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Testing method for heat resistance
under temperature gradient

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Foreword

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In the event of any doubts arising as to the contents,
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Testing method for heat resistance under temperature gradient

1 Scope This Japanese Industrial Standard specifies the testing method for heat resistance under the temperature gradient of materials and coating materials used for the apparatus facing high temperatures such as aircraft engine, gas turbine, reciprocating engine, accelerator, electric switchgear, and so on.

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 standard (including amendments) indicated below shall be applied.

JIS B 7502 *Micrometer callipers*

JIS B 7507 *Vernier, dial and digital callipers*

JIS C 1602 *Thermocouples*

JIS C 1605 *Mineral insulated thermocouples*

JIS C 1612 *Test methods for radiation thermometers*

JIS H 8200 *Thermal spraying terms*

JIS Z 8401 *Guide to the rounding of numbers*

JIS Z 8710 *Temperature measurement—General requirement*

3 Terms and definitions For the purpose of this Standard, the definitions given in **JIS H 8200** and the following definitions apply.

- a) **temperature gradient** field consisting of a heating surface and cooling surface to give temperature gradient
- b) **test for heat resistance** to estimate the condition for the test specimen to break such as peel-off and crack under the imposition or repeated imposition of temperature gradient
- c) **acoustic emission (AE)** phenomenon to generate an elastic wave by releasing the strain energy stored till the moment of deformation or destruction of solid body

Utilizing this phenomenon, it is possible to monitor the detection of defect or developing process of destruction.

4 Principle To estimate the condition of destruction such as peel-off and crack of the test specimen, at the time of on loading and on load releasing, under the imposition of temperature gradient and the application of heating/cooling cycle at the specified temperature.

5 Test specimen

5.1 Structure of test specimen Structure of test specimen shall be based on figure 1. A part of test specimen may serve as a jig, too, as shown in figure 1 c).

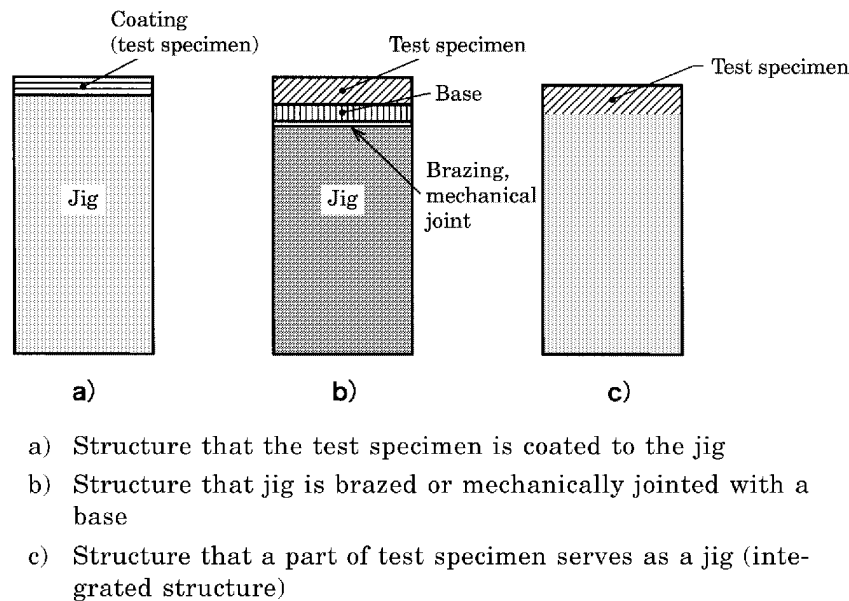


Figure 1 Structure of test specimen

5.2 Shape and dimension of test specimen and jig Examples of shape and dimension of test specimen and jig are shown in figure 2. Test specimen shall cover the whole heating surface of the base or jig, their thickness shall be measured with micrometer (**JIS B 7502**), slide caliper (**JIS B 7507**) and so on and the tolerances shall be within $\pm 10\%$ to the mean value. Typical shape and dimension of test specimen shall be a circular plate of 10 mm to 30 mm diameter and the thickness may be the same thickness of material applied. For the jig, two or more thermocouple holes reaching to the centre axis of jig shall be set, to measure the heat flux.

5.3 Material of jig The material of jig is not specially specified, and the material whose thermal conductivity is known and the material that can bear with the test shall be selected.

5.4 Surface condition Surface condition of test specimen is not specified. The surface condition, for example roughness, shall be measured by surface roughness meter.

In the case to paint a different material on the surface of test specimen for the purpose to control the heat transfer and emissivity, the thickness of painting film shall be $5\ \mu\text{m}$ or under.

5.5 Fixing a test specimen to a jig After fixing a test specimen to the jig, heating test shall be performed.

To reduce the heat resistance of contact, it is preferable for test specimen and jig to be an integrated structure. For this purpose, jig is soldered or mechanically jointed with the base as shown in figure 1.

5.6 Cooling of jig To prepare temperature gradient field steadily, the test specimen shall be fixed to the holding apparatus provided with cooling function (air, water and so on), and the jig cooling surface shall be cooled (see figure 3).