



Paper and board — Determination of resistance to picking — Accelerating speed method using the IGT tester (Pendulum or spring model)

Papier et carton — Détermination de la résistance à l'arrachage — Méthode d'impression à vitesse accélérée avec l'appareil IGT (modèle à pendule ou à ressort)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3782 was developed by Technical Committee ISO/TC 6, *Paper, board and pulps*, and was circulated to the member bodies in October 1978.

It has been approved by the member bodies of the following countries :

Belgium	India	Poland
Brazil	Iran	Romania
Canada	Ireland	South Africa, Rep. of
Chile	Israel	Spain
Czechoslovakia	Italy	Sweden
Egypt, Arab Rep. of	Kenya	Switzerland
Finland	Mexico	Turkey
Germany, F. R.	Netherlands	United Kingdom
Hungary	Norway	USSR

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Austria
France
USA

Paper and board — Determination of resistance to picking — Accelerating speed method using the IGT tester (Pendulum or spring model)

0 Introduction

A number of methods for assessing the picking resistance of paper, i.e. the ability of paper to withstand the forces involved in splitting of ink films in printing processes, have been developed and accepted in different countries. However, it has not been possible to achieve reproducibility between the results obtained by the different methods; nevertheless several of the methods do rank particular papers in the same order and to this extent enable comparisons to be made.

It is hoped that it will eventually be possible to achieve genuine reproducibility, but meanwhile it is considered necessary to provide internationally agreed guidance on the use of instruments that are employed in many countries. One of the most widely used pick testers is the IGT¹⁾ instrument. This International Standard deals with two models of that tester. ISO 3783 deals with another IGT instrument (electric model), and the preparation of further methods is being considered.

1 Scope

This International Standard specifies a method of operating the pendulum or spring model of the IGT printability tester in order to provide a measure of the picking resistance of paper and board.

2 Field of application

This International Standard applies to the testing of any kind of paper and board likely to be used for printing, mainly by lithographic or letterpress processes.

3 References

ISO 186, *Paper and board — Sampling for testing.*

ISO 187, *Paper and board — Conditioning of samples.*

4 Definitions

4.1 picking : The rupture of the surface of a paper or board during printing, which occurs when an external tensile force applied to the surface is greater than the cohesion of the paper or board.

NOTE — In the case of coated papers, the rupture may take the form of particles of coating or fibres wholly or partly detached from the sheet, "blistering" of the surface or gross stripping of the surface. In the case of board, "blistering" is called delamination and this is often reported separately from picking. In the case of uncoated papers the rupture normally takes the form of the removal of fibre aggregates.

4.2 picking velocity : The velocity of printing at which the picking of the surface of the printed paper begins.

5 Principle

A strip of paper or board is printed at constant force and increasing velocity with a standard oil.

The minimum velocity at which picking occurs is a measure of the picking resistance of the paper or board.

6 Apparatus and materials

6.1 IGT tester

The tester comprises two separate units : an oil applicator which enables an oil film of known (controlled) thickness to be placed on a printing disc, and a printing unit driven by pendulum weight or by a special spring device. Printing force is controlled by variable spring loading.

Slightly different versions of the pendulum and spring models of the IGT tester are in existence, the differences being of detail and affecting mainly the positions of certain controls.

1) Stichting Instituut voor Grafische Techniek TNO, Postbus 4150, 1009 AD Amsterdam.

The detailed instructions given in clauses 10 and 11 apply to a version of pendulum or spring model in common use and a diagram of the pendulum model printing unit is given in annex A.¹⁾

Annex B gives the amendments required to the text of 10.1 when using the version of IGT tester (pendulum or spring model) available from the manufacturer during 1977.¹⁾ A diagram of the pendulum model printing unit, in this version, is included in annex B.

NOTE — If there is any doubt concerning which version of IGT tester is being used, the instrument manufacturer should be consulted.

6.1.1 Printing apparatus

The printing apparatus consists of a 150° sector, having a radius of 85 mm, which is covered with standard packing against which the test piece is secured. This sector rotates with an increasing velocity against a smooth metal printing disc. The disc, which is 65 mm in diameter and 10 mm wide, presses against the test piece with a force that is adjustable to 345 ± 10 N (35 kgf)²⁾.

NOTE — Special attention is drawn to the importance of ensuring correct adjustment of the distance between the sector and the shaft that carries the printing disc during printing, preferably in consultation with the instrument manufacturer.

For each point on the test strip, the corresponding velocity should be known.

NOTE — Diagrams are supplied with the apparatus showing velocity versus distance on the strip (see 12.3 and 12.4).

The printing force is adjusted by means of a spring. The test piece is placed on the packing and secured with a clamp. The printing disc is in contact with the bottom of the strip. The print is produced by releasing the pendulum or spring device.

NOTE — Special attention is drawn to the importance of ensuring accurate calibration of the apparatus, preferably in consultation with the instrument manufacturer.

6.1.2 Oil application system

The distribution roller used for oil application shall be of polyurethane. The printing disc shall be provided with an even layer of oil $7,6 \pm 0,6$ µm in thickness. This will normally be produced by the application of 1 ml of oil to the distribution system.

NOTE — The oil film thickness on the printing disc is checked by weighing the printing disc before and after inking, using a knowledge of the density of the oil.

6.2 Standard picking oils

6.3 Standard card packing material

The packing shall be $1,5 \pm 0,1$ mm thick.

NOTE — The Nederlands Normalisatie-instituut (NNI), Postbus 5810, 2280 HV, Rijswijk (ZH) Netherlands, is willing to provide information as to the source of supply of appropriate oils and cards.

6.4 Oil-measuring devices

A balance capable of weighing a mass of approximately 60 g to an accuracy of $\pm 0,1$ mg.

A graduated ink pipette to dispense a volume to an accuracy of $\pm 0,01$ ml.

7 Sampling

Sample in accordance with ISO 186.

8 Conditioning

Condition the sample in accordance with ISO 187.

9 Preparation of test pieces

Cut 10 test pieces each for each side of the test material (for example, top side and wire side respectively) and also in the machine and cross directions, or as appropriate. Each test piece shall measure 250 mm × 25 mm.

Mark the sides, and the machine and cross direction, on the test pieces. This marking shall be carried out in such a manner that it is possible, after the test pieces have been cut, both to identify each side of the test material and the machine direction and cross direction, and to test half the machine direction test pieces in one direction and half in the other.

10 Preparing the tester

10.1 Mounting and tensioning of packing

With clamp (9) of the sector in line with the lever (2), position the packing (3) exactly straight on the sector and secure the front edge at the clamp.

Attach, but do not fully tighten, the other end of the top sheet of the packing to the tensioning bar (4).

1) See also Bibliography.

2) In view of the ISO decision to use SI units and their preferred multiples and sub-multiples, these have been adopted in this International Standard; metric technical units are given in parentheses as many existing instruments use these units for their scale readings.

Hold the knob of the pendulum, rotate the pendulum until the sector engages in the position for printing and at the same time manually smooth out the packing.

Unscrew lock nut (10) of the tensioning bar and turn the outer milled screw of the bar clockwise to tighten the top sheet of the packing. Hold this screw firmly until the lock nut has been secured.

Renew the packing if it becomes damaged or shows obvious signs of wear.

10.2 Adjustment of printing force

Verify that the distance between the sector and the shaft that carries the printing disc during printing has been correctly adjusted.

Mount the test piece on the sector so that it lies flat against the packing.

Turn the handle (6) clockwise as far as it will go. Place an un-oiled printing disc on the shaft.

Turn the sector to its starting position.

Turn the handle (6) counter-clockwise as far as it will go.

Turn the handle (7) and adjust the printing force until the printing force scale reads 345 ± 10 N (35 kgf).

11 Procedure

11.1 Test conditions

Carry out all tests in the atmospheric condition at which the paper or board has been conditioned. Ensure that the tester and the test material are at the test temperature.

11.2 Inserting test pieces

Place the test piece in the clip.

Turn the sector into the start position, keeping the strip in line with the sector and flat against the packing.

11.3 Preparation of printing disc

Apply the appropriate quantity of oil to the oil application system and distribute it on the system for a minimum time of 8 min. Then place the printing disc on the appropriate shaft to receive the oil for a minimum time of 90 s.

NOTE — The use of the back rollers supplied with the IGT tester is optional.

11.4 Making a test

Place the oiled printing disc on the shaft of the printing apparatus until it snaps into position.

Turn the handle (6). Turn the brush to make contact with the test piece on the sector. Make a print by operating the lever (2).

12 Determination of picking

12.1 Define the beginning of the print by marking the centre of the initial (stationary) contact area, which shows as a band across the print, bounded by darker lines about 5 mm apart.

It sometimes happens that, at the printing velocity of the tester when equipped with the pendulum weight (approximately 1,15 m/s at 345 N (35 kgf) spring tension), no picking occurs. In this event the printing velocity may be increased to about 2,4 m/s or to about 3,3 m/s by putting a spring drive device on the tester, or the force applied on surface of the paper may be increased by the use of a higher viscosity oil.

12.2 The start of picking is the first visible sign of disturbance of the flat printed surface when viewed at a suitable magnification (for example X 5) with oblique illumination in the printing direction. Isolated picked spots separated by more than 20 mm from the main area of picking should not be regarded as the start of picking. If such spots occur in a number of sheets, this should be reported.

While ordinary picking is best seen from a straight strip, the delamination of board (see the note to 4.1) should be observed without magnification on a strip which is bent with the printed side inwards. Since repeated bending causes delamination, the strip should be bent only once and this is conveniently done in a special jig with a curvature of 55 mm.

NOTE — The appearance of debris on the printing disc should be observed, since very minute picking may be missed on the strip. It is best to carry out the observation of the test prints as soon as possible.

12.3 Lay the printed strip along the horizontal axis of a diagram of velocity against sector displacement for various printing forces, or use a velocity-distance scale. Ensure that the beginning of the print coincides with the zero of the scale.

12.4 Read off, on the vertical axis of the diagram, or from the scale, the picking velocity.

NOTE — Precise values cannot normally be expected when picking starts within 20 mm of the beginning.

12.5 Note the type of picking that has occurred.

13 Steps for subsequent tests

Clean the printing disc with a cloth soaked in a low boiling point solvent such as petroleum ether, boiling point range 60 to 100 °C. Wipe dry with a clean cloth.

NOTE — The printing disc shall be allowed to return to the temperature of the conditioning atmosphere before making the next test.

Repeat the test procedure according to clauses 11 and 12 for the next test.

After 10 tests have been carried out, it is preferable to clean and recharge the oil application system.

Ensure that all traces of solvent have been removed before applying the fresh oil.

In those instances in which more than 10 tests are made in rapid succession, maintain the correct film thickness by adding the appropriate volume (that is, approximately 0,16 ml per 10 tests) of fresh oil to the oil application system.

14 Test report

The test report shall refer to this International Standard, and include the following :

- a) whether pendulum or spring model tester used;
- b) if spring model used, the spring tension employed;
- c) oil used;
- d) mean picking velocity in millimetres per second, rounded to the nearest 50 mm/s, the values for each side and

direction (that is, machine or cross direction) of the test material being reported separately;

- e) standard deviation;
- f) atmospheric conditions of test;
- g) description of picking observed, including isolated spots on a number of test pieces;
- h) any deviation from this procedure, for example the use of fewer test pieces, and any circumstances of such a nature as to influence the results (see, for example, the note to 12.4).

In the case of board the test report may also include :

- j) mean delamination velocity (see the note to 4.1) expressed in metres per second, rounded to the nearest 0,5 m/s;
- k) standard deviation of delamination velocity.

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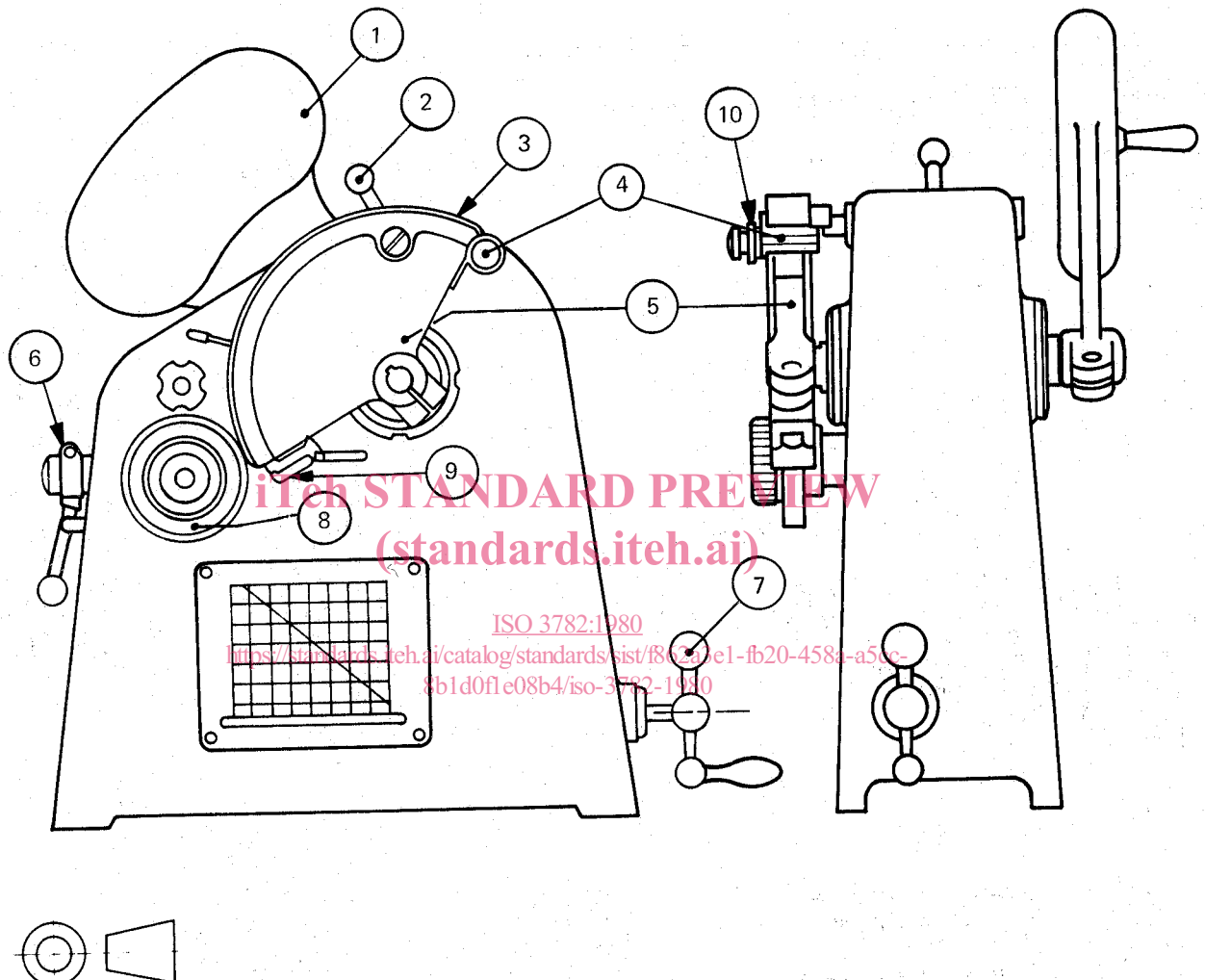
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Annex A

Diagram of IGT printability tester (pendulum model) in common use



KEY

- 1 Pendulum
- 2 Lever
- 3 Packing
- 4 Tensioning bar
- 5 Sector
- 6 Handle to move disc
- 7 Handle to adjust printing force
- 8 Printing disc
- 9 Clamp for packing and gripper clip for test piece
- 10 Lock nut

Annex B

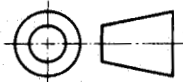
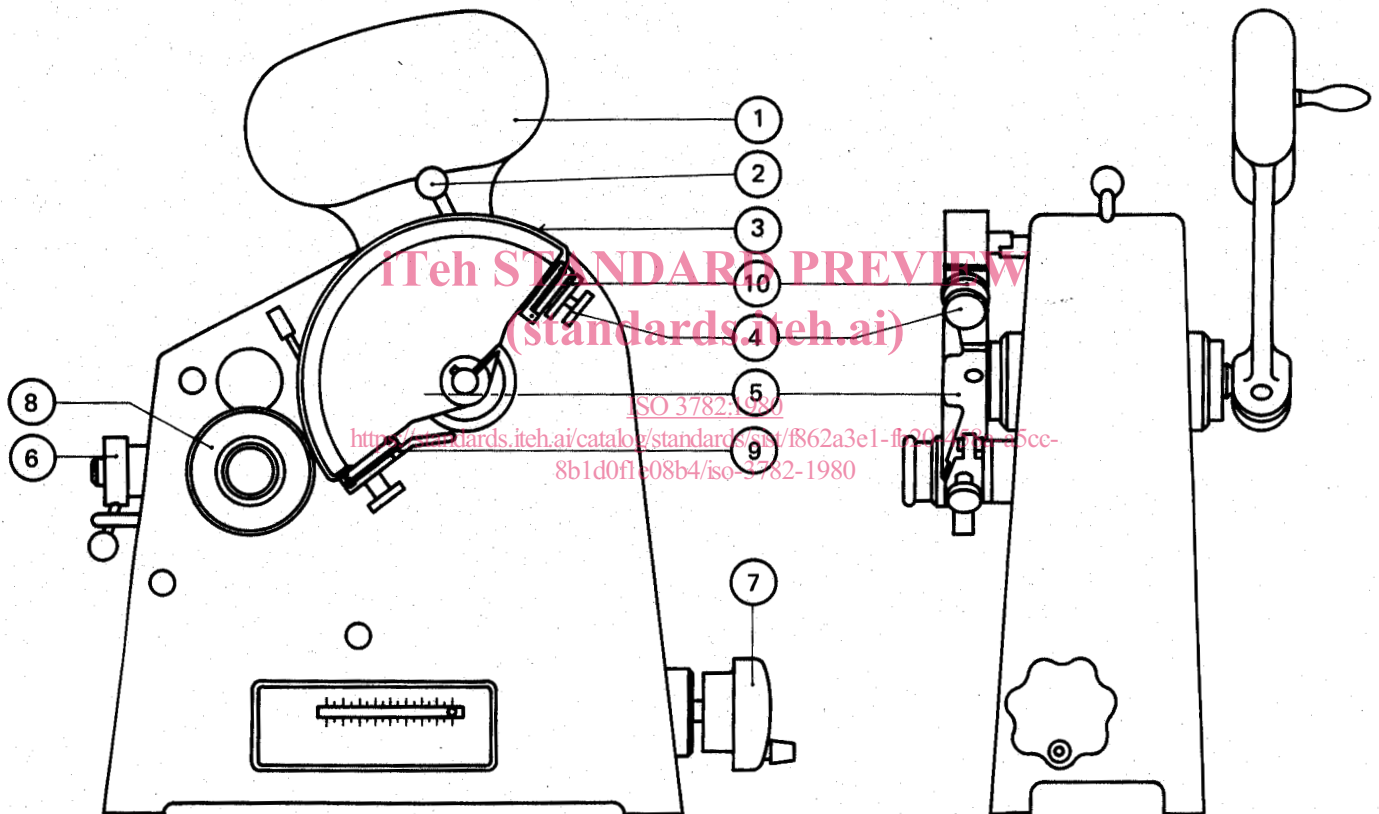
1977 Version of IGT tester (pendulum or spring model)

When the 1977 version of the IGT tester (pendulum or spring model) is used, sub-clause 10.1 of this International Standard should be amended as indicated below. A diagram of the 1977 pendulum model printing unit is included in this annex.

The amendments referred to are :

- 1) In sub-clause 10.1, delete the term "tensioning bar (4)" and replace with "packing clamp".
- 2) In sub-clause 10.1, replace the fourth paragraph with the following text :

Fasten lock nut (10) to tighten the top sheet of the packing in the clamp and turn screw (4) to tighten the packing clamp firmly against the sector.



KEY

- 1 Pendulum
- 2 Lever
- 3 Packing
- 4 Tightening screw of packing clamp
- 5 Sector
- 6 Handle to move disc
- 7 Handle to adjust printing force
- 8 Printing disc
- 9 Clamp for packing and gripper clip for test piece
- 10 Lock nut