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# *Minimum Porosity, Bed Weight, Pressure drop in fluidized bed*

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## Introduction

### Advantages of fluidized bed system for agglomeration

There is sufficient agitation in the bed to obtain a satisfactory distribution of the binder liquid on the particle surfaces and to prevent lump formation.

- Agglomerate characteristics can be influenced by varying operating parameters such as the fluidizing velocity, re-wet binder rate and temperature levels.
- The system can accept some degree of variation of the feed rate of powder and liquid as the product level in the fluid bed is always constant, controlled by an overflow weir. Thus, the re-wetting section will not be emptied of powder. Even during a complete interruption of powder flow, the fluidized material will remain in the re-wet section as a stabilizing factor in the process.
- By using fluid bed drying and cooling of the formed agglomerates, it is possible to combine the entire agglomeration process into one continuously operating unit.
- Start-up, shut-down and operation of the fluid bed agglomerator are greatly simplified due to the stabilizing effect of the powder volume in the re-wet zone.



## Back mix flow fluid beds

These are applied for feeds that are non-fluidizable in their original state, but become fluidizable after a short time in the dryer, e.g. after removal of surface volatiles from the particles. The condition of the fluidizing material is kept well below this fluidization point.

Proper fluidization is obtained by distributing the feed over the bed surface and designing the fluid bed to allow total mixing (back-mix flow) within its confines. The product temperature and moisture are uniform through out the fluidized layer.



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## Plug Flow fluid bed:

These are applied for feeds that are directly fluidizable. Plug flow of solids is obtained by designing the fluid bed with baffles to limit solids mixing in the horizontal direction. The volatile content and temperature vary uniformly as solids pass through the bed, and the plug flow enables the solids to come close to equilibrium with the incoming gas.



## Vibratory Fluid bed dryer (VFBD)

For beds of particles, which are difficult, to fluidize due to strong poly dispersity, particle size, or particle-to-particle adhesive forces (stickiness) it is worth considering a batch or continuous vibrated bed dryer. An application of nearly vertical sinusoidal mechanical vibration (half amplitude 3-5 mm; frequency 10-50 Hz) allows ‘pseudo-fluidization’ of the bed with rather low airflow rates.

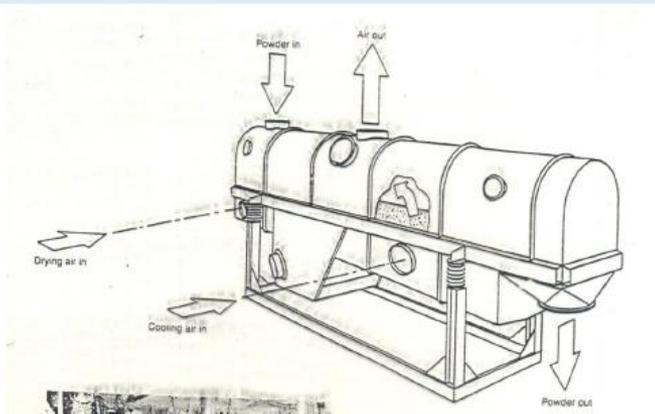
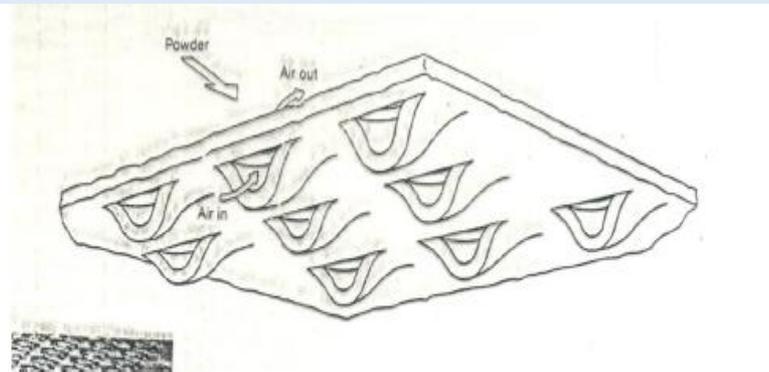


Fig. 19.1 Schematic diagram of vibro fluidizer



19.4 Schematic diagram of perforated plate of fluidized bed



## Contact fluidizers

### Batch fluidized bed dryers

Batch fluidized bed dryers are used for low through out, multi product applications. Drying air is heated directly or indirectly usually to a fixed temperature. The drying air flow rate is also usually fixed. However, it is possible to start drying at a higher inlet gas temperature and flow rate and lower it since the product moisture content falls below the critical value.

Mechanical agitators or vibration may be needed if the material is difficult to fluidize.



## Multi tier fluid beds

These fluid beds consist of two or more stacked fluid beds. The upper tier (back-mix or plug flow) is for pre drying and the lower tier (plug flow) for the post drying. The drying gas travels counter-current to the solids. The gas leaving the lower tier contains sensible heat, which is transferred to the upper tier. Furthermore, each fluid bed may be provided with immersed heating surfaces. These designs result in a low gas throughput and high thermal efficiency, which are of great importance in closed cycle drying systems.



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# Thank you