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 (m³/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 m³/h.

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

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

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

\[
D = 11.3
\]

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,

\[
T = \text{Torque} = K \times D^2
\]

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)

\[
\text{Torque} = 15 \times (12 \times 3.281)^2
\]
\[
= 23,252 \times 1.35 \text{ Nm}
\]
\[
= 31,390 \text{ Nm}
\]

Note:

\[
1\text{m} = 3.281\text{ft.}
\]
\[
1\text{ft.lb} = 1.35 \text{Nm}
\]

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**

<table>
<thead>
<tr>
<th>Gearbox Type</th>
<th>Installed Torque (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR70</td>
<td>1200</td>
</tr>
<tr>
<td>RR120</td>
<td>2000</td>
</tr>
<tr>
<td>RR220</td>
<td>2500</td>
</tr>
<tr>
<td>RR320</td>
<td>5500</td>
</tr>
<tr>
<td>RR520</td>
<td>7000</td>
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<tr>
<td>RR620</td>
<td>8500</td>
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<tr>
<td>RR55000</td>
<td>900000</td>
</tr>
<tr>
<td>RR65000</td>
<td>1300000</td>
</tr>
</tbody>
</table>

Thus, actual K-factor = 17.1
(c) Gearbox output speed

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

Thus gearbox output rpm =

\[
= \frac{\text{rake tip speed (m/min)}}{\pi \times \text{diameter (m)}}
\]

\[
= \frac{8}{\pi \times 12}
\]

\[
= 0.21 \text{ rpm}
\]

(d) Electric motor sizing

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

\[
P = \frac{2 \pi N T}{60 \times E \times 1000}
\]

\[N = \text{Actual Gearbox output speed rpm}\]
\[T = \text{Trip torque (Nm)}\]
\[E = \text{Overall efficiency} = 0.5\]
\[P = \text{Power (kW)}\]

Therefore, for our 10m thickener,

\[
P = \frac{2 \times \pi \times 0.21 \times 36000}{60 \times 0.5 \times 1000}
\]

\[
= 1.6 \text{ kW}
\]

\[
= \text{Use 2.2 kW}
\]

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