



Introduction

The purpose of this document is to provide a brief guide for scaling up a fluid bed process. The Theoretical Scale Up section describes how to theoretically calculate the starting operating parameters when scaling up a process. The starting parameters will most likely need to be adjusted to achieve the desired results. The Practical Tips section offers practical things to be considered when scaling up a process.

Drying

A. Critical Parameters

- Air flow ft.³/min
- Air velocity - ft/min
- Air temperature degrees F or C
- Bed depth
- Product Characteristics

B. Theoretical Scale Up

- Use same inlet temperature
- Use same velocity - velocity calculation
- Keep bed depth the same

$$\frac{\text{Air flow ft.}^3/\text{min}}{\text{Ft.}^2 \text{ of distributor plate}} = \text{ft./min}$$

C. Practical Tips

- Visually achieve same fluidization level
- Keep the same bed depth if equipment design allows or note that deeper bed will have longer dry time



Granulating

A. Critical Parameters

- Air flow - ft.³/min
- Air velocity ft./min
- Air temperature degrees F or C
- Total amount of liquid - kgs
- Spray rate - g/min
- Atomizing pressure - psi
- Fluidized bed depth - inches/mm
- Nozzle height above bed

B. Theoretical Scale Up

- Use same inlet temperature
- Use same velocity - velocity calculation
$$\frac{\text{Air flow ft.}^3/\text{min}}{\text{Ft.}^2 \text{ of distributor plate}} = \text{ft./min}$$
- Calculate total amount of liquid per kg of product processed and maintain
- Calculate spray rate per CFM and maintain
- Maintain same liquid droplet size by adjusting air pressure as required
- Maintain same bed height
- Maintain nozzle height above bed

C. Practical Tips

- Visually achieve same fluidization level
- Note that deeper bed will result in denser granule
- In small R&D machines (up to 20 liters) the nozzle may be closer to the bed. The lower liquid addition rate and smaller nozzle will produce a smaller droplet size to compensate. The nozzle height may need to be adjusted upwards when scaling up from small R&D to larger systems.

Wurster Coating

A. Critical Parameters

- Air flow - CFM
- Air velocity ft./min
- Air temperature - degrees F or C
- Total amount of liquid - kgs
- Spray rate - g/min
- Atomizing pressure - psi
- Distributor plate configuration (% open inside and % open outside partition)
- Partition gap - inches or mm (distance between distributor plate and bottom of partition)
- Product Characteristics

B. Theoretical Scale Up

- Use same inlet temperature
- Use same velocity - velocity calculation
$$\frac{\text{Air flow ft.}^3/\text{min}}{\text{Ft.}^2 \text{ of distributor plate}} = \text{ft./min}$$
- Calculate total amount of liquid per kg of product processed and maintain
- Calculate spray rate per CFM and maintain
- Maintain same liquid droplet size by adjusting air pressure as required
- Maintain same distributor plate configuration (% open inside and % open outside partition)
- Maintain same partition gap

C. Practical Tips

- Visually achieve same fluidization level inside and outside the partition. Fluidization levels should primarily be adjusted by changing the plate pattern. Total airflow and amount of product allowed inside the partition (partition gap) can also be varied but may require an adjustment of the spray rate.
- Somewhat higher fluidizing airflows may be needed inside the partition in larger machines as the atomizing airflow is a lower percentage of the total airflow through the partition.