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**Plastics — Determination of compressive
properties**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by the Japan Plastics Industry Federation (JPIF)/ Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently, **JIS K 7181:1994** is replaced with this Standard.

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Plastics — Determination of compressive properties

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **ISO 604** published in 2002 with some modifications of the technical contents.

The portions given dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies a method for determining the compressive properties of plastics (compressive strength, compressive modulus and compressive stress/strain curves) under defined conditions. A range of test speed is included.

The method applies to the following range of materials :

- rigid and semi-rigid (**JIS K 6900**) thermoplastic moulding and extrusion materials, including compounds filled and reinforced by e.g. short fibres, small rods, plates or granules in addition to unfilled types; rigid and semi-rigid thermoplastic sheet;
- rigid and semi-rigid thermoset moulding materials, including filled and reinforced compounds; rigid and semi-rigid thermoset sheet;
- thermoplastic liquid-crystal polymers.

In agreement with **JIS K 7140-1** and **JIS K 7140-2**, this Standard applies to fibre-reinforced compounds with fibre lengths ≤ 7.5 mm prior to processing.

The method is not normally suitable for use with materials reinforced by textile fibres (**ISO 3597-3** and **JIS K 7018**), fibre-reinforced plastic composites and laminates (**JIS K 7018**), rigid cellular materials (**JIS K 7132**) or sandwich structures containing cellular material or rubber (**JIS K 6254**).

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

ISO 604 : 2002 *Plastics — Determination of compressive properties*
(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**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (in-

cluding amendments) indicated below shall be applied.

JIS B 0182 *Machine tools — Test codes — Vocabulary*

JIS K 6254 *Rubber, vulcanized or thermoplastic — Determination of stress-strain properties*

JIS K 6272 *Rubber — Tensile, flexural and compression test equipment (constant rate of traverse) — Specification*

NOTE : The cited matters correspond to **JIS K 6272**. Corresponding International Standard : **ISO 5893** *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification* (MOD)

JIS K 6900 *Plastics — Vocabulary*

JIS K 7018 *Fiber-reinforced plastic composites — Determination of compressive properties in the in-plane direction*

JIS K 7100 *Plastics — Standard atmospheres for conditioning and testing*

NOTE : Corresponding International Standard : **ISO 291** : 1997 *Plastics — Standard atmospheres for conditioning and testing* (MOD)

JIS K 7132 *Cellular plastics, rigid — Determination of compressive creep under specified load and temperature conditions*

JIS K 7139 *Plastics — Test specimens*

JIS K 7140-1 *Plastics — Acquisition and presentation of comparable single-point data — Part 1 : Moulding materials*

JIS K 7140-2 *Plastics — Acquisition and presentation of comparable single-point data — Part 2 : Long-fibre-reinforced plastics*

JIS K 7144 *Plastics — Preparation of test specimens by machining*

NOTE : Corresponding International Standard : **ISO 2818** : 1994 *Plastics — Preparation of test specimens by machining* (IDT)

JIS K 7151 *Plastics — Compression moulding test specimens of thermoplastic materials*

NOTE : Corresponding International Standard : **ISO 293** : 1986 *Plastics — Compression moulding test specimens of thermoplastic materials* (IDT)

JIS K 7152-1 *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 1 : General principles, and moulding of multipurpose and bar test specimens*

NOTE : Corresponding International Standard : **ISO 294-1** : 1996 *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 1 : General principles, and moulding of multipurpose and bar test specimens* (IDT)

JIS K 7154-1 *Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 1 : General principles*

and moulding of multipurpose test specimens

NOTE : Corresponding International Standard : **ISO 10724-1** : 1998 *Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 1 : General principles and moulding of multipurpose test specimens* (IDT)

JIS Z 8401 *Guide to the rounding of numbers*

JIS Z 9041-2 *Statistical interpretation of data Part 2 : Techniques of estimation and test relating to means and variances*

NOTE : Among other corresponding International Standards of **JIS Z 9041-2**, the following contains the matters cited in this Standard. Corresponding International Standard : **ISO 2602** : 1980 *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

ISO 295 *Plastics — Compression moulding of test specimens of thermosetting materials*

ISO 3597-3 *Textile-glass-reinforced plastics — Determination of mechanical properties on rods made of roving-reinforced resin — Part 3 : Determination of compressive strength*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply (see figure 1).

3.1 gauge length, L_0

initial distance between the gauge marks given on the test specimen prior to test

NOTE : It is expressed in millimetres (mm).

3.2 test speed, ν

rate of approach of the plates of the test machine during the test

NOTE : It is expressed in millimetres per minute (mm/min).

3.3 compressive stress, σ

compressive load, per unit area of original cross-section, carried by the test specimen

NOTE 1 It is expressed in megapascals (MPa).

NOTE 2 In compression tests, the stresses σ and strains ε are negative. The negative sign, however, is generally omitted. If this generates confusion, e.g. in comparing tensile and compressive properties, the negative sign may be added for the latter. This is unnecessary for the nominal compressive strain ε_c .

3.4 compressive stress at yield, σ_y

first stress at which an increase in compressive strain (see 3.8) occurs without an increase in compressive stress (see figure 1, curve a, and NOTE 2 to 3.3)

3.5 compressive strength, σ_M

maximum compressive stress sustained by the test specimen during a compressive test (see figure 1 and NOTE 2 to 3.3)

NOTE : It is expressed in megapascals (MPa).

3.6 compressive stress at break (rupture), σ_B

compressive stress at break of the test specimen (see figure 1 and NOTE 2 to 3.3)

NOTE : It is expressed in megapascals (MPa),

3.7 compressive stress at x % strain, σ_x

stress at which the strain reaches a specified value x % (see 3.9)

NOTE 1 It is expressed in megapascals (MPa).

NOTE 2 The compressive stress at x % strain may be measured, e.g. if the compressive stress/strain curve does not exhibit a yield point (see figure 1, curve b, and NOTE 2 to 3.3). In this case, x is taken from standard of the material to be tested or agreed upon by the interested parties. In any case, x will have to be lower than the strain at compressive strength.

3.8 compressive strain, ε

decrease in length per unit original gauge length L_0 [see 10.2, equation (6), and NOTE 2 to 3.3]

NOTE : It is expressed as a dimensionless ratio or percentage (%).

3.9 nominal compressive strain, ε_c

decrease in length per unit original length L of the test specimen [see 10.2, equation (8)]

NOTE : It is expressed as a dimensionless ratio or percentage (%).

3.10 nominal compressive yield strain, ε_{cy}

strain corresponding to the compressive stress at yield σ_y (see 3.4) (see figure 1, curve a, NOTE 2 to 3.3)

NOTE : It is expressed as a dimensionless ratio or percentage (%).

3.11 nominal compressive strain at compressive strength, ε_{cM}

nominal compressive strain corresponding to the compressive strength σ_M (see 3.5) (see figure 1, NOTE 2 to 3.3)

NOTE : It is expressed as a dimensionless ratio or percentage (%).

3.12 nominal compressive strain at break, ε_{cB}

nominal compressive strain corresponding to the compressive stress at break σ_B (see 3.6) (see figure 1, NOTE 2 to 3.3)

NOTE : It is expressed as a dimensionless ratio or percentage (%).

3.13 compressive modulus, E_c

when the compressive stresses corresponding to the compressive strains at the specified two points $\varepsilon_1 = 0.000\ 5$ and $\varepsilon_2 = 0.002\ 5$ are σ_1 and σ_2 , the ratio of the stress difference

$(\sigma_2 - \sigma_1)$ to the corresponding strain difference values $(\varepsilon_2 - \varepsilon_1)$ [see 10.3, equation (9)]

NOTE : It is expressed in megapascals (MPa).

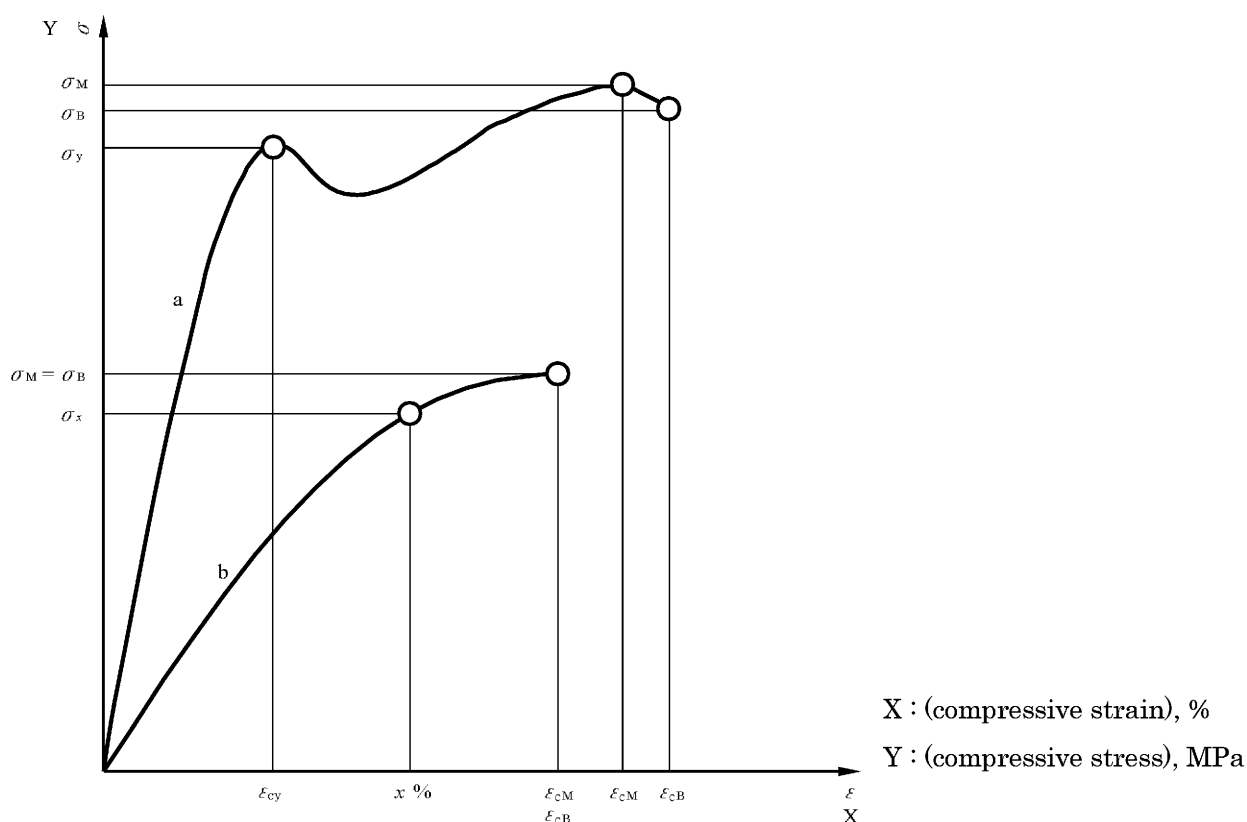


Figure 1 Typical compressive stress/strain curves

4 Principle

The test specimen is compressed along its major axis at constant speed until the specimen fractures or until the load or the decrease in length reaches a predetermined value. The load sustained by the specimen is measured during this procedure.

5 Apparatus

5.1 Test machine

5.1.1 General

The test machine shall comply with **JIS K 6272** and meet the specifications given in 5.1.2 to 5.1.5, as follows.

5.1.2 Test speeds

The machine shall be capable of maintaining the test speeds as specified in table 1 (**JIS K 6272**). If other speeds are used, the machine shall be capable of maintaining the speed to a tolerance of ± 20 % for speeds less than 20 mm/min and ± 10 % for speeds greater than 20 mm/min.