



## PRA RANCANGAN PABRIK

“Pabrik Urea dengan Proses Stamicarbon CO<sub>2</sub> Stripping”

### BAB 3 NERACA MASSA

$$\begin{aligned}
 \text{Kapasitas Produksi} &= 150,000 \text{ Ton Urea/tahun} \\
 \text{Waktu Operasi} &= 330 \text{ hari/tahun} \\
 &= 24 \text{ jam/hari} \\
 \text{Kapasitas Produksi} &= \frac{150,000 \text{ ton}}{1 \text{ tahun}} \times \frac{1 \text{ tahun}}{330 \text{ hari}} \times \frac{1 \text{ hari}}{24 \text{ jam}} \\
 &= 18.9394 \text{ ton/jam} \\
 &= 18939.3939 \text{ kg/jam}
 \end{aligned}$$

REAKTOR AMMONIUM CARBAMATE (R - 1)

NERACA MASSA REAKTOR KARBAMAT	
Aliran Masuk (Kg/Jam)	Aliran Keluar (Kg/Jam)
Dari mix point dan fresh feed (3)	Ke Reaktor Urea (5)
NH <sub>3</sub> = 21514.702	NH <sub>2</sub> COONH <sub>4</sub> = 0.0000
H <sub>2</sub> O = 4.4027	NH <sub>3</sub> = 30609.152
= 21519.105	H <sub>2</sub> O = 4.4027
	CO <sub>2</sub> = 21519.105
Recycle dari Stripper <4>	O <sub>2</sub> = 1.705
NH <sub>3</sub> = 3502.3934	= 46606.580
CO <sub>2</sub> = 4532.5091	
= 8034.9024	
Dari Tangki CO <sub>2</sub> melewati stripper (2)	
CO <sub>2</sub> = 17050.867	
O <sub>2</sub> = 1.7053	
= 17052.573	
= 46606.580	= 46606.580



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### 2. REAKTOR UREA

NERACA MASA REAKTOR UREA			
Aliran Masuk (Kg/Jam)		Aliran Keluar (Kg/Jam)	
Dari Reaktor Ammonium Carbamate (<5>)		Ke Stripper (<6>)	
NH <sub>2</sub> COONH <sub>4</sub>	= 30609.152	NH <sub>2</sub> CONH <sub>2</sub>	= 15304.576
NH <sub>3</sub>	= 11674.6445	NH <sub>2</sub> COONH <sub>4</sub>	= 10713.203
H <sub>2</sub> O	= 4591.3728	H <sub>2</sub> O	= 9182.746
CO <sub>2</sub>	= 4316.6753		35200.525
O <sub>2</sub>	= 1.7053	Ke Scrubber <7>	
	= 51193.550	CO <sub>2</sub>	= 4316.6753
		O <sub>2</sub>	= 1.7053
		NH <sub>3</sub>	= 11674.6445
			= 15993.0251
	= 51193.550		= 51193.550

### 3. STRIPPER

NERACA MASSA STRIPPER			
Aliran Masuk (Kg/Jam)		Aliran Keluar (Kg/Jam)	
Dari Reaktor Urea <6>		Ke Dekomposer <8>	
NH <sub>2</sub> CONH <sub>2</sub>	= 15304.576	NH <sub>2</sub> CONH <sub>2</sub>	= 15304.576
NH <sub>2</sub> COONH <sub>4</sub>	= 10713.203	NH <sub>2</sub> COONH <sub>4</sub>	= 2678.3008
H <sub>2</sub> O	= 4591.3728	H <sub>2</sub> O	= 4591.3728
	= 30609.152		= 22574.250
		Ke Reaktor Amonium Karbamat <4>	
		NH <sub>3</sub>	= 3502.3934
		CO <sub>2</sub>	= 4532.5091
			= 8034.9024
	= 30609.152		= 30609.152



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### 4. LOW DEKOMPOSER

NERACA MASSA LOW DEKOMPOSER	
Aliran Masuk (Kg/Jam)	Aliran Keluar (Kg/Jam)
Dari Stripper <8>	Ke Evaporator 1 <15>
NH <sub>2</sub> CONH <sub>2</sub> = 15304.576	NH <sub>2</sub> CONH <sub>2</sub> = 15304.576
NH <sub>2</sub> COONH <sub>4</sub> = 2678.3008	H <sub>2</sub> O = 4591.3728
H <sub>2</sub> O = 4591.3728	H <sub>2</sub> O = 19895.949
= 22574.250	
	Ke Scrubber <9>
	NH <sub>3</sub> = 1167.4645
	CO <sub>2</sub> = 1510.8364
	= 2678.3008
= 22574.250	= 22574.250

### 5. EVAPORATOR 1

NERACA MASSA EVAPORATOR 1	
Aliran Masuk (Kg/Jam)	Aliran Keluar (Kg/Jam)
Dari Dekomposer <15>	Ke Evaporator 2 <16>
NH <sub>2</sub> CONH <sub>2</sub> = 15304.576	NH <sub>2</sub> CONH <sub>2</sub> = 15304.576
H <sub>2</sub> O = 4591.3728	H <sub>2</sub> O = 1700.5084
= 19895.949	H <sub>2</sub> O = 17005.084
	Aliran 17
	H <sub>2</sub> O = 2890.8644
	= 2890.8644
= 19895.949	= 19895.949



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### 6. EVAPORATOR 2

NERACA MASSA EVAPORATOR 2	
Aliran Masuk (Kg/Jam)	Aliran Keluar (Kg/Jam)
Dari Evaporator 1 <16>	Ke Prilling Tower <18>
NH <sub>2</sub> CONH <sub>2</sub> = 15304.576	NH <sub>2</sub> CONH <sub>2</sub> = 15304.576
H <sub>2</sub> O = 1700.5084	H <sub>2</sub> O = 233.0646
= 17005.084	= 15537.641
	<Aliran 19>
	H <sub>2</sub> O = 1467.4438
	= 1467.4438
= 17005.084	= 17005.084

### 7. PRILLING TOWER

NERACA MASSA PRILLING TOWER	
Aliran Masuk (Kg/Jam)	Aliran Keluar (Kg/Jam)
Dari Evaporator 2 <18>	Ke Cooling Screw Conveyor <20>
NH <sub>2</sub> CONH <sub>2</sub> = 15304.5760	NH <sub>2</sub> CONH <sub>2</sub> = 15303.0456
H <sub>2</sub> O = 233.0646	H <sub>2</sub> O = 1.5303
= 15537.641	= 15304.576
	Ke Cyclone <21>
	NH <sub>2</sub> CONH <sub>2</sub> = 1.5305
	H <sub>2</sub> O = 231.5343
	= 233.0648
= 15537.641	= 15537.641



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### 8. CYCLONE

NERACA MASSA CYCLONE			
Aliran Masuk (Kg/Jam)		Aliran Keluar (Kg/Jam)	
Dari Prilling Tower <21>		Ke Udara <23>	
NH <sub>2</sub> CONH <sub>2</sub>	= 1.5305	NH <sub>2</sub> CONH <sub>2</sub>	= 15303.046
H <sub>2</sub> O	= 233.0646	H <sub>2</sub> O	= 1.5303
	= 15537.641		= 15304.58
		Ke Cooling Screw Conveyor <22>	
		NH <sub>2</sub> CONH <sub>2</sub>	= 1.5305
		H <sub>2</sub> O	= 231.5343
			= 233.0648
= 15537.641		= 15537.641	

### 9. COOLING SCREW CONVEYOR

NERACA MASSA COOLING SCREW CONVEYOR			
Aliran Masuk (Kg/Jam)		Aliran Keluar (Kg/Jam)	
Dari Prilling Tower <20>		Ke Silo <24>	
NH <sub>2</sub> CONH <sub>2</sub>	= 15303.05	NH <sub>2</sub> CONH <sub>2</sub>	= 15304.561
H <sub>2</sub> O	= 1.5303	H <sub>2</sub> O	= 230.7493
	= 15304.576		= 15535.310
Dari Cyclone <22>			
NH <sub>2</sub> CONH <sub>2</sub>	= 1.5152		
H <sub>2</sub> O	= 229.2190		
	= 230.7341		
= 15535.310		= 15535.310	



10. SCRUBBER

NERACA MASSA SCRUBBER			
Aliran Masuk (Kg/Jam)		Aliran Keluar (Kg/Jam)	
Dari Reaktor Urea <7>		Ke Vaporizer <10>	
CO <sub>2</sub>	= 4316.6753	NH <sub>3</sub>	= 12842.1090
O <sub>2</sub>	= 1.7053	H <sub>2</sub> O	= 40131.591
NH <sub>3</sub>	= 11674.6445		= 52973.700
	15993.0251		
		Ke Absorber <11>	
Dari Low Dekomposer <9>		CO <sub>2</sub>	= 5827.5116
NH <sub>3</sub>	= 1167.4645	O <sub>2</sub>	= 1.7053
CO <sub>2</sub>	= 1510.8364		= 5829.2169
	2678.3008		
Dari Utilitas <14>			
H <sub>2</sub> O	= 40131.591		
	= 58802.916		= 58802.916

11. ABSORBER

NERACA MASSA ABSORBER			
Aliran Masuk (Kg/Jam)		Aliran Keluar (Kg/Jam)	
Dari Scrubber <11>		Ke Udara <13>	
CO <sub>2</sub>	= 5827.5116	O <sub>2</sub>	= 1.7053
O <sub>2</sub>	= 1.7053		
	= 5829.2169		
		Ke WWTP <26>	
Dari Utilitas <25>		CO <sub>2</sub>	= 5827.5116
H <sub>2</sub> O	= 4316.6753	H <sub>2</sub> O	= 4316.6753
			= 10144.187
	= 10145.8922		= 10145.8922



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### 12. VAPORIZER

NERACA MASSA VAPORIZER			
Aliran Masuk (Kg/Jam)		Aliran Keluar (Kg/Jam)	
Dari Scrubber <10>		Ke WWTP <28>	
NH <sub>3</sub>	= 12842.1090	NH <sub>3</sub>	= 128.4211
H <sub>2</sub> O	= 40131.591	H <sub>2</sub> O	= 40131.591
	= 52973.700		= 40260.012
		Ke Mix Point <27>	
		NH <sub>3</sub>	= 12713.6879
= 52973.700		= 52973.700	

### 13. Mix Point

NERACA MASSA MIX POINT			
Aliran Masuk (Kg/Jam)		Aliran Keluar (Kg/Jam)	
Dari Vaporizer <27>		Ke Reaktor Amonium Carbamate <3>	
NH <sub>3</sub>	= 12713.6879	NH <sub>3</sub>	= 25017.095
		H <sub>2</sub> O	= 6.1548
			= 25023.250
Dari Tangki Penyimpanan <1>			
NH <sub>3</sub>	= 12303.408		
H <sub>2</sub> O	= 6.1548		
	= 12309.562		
= 25023.250		= 25023.250	