

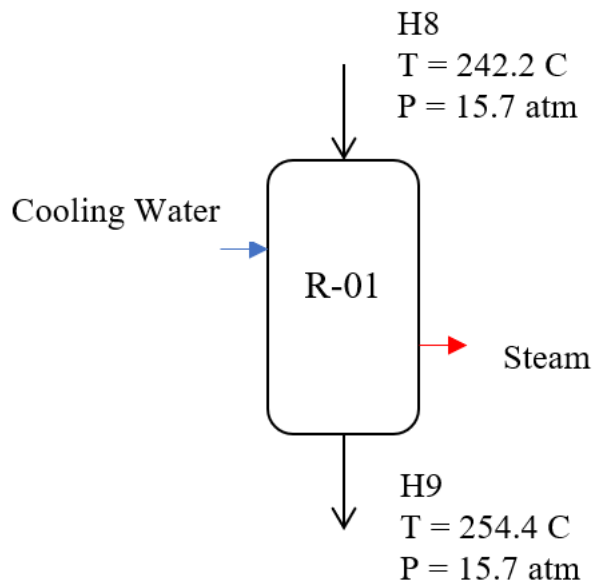
BAB VI

NERACA PANAS

Perhitungan neraca panas didasarkan pada prinsip hukum kekekalan energi dengan aliran beroperasi dalam keadaan tunak (*Steady State*). Persamaan umum neraca panas adalah sebagai berikut:

$$\text{Akumulasi Panas} = \text{Panas masuk} - \text{Panas keluar}$$

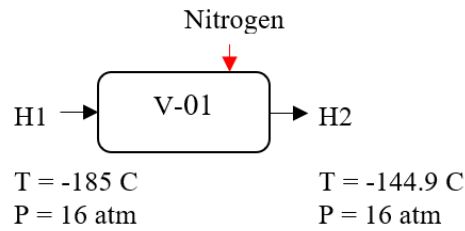
6.1. Reaktor



Tabel 6. 1 Neraca Panas Reaktor

Komponen	Input		Output	
	H8	ΔH_{reaksi}	H9	Q pendingin
Etilen	10683015,42		1139681,67	
Oksigen	6961164,222		736491,9816	
Etilen Oksida			15111787,89	
Air			1695721,626	
Nitrogen	967231,3282		1076937,403	
Etana	39951,87331		42652,40569	
Metana	7153249,321		7614251,076	
Hidrogen	24839,20672		26244,50482	
Karbondioksida	21712,42281		23940721,5	
Reaksi 1		69009695,71		
Reaksi 2		220980026,4		
Pendingin (Air)				264456395,8
Subtotal	25851163,8	289989722,1	51384490,05	264456395,8
Total	315840885,9		315840885,9	

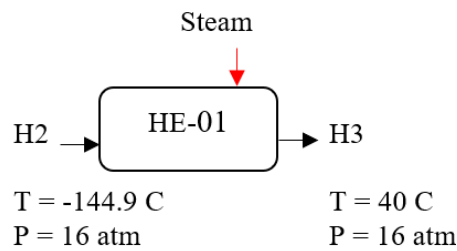
6.2. Vaporizer V-01



Tabel 6. 2 Neraca Panas *Vaporizer* V-01

Komponen	Input		Output
	H1	Q Beban	H2
Oksigen	-41304231,35		-26747472,12
Nitrogen	-61059,59313		74690,00023
Pemanas		14692508,82	
Subtotal	-41365290,94	14692508,82	
Total	-26672782,12		-26672782,12

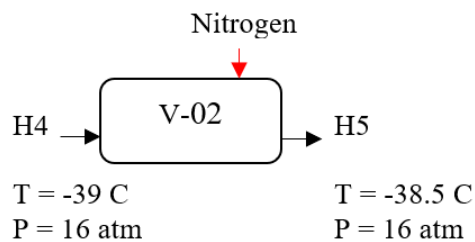
6.3. Heat Exchanger HE-01



Tabel 6. 3 Neraca Panas *Heat Exchanger* HE-01

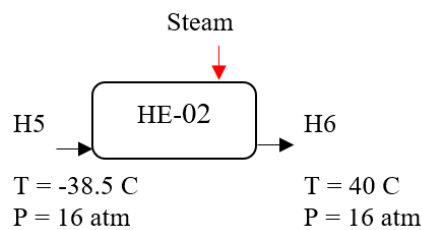
Komponen	Input		Output
	H2	Q Beban	H3
Oksigen	-26747472,12		423047,3798
Nitrogen	74690,00023		2001,939094
Pemanas		27097831,44	
Subtotal	-26672782,12	27097831,44	
Total	425049,3189		425049,3189

6.4. Vaporizer V-02

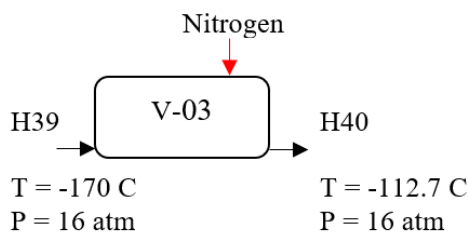


Tabel 6. 4 Neraca Panas *Vaporizer* V-02

Komponen	Input		Output
	H4	Q Beban	H5
Etilen	-5309825,414		16042986,22
Etana	-520,6652523		1533,230985
Metana	-5943,199437		2177,21942
Pemanas		21362985,95	
Subtotal	-5316289,278	21362985,95	16046696,67
Total	16046696,67		16046696,67

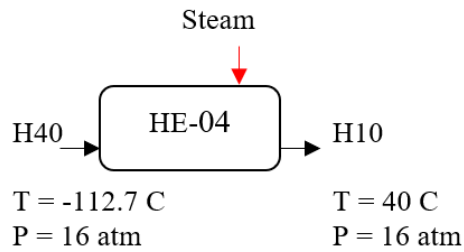
6.5. *Heat Exchanger* HE-02Tabel 6. 5 Neraca Panas *Heat Exchanger* HE-02

Komponen	Input		Output
	H5	Q Beban	H6
Etilen	16042986,22		559256,0807
Etana	1533,23		68,08302324
Metana	2177,22		230,28527
Pemanas		-15487142,22	
Subtotal	16046696,67	-15487142,22	
Total	559554,45		559554,45

6.6. *Vaporizer* V-03Tabel 6. 6 Neraca Panas *Vaporizer* V-03

Komponen	Input		Output
	H39	Q Beban	H40
Metana	-602290,7249		-130722,59
Hidrogen	-107046,6333		-100349,3475
Pemanas		478265,4207	
Subtotal	-709337,3582	478265,4207	
Total	-231071,94		-231071,94

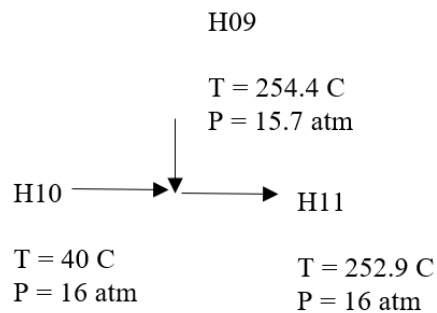
6.7. Heat Exchanger HE-04



Tabel 6. 7 Neraca Panas Heat Exchanger HE-04

Komponen	Input		Output
	H40	Q Beban	H10
Metana	-130722,59		13285,78782
Hidrogen	-100349,3475		52,50194703
Pemanas		244410,2273	
Subtotal	-231071,9375	244410,2273	
Total	13338,28976		13338,28976

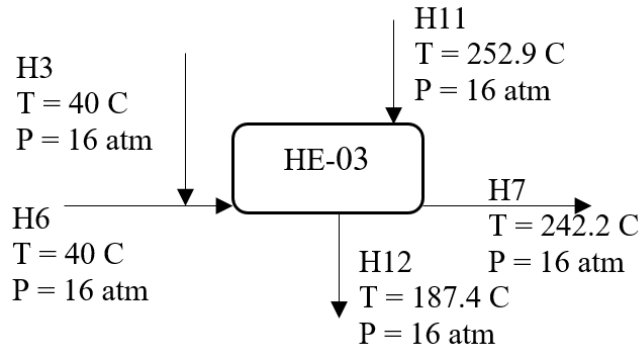
6.8. Titik Campur



Tabel 6. 8 Neraca Panas Titik Campur

Komponen	Input		Output
	H9	H10	H11
Etilen	1139681,67		1136102,641
Oksigen	736491,9816		734480,4093
Etilen Oksida	15111787,89		15063156,54
Air	1695721,626		1691103,3
Nitrogen	1076937,403		1019122,669
Etana	42652,40569		42516,95466
Metana	7614251,076	13285,78782	7821817,64
Hidrogen	26244,50482	52,50194703	26984,12004
Karbondioksida	23940721,5		23862544,07
Subtotal	51384490,05	13338,28976	
Total	51397828,34		51397828,34

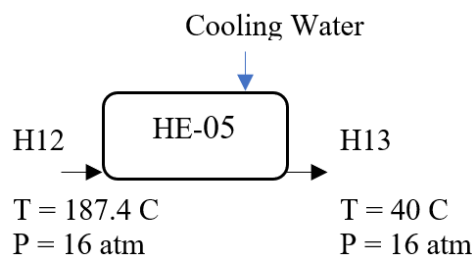
6.9. Heat Exchanger HE-03



Tabel 6. 9 Neraca Panas *Heat Exchanger* HE-03

Komponen	Input		Output		
	H3	H6	H11	H7	H12
Etilen	0,0	559256,1	1136102,6	9646762,9	806993,7
Oksigen	423047,4	0,0	734480,4	6285931,3	543260,5
Etilen Oksida	0,0	0,0	15063156,5	0,0	10613127,6
Air	0,0	0,0	1691103,3	0,0	1251977,5
Nitrogen	2001,9	0,0	1019122,7	29016,9	798701,5
Etana	0,0	68,1	42517,0	1198,6	30084,5
Metana	0,0	230,3	7821817,6	3767,4	5620578,2
Hidrogen	0,0	0,0	26984,1	0,0	20081,4
Karbon Dioksida	0,0	0,0	23862544,1	0,0	16730950,2
Subtotal	425049,3	559554,4	51397828,3	15966677,1	36415755,0
Total		52382432,1		52382432,1	

6.10. Heat Exchanger HE-05

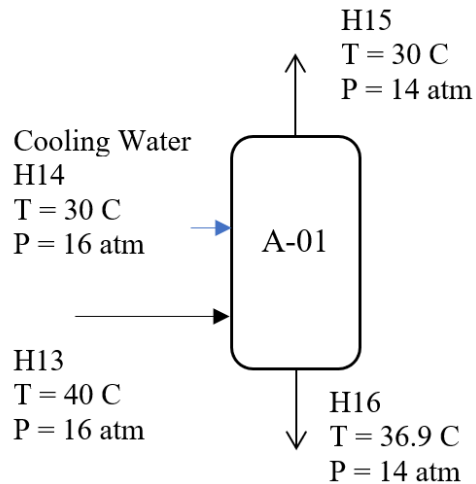


Tabel 6. 10 Neraca Panas *Heat Exchanger* HE-05

Komponen	Input	Output
	H12	Q Lepas H13
Etilen	806993,6717	61933,12078
Oksigen	543260,4984	46849,10075
Etilen Oksida	10613127,57	791648,4085
Air	1251977,518	108366,5345
Nitrogen	798701,4609	69834,51438
Etana	30084,52938	2269,434108

Metana	5620578,161	450535,7696
Hidrogen	20081,35039	1750,064901
Karbondioksida	16730950,25	1219595,188
Pendingin	33662972,87	
Subtotal	36415755,01	33662972,87
Total	36415755,01	36415755,01

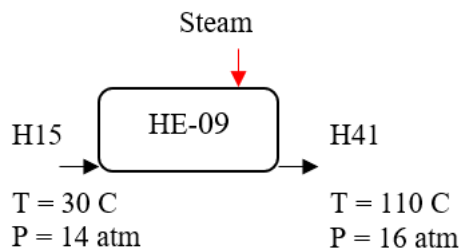
6.11. Kolom *Water Absorber* A-01



Tabel 6. 11 Neraca Panas *Water Absorber* A-01

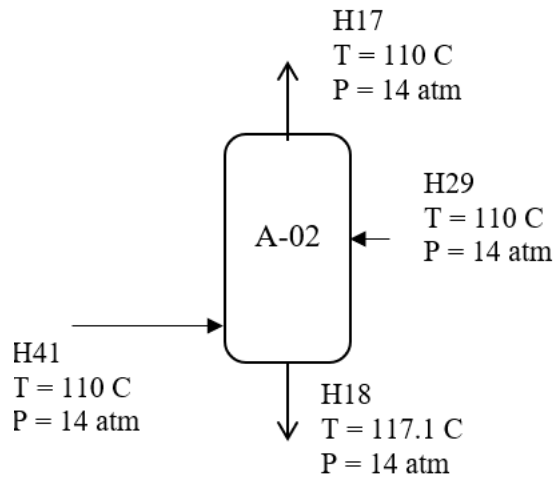
Komponen	Input			Output	
	H13	H14	Q	H15	H16
Etilen	61933,1			20464,2	
Oksigen	46849,1			15599,9	
Etilen Oksida	791648,4			522,0	1281342,0
Air	108366,5	396836,8			1282451,8
Nitrogen	69834,5			23272,5	
Etana	2269,4			748,7	
Metana	450535,8			149383,6	
Hidrogen	1750,1			582,9	
Karbondioksida	1219595,2			401124,5	
Panas Penyerapan			25873,2		
Subtotal	2752782,1	396836,8	25873,2	611698,3	2563793,8
Total	3175492,1			3175492,1	

6.12. *Heat Exchanger* HE-09



Tabel 6. 12 Neraca Panas *Heat Exchanger* HE-09

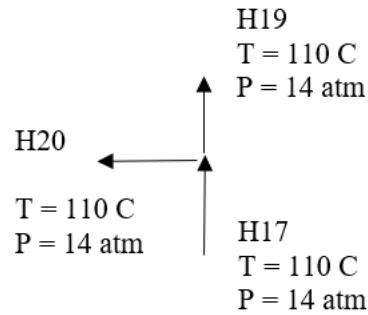
Komponen	Input		Output
	H15	Q Beban	H41
Etilen	20464,19901		373274,4641
Oksigen	15599,90572		267637,7266
Etilen Oksida	522,0204501		9677,846423
Nitrogen	23272,45315		396562,9686
Etana	748,6657567		13806,44815
Metana	149383,6404		2656463,612
Hidrogen	582,8914765		9963,784844
Karbondioksida	401124,5131		7553178,413
Pendingin		10668866,97	
Subtotal	611698,289	10668866,97	
Total	11280565,26		11280565,26

6.13. Kolom CO₂ Absorber A-02Tabel 6. 13 Neraca Panas Kolom CO₂ Absorber A-02

Komponen	Input			Output	
	H41	H29	Q	H17	H18
Etilen	373274,5			373274,5	
Oksigen	267637,7			267637,7	
Etilen Oksida	9677,8			9677,8	
Air		24480465,4			41721706,5
Nitrogen	396563,0			396563,0	
Etana	13806,4			13806,4	
Metana	2656463,6			2656463,6	
Hidrogen	9963,8			9963,8	
Karbon Dioksida	7553178,4			7553,2	
K ₂ CO ₃		17526403,7			
KHCO ₃		0,0			7961983,2
V ₂ O ₅		168131,8			30025,5
DEA		30245,7			13431,5

Panas	-23725,1				
Penyerapan					
Subtotal	11280565,3	42205246,6	-23725,1	3734940,0	49727146,7
Total	53462086,7		53462086,7		

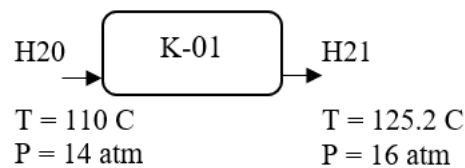
6.14. Titik *Recycle*



Tabel 6. 14 Neraca Panas Titik *Recycle*

Komponen	Input	Output	
	H17	H19	H20
Etilen	373274,4641	11198,23392	362076,2304
Oksigen	267637,7266	8029,131799	259608,595
Etilen Oksida	9677,846423	290,3353927	9387,511037
Nitrogen	396562,9686	11896,88906	384666,0797
Etana	13806,44815	414,1934445	13392,25471
Metana	2656463,612	79693,90835	2576769,705
Hidrogen	9963,784844	298,9135453	9664,871305
Karbondioksida	7553,178413	226,5953524	7326,583066
Subtotal	3734940,029	112048,2009	3622891,83
Total	3734940,029	3734940,029	

6.15. Kompresor *Recycle* K-01

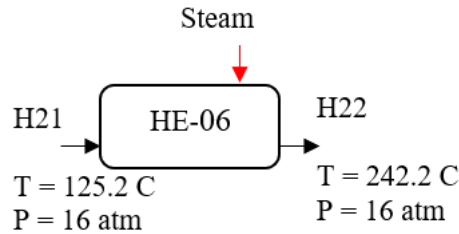


Tabel 6. 15 Neraca Panas Kompresor *Recycle* K-01

Komponen	Input	Output
	H20	H21
Etilen	362.076,2	289.810,8
Oksigen	259.608,6	300.580,2
Etilen Oksida	9.387,5	6.430,6
Nitrogen	384.666,1	454.612,9
Etana	13.392,3	8.402,9
Metana	2.576.769,7	2.675.803,0
Hidrogen	9.664,9	10.358,6

Karbondioksida	7.326,6		2.478,8
Q Serap		125.586,0	
Subtotal	3.622.891,8	125.586,0	3.748.477,8
Total	3.748.477,8		3.748.477,8

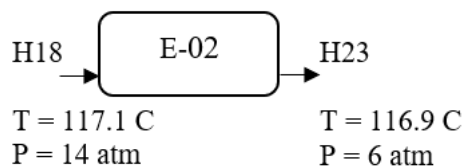
6.16. *Heat Exchanger HE-06*



Tabel 6. 16 Neraca Panas *Heat Exchanger* HE-06

Komponen	<i>Input</i>		<i>Output</i>
	H21	Q Beban	H22
Etilen	289.810,8		660.619,5
Oksigen	300.580,2		648.439,9
Etilen Oksida	6.430,6		15.189,7
Nitrogen	454.612,9		981.697,7
Etana	8.402,9		20.833,6
Metana	2.675.803,0		5.744.779,2
Hidrogen	10.358,6		23.098,8
Karbondioksida	2.478,8		8.078,3
Q Beban		4.354.258,9	
Subtotal	3.748.477,8	4.354.258,9	8.102.736,7
Total	8.102.736,7		8.102.736,7

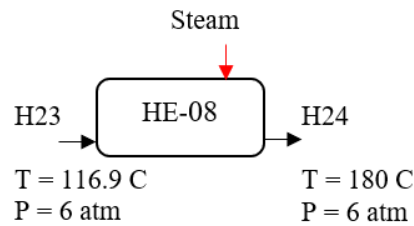
6.17. *Expansion Valve E-02*



Tabel 6. 17 Neraca Panas *Expansion Valve* E-02

Komponen	<i>Input</i>		<i>Output</i>
	H18	H23	W
Air	41721706,47	41639556,46	
K2CO3			
KHCO3	7961983,217	7946502,642	
V2O5	30025,45064	29967,07181	
DEA	13431,54222	13405,42712	
W			97715,05297
Sub Total		49629431,6	97715,05297
Total	49727146,68		49727146,68

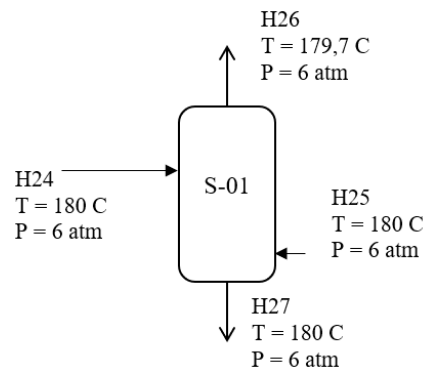
6.18. Heat Exchanger HE-08



Tabel 6. 18 Neraca Panas *Heat Exchanger* HE-08

Komponen	Input		Output
	H23	Q Serap	H24
Air	41639556,46		66551056,38
K ₂ CO ₃			
KHCO ₃	7946502,642		12536108,66
V ₂ O ₅	29967,07181		47274,94412
DEA	13405,42712		21147,906
Pemanas		29526156,29	
Sub Total	49629431,6	29526156,29	79155587,89
Total	79155587,89		79155587,89

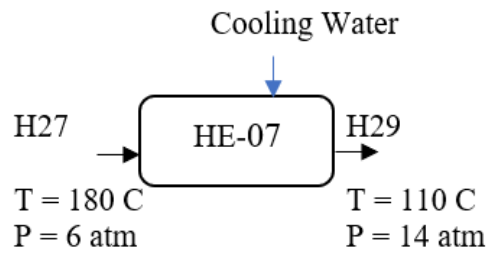
6.19. Stripper S-01



Tabel 6. 19 Neracca Panas *Stripper* S-01

Komponen	Input			Output	
	H24	H25	ΔH_{rx}	H26	H27
Air	66551056	16640687		15155752	45290683
Karbon dioksida				3004454	0
K ₂ CO ₃					31959913
KHCO ₃	12536109				0
V ₂ O ₅	47275				306593
DEA	21148				55154
Reaksi			23726		
Subtotal	79155588	16640687	23726	18160206	77612343
Total	95796275			95796275	

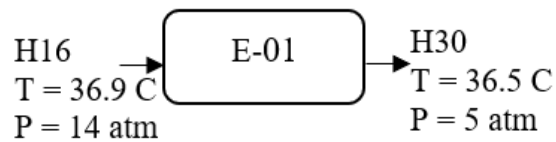
6.20. Heat Exchanger HE-07



Tabel 6. 20 Neraca Panas *Heat Exchanger* HE-07

Komponen	Input	Output	
	H27	Q Lepas	H29
Air	45290683,31		24480465,37
K ₂ CO ₃	31959912,71		17526403,75
KHCO ₃	0,00		0
V ₂ O ₅	306593,22		168131,7639
DEA	55153,88		30245,67564
Pendingin		35407096,56	
Subtotal	77612343,12	35407096,56	42205246,56
Total	77612343,12	77612343,12	

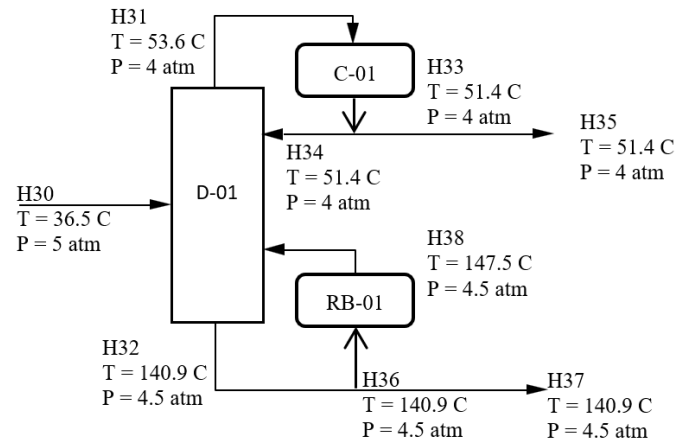
6.21. Expansion Valve E-01



Tabel 6. 21 Neraca Panas *Expansion Valve* E-01

Komponen	Input	Output	
	H16	H30	W
Etilen Oksida	1.281.342	1230231,724	
Air	1.282.452	1231949,314	
W			101612,7841
Subtotal	2563793,822	2462181,038	101612,7841
Total	2563793,822	2563793,822	

6.22. Kolom Distilasi D-01



Tabel 6. 22 Neraca Panas Kolom Distiasi D-01

Komponen	Input		Output		
	H30	Q Reboiler	H35	H37	Q kondensor
Etilen Oksida	1230231,7		2285601,3	1126115,9	
Air pemanas	1231949,3		1873,4	10169157,3	
pendingin		69437530,4			58316963,6
Subtotal	2462181,0	69437530,4	2287474,7	11295273,1	58316963,6
Total		71899711,4		71899711,4	