Collaborative Testing Services, Inc

Paper & Paperboard Specific Test Instructions

Odd month testing (January, March, May, July, September, November)

Please review the following information before testing.

Participants in a multiple property test will notice that the results for each property are reported with a separate data entry form. It is not required that participants report results for all properties in multiple property tests.

Please submit **all** data entry forms using the online portal: (http://www.cts-portal.com/). If you are not reporting data for a test or property, leave the data entry form blank.

General Testing Instructions

Analysis	Analysis Name
3101	Thickness (Caliper) – Print
3111	Bursting Strength – Print
3113	Tearing Strength – Print
3115-3117	Tensile Strength, Tensile Energy Absorption, Elongation to Break – Print
3121	Air Resistance
3131	Roughness, Print Surf Method – 2.5 to 6.0 Microns
3133	Roughness, Sheffield
3135	Grammage (Mass per Unit Area)
3141	Opacity
3145-3146	Brightness
3201/3203/3205	Bending Resistance, Taber Type
3207/3209	Z-Directional Tensile
3211/3213	Internal Bond Strength
3801-3846	Autoline

GENERAL TESTING INSTRUCTIONS FOR ODD MONTH 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 in the data entry form that you return for that analysis.

The samples were **pre-conditioned** according to TAPPI T402, "Standard conditioning and testing atmospheres for paper, board, pulp, hand sheets 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 ± 2% RH and 23 ± 1ºC or 73.4 ± 1.8ºF, 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 entry form.

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 Sample Code in the upper right corner. Unless otherwise specified, always **test the side bearing the Sample Code**.

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 entry form.

Always keep copies of completed data entry forms for your records. Retain copies of computer print outs and/or calculation worksheets with the data entry forms 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.

Thickness (Caliper) – Printing Papers

Analysis	Pack Code	Title
3101	CP	Thickness (Caliper) - 3 to 6 mils

Applicable Method: TAPPI Official Test Method T411

For each sample sheet, record the test determination as the average of 5 observations made in non-overlapping, regular intervals in the cross direction (short direction) of each sheet. Verify that you have indicated a valid unit for caliper data (*the default unit is mils*) on your data entry forms.

Bursting Strength – Printing Papers

Analysis	Pack Code	Title
3111	BP	Bursting Strength - Printing Papers

Applicable Method: TAPPI Official Test Method T403

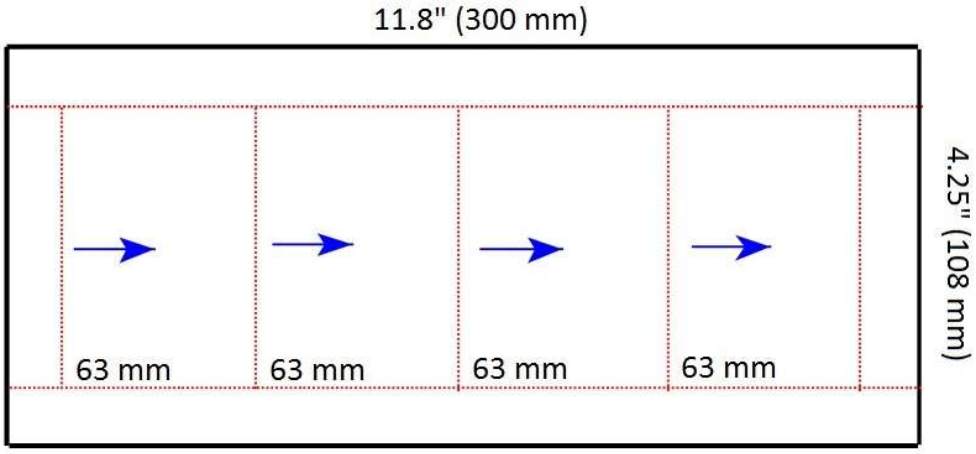
Conduct testing according to TAPPI T403, except keep the side of the sample sheet that was marked with the Sample Code facing up, so that during the test, the test piece bulges toward the marked side. It is not necessary to make tests on both sides of the specimen. Make the test at the center of the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

Tearing Strength – Printing Papers

Analysis	Pack Code	Title
3113	RP	Tearing Strength - Printing 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 below). The length of plies, parallel to short direction of the sheet, should be determined by instrument jaws (see T414 Note 3). 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 sides marked with the Sample Code facing the pendulum sector for all plies.



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

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 entry form, the instrument capacity used and the number of plies tested. Use one of the equations from Section 8.6 of the test method to calculate the tearing force required to tear a single ply.

Tensile Strength, Tensile Energy Absorption, Elongation to Break

Analysis	Pack Code	Title
3115	**NP**	**Tensile Breaking Properties - Printing Papers**

Applicable Method: TAPPI Official Test Method T494

Refer to TAPPI T494, for measurement of test 3115 Tensile Breaking Strength, subtest 3116 Tensile Energy Absorption (TEA) and subtest 3117 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 entry form.

Air Resistance, Porosity

Analysis	Pack Code	Title
3121	PP	Air Resistance, Gurley Oil Type

Applicable Method: TAPPI Official Test Method T460 – For Gurley Oil Type

Follow TAPPI Test Method T460. Test at the center of the test piece with the side marked with the Sample Code face up.

Roughness, Print Surf Method

Analysis	Pack Code	Title
3131	PH	Roughness, Print Surf Method - 2.5 to 6.0 microns

Applicable Method: TAPPI Official Test Method T555

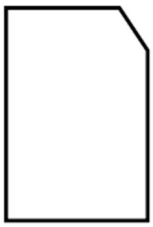
Follow TAPPI Official Test Method T555. It is recommended labs use the soft backing plate with10 kg-f/cm^2 clamping pressure. Please indicate on the data entry form if a different backing or clamping pressure is used. Test the center of the side marked with the Sample Code of each sample sheet.

Roughness, Sheffield

Analysis	Pack Code	Title
3133	SR	Roughness, Sheffield

Applicable Method: TAPPI Official Test Method T538

Perform testing according to TAPPI T538. To maintain the proper sidedness for these samples, a notch has been cut on the upper corner of the sample packs. Orient the notch in the top right corner as the image to the right. **Make all measurements in the center of the specimen while maintaining the notch in the upper right corner.** Avoid any wrinkled or damaged portions of specimens. Report data to the nearest Sheffield unit.



If testing with the traditional variable-area flowmeter type of construction, use the following range recommendations: 0 - 56 SU use Sheffield tube #1, 56 - 170 SU use Sheffield tube #2, and 170+ SU use Sheffield tube #3. These ranges are not applicable to electronic flowmeter instruments.

Grammage

Analysis	Pack Code	Title
3135	**GM**	**Grammage (Mass per Unit Area)**

Applicable Method: TAPPI Official Test Method T410

From the sample (10 sheets, each 13 x 20 ins.), cut sufficient paper with the cutting device to provide a total test area of at least 800 in^2 (5000 cm^2). Divide into 3 to 10 equal areas (weighing units) as appropriate for the weighing device to be used: e.g., 5 pairs of 8.5 x 11 in. sheets for a total area of 935 in^2 (6032 cm^2). Observing the requirements of T410, measure and weigh each of the 3 to 10 weighing units. Calculate the grammage of each unit in grams per square meter (g/m^2). Report grammage values for each weighing unit to the nearest 0.1 g/m2.

NOTE: Condition and test the samples in the TAPPI standard atmosphere of 50 ± 2% RH and 23± 1°C. **Do not** determine "as received" grammage.

Opacity (89% Reflectance Backing)

Analysis	Pack Code	Title
3141	**VR**	**Opacity, TAPPI T425, 89% Backing - Fine Papers**

Applicable Method: TAPPI Official Test Method T425
- Integrating cube type instruments and 89% white backing

Make one test at the center of the sample sheet marked with the Sample Code. Use 89% backing tile. Report opacity values to the nearest 0.1%.

Brightness - Directional

Analysis	Pack Code	Title
3145/3146	**BF**	**Brightness - Directional, Fluorescently Brightened Papers**

Applicable Method: TAPPI Official Test Method T452

Make one test per specimen at the center of the sample sheet marked with the Sample Code. Back the specimen with the remaining sample sheets. Report brightness values to the nearest 0.1%.

Perform directional brightness tests with the center line of the light beam in the plane perpendicular to the pad of sheets and parallel to the long direction of the pad. Make only one **machine direction** measurement per sample. Do **NOT** make cross direction measurements, rotate the pad or average multiple readings.

For Analyses 3145-3146, please refer to Appendix C of the method. Laboratories must use an instrument with fluorescence separation capability and be able to calibrate the instrument with a fluorescent paper standard as mandated by Appendix C. Report brightness **("fluorescence included")** measurements for the five specimens in the data entry form **labeled Analysis 3145**, then calculate and report the fluorescent component of brightness (Section C.5) in the data entry form **labeled Analysis 3146**.

The following instructions are a synopsis of the referenced procedure:

1. Calibrate the instrument. The calibration should include at least 1 fluorescent standard.
2. Measure the brightness of the specimen with the instrument configuration used for calibration.
3. **Report the brightness measurements in the data entry form for Analysis 3145**, Directional Brightness of Fluorescent Samples.
4. Move the UV-absorbing component of the brightness filter from the reflected beam to the incident beam.
5. Measure the brightness of the specimen again, in this **UV-excluded** configuration.
6. Subtract the UV-excluded measurement from the original brightness measurement to obtain the fluorescent component of brightness.
7. **Report the fluorescent component** of brightness to 0.1% Brightness for each specimen in the data entry form **for Analysis 3146**, Fluorescent Component of Directional Brightness.

Example: Brightness = 93.1 and
UV-excluded brightness = 87.3 the
Fluorescent component is 5.8

Bending Resistance, Taber Type

Analysis	Pack Code	Title
3201	**TP**	**Bending Resistance, Taber - 0 to 10 Taber Units**
3203	**TC**	**Bending Resistance, Taber - 10 to 100 Taber Units**
3205	**TR**	**Bending Resistance, Taber - 50 to 500 Taber Units (Recycled Paperboard)**

Applicable Method: TAPPI Official Test Method T489 (**For 10 to 100 range & 50 to 500 range**)
TAPPI Official Test Method T566 (**For 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 entry form.

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 that is parallel to the long direction of the sheet. **DO NOT** average machine direction and cross direction readings, as specified in TAPPI Official **Test Method T566**. 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

Analysis	Pack Code	Title
3207	**ZR**	**Z-Directional Tensile (Recycled Paperboard)**
3209	**ZP**	**Z-Directional Tensile**

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 entry form 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 entry forms.

Internal Bond Strength

Analysis	Pack Code	Title
3211	**SM**	**Internal Bond Strength, Modified Scott Bond**
3213	**SB**	**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.

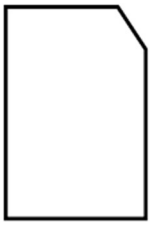
It is recommended that the sample and tape be clamped together two seconds using a pressure of 100 psi. For each test piece, average the five readings; discard readings of samples that do not completely separate. Report the average of the five readings as one determination on your data sheet. Verify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

Autoline Test Series – Printing Papers

Analysis	Pack Code	Title
3801	AP	Thickness (Caliper) - 3 to 6 mils
3811	AP	Bursting Strength - Printing Papers
3813	AP	Tearing Strength - Printing Papers
3815/16/17	AP	Tensile Breaking Properties - Printing Papers
3821	AP	Air Resistance, Gurley
3833	AP	Roughness, Sheffield
3845/46	AP	Brightness - Directional, Fluorescently Brightened Papers

In this test series, participants have option to report for any or all of the following seven tests: Caliper, Bursting Strength, Tearing Strength, Tensile Breaking Strength, Gurley Air Resistance, Roughness using the Sheffield method, & Directional Brightness - Fluorescent. Testing is similar to their corresponding tests with the smaller samples and will be analyzed together.

This test series includes one package of print paper, containing two samples of ten 12" by 24" sheets. The long direction of each sheet is cut in the machine direction. The samples have been notched to ensure proper orientation for certain tests. During testing, the notch should be oriented in the top right corner.



3801 - Caliper – Autoline

Test in accordance with TAPPI Method T411, Thickness (Caliper) of Paper, Paperboard and Combined board and the instrument manufacturer's instructions. Record the test determination as the average of 5 observations made in non-overlapping, regular intervals in the cross direction (short direction). Verify that you have indicated a valid unit for caliper data (*the default unit is mils*) on your data entry forms.

3811 - Burst – Autoline

Test in accordance with TAPPI Method T403, Bursting strength of Paper and the instrument manufacturer's instructions. Orient that sample with the notch in the top right corner, so that during the test, the test piece bulges toward the top side. It is not necessary to make tests on both sides of the specimen. Verify that you have indicated a valid unit for bursting strength data *(the default unit is psi)* on your data entry form.

3813 - Tear – Autoline

Test in accordance with TAPPI Method T414, Internal tearing resistance of Paper and the instrument manufacturer's instructions. Orient that sample with the notch in the top right corner, so that during the test, the test piece tears toward the top side. Verify that you have indicated a valid unit for bursting strength data *(the default unit is gf)* on your data entry form.

3815/3816/3817 - Tensile – Autoline

Test in accordance with TAPPI Method T494, Tensile breaking properties of Paper & Paperboard, and the instrument manufacturer's instructions, for measurement of test 3815 Tensile Breaking Strength, subtest 3816 Tensile Energy Absorption (TEA) and subtest 3817 Stretch (%Elongation). Orient that sample with the notch in the top right corner, and test in the machine direction only. Verify that you have indicated a valid unit for bursting strength data *(the default unit is kN/m)* on your data entry form.

3821- Air Resistance (Gurley) – Autoline

Test in accordance with TAPPI Method T460, Air resistance of Paper, and the instrument manufacturer's instructions. Orient that sample with the notch in the top right corner, and test on the top side.

3833 – Roughness (Sheffield) – Autoline

Test in accordance with TAPPI Method T538, Roughness of Paper & Paperboard (Sheffield) and the instrument manufacturer's instructions. Orient the notch in the top right corner. **Make all measurements while maintaining the notch in the upper right corner to test on the topside.** Avoid any wrinkled or damaged portions of specimens. Report data to the nearest Sheffield unit.

3845/3846 – Brightness – Autoline

Test in accordance with TAPPI Method T452, Brightness of pulp, paper, and paperboard (directional reflectance at 457nm) and the instrument manufacturer's instructions. Report brightness values to the nearest 0.1%. Perform directional brightness tests parallel to the long direction of the sample. Make only one **machine direction** measurement. Do **NOT** make cross direction measurements or average multiple readings.

For Analyses 3145-3146, please refer to Appendix C of the method. Laboratories must use an instrument with fluorescence separation capability and be able to calibrate the instrument with a fluorescent paper standard as mandated by Appendix C. Report brightness **("fluorescence included")** measurements for the five specimens in the data entry form **labeled Analysis 3145**, then calculate and report the fluorescent component of brightness (Section C.5) in the data entry form **labeled Analysis 3146**.