AUSTRALIAN STANDARD
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INTERNAL TEARING RESISTANCE OF PAPER

This Standard Method, for the internal tearing resistance of paper and certain classes of paperboard, consists of measuring the work done when a test piece of paper is torn through a specified distance. The work is done partly in rupturing the paper along the line of the tear and partly in lifting and bending the paper as it is being torn. The total work done is used, along with the length of the tear and the number of sheets torn together in the test, to calculate a single force which, for the purpose of this Standard, is described as the force required to continue the tearing of a single sheet of paper. This force is by definition the internal tearing resistance of the paper and is expressed in millinewtons. This Standard provides for the measurement of tearing resistance within the range 0 to 7500 mN.

The tear index, expressed in $mN.m^2/g$, of the paper is the tearing resistance divided by the conditioned grammage.

Maintenance and calibration procedures, which will ensure that instruments meet the requirements of this Standard, are contained in Appendices A and B.

1. APPARATUS

1.1 Tear Tester. An approved tester (Note 7.1) consists of a frame, mounted on a rigid base, carrying a pendulum which is free to swing about a horizontal axis on bearings of very low frictional resistance. The test piece is held by two clamps, one of which is attached to the frame and the other to the pendulum. The clamping surfaces are at least 25 mm wide and 15 ± 1 mm deep.

In the starting position, before the paper is torn, the pendulum is displaced from its equilibrium position and held by a suitable device. The distance between the clamps is then 2.8 ± 0.3 mm and the clamping surfaces lie in a vertical plane which is perpendicular to the plane of oscillation of the pendulum. The upper edges of the clamping surfaces are in a horizontal line, lying at a distance 104 ± 1 mm from the axis of the pendulum, and the plane containing this line and the pendulum axis makes an angle of 27.5 ± 0.5° with the vertical.

The loss in potential energy of the pendulum due to the work done in tearing the test piece is a measure of the tearing resistance of the paper. The instrument is provided with a means of indicating this, preferably as a direct reading of tearing resistance in mN. In some instruments it is achieved by a transducer/digital display system or an optical encoder/digital display system. In others it is achieved by means of a pointer assembly which consists of a sleeve, to which a pointer is attached, mounted coaxially on the pendulum. The position of the pointer relative to the pendulum can be read from a circumferential scale carried on the pendulum. The frictional resistance of this sleeve must be kept within the range 40 to 80 mN (see Appendix A3). The pointer engages an adjustable base plate pointer stop, and the scale, pointer and stop are so arranged that the scale reading is a measure of the force required to tear the test piece. The base plate pointer stop provides a means for setting the scale reading to zero when no work is done in tearing. This adjustment provides an approximate compensation for pendulum and pointer friction at other points on the scale.

A knife is mounted on the pendulum support so that, when a test piece is clamped in the instrument with the pendulum in its starting poisition, operation of the knife produces a cut in the test piece. The cut must be such that the length of test piece to be torn is 43.0 ± 0.5 mm and the end of the cut is 4.0 ± 0.5 mm from the edge of the clamps.

Interchangeable pendulums, or a pendulum with interchangeable weights, are provided to allow for the measurement of a wide range of tearing resistance. Each pendulum or pendulum weight combination is associated with a scale which preferably gives a direct reading in mN (Note 7.3). The most common pendulums are known as A–pendulum which is used for papers with tearing resistance of 0 to 1500 mN, B-pendulum which is used for papers with a tearing resistance of 600 to 3000 mN, and C-pendulum which is used for papers with a tearing resistance of 2000 to 7500 mN (Note 7.4).

In some instruments of the type described it is possible for a test piece to foul the pendulum during the test (Reference 8.1). Such instruments are not acceptable for testing in accordance with this Standard.

In order to obtain accurate results it is essential that the instrument be properly maintained and calibrated. The appropriate procedures are described in Appendices A and B.

1.2 Test piece cutter, capable of cutting test pieces to the required dimensional tolerances.

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