GENERAL BOOK

PULP - PAPER - CORRUGATED BOARD

PACKING & PACKAGING
INDEX

General Information  Pag.  3

Introduction to the packaging  Pag.  5

Recommended laboratories for
* Pulp & Paper Fluting/Liner manufacturers  Pag.  7
* Corrugated Board and/or packaging manufacturers  Pag. 18
* Big consumers of corrugated board boxes  Pag. 26

LYNX  Integral Laboratory management  Pag. 28

UNITS  Pag. 33

GLOSSARY - Board and Carton  Pag. 34
The paper and cardboard are principally formed by cellulose fibres which are interlaced. The spaces between fibres that can be of different sizes, can be filled by AIR, MINERAL CHARGES or GLUE PRODUCTS. The shape and quality of fibres, the sizes of the pores and the quantity and quality of the non-fibre materials determine the paper properties.

Generally, the fibres are dead cells whose mission is to give strength to the vegetable they are part of.

The vegetable fibres are principally located in:

• **Fruits - Cotton.**
  There are manufactured: *paper money, drawing paper, filter paper, strong papers and of long duration.*

• **Wood:**
  - Leafy - short fibres (eucalyptus)
  - Resinous - long fibres (pine).
  Strong papers

• **Annual stems (straw)**
  Corrugated cardboard

• **Leaves - Esparto**
  Paper of high opacity (India paper)

• **Bark - Hemp, jute and flax**
  Cigarette paper, drawing and copies.
For the last few years, the recycled paper is getting more importance, it means that the used or old paper is used as raw material:

a) In a 100%

b) or Mixed with cellulose fibres of first generation.

Normally, the recycled paper is a paper of a worst quality regarding the look and physical-mechanical properties, but due to ecological and economical reasons its development is being more and more important.

The recycled paper is being used when a high quality and finish is not essential:

a) Notebooks
b) Tissue
c) Packing
d) Corrugated board.
e) Paper for envelops and letters ...

The main problem when recycling is the removal of:

a) Inks
b) Coated layers
c) Plastic and aluminium covering
d) Staples ...

The main difference between paper and cardboard refers to the basis weight, the thickness and the specific volume.

The materials can be classified taking into account their cellulose fibres content:

a) Paper ...................... from 9 up to 150 grs/m2
b) Gross paper ............. from 150 up to 250 grs/m2
c) Fine cardboard ........ from 250 up to 450 grs/m2
d) Cardboard (1) ........... from 450 up to 2.000 grs/m2

(1) - In Germany from 600 to 3.000 grs/m2
     - In North America when it has more than 0,3mm. of thickness.
PACKING & PACKAGING

Although the corrugated board is approximately 100 years old, it is a modern product which is continuously present at the market offering new solutions to the packaging world, very important in nowadays. The corrugated board packaging has become the most suitable way for transport.

Obviously, the packaging has been highly developed in the last few years (in its design as well as in its physic and printability characteristics). All kind of products are transported in corrugated board packaging: food, pharmaceutical, cosmetics, car components, electronic components, computers, agricultural products, household appliances, furniture, ...etc.)

This continuous development, requires better properties of the product as well as a more defined and stable quality than in the past. Some of these properties, affect directly in a higher resistance to the compression strength, a better printability, a higher stiffness to the flexion and a better resistance to the moisture.

In world of marketing, the packaging is very important. Sometimes, the packaging is decisive over the concurrence products. In the big shopping centres, all kind of products are exposed, with a good packaging, with a high quality printing, and attractive colours and designs. Many of these products, have a high cost, therefore, they must be well protected for the transport. Besides the corrugated board packaging, there are internal structures like flexible or semi-rigid foams, designed to avoid damages and absorb shocks.

TLS - TECHLAB SYSTEMS S.L., with the aim of improving its services, has developed a modern line of equipments suitable for the Quality Control, Research, and Development of paper, corrugated board and finished packaging. It has also developed the computerization of testing laboratories LYNX Systems.
TECHLAB SYSTEMS also gives solutions in quality control and research in the PACKING SECTOR (liner / fluted paper manufacturers, corrugated cardboard manufacturers, packing boxes manufacturers and big consumers of these products).

There are:

- **INTEGRATED FACTORIES.** Starting from the pulp as a raw material paper (liner and/or fluted) is manufactured, then these papers are transformed into corrugated cardboard and finally corrugated cardboard boxes, ready to be used, are manufactured (with or without graphic printing).

- **SINGLE-PRODUCT FACTORIES:** - Pulp / Paper (liner and/or fluting)
  - Corrugated cardboard plates
  - Corrugated cardboard boxes manufacturers

- **BIG CONSUMERS OF BOXES:**
  - Cosmetic
  - Food sector
  - Drinks sector
  - Pharmaceutical sector
  - Electronic sector
  - Chemical sector (detergents, ...)

- **INSTITUTES AND RESEARCH CENTRES OF PAPER AND/OR CARDBOARD**

The quality control equipments help the paper and packing manufacturers to approach to the quality standards (in the manufacturing of raw materials, half-finished products or finished products) wanted or required by the buyers or big consumers.

Also the quality control laboratories help the big customers of finish products (p.e. corrugated cardboard boxes) to define the packing, the suitable design, the cost. The customers can require from the manufacturers a defined and agreed quality, and control the reception of the products, securing continuously the quality.

In many occasions, the big consumers are the ones who force the manufacturers to be equipped with modern laboratories of quality control.
For use in the laboratory for beating of chemical pulps under standardized conditions and also for the defibration of semi-digested raw material fibres.

The beating elements of the mill consist of a roll with chiselled bars and a circular smooth bedplate, both made of stainless steel. The roll and the bedplate are independently driven and rotate in the same direction but the roll has a higher peripheral speed. Beating conditions, such as pulp consistency, beating pressure and distance between the beating elements may be varied within wide limits. The mill beater is equipped with a digital counter to register of roll revolution during a beating test.

- Absorbed power in Watt (continuous measure)
- Consumed energy in kWh, during the beating process
Freeness Tester
Schopper-Riegler and Canadian types

The “Schopper Riegler” Beating and Freeness Tester and the Canadian Freeness Testers CSF are designed to determine the rate of drainage of a dilute pulp suspension and express it in terms of the Schopper-Riegler (SR) value. The SR value is the inverse of the volume of water collected divided by 10. The rate of drainage is related to the work done on the fibre during beating and refining.

Sheet Former
With White Water Recirculation
Manual laboratory sheet former used for the production of standard laboratory handsheets for physical and optical testing. The sheet is formed from a pulp suspension on a standard wire screen under suction generated by the flow of the water column.

Disintegrator
For desintegration of pulp and the correct preparation of pulp suspensions in the laboratory

Sheeter Dryer
For rapid drying of handsheets after pressing, prior to evaluation. The uniformly distributed heat from the drying surface reduces the moisture content of paper samples.

Press
Wet Paper Sheets
Handsheets are fundamental for all laboratory physical tests for pulp and paper. Handsheets are formed by the drainage of a pulp suspension through a forming wire screen gauze and must be pressed before being dried on air.

Fibers Classifier Bauer Mc Nett type
Through this equipment can determine the distribution of the fibers segregated in fractions of different lengths. The classification be done through sieves of different light aperture, in aqueous suspension and cascading according to the method of Bauer McNett. Teams with 4 or 5 stations classified.

According to standards: TAPPI T233 - SCAN M6 - PAPTAC C.5V...
SAMPLES CUTTER PRESS - (Manual or pneumatic), for paper samples preparation of 12.7 x 152.4 mm. (other dimensions under order) in order to do tests of:

- Fluted paper:  
  - C.M.T. (Corrugating Medium Test). The samples must be previously fluted in a laboratory flutter.  
  - C.C.T. (Corrugated Crush Test)

- Liner paper:  
  - R.C.T. (Ring Crush Test)  
  - C.L.T. (Crush Liner Test)

CIRCULAR CUTTERS - (100 cm²) - To obtain circular samples of 100 cm², and afterwards determine the basis weight in an precision scale.

Neumatic PRESSE (20x20 cm - DIN A4 or other sizes) To obtain big samples and afterwards determine the basis weight in an precision scale.
**Electronic Digital Scale.** (accuracy 0.001 gr.) to determine the basis weight and the COBB index.

**Electronic Moisture Scale.** With samples drying by “Infrared”. With this new generation of scales of double use, it is possible to quickly obtain:

- The basis weight (g/m²)
- The moisture (%)
- The Cobb Index (g/m²)
- Direct weights in g. (Every 0.001 g.)

**Precision Double Blade Cutter.** There are several cutting widths available: 12.7 - 15 - 25 or 50 mm. with a length of 260mm. To lately do tension, SCT tests. It is also useful to cut paper samples for CMT - CCT - RCT - CLT .... because its cutting width is 12.7mm. (as specified by the standards) but as its length is 260mm. it is necessary to use a pattern to cut the sample with a length of 152.4 mm. as specified by the standards.

**Cobb Sizing Tester.** To determine the water absorption capacity of the paper. A precision scale with reading every 0.001 g must also be used.
COMPUTERIZED SLIP & FRICTION TESTER
Manufactured according to ASTM D 1894 method B or TAPPI T816 – TAPPI T 549, to determine the static and kinetic (dynamic) friction coefficient on laminated materials as: papers, cardboards, films Following the indications of these Standards, this equipment is based on a mobile sled of a determinate weight and size, pulled by a dynamometric system of high accuracy.

Due to its high precision and reproducibility, this equipment can be use for R+D (Research and Development) or as a Quality Control Equipment.

MULLEN" BURST TESTER – Computerized Tester, to be connected with pneumatic closing of samples support (with clamping strength regulation). The burst resistance (Mullen value) has been along many years, the most important feature or resistance value of the paper – cardboard - corrugated cardboard, as several transport regulations impose this measurement.

During the burst test, a circular zone of a paper or corrugated cardboard sheet is deformed by an hydraulic pressure transferred to the sample by means of a rubber membrane. A test specimen is held between circular clamps and subjected to an increasing pressure from a rubber diaphragm. The diaphragm is expanded by a controlled hydraulic pressure until test specimen ruptures. The bursting strength of the specimen of paper is the pressure reading at the time of rupture.

The maximum pressure reached in the moment of the sample breaking, is indicated in Kg/m2, PSI or Kpa.

Through software is possible to determine the B.E.A. the Burst Energy Absorbed during the breaking of the sample in J/m2. BEA is used to determine the energy absorption capability of a material. Strong, flexible paper has higher energy absorption values, while brittle, stiff paper has lower values.
**LABORATORY FLUTER** - To flute paper samples of 12.7 x 152.4 mm. under determinate temperature and pressure conditions, for their further evaluation in C.M.T and C.C.T. in a suitable crush tester.

**DIGITAL MICROMETERS** - To quickly and accurately measure the thickness of paper.

**SAMPLES SUPPORT DEVICES** - They are placed between the plates of the samples crush tester, to make compression tests on paper and cardboard samples.

Available devices:

**C.C.T.** (Corrugated Crush Test) - It measures the compression in “KN/m” on the edge of a standarized band of fluting paper (12.7x152.4mm.) and in a parallel direction to the crests of the sample. This band has been previously fluted in a laboratory flutter.
β **R.C.T.** (Ring Crush Test). It measures the crushing endurance on a ring-shaped sample. The sample must be of 12.7 x 152.4 mm. of paper or cardboard, in “KN/m”. This crushing is also produced on the edge.

β **C. L.T** (Compression Liner Test). It measures the compression endurance on the edge of a liner paper sample standardized (12.7 x 152.4 mm.) in “KN/m”.

β **SAMPLES CRUSH TESTER**. (fluted / liner and corrugated board). To do and evaluate compression tests on fluted / liner paper samples:

**C.M.T.** (Corrugating Medium Test). In fluted paper samples, previously fluted in a laboratory flutter and a face of crests glued to a suitable adhesive tape. For this test, a samples support device is not necessary because the sample is placed between the compression plates, and the CMT is indicated in “N”.

Laboratorio Standard FLUTER
SHORT SPAN COMPRESSION TESTER. - According to standards: BS 7325, ISO 9895, DIN 54.518, SCAN P46, TAPPI T826, UNE 57.142...

According to the tendency and the level of acceptance in the market of this new type of tests in papers (liner/medium-fluted) used in the manufacture of boxes and packages, TLS has developed equipment SCT to be able to make with high accuracy and rapidity these tests in the laboratory.

The equipment measures the compressive strength (in the longitudinal and cross directions) of the samples of paper or cardboard object of tests, with a basis weight between 100 and 400 g/m².

The separation between jaws (pneumatic) of the zone of compression is of 0.7 mm and the width of the samples to try is of 15 mm.

The compressive strength is related to the resistance to the piling up of the boxes or finished packages. Optimizing the compressive strength of the papers/cardboards, it is possible to make boxes with the same resistance, using less fibres.

With this equipment of high accuracy and repeatability, the influence of the errors introduced by the worker is minimum.

The tests are made of automatic form and its duration does not surpass the 10 seconds. Through Software developed for this test, the results of the tests are gathered automatically and represented in the screen. The program directly turns these data to compressive strength short (KN/m). Later, these data can be managed and be treated obtaining historical, manageable a data base by: product, reference, client, supplier... with possibility of several types of calculations and statistical representations.
The Photovolt is designed to simplify the determination of appearance characteristics. This rugged portable instrument is easy to operate, sets up in just minutes and provides you with unparalleled flexibility. You can read percent reflectance directly from a sample by using any one of Photovolt's standard “search unit” packages. With the Photovolt it becomes easy to measure color, opacity, hiding power, brightness and tristimulus reflectance. With just the touch of a button the Photovolt will automatically reconfigure itself for changes in search unit filters. Naturally, the Photovolt has applications that conform to ASTM, TAPPI, and ISO standards.

- **MOISTURE DETERMINATION**
  To determine moisture content in Paper rolls.

- **BRIGHTNESS AND OPACITY MEASUREMENT**
  To determine the Brightness and the Opacity in paper samples.

Other Method, Balance and Drying Oven combination

SEARCH UNITS “Y” OR “T” use filter sets that measure surface color reflectance, paper opacity or hiding power. SEARCH UNIT “W” is designed to measure paper brightness.
Determination of the air permeance of Paper and Board according to Gurley Method
According to standard: TAPPI T460 - ASTM D 726 - APPITA / AS 1301-420 - BS 5926 - CPPA D.14 - ISO 5636/5
Densometers are the accepted standard for measuring the porosity, air-permeability or air-resistance of sheet-like materials such as papers, wovens, plastics and membranes. All Densometers measure the time required for a given volume of air (25cc to 400cc) to flow through a standard area of material being tested under light uniform pressure. Certain models such as the S-P-S Tester are also used to measure surface smoothness and material softness. Manual and automatic units available.

APPLICATIONS INCLUDE:
• In manufacturing and printing, to control the selection of materials affording the appropriate degree of liquid (ink, varnish, sizing) absorption.
• To test filters, porous bags & materials where controlled porosity is essential.
• To test insulating materials for air resistance.
• To supplement other physical tests enabling regulation or strength of manufacturing process to give the desired formation, appearance or strength since there is a close correlation in a given material between air permeability and these other properties.

SMOOTHNESS AND POROSITY MEASUREMENTS “Gurley Method”

Applicable standards: TAPPI T-460, T-536, T-490

Smoothness and Roughness of paper and board

The Model 4340 differs from the traditional manual Densometers in several ways. First, the Model 4340 utilizes the latest mass flow and servo-regulator technology to provide a quick, accurate test that is oil-free. Second, pneumatic cylinders insure both a consistent clamping pressure as well as an automatic test feature; which allows the user to test a sample several times without constantly opening and closing the test area by hand. Third, with the addition of an auto-drive mechanism, the user can program the number tests as well as the span they are tested over. Therefore, a sheet or strip of paper can be analyzed automatically, with output in either Gurley seconds, Sheffield, Bendtsen or Bekk equivalent seconds.

SMOOTHNESS AND POROSITY “BENDTSEN Method”

The surface roughness Bendtsen is compiled from the air flow on the surface of contact between a flat surface (substrate glass plate), head movement and measurement of a sample of paper or cardboard resting on the glass plate. The air passed through the space between the crown stripped from the head and the contact surface of the sample of paper or cardboard. The air flow measured in ml / min, is a measure of the sample surface roughness.
INTERNAL BOND TESTER - This equipment has wide application in quality control testing of paper and paper products. It measures the bond strength of paper and paperboard, coated cardboard, kraft paper, ...

The instrument is based on a falling pendulum which creates a high speed impact on a paper specimen. The specimen is sandwiched between two double-coated tape substrates. The pendulum impact measures the total energy required to delaminate the internal fibers of a specimen in a “Z” type direction into two separate piles.

This information is very important to packaging and related industries particularly where the material (paperboard…) will be used with an adhesive for sealing purposes, and the consumer will be required to detach the bonded surfaces (cereal, boxes and other boards).

CLIMATIC CHAMBER.- For To put small samples of Paper in temperature and relative humidity. Under the terms specified in international standards employed, this is a very important point because it is hygroscopic materials (taken and transferred humidity). In order to reproduce the tests provided under the same environmental conditions. It is the most economical solution for conditioning samples should be tested very quickly since they are extracted from the interior of the Climatic Chamber.

LABORATORY CLIMATIZATION.- To create a laboratory working environment at determinate temperature and relative humidity conditions.

IMPORTANT: If it is desired to automate all the laboratory through software “LYNX” (to see annexed) is necessary to acquire the equipment with its corresponding interface RS232, for its connection to the computer.
B.- CORRUGATED BOARD AND / OR BOXES MANUFACTURERS

- **ELECTRONIC DIGITAL SCALE.**- (accuracy 0,001 gr.) to determine the basis weight and the COBB index in g/m².

- **ELECTRONIC MOISTURE SCALE.**- With samples drying by “Infrared”.- With this new generation of scales of double use, it is possible to quickly obtain:
  - The basis weight (g/m²) (paper & board)
  - The moisture (%)
  - The Cobb Index (g/m²)
  - Direct weights in g. (Every 0,001 g.)

- **COBB SIZING TESTER.** - To determine the water absorption capacity of the paper. A precision scale with reading every 0,001 g must also be used.
MULLEN™ BURST TESTER – Computerized Tester, to be connected with pneumatic closing of samples support (with clamping strength regulation). The burst resistance (Mullen value) has been along many years, the most important feature or resistance value of the paper – cardboard - corrugated cardboard, as several transport regulations impose this measurement.

During the burst test, a circular zone of a paper or corrugated cardboard sheet is deformed by an hydraulic pressure transferred to the sample by means of a rubber membrane. A test specimen is held between circular clamps and subjected to an increasing pressure from a rubber diaphragm. The diaphragm is expanded by a controlled hydraulic pressure until test specimen ruptures. The bursting strength of the specimen of paper is the pressure reading at the time of rupture.

The maximum pressure reached in the moment of the sample breaking, is indicated in Kg/m², PSI or Kpa

CIRCULAR CUTTERS - (100 - 50 cm² / 10 - 5 inches²) - To cut accurate samples of 100 or 50 cm², 10 or 5 inches², and afterwards determine the basis weight in an precision scale and FCT (Flat Crush Test) in the precision crush tester.

- BASIS WEIGHT
- F.C.T. (Flat Crush Test)

PNEUMATIC SAMPLES CUTTER To cut corrugated cardboard samples of 25mm. width and up to 15 mm thickness, and afterwards do Edge Crush Tests (E.C.T.) in the samples crush tester.

- 25 ±0,5 mm - FEFCO Nº 8
- 31,8 ±1,6 mm (1.25” ±0,063 in. ) - Flute B - TAPPI T811
- 38,1 ±1,6 mm (1.50” ±0,063 in. ) - Flute C - TAPPI T811
- 50,8 ±1,6 mm (2.00” ±0,063 in. ) - Flute A - TAPPI T811
- 50,8 ±1,6 mm (2.00” ±0,063 in. ) - Flutes A-B-C - TAPPI T839

Fixed wide of cut to be chosen between:
SAMPLES CUTTER PRESS - (Manual or pneumatic), for paper samples preparation of 12,7 x 152,4 mm. (other dimensions under order) in order to do tests of:

- Fluted paper:  
  - C.M.T. (Corrugating Medium Test). The samples must be previously fluted in a laboratory flutter.  
  - C.C.T. (Corrugated Crush Test)

- Liner paper:  
  - R.C.T. (Ring Crush Test)  
  - C.L.T. (Crush Liner Test)

DIGITAL MICROMETERS.- To quickly and accurately measure the thickness of corrugated board according to the standards: ISO, FEFCO, DIN, TAPPI, UNE... with manual drive by handle lateral, with contact area of 10 cm², and pressure of 200 g/cm². The reading is display digital with a resolution of reading of 0.01mm and a capacity of measurement between 0 and 20 mm.

SAMPLES SUPPORT DEVICES.- They are placed between the plates of the samples crush tester, to make compression tests on paper and cardboard samples.

Available devices:

- E.C.T. (Edge Crush Test)
- R.C.T. (Ring Crush Test)
C.L.T. (Crush Liner Test) this test allows to determine in the crush tester the take off resistance of the cardboard crests from the liner paper, in KN/m”.

P.A.T. (Pin Adhesion Test). This test allows to determine in the crush tester the take off resistance of the cardboard crests from the liner paper, in KN/m”.

NOTE: For the following test it is not necessary any sample support device, because it is done placing the sample directly between the compression plates.

F.C.T. (Flat Crush Test). This test determines the perpendicular compression resistance, in “Kpa” of the fluted paper. The compression is applied on a corrugated cardboard sample of 100 or 50 cm² / 10 or 5 inches² under the testing conditions defined in standards.
SAMPLES CRUSH TESTER - (corrugated board and paper). To do and evaluate compression tests on corrugated board and paper samples:

Tests such as: ECT – CMT – CCT – RCT – CLT - FCT - PAT

One the more important test in the Corrugated Cardboard is ECT (Edge Crush Test):

According To:

TAPPI-T 811

Optional: Test software LYNX SINGLE and Test Packs CorruTEST in WINDOWS, for the analysis and test data management.
This equipment enables to evaluate quality relating score lines in corrugated board boxes quickly and precisely. Packaging and packing industry use mechanized production processes, so it is essential to know how the used materials (corrugated-compact board, thin cardboard...) will act in the process.

Score Quality Tester allows:

- SQT-10 instrument enables to determine (according to TAPPI T 829) the SCORE index that consists of:
  \[ \text{SCORE Index} = \frac{F \text{ (score breakage)}}{F \text{ (no score breakage)}} \times 100 \]
- Determining quality and efficiency of the used cardboards in the process.
- Carrying out Quality Control and Development, and Innovation.

- PUNCTURE TESTER PM-01.- Equipment designed to determine the puncture resistance (in Joules) of corrugated cardboard samples. This test allows to know the puncture resistance of a corrugated cardboard box, simulating the conditions that a box can suffer during its manipulation or transport, when smashing against other boxes or puncturing things. The test consists on puncturing a sample with an standardized pyramidal striker head, fixed to a pendulum.
TLS supplies a wide range of equipments to make compression tests of packages (boxes) or packing and determine their piling up resistance (for storage and transport). These tests are called B.C.T. (Box Compression Test). The strength units are in “KN” and the deformation units “mm.”

With these compression testers of packing it is possible to be determined:

- To the resistance in KN or KGF that has the packing or even packages to the compression that it exceeds the elastic limit and it falls the force. The test is made at a speed of 10+/-1mm/min.
- The deformation in mm that has taken place during the test.

In the series Validator & VAL, through Software LYNX™ in WINDOWS that they include for tests BCT, the following tests can be made in boxes of:

- Standard supply:
  - COMPRESSION TO BREAKAGE (Box Compression Test - B.C.T.)
  - PILING UP (by constant load in the time)
  - CYCLICAL (based on load or deformation).

The Compression Testers can operate in two ways:

1. With the floating superior movable plate by means of a universal lozenge. The plate is complied to geometry that acquires the box during the test.

2. With the fixed and parallel movable plate superior to the inferior plate, to fulfill norm American TAPPI T804.

Any of the two methods are valid in the main European standards (FEFCO, ISO, etc.)

When defining the suitable model of crush tester, it is necessary to know:

- Maximum and minimum size of the packaging to be tested.
- Maximum and minimum compression resistance.
- Voltage of the laboratory (Single-phase < 50 kN and Three-phase > 50 kN capacity).
CLIMATIC CHAMBER.- For to put small samples of Paper and Corrugated Carton and Packaging in temperature and relative humidity. Under the terms specified in international standards employed, this is a very important point because it is hygroscopic materials (taken and transferred humidity). In order to reproduce the tests provided under the same environmental conditions. It is the most economical solution for conditioning samples should be tested very quickly since they are extracted from the interior of the Climatic Chamber.

LABORATORY CLIMATIZATION.- To create a laboratory working environment at determinate temperature and relative humidity conditions.
In this sector, the quality control needs can vary depending on the goods, materials or products to be packed. However, from our point of view and wide experience the following equipments are the most required ones:

- **ELECTRONIC DIGITAL SCALE.** - (accuracy 0,001 gr.) to determine the basis weight of the corrugated board and the COBB index.

- **COBB SIZING TESTER.** - To determine the water absorption capacity of the paper. A precision scale with reading every 0,001 g must also be used.

- **MULLEN” BURST TESTERS.** - Computerized Tester, to be connected with pneumatic closing of samples support (with clamping strength regulation). The burst resistance (Mullen value) has been along many years, the most important feature or resistance value of the corrugated board, as several transport regulations impose this measurement.

  During the burst test, a circular zone of a corrugated cardboard sheet is deformed by an hydraulic pressure transferred to the sample by means of a rubber membrane. The maximum pressure reached in the moment of the sample breaking, is indicated in Kg/m², PSI or Kpa.
COMPONENTS CRUSH TESTERS FOR PACKING AND PACKAGING
(MiniVAL – VALIDATOR – VAL30 – 50 – 100 – 150 – 300 series

TLS supplies a wide range of equipment to make compression tests of packages (boxes) or packing and determine their piling up resistance (for storage and transport). These tests are called B.C.T. (Box Compression Test). The strength units are in “KN” and the deformation units “mm.”

This test is very representative and effective as it can determine the ability of accumulation of stacked boxes with their contents during storage or during shipping.

OPENING FORCE TESTER “OpenPACK” This equipment can determine quickly and accurately the force necessary to deploy and to open the boxes and boxes of cardboard used in the modern industry of food packaging, pharmaceuticals, cosmetics ...
LYNX – INTEGRAL MANAGEMENT SOFTWARE FOR, CORRUGATED BOARD, PAPER AND BOXES TESTING LABORATORIES

The use of this software offers high advantages, as one of the most important challenges in the future is the management, organization and analysis of all the information originated in the Quality Control Laboratories regarding the tests.

This development consists of an advanced hardware (data acquisition boards, inputs, outputs, digital reading boards,...), and a powerful and easy use (even for non experienced users) Software in Windows XP - VISTA, using advanced programming tools.

All the testing equipments of the laboratory are connected to a central computer (1), obviously, these equipments should have an analogical or digital output (RS-232).

LYNX is available in English, Spanish, French, German ...

In such equipments as the Packaging and Samples Crush Testers, its control in managed from the computers keyboard. For the standard tests, a configuration is made (strength scale, deformation scale, test speed, preload, samples size, auto-return, measurement units...). This configuration, is save in a file, for further tests with the same parameters. Therefore, make a test, is as easy as placing the sample on the equipment, and pressing the TEST key showed on the screen. After making the test, it is possible to print the results (curves, numerical values, or both), or file them in the hard disc. The software works with the data transmitted by the equipment of test in real time.

VERSIONS OF THE SOFTWARE :

- **LYNX** (single user system to connect only 1 equipment)
- **LYNX Plus** (single user system to connect unlimited equipments)
- **LYNX PRO** (Multi user system to connect unlimited equipments)
- **Mercury Net** Management Module - (Connection to the information by INTERNET)
INTEGRAL TESTING AND DATA MANAGEMENT SOFTWARE

NOTE: TLS can install the small local network to operate the equipment in the laboratory. If you want to share the data generated in the laboratory with other departments connected in local network, the company must provide the connection of it to the PC Server of the Laboratory (where it is LYNX installed and request to TLS the quotation to install the viewers in different PCs in the network that are needed for implementing the REMOTE MANAGEMENT INTRANET.

NOTE: In the TLS Testers, BURST - Samples CRUSH - OPENPACK and VALIDATOR have included the Ultralight PC and Testing LYNX software for each tester.

When some Tester has included control by PC, it is necessary to provide the architecture LYNX PRO
In the equipments connected to the computer on which Control of he himself cannot be had, (porosity tester, balances, Micrometers …) a taking of data is made in the same way. The configuration of the parameters is equal, (scales, units of measurement…), everything is equal except the Control of the equipment.

All the data ordered by files, references, dates, clients…, can later be handled. It is possible to very easily analyze the information kept in the hard disk of the computer. In the main menu there is a defined index perfectly and that takes step to tests or to the data base to analyze the information, or by the Laboratory Manager, the General Director of Production Manager. By the simplicity and rapidity of obtaining of data, this system, becomes and a helpful effective tool at the time of making important decisions in the company. Being able to obtain very quickly, statistical data of the tests made (individual or grouped) by: Clients, References, Qualities...

With the implantation of this system, aside from obtaining immediate benefits in direct costs, since a 30% of the time of a worker in the Laboratory are saved approximately, standard errors of transcription of data are avoided manually and long time of analysis of data is saved.

When it is desired to computerize a laboratory where already apparatuses of tests exist (of diverse manufacturers), it is necessary to contribute documentation of such, mainly in which it talks about technical characteristics, models, marks, exits available….Next TECHLAB SYSTEMS makes a previous study to propose a technical and economic solution that approaches most possible the necessities of each client. All the programs are modular and standard, which allows its extension and/or improves in the future.

The last version of LYNX in line incorporates a program of aid for the explanation of possible doubts during the tests. Some of the physical-mechanical tests that are made on the Paper (to liner / fluted), Corrugated Board and finished Packing (Boxes):
INTEGRAL TESTING AND DATA MANAGEMENT SOFTWARE

Quality Control Computerized Laboratory of "Liner / Medium" PAPER in Real Time

Direct information in the process of production parameters to the operators:
- GRAMMAGE, MOISTURE, THICKNESS, RCT,
- CMT, SCT, COBB...
Update of the Data in Real Time

Remote MANAGEMENT by Intranet
Manager - General Manager

Remote MANAGEMENT by Intranet
Production, Purchases, Sales
<table>
<thead>
<tr>
<th>TEST / MEASURES</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis Weight</td>
<td>g/m²</td>
</tr>
<tr>
<td>Box Compression Test B.C.T.</td>
<td>KN y mm</td>
</tr>
<tr>
<td>Burst Index</td>
<td>kPa m²/g</td>
</tr>
<tr>
<td>Burst Strength</td>
<td>kPa</td>
</tr>
<tr>
<td>COBB Index</td>
<td>g/m²</td>
</tr>
<tr>
<td>Compression C.C.T.</td>
<td>KN/m</td>
</tr>
<tr>
<td>Compression C.L.T.</td>
<td>KN/m</td>
</tr>
<tr>
<td>Compression C.M.T.</td>
<td>N</td>
</tr>
<tr>
<td>Compression E.C.T.</td>
<td>KN/m</td>
</tr>
<tr>
<td>Compression F.C.T.</td>
<td>Kpa</td>
</tr>
<tr>
<td>Compression P.A.T.</td>
<td>KN/m</td>
</tr>
<tr>
<td>Compression R.C.T.</td>
<td>KN/m</td>
</tr>
<tr>
<td>Dynamic Puncture Resistance</td>
<td>J</td>
</tr>
<tr>
<td>Energy Absorbed during Bursa test “B.E.A.”</td>
<td>j/m²</td>
</tr>
<tr>
<td>Flexion - 4 points</td>
<td>N/m</td>
</tr>
<tr>
<td>Moisture</td>
<td>%</td>
</tr>
<tr>
<td>Porosity Gurley</td>
<td>s</td>
</tr>
<tr>
<td>Score Quality Test</td>
<td>Score ratio in %</td>
</tr>
<tr>
<td>Short Span Compression Test “S.C.T.”</td>
<td>KN/m</td>
</tr>
<tr>
<td>Short Span Compression Test S.C.T. Index</td>
<td>KNm/kg</td>
</tr>
<tr>
<td>Smoothness (Bendtsen method)</td>
<td>ml / min.</td>
</tr>
<tr>
<td>Stacking Test (Constant load)</td>
<td>mm/time</td>
</tr>
<tr>
<td>Tear Index</td>
<td>mNm²/g</td>
</tr>
<tr>
<td>Tearing Strength</td>
<td>N</td>
</tr>
<tr>
<td>Tensile / Breaking Elongation</td>
<td>N y mm</td>
</tr>
<tr>
<td>Tensile Energy Absorbed T.E.A.</td>
<td>J/m²</td>
</tr>
<tr>
<td>Tensile Index</td>
<td>N m / g</td>
</tr>
<tr>
<td>Thickness</td>
<td>μ m, mm</td>
</tr>
</tbody>
</table>

* LYNX has been developed by TLS – TECHLAB SYSTEMS S.L.

* WINDOWS are a registered trademark of Microsoft Corporation
**Board**  (of [www.paperonline.org](http://www.paperonline.org))
Generic term for stiff paper usually made in several layers with a substance normally varying from 160 to 500 g/m², for certain grades even higher; widely used for packaging (e.g. folding cartons) and graphic applications.

**Box**  (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
(1) A term describing unit container made from (a) non-bending grades of paperboard, i.e., set-up box; or (b) shipping container containerboard grades of corrugated or solid fiber, i.e., corrugated or solid fiber boxes. (2) The term used to distinguish set-up, corrugated or solid fiber unit containers from cartons made from bending grades of paperboard.

**Boxboard**  (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A term used to describe bending and non-bending grades of the fibrous material used in the manufacture of folding cartons, set-up boxes, fiber cans and the like. In the folding carton industry this term is used interchangeably with the terms “board,” “paperboard,” or “folding boxboard.” (See Paperboard)

**Box Board**  (of [www.paperindex.com](http://www.paperindex.com))
Paperboard used in the manufacture of boxes. May be made of wood pulp or wastepaper. May be plain, lined or clay coated.

**Box Enamel Paper**  (of [www.paperindex.com](http://www.paperindex.com))
A glossy coated paper used to cover paper boxes.

**Box Liners**  (of [www.paperindex.com](http://www.paperindex.com))
A coated paper used on the inside of boxes, which are used for food.

**Box Paper**  (of [www.paperindex.com](http://www.paperindex.com))
Plain or coated papers usually colored and embossed.

**Cardboard**  (of [www.paperindex.com](http://www.paperindex.com))
Cardboard A thick, stiff paper produced by pasting multiple layers of paper together.

**Carton**  (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A unit container made from bending grades of boxboard. It is a shortened term for “folding carton,” the preferred designation for folding boxes, folding paper boxes and folding paperboard boxes. The word carton does not refer to set-up boxes, corrugated or solid fiber shipping containers.

**Carton**  (of [www.paperindex.com](http://www.paperindex.com))
A container usually of relatively thin carton or folding board manufactured by carton manufacturers. It is delivered to users in either flat or collapsed form.

**Containerboard**  (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A general term applied to both solid fiberboard and corrugated fiberboard which are used in the manufacture of shipping containers. Containerboard grades include medium and linerboard.

**Contour Packaging**  (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
(a.k.a. skin packaging) The overwrapping or covering of an irregular-shaped object with a flexible film applied in connection with a paperboard base. The air surrounding the product is exhausted, thus causing the film to fit or cling closely to all parts of the packaged item.
**Converter** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))

A manufacturer who fabricates folding cartons from boxboard and other packaging materials. In general can refer to any manufacturer who fabricates packaging materials from various unfinished, raw materials.

**Corrugated Board** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))

A structure made from containerboard grades of paperboard. Corrugated consists of a medium, that has been fluted on a corrugator, to which one (single-face) or two sheets (double-face) of linerboard are attached to create the structure. A double-face corrugated container is referred to as a single-wall container. Corrugated is primarily used for shipping containers. The height of the fluted medium varies and is referred to by a letter. Common flute sizes are A, B, C, E, F, G and N.

**Corrugated board** ([www.paperonline.org](http://www.paperonline.org))

Corrugated board is produced by guiding a paper web, the corrugating medium or fluting, through a slit between two corrugated rolls and pressing it into a waveform through a combination of pressure and heat. In the same machine, an even paper web (facing or liner) is then glued on to this corrugated paper on one or both sides. See "Kraftliner".

**Corrugated Board** (of [www.paperindex.com](http://www.paperindex.com))

Corrugated board is manufactured by gluing two flat layers of paper (liner) with a rippled layer of corrugating medium (fluting) in the middle.

**Corrugated Board – Double Wall** (of [www.paperindex.com](http://www.paperindex.com))

The structure formed by three flat facings and two intermediate corrugated medium.

**Corrugated Board – Single Face** (of [www.paperindex.com](http://www.paperindex.com))

The structure formed by one corrugated member glued to one flat facing.

**Corrugated Board – Single Wall** (of [www.paperindex.com](http://www.paperindex.com))

The structure formed by one corrugated inner member glued between two flat facings. It's also known as Double Face.

**Corrugated Cardboard** (of [www.paperindex.com](http://www.paperindex.com))

Layers of paper glued together with a ruffled or grooved inner liner. This is the material, which makes corrugated cardboard boxes.

**Corrugated Fiberboard** (of [www.paperindex.com](http://www.paperindex.com))

Consists of one or more sheets of fluted paper stuck to a flat sheet(s) of paper.

**Corrugating Medium** (of [www.paperindex.com](http://www.paperindex.com))

Paperboard made from chemical and semi-chemical pulp, or waste paper, that is converted to a corrugated board by passing it through corrugating cylinders.

**Corrugating medium** (of [www.paperonline.org](http://www.paperonline.org))

Papers used as fluting for the production of corrugated board.

**Duplex board** (of [www.paperonline.org](http://www.paperonline.org))

Duplex board consists of two layers, mostly made from waste paper pulp. It is used for packaging purposes.
**BOARD & CARTON GLOSSARY**

**Fiber** (1) (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A small thread-like cellulose unit of vegetable growth obtained from plants such as trees, sugar cane, cotton, jute, etc., from which paper and board are made. (2) In packaging, this designates converted paperboard products such as fiberboard, fiber boxes, fiber containers or fiber drums.

**Fiberboard** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
The general term indicating boxboard that contains center plies of a different furnish than used for the top and bottom liners.

**Fiberboard** (of [www.paperindex.com](http://www.paperindex.com))
A type of board made from defibrated wood chips on wet-lap forming machine. Fiberboard is used as a building board.

**Fluting** (of [www.paperindex.com](http://www.paperindex.com))
The rippled middle layer in corrugated board, produced generally from recycled fiber.

**Folding boxboard** (of [www.paperonline.org](http://www.paperonline.org))
Single or multilayer paperboard made from primary and/or secondary fibres, sometimes with a coated front, used to make consumer packaging (cartons)

**Folding boxboard** (of [www.paperindex.com](http://www.paperindex.com))
A multi-layer coated board with an outer layer of Kraft pulp and the middle layer of mechanical pulp. It is used primarily for consumer cartons for packaging of dry and moist foods, cigarettes and other consumer products. Also used in the graphic industry for catalogue covers, postcards and folders, etc.

**Folding Carton** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
Generally accepted designation of containers made by bending grades of plain or printed boxboard, cut and creased in a variety of sizes and shapes; delivered to the user in a flat, or glued and collapsed form.

**Kraft** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
Paper or paperboard made from virgin pulp produced by the sulfate process. Natural kraft is unbleached and has a characteristic light brown color; bleached kraft is a sheet having a higher brightness rating then natural kraft.

**K.D.F.** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A term used by public carriers in referring to boxes (cartons) other than corrugated when Knocked Down Flat.

**Laminated Board** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A combination of different kinds of boxboards, films, foils, papers or other materials bonded by adhesives in webs or sheets. May also be designated as “lined board.”

**Liner** (of [www.paperindex.com](http://www.paperindex.com))
Packaging board used as a surface layer on corrugated board.

**Linerboard** (of [www.paperindex.com](http://www.paperindex.com))
The grade of paperboard used for the exterior facings of corrugated board. Used in the manufacture of corrugated and solid fiber shipping containers, linerboard is made predominantly on a Fourdrinier machine. It is used by the packaging industry as a facing material for containers.
**Mini-Flute** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A term used for corrugated boards with small flute heights. These boards can be printed and converted on folding carton equipment with minor modifications. Also referred to as small flute boards, mini-flute boards include E, F, G and N flute.

**Package** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A container that provides protection and identification, and promotes the sale and use of a product.

**Pallet** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A low, portable platform of wood, metal, plastic, or fiberboard which facilitates the handling, storage, and transportation of materials as a unit.

**Panel** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A face, side, top or bottom of a folding carton.

**Paperboard** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A general term descriptive of a sheet of fibrous material usually made on a cylinder or fourdrinier machine from either virgin wood fiber (pulp), or recycled paper stock (old newspapers, old corrugated), or a combination of these fiber sources. Paperboard differs from paper in that it is heavier, thicker, and more rigid. The two general classifications of paperboard are containerboard, which is used principally in making corrugated and solid fiber boxes; and boxboard, the bending grades of which are used in the manufacture of folding cartons.

**Pulp** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
The basic cellulose fibers resulting from the disintegration of wood, rags or other vegetable matter by chemical and/or mechanical processes or combination from which all paper and paperboard are made.

**Recycled Material (Fiber)** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
Reclaimed material which, after repulping, is used as one of the two principal furnishes for paper or paperboard. This includes boxboard cuttings, over-issue newspaper, reclaimed corrugated containers, mixed paper, tabulating cards, envelope cuttings, kraft cuttings, etc.

**Shipping Container** (Of PaperBoard Packaging Council [www.ppcnet.org](http://www.ppcnet.org))
A Corrugated or solid fiber box used to pack and transport products or packages.
1/ PAPERONLINE (Europe)

Paperonline is provided by the Confederation of European Paper Industries. CEPI is a Brussels-based non-profit making organisation which is both the forum for and voice of the European pulp and paper industry.

CEPI aisbl
250 Avenue Louise, Box 80
B-1050 Bruxelles
BELGIc

Tel +32 2 627 49 11
Fax +32 2 646 81 37
www.paperonline.org

2/ PAPERBOARD PACKAGING COUNCIL (USA)

The Paperboard Packaging Council
700 Princess Street, Suite 202
Alexandria, VA 22314
Phone: (703) 836-3300
Fax: (703) 836-3290
www.ppcnet.org

3/ PAPERINDEX (ASIA – India)

PaperIndex is an online marketplace for buyers and suppliers in the pulp, paper, converting, packaging, and related industries

Registered Office:
PaperIndex (India) Private Limited
4BC - 317, 4B Cross 4th Main
East of NGEF, Kasturinagar
Bangalore, Karnataka 560016
India