

# Sieving and cleaning gypsum: techniques and tools

## Introduction

Gypsum, an essential material in construction and the decorative arts, requires thorough preparation before use. Two essential operations determine the quality of the final result: sieving, which ensures a fine, uniform powder, and the cleaning of recycled plaster, which allows for the reuse of construction waste and residues. Among equipments designed for these tasks, the ZigZag air classifier (or windsifter) stands out for its efficiency and versatility.

## 1. Sieving gypsum

Raw gypsum whether freshly ground or stored for some time, inevitably contains lumps, hardened aggregates and various impurities (gravel, material debris, organic residues). These heterogeneous elements adversely affect:

- The fluidity of the mixture: lumps absorb water at different rates, making the mixing process difficult to control.
- The uniformity of setting: unsifted plaster sets unevenly, causing cracks or surface imperfections.
- Mechanical performance: poorly prepared plaster has a compressive strength below the specified values.
- The finish of the plaster: on smooth or decorative surfaces, even the smallest coarse particle leaves visible marks.

Sieving ensures a consistent particle size, which guarantees quality and reproducibility in professional applications.

## 2. Cleaning gypsum and plaster

The ‘cleaning’ of gypsum refers to two distinct processes depending on the context:

### Separation of impurities from raw gypsum

In quarries and manufacturing plants, raw gypsum contains associated minerals (limestone, clay, silica) that must be removed before firing.

Cleaning is achieved by taking advantage of the particle-size difference of gypsum and the present contaminants. By sieving and thus classifying the different substances it is possible to isolate the pure gypsum fraction.

### Recycling of plaster waste

On construction and renovation sites, significant quantities of hardened plaster (plasterboard, loose render, plaster) are generated. After crushing, this recycled plaster can be re-fired and reintroduced into the production line — provided that contaminants such as glass fibres, paper from plasterboards, insulating foam and cement dust have been removed.

Cleaning here becomes an air-classification process: by exploiting the differences in density and aerodynamic behaviour of particles, the pure plaster is separated from the lightweight contaminants.

### 3. ZigZag Air Classifier

Principle and operation is a counter-current air-classification device. The process is based on the disparity between gravity and the drag force exerted by an upward air flow.

#### Structure

The separation column consists of a series of alternately inclined baffles, forming a zigzag path. This broken geometry is the key to the process: at each change of direction, the particles undergo centrifugal acceleration, which accentuates the separation based on their inertia.

- Air is supplied to the bottom and top of the column by a fan.
- The material to be processed enters from the side at mid-height.
- The air velocity is precisely adjusted according to the desired particle size cut-off.

#### Separation mechanism

| Particle             | Behaviour                  | Destination                  |
|----------------------|----------------------------|------------------------------|
| Dense plaster grains | Gravity prevails → descent | Lower outlet (clean product) |
| Fibres, paper, foam  | Drag prevails → ascent     | Upper outlet (rejects)       |

### 4. Advantages of using a ZigZag classifier for gypsum

#### Preservation of fine particle size

Unlike mechanical vibrating mesh screens, the zigzag classifier **does not reduce particle size through friction**. The relatively fragile gypsum particles are not subjected to any abrasion, which preserves their angularity and hydraulic properties.

#### Processing of recycled fibrous gypsum

Standard plasterboards (BA13 type) contain cellulose fibres incorporated into the matrix and a facing board on both sides. After grinding, these fibres remain entangled in the powder. Their aerodynamic behaviour — high specific surface area, low bulk density — makes them particularly susceptible to upward airflow, which facilitates their extraction with windsifter-technology.

#### Flexibility of adjustment

By adjusting the fan speed, the operator shifts the cut-off point:

- Low speed → only very light impurities (foam, fine dust) are carried away.

- High speed → fine plaster particles are also carried away, with the risk of product loss.

The optimal setting is determined experimentally based on the particle size analysis of the input material.

## **5. Practical implementation**

### **Pre-treatment of recycled plaster**

Before being fed into the ZigZag classifier, recycled plaster generally undergoes the following processes:

1. A hammer mill or roller mill, which reduces the hardened plaster to a particle size of less than 5 mm.
2. A pre-screener (fixed or rotating screen) to remove any remaining coarse particles.
3. A dryer if the moisture content exceeds 2%, as moisture causes the particles to stick together and disrupts the air separation process.

### **Coupling with a cyclone**

The upper outlet of the windsifter generates an air flow laden with light particles. This flow is treated by a cyclone followed by a bag filter to:

- Recover any remaining fine plaster particles (product loss).
- Clean the air discharged into the atmosphere.

## **6. Limitations**

- The ZigZag Classifier does not separate particles of the same density: a cement grain of the same size as a plaster grain follows the same trajectory, hence the need for upstream control of the incoming flows.
- Wear on the deflectors must be monitored, as gypsum is slightly abrasive. Polyurethane or hard rubber linings extend the service life of the components.

## **Conclusion**

Screening and cleaning of gypsum using a ZigZag Classifier is a proven technical solution for ensuring the quality of gypsum products, whether it be raw gypsum from quarries or recycled plaster material from demolition projects. The windsifter geometry, by increasing the number of separation stages within a compact footprint, offers a level of separation precision and adjustment flexibility that conventional vibrating screens cannot match for fine materials that are sensitive to fragmentation. Combined with effective pre-treatment and dust removal management, this equipment has now established itself as a key component in the plaster waste recovery sector.

Sifted gypsum will guarantee optimal processing and excellent results of finished surfaces.

According to your specific manufacturing requirements RITEC / France can provide powerful TN Sifters with surfaces up to 2,5m<sup>2</sup> and efficient ZigZag Air Classifiers with separation columns with a height of up to 3 meters.