Available Tests for Tissue, Towel and Napkin Testing

Brightness/whiteness   - A Technidyne TB-1C spectrophotometer uses diffuse light scattering configuration to measure the amount of light reflected from the surface of a stack of tissues. Calculations are performed by the instruments to determine the whiteness using CIE or ASTM conventions. 5 readings were made on the outside roll surface of each sample.

Caliper - thickness of tissue is measured using the OPUS instrument using soft rubber platens and 20 kPa pressure. Soft rubber platens and 20 kPa pressure are specific for tissue caliper measurement. 5 readings per sample were made.

Basis weight - large sheet areas of each sample were cut using a rotary photographic sheet cutter and weight to 3 decimal places, the method is known to be accurate to 0.5%

Surface Roughness - a Sheffield air leak roughness tester was used on the outside roll surface side of the sheets, 6 readings per sample were made on the outside surface of the rolls. Higher numbers mean a higher level of surface roughness.

Water Retention post Immersion weighed towel or tissue sheets were fully immersed in a tray of deionized water, then removed, placed between blotters and the excess water squeezed out with a 20 kg steel roller, then weighed on a balance. Water retention is calculated as: (wet weight – dry weight)/dry weight x 100 = % retained water

Dynamic Water Absorption a siphon arrangement conducted water to an adjustable level platform on which towel or tissue sample could be observed underneath a Plexiglas plate to absorb water from a reservoir sitting on a balance. The platform would be lowered to start wetting the sample and the weight of water absorbed in the time recorded by a stopwatch noted. The result is grams of water absorbed per unit time. 6 measurements per sample are made.

Tensile properties, wet and dry the Tappi standard test was modified to test strips 1 inch width and 3 inches in length. Strips are tested with the length along the roll direction (MD) and along the roll axis (CD). 6 measurements were made for each strip in each direction. Measurements were conducted on an Instron Model 1122 using Series IX software which provides the tensile strength, stretch to break and tensile stiffness values form the load deformation data from each test. Wet strength measurements were made by mounting the strips in the holding clamps and spraying the free sections with a water sprayer saturating the strips prior to test commencement. 6 measurements per sample are made. Tensile stiffness is governed principally by the fiber quality and level of fiber bonding.

Air permeability a Frazier air permeability tester measures the air flow through a sheet with a 0.5 psi pressure difference from the outside roll surface to the other side. 6 measurements per sample are made.

Formation an MBR video formation tester measures the variation of light intensities transmitted through the sheet. Digital images of back lighted sheet samples are captured and analyzed by a PC to produce a formation number proportional to the light variation or paper non-uniformity and also a relative floc size. 6 measurements per sample are made. High formation numbers corresponding to a splotchy appearance of the sheet attributable to high and low basis weight areas arising usually from poor papermaking practice.

Ultrasound propagation (softness) a Sonisys OPUS ultrasonic caliper instrument is used to measure the soft platen caliper of samples at a lightweight pressure of 20 kPA and also the time of flight of ultrasound through the sheet. Together with the separate measurement of the basis weight of a sample, a series of calculations are made by the software to produce the ZD modulus, attenuation and impedance values. A softness value known to positively correlate with subjective panel assessment of tissue softness follows the following calculation:
Softness rank = 193.49 x (ZD Impedance) + 17.23 x (Attenuation/Basis weight) + 0.84 x (Basis weight).
"ZD Impedance" is the (basis weight)/(time of flight of sound) and "Attenuation" is obtained from Fourier analysis of the sent and transmitted ultrasonic signal waveforms.

Rub resistance a Sutherland rub resistance tester is used to simulate a hand rubbing action. (2 x 6) inch areas of the sample are affixed to a 4 lb sled which runs cyclically back and forth over a polyethylene sheet roughened with #80 grit sandpaper to simulate rubbing over a counter-top with mild abrading action. For towels, 0.5 ml of water was applied prior to the surface prior to rubbing. No water was applied for tissues. The number of rub cycles to break of the sample was recorded. 6 measurements per sample are made.

Fiber microscopy 0.2 gram samples are disintegrated by boiling torn segments in 0.1% NaOH solution, neutralized by washing with 0.05 N HCl and stained with Graff's C stain. Optical microscopy examination at 100X and 400X to identify morphological surface pitting of conifer fibers and hardwood vessels identifies the species through comparison of features in photomicrographic atlases of papermaking fibers. A tally count of the scan of the stained slide with applied tabulated weight factors for the identified species produces a relative weight ratio of softwood to hardwood that characterizes the pulp furnish. Estimates of % recycled content can also be made on the basis of the observed number of intact long fibers.