SUTHERLAND® 2000™ RUB TESTER

Illustrated is the 4-speed SUTHERLAND® 2000® Rub Tester showing the two-pound and four-pound weights to which test specimens are attached and the scoring device which are the standard equipment for the instrument. The receptacle is the same voltage as the instrument. 110 volts single phase is standard. 220 volts optional at extra cost.

SUTHERLAND® 2000® is a registered trade mark of Danilee Co., LLC U.S. PATENT NO. 2,734,375 CANADIAN PATENT NO. 532,864

Description

The tester is a motor-driven instrument for moving a weighted test strip over a printed specimen through an arc. The SUTHERLAND® Ink Rub Tester, the industry standard for decades, has undergone some significant changes to enhance its utility and reliability. Combined with a new ASTM (American Society for Testing & Materials) recommended practice for its use, the SUTHERLAND® Tester is in an excellent position to enjoy even more widespread use in the coming years. The result of this work is an affordable abrasion-testing instrument that retains all the features that made it an industry standard plus improvements that ensure it will remain the industry standard in the new millennium. The cover shows the new tester, including the options that come standard with each new unit.

In 1990 the stroke of the SUTHERLAND® Ink Rub Tester was shortened, which increased the precision and more closely simulates abrasion damage found in the field. Research and other published work in the print-abrasion-testing arena have shown that quick strokes simulate some types of rub damage (most notably shipping damage). One of the biggest problems with the use of the SUTHERLAND® had been the lack of a well-publicized test procedure for its use. While a procedure is available with the instrument, there was no nationally available method that could be readily referenced. ASTM corrected this with D-5264 "Standard Practice for Abrasion Resistance of Printed Materials by the Sutherland Ink Rub Tester" (copies available from ASTM). This method spells out the proper procedure for using the SUTHERLAND® Tester.

The SUTHERLAND® 2000 motor now has four speeds[1]; the first speed (21 cycles per minute) is half the speed of the older models; which will make the "wet" tests, and tests using under 5 strokes easier to perform. The second speed (42 cycles per minute) and third speed (85 cycles per minute) are the same as the older models, while the fourth speed (106 cycles per minute) is faster. These new improvements allow the customer the ability to customize the testing procedure to their individual product, yet maintain the ability of duplicating a procedure used by someone with an older model unit. The higher speeds will reduce the long test times needed for certain types of substrates (plastics, UV varnishes, printed films, etc.)

The SUTHERLAND® 2000 incorporates a digital counter with a fiber optic sensor to ensure the accuracy of the number of rubs for a given test. Simply enter the number of rubs desired and the instrument will shut off automatically after the correct number of strokes. Changes to the control board programming will now allow the unit to stay on for 60 minutes before automatically turning off the LED display. Also, after the display has turned off, pressing any button will automatically display the last number of strokes entered, allowing time to record results without having to hold down the count button and re-enter the strokes with each test.

A single mounting pad for the test strip is cut to fit the weight. It was found by using a two-inch (5cm) by four-inch (10cm) pad on the bottom of the weight that precision of the test increased. Two-pound (907g) and four-pound (1814g) weights and scoring fixture are included.

A supply of 80 x 80 count bleached cloth (not included[2]) has been found useful in testing wet smear, wet rub, and wet bleed.

Although the SUTHERLAND® Ink Rub Tester was originally designed to fill a need for testing the scuffing or rubbing resistance of inks used in the paper and paper-board industries; today it is being used by manufacturers of cleaning compounds, waxes, floor tile, film, and many other items. The test results are reproducible.

The following tests may be made with the instrument:

A. Dry Rub
B. Wet Rub
C. Wet Bleed or Transfer
D. Wet Smear
E. Functional Rub

Test Specimen

The test requires two pieces of stock, the test specimen and a test receptor. Cut a test specimen, approximately six (6) inches by three (3) inches. When printed area permits, the six-inch directions should be cut across the grain of the sheet, but must not cross pressed or cut scores.

Prepare test receptor strips of material from the same shipment of stock used in the test sample. Cleanly cut two (2) by seven (7) inch strips for the four-pound weight are prepared by placing the strip face up against the end pin of the scoring device and scoring at the white dot

[1] Speeds of the SUTHERLAND® 2000 Rub Tester can be adjusted to meet the needs of the customer, or other test standard requirements such as TAPPI T830 om-11

[2] Muslin cloth can be purchased through Testfabrics, Inc. at www.testfabrics.com

positions to facilitate bending the strip to conform to the test weight (block). See Table 1: 'Test Specimen'

To prepare samples for the two-pound weight, two (2) by five and a quarter (5 ¼) inch strips are placed face down against the end pin of the scoring device and scored at the red dot position to facilitate bending the strip to conform to the test weight (block).

Operating Procedure

A. Dry Rub

Clip a two (2) by seven (7) inch test strip to the four-pound test block, with the abrasive surface away from the rubber pad (facing the test specimen on base pad). Mount the test specimen securely (if printed material, mount with printed side up) on the rubber pad of the base plate securing with the hold down bracket.

Using a camel-hair brush (not included[3]), brush the test strip and the test specimen thoroughly before starting the test to remove any dust or foreign material. Place the weights over the sample, making sure that the 2 x 4 inch rubber pad of the test block is over the are being tested, that both surfaces are free of dirt. Preset the tester for ten strokes, or for any number of strokes selected as standard for a particular surface.

1. Plug in the power cord to the correct voltage, the display will read a version number such as 1-0. If the machine is already plugged in, touching any key will reactivate the display to whatever the previous setting was. For all speed 1, low count rub tests, cycle instrument one time (001) to allow the instrument to reset for exact stroke.

2. COUNT BUTTON. Each time the COUNT button is pressed the displayed cycle counts will increase by one. When the COUNT button is held down, the count will increase each ½ second. When the count reaches 10, it will start incrementing by 10's. When the count reaches 100, it will start incrementing by 100's. Anytime the button is released, the process will start over (i.e. ones, tens, hundreds). While the motor is running the COUNT button is deactivated and “count” adjustments can not be made. Maximum count is 999. Press “Reset” to remove the count number readout. If the motor is running, pressing reset will also stop the motor and remove the count number to 000.

Note: When adjusting the cycle count, the displayed value in the starting point, not the cycle count previously set. If the cycle count is 100 and the motor is started and then stopped at 95, pressing the COUNT button will set the cycle to 96 (replacing the previously set “count” number).

3. START / STOP BUTTON. This controls the starting and stopping of the motor. After the count has reached 000, the motor will stop and after a short delay the display will reset back to the number that was displayed at the time of the last start cycle. If the motor is running when the START/STOP button is pressed, the motor will stop. The display is not cleared. Pressing START/STOP will start the motor again and the count will continue from the point at which the motor was stopped.

4. MOTOR SPEED BUTTON. Pressing the SPEED button will increment the motor through speeds 1 – 4. The speed is indicated by one of the four LED lights above the buttons. The speeds available for testing are: Speed 1 (21 cycles per minute), Speed 2 (42 cycles per minute), Speed 3 (85 cycles per minute), and Speed 4 (106 cycles per minute). When the machine is first plugged in it will automatically default to slow speed (i.e. Speed 1) unless you press the SPEED button. The motor's speed may be changed at any time, before starting the motor or after it is running. The speed of the motor is retained when the “Reset” button is pressed, to change the speed you must press the SPEED button.

5. RESET BUTTON. This button will reset the count of the board. When pressed, the display will reset to 000. If the motor is running, the motor will shut off. This button may be pressed at any time.

When the rub has bee completed, examine both the test strips for signs of transfer. The two pieces should be stapled together and used for visual reference and interpretation. They should be marked plainly with the number of rubs (cycles) given. Place the test block on its side after using: do <u>not</u> place it on the machine or lay it on the rubber base.

B. Wet Rub

Mount the strips in the same manner as for dry rubs, using the two-pound test block. Preset the tester for one rub. Place three to six drops of water on the printed surface so that they will be covered by the test block. Place the block in position and immediately press the “start” button. After one stroke, examine both surfaces for color transfer. Repeat single strokes until ink failure is noted or the surface of the sample shows fuzz or abrasion.

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[3] Camel-hair brushes can be obtained from any art supply store

C. Wet Bleed or Transfer

Mount a two (2) by five and a quarter (5 ¼) inch strip on the two-pound test block with the felt or smooth side out, and saturate the blotter with water (an eyedropper is convenient). Place the wet blotter on the sample to be tested and leave in place for four minutes. Remove the block without rubbing and examine for ink transfer to the blotter.

D. Wet Smear

Use a water-saturated blotter on the two-pound block and actuate the tester for one rub (cycle/stroke). Examine the blotter for color transfer. In cases where extreme water resistance is required, more rubs may be specified. An alternate procedure consists of mounting a two (2) by six (6) inch piece of 80 x 80 count muslin on the two-pound test block over a blotter as specified above. This procedure has been found particularly useful since it eliminates the effects of surface abrasion on the blotting paper.

E. Functional Rub

Functional Rub is a term of embracing a number of miscellaneous uses for the SUTHERLAND® Rub Tester. An ink, which is acceptable under the outlined test procedures, may fail under exposure to foreign liquids or pastes. For example, certain inks might be tested to conform to specifications such as "one rub, cod liver oil" or "three rubs, Jones Antacid Toothpaste".

In reporting functional rubs, the operator must specify the number of rubs, the time of contact before rubbing, and the special conditions and testing mediums employed.

Evaluation of Tests

A practical approach should be emphasized in test evaluation. Few, if any, inks will pass rubbing, wet or dry, without a slight transfer of color. Decisions on suitability of ink are best made by running comparative tests, checking an acceptable sample at the same time and under the same conditions.

A quantitative method of evaluating samples for rub damage has bee developed. The test strip (receptor) is measured (zeroed) with a densitometer or a spectrophotometer before the rub test. After the test, the strip is measured again with either the change in density (densitometer) or delta E (CIE L*a*b* spectophotometer) reported. The larger the number, the greater the rub damage.

Consideration must be given to the time interval between printing and testing, particularly with slow-drying inks. Also, prints should be protected from dust and dirt between printing and testing.

An attempt should be made to use test samples which are representative of the run (i.e. eliminating the use of sheets with excessive anti-offset materials, or sheet taken from the top of a load which may have collected dust or foreign material).

New Rubber Pads

The pads should be changed when they become hard or damaged from age and use. Recommendation is six (6) month minimum. These can be ordered from DANILEE CO., LLC. To replace pads; remove old pads, clean metal surface with solvent such as naphtha. At this time weight blocks should be checked for proper alignment to the base (refer to "Procedures for Calibrating/Aligning Weights for the SUTHERLAND® Rub Tester"). Remove protective back from pressure-sensitive surface. Press this surface to the metal in the proper location.
See Table: II 'Procedures for Calibrating & Aligning Weights for the SUTHERLAND® Rub Tester

Optional Heated Weight ~ Designed for use with the SUTHERLAND® Rub Tester

This heated weight provides a uniform test for evaluating the "hot abrasion" resistance of printed cartons, labels, etc. Where required, rub resistance specifications may now be based on number of strokes at a given temperature as well as pressure. (refer to "Notes on the SUTHERLAND® Heated Weight & Suggested Procedures...")

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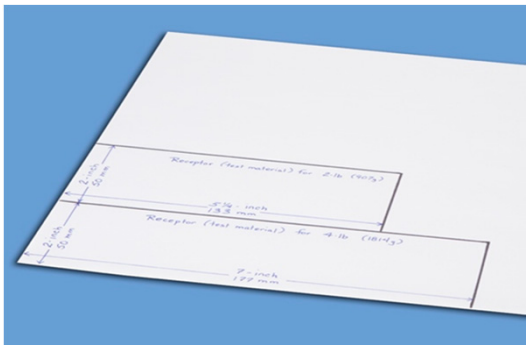
Table I: "Test Specimen"



Step 1. Prepare test strips (receptors) of material from the same shipment of stock used in creating the test sample. Cleanly cut 2 inch by 5 ¼ inch (50 mm By 135 mm) strips for the 2-pound and/or 2 inch by 7 inch (50 mm by 177 mm) strips for the 4-pound weight.

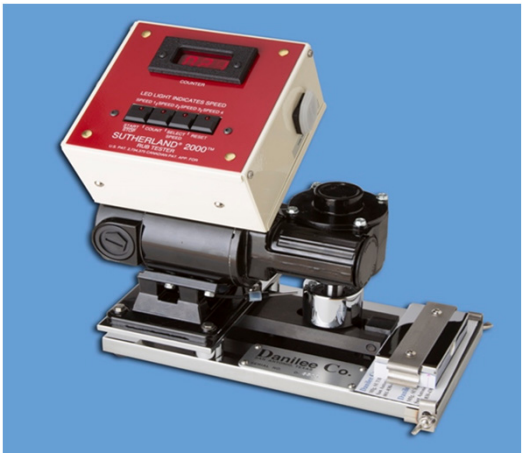
Step 2. To prepare samples for the 2-pound weight: The 2 inch by 5 ¼ inch (50 mm by 135 mm) strips are placed face up against the end pin of the scoring device (wooden block) and on top of the wires (as shown). Then "scored" using the micarta scoring tool at the red dot positions. This will facilitate bending the strip to conform to the test weight.

Step 3. Bend the test strip at the "scores", this will help it to lie flat on the weight pad.

Step 4. Placing the strip on the 2-pound weight. The test strip should be placed under one clip with the scoring lined up with the edge of the weight. Smooth the test strip across the bottom of the weight and attach the other end under the opposite clip.

Step 5. Place your 2 5/8 inch by 6 inch (66 mm by 150 mm) printed stock test specimen on the base pad of the unit, printed side up. Attach the hold down brackets to secure the test speimen from movement.

Step 6. Place the weight (with the receptor attached) on the arm of the unit by slipping the hook into the arm over the pin. The weight should lay flat on the test specimen. The machine should **NOT** be running.



Step 7. With the machine plugged in: use the “count” button to select the number of cycles (strokes) desired. Pressing the button will start the count. Holding the count button down, the machine will count in increments of 1 until it reaches 10, then the machine will count in increments of 10 until it reaches 100; continuing to hold the count button the machine will count by 100's. When the button is released the machine will count in increments of one again, following the same sequence previously mentioned. Use the 'select speed' button to choose speed 1, 2, 3, Or 4. The small light at the top of the black buttons will indicate the speed chosen. Press the 'start' button to begin the test. The unit will count down the strokes to 000, then it will automatically reset to the count just entered. Remove the weight and examine the test specimen.

Steps 10 – 12 are the same as steps 5 – 7; only using the 4-pound weight.

Step 8. To prepare samples for the 4-pound weight, The 2 inch by 7 inch (50 mm by 177 mm) strips are placed face up against the end pin of the scoring device (wooden block), on top of the wires (as shown), then 'scored' using the micarta scoring tool at the white dot positions. This will facilitate bending the strips to conform to the test weight.

Step 9. Placing the strip on the 4-pound weight: the test strip should be placed under one clip with the scoring lined up with the edge of the weight. Smooth the test strip across the bottom of the weight against the pad and attach the other end under the opposite clip on the weight.

Table II

PROCEDURES FOR CALIBRATING/ALIGNING WEIGHTS FOR THE SUTHERLAND® RUB TESTER

Step 1. Remove old pads from the base unit and from the weights.

Step 2. With no pads; attach the weight to the arm of the unit. Check the long edge opposite of the hook to verify that the edge lies flat to the base. If one edge or the other is raised, loosen ¼ inch allen screw, re-align and tighten screw.

Step 3. Repeat step 2 for both weights.

Step 4. Place new pads on base unit and both weights.

Note: Tolerance for weights is plus/minus three (3) grams.

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Table III

- NOTES ON THE SUTHERLAND® HEATED WEIGHT -

Before putting the weight into service, replace the natural rubber pads on the SUTHERLAND® Rub Tester base with the silicone pad furnished. Peel the cloth cover from the adhesive and apply the pad directly to the clean base.

The lamp in the end of the heat shield functions with the contacts in the thermostat. “Templesticks” or a pyrometer may be used to occasionally check temperature control knob settings.

When using the weight, have trichlorethylene or similar fireproof solvent and toweling handy for removing foreign material from the heated shoe between tests.

SUGGESTED PROCEDURE FOR TESTING FOR “Hot Abrasion” Resistance:

Test each sample at 200°F, 300°F, 400°F and with 10 and 20 rubs at each temperature.

Start the machine oscillating at once after placing the heated weight on the sample and remove the weight immediately after oscillation ceases.

The tested specimens may be rated for wear and smear using a scale of “none, very slight, moderate, and severe”.

Consideration must be given to the time interval between printing and testing, as well as to the cleanliness of the surface of the sample.

Note: *This procedure does not purport to address safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices.*

Direct correspondence relating to the instrument to:

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