

Think Powder.

Think Brookfield PFT™ POWDER FLOW TESTER

...affordable testing for powder characterization



QUICK & EASY ANALYSIS
of powder flow behavior
using proven scientific
method ASTM D6128

**IDEAL FOR
MANUFACTURERS**
who process powders daily
and have flow problems
with bins, hoppers, silos
and feeders

**ACCURATE TEST
RESULTS**
in minutes

R&D TOOL
to predict flow behavior
for new formulations
before scale-up

CHOICE OF TESTS

- Flow Function
- Wall Friction
- Bulk density
- Time Consolidation

QC CHECK
for incoming materials and
final product shipments

CHOICE OF RESULTS

- Flow Index
- Arching Dimension
- Rathole Diameter
- Hopper Half Angle

COMPACT DESIGN
fits easily on workbench

Developed in association with
The Wolfson Centre for Bulk Solids Handling Technology
at the University of Greenwich, England.

BROOKFIELD
ISO 9001 CERTIFIED

What is powder analysis?



Particulate materials constitute a large group of solids that can range in size from submicron particles to large rocks and minerals. Brookfield's Powder Flow Tester measures the flow behavior of bulk solid materials that have a top particle size of 2mm. At least 90% of the sample should consist of particles less than 1mm in diameter. In many instances, powders with larger particles can still be characterized effectively by sieving the material at 1mm and testing the fines (the fines control the flow properties of a material with a wide size range). The generic term used by Brookfield to name these materials is "powder", therefore the name of our instrument is "Powder Flow Tester".

Unlike liquids which, under the influence of gravity, tend to have a horizontal surface, powders exhibit a structure, due to internal friction and cohesion, which allows them to form piles with angles relative to the surface on which they are placed. At ambient conditions, powders do not change flow behavior when subjected to variable shear rates, whereas most liquids do. However, pressure controls the strength of a powder (i.e., increases the resistance to flow) whereas a liquid will show limited change in rheology under pressure. In other words, the consequence of subjecting a powder to a compressive force is that the powder will flow less easily; the relationship between the compressive stress applied to consolidate the powder and the strength it obtains is the measurement of the powder flowability, or its "Flow Function".

There is a need throughout industry to characterize powder flow properties and flow behavior. The Brookfield Model PFT Powder Flow Tester is a precision instrument of robust design that satisfies this need and more.

What are the industrial issues with powders?

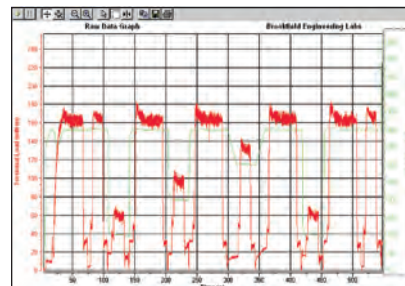
The classic problem with powders is their failure to discharge reliably from bins, hoppers, silos, etc., and poor or unpredictable flow in feeders, dosing machines, packing machines, etc. This causes unwanted interruptions in the production process, leading at times to complete plant shutdown in order to correct the flow restrictions and stoppages. It also leads to variations in pack weight, mixture, performance and sensory properties of powder products.

Quality Control Departments are constantly dealing with raw materials in powder form, which come from multiple suppliers. The variability in particle size and distribution, moisture content, and basic ingredients requires a battery of incoming inspection tests, none of which assure that proper flow will take place when loaded into the plant equipment. The Brookfield Powder Flow Tester is a single-solution instrument which can resolve this uncertainty.

R&D Departments are constantly adjusting formulations of powder products to satisfy customer demand for improved properties: better coating action for paints, enhanced taste for spices, rapid dissolving of chemicals when put into solution. New formulations do not necessarily have the same flow properties, thereby leading to production problems when the process is scaled up to high volume. The Brookfield Powder Flow Tester can predict those problems so they can be prevented.

How can flow problems with powders be eliminated?

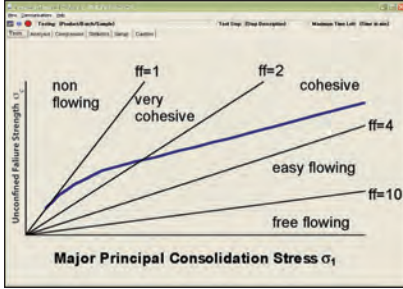
The answer is simple: use a shear cell methodology. Brookfield collaborated with The Wolfson Centre at the University of Greenwich to develop an instrument that uses such a methodology, Model PFT Powder Flow Tester.



Test algorithm for powder flow analysis requires compression of the sample contained in an annular cell to a defined axial load followed by torsional shearing. Raw data output shows torsional load values in red. Compression of the sample is shown as axial load values in green.

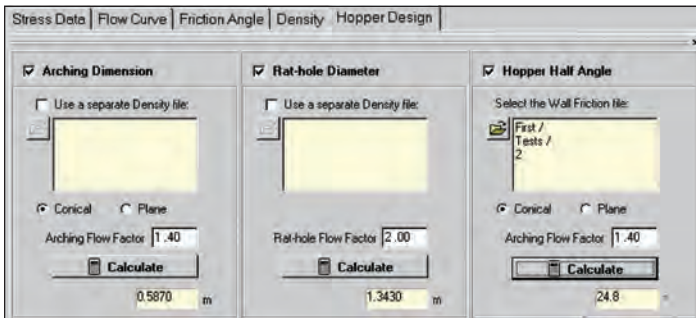
BROOKFIELD PFT POWDER FLOW TESTER

The resulting data produces a “Flow Function”, much like what is obtained for liquids when testing with a viscometer to create a “flow curve”.



Flow Function for powder sample shows “non-flowing” to “very cohesive” behavior at low consolidation stresses and “cohesive” behavior at higher consolidation stresses.

Analysis of the “Flow Function” leads to calculation of the critical outlet dimensions of feeders, hoppers, etc., through which the powder will flow. Comparing the “Flow Function”, or these critical dimensions, allows powders to be benchmarked, ranked and compared against one another for flowability. The dimensions can also be used to determine whether a particular powder will flow through an existing plant or process, or to determine what the geometry should be if purchasing new solids handling equipment.



Data output from Flow Function test provides “Arching Dimension” and “Rathole” diameter. Data output from additional Wall Friction test provides “Hopper Half Angle”.

The PFT is an easy-to-use, inexpensive tester that doesn’t require an experienced operator nor a technical expert to interpret the results.



Why Choose Brookfield?

Brookfield has over 75 years experience in providing reliable, **low cost** viscosity and texture measurement instruments while offering **high quality** products and product support. We are now using this formula for success to expand our line of physical testing products to include the Powder Flow Tester .

The new Brookfield Powder Flow Tester is the simple answer to industry needs:

- A competent lab technician can run tests and collect data within minutes, eliminating the need for a powder specialist.
- The automated analysis provided by the Powder Flow Pro software calculates various properties of the powder, including the critical dimensions for reliable powder flow out of the hoppers, feeders, bins and silos.
- **The Wolfson Center for Bulk Solids Handling Technology** at the University of Greenwich, England, has worked closely with Brookfield to design the Powder Flow Tester, thereby ensuring its suitability for practical industrial use.
- The competitive purchase price is a small fraction of comparable devices available in the powder flow market.

Applications

R&D, Incoming Materials Inspection, New Product Formulation, Quality Control, Process Plant Design

Adhesives

Ceramics

Cosmetics

Chemicals

Construction

Cement
Fly Ash
Gypsum
Hydrated Lime

Dairy / Cheese

Detergents

Equipment Manufacturers

Silos / Bins / Hoppers
Feeders

Energy

Biomass
Coal

Fluxes

Food

Biscuits / Cookies / Crackers
Cereal
Chocolate / Cocoa
Flavorings / Seasonings
Flour
Spices
Sugar

Gunpowder/Ammunition

Healthcare Products

Tablets

Inks / Toners

Paints / Coatings / Pigments

Minerals

Personal Care Products

Talcom Powder

Pharmaceuticals

Starch

Properties Measured

Flow Function (relation between consolidation stress and powder strength)

Angle of internal friction

Angle of wall friction

Cohesive strength

Bulk density

What's Included?

Instrument, choice of 115 or 230 V
 Powder Flow Pro Software with USB Cable
 Trough (230 cc)
 Vane Lid (33cc)
 Wall Friction Lid: 304 s/s with 2B finish
 Outer Catch Tray
 Inner Catch Tray with Scraping Tool
 Powder Scoop
 Cleaning Brush

Optional Accessories

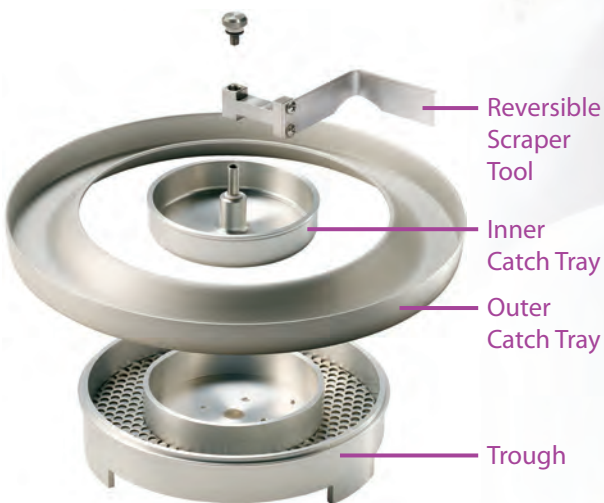
Temperature Probe
 Humidity Sensor
 Wall Friction Lid: mild steel or Tivar 88



Close-up View of Vane Lid used for Flow Function Test.



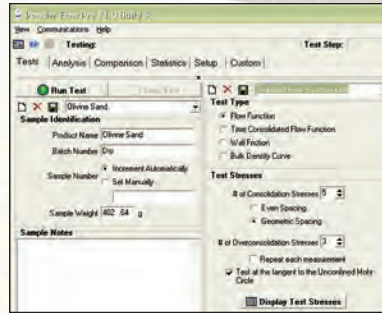
Close-up View of Wall Friction Lid



Outer and Inner Catch Trays with Scraper Tool for Sample Preparation in Trough

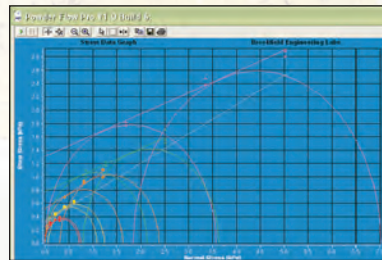
Powder Flow Pro Software (Included)

Operation and control of the Powder Flow Tester is accomplished with Powder Flow Pro Software.

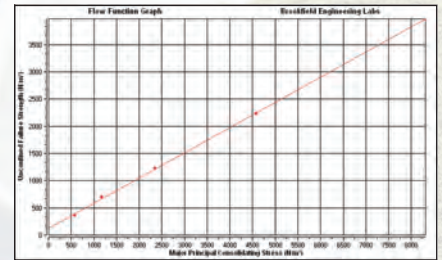


Main screen provides choice of basic tests:

- Flow Function
- Wall Friction
- Time Consolidated Flow Function
- Bulk Density



Stress data output screen captures "normal stress" and "shear stress" values and plots data in graphical format (calculates Mohr Circle Failure Loci).



Flow Function test produces graph of powder flow behavior which shows Unconfined Failure Strength vs. Major Principal Consolidating Stress

PFT Powder Flow Tester Specifications

Load for Vertical Axis Compression:

7 kg Accuracy $\pm 0.6\%$ FSR

Axial Speeds: 1mm/second up to 5mm/second

Distance: Accuracy ± 0.3 mm

Torque: ± 7.0 N•m Accuracy $\pm 1.2\%$ FSR

Trough Rotational Speeds:

1 revolution/hour (RPH) up to

5 RPH

Temperature Sensing: -20°C to 120°C^*

Humidity Sensing: 10% to 95% RH $\pm 5\%^{\dagger}$

Dimensions (wxdxh):

(cm) 36.2 x 39.7 x 67.6

(in) 14 $\frac{1}{4}$ x 15 $\frac{5}{8}$ x 26 $\frac{5}{8}$

Weight: 34 kg (75 lb)

* Requires Part No. DVP-94Y

\dagger Requires Part No. PFT-607Y

Computer Specifications for Powder Flow Pro Software

2GHz processor with 512 MB of RAM and 30 MB hard drive space available

1024x768 video resolution with 128 MB of graphics memory

Windows XP or Vista with one USB or RS-232 port



Brookfield Engineering Laboratories, Inc.

11 Commerce Boulevard, Middleboro, MA 02346-1031 USA

T: 800.628.8139 or 508.946.6200 F: 508.946.6262

W: www.brookfieldengineering.com

L10-743-A0215