MIP Thickener Design

The following is a short cut to designing your own thickener:

(a) Size of Thickener

As a first stab we can either use the thickener flux (m^2/tpd) or the rise rate, depending if solids loading is the dominant (eg. Platinum Tailings) or feed flow rate (e.g. Clarification or low feed solids).

Say, we have a coal tailings application and testwork shows a rise rate of 2 m/h with a pulp feed flow rate of 200 m^3/h.

$$\text{Thus, Rise Rate} = \frac{\text{Pulp Flow Rate}}{\text{Area}}$$

$$\text{Thus, Area} = \frac{\pi}{4} D^2 = \frac{\text{Pulp Flow Rate}}{\text{Rise Rate}}$$

$$D = \sqrt{\frac{4 \times \text{Flowrate}}{\pi \times \text{Riserate}}} = \sqrt{\frac{4 \times 200}{3.14 \times 2}}$$

$$= 11.3$$

Use 12m diameter

(b) Torque requirement

In order to select the drive we need to calculate the torque required. A factor (Z-Factor) is used based on the following:

- Material type
- Particle size distribution
- Size range
- Thickener type
- Underflow density required
- Rheology

So, you need to check with clever process guys at MIP before using a value!!

Now,

T = Torque = $K \times D^2$

Where T = Max operating torque in ft. lbs

D = Thickener diameter in feet

Typical K – Factors are:

Light duty:	5 - 10
Medium duty:	10 - 20
Heavy duty:	20 - 35
Extra heavy duty:	> 35

Therefore for a 12m diameter high rate thickener with the coal tailings duty, we can use medium duty (K-Factor of 15)

Note:

1m = 3.281ft.
1ft.lb = 1.35 Nm

T orque = $15 \times (12 \times 3.281)^2$

= 23 252 x 1.35 Nm

= 31 390 Nm

From the MIP range of gearboxes, (below), we would select a RR2500, with a maximum Torque value of 36 000 Nm.

MIP PROCESS TECHNOLOGIES THICKENER GEARBOX TABLE

Gearbox Type	Installed Torque (Nm)
RR70	1 200
RR120	2 000
RR220	2 500
RR320	5 500
RR520	7 000
RR620	8 500
RR820	14 500
RR1200	17 500
RR1800	24 000
RR2500	36 000
RR3200	45 000
RR5200	62 000
RR6500	105 000
RR8000	155 000
RR15000	300 000
RR20000	330 000
RR25000	420 000
RR30000	460 000
RR40000	720 000
RR55000	900 000
RR65000	1 300 000

Thus, actual K-factor = 17.1

(c) Gearbox output speed

We generally operate at a thickener rake speed of 8 to 12m/min

Thus gearbox output rpm =

$$= \frac{\text{rake tip speed (m/min)}}{\pi \text{ x diameter (m)}}$$

$$= \frac{8}{\pi \text{ X } 12}$$

$$= 0.21 \text{ rpm}$$

(d) Electric motor sizing

To size an electric motor, we would use the following calculation;

$$P = \frac{2 \pi N T}{60 \text{ x } E \text{ x } 1000}$$

N = Actual Gearbox output speed rpm
T = Trip torque (Nm)
E = Overall efficiency = 0.5
P = Power (kW)

Therefore, for our 10m thickener,

$$P = \frac{2 \text{ x } \pi \text{ x } 0.21 \text{ x } 36\ 000}{60 \text{ x } 0.5 \text{ x } 1\ 000}$$

$$= 1.6 \text{ kW}$$

$$= \text{Use } 2.2 \text{ kW}$$

We would not recommend being tight in motor selection since the price difference of being conservative in electric motor selection is minimal.