INTERNATIONAL STANDARD

ISO 204

Fourth edition
2023-07

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

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

Reference number
ISO 204:2023(E)

© ISO 2023



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

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
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

© ISO 2023 – All rights reserved

Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Symbols and designations **6**
5 Principle **7**
6 Apparatus **8**
6.1 Testing machine 8
6.2 Extension and elongation measuring devices 8
6.2.1 Extension measuring device 8
6.2.2 Elongation measuring device 9
6.3 Heating device, temperature measuring equipment and calibration 9
6.3.1 Permissible temperature deviations 9
6.3.2 Temperature measurement 10
6.3.3 Thermocouples 11
6.3.4 Calibration of the thermocouples 11
7 Test pieces **12**
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 13
7.4 Marking of the original gauge length, L_0 14
7.5 Determination of the reference length, L_r 14
8 Test procedure **15**
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 curve or extension-time curve 17
9 Determination of results **17**
10 Test validity **17**
11 Accuracy of the results **17**
11.1 Expression of the results 17
11.2 Final uncertainty 18
12 Test report **18**
Annex A (informative) **Information concerning drift of thermocouples** **23**
Annex B (informative) **Information concerning methods of calibration of thermocouples** **26**
Annex C (normative) **Creep testing using test pieces with V or blunt circumferential notches** **27**

© ISO 2023 – All rights reserved

Annex D (informative) **Method of estimating the uncertainty of the measurement in accordance with the Guide to the expression of uncertainty in measurement (GUM)** **30**

Annex E (informative) **Representation of results and extrapolation** **36**

Bibliography **45**

© ISO 2023 – All rights reserved

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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

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 164, *Mechanical testing of metals*, Subcommittee SC 1, *Uniaxial testing*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 459/SC 1, *Test methods for steel (other than chemical analysis)*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 204:2018), which has been technically revised.

The main changes are as follows:

— Figure 1 has been corrected;

— symbols were revised;

— Formulas in Table 1 have been removed;

— the informative annex relating to computer compatible representation of standards has been deleted;

— Bibliography has been updated.

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.

© ISO 2023 – All rights reserved

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 and methods of extrapolation of creep rupture life.

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 can 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[1].

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

© ISO 2023 – All rights reserved

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 terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
reference length
L_r
base length used for the calculation of either percentage elongation or percentage extension

Note 1 to entry: 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.

Note 2 to entry: A method to calculate this value is given in 7.5.

© ISO 2023 – All rights reserved