



## PRA RANCANGAN PABRIK

### “PABRIK ETILEN GLIKOL DARI ETILEN OKSIDA DAN AIR DENGAN PROSES HIDRASI NON KATALITIK KAPASITAS 100.000 TON/TAHUN”

#### BAB III NERACA MASSA

|                    |   |             |            |
|--------------------|---|-------------|------------|
| Kapasitas Produksi | = | 100,000     | ton/tahun  |
|                    | = | 12,626.2626 | kg/jam     |
| Waktu Operasi      | = | 330         | hari/tahun |
| 1 hari             | = | 24          | jam/hari   |
| Basis Perhitungan  | = | 11,170.7483 | kg/jam     |

##### 1. REAKTOR (R-210)

| Bahan Masuk        |                     | Bahan Keluar      |                     |
|--------------------|---------------------|-------------------|---------------------|
| (kg/jam)           |                     | (kg/jam)          |                     |
| Feed dari F-110    |                     | Feed menuju V-310 |                     |
| $C_2H_4O$          | = 11170.7483        | $C_2H_4O$         | = 0.0000            |
| Feed dari Utilitas |                     | $H_2O$            | = 41572.1251        |
| $H_2O$             | = 45680.3028        | $C_2H_6O_2$       | = 12651.5531        |
|                    |                     | $C_4H_{10}O_3$    | = 2475.0907         |
|                    |                     | $C_6H_{14}O_4$    | = 152.2822          |
| <b>Total</b>       | <b>= 56851.0511</b> | <b>Total</b>      | <b>= 56851.0511</b> |



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#### 2. MULTIPLE EFFECT EVAPORATOR

| Bahan Masuk                                               | Bahan Keluar                                              |
|-----------------------------------------------------------|-----------------------------------------------------------|
| (kg/jam)                                                  | (kg/jam)                                                  |
| <b>Effect 1</b>                                           |                                                           |
| Evaporator - 1 (V-310)                                    | Feed menuju V-320                                         |
| C <sub>2</sub> H <sub>4</sub> O = 0.0000                  | C <sub>2</sub> H <sub>4</sub> O = 0.0000                  |
| H <sub>2</sub> O = 41572.1251                             | H <sub>2</sub> O = 22379.9619                             |
| C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12651.5531 | C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12651.5531 |
| C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2475.0907 | C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2475.0907 |
| C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.2822  | C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.2822  |
|                                                           | Uap H <sub>2</sub> O = 19192.1632                         |
| <b>Effect 2</b>                                           |                                                           |
| Evaporator - 2 (V-320)                                    | Feed menuju V-330                                         |
| C <sub>2</sub> H <sub>4</sub> O = 0.0000                  | C <sub>2</sub> H <sub>4</sub> O = 0.0000                  |
| H <sub>2</sub> O = 22379.9619                             | H <sub>2</sub> O = 10864.6640                             |
| C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12651.5531 | C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12651.5531 |
| C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2475.0907 | C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2475.0907 |
| C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.2822  | C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.2822  |
|                                                           | Uap H <sub>2</sub> O = 11515.2979                         |
| <b>Effect 3</b>                                           |                                                           |
| Evaporator - 3 (V-330)                                    | Uap H <sub>2</sub> O = 7676.8653                          |
| C <sub>2</sub> H <sub>4</sub> O = 0.0000                  | Feed menuju H-400                                         |
| H <sub>2</sub> O = 10864.6640                             | C <sub>2</sub> H <sub>4</sub> O = 0.0000                  |
| C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12651.5531 | H <sub>2</sub> O = 3187.7987                              |
| C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2475.0907 | C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12651.5531 |
| C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.2822  | C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2475.0907 |
|                                                           | C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.2822  |
|                                                           | Feed menuju Steam Jet Ejector                             |
|                                                           | H <sub>2</sub> O = 38384.3265                             |
| <b>Total = 56851.0511</b>                                 | <b>Total = 56851.0511</b>                                 |



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#### 3. STRIPPER (H-400)

| Bahan Masuk                                               | Bahan Keluar                                              |
|-----------------------------------------------------------|-----------------------------------------------------------|
| (kg/jam)                                                  | (kg/jam)                                                  |
| Konsentrat dari V-330                                     | Produk menuju AC-404                                      |
| C <sub>2</sub> H <sub>4</sub> O = 0.0000                  | C <sub>2</sub> H <sub>4</sub> O = 0.0000                  |
| H <sub>2</sub> O = 3187.7987                              | H <sub>2</sub> O = 3184.6109                              |
| C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12651.5531 | C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12.6516    |
| C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2475.0907 | C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2.4751    |
| C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.2822  | C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 0.1523    |
|                                                           | Produk samping menuju D-410                               |
|                                                           | C <sub>2</sub> H <sub>4</sub> O = 0.0000                  |
|                                                           | H <sub>2</sub> O = 3.1878                                 |
|                                                           | C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12638.9015 |
|                                                           | C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2472.6156 |
|                                                           | C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.1299  |
| <b>Total = 18466.7246</b>                                 | <b>Total = 18466.7246</b>                                 |

#### 4. MENARA DISTILASI I (D-410)

| Bahan Masuk                                               | Bahan Keluar                                              |
|-----------------------------------------------------------|-----------------------------------------------------------|
| (kg/jam)                                                  | (kg/jam)                                                  |
| Bottom dari H-400                                         | Produk menuju F-450                                       |
| C <sub>2</sub> H <sub>4</sub> O = 0.0000                  | C <sub>2</sub> H <sub>4</sub> O = 0.0000                  |
| H <sub>2</sub> O = 3.1878                                 | H <sub>2</sub> O = 3.1846                                 |
| C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12638.9015 | C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12626.2626 |
| C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2472.6156 | C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2.4726    |
| C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 152.1299  | C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 0.1521    |
|                                                           | Produk samping menuju D-420                               |
|                                                           | C <sub>2</sub> H <sub>4</sub> O = 0.0000                  |
|                                                           | H <sub>2</sub> O = 0.0032                                 |
|                                                           | C <sub>2</sub> H <sub>6</sub> O <sub>2</sub> = 12.6389    |
|                                                           | C <sub>4</sub> H <sub>10</sub> O <sub>3</sub> = 2470.1430 |
|                                                           | C <sub>6</sub> H <sub>14</sub> O <sub>4</sub> = 151.9778  |
| <b>Total = 15266.8348</b>                                 | <b>Total = 15266.8348</b>                                 |



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#### 5. MENARA DISTILASI II (D-420)

| Bahan Masuk                | Bahan Keluar                |
|----------------------------|-----------------------------|
| (kg/jam)                   | (kg/jam)                    |
| Bottom dari D-410          | Produk samping menuju F-460 |
| $C_2H_4O$ = 0.0000         | $C_2H_4O$ = 0.0000          |
| $H_2O$ = 0.0032            | $H_2O$ = 0.0032             |
| $C_2H_6O_2$ = 12.6389      | $C_2H_6O_2$ = 12.5125       |
| $C_4H_{10}O_3$ = 2470.1430 | $C_4H_{10}O_3$ = 2445.4415  |
| $C_6H_{14}O_4$ = 151.9778  | $C_6H_{14}O_4$ = 1.5198     |
|                            | Produk samping menuju F-470 |
|                            | $C_2H_4O$ = 0.0000          |
|                            | $H_2O$ = 0.0000             |
|                            | $C_2H_6O_2$ = 0.1264        |
|                            | $C_4H_{10}O_3$ = 24.7014    |
|                            | $C_6H_{14}O_4$ = 150.4580   |
| <b>Total = 2634.7629</b>   | <b>Total = 2634.7629</b>    |

#### SPESIFIKASI PRODUK ETILEN GLIKOL :

| Komponen       | Massa (kg/jam)    | %W            |
|----------------|-------------------|---------------|
| $C_2H_4O$      | 0.0000            | 0.00          |
| $H_2O$         | 3.1846            | 0.03          |
| $C_2H_6O_2$    | 12626.2626        | 99.95         |
| $C_4H_{10}O_3$ | 2.4726            | 0.02          |
| $C_6H_{14}O_4$ | 0.1521            | 0.00          |
| <b>Total</b>   | <b>12632.0720</b> | <b>100.00</b> |