

Hi-Shear Viscometers

HERCULES



Touch Screen Control

Pentium Powered

Quick Cup

Multiple Options
for Data Handling



TAPPI
Standard
T648

ts ONE Quality Assurance Viscometer



Kaltec Scientific, Inc.

HERCULES® HI-SHEAR VISCOMETER, MODEL TS-1

User Guide

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Guaranty and Certificate of Quality

All Hercules® Hi-Shear Viscometers are guaranteed against defects in materials and workmanship for one year providing:

1. The defective unit has been operated within published electrical specifications;
2. The unit has not been damaged by misuse, improper operation, or accident;
3. The unit has not been modified or altered; and
4. All costs of transportation of the unit to Kaltec Scientific, Inc., are prepaid by the original purchaser.

VISCOMETERS MUST BE RETURNED DIRECTLY TO THE FACTORY, NOT TO THE DISTRIBUTOR OR AGENT FROM WHICH THEY WERE PURCHASED.

Kaltec Scientific, Inc. limits its obligation under this warranty solely to the repair or replacement of any unit returned during the period covered by the warranty. No other obligations or liabilities are implied or expressed. This form also serves as a certificate of quality.

Kaltec Scientific, Inc.

Description and Features

Model TS-1 Quality Assurance Viscometer measures the viscosity and other flow properties of fluid materials in a work environment where speed, simplicity and flexibility in modifying test procedures are critical factors. With the help of a touch- screen computer, an operator can call up a preset test condition; conduct the test; save the results; and prepare for the next test in a minimum amount of time. It is best suited to situations of repetitive testing, but can be easily changed to a new set of conditions with two touches of the screen.

Features

The Touch-Screen Computer — This viscometer was designed to operate in a rugged production environment. The touch-screen feature eliminates the presence of a separate computer keyboard and mouse. It allows an operator to choose and perform a test with only three touches of the screen. Once the test is chosen and run, subsequent tests are made with only two touches. However, if different testing parameters are required, the operator can make a change with only a single touch of the screen to prepare for it. Model TS-1 comes with an automatic counter that identifies each test performed and password-protected settings to maintain control of the preset test parameters.

The Quick Cup — Two design changes have greatly improved the ease and speed of use, as well as, avoiding the possibility of repair. First, we have added a fill line etched on the inner wall. This eliminates the awkward step of using a dip stick in determining the proper sample level. Secondly, the new cup design allows the easy placement into and removal from the cupholder while maintaining the tight tolerances required for precision testing. This innovative design prevents binding between the cup and cupholder that is sometimes common in a dusty environment.

Data Reporting and Storage — Test results can be saved either in the touch-screen's hard drive or on a floppy disk. Results can also be printed by an auxiliary printer or can be sent to a network system (optional). If the customer chooses to evaluate his results in greater detail, he can take a floppy disk containing the TS-1 data and open it in another computer containing the WinShear Viewer (contact us about details).

Calibration — This instrument can be calibrated by the operator in accordance with TAPPI standard T-648 with minimal effort and time.

Precision — The torque sensor in the model TS-1 is identical to the ones used in other Hercules viscometers and, therefore, provides the same level of accuracy, repeatability and reproducibility expected from other Hercules instruments.

Viscometer

Please read this manual and any other instructions sent with the instrument before assembling.

Your viscometer and its components were inspected and in good working order before leaving the factory. Carefully assemble the viscometer by following the instructions listed below.

General Assembly

Except for a few small components, the unit was shipped pre-assembled. The small components include the following:

- 4 Leveling Mounts
- 1 Quick Cup
- 4 Bobs (A, B, C, & E)
- Printer Cable (optional)
- 2 Pinion Levers
- 1 Electrical Cord
- Wooden Bob Box
- Printer (optional)

1. Screw the four rubber Leveling Mounts into the extended feet of the main casting. Adjust the leveling mounts until the unit stands firmly on the table or bench. (Precision leveling is not required.)
2. Screw the Pinion Levers in to the Pinion located on the right side of the Spindle Housing.
3. Connect the Power Cord to the rear of the instrument. Plug the Power Cord into the properly rated and grounded electrical outlet. (Refer to the specification plate affixed to the rear of the unit).
4. Connect the printer using the cable provided to the printer port on the rear of the instrument. Drivers for that printer have been loaded prior to delivery.

Accessories

The accessories listed below were shipped with the viscometer.

Quick Cup (P/N 10044)

Insert the Cup carefully into the Cup Holder. Align the Cup's key with the Cup Holder's key. Carefully lower the Cup to the bottom. Turn the Cup slightly counterclockwise until the Cup locks into place.  **CAUTION: If the Cup is difficult to remove from the Cup Holder, do not force the Cup out.**

Forcing the Cup will either damage the Cup or the Cup Holder. To remove, gently tap the Cup with your hand. Lift the Cup straight up.

Bobs (P/N 10020 - 10028):

Screw the Bob clockwise no more than finger tight onto the lower, threaded end of the Drive Spindle.  **NOTE: Hold the Drive Spindle only by the flats at the top, using the Spindle Wrench provided.**

Bob Box (P/N 10035):

The Bob Box was specifically designed to hold Bobs A, B, C, D, and E. The box prevents the Bobs from being damaged while not in use.

Splash Shield (P/N 12101):

The shield is a safety precaution. It also prevents possible splattering of test material. This shield must be in place while spindle is rotating.

How the Viscometer Works

The Hercules® Hi-Shear Viscometer is a coaxial cylinder viscometer that uses a Searle method of measurement. It produces rheograms (speed versus torque or shear stress versus shear rate) at a wide range of shear rates using a cup and bob configuration.

The sample being tested is confined between two coaxial cylinders and the inner cylinder (bob) is rotated. The viscous drag of the sample induces rotational force to the outside cylinder (cup) which is sensed by a torque sensor. The torque and bob speed are recorded throughout the test and used for all calculations and plot displays.

Kal-Touch Software



Run Button

Press the RUN button to activate a test. You have an option of eight tests to run.

3 Standard Tests: A Bob, 1100, 100K
A Bob, 4400, 100K
E Bob, 4400, 400K

A password is required to make changes to the sample density, percent solids, start temperature, and the Auto Save feature only.

1 Custom Test Changes to the test parameters can be done just prior to running the test. A password is not required.

4 User Tests: The operator sets the parameters and can save the test under a new name. To change the test parameters, a password is required.

Running a test:

1. **Enter Operator's Name.** After pressing the RUN button, a keypad is displayed to enter the operator's name. This is used to track who ran the test.
2. **Enter Sample Name.** Another keypad is displayed to enter the sample's name that is being tested. The sample name is also used in the file name.
3. **Test parameters.** This screen allows the user to verify that the test settings are correct before the test is ran, and gives the option to change the settings, if they are not. Note: The actual starting of the machine will always be from this screen by pressing the RUN button.

- a. **Changing test parameters:** Enter password. (See page 7.)

Test Name	Press the Change button to display a keypad and enter the new test name. (Cannot be changed on Standard Tests.)
Input density	Press the Change button to display a keypad and enter the density of the sample (0.001-9.999). Use an external measuring device for the density value in g/cm ³ . This field is for the operator's use only. It is not used in any of the calculations rendered by the TS-1.
Percent solids	Press the Change button to display a keypad and enter the percent of solids in sample (0 to 100). This field is for the operator's use only. It is not used in any of the calculations.
Temperature	Press the Change button to display a keypad and enter the temperature of the sample in Celsius (0 to 999). The temperature of the sample must be taken when it is in the Cup and the Bob is lowered. This is done for repeatability.
Max RPM	Continue to press the Change button until the desired RPM is shown. There are three choices: 1100, 2200, 4400 RPM. (Cannot be changed on Standard Tests.)
Bob	Continue to press the Change button until the desired Bob is shown. There are 5 bob choices: A, B, C, D, and E. (Cannot be changed on Standard Tests.)
Spring Set	Continue to press the Change button until the desired Spring Set is shown. There are 4 choices: 50K, 100K, 200K, and 400K. This is a scale factor used for the Standard Hercules graph. It represents the division (in kdynes) between lines in the X (horizontal) axis. (Cannot be changed on Standard Tests.)
Max Torque	Continue to press the Change button until the desired Maximum Torque is shown. There are 5 choices: 900, 1600, 1800, 3600, and 7200. If the Max Torque is reached before the Max RPM is reached, the ramp up will stop. (Cannot be changed on Standard Tests.)
Auto Save	<p>Press the Change button to activate or deactivate the Auto Save function. If a check mark is in the Auto Save box, the test will be automatically saved after it is completed. If the auto save is off, then you will see a "Save Test? Yes/No" prompt after the test is completed.</p> <p>Data files are saved using the date, the test sequence, and the sample name. For example, "01-03-00 5 Test Fluid.VIS." "01-03-00" is the date the test was ran; "5" means it was the fifth test of that date and "Test Fluid" is the sample name. The file name is located in the lower left corner of the graph screen.</p>

Press OK to save the changes to the parameters.

4. **Press the RUN button to start the test.** A standard Hercules rheogram will appear showing the results in the real time. The actual RPM and Torque values will be displayed. NOTE: The Stop button is used to terminate the running test. If the Stop button is used, the data that was collected will be displayed.

5. **After the test is completed**, the standard Hercules graph, apparent viscosity (in centipoise), the deflection (in cm), the torque at peak RPM, maximum RPM and torque (in kilodyne-cm) reached during the test is displayed.

- a. **Save Test? Yes or No.** You must press Yes or No to continue viewing results. This will only appear if the Auto Save is turned off.

Data files are saved using the date, the test sequence number, and the sample name. For example, "01-03-00 5 Test Fluid.VIS." "01-03-00" is the date the test was ran; "5" means it was the fifth test of that date and "Test Fluid" is the sample name. The file name is located in the lower left corner of the graph screen.

- b. **Dilatant Results** — Displays a table showing torque results at 1100, 2200, and 4400 RPM. Also shows RPM results at 1800 kilodynes of torque.
- c. **Show Test Info** — Displays the test parameters.
- d. **Run Again** — Press this to run the exact same test with the same sample.
- e. **Run New** — Press this run a test on a different sample or different test parameters.
- f. **Print** — Prints the graph with the test information, apparent viscosity value, deflection, and file name at the top of the graph.
- g. **Back** — Returns to the main screen.

Archive Button

Scrolling

You can scroll through the saved files either one at a time using the up/down buttons, or view five at a time using the page up/down buttons.

Find

Shows the keypad to allow you to type in the first few characters of a file name that you are trying to find, then press enter and it will find the closest match.

Example: By typing: 10-12-99 <Enter>
Will list the first data file of that day.

Open

Opens the highlighted file and displays the graph and test calculations. Also allows you to print the graph or copy the file to a floppy disk.

Copy

Saves the archived data file to a floppy disk.

1. Open an archived data file.
2. Press the COPY button.
3. Insert a diskette.
4. Press the OK button. Your file is saved to the diskette.

Setup Button

Password

A password is required to enter into the setup screen, perform calibration, and to change test parameters. The default password is "TS1," if you have changed the password and forgotten what it was changed to, contact Kaltec Scientific at 248-349-8100.

Change Password

Since you have all ready entered the current password in order to get to this point, simply enter the new password, and then enter it again to confirm. Please keep your new password on record.

Change Test Parameters

Allows you to pick the test parameter's you wish to change. You can change all the different parameters on the 4 user tests and the custom test, but only limited parameters on the standard tests.

Test Name	Press the Change button to display a keypad and enter the new test name.
Input density	Press the Change button to display a keypad and enter the density of the sample (0.001-9.999). Use an external measuring device for the density value in g/cm ³ . This field is for the operator's use only. It is not used in any of the calculations rendered by the TS-1.
Percent solids	Press the Change button to display a keypad and enter the percent of solids in sample (0 to 100). This field is for the operator's use only. It is not used in any of the calculations.
Temperature	Press the Change button to display a keypad and enter the temperature of the sample in Celsius (0 to 999). The temperature of the sample must be taken when it is in the Cup and the Bob is lowered. This is done for repeatability.
Max RPM	Continue to press the Change button until the desired RPM is shown. There are three choices: 1100, 2200, 4400 RPM.
Bob	Continue to press the Change button until the desired Bob is shown. There are 5 bob choices: A, B, C, D, and E.
Spring Set	Continue to press the Change button until the desired Spring Set is shown. There are 4 choices: 50K, 100K, 200K, and 400K. This is a scale factor used for the Standard Hercules graph. It represents the division (in kdynes) between lines in the X (horizontal) axis.
Max Torque	Continue to press the Change button until the desired Maximum Torque is shown. There are 5 choices: 900, 1600, 1800, 3600, and 7200. If the Max Torque is reached before the Max RPM is reached, the ramp up will stop.
Auto Save	Press the Change button to activate or deactivate the Auto Save function. If a check mark is in the Auto Save box, the test will be automatically saved

after it is completed. If the auto save is off, then you will see a "Save Test? Yes/No" prompt after the test is completed.

Data files are saved using the date, the test sequence, and the sample name. For example, "01-03-00 5 Test Fluid.VIS." "01-03-00" is the date the test was ran; "5" means it was the fifth test of that date and "Test Fluid" is the sample name. The file name is located in the lower left corner of the graph screen.

Press **OK** to save the changes to the parameters.

Calibrate Button

Note: *It is very important that you do not calibrate your machine when you first set it up. The viscometer was calibrated before it left the factory and will hold for a long time. Please call Kaltec's Service Department before any calibration procedure is conducted.*

All Hercules Hi-Shear Viscometers are calibrated at the factory and are ready for use at delivery. However, calibration should be checked periodically (after every 100 tests or monthly). The viscometer should be re-calibrated only after the operator has determined it is not in conformance. **NOTE:** If any errors occur during the calibration procedure, all tests performed afterwards will be incorrect. Please follow the directions carefully.

Check Calibration

Setup the viscometer to the given requirements, and touch the "Check Calibration" button. The viscometer will automatically run a standard A Bob, 1100 test, then show the results. It will also automatically store the date and display it on the calibration screen to verify how long it's been since the last check.

Requirements are as follows:

- "A" Bob (P/N 10020)
- 1100 RPM (preset in the program)
- 100K Spring Constant (preset in the program)
- Kaltec Test Fluid (P/N 10307) or equivalent of approximately 100 cps.
- Bob, Cup, and Test Fluid conditioned to exactly 25°C.

Conditioning Sample: Install the Cup into the Cup Holder. Pour the Kaltec Test Fluid into the Cup to the fill line.. Install the "A" Bob on to the Spindle and lower it into the Cup. It is imperative that the Cup, Bob, and Test Fluid are exactly 25°C before running the calibration procedure. Conditioning by use of a precision constant temperature bath is an acceptable method. Kaltec recommends using a calibrated microprobe thermocouple (less than 0.018" in diameter) to measure temperature in the gap. To lower the temperature, use a cold, damp cloth wrapped around the cup. To raise the temperature, use a hot, damp cloth.

Calibrate

1. Condition the "A" Bob, Cup, and sample to 25°C. (This is very important.)
2. Enter the Apparent Viscosity value located on the Kaltec Test Fluid bottle. Press the "Calibrate Now" button. The spindle will begin to rotate and reach maximum RPM.

3. Once maximum RPM (1100) has been reached, the viscometer will automatically set the gain of the torque sensor. Your viscometer is now calibrated.
4. Confirm calibration by running Calibration Check again.
5. Compare the Apparent Viscosity results to the value on the Kaltec Test Fluid bottle. If the value is $\pm 2\%$ from the Kaltec Test Fluid value, your viscometer has been calibrated properly.

Viscometer Maintenance

We recommend that you always do preventive maintenance on the viscometer.

Lubricating the Viscometer

Bi-Monthly:

Clean and lubricate the four areas of the Dovetail Slide that has contact with the Spindle Housing and the top half of the Drive Spindle that slides through the Drive Pulley. Use a heavy lithium grease to do the lubrication. Apply the grease while in both the raised and lowered positions of the Spindle Housing.

NEVER:

DO NOT lubricate bearings. All of the bearings are permanently sealed and do not require lubrication. Especially **DO NOT** lubricate the Cup Holder bearings; they are designed for “dry” operation, and any lubrication whatsoever will adversely affect measurement accuracy.

Preventive Maintenance

Your Hercules® TS-1 Hi-Shear Viscometer has been ruggedly designed and has been operated for 24 hours before shipment. Like all fine instruments, however, it is vulnerable to misuse and neglect. Observing the following rules and tips will ensure many years of trouble-free and effective use.

Be especially careful when handling the Cup Holder, and try to protect it from any undue pressures or shocks. **DO NOT** use it as a handle when moving the viscometer. Abuse may result in the Cup Holder shaft becoming bent or damage the torque sensor.

Never force the Cup in to or out of the Cup Holder. If insertion or removal ever becomes more difficult than usual, check under the cam slot for a recently formed bur. Such a bur should be filed and polished away to prevent interference with the Cup's normal outer dimension.

Keep unit clean. Sample spills and other contaminants can permanently damage some components, especially the Cup Holder bearings.

Never lubricate the Cup Holder bearings.

Clean and lubricate the Dovetail Slide and upper Drive Spindle regularly. **See Lubricating the Viscometer.**

Major problems such as Bob and Cup misalignment, bent shafts, or electronic malfunction should be serviced only by qualified technicians.

Cleaning the Viscometer

Unplug the viscometer from the AC power outlet before cleaning. Clean the viscometer after every test. If the sample spills on to the viscometer, wipe it off before it dries. The sample could damage the Cup Holder bearings or other small components.

When washing, use a damp sponge. Water should not run inside the viscometer. This could create an electronic malfunction and cause a shock hazard. Water or cleaning solution should **NEVER** be poured directly on the viscometer. This could cause more damage to the viscometer. **ONLY** clean the outer surface of the viscometer.

General Troubleshooting

Symptom: Cup resists attachment/detachment from Cup Holder.

Likely Cause: ♦ Dried sample material in and around Cup Holder.
Solution: ♦ Clean thoroughly with steel wool.

Likely Cause: ♦ Bur has formed on Cup's camlock groove.
Solution: ♦ File bur off.

Likely Cause: ♦ Cup is bent.
Solution: ♦ Replace with a new cup immediately.

Symptom: Spindle Housing tracks poorly.

Likely Cause: ♦ Sample material on Slide.
Solution: ♦ Clean thoroughly with stiff brush.

Likely Cause: ♦ A bur has formed on the Slide.
Solution: ♦ Use fine sandpaper or emery cloth to remove bur and lubricate.

Symptom: Bob does not rotate when running a test.

Likely Cause: ♦ DC fuse (located in back of unit) has blown.
Solution: ♦ Replace with AGC 20 fuse only.

Symptom: Power switch indicator does not light up and the computer won't boot up, when the power is turned on (and unit is properly plugged in).

Likely Cause: ♦ AC fuse is blown.
Solution: ♦ Contact Kaltec's Service Department before replacing.

Returning the Viscometer for Service

Call Kaltec's Service Department and receive free unlimited telephone support. If your viscometer is required to return to Kaltec for service, the Service Representative will assign an **Return Authorization Number (RA#)**. Please include this number on all paperwork (especially the shipping labels).

If you need to ship your viscometer back to Kaltec Scientific, pack it in its original crate. If needed, a shipping crate may be obtained from Kaltec. In-transit damage is not covered by the warranty. We suggest that you always insure shipments.

Include the following items when you return your viscometer for service:

- ◆ All Bobs, Cups, & Cup Holders
- ◆ Leveling Mounts (4)
- ◆ Electrical Cord (1)
- ◆ Pinion Levers (2)

Include the following paper work:

1. A brief description of symptoms, software version, and firmware version.
2. A graph from the Auto test using the A Bob, 1100 RPM, 100,000 Spring, and Kaltec Test Fluid at 25°C.
3. A graph from the test when the problem occurred.
4. Return Authorization forms.

When shipping the instrument, you must pay for all freight. Kaltec will ship the viscometer back to you "Prepaid" and then add it to the invoice. If any shipments are sent to Kaltec "Collect," a service charge of \$10.00 plus the amount of the freight bill will be added to your invoice.

Ship to: **Kaltec Scientific, Inc.**
22425 Heslip Drive
Novi, Michigan 48375-4138
U.S.A.

On your Bill of Lading list the instrument as follows:

Crated Machinery
NMFC Item #133300, Sub 3
Class 85

For international shipments, the schedule B number for the instrument is:

9026.80.0000

After Kaltec has received and inspected your instrument, a representative from Kaltec will call with the cost of repairs. A purchase order number will be required for repairs to be made.