



CTS Interlaboratory Program for Paper, Paperboard and Corrugated Containers

SPECIFIC ANALYSIS INSTRUCTIONS FOR STRENGTH “S” TESTS

The following pages give specific instructions and the appropriate test method for each analysis. Perform each test in accordance with the referenced test method except where it is modified or augmented in these instructions. If you deviate from the test method or these instructions, please carefully describe the deviation on the data sheet that you return for that analysis.

The samples were **pre-conditioned** according to TAPPI T402, “Standard conditioning and testing atmospheres for paper, board, pulp, handsheets and related products,” and sealed before shipment (to 35% RH, 21°C). **Condition** and test the samples in your laboratory at the standard conditions of $50 \pm 2\%$ RH and $23 \pm 1^\circ\text{C}$ or $73.4^\circ\text{F} \pm 1.8^\circ\text{F}$, as listed in TAPPI T402. If your lab can not test according to TAPPI standard conditions, then test the samples immediately after removing them from the sealed package. Indicate that the samples were not conditioned on the data sheet.

For most sample packs, the sample code for this round, is printed on gold or green sample divider sheets. Please keep all following sheets facing up and mark them with the same code. Unless otherwise specified, always **test the side bearing the sample code**. For some analyses, such as linerboard tests, the Sample Code may appear on the exterior packaging instead of being stamped onto the samples.

Measure or cut all of the test pieces in the same direction (keep the long edge of the sample parallel to the test direction of the cut test specimen), as specified in these instructions.

Make only one test on each specimen in the sample; do not make multiple tests on a specimen or average multiple readings on a specimen unless specified in these instructions. Record only the number of replicates provided for on each data sheet.

Always keep copies of completed data sheets for your records. Retain copies of computer print outs and/or calculation worksheets with the data sheets to check for transcription and calculation errors. For non-destructive tests, it is also advisable to keep the sample until analysis results are received. For destructive tests, it may be possible to retain the unused portion of each specimen. In most cases, the retained sample can be used for additional testing in the event of questionable results. Extreme care must be taken to protect the sample from environmental effects which could affect the measured properties.

Since the analysis technique employed by CTS is bivariate, measures performance on two samples simultaneously, it is important to use the same instrument and procedure throughout a test.

Bursting Strength

<u>Analysis</u>	<u>Pack Code</u>	<u>Title</u>
305	SA	Bursting Strength, Printing Papers
310	SB	Bursting Strength, Packaging Papers

Applicable Method: TAPPI Official Test Method T403

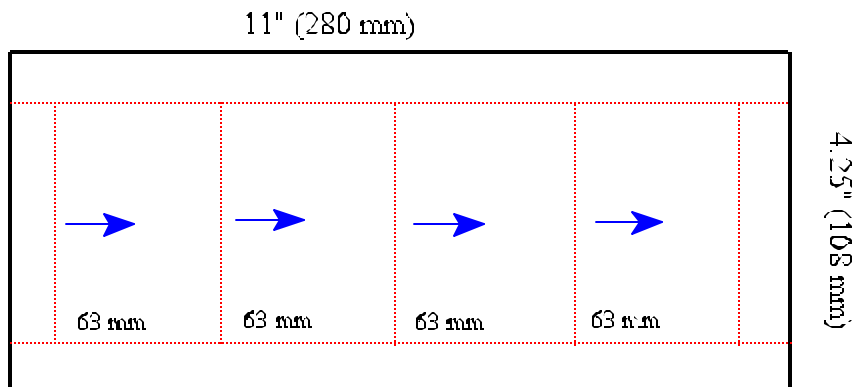
Conduct testing according to TAPPI T403, except keep the stamped side of the sample sheet facing up so that during the test the test piece bulges toward the stamped side. It is not necessary to make tests on both sides of the specimen. Make the test at the center of the test piece. Verify that you have indicated a valid unit for bursting strength data (*the default unit is psi*) on your data sheets.

Tearing Strength

<u>Analysis</u>	<u>Pack Code</u>	<u>Title</u>
311	SK	Tearing Strength - Newsprint
312	SC	Tearing Strength - Printing Papers
314	SD	Tearing Strength - Packaging Papers

Applicable Method: TAPPI Official Test Method T414

Cut the plies with the 63 mm dimension parallel to the long direction of the sheet (see diagram). The length of plies, parallel to short direction of the sheet, should be determined by instrument jaws (see T414 Note 4). The tear line will be along the center of the sheet in the 63 mm direction, as indicated by the arrows in the diagram. Test with the stamped sides of all plies facing the pendulum sector.



Verify that you have indicated a valid unit for tearing strength data (*the default unit is gf*) on your data sheets.

For the 1600-gf instrument:

Refer to the label on the pack cover sheet for the number of plies to test per specimen. To calculate the tearing force needed to tear a single ply, multiply the scale reading by the factor indicated on the pack.

NOTE: If an instrument with a direct-reading scale is used (e.g., digital read-out), report the scale reading directly if the instrument has been preset for the number of plies tested.

For multiple pendulum instruments:

Indicate in the spaces provided on the data sheet the instrument capacity used and the number of plies tested. Use one of the equations from Section 7.6 of the test method to calculate the tearing force required to tear a single ply.

Tensile Strength, Tensile Energy Absorption, Elongation to Break

<u>Analysis</u>	<u>Pack Code</u>	<u>Title</u>
320	SR	Tensile Breaking Properties - Newsprint
325	SF	Tensile Breaking Properties - Printing Papers
330	SE	Tensile Breaking Properties - Packaging Papers

Applicable Method: TAPPI Official Test Method T494

Refer to TAPPI T494, for measurement of Tensile Breaking Strength, Tensile Energy Absorption (TEA) and Stretch (%Elongation). Cut the test piece from the center of the sample sheet with its length parallel to the long direction of the sheet, to yield a machine direction tensile specimen. Verify that you have indicated a valid unit for the data (*the default unit is kN/m*) on your data sheets.

Folding Endurance

<u>Analysis</u>	<u>Pack Code</u>	<u>Title</u>
334	SG	Folding Endurance, MIT Type

Applicable Method: TAPPI Official Test Method T511

Cut the test piece from the center of the sample sheet with its length parallel to the long direction of the sheet. The test piece shall be 15 ± 0.02 mm wide and 150 mm long. Place only one test specimen at a time in the instrument. Be careful not to touch the test area.

It is extremely important that the sample be kept cool for this test. Use the exhaust fan (Section 4.5 of T511) or other means to prevent the motor from heating the test piece. Report the results as the number of double folds.

Bending Resistance, Gurley Type

<u>Analysis</u>	<u>Pack Code</u>	<u>Title</u>
336	SH	Bending Resistance, Gurley Type

Applicable Method: TAPPI Official Test Method T543

Cut the test piece from the center of the sample sheet with its length parallel to the long direction of the sheet. The test piece shall be 2.0 inches (50.8 mm) wide and 2.5 inches (63.5 mm) long.

Convert your readings to Gurley units (milligrams of stiffness for a standard 1" x 3" sample) using the manufacturer-supplied conversion factors or Table 1 of the test method.

For digital instruments, preset the test variables and use the pushbutton command to automatically convert the readings to milligrams of stiffness.

Bending Resistance, Taber Type

<u>Analysis</u>	<u>Pack Code</u>	<u>Title</u>
338	SJ	Bending Resistance, Taber Type - 0 to 10 Taber Units
339	SQ	Bending Resistance, Taber Type - 10 to 100 Taber Units
340	ST	Bending Resistance, Taber Type - 50 to 500 Taber Units (Recycled Paperboard)

Applicable Method: TAPPI Official Test Method T489
(For the 10 to 100 range and the 50 to 500 range)
TAPPI Official Test Method T566
(For the 0 to 10 range)

Verify that you have indicated a valid unit for bending resistance data (*the default unit is g-cm*) on your data sheets.

For the 0 to 10 unit range, cut the test specimen from the center of the sample sheet to 1.5" by 1.5" and test the direction of the specimen which is parallel to the long direction of the sheet. Mount the rollers up, use the 10 unit compensator weight, and multiply the average of the two readings by 0.1.

For the 10 to 100 unit range and the 50 to 500 unit range, follow TAPPI Official Test Method T489. Cut the test specimen from the center of the sample sheet to 1.5" wide by 2.75" long with its length parallel to the long direction of the sheet. The rollers should be mounted down. For the 50 to 500 unit range, add the 500 unit calibrated weight and multiply the average of the two readings by 5.

Z-Directional Tensile

<u>Analysis</u>	<u>Pack Code</u>	<u>Title</u>
343	SM	Z-Directional Tensile
345	SZ	Z-Directional Tensile (Recycled Paperboard)

Applicable Method: TAPPI Official Test Method T541

Place the double coated, pressure-sensitive tape through the center of both sides of the sample sheet, being careful not to touch the test area. (Do not remove the protective liner from the tape until ready to perform the test). Cut the test specimen from the center of the taped area to 2" by 2" before testing.

It is suggested that the following tape be used for the test: 3M 404, 2" wide, double coated. Please note on the data sheet if a different tape is used. Verify that you have indicated a valid unit for z-directional tensile data (*the default unit is psi*) on your data sheets.

Internal Bond Strength

<u>Analysis</u>	<u>Pack Code</u>	<u>Title</u>
348	SN	Internal Bond Strength, Modified Scott Bond Mechanics
349	SP	Internal Bond Strength, Scott Bond Mechanics

Applicable Method: TAPPI Official Test Method T569
- Calibrate the instrument to low range scale

For both analyses, cut the test piece from the center of the sample sheet with its length parallel to the long direction of the sheet. The test piece shall be 2.5 cm (1 in.) wide and 16.5 cm (6.5 in.) long. Please indicate the type of tape that is used for this test.

It is recommended that the sample and tape be clamped together two seconds using a pressure of 100 psi. For each test piece, average the five readings; discard readings of samples that do not completely separate. Report the average of the five readings as one determination on your data sheet. Verify that you have indicated a valid unit for internal bond strength data (*the default unit is 1000th of ft-lb*) on your data sheets.