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Plastics - Determination of resistance to environmental stress cracking (ESC) - Part 1:
General guidance (ISO 22088-1:2006)

Kunststoffe - Bestimmung der Beständigkeit gegen umgebungsbedingte
Spannungsrisssbildung (ESC) - Teil 1: Allgemeine Anleitung (ISO 22088-1:2006)

Plastiques - Détermination de la fissuration sous contrainte dans un environnement
donné (ESC) - Partie 1: Lignes directrices générales (ISO 22088-1:2006)

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ICS 83.080.01

English Version

Plastics - Determination of resistance to environmental stress
cracking (ESC) - Part 1: General guidance (ISO 22088-1:2006)

Plastiques - Détermination de la fissuration sous contrainte
dans un environnement donné (ESC) - Partie 1: Lignes
directrices générales (ISO 22088-1:2006)

Kunststoffe - Bestimmung der Beständigkeit gegen
umgebungsbedingte Spannungsrissbildung (ESC) - Teil 1:
Allgemeine Anleitung (ISO 22088-1:2006)

This European Standard was approved by CEN on 21 July 2006.

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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 Central Secretariat has the same status as the official versions.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN ISO 22088-1:2006) has been prepared by Technical Committee ISO/TC 61 "Plastics" in collaboration with Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

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of an identical text or by endorsement, at the latest by February 2007, and conflicting national standards shall be withdrawn at the latest by February 2007.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 United Kingdom.

Endorsement notice

The text of ISO 22088-1:2006 has been approved by CEN as EN ISO 22088-1:2006 without any modifications.

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**Plastics — Determination of resistance to
environmental stress cracking (ESC) —**

**Part 1:
General guidance**

*Plastiques — Détermination de la fissuration sous contrainte dans un
environnement donné (ESC) —
Partie 1: Lignes directrices générales*

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 75 % of the member bodies casting a vote.

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.

ISO 22088-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 6, *Ageing, chemical and environmental resistance*.

ISO 22088 consists of the following parts, under the general title *Plastics — Determination of resistance to environmental stress cracking (ESC)*:

- iTeh STANDARD PREVIEW**
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- *Part 1: General guidance* SIST EN ISO 22088-1:2006
 - *Part 2: Constant tensile load method* (replacement of ISO 6252:1992)
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 - *Part 3: Bent strip method* (replacement of ISO 4599:1986)
 - *Part 4: Ball or pin impression method* (replacement of ISO 4600:1992)
 - *Part 5: Constant tensile deformation method* (new test method)
 - *Part 6: Slow strain rate method* (new test method)

Introduction

When a plastic material is stressed or strained in air below its yield point, stress cracking can occur after a period of time, which may be very long. These stresses may be internal or external, or a combination of both. Simultaneous exposure to a chemical environment and stress or strain may result in a dramatic shortening of the time to failure compared to that in an inert environment. The phenomenon is referred to as environmental stress cracking (ESC) and is exhibited by many materials, including plastics. The permissible long-term stress or strain may be reduced considerably by this phenomenon.

It is generally believed that ESC occurs via the following processes:

- 1) Formation of microvoids in specimens by microscopic stress concentrations after applying stress.
- 2) Formation and subsequent growth of macrovoids caused by the breakdown of intermolecular bonds in intervoids that is produced by the action of a chemical environment, and formation of crazes which are composed of interconnected voids and fibrils.
- 3) Growth of the crazes caused by the break-down of the fibrils due to the applied stress and contact with a chemical environment.
- 4) Finally, a crack starts at the tip of the craze, leading to brittle failure.

The cracks may penetrate completely through the thickness of the material, separating it into two or more pieces, or they may be arrested on reaching regions of lower stress or different material morphology.

The determination of ESC is complex because it is influenced by many parameters, including:

- test specimen dimensions;
- test specimen state (orientation, structure, internal stresses);
- specimen preparation;
- thermal history of specimen;
- stress and strain;
- temperature of test;
- duration of test;
- chemical environment;
- method of application of stress and strain;
- failure criterion.

By keeping all but one parameter constant, the relative influence of the variable parameter on ESC can be assessed. The main objective of ESC measurements is to determine the relative effect of chemical media exposure on plastics (test specimens and articles).

The measurements may also be used to evaluate the influence of the moulding conditions upon the quality of an article when the failure mode corresponds to that obtained in actual service.

It is almost impossible, however, to establish any direct correlation between the results of short-duration ESC measurements on test specimens and the actual service behaviour of articles, because the behaviour of the latter is likely to be more complex than that of test specimens.