
Imaging materials — Evaluation of image permanence of photographic colour prints in consumer home applications

*Support d'image — Évaluation de la permanence de l'image de
tirages couleur photographiques dans les applications domestiques
grand public*



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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 42, *Photography*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Reflection colour photographic-indoor stability specifications for consumer home have been discussed (Physical properties and image permanence of photographic materials). Many matters have been discussed about environmental data, psychophysically based end of test, nominal use case conditions, and mechanics of rating system, reciprocity issues, and experimental testing issues in the meetings.

This document describes cumulated information, data and knowledge work over the last 15 years as 'Guidelines for print-life-estimations'. Furthermore, it describes the background and the history of the discussion in TC 42/WG 5.

The purpose of this document provides data, information, and indicating the guidelines for evaluation of image permanence. These data and information were introduced and discussed and were quoted from the papers reported in conferences by TC 42/WG 5 members. Furthermore, detailed information and understanding are available in the references listed in the Bibliography in this paper.

It describes four important environmental stressors (heat, light, atmospheric pollutants, and humidity) in main body of this document. Ozone was chosen as the model system for atmospheric pollutant, but SO_x, NO_x and other atmospheric pollutants are present in the indoor environment. In addition, it includes an [Annex A](#) about accidental stressor (water, abrasion and others), examples of many topics and useful data collections and information.

Information about the stability of colour photographs toward these various factors can be obtained by accelerated stability tests. The starting assumption for indoor use cases is that the various environmental factors (heat, light, atmospheric pollutants, and humidity) each act independently on the photograph, i.e., there are no synergistic interactions taking place between these factors under typical storage and display conditions. While interactions most certainly do take place in the real world, modelling and testing for interactions is extremely difficult. The accelerated tests are therefore designed such that only one factor (heat, light, atmospheric pollutants and humidity) is varied at a time. The other factors not under investigation are controlled or held at a level that will induce only negligible changes in the image during the course of the accelerated test.

In accelerated testing, high levels or "loads" are required for each of the factors in test in order to complete the tests in a reasonable amount of time. The validity of accelerated testing for light and pollutants assumes that equal change will occur for the same cumulative exposure, i.e., one assumes reciprocity for the dose. However, for some systems "reciprocity failure" has been observed. When applied to light-induced fading and staining of colour images, reciprocity failure refers to the failure of many colorants to fade, or to form stain, equally when irradiated with high-intensity versus low-intensity light, even though the total light exposure (intensity × time) is kept constant through appropriate adjustments in exposure duration. This concept can be applied to any accelerated test where the same cumulative exposure can be obtained by different intensities or concentrations and time. Note, however, that this concept cannot be applied to accelerate testing for heat or humidity where special test procedures are required. This concept does hold for ozone stability testing, where the ozone concentration can be high or low. The extent of colorant fading, colorant migration, and stain formation can be greater or smaller under accelerated conditions, depending on the chemical reactions involved in the colorant degradation, on the kind of colorant dispersion, on the nature of the binder material, and on other variables. For example, the supply of oxygen that can diffuse into a photograph's image-containing layers from the surrounding atmosphere may be restricted in an accelerated test (dry gelatine, for example, is an oxygen barrier). This may change the rate of colorant fading relative to the fading that would occur under normal display conditions. The magnitude of reciprocity failure may also be influenced by the temperature and moisture content of the test specimen. Comparisons between products will more accurately reflect observed differences when accelerated aging conditions are close to actual use conditions.

The following International Standards describe test methods relating to indoor stability. These Standards provide procedures for reporting technical data.

A test method for thermal stability is described in ISO 18936. A test method for humidity fastness is described in ISO 18946. A test method for indoor light stability is described in ISO 18937. A test method

for ozone gas fading stability is described in ISO 18941. A test method for stability under low humidity conditions in ISO 18949.

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Imaging materials — Evaluation of image permanence of photographic colour prints in consumer home applications

1 Scope

This document provides data and information related to evaluation of image permanence of photographic colour prints in consumer home applications. This document characterizes the test methods, the end of test criteria, the environmental factors, and the reporting. It also provides the background and the history of those.

This document describes guidelines and limitations for print life estimates, i.e. translation of the test results to the performance in actual usage as well as limitations of such a translation.

The photographic colour prints printed digitally described in this document can be generated with dyes or pigments by several processes, including ink jet, chromogenic (silver halide), thermal dye transfer processes, and electro photography, excluding lithographic printing, screen printing and other non-digital printing.

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 18913, *Imaging materials — Permanence — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18913 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

test load

cumulative dose, which is the product of a stress level and exposure time

3.2

specimen aim temperature

controlled aim value temperature of the specimen by configuring the light exposure equipment

4 Overview

4.1 General

This document describes approaches for the evaluation of image permanence of photographic colour prints in consumer home applications. The use profile “consumer home” is defined with two sub-cases i) display and ii) storage. In addition, variants of the use profile due to “partial protection” are introduced.