

## Application Note: High-Performance Recovered Carbon Black (RCB) Grinding Plant

### 1.0 INTRODUCTION

Recovered Carbon Black (RCB) is obtained from pyrolysis of waste tires and is widely used in **rubber, plastics, masterbatch, and pigment applications**. To make it suitable for end-use, RCB requires **ultra-fine grinding with tight particle size distribution (PSD)** and removal of agglomerates.

Due to its **high bulk density, dusty nature, and tendency to form agglomerates**, conventional grinding systems often face challenges such as **inconsistent fineness, poor dispersion, and handling issues**.

The **Air Classifying Mill (ACM)** system provides a high-efficiency solution for producing ultra-fine carbon black powder. Its integrated grinding and classification design ensures **precise micron-level control, high recovery, and closed-loop dust-free operation**.

This application note outlines the process flow, system design, technical performance, and advantages of an ACM plant optimized for **Recovered Carbon Black grinding**.

---

### 2.0 Design & Working Principle

The grinding system operates on a continuous, automated principle comprising the following stages:

---

#### Step 1: Material Feeding

Recovered Carbon Black is fed into the system through a **feed hopper**.

A **Rotary Airlock Valve (RAL)** ensures:

- Uniform and controlled feeding
  - Air sealing to maintain system pressure balance
  - Prevention of backflow
- 

#### Step 2: Fine Grinding in ACM Rotor

Material enters the **ACM** grinding chamber where it is subjected to high-speed rotor action.

Grinding occurs due to:

- Impact forces
- Shearing forces
- Particle-to-particle collision
- Air turbulence

The rotor creates strong airflow, keeping particles suspended and ensuring efficient Micronisation.

---

### **Step 3: Air Classification**

The ground material enters the dynamic classifier zone.

- Classifier wheel rotates at controlled speed (VFD driven)
- Fine particles pass through and exit with airflow
- Coarse particles are rejected and returned for regrinding

This ensures:

- Ultra-fine grinding (~8 micron)
  - Narrow PSD
  - High dispersion quality
- 

### **Step 4: Pneumatic Conveying**

The centrifugal fan generates airflow that:

- Conveys material to downstream system
  - Maintains system pressure balance
  - Enhances classification efficiency
- 

### **Step 5: Bag Filter & Product Collection**

The air-material mixture enters the bag filter where:

- Powder is separated from air
- Fine particles are collected efficiently (>99%)
- Clean air is exhausted

Pulse-jet cleaning ensures continuous operation.

---

### **Step 6: Product Discharge**

Collected powder is discharged via **Rotary Airlock Valve** into:

- Storage silos
  - Jumbo bag filling systems
  - Downstream processing
-

### 3.0 Key Components

Component	Function	Key Technical Feature
ACM Mill	Grinding & classification	High-capacity mill, ultra-fine grinding (~8 micron)
Feed Hopper + RAL	Controlled feeding	Uniform feed, airlock sealing
Bag Filter (TRL Type)	Powder separation & dust control	>99% recovery, pulse-jet cleaning
Rotary Airlock Valve	Product discharge	Maintains pressure balance
Centrifugal Fan with Silencer	Airflow generation	Cooling, conveying, noise reduction
Ducting System	Interconnection	Optimized airflow, low pressure drop
Control Panel (MCC/PLC)	System control	VFD, interlocks, automation ready

### 4.0 Model Variants

Variant	Model	Capacity (Approx.)	Target Fineness
RCB-150	ACM 150	450 – 500 kg/hr	90% < 8 microns
RCB-250	ACM 250	650 – 750 kg/hr	90% < 8 microns

⚠ Capacity may vary depending on feed characteristics and fineness requirement.

### 5.0 Key Features & Benefits

#### Ultra-Fine Grinding Capability

Achieves ~8 micron particle size suitable for high-end applications.

#### Consistent Product Quality

Dynamic classifier ensures narrow PSD.

#### High Product Recovery (>99%)

Efficient bag filter minimizes material loss.

#### Dust-Free Operation

Fully enclosed system ensures clean and safe working conditions.

#### Suitable for High Bulk Density Material

Designed for handling dense powders (1100–2200 kg/m<sup>3</sup>).

#### Energy Efficient System

Optimized airflow reduces power consumption.

## **Continuous Operation**

Designed for industrial 24/7 operation.

## **Automation & Easy Control**

PLC/MCC system with VFD enables process control.

---

## **6.0 Applications**

- Rubber compounding
  - Plastic masterbatch
  - Pigments & coatings
  - Carbon black replacement applications
- 

## **7.0 Performance Parameters**

- Feed Size: ~100 micron
  - Final Fineness: 90% < 8 micron
  - Bulk Density: 1100 – 2200 kg/m<sup>3</sup>
  - Product Recovery: > 99%
  - Operating Temperature: Ambient
  - Noise Level: ~110 dB (without enclosure)
- 

## **8.0 Automation & Integration**

The system supports:

- Closed-loop control of airflow, pressure & classifier speed for stable PSD
  - Load-based feed control
  - Differential pressure monitoring across bag filter
  - VFD control for classifier, feeder, and fan
  - Safety interlocks
  - Integration with DCS/SCADA systems
- 

## **9.0 Frequently Asked Questions (FAQ)**

### **Q1: Can RCB be ground to ultra-fine levels (~8 micron)?**

A: Yes, ACM system is specifically designed for micron-level grinding with stable PSD.

---

**Q2: How are agglomerates handled?**

A: High-speed rotor and classifier ensure effective de-agglomeration.

---

**Q3: Is the system suitable for dusty materials like carbon black?**

A: Yes, the closed-loop system with bag filter ensures dust-free operation.

---

**Q4: What ensures consistent quality?**

A: Closed-loop control of airflow and classifier speed ensures stable PSD.

---

**Q5: Can the system operate continuously?**

A: Yes, designed for 24/7 industrial operation.

---

**Q6: How is product loss minimized?**

A: High-efficiency bag filter ensures >99% product recovery.