



**NSAI**  
Standards

Irish Standard  
I.S. EN 3987:2009

# Aerospace series - Test methods for metallic materials - Constant amplitude force-controlled high cycle fatigue test

## I.S. EN 3987:2009

*Incorporating amendments/corrigenda issued since publication:*

<i>This document replaces:</i>	<i>This document is based on:</i> EN 3987:2009	<i>Published:</i> 7 October, 2009
This document was published under the authority of the NSAI and comes into effect on: 10 November, 2009		ICS number: 49.025.01 49.025.05
<b>NSAI</b> 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	<b>Sales:</b> T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		

ICS 49.025.01; 49.025.05

English Version

## Aerospace series - Test methods for metallic materials - Constant amplitude force-controlled high cycle fatigue testing

Série aérospatiale - Méthodes d'essais applicables aux  
matériaux métalliques - Essais de fatigue mégacyclique en  
contrainte imposée

Luft- und Raumfahrt - Prüfverfahren für metallische  
Werkstoffe - Schwerlastwechseleermüdung (HCF) im  
kraftgesteuerten Versuch

This European Standard was approved by CEN on 11 July 2008.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, 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.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

---

<b>Contents</b>		Page
<b>Foreword</b> .....		<b>3</b>
<b>1</b>	<b>Scope</b> .....	<b>4</b>
<b>2</b>	<b>Normative references</b> .....	<b>4</b>
<b>3</b>	<b>Principle</b> .....	<b>4</b>
<b>4</b>	<b>Terms and definitions</b> .....	<b>4</b>
<b>5</b>	<b>Symbols and abbreviations</b> .....	<b>5</b>
<b>6</b>	<b>Test equipment</b> .....	<b>6</b>
<b>7</b>	<b>Test piece</b> .....	<b>10</b>
<b>8</b>	<b>Test method</b> .....	<b>14</b>
<b>9</b>	<b>Post-test checks</b> .....	<b>15</b>
<b>10</b>	<b>Test report</b> .....	<b>16</b>
<b>Annex A (informative) Use of thermocouples</b> .....		<b>17</b>
<b>Annex B (informative) Test piece preparation</b> .....		<b>18</b>
<b>Annex C (informative) Guidelines on test piece handling and degreasing</b> .....		<b>20</b>
<b>Annex D (informative) Guidelines on producing an S-N curve</b> .....		<b>21</b>
<b>Bibliography</b> .....		<b>22</b>

## **Foreword**

This document (EN 3987:2009) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

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 2010, and conflicting national standards shall be withdrawn at the latest by April 2010.

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.

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, 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.

## 1 Scope

This document applies to constant amplitude force-controlled high cycle fatigue (HCF) testing of metallic materials governed by EN Aerospace standards. It defines the mechanical properties that may need to be determined, the equipment, test pieces, methodology of test and presentation of results.

It applies to uniaxially loaded tests carried out on plain or notched test pieces at ambient and elevated temperatures. It is not intended to cover the testing of more complex test pieces, full scale components or structures, although the methodology could well be adopted to provide for such tests.

The purpose of this document is to ensure the compatibility and reproducibility of test results. It does not cover the evaluation or interpretation of results.

## 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.

EN 10002-2:1991, *Metallic materials — Tensile testing — Part 2: Verification of the force measuring system of the tensile testing machine.*

ASTM E 1012, *Standard practice for Verification of test frame and specimen alignment under tensile and compressive axial force application.* <sup>1)</sup>

## 3 Principle

The uniaxially loaded force-controlled high cycle fatigue test consists of maintaining a test piece at a uniform temperature and subjecting it to a constant force-amplitude waveform. The magnitude of the applied cyclic force affects the development of microscopic plastic strain within the test section, thus determining the fatigue life. A series of such tests allows the relationship between the applied force and the number of cycles to failure to be established.

The fatigue lives generated are typically in the range  $10^4$  -  $10^8$  cycles to failure and the test regime is said to be that of high cycle fatigue (HCF).

## 4 Terms and definitions

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

### 4.1

#### **force-control**

used to describe tests in which the force acting on a known test section is controlled

### 4.2

#### **test section**

defined as the region of the test piece between the blending fillets into the gripping section, and may be a continuous radius or a parallel sided section

---

1) Published by: American Society for Testing and Materials (ASTM), 1916 Race Street- Philadelphia PA 19103 USA.

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

- 
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
  - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-