
**Imaging materials — Processed films —
Method for determining lubrication**

*Matériaux pour l'image — Films traités — Méthode de détermination de la
lubrification*

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 18904 was prepared by Technical Committee ISO/TC 42, *Photography*.

This first edition cancels and replaces ISO 5769:1984, of which it constitutes a minor revision.

This International Standard is one of a series of standards dealing with the physical properties and stability of imaging materials. To facilitate identification of these International Standards they are assigned a number within the block from 18900 — 18999 (see annex A).

Annexes A and B of this International Standard are for information only.

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Introduction

The advantages of post-process lubrication of photographic film have been known for several decades and there have been numerous technical publications on this subject. Lubrication has a beneficial effect in reducing film susceptibility to abrasion (see [1] in the bibliography). This is of importance in microfilm applications (see [2] in the bibliography) or whenever moving film is forced against stationary surfaces. Lubrication of motion-picture release prints, for example, prevents sticking and premature perforation breakdown during projection or viewing (see [3] and [4] in the bibliography). More recently, the advent of sprocketless projectors with higher gate tensions has intensified the need for lubrication.

Since lubrication is an additional step for processing laboratories, processed films are frequently left unlubricated, either intentionally or inadvertently. As a result, films may be irreparably damaged when in use. Abrasion damage of microfilm and projection or viewing failure of motion-picture films has been linked directly to the absence of any lubricant. Until recently, the detection of lubricant on films has been very difficult.

This International Standard specifies a non-destructive test method for determining, by measurement of a frictional property, whether or not any lubricant exists on films. The test can even be applied to very small areas of film, such as the margin between the edge of a super 8 film and its perforations. The emulsion and support sides of the film can be tested separately.

The test method is proposed as a means of monitoring the application of lubricant to film by measuring one of many possible friction coefficients. It does not completely characterize the friction properties of a material. Against stationary equipment, for example, a film may not have the same friction coefficient as measured in the friction test described in this International Standard. Likewise, it will not evaluate the effectiveness of a lubricant for any given application. It is strongly recommended that its use be limited to the detection of lubricant, for which purpose it is well suited.

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1 Scope

This International Standard specifies a method of determining the presence of a lubricant on photographic film. It is intended that the test should be applied to film after processing, but the test may be used in other situations. It is applicable to both the emulsion and support sides of the film.

The results of the test are calculated in terms of a coefficient of friction, but the test does not purport to characterize the frictional characteristics of the film material.

2 Principle

The test is based on the classical inclined-plane friction test. It gives the angle of inclination of the film surface at which a rider, bearing on the film surface through the round end of a common paper clip under a relatively high contract pressure (see [5] in the bibliography), will slide downwards along the film. The tangent of this angle represents a coefficient of friction between the film and the paper clip. Values of this coefficient of friction give an indication of when the lubricant is adequate or inadequate.

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3 Apparatus

3.1 Friction slider

This consists of an inverted U-shaped structure with the larger round end of a common steel paper clip (see annex B) projecting downward from the inside centre (see Figure 1). The centre of gravity shall be at least 25 mm below the lower end of the paper clip. The mass should be between 50 g and 100 g, to have sufficient mass yet avoid film damage.

To construct the friction slider, cut off the smaller round end of the paper clip and insert the resulting cut ends of the clip into holes drilled in the U-shaped structure. The diameter of the drilled holes should allow a push-fit to be obtained.

The choice of materials for the friction slider is not critical, provided that it permits compliance with the constraints stated above. Acrylic plastic has been found to be suitable.

The slider shall be marked to differentiate between the two faces.

After much use, a paper clip will become flat from wear. This will have a tendency to produce lower readings, particularly at high friction levels. The side of the slider which is marked should always be oriented in one direction during use. An occasional comparison of values obtained by reversing the direction of the slider face will provide a reference to determine when the paper clip is worn. It should then be replaced.

3.2 Test rig

The dimensions and typical construction of the test rig, on which the film sample is mounted for testing, are shown in Figure 2. Essential requirements are as follows.

- The surface of the inclined plane shall be smooth, hard, and not deformable under the test conditions.
- It shall be narrow and high enough to accommodate the legs of the slider and be provided with clips at each end to hold the film flat. The clips shall have rounded edges and smooth undersides to avoid damage to the film. The pressure exerted by the clips shall be not greater than that required to secure the film.
- It shall be capable of being raised and lowered with a minimum of resistance, and there shall be a means provided to clamp the plane firmly at the desired angle.
- The equipment shall be calibrated to read in terms of the tangent of the angle of inclination in units of 0,05 up to a value of at least 0,50. This equates mathematically to a coefficient of friction.
- Any suitable material may be used to construct the inclined plane. Acrylic plastic has been found to be suitable.

4 Sample preparation

The dimensions of samples are not critical, provided that the sample may be held firmly by means of the securing clips and not impede the movement of the friction slider. Samples should be about 150 mm in length and from several millimetres to 35 mm in width. Roll-film samples need not be detached from the balance of the roll.

Care should be exercised not to contaminate the test area with substances that have a lubricating effect, for example, grease from finger marks, residues from cotton gloves, etc. For this reason, the outermost convolutions of roll films shall not be used as the test sample.

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5 Test conditions

The standard relative humidity for testing shall be between 30 % and 55 %. These tolerances are acceptable since the paper clip friction coefficient is not sensitive to humidity in this range.

The standard temperature for testing shall be $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

Samples shall be conditioned at the test conditions prior to testing. Since this test involves a surface property, a relatively short conditioning time of 2 h is sufficient.

6 Procedure

Place the test rig (3.2) on a stable, smooth, horizontal surface. Confirm that the base of the test rig is level and adjust it if necessary.

NOTE Use may be made of a spirit level. Alternatively, the apparatus may be checked by obtaining a measurement on one film sample, then turning the apparatus through 180° and repeating the test. If the two results do not agree to within 10 %, the apparatus is not horizontal.

Secure the film sample in place on the inclined plane by means of the clips.

Raise the plane to any arbitrary angle. (Using the models detailed in Figures 1 and 2 and illustrated in Figure 3, this might best be done by the left thumb and forefinger while holding the base down with the other hand.)

Place the friction slider (3.1) on the film with a slight sliding motion. It is essential that the operator be prepared to grasp it again quickly at the end of its travel in case it slides rapidly. It is very important that some sliding motion be imparted at the start of each individual trial. Experience with lubricated and unlubricated film in this procedure will provide the operator with a facility for this requirement. If it continues to slide, lower the plane slightly and repeat the test. If it does not slide freely, raise the plane slightly and repeat the test. Repeat this operation until a minimum angle is found to the precision desired, at which point the slider will just sustain the initial motion imparted to it. Read the tangent of this angle from a scale attached to the inclined plane. This is the paper-clip friction coefficient.

Repeat the procedure twice more on different areas of the same sample. Calculate the arithmetic average of the three determinations.

7 Test report

7.1 Test data

The following values shall be recorded:

- name and number of the film sample;
- film type;
- average friction coefficient of the emulsion side and of the support side of the film;
- an indication as to whether measurements were made in the picture area or at the film edges;
- number of samples tested;
- temperature and relative humidity of the test.

7.2 Interpretation of results

Totally unlubricated film will generally produce values in excess of 0,40. Striking exceptions to this generalization will be found on the emulsion side of certain films, principally colour films that have an inherently low coefficient of friction even when not lubricated after processing. For this reason, the support side is a more reliable indicator of post-process lubrication.

Experience has shown that effective lubricants, well applied, will generally produce values of 0,15 or less. However, the presence of lubrication can only be determined with certainty if the paper-clip friction coefficient of an unlubricated sample is known.

The effectiveness of a lubrication treatment for any particular application cannot be predicted by the paper-clip friction coefficient.

7.3 Repeatability

With careful operation, the precision attainable is generally within 10 % of the measured value for any given tester and operator.