Vertical Dryer Feed Suitability, Sizing and Operating Control Guide

Material Qualification, Moisture-Load Inputs, Airflow Control and Troubleshooting

1. Is a Vertical Dryer Suitable for Your Material?

A vertical dryer is suitable for briquettes, pellets, and other formed solids that can move downward under gravity while retaining sufficient wet strength and open airflow passages. Suitability is determined by feed behavior during loading, bed movement, heating, and discharge.

Quick Suitability Check

Evaluation Item	Suitable Condition	Requires Review	Normally Unsuitable
Feed form	Briquette, pellet, or stable formed solid	Irregular compacted pieces	Slurry, paste, or loose ultrafine powder
Wet strength	Retains shape during loading and discharge	Minor edge breakage	Collapses under light handling
Bed permeability	Open voids remain between formed pieces	Moderate fines or broad size variation	Dense or impermeable bed
Surface condition	Low stickiness and stable movement	Limited adhesion	Severe sticking or bridging
Thermal behavior	Maintains shape during heating	Moderate shrinkage or cracking	Softening, melting, or major deformation
Vapor release	Water vapor or acceptable process gas	Exhaust treatment review required	Uncontrolled combustible, corrosive, or hazardous release

A vertical dryer should be selected only after confirming that the formed feed can maintain a stable, permeable moving bed throughout the full drying cycle.

2. Feed Qualification Before Vertical Drying - Physical Condition

Feed checks should use representative wet material taken immediately after forming. Final dry-product strength does not show whether the wet feed can survive transfer, top loading, bed pressure, heating, and controlled discharge.

Physical Condition and Flow Behavior

Feed Property	What to Check	Why It Matters	Evidence or Test Input
Formed shape	Dimensions, shape consistency, and visible deformation	Controls bed voids and downward movement	Representative samples and dimension record
Wet strength	Resistance to transfer, loading, bed pressure, and discharge	Weak feed breaks and generates airflow-blocking fines	Handling assessment or project-specified strength check
Size distribution	Variation between large and small formed pieces	Broad variation causes segregation and unequal resistance	Size-distribution or screening record
Fines content	Loose particles from forming and conveying	Fines fill air passages and create wet zones	Fines percentage or screening result
Surface stickiness	Adhesion between pieces or to equipment surfaces	Sticky feed may bridge or build up on chamber walls	Observation under expected feed conditions

The wet formed material must retain its shape during transfer and loading while preserving enough void space for hot air to pass through the bed.

3. Feed Qualification Before Vertical Drying - Thermal and Process Properties

Moisture, density, thermal response, and vapor release determine the heat load, bed behavior, and exhaust requirements of the drying system.

Thermal and Process Properties

Feed Property	What to Check	Why It Matters	Evidence or Test Input
Bulk density	Mass per unit volume of wet feed	Affects chamber inventory and bed loading	Bulk-density measurement
Inlet moisture	Moisture entering the dryer	Defines the hourly water-removal load	Moisture test with stated basis
Thermal stability	Shape, strength, color, or chemical change during heating	Defines allowable drying conditions	Material test or technical data
Binder behavior	Softening, cracking, or loss of strength	Controls pellet or briquette integrity	Binder information and heating response
Dust or vapor release	Dust, odor, combustible gas, or corrosive vapor	Defines exhaust, treatment, and safety requirements	Process and material safety information

Feed approval should be based on the wet formed material immediately before drying. A product that becomes strong after drying may still be unsuitable in its wet state.

4. Vertical Dryer Sizing Starts with Water Evaporation

Wet feed tonnage alone does not define the required dryer size. The dryer must provide enough heat, airflow, chamber volume, and residence time to remove the required water while maintaining product integrity.

Preliminary Moisture-Load Calculation

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

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

Hourly water evaporation = Wet feed rate - Final product flow

Moisture values must use the same basis before calculation.

Sizing Inputs and Their Engineering Effect

Sizing Input	Engineering Effect	Required Project Information
Feed rate and moisture	Define the hourly mass and water-removal duty	Wet feed rate, inlet moisture, target outlet moisture, and moisture basis
Formed product size	Affects bed voids, airflow resistance, and discharge behavior	Briquette or pellet dimensions and size distribution
Bulk density and fines	Affect chamber loading, pressure drop, and usable airflow	Wet bulk density and fines content
Wet strength and stickiness	Determine breakage, bridging, and bed stability	Wet-strength assessment and surface condition
Thermal limits	Set the allowable drying temperature and exposure time	Maximum product temperature and heat sensitivity
Heat source, schedule, and downstream process	Define available heat input, continuous-duty demand, and outlet handling requirements	Fuel or energy source, calorific value, operating hours, and downstream process

5. Airflow and Operating Control - Moisture and Capacity

Stable drying requires balanced feeding, uniform bed permeability, sufficient hot-air flow, and controlled bottom discharge. The following conditions help separate a thermal limitation from a material-flow or airflow limitation.

Moisture and Capacity Conditions

Operating Condition	Likely Process Cause	What to Verify	Control Direction
Outlet moisture remains high	High water load, short residence time, or insufficient airflow	Inlet moisture, feed rate, discharge speed, heat input, and bed resistance	Restore airflow and residence-time balance
Outlet moisture is uneven	Uneven feeding or airflow channeling	Bed depth, feed distribution, fines accumulation, and local blockage	Correct feed distribution and permeability
Dryer capacity decreases	Higher evaporation load or restricted material movement	Feed moisture, airflow, buildup, and discharge condition	Identify whether the limit is thermal or mechanical
Breakage and fines increase	Low wet strength, excessive drop, or unstable discharge	Forming condition, transfer points, bed level, and outlet movement	Reduce handling damage and stabilize discharge

Temperature adjustment alone cannot correct restricted airflow, unstable material movement, or insufficient wet strength.

6. Airflow and Operating Control - Material Movement and Heat Use

Airflow resistance, material movement, local temperature, and heat consumption should be checked in the order of the material path.

Airflow and Material-Movement Conditions

Operating Condition	Likely Process Cause	What to Verify	Control Direction
Airflow resistance rises	Excessive fines, compaction, or material deformation	Fines content, material condition, chamber buildup, and exhaust draft	Restore open airflow passages
Material movement becomes unstable	Sticking, bridging, or broad size variation	Surface condition, size distribution, chamber walls, and outlet section	Remove buildup and correct feed preparation
Local overheating appears	Airflow imbalance or slow material movement	Hot-air distribution, bed condition, and discharge rate	Correct local airflow and material movement
Heat consumption increases	Higher inlet moisture, air leakage, or poor heat transfer	Seals, feed moisture, exhaust condition, and bed permeability	Reduce heat loss and restore effective contact

Recommended Troubleshooting Sequence

Feed condition -> Top distribution -> Bed movement -> Airflow and exhaust -> Bottom discharge -> Outlet moisture

Troubleshooting should follow the material path. Increasing hot-air temperature before checking feed condition, bed permeability, and discharge stability may raise energy use without correcting the original cause.

7. Pre-Quotation Inputs

Complete project inputs are required before final vertical dryer selection. These inputs define material suitability, water-evaporation duty, airflow demand, residence time, and system interfaces.

Required Project Information

Category	Required Information
Material	Name, composition, process origin, and relevant safety information
Feed form	Briquette, pellet, or other formed shape
Dimensions	Diameter, length, thickness, and size variation
Production duty	Wet feed rate and operating schedule
Moisture duty	Inlet moisture, target outlet moisture, and moisture basis
Physical properties	Bulk density, wet strength, fines content, and stickiness
Thermal limits	Maximum product temperature and heating sensitivity
Heat source	Fuel type, calorific value, or available thermal source
Site conditions	Voltage, elevation, climate, installation space, and utilities
Downstream process	Screening, cooling, storage, packing, or further processing

The quotation data should describe the wet material entering the dryer, not only the final dried product.

8. Commissioning Acceptance Checks

Commissioning should confirm that the material, airflow, and discharge system operate as one stable process under the agreed production duty.

Acceptance Checklist

Check Point	Acceptance Focus
Feed distribution	Material spreads evenly across the chamber
Material movement	No persistent bridging, collapse, or irregular discharge
Airflow condition	Stable hot-air and exhaust flow through the material bed
Outlet moisture	Representative discharge samples meet the agreed target
Moisture uniformity	No major difference between representative discharge positions
Product integrity	Breakage, deformation, and fines remain acceptable
Operating stability	Feed, bed level, hot-air conditions, and discharge remain coordinated
System interfaces	Feeding, heating, exhaust, discharge, and downstream equipment operate together
Documentation	Drawings, component list, test records, manuals, and packing documents are complete

OctaMach reviews material condition, hourly water evaporation, airflow requirement, residence time, heat source, and downstream handling as one process system before confirming the vertical dryer configuration.

This process-level review aligns the dryer body, feed section, hot-air system, exhaust connection, and discharge equipment with the actual production duty.