Section 3 - Physical Testing Application Information

The structural properties of paper or board are dependent upon the morphological characteristics of the fibers from which it is made (see “Strength Testing”). Fibers are hygroscopic and the amount of moisture that they contain has a significant effect on their chemistry that in turn affects the dimensional and structural properties of the paper.

On the paper machine it is imperative to maintain an even distribution of moisture across the width of the paper to avoid dimensional instability also, at the reel, the moisture must be at an economic level close to the average ambient value.

In the laboratory, under standard atmospheric conditions, The rate change of moisture in the paper varies with time and according to whether the paper is drying or gaining moisture – the hysteresis effect and the structural properties at a given moisture content can therefore vary according to which curve is being followed.

Under end-user conditions, stacked paper can change in moisture around the circumference of a pack quicker than at its interior, giving rise to curl problems. Even with unpacked paper ready for use, dimensional stability problems can occur if the paper is not pre-conditioned in the atmosphere of the workplace.

Grammage and thickness of paper, together with the relationship that exists between them, are important criteria in the sale and use to which a paper is put. The mineral content of a paper again has an economic as well as practical application and ashing is an important control method.

The following section of instruments covers the requirements to measure and control these aspects of paper manufacture, testing and use.

Application

The weight per unit area, described as “basis weight” or more correctly “grammage”, defines the basic property of a paper or board necessary to coordinate end-use with economic production of the material. As such, it must be accurately measured.

Instruments used for this purposes fall into two main categories, the simple quadrant scale or the microprocessor based digital scale. Both types of instrument are able to accurately determine grammage values but the degree of accuracy achieved depends largely upon the correctly dimensioned specimen presented.

Four types of quadrant scales are available, the choice depending upon use. The 70-10-00 Series Quadrant Scales are suitable for all papers and light boards up to 250 g/m^2.

The Monitor Basis Weight Scale is a microprocessor based electronic instrument programmed to provide a choice of formats using a selected sample size and is suitable for measuring the grammage of paper and board. It can also be used to calculate ream weights and board weights in pounds per 1000 ft^2.

QUADRANT SCALES

Product link: ***http://www.testingmachines.com/product/70-02-paper-basis-weight-scales***

These are high precision scales, calibrated to within 0.5% prior to delivery.

Item no. 70-10-00-0001 and 70-10-00-0002 have a range of 0 to 250 g/m_2 in $1g/m^2$ division but with differing scales and paper cutting templates to suit sample size, 10 x 10 cm. in the case of 70-10-00-0001 or 20 x 25 cm for 70-10-00-0002 (which is also supplied with a 10 x 5 cm template to double the range).

The 70-02-03 Pocket Scale, with range of 200 g/m^2 graduated in 2 g/m_2 division, is provided with templates for cutting 10 x 5 cm. and 5 x 5 cm. It is supplied in a carrying case together with its separate stand.

The 70-10-02-0001 Universal instrument, as its name implies, has scales to cover all needs. The are:

Range	Divisions	Template
0 to 175	g/m_2 0.5 g/m^2	20 x 50 cm.
0 to 350	g/m_2 1.0 g/m^2	20 x 25 cm.
0 to 500	g/m_2 2.0 g/m^2	20 x 25 cm.
0 to 1000	g/m_2 2.5 g/m^2	20 x 25 cm.

(The lowest range is supplied with an additional 20 x 25 cm. template.)

The 70-02-01 Pocket Scale, with a range of 100 lbs./ream graduated in ½ lb. division, is provided with a 2 in x 4 in template. It can calculate ream weights for The standard trade sizes 17 in x 22 in, 34 in x 36 in and 25 in x38 in for both 480 and 500 sheet reams.

49-56 DIGITAL MICROMETER

Product link: http://www.testingmachines.com/product/49-56-digital-micrometer

The model 49-56 precision digital micrometer combines a modern contemporary look with a robust mechanical design and new improved electronics, including a digital linear encoder. The system features a comprehensive software program for controlling test speed, auto zero, auto sample detect, selectable opening distance, selectable measurement range, selectable dwell time, built-in auto sample feed option, statistics, multiple languages and calibration records. Designed for thickness measurements of sheet materials, the 49-56 can be configured to meet any ISO, ASTM, EDANA or other International specifications for paper, corrugated, plastics, plastic film, tissue paper, nonwovens, textiles and other sheet like substrates.

Unlike conventional micrometers, the 49-56 precision micrometer offers a cantilever balance system to allow extremely light pressure measurements. This feature also allows adding or removing additional weights for multiple pressure applications.

Features

- Modern design
- Movable color TFT display with touch screen
- Measuring range 0.000 – 10.000 mm
- GraphMaster compatible
- High resolution option (extra decimal)
- Adjustable gap (measuring height)
- Metric or imperial units
- On screen statistics
- Sample detect sensor
- Multilingual user interface
- Special anvil diameters and dead weight loads available
- Internal calibration routine Serial port for RS232, Printer and GraphMaster output

Applications

Paper, Paperboard, Corrugated, Cloth, Plastic, Plastic film, Textile Fabrics, Nonwovens, Battery Separators, Felts, Floor Coverings, Leather, Tissue Paper, Paper Towels, Handkerchiefs and Wipes

49-86/87 DIGITAL MICROMETER

Product link (49-86): http://www.testingmachines.com/product/49-86-digital-micrometer
Product link (49-87): http://www.testingmachines.com/product/49-87-digital-micrometer

The model 49-86 Digital Micrometer combines a precision thickness measuring system with an ultra-clear, easy-to-read digital display. The motor-driven instrument utilizes the dead weight micrometer principle for high accuracy and repeatability. Each unit is designed and manufactured for use where the utmost precision is required.

The model 49-86's construction consists of a heavy, solid frame which supports the unit and houses the reflective linear encoder and associated circuitry. A digital readout is provided to automatically display the specimen thickness. The lower anvil and movable pressure foot is made from lapped, stainless steel.

The model 49-86 can be configured to meet a variety of international specifications and test standards for different types of materials including plastic film, paper, corrugated, tissue paper, nonwovens, textiles and other sheet like substrates.

Features

- Digital readout and superior mechanical design
- For use throughout the laboratory and production floor
- Utilizes dead weight micrometer principle
- Changes between Imperial and SI units
- Zeroing on next dwell after Zero button press
- Serial output for simple data collection
- GraphMaster™ compatible
- User configurable options: lowering speed, dwell time, time of day, zero threshold, live readings, starting units, LED pulse, set manager password, calibration menu (requires password)
- Special anvil diameters and dead weight loads available
- Calibratable with certified gauge blocks

Applications

The model 49-86 is designed to measure the thickness or caliper of paper sheets, films and foils. Almost any material including paper, natural or synthetic fabrics, leathers, metals, plastics and rubber can be measured with precision and ease.

ELECTRIC INCINERATOR

Product link: http://www.testingmachines.com/product/56-15-electric-incinerator

Application

Ash in paper and board may arise from various sources. These may be chemicals originating from wood or raw materials from which it has been produced and from the digestion and bleaching processes, loadings added during stock preparation and coatings applied to the paper or board surface.

In most routine measurements, the presence of production chemicals is ignored. Should they need to be determined, this must be by chemical analysis. However, if total ash is required, this may be achieved by ashing in the electric incinerator at the temperature indicated in the standard procedure.

Should there be a need to differentiate between the loading and coating, the latter must first be removed by dissolving the binder and the ash contents of each determined before and after removal to obtain the difference.

The temperature of ignition is important when materials such as china clay and calcium carbonate are present as there will be a significant weight loss when the higher temperature recommended by some standards is employed.

Specification

The incinerator consists of a silica tube surrounded by a heating element, mounted on a tripod stand and fitted with a substantial handle for rotation to empty the ash. Spare tubes and heating elements are available should replacement be needed.

The instrument reaches an operating temperature of 575 deg. C after about 30 minutes and 900 degrees after about 1 hour and may be manufactured to suit any electrical supply. It is suitable for use with a 5-amp circuit, if necessary.

Operational Characteristics

Operation is extremely simple with little technical training required.

Maintenance is minimal, requiring only that the tube be carefully cleaned after use.

Comparison with Other Instruments

This type of instrument is inexpensive and compact. Alternative equipment consists of muffle furnaces, which are less economic, and more space consuming, effectively to carry out an identical operation.