BAB II

DESKRIPSI PROSES

2.1 Spesifikasi Bahan Baku dan Produk

7.4.1 Spesifikasi dan Komposisi Bahan Baku

a. Berat molekul = 19.2591 g/mol
b. Volume = 0.0398 m^3/kmol
c. Densitas = 484.7 kg/m^3
d. *Heating value per mass* = 53.7781 MJ/Kg
e. *Heating value per volume* = 1173.3 BTU/SCF
f. *Energy per volume* = 24.71 Kg/m^3

Tabel 6. Komposisi Bahan Baku LNG

Komposisi	mol %
CH_4	89.43
C_2H_6	2.31
C_3H_8	4.58
i-C_4H_{10}	2.14
n-C_4H_{10}	0.41
i-C_5H_{12}	0.49
n-C_5H_{12}	0.16
n-C_6H_{14}	0.10
N_2	0.04
CO_2	0.34
Total	100

7.4.2 Spesifikasi dan Komposisi Produk

a. Berat molekul = 16.5473 g-mol = 0.036 lb-mol
b. Volume = 0.0374 m^3/kmol
c. Densitas = 443.3 Kg/m^3
d. *Heating value per mass* = 55.2715 MJ/Kg = 13.2102 Mcal/Kg
e. *Heating value per volume* = 1036.1 BTU/SCF

f. *Energy per volume* = 23.22 Kg/m^3

Tabel 7. Komposisi Produk LNG

Komposisi	mol %
CH_4	96.66
C_2H_6	2.37
C_3H_8	0.48
i-C_4H_{10}	0.09
n-C_4H_{10}	0.12
i-C_5H_{12}	0.02
n-C_5H_{12}	0.00
n-C_6H_{14}	0.00
N_2	0.26
CO_2	0.00
Total	100

2.2 Sifat Fisika dan Kimia Bahan Baku dan Produk

2.2.1 Sifat Fisika dan Kimia Bahan Baku

Sifat fisika gas alam adalah sebagai berikut:

Suhu : suhu ruangnya 20 ºC

Wujud : gas

Warna : tidak berwarna

Bau : bau hidrokarbon dan sulfur (PGN, 2023)

Sifat kimia adalah sebagai berikut:

Komponen utama : hidrokarbon

Racun : beracun dari senyawa sulfur (PGN, 2023)

2.2.2 Sifat Fisika dan Kimia Produk

Sifat fisika LNG adalah sebagai berikut:

Suhu : -260 ºF

: -162 ºC

Titik didih : -160 ºC

Wujud : cair

Warna : tidak berwarna

Bau : tidak berbau (PGN, 2024)

Sifat kimia LNG adalah sebagai berikut:

Komponen utama : Metana (CH_4)

Racun : tidak beracun (PGN, 2024)

2.3 Konsep Proses

2.3.1 *Gas Filtration Unit*

Feed gas untuk pabrik LNG ini didapatkan dari sumur *natural gas* Jatibarang *Field* milik PT. Pertamina EP yang diolah terlebih dahulu oleh PT. Pertamina (Persero) RU-IV Balongan sehingga menjadi *sales natural gas* atau gas alam yang sudah bisa dijual. *Sales natural gas* yang dibeli sudah diperiksa kembali untuk menjamin kandungan serta mutu *natural gas* tersebut.

Feed gas yang sudah dibeli akan disalurkan melalui *gas pipeline* menuju lokasi pabrik LNG. Kemudian *feed gas* akan dinaikkan tekanannya menjadi 145.04 psia dan diturunkan suhunya menjadi 86 ºF agar sesuai dengan suhu proses. Setelah suhu dan tekanannya sesuai, *feed gas* melewati proses filtrasi pada *Splitter* V-101 untuk memisahkan kontaminan padat yang ikut masuk.

Pada *Splitter* V-101 selain untuk filtrasi *feed gas*, dilakukan juga proses *acid removal* untuk menghilangkan kandungan CO_2 dan gas asam lainnya. Hal ini dilakukan sebagai pencegahan korosi pada alat yang disebabkan gas asam tersebut. *Acid gas removal treatment* menggunakan proses adsorbsi dengan *metal pall ring packing* dan adsorber *Pentaethylenehexamine* (PEHA) yang mempunyai luas permukaan yang lebar serta titik didih yang lebih rendah dari adsorber berbahan silika lainnya (Ali et al., 2020).

2.3.2 *Dehydration Unit*

Feed gas yang sudah bersih dari CO_2 dan kontaminan padat masih mengandung H_2O berlebih yang disebabkan dari distribusi *natural gas* lewat *gas pipeline* sehingga butuh dihilangkan dari kandungan *feed gas*. Bertambahnya kandungan H_2O biasanya terjadi karena kondensasi yang terjadi pada *gas pipeline*.

Dehydration Unit dengan alat *Dehydration Column* T-100 digunakan untuk menghilangkan kandungan H_2O menggunakan desikan silika padat sehingga

kandungan H_2O pada *feed gas* menjadi kurang dari 10 ppm yang aman bagi alat produksi. Desikan disusun di dalam kolom sehingga *feed gas* melewati desikan sepenuhnya dan diteruskan menjadi *main stream gas.*

Regenerasi atau pencucian ulang desikan dilakukan dengan cara dipanaskan menggunakan alat pemanas atau cukup dijemur di bawah sinar matahari sehingga H_2O akan menguap sehingga desikan bisa digunakan kembali. Desikan dapat digunakan beberapa kali hingga desikan tersebut rusak atau tidak dapat menyerap air lagi.

2.3.3 *Fractionation Unit*

Main stream gas yang sudah bersih dari kandungan H_2O masih mengandung hidrokarbon berat selain *methane* sebagai bahan utama pada LNG. Hidrokarbon yang masih terkandung dalam *main stream gas* akan mengurangi kandungan *methane* di dalamnya sehingga mengurangi nilai jual dari LNG.

Fractionation Unit dengan alat *Fractionation Column* T-101 digunakan untuk memisahkan kandungan hidrokarbon berat dari *main stream gas* sehingga menyisakan kandungan *methane* sebagai bahan utama pada *main stream gas*. Hidrokarbon berat yang terpisah akan diolah menjadi kondensat cair.

Sebelum menjadi kondensat cair, hidrokarbon berat akan dipisahkan sebagian dengan alat *Separator* V-102 sehingga menjadi bahan pendingin pada LNG *Heat Exchanger*. Bahan pendingin dinaikkan tekanannya menjadi 145.04 psia dan didinginkan suhunya menjadi -256 ºF hingga dapat digunakan menjadi pendingin *main stream gas*. Setelah digunakan bahan pendingin akan diregenerasi kembali bersama hidrokaron berat.

2.3.4 *Liquefaction Unit*

Main stream gas yang sudah bersih dari kandungan hidrokarbon berat selain *methane* akan didinginkan sehingga menjadi cair dengan *liquefaction unit*. Ada dua tahapan dalam *liquefaction unit* supaya suhu *main stream gas* didinginkan perlahan hingga tidak mencapai titik kritis.

Liquefaction unit menggunakan metode *Dual Mixed Refrigerant* (DMR) dengan jenis alat *Plate-Fin Heat Exchanger* yang terbagi menjadi dua tahapan. Pertama adalah tahap *pre cooling* menggunakan LNG *Heat Exchanger* LNG-101 dengan suhu awal *main stream gas* -162.30 ºF didinginkan menjadi -184.63 ºF. Tahap kedua adalah tahap *main cooling* menggunakan LNG *Heat Exchanger*

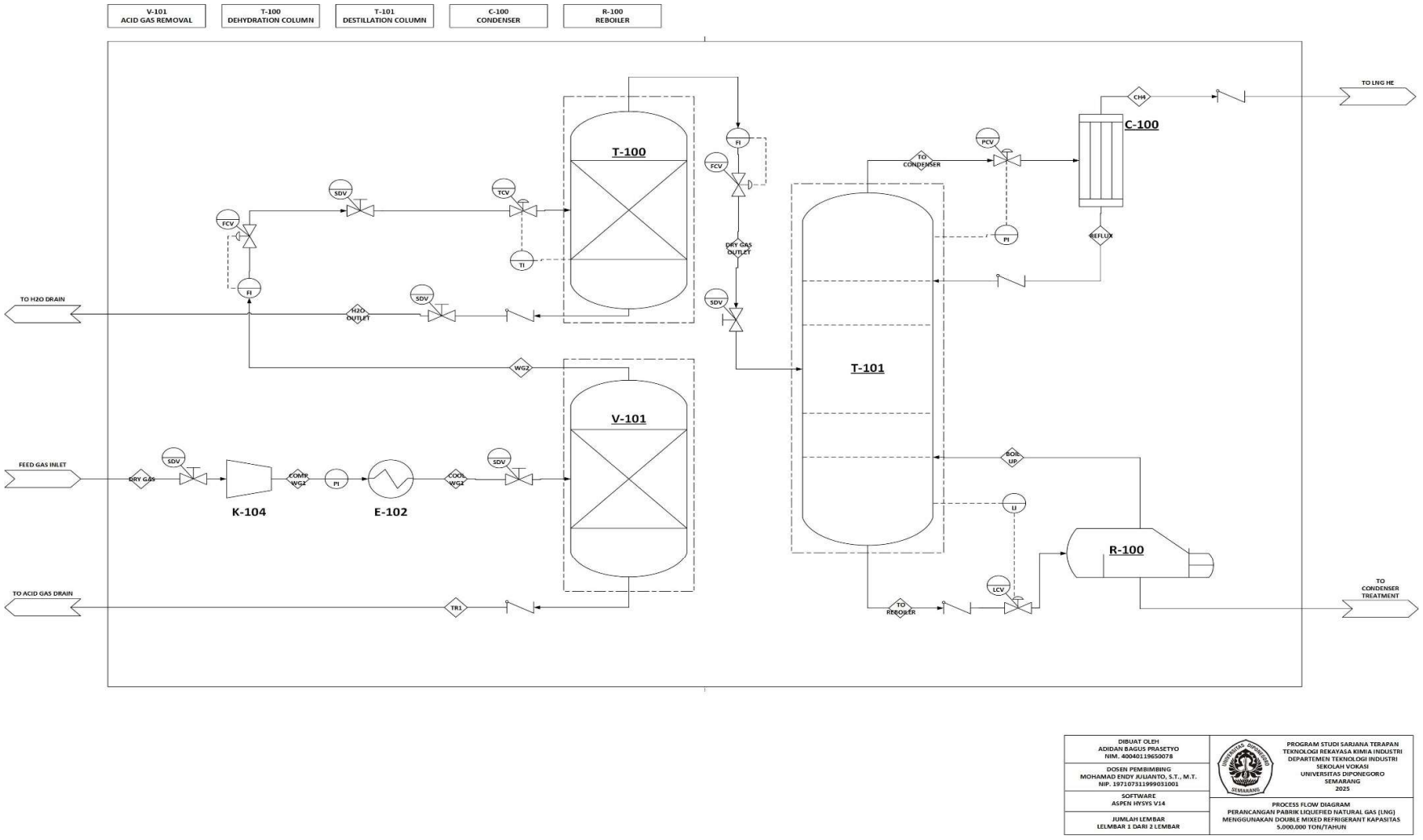
LNG-100 sehingga suhu *main stream gas* menjadi -256 ºF yang cocok untuk menjadi produk LNG yang siap dijual.

Bahan material yang digunakan pada LNG-100 dan LNG-101 adalah *aluminum alloy*. *Alloy* adalah paduan logam yang terdiri dari dua atau lebih komponen logam yang dikombinasikan untuk menghasilkan logam yang lebih kuat dan tahan terhadap korosi. Kombinasi dilakukan dengan cara melelehkan komponen logam tersebut dan dicampur sehingga menghasilkan paduan logam yang lebih baik (Robberge, 2008). Digunakan *aluminum alloy* ASME SB-210 *type* 3003, kandungannya terdiri dari aluminum (Al), magnesium (Mg), dan tembaga (Cu). Juga pada *destillation column* T-101 digunakan *high alloy steel* ASME SA-240 *type* 304L dengan kandungan 18% *chrome* (Cr) dan 8% nikel (Ni) dari total berat logam tersebut (ASME, 2015).

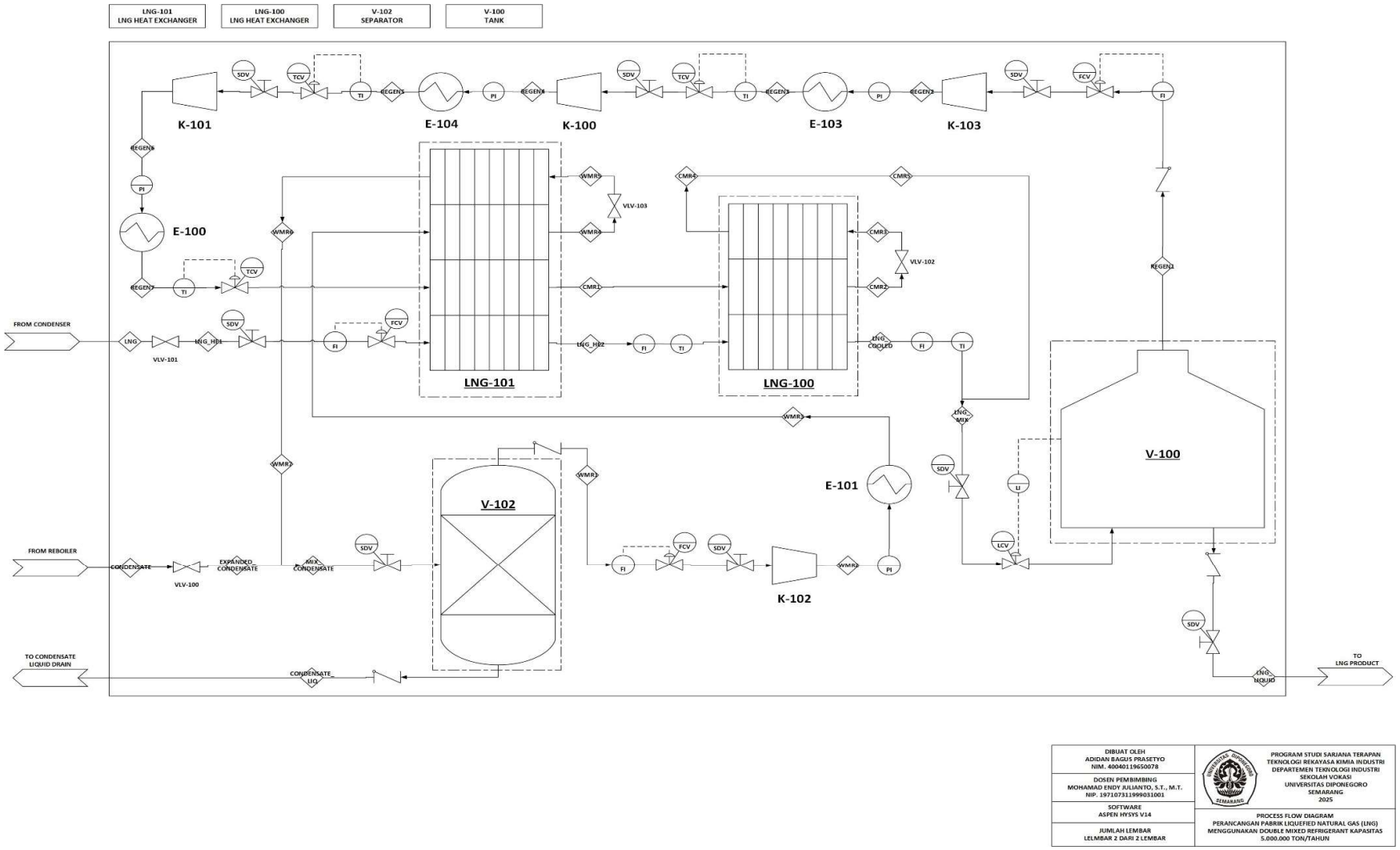
Liquefaction unit menggunakan pendingin berbahan hidrokarbon berat untuk tahap *pre cooling* dan pendingin berbahan *methane* untuk tahap *main cooling*. Pendingin untuk *main cooling* didapat dari *vapour phase* produk LNG pada tangki penyimpanan. *Vapour phase* yang menguap diregenerasi dengan menaikkan tekanannya dan menurunkan suhunya masing-masing tiga kali. Tekanan awal 14.70 psia dinaikkan hingga mencapai 217.56 psia. Sementara suhu awal -125.75 ºF didinginkan hingga -260.80 ºF. Selain didinginkan dengan *cooler*, bahan pendingin juga menggunakan *expansion valve* untuk mendinginkannya.

2.4 Diagram Alir dan Langkah Proses

Desain proses menggunakan *software* Aspen Hysys V14 dengan *Process Flow Diagram* (PFD) dapat dilihat pada gambar 3 dan 4.



Gambar 3. *Process Flow Diagram*



Gambar 4. *Process Flow Diagram* (Lanjutan)

Tabel 8. Neraca Panas dan Massa Utama

Stream Name	Dry Gas	Comp WG1	Cool WG1	TR1	WG2	Dry Gas Outlet	LNG	LNG_HE1	LNG_HE2	LNG_Cooled	Condensate	Expanded Condens
Vapour / Phase Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.8059	0.0000	0.4545
Temperature [C]	30.00	415.93	30.00	30.01	30.01	29.83	-107.60	-120.78	-130.00	-160.00	42.80	-26.76
Temperature [F]	86	780.674	86	86.02	86.01	85.71	-161.69	-185.40	-202.00	-256.00	109.03	-16.16
Pressure [kPa]	15.92	1,000.00	1,000.00	1,000.00	1,000.00	950.00	1,000.00	101.32	101.32	101.32	1,000.00	101.32
Pressure [psia]	2.31	145.04	145.04	145.04	145.04	137.78	145.04	14.70	14.70	14.70	145.04	14.70
Molar Flow [kgmole/h]	34,582.43	34,582.43	34,582.43	116.39	34,466.04	34,462.58	31,740.26	31,740.26	31,740.26	31,740.26	2,725.05	2,725.05
Mass Flow [kg/h]	666,038.92	666,038.92	666,038.92	5,122.41	660,916.51	660,854.21	520,607.89	520,607.89	520,607.89	520,607.89	140,295.12	140,295.12
Std Ideal Liq Vol Flow [m3/h]	1,990.33	1,990.33	1,990.33	6.21	1,984.13	1,984.07	1,725.25	1,725.25	1,725.25	1,725.25	258.97	258.97
Molar Enthalpy [kJ/kgmole]	-79,411.82	-58,817.53	-79,646.57	-394,016.72	-78,584.93	-78,563.61	-80,178.56	-80,178.56	-80,488.82	-83,302.49	-134,228.12	-134,228.12
Molar Entropy [kJ/kgmole-C]	201.88	209.81	166.92	153.14	166.78	167.21	143.74	161.70	159.60	136.49	99.89	104.98
Heat Flow [kJ/h]	-2,746,254,086.10	-2,034,053,269.45	-2,754,372,243.18	-45,860,720.96	-2,708,511,522.22	-2,707,504,982.48	-2,544,888,026.95	-2,544,888,026.95	-2,554,735,629.20	-2,644,042,311.82	-365,778,863.60	-365,778,863.60
Liq Vol Flow @Std Cond [m3/h]	814,805.97	814,805.97	814,805.97	6.20	812,066.74	811,985.28	748,518.26	748,518.26	748,518.26	748,518.26	256.89	256.89
Vapour Phase												
Vapour / Phase Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.8059	0.0000	0.4545
Temperature [C]	30.00	415.93	30.00	30.01	30.01	29.84	-107.60	-120.78	-130.00	-160.00	42.80	-26.76
Temperature [F]	86	780.674	86	86.018	86.01	85.71	-161.69	-185.40	-202.00	-256.00	109.03	-16.16
Pressure [kPa]	15.92	1,000.00	1,000.00	1,000.00	1,000.00	950.00	1,000.00	101.32	101.32	101.32	1,000.00	101.32
Pressure [psia]	2.31	145.04	145.04	145.04	145.04	145.04	145.04	14.70	14.70	14.70	145.04	14.70
Molar Flow [kgmole/h]	34,582.43	34,582.43	34,582.43	116.39	34,466.04	34,462.58	31,740.26	31,740.26	31,740.26	25,579.51	0.00	1,238.63
Mass Flow [kg/h]	666,038.92	666,038.92	666,038.92	5,122.41	660,916.51	660,854.21	520,607.89	520,607.89	520,607.89	410,634.35	0.21	58,783.43
Std Ideal Liq Vol Flow [m3/h]	1,990.33	1,990.33	1,990.33	6.21	1,984.13	1,984.07	1,725.25	1,725.25	1,725.25	1,370.63	0.00	112.48
Molar Enthalpy [kJ/kgmole]	-79,411.82	-58,817.53	-79,646.57	-394,016.72	-78,584.93	-78,563.61	-80,178.56	-80,178.56	-80,488.82	-81,195.39	-110,614.62	-114,902.04
Molar Entropy [kJ/kgmole-C]	201.88	209.81	166.92	153.14	166.78	167.21	143.74	161.70	159.60	150.59	148.84	151.36
Heat Flow [kJ/h]	-2,746,254,086.10	-2,034,053,269.45	-2,754,372,243.18	-45,860,720.96	-2,708,511,522.22	-2,707,504,982.48	-2,544,888,026.95	-2,544,888,026.95	-2,554,735,629.20	-2,076,937,928.66	-480.96	-142,321,245.43
Liq Vol Flow @Std Cond [m3/h]	814,805.97	814,805.97	814,805.97	6.20	812,066.74	811,985.28	748,518.26	748,518.26	748,518.26	603,304.28	0.00	111.94
Liquid Phase												
Vapour / Phase Fraction										0.1941	1.0000	0.5455
Temperature [C]										-160.00	42.80	-26.76
Temperature [F]										-256.00	109.03	-16.16
Pressure [kPa]										101.32	1,000.00	101.32
Pressure [psia]										14.70	145.04	14.70
Molar Flow [kgmole/h]										6,160.75	2,725.05	1,486.42
Mass Flow [kg/h]										109,973.54	140,294.91	81,511.69
Std Ideal Liq Vol Flow [m3/h]										354.63	258.96	146.49
Molar Enthalpy [kJ/kgmole]										-92,051.18	-134,228.16	-150,332.48
Molar Entropy [kJ/kgmole-C]										77.93	99.89	66.33
Heat Flow [kJ/h]										-567,104,383.16	-365,778,382.64	-223,457,618.17
Liq Vol Flow @Std Cond [m3/h]										145,210.02	256.89	145.20
Aqueous Phase												
Vapour / Phase Fraction												
Temperature [C]												
Temperature [F]												
Pressure [kPa]												
Pressure [psia]												
Molar Flow [kgmole/h]												
Mass Flow [kg/h]												
Std Ideal Liq Vol Flow [m3/h]												
Molar Enthalpy [kJ/kgmole]												
Molar Entropy [kJ/kgmole-C]												
Heat Flow [kJ/h]												
Liq Vol Flow @Std Cond [m3/h]												
Composition [mole fraction]												
Methane	0.894210	0.894211	0.894211	0.000000	0.897230	0.897320	0.974363	0.974363	0.974363	496,151.145760	0.000002	0.000000
Ethane	0.023097	0.023098	0.023098	0.000000	0.023176	0.023178	0.025164	0.025164	0.025164	24,017.586055	3.074079	0.000038
Propane	0.045795	0.045795	0.045795	0.000000	0.045950	0.045955	0.000000	0.000000	0.000000	0.013478	69,840.830912	0.581200
i-Butane	0.021397	0.021398	0.021398	0.000000	0.021470	0.021472	0.000000	0.000000	0.000000	0.000000	43,013.253506	0.271564
n-Butane	0.004099	0.004100	0.004100	0.000000	0.004113	0.004114	0.000000	0.000000	0.000000	0.000000	8,240.640714	0.052027
i-Pentane	0.004899	0.004900	0.004900	0.000000	0.004916	0.004917	0.000000	0.000000	0.000000	0.000000	12,225.589407	0.062180
n-Pentane	0.001599	0.001600	0.001600	0.000000	0.001605	0.001605	0.000000	0.000000	0.000000	0.000000	3,991.880528	0.020303
n-Hexane	0.000999	0.001000	0.001000	0.000000	0.001003	0.001003	0.000000	0.000000	0.000000	0.000000	2,979.846689	0.012689
n-Heptane	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
H2O	0.000099	0.000100	0.000100	0.000000	0.000100	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Nitrogen	0.000399	0.000400	0.000400	0.000000	0.000401	0.000401	0.000436	0.000436	0.000436	387.483763	0.000000	0.000000
CO2	0.003399	0.003400	0.003400	116.392831	0.000034	0.000034	0.000037	0.000037	0.000037	51.663099	0.000000	0.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Tabel 9. Neraca Panas dan Massa Utama (Lanjutan)

Stream Name	Mix Condensate	Condensate_Liq	CMR1	CMR2	CMR3	CMR4	CMR5	WMR1	WMR2	WMR3	WMR4	WMR5
Vapour / Phase Fraction	0.2372	0.0000	0.0000	0.0000	0.0217	0.4894	0.4898	1.0000	1.0000	0.0000	0.0000	0.0000
Temperature [C]	-32.42	-32.42	-128.00	-168.00	-169.94	-162.65	-162.67	-32.42	65.00	-160.00	-125.00	-124.37
Temperature [F]	-26.35	-26.35	-198.40	-270.40	-273.90	-260.77	-260.80	-26.35	149.00	-256.00	-193.00	-191.87
Pressure [kPa]	101.32	101.32	1,500.00	1,500.00	101.32	101.32	101.32	101.32	1,000.00	1,000.00	1,000.00	101.32
Pressure [psia]	14.70	14.70	217.56	217.56	14.70	14.70	14.70	14.70	145.04	145.04	145.04	14.70
Molar Flow [kgmole/h]	3,579.49	2,730.47	50,352.67	50,352.67	50,352.67	50,352.67	50,461.11	849.02	849.02	849.02	849.02	849.02
Mass Flow [kg/h]	179,667.23	140,551.59	833,867.42	833,867.42	833,867.42	833,867.42	836,090.59	39,115.64	39,115.64	39,115.64	39,115.64	39,115.64
Std Ideal Liq Vol Flow [m3/h]	335.25	259.46	2,657.22	2,657.22	2,657.22	2,657.22	2,662.27	75.79	75.79	75.79	75.79	75.79
Molar Enthalpy [kJ/kgmole]	-136,111.24	-143,503.18	-84,018.58	-86,376.45	-86,376.45	-82,244.95	-82,188.94	-112,338.46	-105,842.66	-142,050.59	-139,422.64	-139,422.64
Molar Entropy [kJ/kgmole-C]	86.34	66.78	92.48	73.57	74.04	112.01	112.03	149.23	154.17	6.01	26.21	26.60
Heat Flow [kJ/h]	-487,208,490.40	-391,831,360.73	-4,230,559,680.49	-4,349,284,750.66	-4,349,284,750.66	-4,141,252,997.86	-4,147,344,764.30	-95,377,129.67	-89,862,087.12	-120,603,194.76	-118,372,025.36	-118,372,025.36
Liq Vol Flow @Std Cond [m3/h]	332.74	257.38	1,187,718.96	1,187,718.96	1,187,718.96	1,187,718.96	1,190,278.82	75.50	75.50	75.50	75.50	75.50
Vapour Phase												
Vapour / Phase Fraction	0.2372	0.0000			0.0217	0.4894	0.4898	1.0000	1.0000			
Temperature [C]	-32.42	-32.42			-169.94	-162.65	-162.67	-32.42	65.00			
Temperature [F]	-26.35	-26.35			-273.90	-260.77	-260.80	-26.35	149.00			
Pressure [kPa]	101.32	101.32			101.32	101.32	101.32	101.32	1,000.00			
Pressure [psia]	14.70	14.70			14.70	14.70	14.70	14.70	145.04			
Molar Flow [kgmole/h]	849.02	0.00			1,091.06	24,642.55	24,713.94	849.02	849.02			
Mass Flow [kg/h]	39,115.64	0.00			24,446.42	420,269.20	421,878.16	39,115.64	39,115.64			
Std Ideal Liq Vol Flow [m3/h]	75.79	0.00			47.53	1,281.21	1,284.31	75.79	75.79			
Molar Enthalpy [kJ/kgmole]	-112,338.46	-112,338.46			-41,195.82	-74,905.96	-74,806.12	-112,338.46	-105,842.66			
Molar Entropy [kJ/kgmole-C]	149.23	149.23			137.29	149.59	149.57	149.23	154.17			
Heat Flow [kJ/h]	-95,377,129.67	0.00			-44,947,158.36	-1,845,873,734.60	-1,848,754,040.92	-95,377,129.67	-89,862,087.12			
Liq Vol Flow @Std Cond [m3/h]	75.50	0.00			25,763.50	581,327.66	583,013.75	75.50	75.50			
Liquid Phase												
Vapour / Phase Fraction	0.7628	1.0000	1.0000	1.0000	0.9783	0.5106	0.5102	0.0000		1.0000	1.0000	1.0000
Temperature [C]	-32.42	-32.42	-128.00	-168.00	-169.94	-162.65	-162.67	-32.42		-160.00	-125.00	-124.37
Temperature [F]	-26.35	-26.35	-198.40	-270.40	-273.90	-260.77	-260.80	-26.35		-256.00	-193.00	-191.87
Pressure [kPa]	101.32	101.32	1,500.00	1,500.00	101.32	101.32	101.32	101.32		1,000.00	1,000.00	101.32
Pressure [psia]	14.70	14.70	217.56	217.56	14.70	14.70	14.70	14.70		145.04	145.04	14.70
Molar Flow [kgmole/h]	2,730.47	2,730.47	50,352.67	50,352.67	49,261.61	25,710.12	25,747.16	0.00		849.02	849.02	849.02
Mass Flow [kg/h]	140,551.59	140,551.59	833,867.42	833,867.42	809,421.00	413,598.22	414,212.44	0.00		39,115.64	39,115.64	39,115.64
Std Ideal Liq Vol Flow [m3/h]	259.46	259.46	2,657.22	2,657.22	2,609.68	1,376.01	1,377.96	0.00		75.79	75.79	75.79
Molar Enthalpy [kJ/kgmole]	-143,503.18	-143,503.18	-84,018.58	-86,376.45	-87,377.12	-89,279.20	-89,275.49	-143,503.18		-142,050.59	-139,422.64	-139,422.64
Molar Entropy [kJ/kgmole-C]	66.78	66.78	92.48	73.57	72.64	76.00	75.99	66.78		6.01	26.21	26.60
Heat Flow [kJ/h]	-391,831,360.73	-391,831,360.73	-4,230,559,680.49	-4,349,284,750.66	-4,304,337,592.30	-2,295,379,263.27	-2,298,590,723.37	0.00		-120,603,194.76	-118,372,025.36	-118,372,025.36
Liq Vol Flow @Std Cond [m3/h]	257.38	257.38	1,187,718.96	1,187,718.96	1,161,951.72	606,390.13	607,263.87	0.00		75.50	75.50	75.50
Aqueous Phase												
Vapour / Phase Fraction												
Temperature [C]												
Temperature [F]												
Pressure [kPa]												
Pressure [psia]												
Molar Flow [kgmole/h]												
Mass Flow [kg/h]												
Std Ideal Liq Vol Flow [m3/h]												
Molar Enthalpy [kJ/kgmole]												
Molar Entropy [kJ/kgmole-C]												
Heat Flow [kJ/h]												
Liq Vol Flow @Std Cond [m3/h]												
Composition [mole fraction]												
Methane	0.000000	0.000000	0.956764	0.956764	0.956764	0.956764	0.956057	0.000000	0.000000	0.000000	0.000000	0.000000
Ethane	0.000108	0.000038	0.000047	0.000047	0.000047	0.000047	0.000047	0.000334	0.000334	0.000334	0.000334	0.000334
Propane	0.648709	0.581595	0.000000	0.000000	0.000000	0.000000	0.000000	0.864547	0.864547	0.864547	0.864547	0.864547
i-Butane	0.234466	0.271386	0.000000	0.000000	0.000000	0.000000	0.000000	0.115730	0.115730	0.115730	0.115730	0.115730
n-Butane	0.042851	0.051972	0.000000	0.000000	0.000000	0.000000	0.000000	0.013519	0.013519	0.013519	0.013519	0.013519
i-Pentane	0.048478	0.062077	0.000000	0.000000	0.000000	0.000000	0.000000	0.004744	0.004744	0.004744	0.004744	0.004744
n-Pentane	0.015697	0.020267	0.000000	0.000000	0.000000	0.000000	0.000000	0.000999	0.000999	0.000999	0.000999	0.000999
n-Hexane	0.009691	0.012664	0.000000	0.000000	0.000000	0.000000	0.000000	0.000127	0.000127	0.000127	0.000127	0.000127
n-Heptane	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
H2O	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Nitrogen	0.000000	0.000000	0.043189	0.043189	0.043189	0.043189	0.043896	0.000000	0.000000	0.000000	0.000000	0.000000
CO2	0.000000	0.000000	0.000001	0.000001	0.000001	0.000001	0.000001	0.000000	0.000000	0.000000	0.000000	0.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Tabel 10. Neraca Panas dan Massa Utama (Lanjutan)

Stream Name	WMR6	WMR7	REGEN1	REGEN2	REGEN3	REGEN4	REGEN5	REGEN6	REGEN7	LNG_Mix	LNG_Liquid
Vapour / Phase Fraction	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.6126	0.0000
Temperature [C]	-159.94	-159.93	-161.82	-87.64	-130.00	-93.02	-120.00	-97.63	-131.00	-161.82	-161.82
Temperature [F]	-255.89	-255.88	-259.27	-125.75	-202.00	-135.44	-184.00	-143.73	-203.80	-259.27	-259.27
Pressure [kPa]	101.32	101.32	101.32	500.00	500.00	1,000.00	1,000.00	1,500.00	1,500.00	101.32	101.32
Pressure [psia]	14.70	14.70	14.70	72.52	72.52	145.04	145.04	217.56	217.56	14.70	14.70
Molar Flow [kgmole/h]	849.02	854.43	50,352.67	50,352.67	50,352.67	50,352.67	50,352.67	50,352.67	50,352.67	82,201.36	31,848.69
Mass Flow [kg/h]	39,115.64	39,372.11	833,867.42	833,867.42	833,867.42	833,867.42	833,867.42	833,867.42	833,867.42	1,356,698.49	522,831.07
Std Ideal Liq Vol Flow [m3/h]	75.79	76.28	2,657.22	2,657.22	2,657.22	2,657.22	2,657.22	2,657.22	2,657.22	4,387.52	1,730.30
Molar Enthalpy [kJ/kgmole]	-142,097.04	-142,117.11	-78,016.11	-75,684.72	-77,163.05	-76,073.66	-77,086.21	-76,478.00	-84,214.93	-82,618.91	-89,895.92
Molar Entropy [kJ/kgmole-C]	6.09	6.09	150.17	153.47	144.41	145.96	139.86	140.74	91.12	121.76	76.83
Heat Flow [kJ/h]	-120,642,630.85	-121,429,626.80	-3,928,319,556.95	-3,810,927,634.70	-3,885,365,547.05	-3,830,512,156.75	-3,881,496,591.39	-3,850,871,479.44	-4,240,446,718.82	-6,791,387,076.12	-2,863,067,519.17
Liq Vol Flow @Std Cond [m3/h]	75.50	75.99	1,187,718.96	1,187,718.96	1,187,718.96	1,187,718.96	1,187,718.96	1,187,718.96	1,187,718.96	1,938,799.23	751,078.22
Vapour Phase											
Vapour / Phase Fraction			1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		0.6126	0.0000
Temperature [C]			-161.82	-87.64	-130.00	-93.02	-120.00	-97.63		-161.82	-161.82
Temperature [F]			-259.27	-125.75	-202.00	-135.44	-184.00	-143.73		-259.27	-259.27
Pressure [kPa]			101.32	500.00	500.00	1,000.00	1,000.00	1,500.00		101.32	101.32
Pressure [psia]			14.70	72.52	72.52	145.04	145.04	217.56		14.70	14.70
Molar Flow [kgmole/h]			50,352.67	50,352.67	50,352.67	50,352.67	50,352.67	50,352.67		50,352.67	0.00
Mass Flow [kg/h]			833,867.42	833,867.42	833,867.42	833,867.42	833,867.42	833,867.42		833,867.42	0.00
Std Ideal Liq Vol Flow [m3/h]			2,657.22	2,657.22	2,657.22	2,657.22	2,657.22	2,657.22		2,657.22	0.00
Molar Enthalpy [kJ/kgmole]			-78,016.11	-75,684.72	-77,163.05	-76,073.66	-77,086.21	-76,478.00		-78,016.11	-78,016.11
Molar Entropy [kJ/kgmole-C]			150.17	153.47	144.41	145.96	139.86	140.74		150.17	150.17
Heat Flow [kJ/h]			-3,928,319,556.95	-3,810,927,634.70	-3,885,365,547.05	-3,830,512,156.75	-3,881,496,591.39	-3,850,871,479.44		-3,928,319,556.95	0.00
Liq Vol Flow @Std Cond [m3/h]			1,187,718.96	1,187,718.96	1,187,718.96	1,187,718.96	1,187,718.96	1,187,718.96		1,187,718.96	0.00
Liquid Phase											
Vapour / Phase Fraction	1.0000	1.0000	0.0000						1.0000	0.3874	1.0000
Temperature [C]	-159.94	-159.93	-161.82						-131.00	-161.82	-161.82
Temperature [F]	-255.89	-255.88	-259.27						-203.80	-259.27	-259.27
Pressure [kPa]	101.32	101.32	101.32						1,500.00	101.32	101.32
Pressure [psia]	14.70	14.70	14.70						217.56	14.70	14.70
Molar Flow [kgmole/h]	849.02	854.43	0.00						50,352.67	31,848.69	31,848.69
Mass Flow [kg/h]	39,115.64	39,372.11	0.00						833,867.42	522,831.07	522,831.07
Std Ideal Liq Vol Flow [m3/h]	75.79	76.28	0.00						2,657.22	1,730.30	1,730.30
Molar Enthalpy [kJ/kgmole]	-142,097.04	-142,117.11	-89,895.92						-84,214.93	-89,895.92	-89,895.92
Molar Entropy [kJ/kgmole-C]	6.09	6.09	76.83						91.12	76.83	76.83
Heat Flow [kJ/h]	-120,642,630.85	-121,429,626.80	0.00						-4,240,446,718.82	-2,863,067,519.17	-2,863,067,519.17
Liq Vol Flow @Std Cond [m3/h]	75.50	75.99	0.00						1,187,718.96	751,078.22	751,078.22
Aqueous Phase											
Vapour / Phase Fraction											
Temperature [C]											
Temperature [F]											
Pressure [kPa]											
Pressure [psia]											
Molar Flow [kgmole/h]											
Mass Flow [kg/h]											
Std Ideal Liq Vol Flow [m3/h]											
Molar Enthalpy [kJ/kgmole]											
Molar Entropy [kJ/kgmole-C]											
Heat Flow [kJ/h]											
Liq Vol Flow @Std Cond [m3/h]											
Composition [mole fraction]											
Methane	0.000000	0.000000	0.956764	0.956764	0.956764	0.956764	0.956764	0.956764	0.956764	0.963125	497,242.741587
Ethane	0.000334	0.000334	0.000047	0.000047	0.000047	0.000047	0.000047	0.000047	0.000047	0.009745	24,018.197179
Propane	0.864547	0.864016	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.013478
i-Butane	0.115730	0.116152	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
n-Butane	0.013519	0.013587	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
i-Pentane	0.004744	0.004777	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
n-Pentane	0.000999	0.001007	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
n-Hexane	0.000127	0.000128	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
n-Heptane	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
H2O	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Nitrogen	0.000000	0.000000	0.043189	0.043189	0.043189	0.043189	0.043189	0.043189	0.043189	0.027115	1,518.440252
CO2	0.000000	0.000000	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000001	0.000015	51.673544
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

Tabel 11. Neraca Panas dan Massa *Dehydration Unit*

Stream Name	WG3	Dry Gas Outlet	H2O Outlet
Vapour / Phase Fraction	1.0000	1.0000	0.0000
Temperature [C]	30.01	29.84	80.00
Temperature [F]	86.01	85.71	176.00
Pressure [kPa]	1,000.00	950.00	950.00
Pressure [psia]	145.04	137.79	137.79
Molar Flow [kgmole/h]	34,466.04	34,462.58	3.46
Mass Flow [kg/h]	660,916.51	660,854.21	62.29
Std Ideal Liq Vol Flow [m3/h]	1,984.13	1,984.07	0.06
Molar Enthalpy [kJ/kgmole]	-78,565.09	-78,544.74	-281,453.44
Molar Entropy [kJ/kgmole-C]	166.81	167.23	68.43
Heat Flow [kJ/h]	-2,707,827,704.55	-2,706,854,467.38	-973,237.17
Liq Vol Flow @Std Cond [m3/h]	5,548.70	5,548.45	0.06
Vapour Phase			
Vapour / Phase Fraction	1.0000	1.0000	
Temperature [C]	30.01	29.84	
Temperature [F]	86.01	85.71	
Pressure [kPa]	1,000.00	950.00	
Pressure [psia]	145.04	137.79	
Molar Flow [kgmole/h]	34,466.04	34,462.58	
Mass Flow [kg/h]	660,916.51	660,854.21	
Std Ideal Liq Vol Flow [m3/h]	1,984.13	1,984.07	
Molar Enthalpy [kJ/kgmole]	-78,565.09	-78,544.74	
Molar Entropy [kJ/kgmole-C]	166.81	167.23	
Heat Flow [kJ/h]	-2,707,827,704.55	-2,706,854,467.38	
Liq Vol Flow @Std Cond [m3/h]	5,548.70	5,548.45	
Liquid Phase			
Vapour / Phase Fraction			
Temperature [C]			
Temperature [F]			
Pressure [kPa]			
Pressure [psia]			
Molar Flow [kgmole/h]			
Mass Flow [kg/h]			
Std Ideal Liq Vol Flow [m3/h]			
Molar Enthalpy [kJ/kgmole]			
Molar Entropy [kJ/kgmole-C]			
Heat Flow [kJ/h]			
Liq Vol Flow @Std Cond [m3/h]			
Aqueous Phase			
Vapour / Phase Fraction			1.0000
Temperature [C]			80.00
Temperature [F]			176.00
Pressure [kPa]			950.00
Pressure [psia]			137.79
Molar Flow [kgmole/h]			3.46
Mass Flow [kg/h]			62.29
Std Ideal Liq Vol Flow [m3/h]			0.06
Molar Enthalpy [kJ/kgmole]			-281,453.44
Molar Entropy [kJ/kgmole-C]			68.43
Heat Flow [kJ/h]			-973,237.17
Liq Vol Flow @Std Cond [m3/h]			0.06
Composition [mole fraction]			
Methane	0.750640	0.897320	0.000000
Ethane	0.036342	0.023178	0.000000
Propane	0.105667	0.045955	0.000000
i-Butane	0.065078	0.021472	0.000000
n-Butane	0.012468	0.004114	0.000000
i-Pentane	0.018497	0.004917	0.000000
n-Pentane	0.006040	0.001605	0.000000
n-Hexane	0.004509	0.001003	0.000000
n-Heptane	0.000000	0.000000	0.000000
H2O	0.000094	0.000000	1.000000
Nitrogen	0.000586	0.000401	0.000000
CO2	0.000078	0.000034	0.000000
	1.000000	1.000000	1.000000

Tabel 12. Neraca Panas dan Massa *Fractionation Unit*

Stream Name	Dry Gas Outlet	To Condenser	Reflux	To Reboiler	Boil Up	CH4	Condensate
Vapour / Phase Fraction	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	0.0000
Temperature [C]	29.84	-71.61	-107.94	36.36	40.45	-107.94	40.45
Temperature [F]	85.71	-96.90	-162.30	97.44	104.82	-162.30	104.82
Pressure [kPa]	950.00	950.00	950.00	950.00	950.00	950.00	950.00
Pressure [psia]	137.79	137.79	137.79	137.79	137.79	137.79	137.79
Molar Flow [kgmole/h]	34,462.58	47,606.20	15,868.52	4,730.55	2,005.65	31,737.68	2,724.90
Mass Flow [kg/h]	660,854.21	897,126.31	376,525.34	235,196.76	94,943.51	520,600.97	140,253.24
Std Ideal Liq Vol Flow [m3/h]	1,984.07	2,833.90	1,108.78	440.85	181.90	1,725.12	258.94
Molar Enthalpy [kJ/kgmole]	-78,563.61	-80,959.71	-97,436.64	-131,329.48	-110,570.37	-80,165.79	-134,536.73
Molar Entropy [kJ/kgmole-C]	167.21	155.39	96.30	97.85	149.03	144.20	98.95
Heat Flow [kJ/h]	-2,707,504,982.48	-3,854,184,610.76	-1,546,175,643.37	-621,260,420.62	-221,765,034.44	-2,544,276,216.52	-366,599,386.22
Liq Vol Flow @Std Cond [m3/h]	811,985.28	1,121,663.74	373,067.77	437.62	180.93	748,457.28	256.84
Vapour Phase							
Vapour / Phase Fraction	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	0.0000
Temperature [C]	29.84	-71.61	-107.94	36.36	40.45	-107.94	40.45
Temperature [F]	85.71	-96.90	-162.30	97.44	104.82	-162.30	104.82
Pressure [kPa]	950.00	950.00	950.00	950.00	950.00	950.00	950.00
Pressure [psia]	137.79	137.79	137.79	137.79	137.79	137.79	137.79
Molar Flow [kgmole/h]	34,462.58	47,606.20	0.00	0.00	2,005.65	31,737.68	0.00
Mass Flow [kg/h]	660,854.21	897,126.31	0.00	0.00	94,943.52	520,600.97	0.00
Std Ideal Liq Vol Flow [m3/h]	1,984.07	2,833.90	0.00	0.00	181.90	1,725.12	0.00
Molar Enthalpy [kJ/kgmole]	-78,563.61	-80,959.71	-80,165.79	-109,104.60	-110,570.37	-80,165.79	-110,570.37
Molar Entropy [kJ/kgmole-C]	167.21	155.39	144.20	147.63	149.03	144.20	149.03
Heat Flow [kJ/h]	-2,707,504,982.48	-3,854,184,610.76	0.00	0.00	-221,765,047.13	-2,544,276,216.52	0.00
Liq Vol Flow @Std Cond [m3/h]	811,985.28	1,121,663.74	0.00	0.00	180.93	748,457.28	0.00
Liquid Phase							
Vapour / Phase Fraction			1.0000	1.0000			1.0000
Temperature [C]			-107.94	36.36			40.45
Temperature [F]			-162.30	97.44			104.82
Pressure [kPa]			950.00	950.00			950.00
Pressure [psia]			137.79	137.79			137.79
Molar Flow [kgmole/h]			15,868.52	4,730.55			2,724.90
Mass Flow [kg/h]			376,525.34	235,196.76			140,253.24
Std Ideal Liq Vol Flow [m3/h]			1,108.78	440.85			258.94
Molar Enthalpy [kJ/kgmole]			-97,436.64	-131,329.48			-134,536.73
Molar Entropy [kJ/kgmole-C]			96.30	97.85			98.95
Heat Flow [kJ/h]			-1,546,175,643.37	-621,260,420.62			-366,599,386.22
Liq Vol Flow @Std Cond [m3/h]			373,067.77	437.62			256.84
Aqueous Phase							
Vapour / Phase Fraction							
Temperature [C]							
Temperature [F]							
Pressure [kPa]							
Pressure [psia]							
Molar Flow [kgmole/h]							
Mass Flow [kg/h]							
Std Ideal Liq Vol Flow [m3/h]							
Molar Enthalpy [kJ/kgmole]							
Molar Entropy [kJ/kgmole-C]							
Heat Flow [kJ/h]							
Liq Vol Flow @Std Cond [m3/h]							
Composition [mole fraction]							
Methane	0.897320	0.808075	0.475496	0.000000	0.000001	0.974362	0.000000
Ethane	0.023178	0.183761	0.501113	0.002062	0.003589	0.025087	0.000939
Propane	0.045955	0.007786	0.023202	0.665487	0.781234	0.000078	0.580292
i-Butane	0.021472	0.000000	0.000001	0.229179	0.171593	0.000000	0.271566
n-Butane	0.004114	0.000000	0.000000	0.040569	0.025000	0.000000	0.052029
i-Pentane	0.004917	0.000000	0.000000	0.041764	0.014024	0.000000	0.062181
n-Pentane	0.001605	0.000000	0.000000	0.013250	0.003667	0.000000	0.020304
n-Hexane	0.001003	0.000000	0.000000	0.007688	0.000893	0.000000	0.012690
n-Heptane	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
H2O	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Nitrogen	0.000401	0.000299	0.000025	0.000000	0.000000	0.000436	0.000000
CO2	0.000034	0.000079	0.000163	0.000000	0.000000	0.000037	0.000000
	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

2.5 Neraca Panas dan Massa

2.5.1 Neraca Panas dan Massa *Compressor* K-104

Tabel 13. Neraca Panas *Compressor* K-104

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
Dry Gas	-2,746,254,086.10	
Comp WG1		-2,034,053,269.45
Total	-2,746,254,086.10	-2,034,053,269.45

Tabel 14. Neraca Massa *Compressor* K-104

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
Dry Gas	666,038.92	
Comp WG1		666,038.92
Total	666,038.92	666,038.92

Tabel 15. Komposisi *Stream Compressor* K-104

Composisition [%]	*Stream*	
	Dry Gas	Comp WG1
Methane	0.894210	0.894211
Ethane	0.023097	0.023098
Propane	0.045795	0.045795
i-Butane	0.021397	0.021398
n-Butane	0.004099	0.004100
i-Pentane	0.004899	0.004900
n-Pentane	0.001599	0.001600
n-Hexane	0.000999	0.001000
n-Heptane	0.000000	0.000000
H_2O	0.000099	0.000100
Nitrogen	0.000399	0.000400
CO_2	0.003399	0.003400
Total	1.000000	1.000000

2.5.2 Neraca Panas dan Massa *Cooler* E-102

Tabel 16. Neraca Panas *Cooler* E-102

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
Comp WG1	-2,034,053,269.45	
Cool WG1		-2,754,372,243.18
Total	-2,034,053,269.45	-2,754,372,243.18

Tabel 17. Neraca Massa *Cooler* E-102

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
Comp WG1	666,038.92	
Cool WG1		666,038.92
Total	666,038.92	666,038.92

Tabel 18. Komposisi *Stream Cooler* E-104

Composisition [%]	*Stream*	
	Comp WG1	Cool WG1
Methane	0.894211	0.894211
Ethane	0.023098	0.023098
Propane	0.045795	0.045795
i-Butane	0.021398	0.021398
n-Butane	0.004100	0.004100
i-Pentane	0.004900	0.004900
n-Pentane	0.001600	0.001600
n-Hexane	0.001000	0.001000
n-Heptane	0.000000	0.000000
H_2O	0.000100	0.000100
Nitrogen	0.000400	0.000400
CO_2	0.003400	0.003400
Total	1.000000	1.000000

2.5.3 Neraca Panas dan Massa *Splitter* V-101

Tabel 19. Neraca Panas *Splitter* V-101

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
Cool WG1	-2,754,372,243.18	
TR1		-45,860,720.96
WG2		-2,708,511,522.22
Total	-2,754,372,243.18	-2,754,372,243.18

Tabel 20. Neraca Massa *Splitter* V-101

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
Cool WG1	666,038.92	
TR1		5,122.41
WG2		660,916.51
Total	666,038.92	666,038.92

Tabel 21. Komposisi *Stream Splitter* V-101

Composisition [%]	*Stream*		
	Cool WG1	TR1	WG2
Methane	0.894211	0.000000	0.897230
Ethane	0.023098	0.000000	0.023176
Propane	0.045795	0.000000	0.045950
i-Butane	0.021398	0.000000	0.021470
n-Butane	0.004100	0.000000	0.004113
i-Pentane	0.004900	0.000000	0.004916
n-Pentane	0.001600	0.000000	0.001605
n-Hexane	0.001000	0.000000	0.001003
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000100	0.000000	0.000100

Composisition [%]	*Stream*		
	Cool WG1	TR1	WG2
Nitrogen	0.000400	0.000000	0.000401
CO_2	0.003400	116.392831	0.000034
Total	1.000000	1.000000	1.000000

2.5.4 Neraca Panas dan Massa *Dehydration Column* T-101

Tabel 22. Neraca Panas *Dehydration Column* T-101

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
WG2	-2,708,511,522.22	
Dry Gas Outlet		-2,706,854,467.38
H2O Outlet		-973,237.17
Total	-2,708,511,522.22	-2,707,827,704.55

Tabel 23. Neraca Massa *Dehydration Column* T-101

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
WG2	660,916.51	
Dry Gas Outlet		660,854.21
H2O Outlet		62.29
Total	660,916.51	660,916.51

Tabel 24. Komposisi *Stream Dehydration Column* T-101

Composisition [%]	*Stream*		
	WG2	*Dry Gas Outlet*	*H20 Outlet*
Methane	0.750640	0.897320	0.000000
Ethane	0.036342	0.023178	0.000000
Propane	0.105667	0.045955	0.000000
i-Butane	0.065078	0.021472	0.000000

Composisition [%]	*Stream*		
	WG2	*Dry Gas Outlet*	*H20 Outlet*
n-Butane	0.012468	0.004114	0.000000
i-Pentane	0.018497	0.004917	0.000000
n-Pentane	0.006040	0.001605	0.000000
n-Hexane	0.004509	0.001003	0.000000
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000094	0.000000	1.000000
Nitrogen	0.000586	0.000401	0.000000
CO_2	0.000078	0.000034	0.000000
Total	1.000000	1.000000	1.000000

2.5.5 Neraca Panas dan Massa *Destillation Column* T-100

Tabel 25. Neraca Panas *Destillation Column* T-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
Dry Gas Outlet	-2,707,504,982.48	
To Condenser		-3,854,184,610.76
Reflux	-1,546,175,643.37	
To Reboiler		-621,260,420.62
Boil Up	-221,765,034.44	
Total	-4,475,445,660.29	-4,475,445,031.38

Tabel 26. Neraca Massa *Destillation Column* T-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
Dry Gas Outlet	660,854.21	
To Condenser		897,126.31
Reflux	376,525.34	
To Reboiler		235,196.76
Boil Up	94,943.51	
Total	1,132,323.06	1,132,323.07

Tabel 27. Komposisi *Stream Destillation Column* T-100

Composisition [%]	*Stream*				
	Dry Gas Outlet	*To Condenser*	*Reflux*	*To Reboiler*	*Boil Up*
Methane	0.897320	0.808075	0.475496	0.000000	0.000001
Ethane	0.023178	0.183761	0.501113	0.002062	0.003589
Propane	0.045955	0.007786	0.023202	0.665487	0.781234
i-Butane	0.021472	0.000000	0.000001	0.229179	0.171593
n-Butane	0.004114	0.000000	0.000000	0.040569	0.025000
i-Pentane	0.004917	0.000000	0.000000	0.041764	0.014024
n-Pentane	0.001605	0.000000	0.000000	0.013250	0.003667
n-Hexane	0.001003	0.000000	0.000000	0.007688	0.000893
n-Heptane	0.000000	0.000000	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000	0.000000	0.000000
Nitrogen	0.000401	0.000299	0.000025	0.000000	0.000000
CO_2	0.000034	0.000079	0.000163	0.000000	0.000000
Total	1.000000	1.000000	1.000000	1.000000	1.000000

2.5.6 Neraca Panas dan Massa *Condenser* C-100

Tabel 28. Neraca Panas *Condenser* C-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
To Condenser	-3,854,184,610.76	
Reflux		-1,546,175,643.37
CH4		-2,544,276,216.52
Total	-3,854,184,610.76	-4,090,451,859.89

Tabel 29. Neraca Massa *Condenser* C-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
To Condenser	897,126.31	
Reflux		376,525.34
CH4		520,600.97
Total	897,126.31	897,126.31

Tabel 30. Komposisi *Stream Condenser* C-100

Composisition [%]	*Stream*		
	To Condenser	*Reflux*	*CH4*
Methane	0.808075	0.475496	0.974362
Ethane	0.183761	0.501113	0.025087
Propane	0.007786	0.023202	0.000078
i-Butane	0.000000	0.000001	0.000000
n-Butane	0.000000	0.000000	0.000000
i-Pentane	0.000000	0.000000	0.000000
n-Pentane	0.000000	0.000000	0.000000
n-Hexane	0.000000	0.000000	0.000000
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000
Nitrogen	0.000299	0.000025	0.000436
CO_2	0.000079	0.000163	0.000037
Total	1.000000	1.000000	1.000000

2.5.7 Neraca Panas dan Massa *Reboiler* R-100

Tabel 31. Neraca Panas *Reboiler* R-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
To Reboiler	-621,260,420.62	
Boil Up		-221,765,034.44

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
Condensate		-366,599,386.22
Total	-621,260,420.62	-588,364,420.66

Tabel 32. Neraca Massa *Reboiler* R-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
To Reboiler	235,196.76	
Boil Up		94,943.51
Condensate		140,253.24
Total	235,196.76	235,196.75

Tabel 33. Komposisi *Stream Reboiler* R-100

Composisition [%]	*Stream*		
	To Reboiler	*Boil Up*	*Condensate*
Methane	0.000000	0.000001	0.000000
Ethane	0.002062	0.003589	0.000939
Propane	0.665487	0.781234	0.580292
i-Butane	0.229179	0.171593	0.271566
n-Butane	0.040569	0.025000	0.052029
i-Pentane	0.041764	0.014024	0.062181
n-Pentane	0.013250	0.003667	0.020304
n-Hexane	0.007688	0.000893	0.012690
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000
Nitrogen	0.000000	0.000000	0.000000
CO_2	0.000000	0.000000	0.000000
Total	1.000000	1.000000	1.000000

2.5.8 Neraca Panas dan Massa *Valve* VLV-101

Tabel 34. Neraca Panas *Valve* VLV-101

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
LNG	-2,544,276,216.54	
LNG_HE1		-2,544,276,216.54
Total	-2,544,276,216.54	-2,544,276,216.54

Tabel 35. Neraca Massa *Valve* VLV-101

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
LNG	520,600.97	
LNG_HE1		520,600.97
Total	520,600.97	520,600.97

Tabel 36. Komposisi *Stream Valve* VLV-101

Composisition [%]	*Stream*	
	LNG	LNG_HE1
Methane	0.974363	0.974363
Ethane	0.025164	0.025164
Propane	0.000000	0.000000
i-Butane	0.000000	0.000000
n-Butane	0.000000	0.000000
i-Pentane	0.000000	0.000000
n-Pentane	0.000000	0.000000
n-Hexane	0.000000	0.000000
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.000436	0.000436
CO_2	0.000037	0.000037
Total	1.000000	1.000000

2.5.9 Neraca Panas dan Massa LNG *Heat Exchanger* LNG-101

Tabel 37. Neraca Panas LNG *Heat Exchanger* LNG-101

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
LNG_HE1	-2,544,276,216.54	
LNG_HE2		-2,554,582,685.31
WMR3	-120,603,194.76	
WMR4		-118,372,025.36
WMR5	-118,372,025.36	
WMR6		-120,642,630.85
REGEN7	-4,240,446,718.82	
CMR1		-4,230,559,680.49
Total	-7,023,698,155.48	-7,024,157,022.01

Tabel 38. Neraca Massa LNG *Heat Exchanger* LNG-101

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
LNG_HE1	520,600.97	
LNG_HE2		520,600.97
WMR3	39,115.64	
WMR4		39,115.64
WMR5	39,115.64	
WMR6		39,115.64
REGEN7	833,867.42	
CMR1		833,867.42
Total	1,432,699.67	1,432,699.67

Tabel 39. Komposisi *Stream* LNG *Heat Exchanger* LNG-101

Composisition [%]	*Stream*			
	LNG_HE1	LNG_HE2	WMR3	WMR4
Methane	0.974363	0.974363	0.000000	0.000000
Ethane	0.025164	0.025164	0.000334	0.000334
Propane	0.000000	0.000000	0.864547	0.864547
i-Butane	0.000000	0.000000	0.115730	0.115730
n-Butane	0.000000	0.000000	0.013519	0.013519
i-Pentane	0.000000	0.000000	0.004744	0.004744
n-Pentane	0.000000	0.000000	0.000999	0.000999
n-Hexane	0.000000	0.000000	0.000127	0.000127
n-Heptane	0.000000	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000	0.000000
Nitrogen	0.000436	0.000436	0.000000	0.000000
CO_2	0.000037	0.000037	0.000000	0.000000
Total	1.000000	1.000000	1.000000	1.000000

Tabel 40. Komposisi *Stream* LNG *Heat Exchanger* LNG-101 (Lanjutan)

Composisition [%]	*Stream*			
	WMR5	WMR6	REGEN7	CMR1
Methane	0.000000	0.000000	0.956764	0.956764
Ethane	0.000334	0.000334	0.000047	0.000047
Propane	0.864547	0.864547	0.000000	0.000000
i-Butane	0.115730	0.115730	0.000000	0.000000
n-Butane	0.013519	0.013519	0.000000	0.000000
i-Pentane	0.004744	0.004744	0.000000	0.000000
n-Pentane	0.000999	0.000999	0.000000	0.000000
n-Hexane	0.000127	0.000127	0.000000	0.000000
n-Heptane	0.000000	0.000000	0.000000	0.000000

Composisition [%]	*Stream*			
	WMR5	WMR6	REGEN7	CMR1
H_2O	0.000000	0.000000	0.000000	0.000000
Nitrogen	0.000000	0.000000	0.043189	0.043189
CO_2	0.000000	0.000000	0.000001	0.000001
Total	1.000000	1.000000	1.000000	1.000000

2.5.10 Neraca Panas dan Massa LNG *Heat Exchanger* LNG-100

Tabel 41. Neraca Panas LNG *Heat Exchanger* LNG-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
LNG_HE2	-2,554,582,685.31	
LNG_*Cooled*		-2,643,887,161.87
CMR1	-4,230,559,680.49	
CMR2		-4,349,284,750.66
CMR3	-4,349,284,750.66	
CMR4		-4,141,252,997.86
Total	-11,134,427,116.46	-11,134,424,910.39

Tabel 42. Neraca Massa LNG *Heat Exchanger* LNG-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
LNG_HE2	520,600.97	
LNG_*Cooled*		520,600.97
CMR1	833,867.42	
CMR2		833,867.42
CMR3	833,867.42	
CMR4		833,867.42
Total	2,188,335.81	2,188,335.81

Tabel 43. Komposisi *Stream* LNG *Heat Exchanger* LNG-100

Composisition [%]	*Stream*		
	LNG_HE2	LNG_*Cooled*	CMR1
Methane	0.974363	496,151.145760	0.956764
Ethane	0.025164	24,017.586055	0.000047
Propane	0.000000	0.013478	0.000000
i-Butane	0.000000	0.000000	0.000000
n-Butane	0.000000	0.000000	0.000000
i-Pentane	0.000000	0.000000	0.000000
n-Pentane	0.000000	0.000000	0.000000
n-Hexane	0.000000	0.000000	0.000000
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000
Nitrogen	0.000436	387.483763	0.043189
CO_2	0.000037	51.663099	0.000001
Total	1.000000	1.000000	1.000000

Tabel 44. Komposisi *Stream* LNG *Heat Exchanger* LNG-100 (Lanjutan)

Composisition [%]	*Stream*		
	CMR2	CMR3	CMR4
Methane	0.956764	0.956764	0.956764
Ethane	0.000047	0.000047	0.000047
Propane	0.000000	0.000000	0.000000
i-Butane	0.000000	0.000000	0.000000
n-Butane	0.000000	0.000000	0.000000
i-Pentane	0.000000	0.000000	0.000000
n-Pentane	0.000000	0.000000	0.000000
n-Hexane	0.000000	0.000000	0.000000
n-Heptane	0.000000	0.000000	0.000000

Composisition [%]	*Stream*		
	CMR2	CMR3	CMR4
H_2O	0.000000	0.000000	0.000000
Nitrogen	0.043189	0.043189	0.043189
CO_2	0.000001	0.000001	0.000001
Total	1.000000	1.000000	1.000000

2.5.11 Neraca Panas dan Massa *Valve* VLV-100

Tabel 45. Neraca Panas *Valve* VLV-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
Condensate	-366,599,386.19	
Expanded Condensate		-366,599,386.19
Total	-366,599,386.19	-366,599,386.19

Tabel 46. Neraca Massa *Valve* VLV-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
Condensate	140,253.24	
Expanded Condensate		140,253.24
Total	140,253.24	140,253.24

Tabel 47. Komposisi *Stream Valve* VLV-100

Composisition [%]	*Stream*	
	Condensate	*Expanded Condensate*
Methane	0.000002	0.000000
Ethane	3.074079	0.000038
Propane	69,840.830912	0.581200
i-Butane	43,013.253506	0.271564

Composisition [%]	*Stream*	
	Condensate	*Expanded Condensate*
n-Butane	8,240.640714	0.052027
i-Pentane	12,225.589407	0.062180
n-Pentane	3,991.880528	0.020303
n-Hexane	2,979.846689	0.012689
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.000000	0.000000
CO_2	0.000000	0.000000
Total	1.000000	1.000000

2.5.12 Neraca Panas dan Massa *Mixer* MIX-100

Tabel 48. Neraca Panas *Mixer* MIX-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
Expanded Condensate	-366,599,386.19	
WMR7	-121,429,626.80	
Mix Condensate		-487,208,490.40
Total	-488,029,012.99	-487,208,490.40

Tabel 49. Neraca Massa *Mixer* MIX-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
Expanded Condensate	140,253.24	
WMR7	39,372.11	
Mix Condensate		179,667.23
Total	179,625.35	179,667.23

Tabel 50. Komposisi *Stream Mixer* MIX-100

Composisition [%]	*Stream*		
	Expanded Condensate	WMR7	*Mix Condensate*
Methane	0.000000	0.000000	0.000000
Ethane	0.000038	0.000334	0.000108
Propane	0.581200	0.864016	0.648709
i-Butane	0.271564	0.116152	0.234466
n-Butane	0.052027	0.013587	0.042851
i-Pentane	0.062180	0.004777	0.048478
n-Pentane	0.020303	0.001007	0.015697
n-Hexane	0.012689	0.000128	0.009691
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000
Nitrogen	0.000000	0.000000	0.000000
CO_2	0.000000	0.000000	0.000000
Total	1.000000	1.000000	1.000000

2.5.13 Neraca Panas dan Massa *Separator* V-102

Tabel 51. Neraca Panas *Separator* V-102

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
Mix Condensate	-487,208,490.40	
WMR1		-95,377,129.67
Condensate_Liq		-391,831,360.73
Total	-487,208,490.40	-487,208,490.40

Tabel 52. Neraca Massa *Separator* V-102

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
Mix Condensate	179,667.23	
WMR1		39,115.64
Condensate_Liq		140,551.59
Total	179,667.23	179,667.23

Tabel 53. Komposisi *Stream Separator* V-102

Composisition [%]	*Stream*		
	Mix Condensate	WMR1	*Condensate_Liq*
Methane	0.000000	0.000000	0.000000
Ethane	0.000108	0.000334	0.000038
Propane	0.648709	0.864547	0.581595
i-Butane	0.234466	0.115730	0.271386
n-Butane	0.042851	0.013519	0.051972
i-Pentane	0.048478	0.004744	0.062077
n-Pentane	0.015697	0.000999	0.020267
n-Hexane	0.009691	0.000127	0.012664
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000
Nitrogen	0.000000	0.000000	0.000000
CO_2	0.000000	0.000000	0.000000
Total	1.000000	1.000000	1.000000

2.5.14 Neraca Panas dan Massa *Compressor* K-102

Tabel 54. Neraca Panas *Compressor* K-102

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
WMR1	-95,377,129.67	
WMR2		-89,862,087.12
Total	-95,377,129.67	-89,862,087.12

Tabel 55. Neraca Massa *Compressor* K-102

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
WMR1	39,115.64	
WMR2		39,115.64
Total	39,115.64	39,115.64

Tabel 56. Komposisi *Stream Compressor* K-102

Composisition [%]	*Stream*	
	WMR1	WMR2
Methane	0.000000	0.000000
Ethane	0.000334	0.000334
Propane	0.864547	0.864547
i-Butane	0.115730	0.115730
n-Butane	0.013519	0.013519
i-Pentane	0.004744	0.004744
n-Pentane	0.000999	0.000999
n-Hexane	0.000127	0.000127
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.000000	0.000000
CO_2	0.000000	0.000000
Total	1.000000	1.000000

2.5.15 Neraca Panas dan Massa *Cooler* E-101

Tabel 57. Neraca Panas *Cooler* E-101

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
WMR2	-89,862,087.12	
WMR3		-120,603,194.76
Total	-89,862,087.12	-120,603,194.76

Tabel 58. Neraca Massa *Cooler* E-101

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
WMR2	39,115.64	
WMR3		39,115.64
Total	39,115.64	39,115.64

Tabel 59. Komposisi *Stream Cooler* E-101

Composisition [%]	*Stream*	
	WMR2	WMR3
Methane	0.000000	0.000000
Ethane	0.000334	0.000334
Propane	0.864547	0.864547
i-Butane	0.115730	0.115730
n-Butane	0.013519	0.013519
i-Pentane	0.004744	0.004744
n-Pentane	0.000999	0.000999
n-Hexane	0.000127	0.000127
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.000000	0.000000
CO_2	0.000000	0.000000
Total	1.000000	1.000000

2.5.16 Neraca Panas dan Massa *Valve* VLV-103

Tabel 60. Neraca Panas *Valve* VLV-103

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
WMR4	-118,372,025.36	
WMR5		-118,372,025.36
Total	-118,372,025.36	-118,372,025.36

Tabel 61. Neraca Massa *Valve* VLV-103

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
WMR4	39,115.64	
WMR5		39,115.64
Total	39,115.64	39,115.64

Tabel 62. Komposisi *Stream Valve* VLV-103

Composisition [%]	*Stream*	
	WMR4	WMR5
Methane	0.000000	0.000000
Ethane	0.000334	0.000334
Propane	0.864547	0.864547
i-Butane	0.115730	0.115730
n-Butane	0.013519	0.013519
i-Pentane	0.004744	0.004744
n-Pentane	0.000999	0.000999
n-Hexane	0.000127	0.000127
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.000000	0.000000
CO_2	0.000000	0.000000
Total	1.000000	1.000000

2.5.17 Neraca Panas dan Massa *Valve* VLV-102

Tabel 63. Neraca Panas *Valve* VLV-102

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
CMR2	-4,349,284,750.66	
CMR3		-4,349,284,750.66
Total	-4,349,284,750.66	-4,349,284,750.66

Tabel 64. Neraca Massa *Valve* VLV-102

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
CMR2	833,867.42	
CMR3		833,867.42
Total	833,867.42	833,867.42

Tabel 65. Komposisi *Stream Valve* VLV-102

Composisition [%]	*Stream*	
	CMR2	CMR3
Methane	0.956764	0.956764
Ethane	0.000047	0.000047
Propane	0.000000	0.000000
i-Butane	0.000000	0.000000
n-Butane	0.000000	0.000000
i-Pentane	0.000000	0.000000
n-Pentane	0.000000	0.000000
n-Hexane	0.000000	0.000000
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.043189	0.043189
CO_2	0.000001	0.000001
Total	1.000000	1.000000

2.5.18 Neraca Panas dan Massa *Mixer* MIX-101

Tabel 66. Neraca Panas *Mixer* MIX-101

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
CMR5	-4,147,344,764.30	
LNG_*Cooled*	-2,643,887,161.87	
LNG_*Mix*		-6,791,387,076.12
Total	-6,791,231,926.17	-6,791,387,076.12

Tabel 67. Neraca Massa *Mixer* MIX-101

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
CMR5	50,461.11	
LNG_*Cooled*	520,600.97	
LNG_*Mix*		1,356,698.49
Total	571,062.08	1,356,698.49

Tabel 68. Komposisi *Stream Mixer* MIX-101

Composisition [%]	*Stream*		
	CMR5	LNG_*Cooled*	LNG_*Mix*
Methane	0.956057	496,151.145760	0.963125
Ethane	0.000047	24,017.586055	0.009745
Propane	0.000000	0.013478	0.000000
i-Butane	0.000000	0.000000	0.000000
n-Butane	0.000000	0.000000	0.000000
i-Pentane	0.000000	0.000000	0.000000
n-Pentane	0.000000	0.000000	0.000000
n-Hexane	0.000000	0.000000	0.000000
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000
Nitrogen	0.043896	387.483763	0.027115

Composisition [%]	*Stream*		
	CMR5	LNG_*Cooled*	LNG_*Mix*
CO_2	0.000001	51.663099	0.000015
Total	1.000000	1.000000	1.000000

2.5.19 Neraca Panas dan Massa *Compressor* K-103

Tabel 69. Neraca Panas *Compressor* K-103

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
REGEN1	-3,928,319,556.95	
REGEN2		-3,810,927,634.70
Total	-3,928,319,556.95	-3,810,927,634.70

Tabel 70. Neraca Massa *Compressor* K-103

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
REGEN1	833,867.42	
REGEN2		833,867.42
Total	833,867.42	833,867.42

Tabel 71. Komposisi *Stream Compressor* K-103

Composisition [%]	*Stream*	
	REGEN1	REGEN2
Methane	0.956764	0.956764
Ethane	0.000047	0.000047
Propane	0.000000	0.000000
i-Butane	0.000000	0.000000
n-Butane	0.000000	0.000000
i-Pentane	0.000000	0.000000
n-Pentane	0.000000	0.000000
n-Hexane	0.000000	0.000000

Composisition [%]	*Stream*	
	REGEN1	REGEN2
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.043189	0.043189
CO_2	0.000001	0.000001
Total	1.000000	1.000000

2.5.20 Neraca Panas dan Massa *Cooler* E-103

Tabel 72. Neraca Panas *Cooler* E-103

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
REGEN2	-3,810,927,634.70	
REGEN3		-3,885,365,547.05
Total	-3,810,927,634.70	-3,885,365,547.05

Tabel 73. Neraca Massa *Cooler* E-103

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
REGEN2	833,867.42	
REGEN3		833,867.42
Total	833,867.42	833,867.42

Tabel 74. Komposisi *Stream Cooler* E-103

Composisition [%]	*Stream*	
	REGEN2	REGEN3
Methane	0.956764	0.956764
Ethane	0.000047	0.000047
Propane	0.000000	0.000000
i-Butane	0.000000	0.000000
n-Butane	0.000000	0.000000
i-Pentane	0.000000	0.000000

Composisition [%]	*Stream*	
	REGEN2	REGEN3
n-Pentane	0.000000	0.000000
n-Hexane	0.000000	0.000000
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.043189	0.043189
CO_2	0.000001	0.000001
Total	1.000000	1.000000

2.5.21 Neraca Panas dan Massa *Compressor* K-100

Tabel 75. Neraca Panas *Compressor* K-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
REGEN3	-3,885,365,547.05	
REGEN4		-3,830,512,156.75
Total	-3,885,365,547.05	-3,830,512,156.75

Tabel 76. Neraca Massa *Compressor* K-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
REGEN3	833,867.42	
REGEN4		833,867.42
Total	833,867.42	833,867.42

Tabel 77. Komposisi *Stream Compressor* K-100

Composisition [%]	*Stream*	
	REGEN3	REGEN4
Methane	0.956764	0.956764
Ethane	0.000047	0.000047
Propane	0.000000	0.000000
i-Butane	0.000000	0.000000

Composisition [%]	*Stream*	
	REGEN3	REGEN4
n-Butane	0.000000	0.000000
i-Pentane	0.000000	0.000000
n-Pentane	0.000000	0.000000
n-Hexane	0.000000	0.000000
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.043189	0.043189
CO_2	0.000001	0.000001
Total	1.000000	1.000000

2.5.22 Neraca Panas dan Massa *Cooler* E-104

Tabel 78. Neraca Panas *Cooler* E-104

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
REGEN4	-3,830,512,156.75	
REGEN5		-3,881,496,591.39
Total	-3,830,512,156.75	-3,881,496,591.39

Tabel 79. Neraca Massa *Cooler* E-104

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
REGEN4	833,867.42	
REGEN5		833,867.42
Total	833,867.42	833,867.42

Tabel 80. Komposisi *Stream Cooler* E-104

Composisition [%]	*Stream*	
	REGEN4	REGEN5
Methane	0.956764	0.956764
Ethane	0.000047	0.000047
Propane	0.000000	0.000000
i-Butane	0.000000	0.000000
n-Butane	0.000000	0.000000
i-Pentane	0.000000	0.000000
n-Pentane	0.000000	0.000000
n-Hexane	0.000000	0.000000
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.043189	0.043189
CO_2	0.000001	0.000001
Total	1.000000	1.000000

2.5.23 Neraca Panas dan Massa *Compressor* K-101

Tabel 81. Neraca Panas *Compressor* K-101

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
REGEN5	-3,881,496,591.39	
REGEN6		-3,850,871,479.44
Total	-3,881,496,591.39	-3,850,871,479.44

Tabel 82. Neraca Massa *Compressor* K-101

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
REGEN5	833,867.42	
REGEN6		833,867.42
Total	833,867.42	833,867.42

Tabel 83. Komposisi *Stream Compressor* K-101

Composisition [%]	*Stream*	
	REGEN5	REGEN6
Methane	0.956764	0.956764
Ethane	0.000047	0.000047
Propane	0.000000	0.000000
i-Butane	0.000000	0.000000
n-Butane	0.000000	0.000000
i-Pentane	0.000000	0.000000
n-Pentane	0.000000	0.000000
n-Hexane	0.000000	0.000000
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.043189	0.043189
CO_2	0.000001	0.000001
Total	1.000000	1.000000

2.5.24 Neraca Panas dan Massa *Cooler* E-100

Tabel 84. Neraca Panas *Cooler* E-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
REGEN6	-3,850,871,479.44	
REGEN7		-4,240,446,718.82
Total	-3,850,871,479.44	-4,240,446,718.82

Tabel 85. Neraca Massa *Cooler* E-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
REGEN6	833,867.42	
REGEN7		833,867.42
Total	833,867.42	833,867.42

Tabel 86. Komposisi *Stream Cooler* E-100

Composisition [%]	*Stream*	
	REGEN6	REGEN7
Methane	0.956764	0.956764
Ethane	0.000047	0.000047
Propane	0.000000	0.000000
i-Butane	0.000000	0.000000
n-Butane	0.000000	0.000000
i-Pentane	0.000000	0.000000
n-Pentane	0.000000	0.000000
n-Hexane	0.000000	0.000000
n-Heptane	0.000000	0.000000
H_2O	0.000000	0.000000
Nitrogen	0.043189	0.043189
CO_2	0.000001	0.000001
Total	1.000000	1.000000

2.5.25 Neraca Panas dan Massa *Tank* V-100

Tabel 87. Neraca Panas *Tank* V-100

Stream	*Inlet Heat Flow* [kJ/h]	*Outlet Heat Flow* [kJ/h]
LNG_*Mix*	-6,791,387,076.12	
REGEN1	-3,928,319,556.95	
LNG_*Liquid*		-2,863,067,519.17
Total	-10,719,706,633.07	-2,863,067,519.17

Tabel 88. Neraca Massa *Tank* V-100

Stream	*Inlet Mass Flow* [kg/h]	*Outlet Mass Flow* [kg/h]
LNG_*Mix*	1,356,698.49	
REGEN1	833,867.42	
LNG_*Liquid*		522,831.07
Total	2,190,565.91	522,831.07

Tabel 89. Komposisi *Stream Tank* V-100

Composisition [%]	*Stream*		
	LNG_*Mix*	REGEN1	LNG_*Liquid*
Methane	0.963125	0.956764	497,242.741587
Ethane	0.009745	0.000047	24,018.197179
Propane	0.000000	0.000000	0.013478
i-Butane	0.000000	0.000000	0.000000
n-Butane	0.000000	0.000000	0.000000
i-Pentane	0.000000	0.000000	0.000000
n-Pentane	0.000000	0.000000	0.000000
n-Hexane	0.000000	0.000000	0.000000
n-Heptane	0.000000	0.000000	0.000000
H_2O	0.000000	0.000000	0.000000
Nitrogen	0.027115	0.043189	1,518.440252
CO_2	0.000015	0.000001	51.673544
Total	1.000000	1.000000	1.000000

2.6 Tata Letak Pabrik dan Alat

Tata letak pabrik merupakan rencara untuk menempatkan bagian-bagian pabrik baik bagian utama maupun bagian pendukung pabrik. Tata letak pabrik menjadi pertimbangan yang cukup penting karena berkaitan dengan efisiensi produksi dan instalasi alat sehingga mendukung kelancaran proses produksi.

Selain kebutuhan *plant area* seperti konsep proses pada bab sebelumnya, kebutuhan penunjang produksi juga dipertimbangkan seperti kantor, laboratorium, poliklinik, dan lainnya sehingga tidak mengganggu proses produksi. Hal-hal yang perlu diperhatikan dalam perancagan tata letak pabrik LNG sebagai berikut:

a. Luas daerah yang tersedia

   Luas tanah yang tersedia mempengaruhi tata letak bangunan serta *plant area* yang juga berkaitan dengan harga tanah. Luas tanah yang sedikit atau harga tanah yang mahal menjadikan *plant area* dibuat lebih sempit atau dibuat elevasi pada susunan alat produksi.

b. Daerah perluasan pabrik

   Daerah perluasan pabrik merupakan kebutuhan yang harus dipenuhi sehingga pabrik mempunyai cadangan lahan untuk perkembangan pabrik. Selain untuk cadangan, daerah perluasan pabrik juga bisa digunakan untuk tempat penyimpanan sementara alat produksi yang tidak digunakan.

c. Keamanan dan keselamatan kerja

   Keamanan dan keselamatan kerja juga harus direncanakan sebagai salah satu bentuk pencegahan terhadap kecelakaan kerja. Penempatan *hydrant*, *power plant*, atau gudang diperhatikan sehingga tidak menimbulkan risiko kecelakaan kerja seperti sekeliling area tangki yang harus mempunyai dam penahan luapan isi tangki sehingga tidak tumpah ke alat lain.

d. Instalasi dan utilitas

   Instalasi alat dan instrumentasi serta kebutuhan utilitas sangat bergantung pada tata letak pabrik. Contohnya semakin jauh instalasi alat dan instrumentasi dari *control room* maka semakin mahal biaya yang dikeluarkan. Penempatan alat dan instrumentasi harus efisien sehingga kebutuhan biaya tidak terlalu banyak.

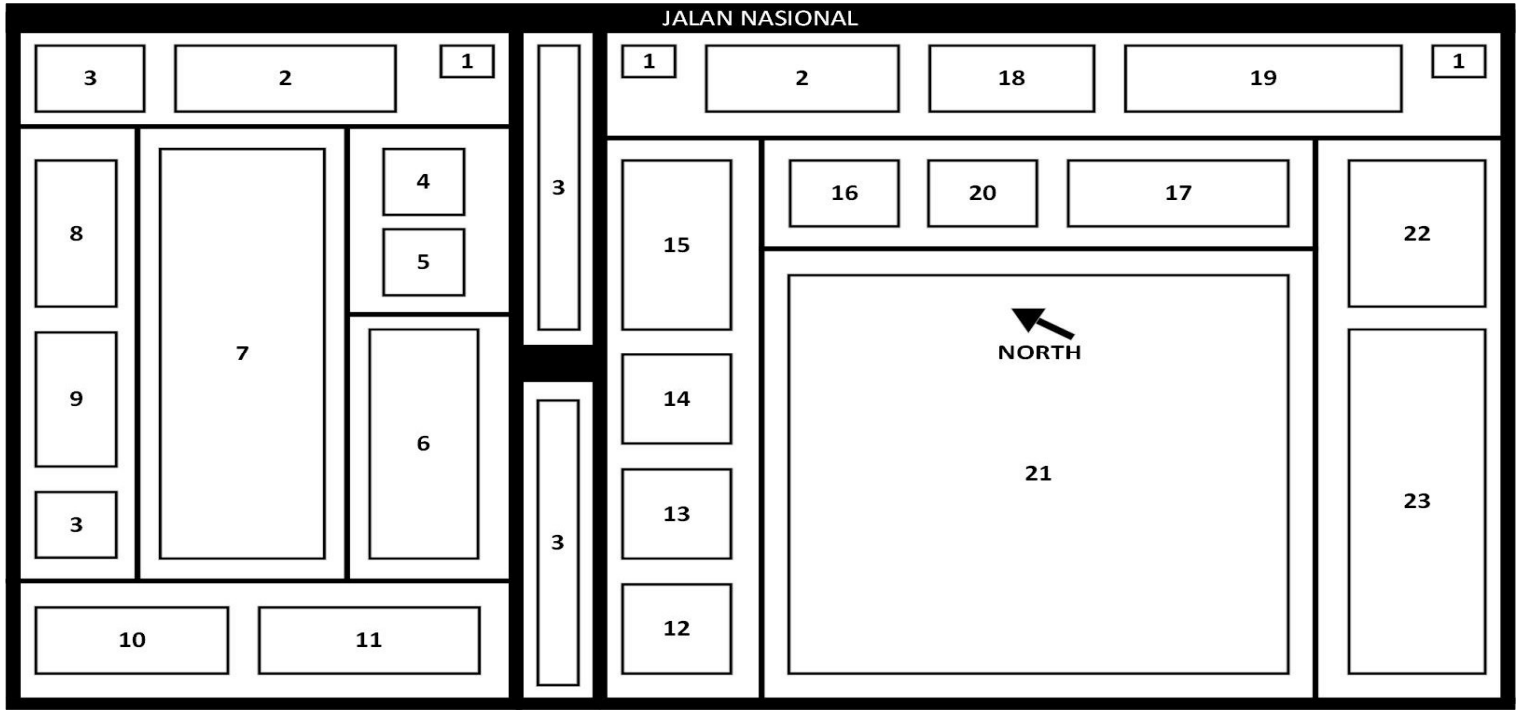
Tata letak pabrik dapat dilihat pada gambar 5 dengan rincian luas tanah sebagai berikut:

Tabel 90. Rincian Luas Tanah

No	Bangunan atau Tempat	Luas (m^2)
1	Pos Keamanan	200
2	Tempat Parkir	1,000
3	Taman	400

No	Bangunan atau Tempat	Luas (m^2)
4	Masjid	200
5	Kantin	200
6	Lapangan Utama	600
7	Kantor Utama	1000
8	Fasilitas Olahraga	400
9	Perpustakaan	350
10	Unit Pengolahan Limbah	350
11	Unit Genset	350
12	Utilitas Listrik	350
13	Utilitas Air	300
14	Utilitas *Steam*	300
15	*Plant Control Room*	300
16	Laboratorium	400
17	Bengkel	700
18	Fasilitas Kesehatan	350
19	Gudang	600
20	Unit *Hydrant*	250
21	*Plant Area*	3,000
22	*Tank Farm*	800
23	Perluasan *Plant*	1000
Total		13,400

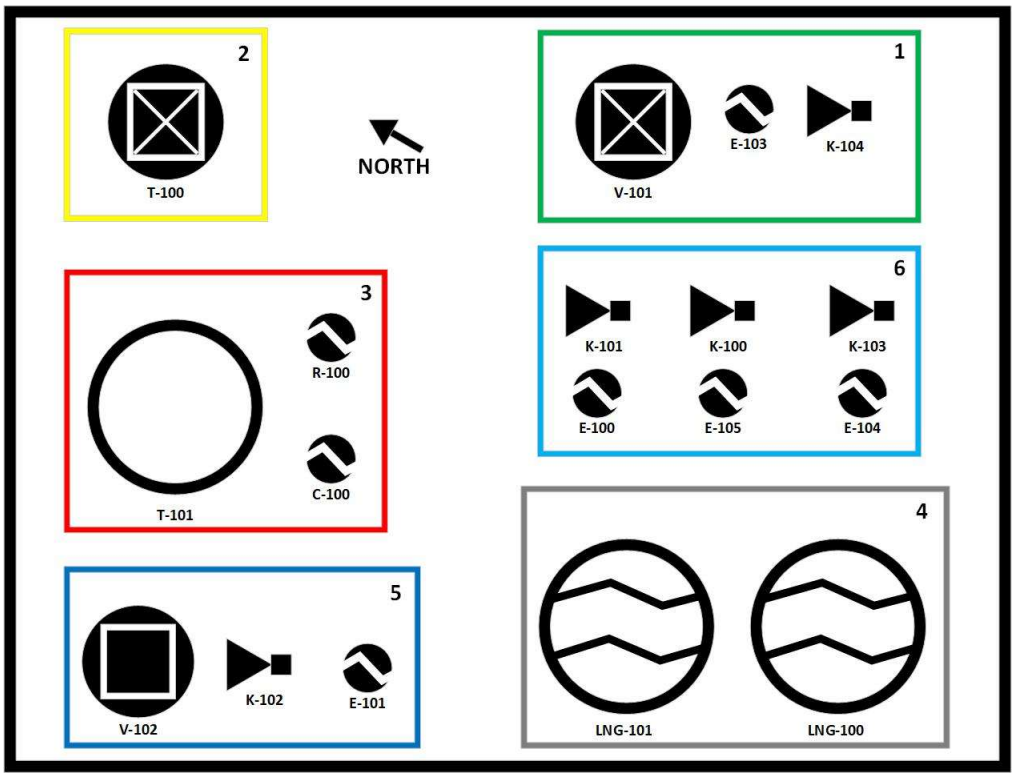
Gambar 5. Tata Letak Pabrik

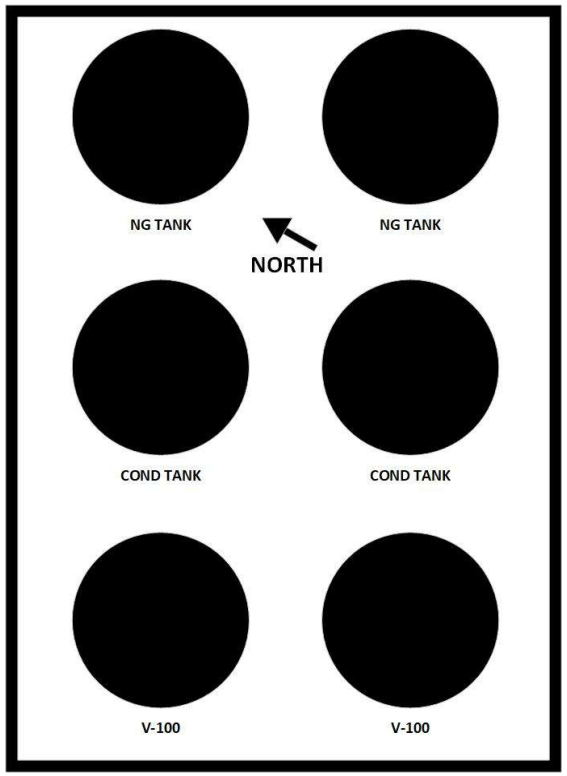


Keterangan:

1. Pos Keamanan
2. Tempat Parkir
3. Taman
4. Masjid
5. Kantin
6. Lapangan Utama
7. Kantor Utama
8. Fasilitas Olahraga
9. Perpustakaan
10. Unit Pengolahan Limbah
11. Unit Genset
12. Utilitas Listrik
13. Utilitas Air
14. Utilitas *Steam*
15. Bengkel
16. Laboratorium
17. *Plant Control Room*
18. Fasilitas Kesehatan
19. Gudang
20. Unit *Hydrant*
21. *Plant Area*
22. *Tank Farm*
23. Perluasan *Plant*

Gambar 6. Tata Letak Alat





Keterangan:

1. *Acid Gas Removal Unit*
2. *Dehydration Unit*
3. *Destillation Unit*
4. LNG *Heat Exchanger Unit*
5. *Condensate Treatment Unit*
6. *Regeneration Unit*