



How to Select the Proper Tooling for your Particle Size

One of the most common questions we get here at Quadro is if you have a desired final particle size in mind, how do you select the right screen, impeller and RPM for the Quadro® Comil®? This can be a very involved topic but in an effort to keep things brief and informative, let's examine the milling example below.

Imagine a scenario where you are given product from a fluid bed or tray dryer and want to mill it so the majority of the material is in the 850 micron (20 mesh) size range. Below is a list of steps to be followed with each new target particle size in order to determine the proper Comil tooling set-up.

1. Screen Type Selection:

A target size of 850 micron indicates the desired end product will be fairly granular which tells us that we want to "cut" nice granular pieces from the infeed material. With this information in mind, we would select one of Quadro's grater style screens ("G" screens) which have a superior cutting action over a round hole screen ("R" screen). An "R" screen can also create nice granular product; however, it can produce more fines than the equivalent "G" screen due to it not having a significant cutting edge.

2. Impeller Type Selection:



1607 Impeller

As a general rule, any time you use a grater "G" screen you use a 1607 square arm impeller as this creates an effective cutting edge for the product. This being said, if the incoming product is very friable and the goal is to have a milled product with as few fines as possible, then a 1601 round arm impeller would be suggested.



1601 Impeller

3. Screen Hole Size Selection:

As a general rule, the mechanical milling action of the Comil will cause a 1.5 – 2X size reduction on the particles being milled. To determine the required screen hole diameter size, we will take our target particle size of 850 micron and multiply this by 2 which equals 1700 micron. Using this value of 1700 micron which is approximately 0.066", we can establish that the closest grater screen size available is a 062G which has a hole diameter of 0.062" or 1575 micron. See Figure 1.0.

To expand on this topic, keeping this 1.5 – 2X size reduction in mind, we can estimate the particle size range you will get from a specific screen. For example, if you have a 079G grater screen which has a hole

diameter of 0.079", we divide this number by 2 to get 0.040" (1016 micron).

We can then divide 0.079", by 1.5 to get 0.053" (1346 micron). Therefore, if we are milling a product with a 079G screen we can estimate that the majority of our product will be in the 1016 - 1346 micron size range. Please keep in mind that every material will mill differently, but typically this rule stays true. (See Figure 2.0).

<i>Figure 1.0</i>	<i>Figure 2.0</i>
Screen Size Calculation Example:	Predicting Particle Size from Screen Example:
<ul style="list-style-type: none"> • Milled particle size target = 850 micron • Typical size reduction of Comil = 850 x 2 = 1700 micron • $1700/25,400 = 0.066''$ • $0.066'' = 062G (0.062'')$ closest Quadro screen size 	<ul style="list-style-type: none"> • Screen size = 079G (0.079" hole size) • Typical size reduction of Comil = 1.5 - 2 x • $0.079/2 = 0.040'' (1016 \text{ micron})$ • $0.079/1.5 = 0.053'' (1346 \text{ micron})$ • Estimate particle size from this screen will be 1016 - 1346 micron with the majority of the product being in the 1346 micron size range. The largest particles expected from this screen would be 2000 micron, but in a very low percentage.

4. Impeller RPM Selection:

When starting any milling trial, it is always recommended that you operate the mill at standard speed as this establishes a starting point (see chart below for standard speeds). If the milled particle size is still too large (or too small) after performing the first trial with the machine at standard speed, try increasing the impeller RPM of the Comil in 500 RPM increments. If the particle size at standard speed is too large, increase the speed in 500 RPM increments. If the particle size at standard speed is too small, reduce the speed in 500 RPM increments. If increasing or decreasing the RPM does not achieve the desired effect, the following changes can also be made:

- try changing the screen to the next smaller or larger screen hole size respectively
- try changing screen types (round vs. grater)
- try changing impeller types (1607 square arm vs. 1601 round arm)

Model:	U3 Comil	U5 Comil	U10/197 Comil	U20/194 Comil	U30/196 Comil	198 Comil
Standard Impeller RPM :	4500	3450	2400	1400	900	450

Using the above four steps will greatly reduce the amount of time required to achieve your desired particle size with the Quadro Comil. Once you get close to your target, fine-tuning can always be done to further improve the grind from the Comil. Do not hesitate to contact us to assist with this process. In a future edition of Quadro Tech Tips, we will look at different impellers/screens that affect the milling process of various products.