INTERNATIONAL STANDARD

ISO 12634

Second edition
2017-09

Graphic technology — Determination of tack of paste inks and vehicles by a rotary tackmeter

Technologie graphique — Détermination du tirant des encres, à l'aide d'un tackomètre rotatif

Reference number
ISO 12634:2017(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition cancels and replaces the first edition (ISO 12634:1996), which has been technically revised.

The document has been entirely revised with regard to instrument specifications and test method settings.

Introduction

On the market, a number of three-roller tackmeters are available that differ in design features such as roller weight, geometry and composition of the distribution system. Instruments of different types do not give the same apparent tack readings. Instruments of the same type will only give apparent tack readings within tolerance, provided that they are maintained and calibrated properly and in the same manner.

Tack is a property indicative of internal cohesion of fluids and the adhesion to surfaces. It varies with measuring conditions, primarily separation velocity, splitting area, force applied, film thickness and temperature. Tack also varies with changes in other rheological properties of the fluid as a result of time and interactions with the separating surfaces.

This document refers to tack measurement of paste inks and their vehicles only, not involving fountain solution. During offset printing, the ink on a press may contain fountain solution and form an emulsion. The amount of fountain solution within the ink partly depends on the composition of both the ink and the fountain solution, the forces present, and the relative position of the ink in the roller train. The tack of an emulsion partly depends on the composition of both the ink and the fountain solution and the ratio of ink and fountain solution.

The tack value is a well-established criterion for assessing a paste ink or vehicle, although the parameter tack is poorly defined. The tack cannot be regarded as a material property that can be derived from basic physical phenomena. However, the tack influences the behaviour of ink in a printing press.

Parameters that affect tack include:

— dimensions, hardness and elasticity parameters of elastomeric rollers;

— surface properties of rollers;

— nip pressure;

— roller speed;

— temperature of rollers and environment;

— temperature of the sample;

— ink film thickness;

— influence of the ink or vehicle on the properties of the elastomeric coverage of the rollers (e.g. absorption of solvents);

— condition of the elastomeric rollers due to the cleaning process;

— condition of the elastomeric rollers due to long-term use;

— properties of the test sample.

The tack of printing inks and vehicles influences their transfer properties, as manifested by throughput in roll milling, picking of paper during printing and wet trapping in multicolour printing. Although a tack measurement does not completely predict the transfer performance of an ink or a vehicle, it provides a meaningful parameter for quality control, development and research.

Parameters that are affected by tack include:

— pick;

— ink trap;

— mottle.

Respecting all differences, this document specifies a method that allows users of comparable equipment to obtain comparable results when working under the same conditions.

The previous version of this document referred mainly to the manufacturers' recommendations for test method specifications such as speed, ink film thickness and temperature. As a result, there was a huge increase in the number of small differences according to user, region, instrument, etc. This new revision standardizes the settings across two platforms, Geometry A and Geometry B, for the purpose of communication. Individual users can still use the familiar settings for internal use. If the deviating settings are used for external communication, the deviation has to be described in the communication.

Mechanical instruments have been excluded from this document.

In this method, a procedure has been added to perform a periodic test with reference material to check deterioration of the materials used, such as rubbers and inks.

Graphic technology — Determination of tack of paste inks and vehicles by a rotary tackmeter

1 Scope

This document specifies the test procedure for determining the tack value of neat paste inks and vehicles which have low volatility and are unreactive under normal room conditions during the timespan required for testing.

This document contains a basic description of Inkometer®[1] and Inkomat®[2] (Geometry A) and TackOscope®[3] and TackTester®[4] (Geometry B).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
breaking-in
<roller conditioning> preparation process for new rollers where these are running in an (or another) ink system to condition the *elastomer* (3.10) until constant readings are achieved

3.2
central roller
temperature controlled metallic roller used in a three-roller tack tester for ink distribution and as ink transfer roller to the *measuring roller* (3.7)

3.3
distribution roller
elastomer covered roller used in a three-roller tack tester for ink distribution over the *central roller* (3.2)

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1) Inkometer® is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

2) Inkomat® is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

3) TackOscope® is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

4) TackTester® is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

3.4
flying
ink fly
tendency of a printing *ink* (3.5) or vehicle to be ejected as large globules from a roller distribution system

Note 1 to entry: Flying is generally most severe during rapid roller acceleration, which occurs when switching immediately from zero (or a slow speed) to a high-operating speed. After some time of running, no more flying appears and the ejected droplets become a mist and eventually, an aerosol.

3.5
ink
fluid to be tested under the conditions of this document

Note 1 to entry: This can be a commercial printing ink, a modified ink for the purpose of the test, a vehicle, a varnish or other materials which create a tack reading under the conditions as specified in this document.

3.6
ink system
range of *inks* (3.5) which are comparable with regard to varnish system and liquid base

Note 1 to entry: For paste inks, there are, e.g. oxidative/setting and UV curing systems. Different ink systems generally require the use of different elastomer materials to avoid interaction of inks and elastomeric materials on short and long term.

3.7
measuring roller
elastomer covered roller used in a three-roller tack tester connected to the measuring device of the tack tester

3.8
misting
tendency of a printing ink or vehicle to be ejected as fine droplets from a roller distribution system

Note 1 to entry: Misting is generally most severe at high operating speeds and with fluids that produce long filaments. After a longer running time, the mist becomes so fine that it creates an aerosol.

3.9
reference material
liquid with well-known tack properties, used to execute a reference test on a regular basis or for comparative testing

Note 1 to entry: *Inks* (3.5) and *rubbers* (3.10) change properties in time. To prevent jumps in results between current and new materials, they should be tested at least once together.

Note 2 to entry: A distinction can be made between reference material, as material with well-known and publicly available specifications and control material which is kept for comparison only and for which the absolute values do not have to be known.

3.10
rubber
elastomer
elastic material covering the *distribution* (3.3) and the *measuring rollers* (3.7)

Note 1 to entry: In practice, some elastomers are rubber and some may be produced from polymeric materials. In common use, the word rubber is used for both.

3.11
tack
restoring force between two rotating rollers of a given width caused by the splitting of an *ink* (3.5) or vehicle film on rapidly separating roller surfaces

Note 1 to entry: Tack is a property indicative of internal cohesion of the fluid. It is not a fixed number but varies with operating conditions, primarily separation velocity, splitting area, force applied by the measuring roller and film thickness. Tack also varies with changes in other rheological properties of the ink or vehicle as a result of time, temperature and interactions with the separating surfaces. Different manufacturers' tackmeters may use different tack scales.

3.12
tackmeter squeal
high-pitched whine or squeal noted when running high tack fluids or at high rotating speeds or both

Note 1 to entry: A squeal usually results in unstable readings or in unreliable/wrong values. If readings are taken where squeal occurs, this has to be recorded in the report.

4 Apparatus

4.1 Applicability

This document describes the method as used on the models of the current testers. Most of the described procedures will also be applicable in analogy to older models but may require additional steps to be executed or recalculation of settings to bring them into conformance with this document. It is important to contact the supplier to confirm compliance with this document before using devices of (very) old age or of non-standard construction. The mechanical instruments have been excluded from this document. This document is based on the content of ASTM D4361.

4.2 Tackmeter

An electrically driven device to generate a uniform ink film with well-known thickness over the surface of all three rollers to be used to measure splitting forces (tack) of fluids. It shall consist of:

— a metallic central roller which is electrically driven with a constant, adjustable speed; the speed can be expressed in m/min or in revolutions per minute. The central roller shall be temperature controlled with an accuracy of ±0,1 °C;

— an elastomer covered distribution roller which shall oscillate during the ink distribution and may oscillate during the measurement phase of the tack measurement;

— an elastomer covered measuring roller;

— a force sensor capable to measure the force induced by the ink on the roller system in at least three relevant digits;

— a tack reading mechanism by means of a display, computer, printer, recorder or a combination thereof;

— a calibration device for the specific tackmeter.

The ink distributing surface area A of the rollers shall be known to the nearest 0,1 cm^2.

The distributing surface area A is calculated as shown in Formula (1):

$$A = \sum_{1}^{n} (\pi \times d_n \times l_n) \quad (1)$$

where

d_n is the diameter of roller number (n);

l_n is the effective (ink containing) length of roller number (n);

n is the number of rollers.

4.3 Central roller

Metallic roller with an internal temperature conditioning system with a diameter as specified in Annex B for either Geometry A or Geometry B.

4.4 Distribution roller

An elastomer covered roller, with a specified weight and diameter as specified in Annex B for either Geometry A or Geometry B and a width of the measuring roller plus more than twice the oscillation distance as specified in the instruments datasheet. The hardness of the covering shall be in conformance with Annex B. Different rollers for conventional or energy-curing applications shall be used. The roller shall be broken-in according to Annex C.

Elastomers deteriorate with use and time; the device shall therefore be positioned in a location with no direct sunlight. The elastomer-covered rollers shall be covered by an opaque cover when not in use and shall be replaced before deterioration starts to influence the results.

Depending on the solvent used and the cleaning procedure, the surface of the roller may sooner or later become glazed. In this case, the roller has to be cleaned carefully with a suitable solvent or has to be replaced because of the ink transfer or ink distribution and, with these, the tack will be considerably affected.

Deterioration might be recognized by cracks, glazing, changing hardness, the increase of distribution time, uneven ink distribution or inability to zero the instrument. Replace the roller no later than three years after its first use.

4.5 Measuring roller

An elastomer covered roller with a diameter as specified in Annex B and a width in correspondence with the width of the central roller as specified in Annex B. It shall have a hardness of the covering in conformance with Annex B. Different rollers for conventional or energy curing applications shall be used. The roller shall be broken-in according to Annex C.

Elastomers deteriorate with use and time; the device shall therefore be positioned in a location with no direct sunlight. The elastomer-covered rollers shall be covered by an opaque cover when not in use and shall be replaced before deterioration starts to influence the results.

Depending on the solvent used and the used cleaning procedure, the surface of the roller may sooner or later get glazed. In this case, the roller has to be cleaned carefully with a suitable solvent or has to be replaced because of the ink transfer or ink distribution and with these, the tack will be considerably affected.

Deterioration might be recognized by cracks, glazing, changing hardness, the increase of distribution time, uneven ink distribution or inability to zero the instrument. Replace the roller no later than three years after its first use.

4.6 Ink pipette

An ink pipette for applying an accurate quantity of ink to the distribution roller, with a resolution of at least 0,01 ml, but preferably 0,001 ml.

The ink application may vary from operator to operator. For that, it is recommended to verify the applied amount of ink from the ink pipette on a regular basis for very high accuracy.

4.7 Additional materials and devices

4.7.1 Cleaning aids

Lint-free rags or soft tissues.

It is practical to use white or light-tinted materials to be able to see if there is still ink coming off from the cleaned roller.

4.7.2 Solvents

In accordance to the ink and the elastomeric materials used, e.g.:

— for conventional inks, petroleum ether with a boiling range of 80 °C to 140 °C and a Kauri-Butanol value of 30 to 40 and less than 1 % benzene content, white spirit;

— for UV inks ethyl alcohol, iso-propylalcohol or ethylacetate or other suitable solvents.

NOTE 1 The supplier can be contacted for information concerning the correct solvents to prevent damage which will result in differences in ink transfer.

Cleaning liquids containing surfactants or non-volatile components shall not be used or a second solvent shall be used to remove the residue.

NOTE 2 The majority of the standard cleaning solvents for rubber blankets for printing presses contain preservatives or surfactants for the blanket which evaporate very slowly, if at all. Evaporation times may be over 1 h which makes these unsuitable for the purpose of these tests.

NOTE 3 It has to be recognized that the same cleaning solvents are sold in different countries under different brand names and that solvents with the same name may have different ingredients in different countries.

The test results depend on the dryness and cleanliness of all the rollers. The drying time of a roller after cleaning, depends on the evaporation rate and on the penetration of the solvent into the surface of the roller. Never let an ink or a vehicle dry completely on the rollers of the tackmeter. Take care not to damage the rollers during the cleaning process or by leaving them in contact when they are not rotating.

4.7.3 Timer

A timer or stopwatch with an accuracy of 1 s.

4.7.4 Temperature control system

An integrated or external system to control the temperature of the roller system. The system shall be able to control the temperature of the rollers to within ±0,1 °C of the set temperature.

Due to the internal friction of the ink on the roller system, the system also generates heat by itself, so the system shall be able to heat or chill the roller.