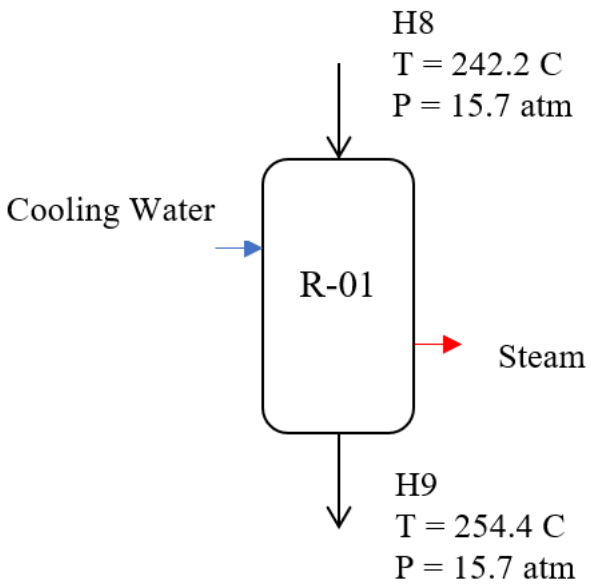
BAB VI
NERACA PANAS

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

Akumulasi Panas = Panas masuk – Panas keluar

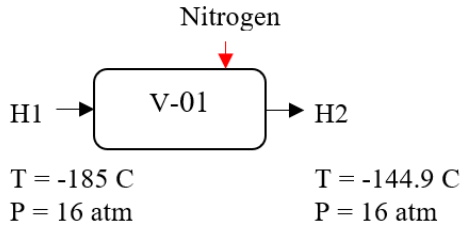
6.1. Reaktor



Tabel 6. 1 Neraca Panas Reaktor

Komponen	*Input*		*Output*	
	H8	**ΔHreaksi**	**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**	

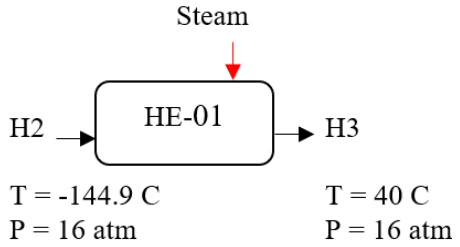
6.2. *Vaporizer* V-01



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**

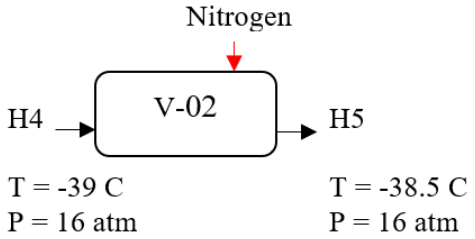
6.3. *Heat Exchanger* HE-01



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**

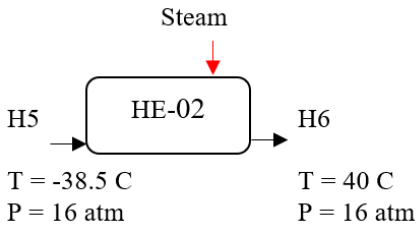
6.4. *Vaporizer* V-02



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**

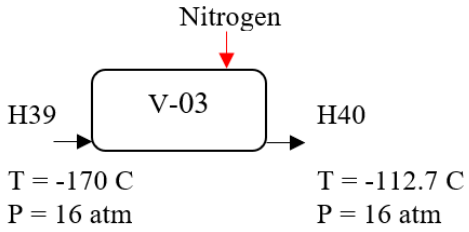
6.5. *Heat Exchanger* HE-02



Tabel 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**

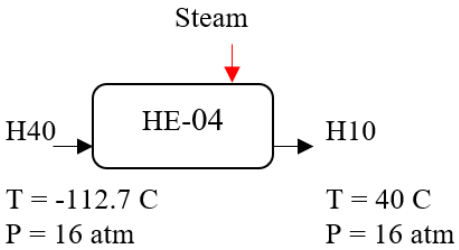
6.6. *Vaporizer* V-03



Tabel 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**

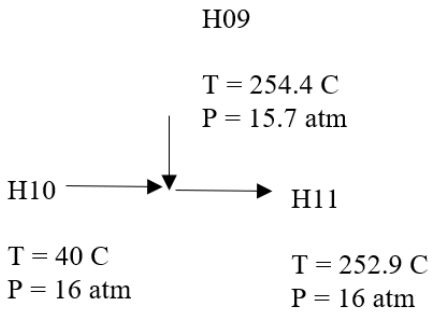
6.7. *Heat Exchanger* HE-04



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**

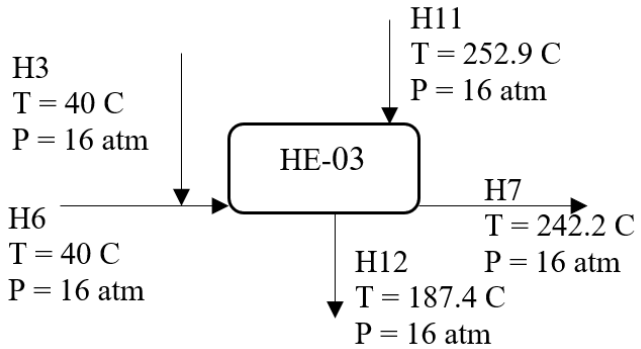
6.8. Titik Campur



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**

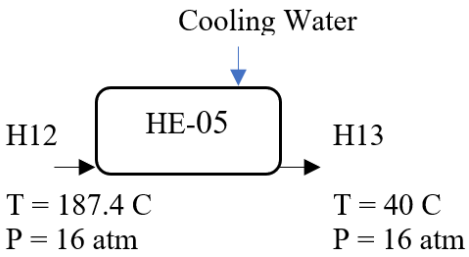
6.9. *Heat Exchanger* HE-03



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

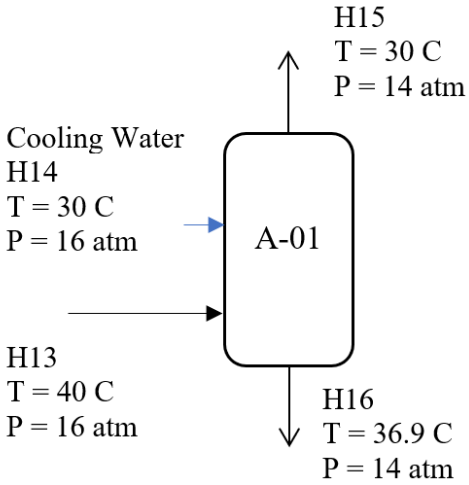


Tabel 6. 10 Neraca Panas *Heat Exchanger* HE-05

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**	**2752782,136**
Total	**36415755,01**	**36415755,01**	

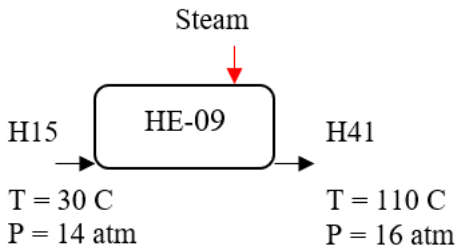
6.11. Kolom *Water Absorber* A-01



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**	

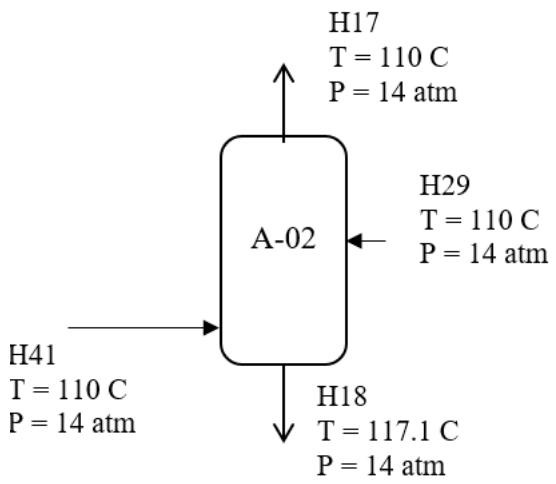
6.12. *Heat Exchanger* HE-09



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 CO_2 *Absorber* A-02

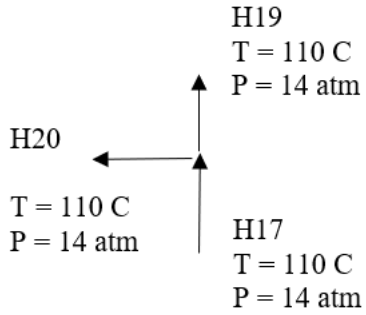


Tabel 6. 13 Neraca Panas Kolom CO_2 *Absorber* A-02

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	
K2CO3		17526403,7			
KHCO3		0,0			7961983,2
V2O5		168131,8			30025,5
DEA		30245,7			13431,5

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

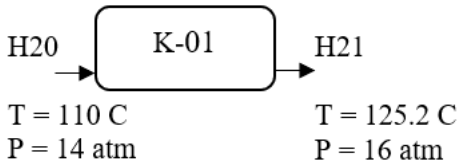
6.14. Titik *Recycle*



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

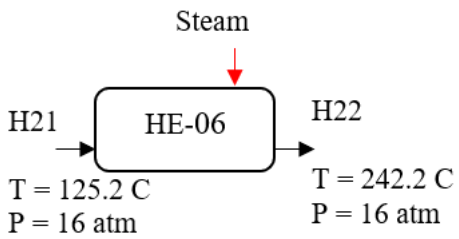


Tabel 6. 15 Neraca Panas Kompresor *Recycle* K-01

Komponen	***Input***		***Output***
	H20	**Q Serap**	**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**

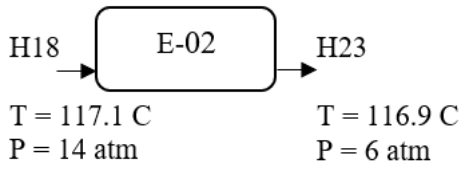
6.16. *Heat Exchanger* HE-06



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

Komponen	***Input***		***Output***
	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**

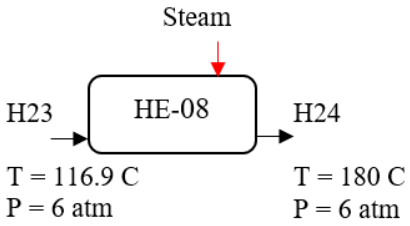
6.17. *Expansion Valve* E-02



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

Komponen	***Input***	***Output***	
	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**	

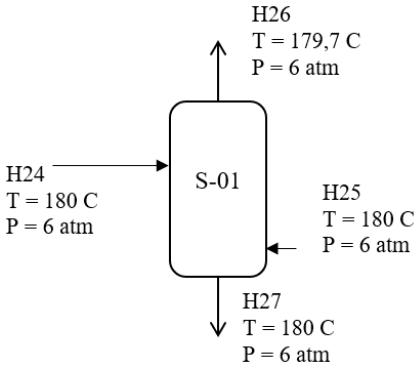
6.18. *Heat Exchanger* HE-08



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

Komponen	*Input*		*Output*
	H23	**Q Serap**	**H24**
Air	41639556,46		66551056,38
K2CO3			
KHCO3	7946502,642		12536108,66
V2O5	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**

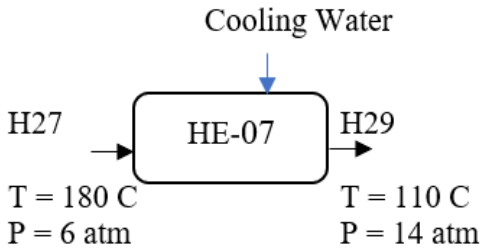
6.19. *Stripper* S-01



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

Komponen	*Input*			*Output*	
	H24	**H25**	**ΔHrx**	**H26**	**H27**
Air	66551056	16640687		15155752	45290683
Karbon dioksida				3004454	0
K2CO3					31959913
KHCO3	12536109				0
V2O5	47275				306593
DEA	21148				55154
Reaksi			23726		
Subtotal	**79155588**	**16640687**	**23726**	**18160206**	**77612343**
Total	**95796275**			**95796275**	

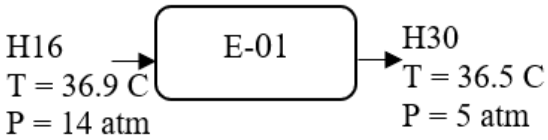
6.20. *Heat Exchanger* HE-07



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

Komponen	*Input*	*Output*	
	H27	**Q Lepas**	**H29**
Air	45290683,31		24480465,37
K2CO3	31959912,71		17526403,75
KHCO3	0,00		0
V2O5	306593,22		168131,7639
DEA	55153,88		30245,67564
Pendingin		35407096,56	
Subtotal	**77612343,12**	**35407096,56**	**42205246,56**
Total	**77612343,12**	**77612343,12**	

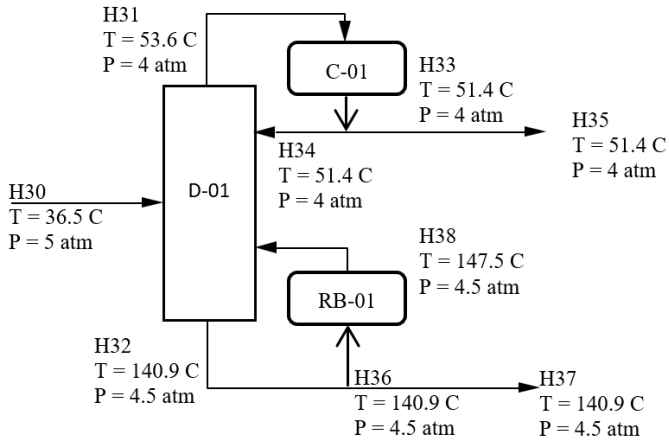
6.21. *Expansion Valve* E-01



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	1231949,3		1873,4	10169157,3	
pemanas		69437530,4			
pendingin					58316963,6
Subtotal	**2462181,0**	**69437530,4**	**2287474,7**	**11295273,1**	**58316963,6**
Total	**71899711,4**		**71899711,4**		