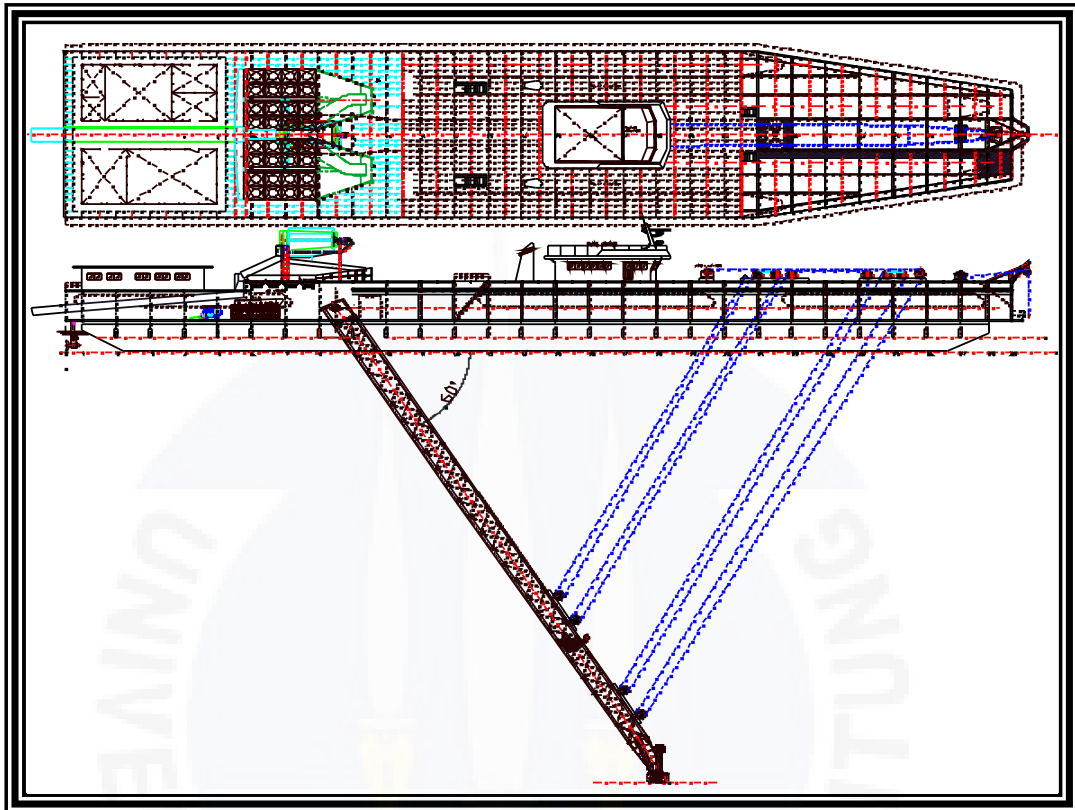


## LAMPIRAN A

### SPESIFIKASI KAPAL ISAP PRODUKSI TIMAH-17



#### A. *DREDGE SUCTION*

1. *Name of the vessel* : KIP TIMAH 17
2. *Type of the vessel* : *Cutter Suction Dredger*
3. *Maker* : PT TIMAH & PT DAK
4. *Year of Manufacture* : 2012

#### B. *PONTOON*

1. *Overall Width* : 17.60 m
2. *Inside pontoon Length* : 80.520 m
3. *Outside Pontoon length* : 58.560 m

4. <i>Inside pontoon dia.</i>	:	2 x 2.58 m
5. <i>Outside pontoon dia.</i>	:	2 x 2.58 m
6. <i>Bow Width</i>	:	9.20 m
7. <i>Ladder way Width</i>	:	3.20 m
8. <i>Ladder way Length</i>	:	58.30 m
9. <i>Port Side Aft Length</i>	:	58.50 m
10. <i>Starboard-Side Aft Length</i>	:	86.50 m
11. <i>Overall Height</i>	:	10.5 m
12. <i>Free board at full operation</i>	:	1.0 m
13. <i>Manhole</i>	:	98 units, all tank dia. 60 cm

### **C. LADDER, ENGINES, HYDRAULIC, CUTTER, PROPELLER**

#### 1. *Ladder*

- *Type of Ladder* : *Weld Joint Steel Structure*
- *Overall Length Ladder* : 58 m
- *Digging depth* : 45 m (*max.* 50 m)
- *Angle* : 45° (*max.* 60°)

#### 2. *Cutter*

- *Type* : *Circular Steel Cutter*
- *Diameter* : 1.8 m (*bladed*)
- *Maximum rpm* : 24 rpm
- *Power at Shaft* : 226 hp

#### 3. *Winch*

*Ladder winch/anchor winch by hydraulic*

- *Pulling Force* : 30 Ton
- *Speed* : 12 m/min
- *Wire Diameter* : 38 mm

4. *Dredge Pump*

- *Type* : *Gravel Pump*
- *Pump Engine* : *Caterpillar C-18: 715 hp, 2100 rpm*
- *Pump Gearbox* : *Paramax, Ratio 3,188 : 1*
- *Suction pipe dia.* : 14”
- *Discharge pipe dia.* : 12 “
- *Pump Capacity* : 250 m<sup>3</sup>/hr (solid)
- *Impeller diameter* : 36”, *pump rpm 560*
- *Head* : 45 m

5. *Engine for sailing and thruster swing with hydraulic system*

- *Main Engine for Propulsion*  
*and rudder propeller* : 2 sets *Yanmar 6HYM – WET : 500*  
*hp,*  
*1950 rpm.*

- *Cooling system* : *Fresh water cooler*
- *Propeller* : 1200 mm, 4 *bladed*

6. *Engine for hydraulic jig, revolving screen and water pump*

- *Engine 1 sets Yanmar 6HYM – WET : 500 hp, 1950 rpm*

7. *Engine for hydraulic cutter, anchor winch, ladder winch and water pump :*

- Engine 1 sets Yanmar 6HYM – WET 500 HP, 1950 rpm.
- 8. Hydraulic pump Power Pack :
  - 2 Pcs Splitter Gear Box 1 : 1
- 9. Flexible Hose pressure : Min 420 bar
- 10. Water Pump : 2 Sets Taki Pump, capacity 1500 m<sup>3</sup>/hour,  
1450 rpm , 150 hp, Total Head : 15 m

#### **D. MINERAL PROCESSING PLANT**

1. Revolving Screen / Trommel :
  - 1 set dia. 2000/1600 x 5160, steel construction
  - Trommel Drive Hydraulic, High Torque Radial Piston
  - Input Power 60 hp, 10 rpm
2. Primary Jigs :
  - 24 cell Pan American Jigs @ 1500 x 1500 / cell
  - Jig drive hydraulic : Gerotor Motor T 400Nm, Speed 250 rpm
3. Clean-up Jigs :
  - 16 cell Pan American Jigs @ 910 x 910 / cell
  - Jig drive hydraulic : Gerotor Motor T 400Nm, Speed 250 rpm
4. Tailing Chute : 1 set
5. Stone Chute : 1 set

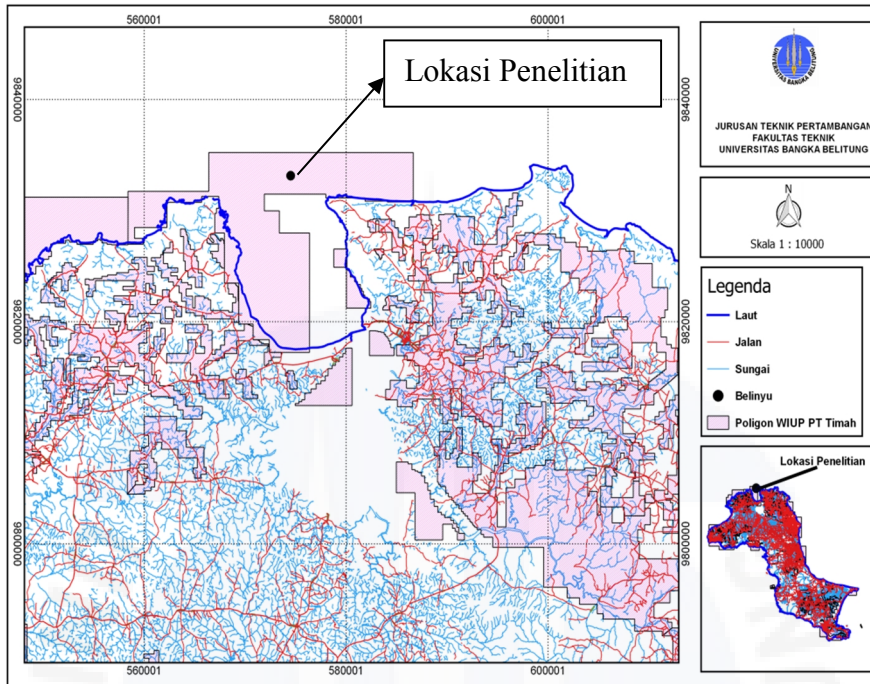
#### **E. POWER PLANT & UTILITIES**

1. Electric Generator :
  - 1 set 150 kva, rpm 1500

- 1 set 60 kva, rpm 1500
- 2. *Navigation* :
- 1 units Radar (Garmin GMR 18) + 1 unit GPS (GarminMap 4012)
- 3. *Communication* :
- VHF Marine ICOM IC – M504 & HF ICOM IC- M700PRO
- 4. *Compressor* :
- 1 unit Multipro / 750 liter/min, 8 bar, Tank Volume 180 Liter
- 5. *Lifecraft* :
- 2 sets for 25 passenger



**LAMPIRAN B**  
**PETA LOKASI KAPAL ISAP PRODUKSI (KIP 17)**



Gambar A.1 Peta Lokasi KIP 17 Timah, PT Timah  
(sumber : Perencanaan Operasi Produksi PT.Timah (Persero),Tbk)

**LAMPIRAN C**  
**SOP PENCUCIAN KIP 17**

Dalam proses pencucian Kapal Isap Produksi (KIP) 17 menggunakan sistem pencucian dengan *Pan American Jig*, ada beberapa variabel standar pengoperasian instalasi pencucian yang perlu diperhatikan guna mencapai hasil yang dihasilkan.

Tabel C.1 Standar Pencucian Kapal Isap Produksi

No	Standar Pengoperasian	Jig Primer	Jig Clean-Up
1.	Kapasitas Tanah (m <sup>3</sup> /m <sup>2</sup> LSE/Jam)	3,00	2,5
2.	Opening Screen Rubber (mm) ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	9x12 9x12 6x9 6x9	6x9 6x9 6x9 6x9
3.	Air tambahan (Underwater) (L/m <sup>2</sup> LSE/Menit) ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	275 250 225	350 350 300 300
4.	Diameter Batu Hematite (mm) ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	30-40 25-30 25-30 25-30	9-12
5.	Tebal Bed (mm)	70-80	70-80
6.	Tinggi Rooster (mm) ➤ Rooster Atas ➤ Rooster Bawah	100 50-75	100 50-75
7.	Kecepatan Aliran (m/s)	1,00-1,30	0,50-0,70
8.	Diameter Lubang Spigot (mm)	25	19

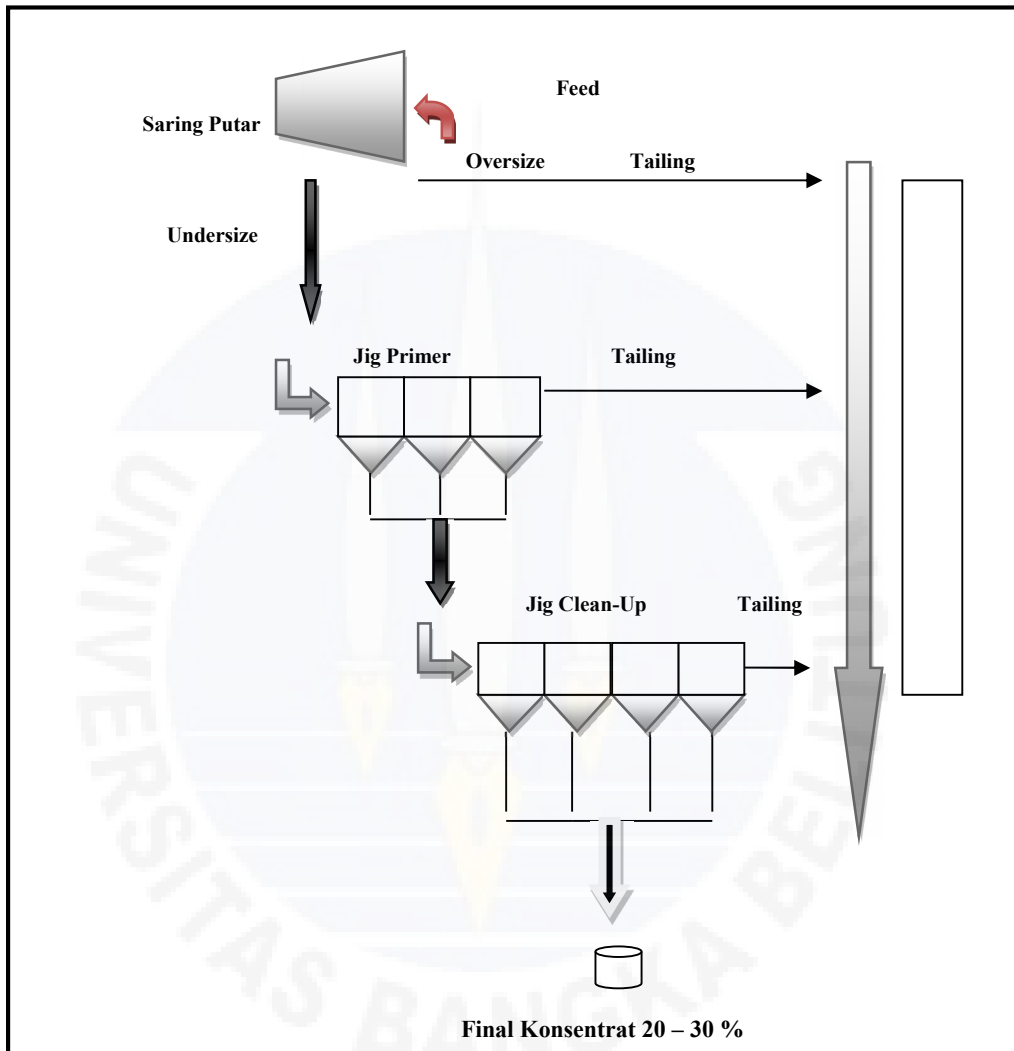
9.	Panjang Pukulan ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	35-40 30-35 25-30 20-25	12-14 10-12 8-10 6-8
10.	Jumlah Pukulan (npm) ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	70-90 70-90 90-110 90-110	130-150 130-150 140-180 140-180
11.	Debit Pulp Spigot (L/menit) ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	30 55 72	30 55 72
12.	Persen Solid (Volume) ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	19 16 16	19 16 16
13.	Berat Jenis Solid (Kg) ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	2,7 2,6 2,6	2,7 2,6 2,6
14.	Berat Jenis Pulp (Kg) ➤ Kompartemen A ➤ Kompartemen B ➤ Kompartemen C ➤ Kompartemen D	1,32 1,26 1,26	1,32 1,26 1,26

(sumber : PT Timah (Persero), Tbk)



LAMPIRAN D

SKETSA PEMISAHAN BIJIH TIMAH PADA KAPAL ISAP PRODUKSI  
*FLWSHEET*PEMISAHAN BIJIH TIMAH KIP TIMAH 17



## LAMPIRAN E

### Perhitungan Data Sampel Tailing

Contoh perhitungan sample *tailing* pada jig primer 1 kanan sebagai berikut :

- Waktu pengambilan conto = 10 s
- Lebar Mulut *Tailing* (LMT) = 300 cm
- Lebar Mulut *Cutter Sampler* (LMC) = 6 cm
- Berat Kering = 0,085 kg
- % Sn Konsentrat dalam Dulang = 0,01 %
- Berat Konsentrat dalam Dulang = 29,04 gr

$$\begin{aligned}\text{➤ Solid} &= \frac{3600 \text{ (s/jam)}}{10 \text{ (s)}} \times \frac{300 \text{ cm}}{6 \text{ cm}} \times 0,085 \text{ kg} \\ &= 18.000 \text{ /jam} \times 0,510 \text{ kg} \\ &= 1,530 \text{ kg/jam}\end{aligned}$$

$$\begin{aligned}\text{➤ \% Sn Asal} &= \frac{\text{Berat konsentrat dulang (gr)} \times \% \text{ Sn konsentrat dulang}}{\text{Berat kering (gr)}} \\ &= \frac{29,04 \text{ gr} \times 0,01 \% \text{ Sn}}{85 \text{ gr}} \\ &= 0,00455 \% \text{ Sn}\end{aligned}$$

## LAMPIRAN F

### Perhitungan Data Sampel Konsentrat

Conto perhitungan konsentrat jig *clean-up* untuk memperoleh nilai kg Sn/jam adalah sebagai berikut:

- Waktu pengambilan conto = 20 s
- Berat kering = 0,085 kg
- Sn asal = 17,09 % Sn

➤ Solid = Waktu Pengambilan Contoh (jam) x Berat Kering (kg)

$$= \frac{3600 \text{ s/jam}}{20 \text{ s}} \times 0,085 \text{ kg}$$

$$= 26,460 \text{ kg/jam}$$

➤ Sn =  $\frac{\text{Solid (kg/jam)} \times \% \text{ Sn Asal}}{100 \%}$

$$= \frac{26,460 \frac{\text{kg}}{\text{jam}} \times 17,09 \% \text{ Sn}}{100 \%} = 4,523 \text{ kg/jam}$$

➤ Sn Asal (%) =  $\frac{\text{Sn (kg/jam)}}{\text{Solid (kg/jam)}} \times 100 \%$

$$= \frac{4,523 \text{ kg/jam}}{26,460 \text{ (kg/jam)}} \times 100 \%$$

$$= 17,09 \% \text{ Sn}$$

## LAMPIRAN G

### Perhitungan *Recovery* / Kompartemen Jig

*Recovery* / kompartemen jig dapat dihitung berdasarkan hasil data sampel *tailing* dan data sampel konsentrat:

$$\begin{aligned}\text{➤ \% Sn asal} &= \frac{\text{Sn kg/jam}}{\text{Solid kg/jam}} \times 100 \% \\ &= \frac{6,392 \text{ kg/jam}}{107,10 \text{ kg/jam}} \times 100 \% \\ &= 5,9683 \%\end{aligned}$$

$$\begin{aligned}\text{➤ } \textit{Recovery} (\%) &= \frac{\text{Sn kg/jam}}{\text{Total seluruh Sn kg/jam}} \times 100 \% \\ &= \frac{6,392 \text{ kg/jam}}{6,822 \text{ kg/jam}} \times 100 \% \\ &= 93,69\%\end{aligned}$$

➤ *Recovery* primer kanan/kiri

$$\begin{aligned}&= \frac{\text{Sn jig primer KN} + \text{Sn jig primer KR}}{\text{Sn jig primer KN} + \text{Sn jig primer KR} + \text{total tailing jig primer KN/KR}} \times 100 \% \\ &= \frac{6,822 + 13,258}{6,822 + 13,258 + 0,549} \times 100\% \\ &= 97,33 \%\end{aligned}$$

➤ *Recovery clean-up* kanan/kiri

$$\begin{aligned}&= \frac{\text{Sn jig clean up KN} + \text{Sn jig clean up KR}}{\text{Sn jig clean up KN} + \text{Sn jig clean up KR} + \text{total tailing jig clean up KN/KR}} \times 100 \% \\ &= \frac{6,392 + 12,907}{6,492 + 12,907 + 0,232} \times 100\% \\ &= 98,81 \%\end{aligned}$$

**LAMPIRAN H**  
**Perhitungan *Recovery* Total**

Perhitungan *recovery* seluruh jig ini dapat di hitung sebagai berikut:

- Total Sn seluruh *tailing* = 0,781 kg/jam
- Total Sn konsentrat *clean-up* = 19,299 kg/jam
- Total Sn konsentrat akhir = 19,299 kg/jam

$$\begin{aligned} \text{➤ Recovery seluruh jig} &= \frac{\text{Total Sn konsentrat akhir}}{\text{Total Sn kons.akhir} + \text{Total Sn seluruh tailing}} \times 100\% \\ &= \frac{19,299}{19,299 + 0,781} \times 100\% \\ &= 96,11 \% \end{aligned}$$



## LAMPIRAN I

### Perhitungan Kadar Konsentrat Akhir

Berdasarkan perhitungan pada data hasil sampel konsentrat, maka perhitungan kadar konsentrat akhir dapat dihitung sebagai berikut :

- Sn total konsentrat akhir = 19,299 kg/jam
- Solid total konsentrat akhir = 211,680 kg/jam
- Kadar konsentrat akhir =  $\frac{\text{Sn total konsentrat akhir}}{\text{Solid total konsentrat akhir}} \times 100\%$   
 $= \frac{19,299 \text{ kg/jam}}{211,680 \text{ kg/jam}} \times 100\%$   
 $= 9,12 \%$

