

JIS

JAPANESE INDUSTRIAL STANDARD

**Test method for Young's
modulus of metallic materials
at elevated temperature**

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In the event of any doubt arising,
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Test method for Young's modulus of
metallic materials at elevated temperature

Z 2280-1993

1. Scope This Japanese Industrial Standard specifies test methods for dynamic and static Young's modulus of metallic materials at elevated temperature.

Remarks: The standards cited in this Standard are the following.

JIS B 0601-Definitions and designation of surface roughness

JIS B 0621-Definitions and designations of geometrical deviations

JIS B 7502-Micrometer callipers for external measurement

JIS B 7503-Dial gauges reading in 0.01 mm

JIS B 7507-Vernier callipers

JIS G 0567-Method of high temperature tensile test for steels and heat-resisting alloys

JIS Z 8401-Rules for rounding off of numerical values

2. Definitions The principal terms used in this Standard are as defined as follows.

- (1) dynamic Young's modulus A Young's modulus determined by measurement of the resonant frequency of test piece (resonance method) and the propagation velocity of ultrasonic pulse thereof (ultrasonic pulse technique).
- (2) static Young's modulus A Young's modulus determined by the stress - strain relationship within the elastic deformation area obtained by applying static load.
- (3) Young's modulus at elevated temperature A Young's modulus at an elevated temperature which exceed room temperature.

In this respect, a Young's modulus at an elevated temperature is calculated by using the dimensions and bulk density of the test piece at room temperature.

3. Classification of test methods

3.1 Test method for dynamic Young's modulus The test method for dynamic Young's modulus shall be as given in the following.

- (1) Transverse resonance method
- (2) Longitudinal resonance method
- (3) Ultrasonic pulse technique (Transmission method and reflection method)

3.2 Test method for static Young's modulus The test method for static Young's modulus shall be as given in the following.

- (1) Strain gauge method
- (2) Pressing method of displacement gauge

4. Test method for dynamic Young's modulus

4.1 Heating apparatus and test piece temperature A heating apparatus and test piece temperature shall be as given in the following.

- (1) Heating apparatus A heating apparatus shall be capable of heating the test piece until the specified temperature and to hold that temperature during the test so that it is heated uniformly and constantly within the permissible range given in Table 1. In the case where it is 573 K or lower or 1473 K or over, however, it shall be agreed between the purchaser and supplier.

Table 1. Permissible range of temperature of test piece
Unit: K

Over 573, up to and incl. 873	Over 873, up to and incl. 1073	Over 1073, up to and incl. 1473
± 3	± 4	± 5

- (2) Heating up and holding time After heating up to the specified temperature, the whole of test piece shall be kept at the said temperature while the measurement is made.
 - (3) Measurement of temperature The temperature of test piece shall be measured with a thermocouple at as near a place to the test piece as possible avoiding contact thereto.
- 4.2 Measurement of dimensions and mass for test piece The dimensions and mass for the test piece shall be measured as given in the following.
- (1) Length gauge The length gauge enumerated in the following shall be used.
 - (a) Micrometer As to the micrometer, those specified in JIS B 7502 or those of equivalent or superior precision shall be used.
 - (b) Dial gauge As to the dial gauge, those specified in JIS B 7503 or those of equivalent or superior precision shall be used.
 - (c) Vernier calliper As to the vernier calliper, those specified in JIS B 7507 of minimum reading of 0.05 mm shall be used.
 - (2) Measurement of dimensions The dimensions of test piece shall be measured with length gauges enumerated in (1). The length, width, thickness and diameter shall be measured at five points, respectively, and expressed as the average values of respective three measurements excluding the maximum and minimum values.