

# JIS

## JAPANESE INDUSTRIAL STANDARD

### Test method for tensile properties of fiber reinforced metals

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In the event of any doubt arising,  
the original Standard in Japanese is to be final authority.

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Test method for tensile properties  
of fiber reinforced metals

H 7405-1993

1. Scope This Japanese Industrial Standard specifies the test method for tensile properties at room temperature and at a high temperature of metal matrix composites reinforced by continuous fiber.

Remarks 1. The test method for tensile properties at a high temperature of fiber reinforced metals shall be in accordance with Annex.

2. The following standards are cited in this Standard:

JIS B 7502 Micrometer callipers for external measurement

JIS B 7507 Vernier, dial and digital callipers

JIS B 7721 Tensile testing machines

JIS B 7741 Extensometers used in metallic material tensile testing

JIS C 1602 Thermocouples

JIS H 7006 Glossary of terms used in metal matrix composites

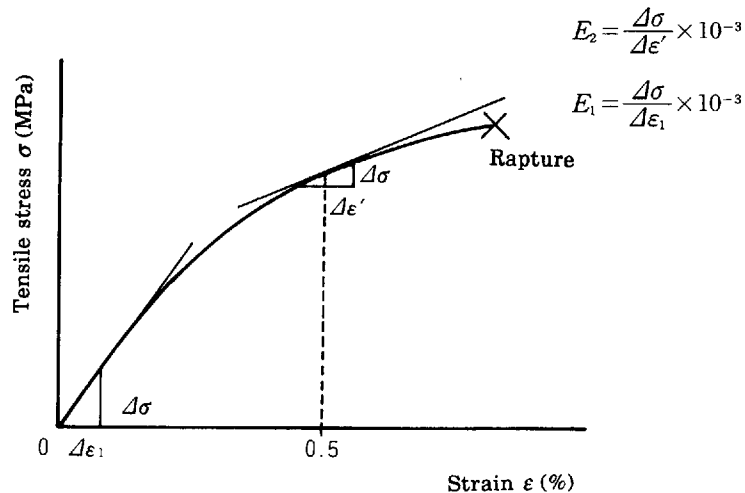
JIS Z 2241 Method of tensile test for metallic materials

JIS Z 8401 Rules for rounding off of numerical values

2. Definitions For the main terms used in this Standard the definitions in JIS H 7006 and JIS Z 2241 apply, and the rest of the terms shall be as follows:

- (1) tensile stress Is a value obtained by dividing tensile load applied to a test piece at any point of time by the original sectional area of the gage part of the test piece.
- (2) tensile strength Is the maximum tensile stress applied to a test piece in a tension test.
- (3) strain Is a dimensionless quantity obtained by dividing the variation in the gage length of a test piece by the original gage length.
- (4) fracture strain Is the maximum strain applied to a test piece in a tension test.
- (5) longitudinal elastic modulus under tension
  - (a) A value obtained from the initial gradient part in a tensile load – strain diagram or a tensile stress – strain diagram. Its quantity symbol shall be  $E_1$  (see Fig. 1).
  - (b) A value obtained from the gradient part of the tangent drawn to a tensile load – strain diagram or a tensile stress – strain diagram at 0.5 % in strain. Its quantity symbol shall be  $E_2$  (see Fig. 1).

Fig. 1. Example of tensile stress – strain diagram



- (6) Poisson's ratio Is the absolute value of a ratio of strain  $\epsilon_1$  in a tensile stress acting direction to strain  $\epsilon_2$  in a direction crossing that at high angles within an elastic limit.
- (7) gage length Is the distance between two gage marks provided to the parallel part of a test piece before a test in order to measure elongation.
- (8) parallel part length Is the length of the parallel part of test piece excluding the tab-bonded part or the length of the parallel part excluding the gripping part for the test piece with no tab.
- (9) test speed Is speed which makes a test piece generate deformation (elongation), which indicates speed of a crosshead.

### 3. Test apparatus

3.1 Test machine A test machine, which can keep the crosshead speed constant in a test, shall be as specified in JIS B 7721.

Further, a closed loop system electrohydraulic material testing machine may be used.

3.2 Gripping device A gripping device shall be so constructed as not to generate slippage between the test piece and the grip section, and shall secure an in-plane and out-of-plane alignment ( $\pm 2^\circ$ ) sufficient to a loading direction.

### 3.3 Measuring tools

3.3.1 Micrometer A micrometer is for measuring the width and thickness of a test piece, and that of 0 mm to 25 mm in measuring range and 0.01 mm in the minimum reading specified in JIS B 7502 or at least equal in precision thereto shall be used therefor.

**3.3.2 Vernier calipers** A vernier caliper is for measuring total length of a test piece and the length of a parallel part, and that of 300 mm in the maximum measuring length and 0.05 mm in the minimum reading specified in JIS B 7507 or at least equal in precision thereto shall be used therefor.

#### 4. Test piece

**4.1 Shape and dimensions of test piece** The shape and dimensions of a standard test piece shall be as given in Fig. 2 and Table 1.

Fig. 2. Shape of standard test piece

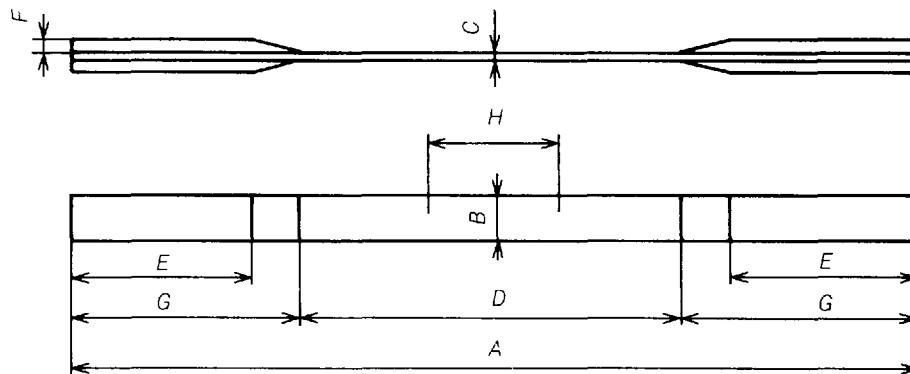


Table 1. Dimensions of standard test piece

Unit: mm

| Part of test piece          | Dimensions of test piece |
|-----------------------------|--------------------------|
| $A$ Total length            | 200                      |
| $B$ Width                   | $10 \pm 0.1$             |
| $C$ Thickness               | 1.0 to 2.0               |
| $D$ Length of parallel part | $100 \pm 0.1$            |
| $E$ Length of grip section  | 40                       |
| $F$ Thickness of tab        | 2.0                      |
| $G$ Length of tab           | 50                       |
| $H$ Gage length             | $30 \pm 1.0$             |

The thickness of the test piece shall be, as a rule, the original thickness of an as-fabricated composite sheet. However, in the case where the standard test piece is difficult to be used, a similar test piece of its  $\frac{1}{2}$  or  $\frac{1}{4}$  subsize may be used.

Further, the parallel part of the test piece may be uniformly thinned within the thickness range as given in Table 1 by reducing the thickness smoothly in a plate thickness direction as agreed upon between the purchaser and supplier.