
**Imaging materials — Protocols for outdoor
weathering experiments**

*Matériaux pour l'image — Protocoles pour expériences de temps en
extérieur*

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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.

The main task of technical committees is to prepare International Standards. 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 seventy-five percent of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

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

ISO/TR 18930 was prepared by Technical Committee ISO/TC 42, *Photography*.

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Introduction

A new application for imaging materials is opening up with the appearance of water and light-resistant ink-jet inks and substrates. This is the outdoor market, with signage being the predominant use.

Materials need to survive typical climate conditions for several years in order to be effective in this market. To test this requirement, it is common to send materials to an outdoor weathering site or to simulate outdoor conditions with an appropriate "weatherometer." Outdoor testing sites, known to this committee at the time of publication, are listed in annex A.

Recommendations in this Technical Report are based on the outdoor weathering experiences of the members of the committee that prepared this document. The report does not attempt to standardize procedures, such as that for washing the specimens. Although this is an important factor and different washing procedures may cause different results, this sort of decision is best left to the experimenter. It should be stressed that procedures such as washing are listed in clause 8 on data reporting and should be reported in significant detail.

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Imaging materials — Protocols for outdoor weathering experiments

1 Scope

This Technical Report discusses a recommended way to prepare and submit specimens for outdoor weathering testing in a variety of locations and covers issues of durability to weather, temperature and environmental influences.

This Technical Report describes the pertinent information to request from the testing service, how to instruct the testing service in the appropriate placement of the test specimens, and lists the type of information to report upon completion of a weathering test.

This Technical Report does not discuss what to measure or how to make the measurement as these are best left to the discretion of the experimenter.

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2 References

ASTM G 7-97, *Standard Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials*¹⁾

ASTM G 90-98, *Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight*¹⁾

ISO 291:1997, *Plastics — Standard atmospheres for conditioning and testing*²⁾

ISO 10977:1993, *Photography — Processed photographic colour films and paper prints — Methods for measuring image stability*²⁾

3 Terms and definitions

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

3.1 encapsulation

sealing of all edges of a specimen that has been laminated on both front and back surfaces

NOTE This process is usually done by laminating with sheets that are larger in dimension than the specimen and then sealing at the overlaps.

1) Available from the American Society for Testing and Materials, 100 Barr Harbor Drive, W. Conshohocken, PA 19428-2959, USA.

2) For electronic copies of these standards, visit the ANSI Electronic Standards Store (ESS) at www.ansi.org. For printed versions of all these standards, contact Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112-5704, USA. Tel: (800) 854-7179.

3.2

laminate

layer of material that goes over the top or bottom of a specimen

NOTE The material is usually water resistant in order to provide physical and/or ultraviolet (UV) light protection of the specimen during a weathering test.

3.3

outdoor weathering

actual placement of specimens outdoors in specific locations, often those of climatic extremes

NOTE This is differentiated from simulated weathering where instruments (weatherometers) are used to obtain very controlled conditions that simulate, to some degree, outdoor weathering results. Use of such instruments is described in ISO 10977.

3.4

reciprocity law failure

non-equivalence in weathering results between a long exposure/low-intensity experiment and its counterpart with an equivalent intensity-time product where exposure time is short and intensity is high

3.5

total UV radiation

radiation in the range from 295 nm to 385 nm integrated over the duration of a test

NOTE This quantity is usually fairly consistent from year to year in a given location and is usually expressed as MJ/m².

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4 Specimen preparation

4.1 General

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Perhaps the most important requirement is that the material be readily adaptable to the outdoor environment. The semi-tropics are hot and humid. The high desert is hot and dry with a very high ultraviolet radiation content. Other outdoor environments can be high in environmental pollutants, including ozone, sulfur dioxide, hydrogen sulfide, hydrogen peroxide, nitrogen oxides, particulates, or salt spray (oceanside locations).

4.2 Size and mounting of specimens

Several sites have pre-built racks in which to install the specimens. It should be determined if the specimens need to be mounted on an additional substrate in order to fit rack size requirements. For example, one testing service uses racks in which one dimension of the specimen must be 30,5 cm.

When fastening images to plastic, care should be given to the nature of the fasteners. Metal staples may hold up well in the high desert, but they rust very quickly in semi-tropical locations and are thus not suitable in this environment. Alternatives would be sewing the specimens to the plastic or fastening with plastic button fasteners.

If the method of fastening is the same as that in actual use, it might be important to note failures such as cracks and tears in the material around the fastening points.

4.3 Number of specimens

The number of specimens for each exposure stage should be determined on the basis of the purpose of the weathering tests and the consistency of the test results in physical measurements.

Because of the variability inherent in any outdoor test, use of duplicate specimens is strongly suggested. Repositioning of specimens during an exposure test will always improve variability.

If more than one specimen is placed on a panel, the panel should be periodically rotated to randomize the effects of water that collects at the bottom of the panel.

4.4 Virgin specimens

In order to compare exposed specimens to unexposed specimens, virgin specimens should be prepared at the same time and should be preserved in the standard condition prescribed by ISO 291.

4.5 Identification of specimens

Identification exposed in the actual specimen may fade during weathering. Therefore, it is necessary to identify specimens in such a way that the identification will not become unusable when the specimens fade.

Certain marking inks can spread, especially under very humid conditions, and, in time, become unreadable. Another problem with inks is that they can bleed through the back of the specimen and possibly affect the image.

Typing information onto gummed labels and placing these labels on the back of the specimens is acceptable for opaque materials. Solvent migration may cause specimen damage. With label applications, care should be taken with regard to solvents found in the adhesive.

Codes punched into the actual specimen may be necessary for translucent or transparent materials, since a label on the back surface would change the pattern of light transmission through the specimen.

5 Simulation of use conditions

5.1 General

Considerable thought should be given to the way in which the specimens will actually be used in the trade. Of particular importance are the backing materials.

5.2 Billboards

If an imaging material is to be used as a billboard, it might be advisable to have the specimen mounted perpendicular to the ground and backed by plywood. However, 90° mounting has the disadvantage that it is very sensitive to the angle of the sun. A winter test (with the sun more nearly perpendicular to the specimen) might give different results than a summer test when the sun will be higher in the sky. However, when this variation in sun angle is part of the actual use of the product, this is the proper test to run, especially over a long duration.

5.3 Other applications

For applications other than billboard use, care should also be taken to choose the appropriate backing material. The darker the backing material, the warmer the specimens will be during daylight hours. For most non-billboard uses, clear polyester sheeting is a suitable backing material. In no case should the backing interfere with specimen weathering.

5.4 Laminates and encapsulation

Another important consideration is the type of laminates and method of application. If the material is on a paper base, it probably needs to be laminated for protection of the paper support and any water-soluble coated materials. Also, gelatin-containing materials do not hold up well without lamination.

A product intended for outdoor use without lamination should be tested without lamination.

Different fading results can occur between simple lamination, where the edges of the material are not sealed, and encapsulation, where a tight seal is effected all around the specimen. For encapsulated specimens, staple holes, etc., should not pierce the capsule, but should be made outside the sealed edges. On some products, a single staple hole can have the same effect on an encapsulated specimen as cutting off the overlapping laminate and thus destroying the capsule.

Care should be taken that hot laminates do not destroy the integrity of the specimen.