

The automatic Ring Shear Tester RST Mk II

Capabilities

The Ring Shear Tester RST Mk II, being the successor of model RST-01.pc, provides computer-controlled measurement of the flow properties of powders and other bulk solid materials, under conditions which duplicate handling situations. Such properties are useful for many applications:

- Product development
- Product characterization
- Quality control
- Comparative tests
- Troubleshooting
- Silo design

Why are flow properties important?

A material's flow properties determine how it will behave in bins, hoppers, feeders, and other handling equipment. Knowing these properties is essential in product development, so that flow problems can be avoided.

Flow properties are also important for quality control. By checking the relative flow properties of a given bulk solid before it is placed into your system, you can reject and recycle unsatisfactory batches, thereby preventing costly handling problems from occurring downstream.

What flow properties need to be measured?

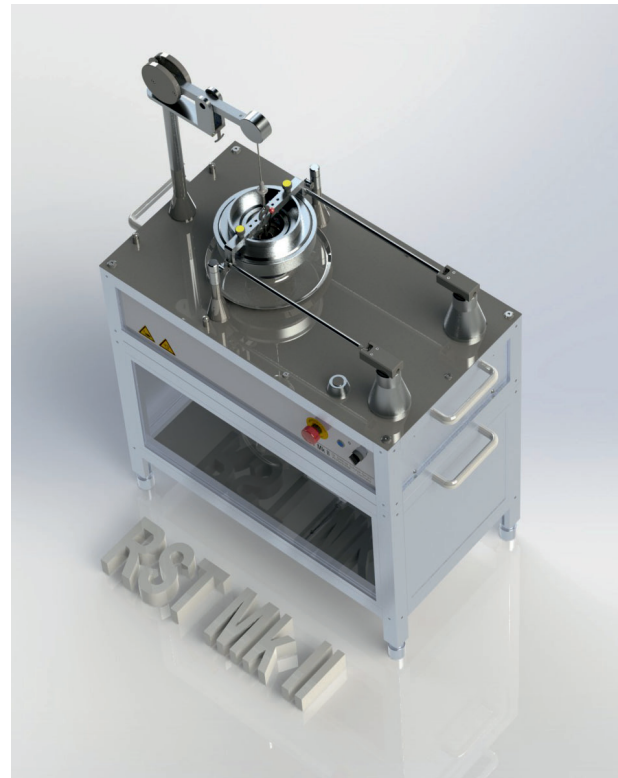
The most important properties are cohesive strength and its increase with time, internal and wall friction, bulk density, and compressibility. While each of these parameters is affected by the material's particle size distribution, particle shape, surface characteristics, and moisture content, there is no direct correlation which allows these variables to be used to calculate the material's flow properties. Therefore, only those testers which directly measure the properties listed above should be considered.

Why choose the Ring Shear Tester RST Mk II?

First, this is a real shear tester. This is important, since shear testers are the only internationally recognized means to measure the flow properties of powders and bulk solids.

Second, this tester is easy to use, requiring minimal operator training and skill. In addition, the time required to test a material and analyze the results is also minimal.

Third, this tester is extremely versatile. Materials which are free flowing, very poor flowing, or require large shear deformation can all be tested. The applied stress level can be varied over a wide range, consistent with how your material is being handled. Shear cells of different volumes allow the testing of limited quantities of your material. The tester can even be used to measure the attrition properties of materials such as granules, flakes and pellets.



○ Ring Shear Tester RST Mk II

Software

The new software version **RST-CONTROL v3** for Microsoft Windows®* serves for controlling the Ring Shear Tester as well as for the automatic evaluation of the test results. It measures instantaneous flow properties (yield loci, or „stress walk“ which is the time-saving, automatic measurement of multiple yield loci with one specimen), time consolidation, wall friction, time wall yield loci, compressibility, and helps to simulate particle attrition in flowing bulk solids.

RST-CONTROL v3 provides several modes of operation. Standard procedures can be used, where test parameters such as the consolidation stress are entered once. Thus, the operator can start a test just with some mouse clicks. For special applications a semi-automatic test mode is provided. Here the operator observes the measured data on the screen and controls the test via the PC keyboard or the mouse.

The software provides detailed analysis of the test data and output of the results in various formats, e.g., as diagram, table or report, with the possibility to export the data/diagrams to other applications (e.g. word processor, spreadsheet) as bitmap, pdf, csv, xls, or just a simple text file.

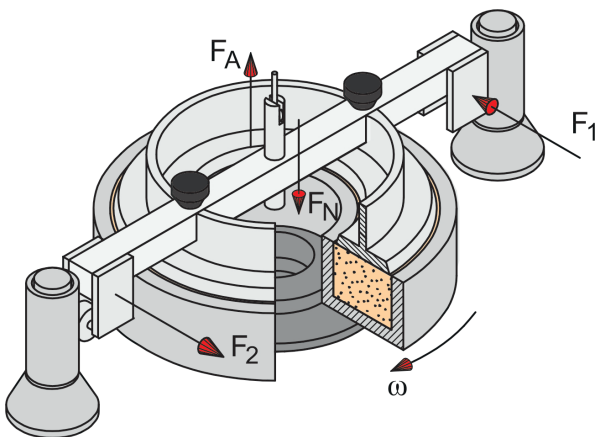
Test results are saved as „flow property exchange files“. These files contain information on the date/time of test, the user (if admin/user option is activated), tester type and number, shear cell number, additional customizable information lines which can be entered while preparing a test. Flow property exchange files can be read by the hopper design software CAHD.

* Windows® 7, 8, 10, and 11 are registered trademarks of Microsoft Corp., U.S.A.



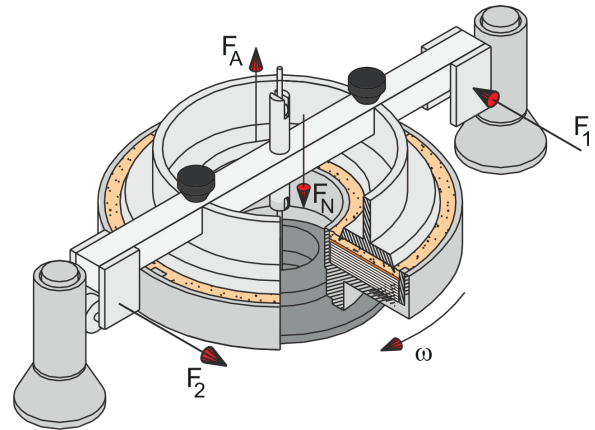
Primary operational components

- **Automated load application** - The vertical load, F_N , as shown on the cut-away view, acting on the bulk solid sample is adjusted via computer commands, which direct a motor to shift weights on a lever arm (max. 450 N; normal stress depends on shear cell dimensions).
- **Digitally controlled motor drive for shear cell rotation** - Cell rotation, ω (see cut-away view), is also computer-controlled, providing flexibility particularly when conducting particle attrition tests.
- **Twin load beam shear force measurement** - The shear force, F_1 and F_2 (see cut-away view), is automatically measured and the output is viewed in real time via a computer (diagram).
- **Counterweight system** - Testing at very low pressures is accomplished with a counterweight system to reduce the weight of the lid and other parts connected to the lid. Thus, tests at stresses < 500 Pa are possible.
- **Inductive displacement transducer measures sample height** - Bulk density is calculated and displayed during shear testing and compressibility testing.
- **Shear cell** - With the Ring Shear Tester RST Mk II a 900 cm³ standard shear cell is delivered (see image below). Additionally cells with volumes of about 32 cm³ to 900 cm³ are available made from aluminum or stainless steel.



○ Cut-away view of shear cell type M

- **Wall friction shear cell** - For wall friction tests a specially designed wall friction cell is available (image on top right corner). It can be equipped with custom-made wall coupons. The bulk solid specimen is located above wall coupon (not beneath) - same situation as in typical applications like hopper walls.
- **Simple calibration by the user** - All tools for the calibration of the tester are included. The software guides the user through the calibration process. The calibration history is saved and can be reviewed.



○ Cut-away view of wall friction shear cell WM

Testing procedure

The testing procedure follows ASTM-D6773 ("Schulze Ring Shear Tester"). The powder specimen is contained in an annular trough. A vertical load is applied through an annular lid. To shear the powder, the shear cell rotates relative to the lid, and the torque necessary for shearing is measured. As with the Jenike shear tester, which has been used since the 1960s, yield loci, wall yield loci, and time yield loci can be measured, with the RST Mk II ring shear tester performing all steps automatically. Usually, a yield locus test requires less than 20 minutes.

Ring shear tester RST Mk II specifications

- Approx. 1300 mm x 900 mm x 450 mm (H x W x D)
- Weight: approx. 85 kg
- Power requirements: 110V-240V, 50-60Hz, 50 W
- Normal stress up to 20 kPa with standard shear cell M, 55 kPa with shear cell S, 165 kPa with shear cell XS
- Shear velocity approx. 0.005 to 30 mm/min (standard shear cell)
- Maximum particle size of specimen: Dependent on shear cell; with standard shear cell about 10 mm for broad particle size distributions; about 5 mm for narrow particle size distributions

PC specifications for RST-CONTROL software

- Microsoft Windows® 7/8/10/11*
- Serial communication port (optimum) or USB port

Small Ring Shear Tester RST-XS.s

An alternative to the Ring Shear Tester RST Mk II is the small automatic Ring Shear Tester RST-XS.s with specimen volumes from 3.5 ml to 70 ml.

With the CAHD software, we offer a solution for hopper design according to the Jenike method.

Further information

Detailed information on our products and some general information about powder and bulk solids are provided on our website www.dietmar-schulze.de.

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