

---

---

**Metallic materials — Uniaxial creep  
testing in tension — Method of test**

*Matériaux métalliques — Essai de fluage uniaxial en traction —  
Méthode d'essai*

**iTeh Standards**  
**(<https://standards.iteh.ai>)**  
**Document Preview**

[ISO 204:2018](#)

<https://standards.iteh.ai/catalog/standards/iso/c06c1a67-e26e-47d9-8de9-7737175767f9/iso-204-2018>



**iTeh Standards**  
**(<https://standards.iteh.ai>)**  
**Document Preview**

ISO 204:2018

<https://standards.iteh.ai/catalog/standards/iso/c06c1a67-e26e-47d9-8de9-7737175767f9/iso-204-2018>



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2018

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Symbols and designations</b> .....	<b>6</b>
<b>5 Principle</b> .....	<b>8</b>
<b>6 Apparatus</b> .....	<b>8</b>
<b>7 Test pieces</b> .....	<b>12</b>
7.1 Shape and dimensions.....	12
7.1.1 Shape and dimension of smooth test pieces.....	12
7.1.2 Shape and dimension of notched test pieces.....	13
7.2 Preparation.....	13
7.3 Determination of the original cross-sectional area.....	14
7.4 Marking of the original gauge length, $L_0$ .....	14
7.5 Determination of the reference length, $L_r$ .....	14
<b>8 Test procedure</b> .....	<b>15</b>
8.1 Heating of the test piece.....	15
8.2 Application of the test force.....	15
8.3 Test interruptions.....	16
8.3.1 Planned interruptions of the test.....	16
8.3.2 Multiple test piece machine with several test pieces in line.....	16
8.3.3 Combined test.....	16
8.3.4 Accidental interruption of the test.....	16
8.4 Recording of temperature and elongation or extension.....	16
8.4.1 Temperature.....	16
8.4.2 Elongation and extension.....	16
8.4.3 Elongation-time diagram or extension-time diagram.....	17
<b>9 Determination of results</b> .....	<b>17</b>
<b>10 Test validity</b> .....	<b>17</b>
<b>11 Accuracy of the results</b> .....	<b>17</b>
11.1 Expression of the results.....	17
11.2 Final uncertainty.....	18
<b>12 Test report</b> .....	<b>18</b>
<b>Annex A (informative) Information concerning drift of thermocouples</b> .....	<b>23</b>
<b>Annex B (informative) Information concerning methods of calibration of thermocouples</b> .....	<b>26</b>
<b>Annex C (normative) Creep testing using test pieces with V or blunt circumferential notches</b> .....	<b>27</b>
<b>Annex D (informative) Method of estimating the uncertainty of the measurement in accordance with the Guide to the expression of uncertainty in measurement (GUM)</b> .....	<b>31</b>
<b>Annex E (informative) Representation of results and extrapolation</b> .....	<b>38</b>
<b>Annex F (informative) Computer compatible representation of standards</b> .....	<b>48</b>
<b>Bibliography</b> .....	<b>49</b>

## 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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 164, *Mechanical testing of metals*, Subcommittee SC 1, *Uniaxial testing*.

This third edition cancels and replaces the second edition (ISO 204:2009), which has been technically revised. The main changes compared to the previous edition are as follows:

- Some of the symbols have been changed to achieve harmonization with the ISO 6892 series.
- For the purpose of this document, the terms “fracture” and “rupture” are interchangeable.
- The term “indicated temperature”,  $T_i$ , has been replaced by “corrected measured temperature”,  $T_c$ , with errors from all sources being taken into account and any systematic errors having been corrected. The terms “elongation” and “extension” have been clarified and aligned with the terms used in the ISO 6892 series. Elongation refers to the test piece deformation measured manually either during deliberate test interruptions or after fracture, whilst extension is determined by continuous measurement using an extensometer.
- Some information relating to the calibration of thermocouples has been transferred from an informative annex into the main body of the document.
- Some changes have been made to [Table 1](#) and formulae have been amended using reference length,  $L_r$ .
- Equation E.1 (now [Formula C.1](#)) has been corrected.
- A new informative annex relating to computer compatible representation of standards has been added.

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](http://www.iso.org/members.html).

## Introduction

Creep is the phenomenon exhibited by materials which slowly deform when subjected to loading at elevated temperature. This document is concerned with the method used to measure such material behaviour.

Annexes are included concerning temperature measurement using thermocouples and their calibration, creep testing test pieces with circumferential V and blunt (Bridgman) notches, estimation of measurement uncertainty, methods of extrapolation of creep rupture life and information about computer compatible representation of standards.

NOTE 1 Information is still sought relating to the influence of off-axis loading or bending on the creep properties of various materials. Based on the future availability of quantitative data, consideration might be given as to whether the maximum amount of bending should be specified and an appropriate calibration procedure be recommended. The decision will need to be based on the availability of quantitative data<sup>[43]</sup>.

NOTE 2 Information concerning the benefit of standards being produced in a computer compatible format is given in [Annex F](#).

This document incorporates many recommendations developed through the European Creep Collaborative Committee (ECCC).

NOTE 3 Several different gauge lengths and reference lengths are specified in this document. These lengths reflect custom and practice used in different laboratories throughout the world. In some cases, the lengths are physically marked on the test piece as lines or ridges; in other cases, the length can be a virtual length based upon calculations to determine an appropriate length to be used for the determination of creep elongation. For some test pieces,  $L_r$ ,  $L_o$  and  $L_e$  are the same length (see [3.1](#), [3.2](#) and [3.3](#)). “Extension” is used for uninterrupted creep test with continuous measurement of the increase of the length of the test piece by using an extensometer. “Elongation” is mainly used for interrupted creep test with the manual measurement of the increase of the length of the test piece.

NOTE 4 For many applications, the term “strain” is synonymous with extension.

ISO 204:2018

<https://standards.iteh.ai/catalog/standards/iso/c06c1a67-e26e-47d9-8de9-7737175767f9/iso-204-2018>



# Metallic materials — Uniaxial creep testing in tension — Method of test

## 1 Scope

This document specifies the methods for

- a) uninterrupted creep tests with continuous monitoring of extension,
- b) interrupted creep tests with periodic measurement of elongation,
- c) stress rupture tests where normally only the time to fracture is measured,
- d) a test to verify that a predetermined time can be exceeded under a given force, with the elongation or extension not necessarily being reported.

NOTE A creep test can be continued until fracture has occurred or it can be stopped before fracture.

## 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 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

ISO 6892-2, *Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature*

ISO 7500-2, *Metallic materials — Verification of static uniaxial testing machines — Part 2: Tension creep testing machines — Verification of the applied force*

ISO 9513, *Metallic materials — Calibration of extensometer systems used in uniaxial testing*

## 3 Terms and definitions

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

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

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

### 3.1 reference length

$L_r$

base length used for the calculation of either percentage elongation or percentage extension

Note 1 to entry: A method to calculate this value is given in 7.5.

### 3.2 original gauge length

$L_o$

length between gauge length marks on the test piece measured at ambient temperature before the test

Note 1 to entry: In general,  $L_o \geq 5D$ .