

# JIS

JAPANESE  
INDUSTRIAL  
STANDARD

Translated and Published by  
Japanese Standards Association

---

JIS Z 2241 : 2022

(JISF)

**Metallic materials — Tensile testing —  
Method of test at room temperature**

Z 2241 : 2022

Date of Establishment: 1952-07-22

Date of Revision: 2022-09-20

Date of Public Notice in Official Gazette: 2022-09-20

Developed by: The Japan Iron and Steel Federation

Investigated by: The Japan Iron and Steel Federation, Standardization  
Center

---

JIS Z 2241 : 2022, First English edition published in 2023-03

Translated and published by: Japanese Standards Association  
Mita MT Building, 3-13-12, Mita, Minato-ku, Tokyo, 108-0073 JAPAN

---

In the event of any doubts arising as to the contents,  
the original JIS is to be the final authority.

© JSA 2023

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

HN

PROTECTED BY COPYRIGHT

## Contents

	Page
Introduction .....	1
1 Scope .....	1
2 Normative references .....	1
3 Terms and definitions .....	2
4 Symbols and designations .....	11
5 Principle .....	19
6 Test pieces .....	20
6.1 Shape and dimensions .....	20
6.2 Types .....	21
6.3 Preparation of test pieces .....	24
7 Determination of original cross-sectional area .....	24
8 Original gauge length and extensometer gauge length .....	24
8.1 Choice of the original gauge length .....	24
8.2 Marking the original gauge length .....	25
8.3 Choice of the extensometer gauge length .....	25
9 Accuracy of testing machine .....	26
9.1 Testing machine .....	26
9.2 Extensometer .....	26
9.3 Length measurement apparatus .....	26
10 Conditions of testing .....	26
10.1 Setting the force zero point .....	26
10.2 Method of gripping .....	26
10.3 Test methods .....	27
11 Determination of upper yield strength $R_{eH}$ .....	30
12 Determination of lower yield strength $R_{eL}$ .....	30
13 Determination of proof strength (plastic extension) $R_p$ .....	30
13.1 Determination of proof strength (plastic extension) $R_p$ (by force — extension curve) .....	30
13.2 Determination of proof strength (plastic extension) $R_p$ (by software etc.) .....	31
14 Determination of proof strength (total extension) $R_t$ .....	31
14.1 Determination of proof strength (total extension) $R_p$ (by force — extension curve) .....	31
14.2 Determination of proof strength (total extension) $R_t$ (by software etc.) .....	31

15	Method of verification of proof strength by permanent set strength $R_r$ .....	32
16	Determination of percentage yield point extension $A_e$ .....	32
17	Determination of percentage plastic extension at maximum force $A_g$ .....	32
18	Determination of percentage total extension at maximum force $A_{gt}$ .....	33
19	Determination of percentage total extension at fracture $A_t$ .....	33
20	Determination of percentage elongation after fracture $A$ .....	33
20.1	General .....	33
20.2	Determination method by fitting two fractured test pieces back together .....	33
20.3	Determination method using extensometer .....	34
20.4	Effectiveness of tests .....	34
20.5	Conversion .....	35
21	Determination of percentage reduction of area $Z$ .....	35
22	Test report .....	36
23	Measurement uncertainty .....	36
23.1	General .....	36
23.2	Conditions of testing .....	37
23.3	Test results .....	37
Annex A (informative)	Recommendations concerning the use of computer-controlled tensile testing machines .....	38
Annex B (normative)	Types of test pieces to be used for thin products (plates/flats/sections/strips) not less than 0.1 mm to and excl. 3 mm thick .....	44
Annex C (normative)	Types of circular test pieces to be used for wires, wire rods and bars with diameter or traverse of less than 4 mm .....	48
Annex D (normative)	Types of test pieces to be used for products (plates/flats/sections/strips) of thickness equal to or greater than 3 mm and products (bars/wires/wire rods) of diameter or width across flats equal to or greater than 4 mm .....	50
Annex E (normative)	Types of test pieces to be used for tubes .....	58
Annex F (informative)	Estimation of crosshead separation rate in consideration of stiffness of testing machine .....	62
Annex G (normative)	Determination of the modulus of elasticity of metallic materials using a uniaxial tensile test .....	64
Annex H (informative)	Measuring the percentage elongation after fracture if the specified value is less than 5 % .....	65
Annex I (informative)	Measurement of percentage elongation after fracture based on subdivision of the original gauge length .....	67

Annex J (informative)	Determination of the percentage plastic elongation without necking for bars, wire rods and wires	69
Annex K (informative)	Estimation of the uncertainty of measurement	70
Annex L (informative)	Precision of tensile testing — Results from interlaboratory programmes	75
Annex JA (normative)	Test method based on strain rate (Test method 2)	76
Annex JB (informative)	Number of measuring positions required for calculation of cross-sectional area of test piece	79
Annex JC (informative)	Test pieces — test piece numbers and summaries	81
Annex JD (informative)	Comparison table between JIS and corresponding International Standard	87

## Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry based on the provision of Article 14, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act in response to a proposal for revision of Japanese Industrial Standard with a draft being attached, submitted by The Japan Iron and Steel Federation (JISF), an accredited standards development organization. This edition replaces the previous edition (**JIS Z 2241** : 2011), which has been technically revised.

This **JIS** document is protected by the Copyright Act.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, published patent application or utility model rights. The relevant Minister is not responsible for identifying any of such patent rights, published patent application or utility model rights.

# Metallic materials — Tensile testing — Method of test at room temperature

## Introduction

This Japanese Industrial Standard has been prepared based on ISO 6892-1 : 2019, Edition 3, with some modifications of the technical contents.

In this Standard, Annex JA is specified based on 10.3.2 of ISO 6892-1 with some modifications of the technical contents. Annex JB and Annex JC are unique to JIS and not given in the corresponding International Standard.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JD.

## 1 Scope

This Standard specifies the method for tensile testing of metallic materials and defines the mechanical properties thereof which can be measured at room temperature (between 10 °C and 35 °C).

**NOTE** The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 6892-1 : 2019 *Metallic materials — Tensile testing — Part 1 : Method of test at room temperature* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21-1.

**WARNING** Persons carrying out tests based on this Standard should be familiar with normal laboratory practice. This Standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this Standard to establish appropriate safety and health practices.

## 2 Normative references

Part or all of the provisions of the following standards, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 7721 *Tension/compression testing machines — Calibration and verification of the force-measuring system*

**NOTE** Normative reference in the corresponding International Standard : ISO 7500-1 *Metallic materials — Calibration and verification of static uni-*