SVENSK STANDARD
SS-EN ISO 11699-1:2011

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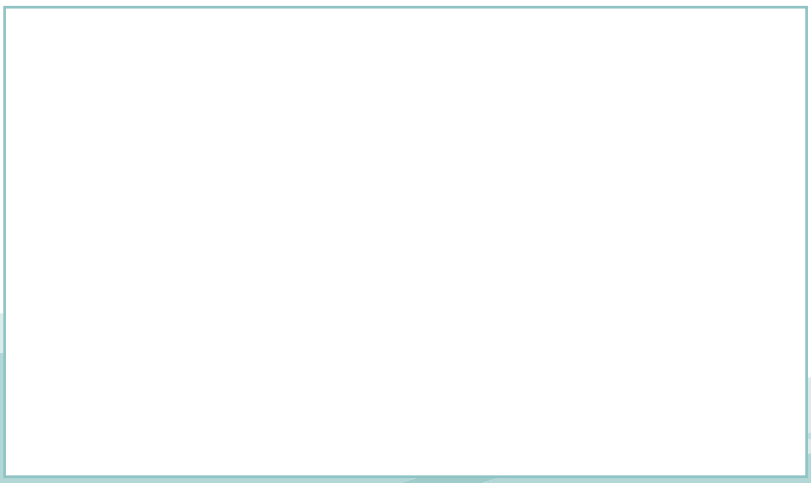
Oförstörande provning – Röntgenfilm för användning i industrin –
Del 1: Klassificering av filmsystem (ISO 11699-1:2008)

Non-destructive testing – Industrial radiographic film –
Part 1: Classification of film systems for industrial radiography (ISO 11699-1:2008)



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Europastandarden EN ISO 11699-1:2011 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN ISO 11699-1:2011.

Denna standard ersätter SS-EN 584-1:2006, utgåva 2.

The European Standard EN ISO 11699-1:2011 has the status of a Swedish Standard. This document contains the official version of EN ISO 11699-1:2011.

This standard supersedes the Swedish Standard SS-EN 584-1:2006, edition 2.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS Förlag AB som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS Förlag AB, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Oförstörande provning, SIS/TK 125.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 11699-1

October 2011

ICS 37.040.25

Supersedes EN 584-1:2006

English Version

Non-destructive testing - Industrial radiographic film - Part 1: Classification of film systems for industrial radiography (ISO 11699-1:2008)

Essais non destructifs - Film pour radiographie industrielle - Partie 1: Classification des systèmes films pour radiographie industrielle (ISO 11699-1:2008)

Zerstörungsfreie Prüfung - Industrielle Filme für die Durchstrahlungsprüfung - Teil 1: Klassifizierung von Filmsystemen für die industrielle Durchstrahlungsprüfung (ISO 11699-1:2008)

This European Standard was approved by CEN on 25 September 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN ISO 11699-1:2011: E

Foreword

The text of ISO 11699-1:2008 has been prepared by Technical Committee ISO/TC 135 “Non-destructive testing” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 11699-1:2011 by Technical Committee CEN/TC 138 “Non-destructive testing” the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2012, and conflicting national standards shall be withdrawn at the latest by April 2012.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 584-1:2006.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 11699-1:2008 has been approved by CEN as a EN ISO 11699-1:2011 without any modification.

Non-destructive testing — Industrial radiographic film —

Part 1:
Classification of film systems for industrial radiography

1 Scope

The purpose of this part of ISO 11699 is to establish the performance of film systems.

This part of ISO 11699 is applicable for the classification of film systems in combination with specified lead screens for industrial radiography (non-destructive testing). This part of ISO 11699 is intended to ensure that the image quality of radiographs — as far as this is influenced by the film system — is in conformity with the requirements of International Standards such as ISO 5579, ISO 17636 and EN 12681.

This part of ISO 11699 does not apply to the classification of films used with fluorescent intensifying screens. The measurement of film systems in this part of ISO 11699 is restricted to a selected radiation quality to simplify the procedure. The properties of films will change with radiation energy, but not the ranking of film system quality.

Additional methods for evaluating the photographic process are described in ISO 11699-2, by which the performance of film systems can be controlled under the conditions given in industry.

2 Normative references

The following referenced documents are indispensable for the application 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 11699-2, *Non-destructive testing — Industrial radiographic films — Part 2: Control of film processing by means of reference values*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

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

3.1
film system
combination of film and film processing which is carried out in accordance with the instructions of the film manufacturer and/or the manufacturer of the processing chemicals

3.2
film gradient
G
slope of the characteristic curve of a film at a specified optical density D

3.3
granularity
σ_D
stochastic density fluctuations in the radiograph, superimposed on the image of the object

NOTE The limiting values given in this part of ISO 11699 are related to fixed radiation energies and specified screens.

3.4
characteristic curve
curve showing the relationship between the common logarithm of exposure log K, and the optical density D

3.5
specular density
quantitative measure of film blackening (optical density) when light passing the optics of a microdensitometer transmits the film

3.6
diffuse density
quantitative measure of film blackening (optical density) as determined by a densitometer

NOTE It is the sum of all transmitted and scattered light into the half sphere behind the film.

3.7
signal/noise ratio
⟨industrial radiography⟩ ratio of a local film density to the granularity σ_D at this density level

NOTE It is correlated to the gradient/noise ratio.

3.8
ISO speed
S
reciprocal value of the dose, K_s, expressed in Gy, which results in a specified diffuse optical transmission density $(D - D_0 = 2)$ on the processed film, where D_0 is the fog and base density:

$$S = \frac{1}{K_s} \tag{1}$$

3.9
film system class
classification which takes account of limiting values given in Table 1

3.10
gradient/noise ratio
G/σ_D
ratio of the gradient, G, and the granularity σ_D

NOTE It relates directly to the signal/noise ratio. All further parameters determining the signal, such as the modulation transfer function or the energy of the radiation, are considered to be constant.

4 Sampling and storage

For product specification, it is important that the samples evaluated yield the average results obtained by users. This will require the evaluation of several different batches periodically under conditions specified in this part of ISO 11699. Prior to evaluation, the samples shall be stored in accordance with the manufacturers' recommendations for a length of time, in order to simulate the average age at which the product is normally used. The basic objective in selecting and storing samples as described above is to ensure that the film characteristics are representative of those obtained by a consumer at the time of use.

5 Test method

5.1 Preparation

The film samples shall be exposed to X-rays from tungsten target tubes. Inherent filtration of the tube, together with an additional copper filter located as close to the X-ray tube target as possible, shall provide filtration equivalent to (8,00 ± 0,05) mm of copper. The potential across the X-ray tube shall be adjusted until the half-value-absorption is obtained with (3,5 ± 0,2) mm of copper. A potential of approximately 220 kV generally meets this requirement.

The film system shall include a front and a back screen of 0,02 mm to 0,04 mm lead. If single coated films are used, the emulsion coated surface shall face the X-ray tube. Good film screen contact shall be ensured.

Exercise care to ensure that the film specimen does not contain density variations arising from the exposing equipment (such as non-uniform beam filters or damaged, or defective lead screens) or processing system. During and after exposure, prior to processing, maintain the film specimen at the temperature of (23 ± 5) °C and relative humidity of (50 ± 20) %. The film processing chemicals and procedures shall be the same for determining gradient and granularity, and they shall be used and described completely as specified.

Use manufacturer certified film test strips in accordance with ISO 11699-2 to test the specified developer system with the specified immersion time and developer temperature. The speed index S_x shall be within ± 5 % of the manufacturer's certificate. The developer temperature may differ by ± 1 °C from the certified value to adjust S_x within ± 5 % of the manufacturer certificate value. The obtained S_x and used developer temperature shall be documented in the test report. This test shall be done, on a daily basis, before and after the development of the exposed films for classification with the same developer temperature and immersion time.

If a manufacturer certificate is not available, film test strips shall be manufactured and calibrated in accordance with ISO 11699-2 by the user.

5.2 Measurement of gradient G

Gradient G relates to a D versus $\log_{10} K$ curve. Within the scope of this part of ISO 11699, G is calculated from the slope $\frac{\mathrm{d}D}{\mathrm{d}K}$ of a D versus K curve at density $(D - D_0)$, i.e.

$$G = \frac{\mathrm{d}D}{\mathrm{d}\log_{10} K} = \frac{K}{\log_{10} \mathrm{e}} \cdot \frac{\mathrm{d}D}{\mathrm{d}K} \tag{2}$$

where

K is the measured dose, expressed in Gy, required for density $(D - D_0)$;

D_0 is the measured optical density of an unexposed and processed film including base (fog and base density).

The D versus K curve is approximated by a polynomial of third order. To obtain a reliable curve, a series of exposures are made with the same film sample to obtain at least 12 uniformly distributed measuring points covering at least density 1,0 and 4,5 above D_0. The polynomial approximation shall include all measured values between 1,0 and 4,5. For the numerical approximation (fit procedure) no zero value shall be included. At least six gradient measurements shall be made on different film samples to determine the mean gradient value G. The densitometer used shall be calibrated regularly up to a diffuse density of $D \geqslant 4{,}8$. For the calibration, a certified film step tablet shall be used. This shall be generated from double sided X-ray film of C3 class or higher (C1 or C2).

NOTE Densitometers can have limited accuracy for measurements at $D > 4$ and need careful calibration correction in the full range. Small deviations of the density values at $D > 4$ have considerable influence on the accuracy of the value of G at $(D - D_0 = 4)$ due to the properties of the polynomial approximation procedure.