Three Cylinder Rotary Dryer Project Sizing,Implementation and Commissioning Guide

Feed Preparation, Three-Pass Moisture Control, System Interfaces and Acceptance Checks

1. Material and Application Qualification

A three cylinder rotary dryer is best suited to free-flowing sand and granular solids that can be lifted, scattered and transferred through the inner, middle and outer drums without persistent sticking or excessive dust entrainment.

Quick Material Suitability Check

Evaluation Item	Suitable Condition	Requires Review	Main Risk
Feed form	Free-flowing sand or granular solid	Wet lumps or irregular agglomerates	Internal buildup and unstable transfer
Particle size	Controlled and relatively stable	Wide size distribution	Segregation and irregular residence time
Fines content	Limited and manageable	High fine fraction	Dust carryover and product loss
Stickiness	Low to moderate	Clay or adhesive contamination	Coating on flights and drum walls
Abrasiveness	Known and included in design	High hard-mineral content	Accelerated flight and transfer-zone wear
Thermal behavior	Stable under selected gas conditions	Heat-sensitive or reactive feed	Product damage or unwanted reaction

Triple-pass drying should be confirmed only after the material can pass through all three drums without persistent buildup, excessive entrainment or unstable loading.

2. Feed Preparation and Drum Loading

Stable operation begins before the material reaches the inner drum. Feed preparation must support a steady material curtain, predictable evaporation duty and reliable pass-to-pass transfer.

Feed Control Item	Preparation Before Drying	Effect on Triple-Pass Operation
Stable feed rate	Use controlled feeding; avoid alternating overload and starvation	Maintains consistent inner-drum loading
Controlled inlet moisture	Blend variable feed or apply drainage / dewatering where needed	Stabilizes hourly evaporation duty
Broken wet lumps	Break large agglomerates before the dryer inlet	Supports lifting and transfer through each pass
Defined size distribution	Confirm maximum size and fine fraction	Limits segregation, blockage and carryover
Limited sticky contamination	Control clay, mud and adhesive impurities	Reduces coating on walls and flights
Known wet bulk density	Measure the actual wet feed condition	Supports correct volumetric loading
Foreign-material removal	Remove metal pieces and oversized debris	Prevents impact damage and internal blockage

Typical Process Connection

Wet Material Storage	Controlled Feeding	Triple-Pass Dryer	Exhaust and Dust Control	Discharge / Screening

Correct drum loading leaves enough internal space for lifting and scattering. Overfeeding creates a dense rolling layer and weakens the material curtain.

3. Preliminary Sizing Starts with Water Evaporation

Wet feed tonnage alone does not define dryer size. The dryer must provide sufficient heat, gas flow, drum volume and residence time to remove the required water.

Preliminary Moisture-Load Calculation

Dry solids flow = Wet feed rate x (1 - Inlet moisture fraction)

Final product flow = Dry solids flow / (1 - Target final moisture fraction)

Hourly water evaporation = Wet feed rate - Final product flow

Moisture values must use the same basis before calculation.

Sizing Inputs and Engineering Effect

Sizing Input	Engineering Effect	Required Project Information
Feed rate and moisture	Define solids throughput and water-removal duty	Wet feed rate, inlet moisture, target moisture and basis
Particle-size distribution	Affects lifting, entrainment and pass transfer	Minimum, maximum and fine fraction
Wet bulk density	Defines volumetric drum loading	Measured wet bulk density
Stickiness and wet lumps	Influence buildup and flight performance	Agglomeration and clay / mud content
Abrasiveness	Defines wear protection	Quartz content or comparable wear information
Heat source and schedule	Define furnace, gas system and continuous duty	Fuel / energy source and operating hours

Projects with the same wet feed rate may require different dryer sizes and heat inputs when moisture duty or material behavior differs.

4. Moisture Control Across the Three Drying Passes

Moisture removal is distributed across the inner, middle and outer drums. Stable final moisture depends on continuous lifting, reliable reversal and transfer, balanced hot-gas flow and uninterrupted discharge.

Drying Stage	Material Condition	Main Process Duty	Key Check
Inner drum	Highest moisture; strongest sticking tendency	Disperse feed and remove initial moisture	Material curtain and wall buildup
Middle drum	Lower moisture; improved flowability	Continue bulk moisture removal	Stable reversal and pass transfer
Outer drum	Near target condition	Complete final drying and stabilize discharge	Residence time and product temperature
Transfer zones	Material changes concentric path	Maintain continuous three-pass movement	Accumulation, blockage and short-circuiting

Control Relationships

- Material curtain: Uneven lifting reduces gas-solid contact and creates fluctuating drying duty.
- Pass transfer: Accumulation in one stage changes residence time in the other stages.
- Hot-gas flow: Temperature and volume must remain coordinated with feed rate and evaporation load.
- Exhaust draft: Stable draft carries evaporated moisture and supports repeatable gas flow.
- Final moisture: Adjustment should consider feed stability, flight condition and transfer performance - not inlet temperature alone.

Three concentric drums do not automatically guarantee uniform drying. Flight performance and pass-to-pass transfer must remain stable.

5. Project Implementation - Process and Mechanical Interfaces

The dryer becomes an operating system only when process and mechanical interfaces are coordinated with the actual site.

Implementation Item	Required Coordination	Main Project Risk
Wet-material feeding	Feeder range, particle size, lump control and moisture stability	Drum overloading and irregular material curtains
Foundation	Approved loads, support positions and elevations	Uneven support and installation error
Drum alignment	Riding rings, support rollers, drum axis and transmission	Irregular rotation, roller contact and seal wear
Heat source	Fuel, furnace capacity, gas temperature and ducting	Insufficient or unstable heat input
Exhaust system	Fan duty, gas volume, duct resistance and operating draft	Unstable gas flow and moisture removal
Dust collection	Fine-particle load, gas condition and collector duty	Product loss, excessive emissions or pressure drop

Foundation and Alignment Focus

Foundation preparation should follow approved loads and support positions. The drum axis, riding rings, support rollers, drive system and seals require coordinated alignment; errors can affect rotation, sealing and material transfer.

6. Project Implementation - Utilities, Handling and Access

Implementation Item	Required Coordination	Main Project Risk
Discharge handling	Conveyor, screen or silo must accept continuous output	Outlet accumulation and unstable discharge
Electrical controls	Voltage, motors, instruments, interlocks and sequence logic	Uncoordinated startup, shutdown or protection
Maintenance access	Space around drive, rollers, seals, ducts and inspection points	Difficult adjustment and component replacement
Utilities	Power, fuel, compressed air and project services	Restricted operation or incomplete commissioning
Downstream interface	Screening, storage, dry mixing or packing requirements	Product accumulation or unsuitable discharge condition
Commissioning records	Feed rate, moisture, gas condition, speed, motor load and final moisture	No defined stable operating window

OctaMach Project Support Advantages

- Integrated coordination: Feeding, heat source, exhaust, dust control and discharge are treated as one drying section.
- Material-based configuration: Drum size, lifting system and auxiliaries are matched to moisture duty, particle size and abrasiveness.
- Site-oriented layout: Foundation positions, maintenance access, utilities and downstream interfaces are considered during layout development.
- Defined documentation: Project packages can include layout, foundation, installation, operation, component and spare-parts information.
- Flexible scope: The dryer may be supplied as a standalone machine or as part of a complete sand drying production line.

The technical proposal should define every process interface and supply boundary before fabrication and shipment.

7. Commissioning and Acceptance Checklist

Commissioning should progress from mechanical verification to controlled feeding and thermal operation. Acceptance should be based on the agreed material condition and operating duty.

Check Point	Acceptance Focus
Mechanical rotation	Stable drum movement without abnormal vibration, interference or noise
Support-roller contact	Consistent contact and acceptable operating condition
Drive system	Stable motor load, reducer condition and transmission
Feeding stability	Continuous feed without alternating overload and starvation
Material curtain	Repeated and reasonably uniform lifting in the drying zones
Pass transfer	No persistent accumulation between concentric drums
Hot-gas flow	Stable inlet condition and exhaust draft
Dust collection	Controlled carryover and stable collector operation
Final moisture	Representative product samples meet the agreed target
Product temperature	Compatible with downstream conveying, screening or storage
Production capacity	Stable output under the agreed feed and moisture conditions
Documentation	Drawings, component lists, manuals and commissioning records are complete

OctaMach coordinates the dryer, feeding system, heat source, exhaust path, dust collection and discharge equipment around approved project data rather than nominal capacity alone.