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**Method of low cycle fatigue
testing for metallic materials
in liquid helium**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of International Trade and Industry through deliberations at Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law:

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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Method of low cycle fatigue testing for metallic materials in liquid helium

Introduction This Japanese Industrial Standard was developed referring to the Method of high temperature low cycle fatigue testing for metallic materials (JIS Z 2279) and the Tensile testing method for metallic materials in liquid helium (JIS Z 2277) and, in particular, taking into account the plastic deformation work which is likely to raise greatly the temperature of materials in a very low temperature such as the liquid helium hard to deal with and more expensive, in addition, than liquid hydrogen used relatively well for coolant.

1 Scope This Japanese Industrial Standard specifies the uniaxial tensile—compressive fatigue testing method under the alternating constant strain range control for the purpose of acquiring the low cycle fatigue life of metallic materials in liquid helium under the atmospheric pressure.

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. Of these normative references, the most recent editions apply.

JIS G 0202 *Glossary of terms used in iron and steel (testing)*

JIS R 6252 *Abrasive papers*

JIS Z 2277 *Tensile testing method for metallic materials in liquid helium*

JIS Z 2279 *Method of high temperature low cycle fatigue testing for metallic materials*

3 Definitions For the purpose of this Standard, the definitions given in JIS G 0202, JIS Z 2277 and JIS Z 2279 and the following definitions apply.

- a) **stress** (σ) The value obtained by dividing the axial direction test force P of the test piece by the initial cross section A_0 of the test piece (nominal stress). P shall be positive in tension and negative in compression.
- b) **total strain** (ϵ_t) When the initial gauge length of the test piece is l_0 and the gauge length after deformation is l , the total strain is expressed by the following formula. Unit of m/m (dimensionless) or % is used.

$$\epsilon_t = \frac{l - l_0}{l_0} \dots\dots\dots (1)$$

Remarks : The initial gauge length of the test piece shall be the gauge length after mounting an extensometer on the test piece and cooling down to the test temperature, but if it is impossible to measure correctly, the value at room temperature may be used.

- c) **elastic strain** (ϵ_e) The elastic component out of the total strain and the value obtained by dividing the stress σ by the Young's modulus E .

$$\epsilon_e = \frac{\sigma}{E} \dots\dots\dots (2)$$