Chalmers DST FAQs

Q1: What does the Chalmers DST measure and how does it do this?

A: The Chalmers Dynamic Stiffness Tester (DST) measures the torsional stiffness of corrugated board by determining the natural angular frequency of a 6" x 1" md sample (MDTS) when it is rotated with an inertial mass attached. This frequency is directly proportional to torsional stiffness.

Q2: Why is torsional stiffness of corrugated board important?

A: Torsional stiffness tells the corrugated board producer how well the flutes have been made then later how much crush the flutes have sustained during conversion. MDTS is also the initial failure to occur in a stacking situation. MDTS failure leads to bending stiffness failure which leads to panel bulge, which leads to compression failure, which leads to panel collapse then box collapse. MDTS also tells you how well you made your corrugated board, not so much how well your paperboard supplier did his job.

Q3: Why is flute strength important?

A: Corrugated board is an engineered structure and the flutes are the bracing elements in the structure that keep the liners apart and from moving relative to each other so when the board is in a box the paperboard can resist buckling and compression forces. If the flutes are well made and not crushed then within the realms of the material used, every other performance property of the board will be maximized.

Q4: What affects flute strength ex the fluter?

A: Medium fibre quality, bonding, grammage, md compressive strength, formation, uniformity, conformability, moisture, coefficient of friction, fracture, thinning, gluing; fluting roll size, profile, temperature, smoothness, velocity, and wear.

Q5: How does MDTS relate to ECT, BCT or FCT?

A: There is no direct relationship because MDTS is an elastic property while the other properties are failure properties. There will be a relationship through grammage. MDTS is better related to Bending Stiffness because that is an elastic property as well.

Q6: Why is MDTS better related to "In service performance" of boxes in a stacking situation than ECT, BCT or FCT?

A: ECT, BCT and FCT are failure tests and these tests are short time tests. With failure (or yield) tests, the faster you do the test, the higher the result. They in fact tell you how strong the board is, not how weak it is. That is why we have to apply safety factors. A dead-load stacking test conducted over several weeks in cyclic humidity is probably the best measure of the stacking performance of a box, but this is very expensive and time consuming and rarely performed. Stacking tests include a time related material creep component which significantly reduces the boxes failure strength.
MDTS measures the stiffness strength of the structure and if this is maximized all the other performance properties of the board will be maximized as well. The MDTS expressed as a percentage of what it should be (model result) can be regarded as a DEGRADATION factor.

Q7: What box performance property is MDTS related to?

A: In a study completed in 2006 it was found that MDTS is inversely related to a boxes safety factor. The study looked at the Cyclic humidity stacking performance of a series of boxes made from identical material but crushed to different levels. The actual safety factors found varied from 4.5 for uncrushed board to 5.7 for board crushed to 58% of the original MDTS.

Q8: How does creep effect the boxes performance?

A: In a corrugated box the medium is typically the weakest link in the boards performance. Material creep produced by compressive forces in a stacking situation has a major effect on the flutes compared to the liners. Poorly formed and/or crushed flutes (reduced shear strength of the core) are particularly susceptible to compressive stresses which amplify material creep in the flutes and produces premature bending of the panels. Which leads to premature box collapse.

Q9: Our boxes are OK now so what is the problem?

A: Every corrugated box made without monitoring MDTS is probably made with less than 70% of its potential structural strength. To ensure performance in the service environment the box will be made with much heavier components than necessary. The extra weight of components will be costing your company a lot of money, typically 15% extra in paperboard costs.

Q10: If we introduce a Chalmers DST into our system what are the first things we will see?

A: The first things you will see will be how badly you are crushing your board during printing. After fixing this problem your customer complaints will be reduced significantly. You may also see how badly worn your corrugating rolls are and how much damage you do while sheeting.

Q11: How can we save money?

A: By using the Chalmers DST to maximize the MDTS of your board you will end up with a much stiffer board that performs so well that you can take the grammage of your liners down at least one or two grades.

Q12: Who uses the Chalmers DST?

A: Right now we have over 180 DSTs being used around the globe but mostly in Europe and Australasia. The Europeans are leading the light-weighting technological thrust and need to know if they are maximizing their flute properties.

Q13: What will it cost me?

A: Apart from the cost of the Chalmers DST you will need to employ a technician on a temporary basis (say two months) to benchmark your process to set the standard to progress from. Once you have this data you will need to improve your equipment settings and maintenance to reach the stage of proper process control. After that you can start to make money by significantly reducing raw material costs.