Table 25.3.1.5. Percentage of Product Passing a Square Opening Equal to Open-side Setting of Gyratory Crusher

<table>
<thead>
<tr>
<th>Feed material</th>
<th>Run of mine</th>
<th>Scalded</th>
<th>Recombined with fines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone</td>
<td>90</td>
<td>85</td>
<td>88</td>
</tr>
<tr>
<td>Granite</td>
<td>82</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>Trap rock</td>
<td>75</td>
<td>70</td>
<td>75</td>
</tr>
<tr>
<td>Ores</td>
<td>90</td>
<td>85</td>
<td>85</td>
</tr>
</tbody>
</table>

DISCHARGE PRODUCT SIZE. Figs. 25.3.1.4 and 25.3.1.5 illustrate typical discharge product size distributions for gyratory crushers. These size distributions should only be considered as good approximations based on actual screen analyses. In practice, the distribution will vary depending on many factors, one of which is the rock type. To determine the expected product from a crusher set at a predetermined discharge opening, obtain from Table 25.3.1.2 the approximate percentage of feed that will pass an opening equivalent to the crusher setting. The intersection of two axes will provide the product curve for the specific application.

25.3.1.5 Power Calculation

The crusher motor size is determined using Bond’s crusher work index. The relation used for calculating the approximate unit power consumption is

\[
W = W_i \times 11.0 \times (\sqrt{P_{80}} - \sqrt{F_{80}}) / (\sqrt{F_{80}} \times \sqrt{P_{80}}) \tag{25.3.1.1}
\]

where \( W \) is specific power required in kWh/t, \( P_{80} \) is 80% passing size of the product in \( \mu \)m, and \( F_{80} \) is 80% passing size of the feed in \( \mu \)m or 2/3 of the crusher feed opening.

To find total power in kW, the calculated specific power is multiplied by a factor of 0.75 for primary crushing and 1.00 for secondary crushing:

\[
\text{Total kW} = (\text{crusher capacity}) \times (W) \times (\text{factor}) \tag{25.3.1.2}
\]

This method of power calculation can be used for calculating the approximate power of primary jaw and gyratory crushers, secondary gyratory crushers, and cone crushers. For empirical values of work index for different materials, see Table 25.3.2.4.

An example of the use of the formula follows.

**Example 25.3.1.1.** Assume a copper ore with Bond crusher work index of 14.2. The design feed rate is 1800 t/h (2000 tph). An Allis Chalmers 5474 crusher is selected with an open-side setting of 165 mm (6-1/2 in.).

**Solution.** Feed size \( F_{80} = 914,400 \) (36 in.) (66% of crusher feed openings).

Product Size \( P_{80} = 139,700 \) mm (5.5 in.)

\[
W = 14.2 \times 11.0 \times (\sqrt{914,400} - \sqrt{139,700}) / (\sqrt{914,400} \times \sqrt{139,700}) = 0.255 \text{ kWh/t (0.310 hp/ton)}
\]

Total power \( \times 0.255 \times 1800 \times 0.75 = 345 \text{ kW (465 hp)} \)