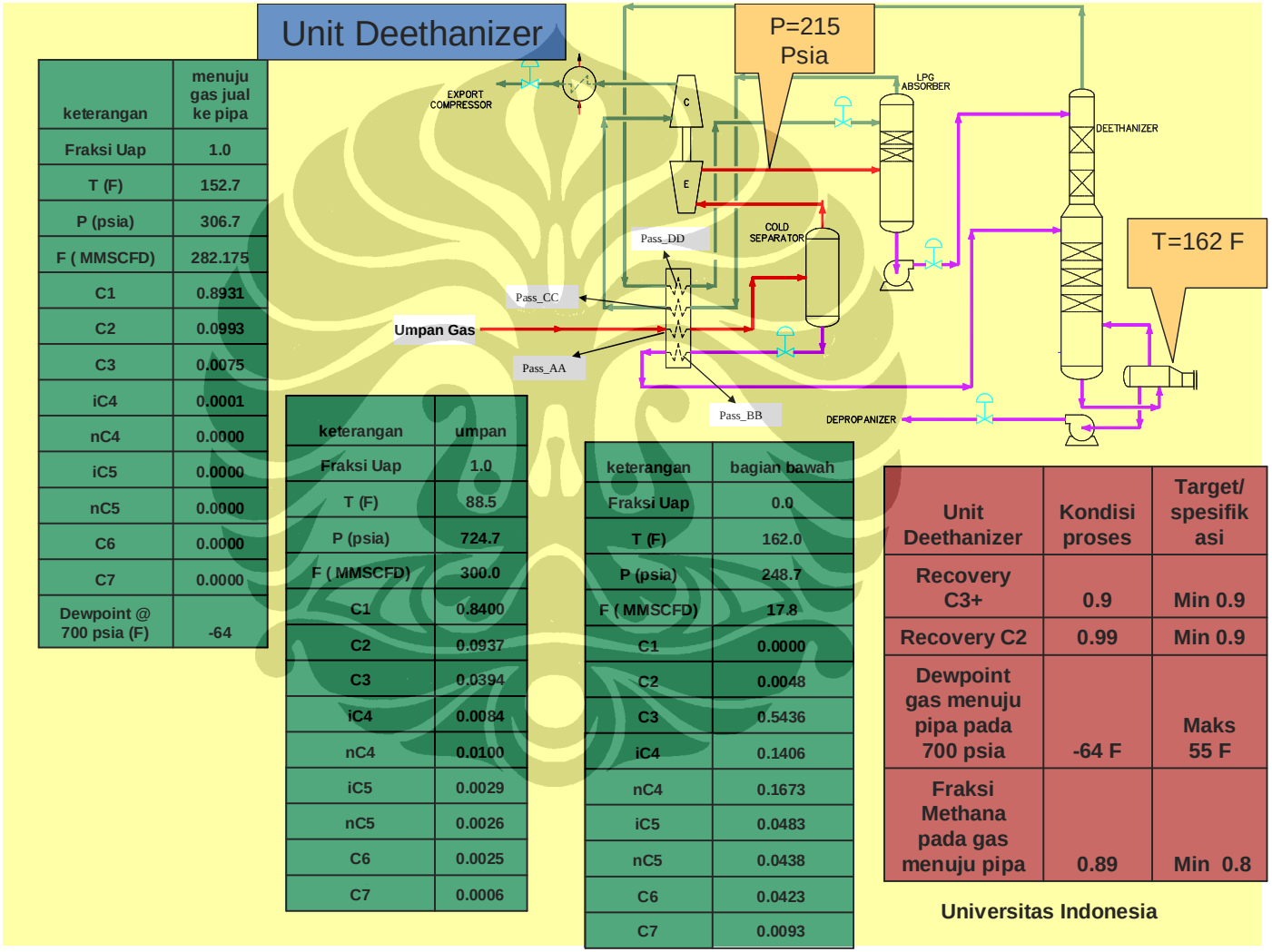
Unit Deethanizer



keterangan	menuju gas jual ke pipa
Fraksi Uap	1.0
T (F)	152.7
P (psia)	306.7
F (MMSCFD)	282.175
C1	0.8931
C2	0.0993
C3	0.0075
iC4	0.0001
nC4	0.0000
iC5	0.0000
nC5	0.0000
C6	0.0000
C7	0.0000
Dewpoint @ 700 psia (F)	-64

keterangan	umpan
Fraksi Uap	1.0
T (F)	88.5
P (psia)	724.7
F (MMSCFD)	300.0
C1	0.8400
C2	0.0937
C3	0.0394
iC4	0.0084
nC4	0.0100
iC5	0.0029
nC5	0.0026
C6	0.0025
C7	0.0006

keterangan	bagian bawah
Fraksi Uap	0.0
T (F)	162.0
P (psia)	248.7
F (MMSCFD)	17.8
C1	0.0000
C2	0.0048
C3	0.5436
iC4	0.1406
nC4	0.1673
iC5	0.0483
nC5	0.0438
C6	0.0423
C7	0.0093

Unit Deethanizer	Kondisi proses	Target/ spesifikasi
Recovery C3+	0.9	Min 0.9
Recovery C2	0.99	Min 0.9
Dewpoint gas menuju pipa pada 700 psia	-64 F	Maks 55 F
Fraksi Methana pada gas menuju pipa	0.89	Min 0.8

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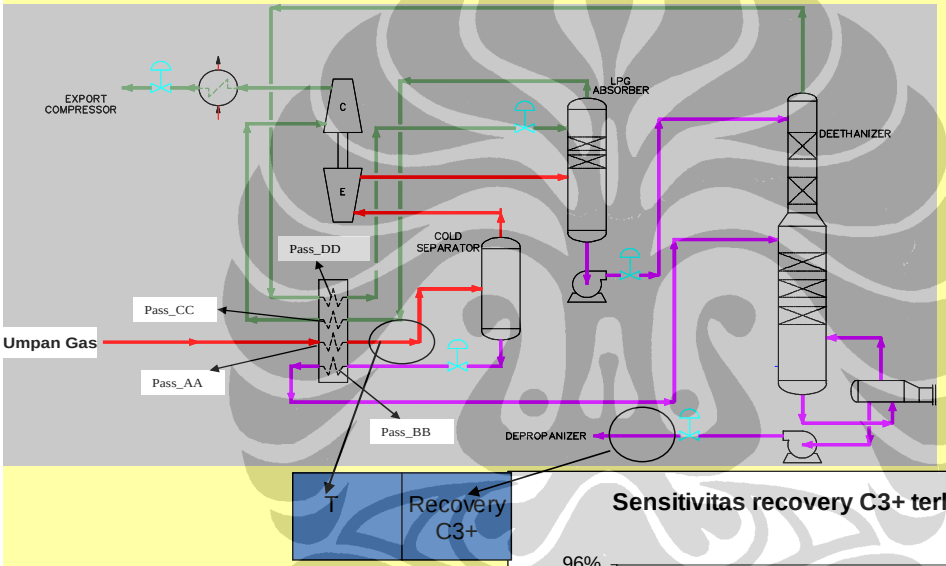
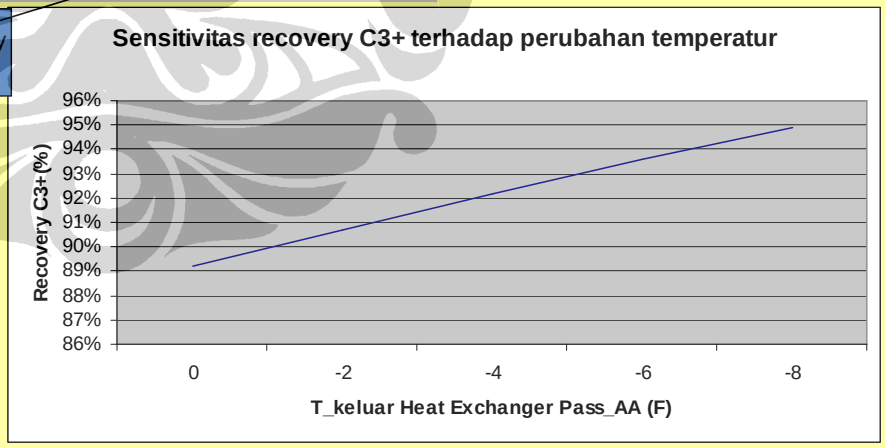
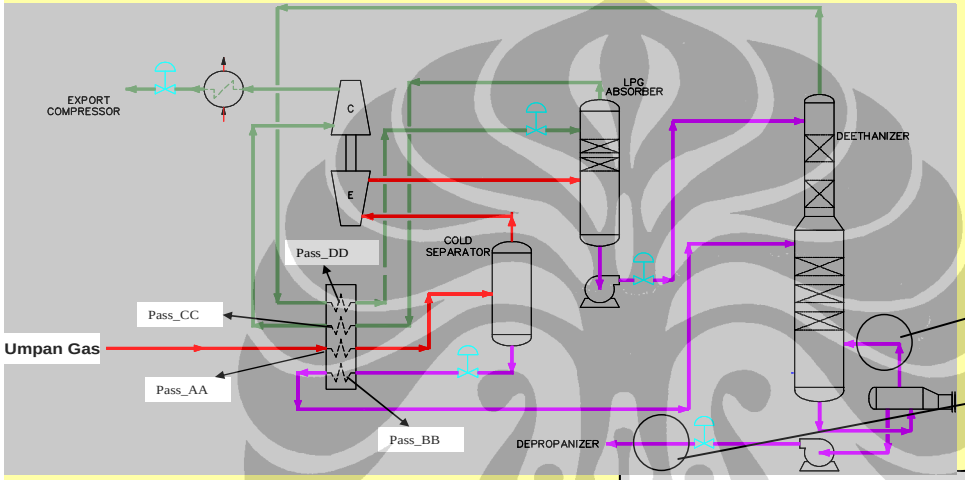
Pengaruh Perubahan Temperatur Umpan terhadap Recovery C3+ pada Unit Deethanizer

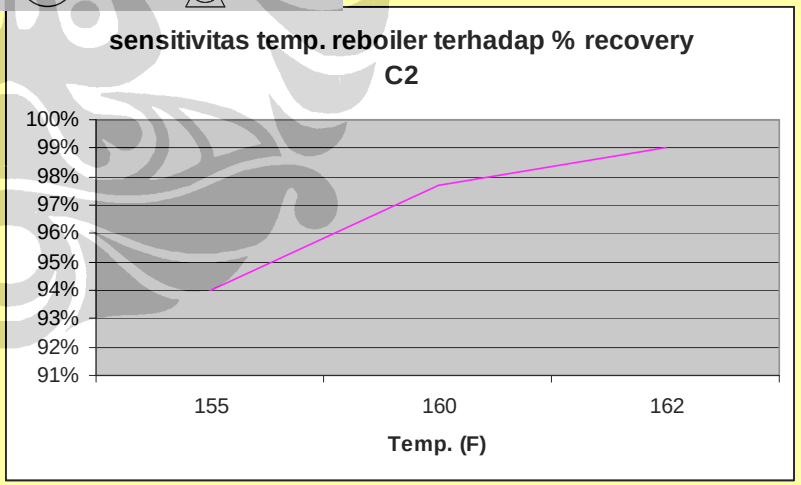


Recovery C3+ naik jika temperatur umpan lebih didinginkan



Pengaruh Perubahan Temperatur Reboiler pada Kolom Deethanizer terhadap Recovery C2

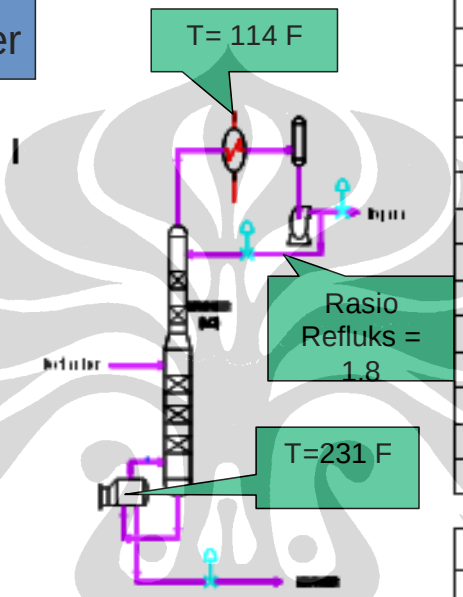




Recovery C2 naik jika temperatur reboiler dinaikkan

Unit Depropanizer

keterangan	umpan
Fraksi Uap	0.1
T (F)	154.7
P (psia)	226.7
F (MMSCFD)	17.8
C1	0.0000
C2	0.0048
C3	0.5436
iC4	0.1406
nC4	0.1673
iC5	0.0483
nC5	0.0438
C6	0.0423
C7	0.0093



keterangan	bagian atas
Fraksi Uap	0.0
T (F)	113.8
P (psia)	224.7
F (MMSCFD)	10.0
C1	0.0000
C2	0.0086
C3	0.9600
iC4	0.0267
nC4	0.0047
iC5	0.0000
nC5	0.0000
C6	0.0000
C7	0.0000

keterangan	bagian bawah
Fraksi Uap	0.0
T (F)	231.0
P (psia)	226.7
F (MMSCFD)	7.8
C1	0.0000
C2	0.0000
C3	0.0100
iC4	0.2865
nC4	0.3757
iC5	0.1101
nC5	0.1000
C6	0.0965
C7	0.0212

Kolom Depropanizer	Kondisi Proses	Target/ Spesifikasi
Recovery C3	0.99	Min 90%
Fraksi C3 di atas	0.96	Min 0.95
Fraksi C4+ di atas kolom	0.037	Maks 0.04
Fraksi C2 di atas kolom	0.009	Maks 0.02
RVP di atas kolom (psia)	187	Maks 200

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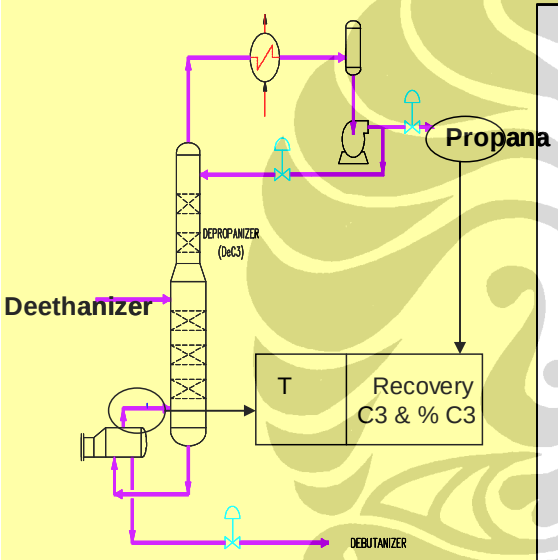
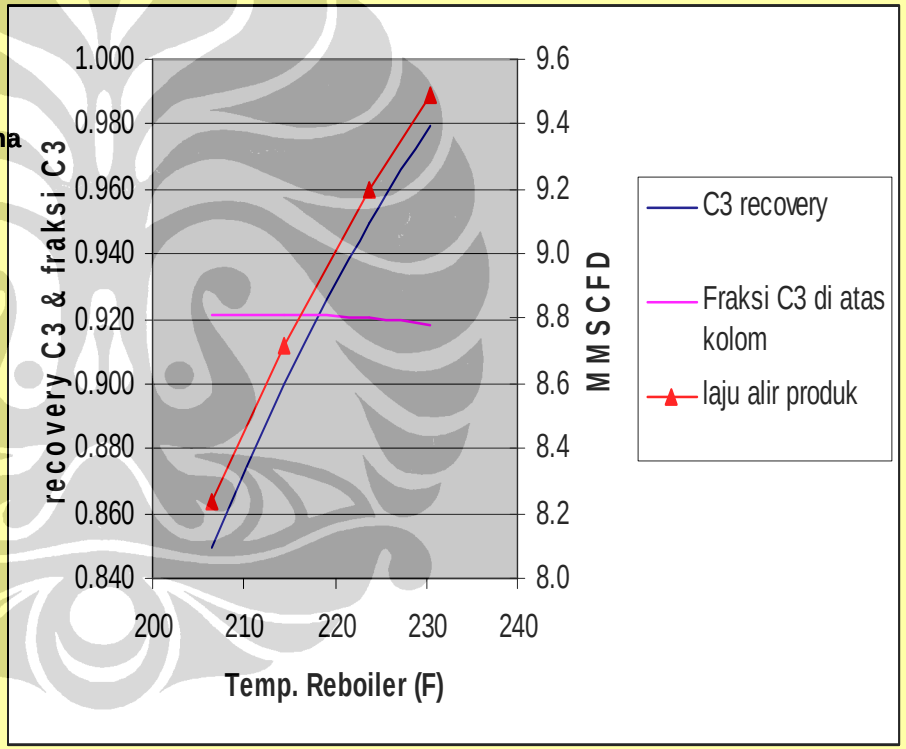
Pengaruh Perubahan Temperatur Reboiler pada Unit Depropanizer





Jika temperatur reboiler dinaikkan maka recovery C3 naik namun % C3 cenderung tidak naik

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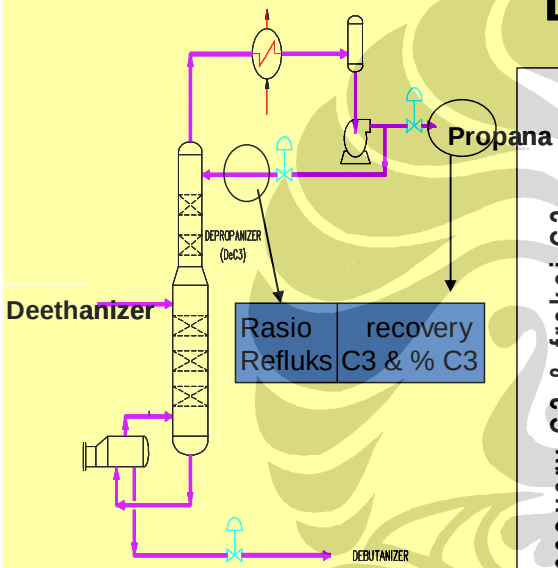
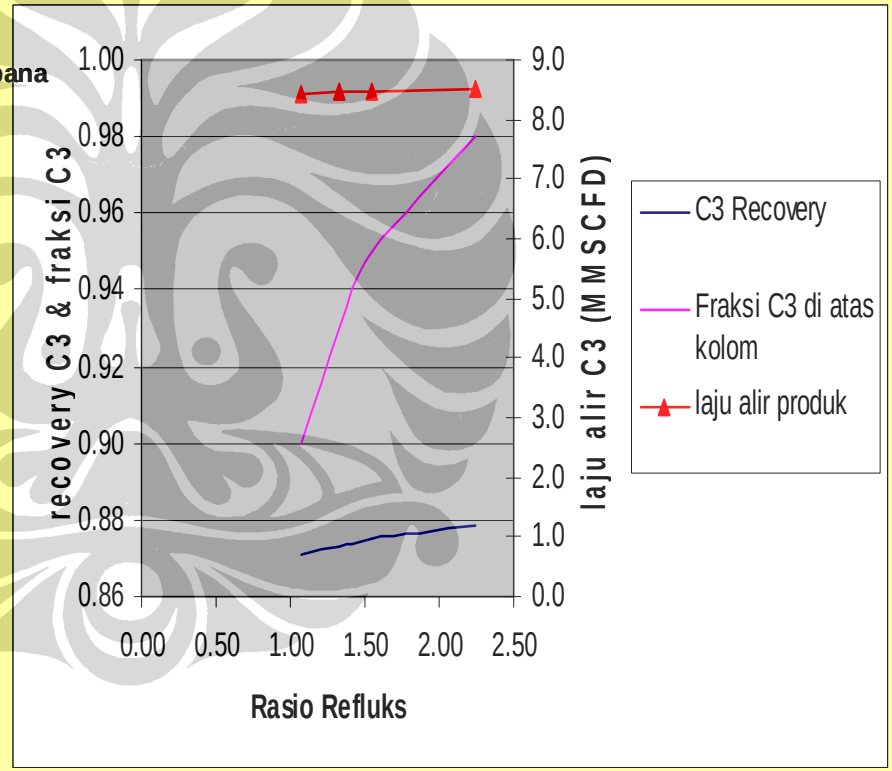
Pengaruh Perubahan Rasio Refluks pada Unit Depropanizer



Jika rasio refluks dinaikkan maka % C3 naik namun Recovery C3 tidak naik secara significant



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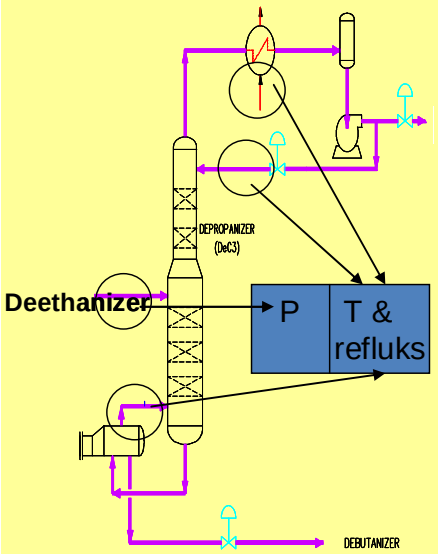
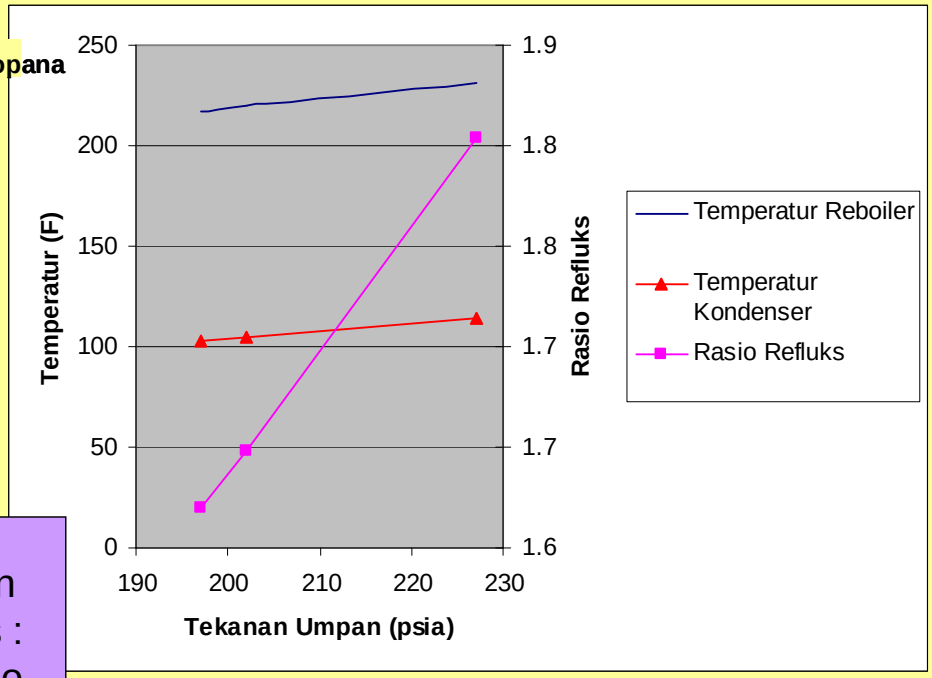
Pengaruh Perubahan Tekanan Umpan pada Unit Depropanizer





Semakin besar tekanan umpan, variabel proses : temperatur reboiler,rasio refluks dan temperatur kondenser semakin besar

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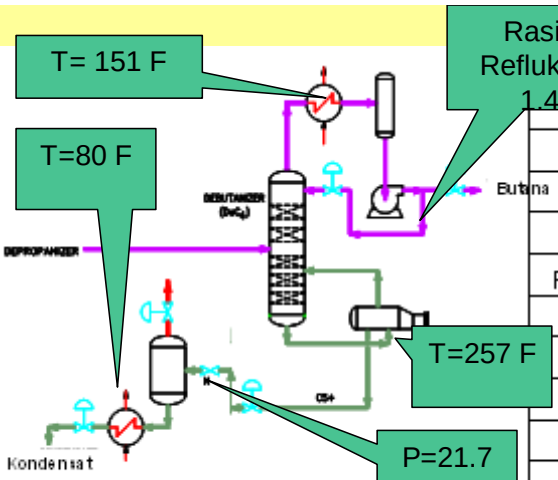
Unit Debutanizer



keterangan	umpan
Fraksi Uap	0.3
T (F)	183.8
P (psia)	126.7
F (MMSCFD)	7.8
C1	0.0000
C2	0.0000
C3	0.0100
iC4	0.2865
nC4	0.3757
iC5	0.1101
nC5	0.1000
C6	0.0965
C7	0.0212

keterangan	bagian atas
Fraksi Uap	0.0
T (F)	150.8
P (psia)	124.7
F (MMSCFD)	5.2
C1	0.0000
C2	0.0000
C3	0.0149
iC4	0.4269
nC4	0.5431
iC5	0.0125
nC5	0.0025
C6	0.0000
C7	0.0000

keterangan	Kondensat
Fraksi Uap	0.0
T (F)	80.0
P (psia)	21.7
F (MMSCFD)	1.3
C1	0.0000
C2	0.0000
C3	0.0000
iC4	0.0009
nC4	0.0165
iC5	0.2326
nC5	0.2558
C6	0.3875
C7	0.1068

Unit Debutanizer	Kondisi Proses	Target/ Spesifikasi
Recovery C4	0.98	Min 90%
Fraksi C4 di atas	0.97	Min 0.97
Fraksi C5+ di atas kolom	0.017	Maks 0.02
Fraksi C3 di atas kolom	0.015	Maks 0.02
RVP di atas kolom	61.3	Maks 70
RVP Kondensat (Psia)	11.5	Maks 13 psia
SG	0.6405	0.64-0.74

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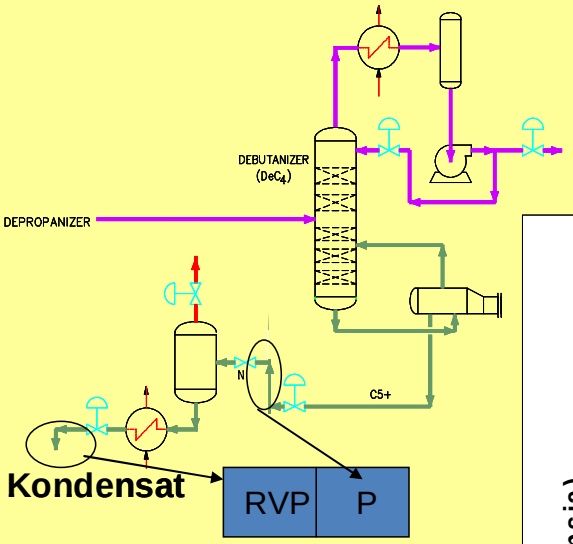
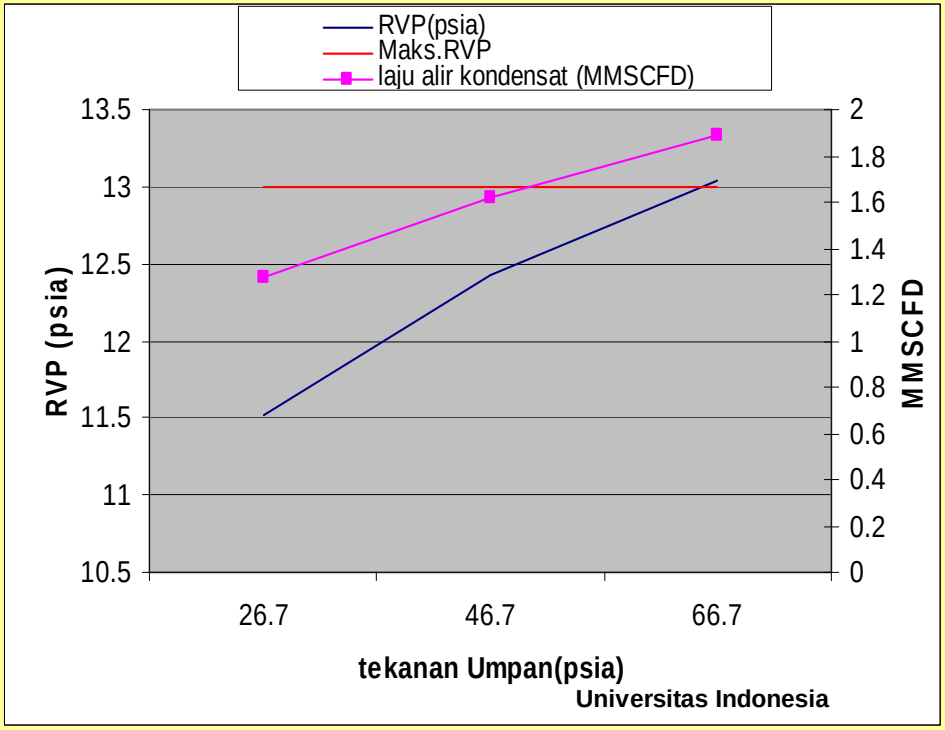
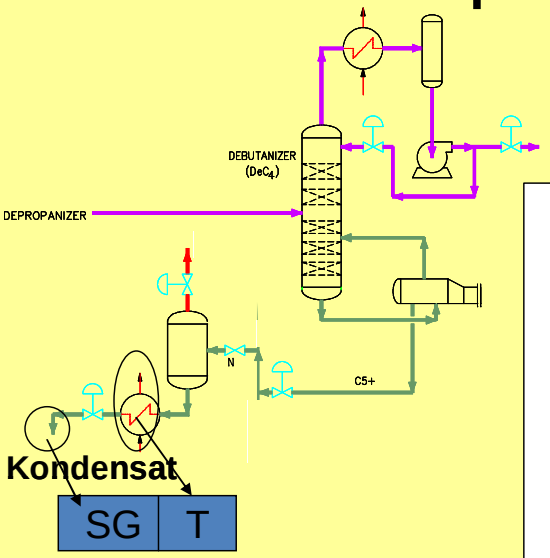
Pengaruh PerubahanTekanan terhadap RVP Kondensat





Semakin rendah tekanan maka nilai RVP semakin rendah namun laju alir produk semakin rendah

Pengaruh PerubahanTemperatur terhadap Specific Gravity (SG)



Semakin dingin temperatur, nilai SG semakin tinggi