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भारतीय मानक ब्यूरो

DRAFT FOR WIDE CIRCULATION

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भारतीय मानक मसौदा

धात्विक सामग्री — तनाव में एकाक्षीय विसर्पण परीक्षण — परीक्षण पद्धति

(*IS 17795 का पहला पुनरीक्षण*)

Draft Indian Standard

Metallic Materials — Uniaxial Creep Testing in Tension — Method of Test

(*First Revision of IS 17795)*

(ISO 204 : 2023, MOD)

(Superseding IS 3407 (Part 1) : 1983 and IS 3407 (Part 2) : 1983)

ICS 77.040.10

Mechanical Testing of Metals Sectional Committee, MTD 3	Last date of comment: 27/07/2024

NATIONAL FOREWORD

This draft standard is identical ISO 204 : 2023 ‘Metallic materials — Uniaxial creep testing in tension — Method of test’ issued by the International Organization for Standardization (ISO), and subject to its finalization, is to be adopted by the Bureau of Indian Standards on the recommendation of the Mechanical Testing of Metals Sectional Committee and approval of the Metallurgical Engineering Division Council.

This standard was originally published in 2022. The portions given in dotted underlines are the matters not specified in the corresponding international standard. A list of technical modifications is given in National Annex G.

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).

The text of ISO standard has been approved as suitable for publication as in Indian Standard without deviations. Certain terminologies and conventions are, however, not identical with those used in Indian Standard. Attention is especially drawn to the following:

a) Wherever the words `International Standard' appear referring to this standard, it should be read as `Indian Standard'

b) Comma (,) has been used as a decimal marker while in Indian Standards the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exists. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the edition indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 6892-1 : Metallic materials — Tensile testing — Part 1: Method of test at room temperature	IS 1608 (Part 1) : 2022 / ISO 6892-1 : 2019 Metallic materials - Tensile testing - Part 1 : Method of test at room temperature (*Fifth Revision*)	Identical
ISO 6892-2 : Metallic materials — Tensile testing — Part 2: Method of test at elevated temperature	IS 1608 (Part 2) : 2020 / ISO 6892-2 : 2018 Metallic Materials - Tensile Testing Part 2 Method of Test at Elevated Temperature (*Fourth Revision*)	Identical
ISO 7500-2 : Metallic materials — Verification of static uniaxial testing machines — Part 2: Tension creep testing machines — Verification of the applied force	IS 1828 (Part 2) : 2015 / ISO 7500-2 : 2006 Metallic materials - Verification of static uniaxial testing machines: Part 2 tension creep testing machines - Verification of the applied force (*First Revision*)	Identical
ISO 9513 : Metallic materials — Calibration of extensometer systems used in uniaxial testing	12872 : 2021 / ISO 9513 : 1999 Metallic Materials - Calibration of Extensometer Systems Used in Uniaxial Testing (*Second Revision*)	Identical

In reporting the result of a test or analysis made in accordance with this standard, is to be rounded off, it shall be done in accordance with IS 2 : 2022 'Rules for rounding off numerical-values (*second revision*)'.

The Scope of the standard is as follows:

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.

The complete document/text of ISO 204 : 2023 'Metallic materials — Uniaxial creep testing in tension — Method of test' may be made available, on request to:

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National Annex G

(*National Foreword*)

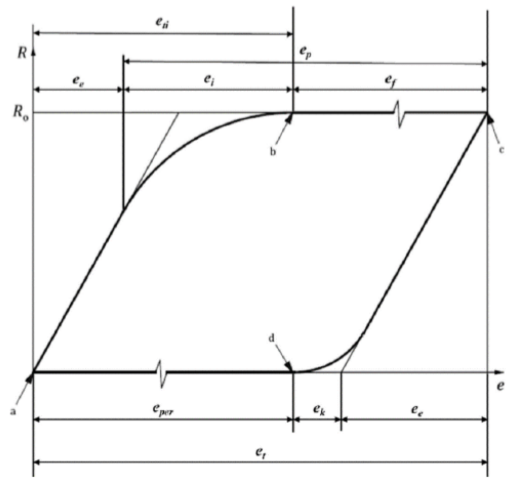
<table>
<tr><th>Clause/Sub clause</th><th>Modifications</th></tr>
<tr><td>Figure 1</td><td>Replace Figure 1


Figure 1 — Schematic stress — extension curve</td></tr>
<tr><td>3.30</td><td>Add 'More definitions related to creep are given in Annex F.'</td></tr>
<tr><td>Annex F</td><td>Definitions related to creep

F.1 Creep

Creep refers to the time dependent part of strain of a metal or alloy when stressed below its yield point or proportional limit. Its effect is more marked at elevated temperatures, and therefore, is important in the case of metals and alloys for high temperature uses.

F.2 The creep diagram pertains to the variation of creep strain with elapsed time at a given temperature and load. A typical creep diagram is shown in Figure. F.1. It consists of following three stages:

a) Primary creep — The exhaustion stage of creep at a diminishing rate;

b) Secondary creep — The stable stage of creep at a constant rate; and

c) Tertiary creep — The final stage of creep at an accelerating rate, preceding fracture.

The constant nominal stress that will bring about a specified creep strain in a given time or creep rate at constant temperature.</td></tr>
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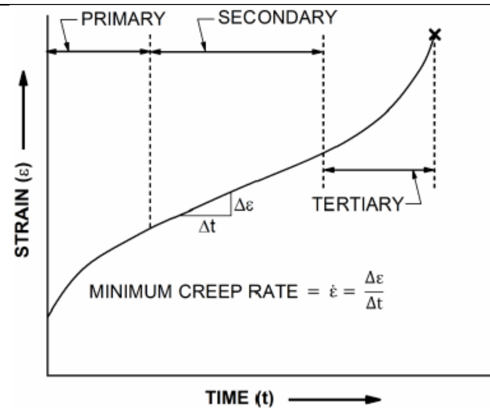

Figure F.1 Creep diagram

F.3 Creep Strength

The constant nominal stress that will bring about a specified creep strain in a given time or creep rate at constant temperature.

F. 4 Creep Rate $(\dot{\varepsilon})$ is defined as rate of changes of strain with time that is, $\Delta\varepsilon/\Delta t'$ as shown on the creep diagram (*see* Figure F.1). Normally creep rate in secondary stage, that is, minimum creep rate is taken into consideration for engineering design, where change in dimension suring service is critical.

F.5 Creep Strain Limit

In engineering design, a limit on the amount of strain occurring over entire service life is specified, for example, 1 percent creep in 100 000 hours. This corresponds to a creep rate limit of 10^{-7} per hour, and hence the limiting stress as given in Figure F.2.

F.6 Creep Rate Limit

In engineering design a limit on creep rate is specified, for example, 10^{-7} per hour. This creep rate will correspond to a limiting stress at a particular temperature. The limiting stress is obtained from a stress vs creep rate diagram as shown in Figure F.2

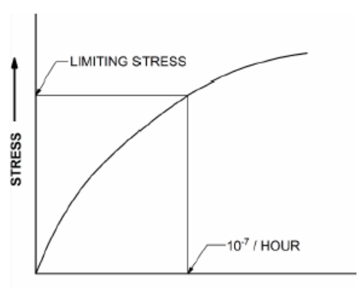

Figure F.2 Stress vs. creep rate diagram