

JAPANESE  
INDUSTRIAL  
STANDARD

Translated and Published by  
Japanese Standards Association

---

---

JIS H 7851 : 2005

Testing method for heat resistance  
under temperature gradient

---

ICS 17.200.10

Reference number : JIS H 7851 : 2005 (E)

## Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the 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.

Date of Establishment: 2005-03-20

Date of Public Notice in Official Gazette: 2005-03-22

Investigated by: Japanese Industrial Standards Committee  
Standards Board  
Technical Committee on Non-Ferrous  
Metals

---

JIS H 7851 : 2005, First English edition published in 2006-01

Translated and published by: Japanese Standards Association  
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

---

In the event of any doubts arising as to the contents,  
the original JIS is to be the final authority.

© JSA 2006

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

## Contents

|     |                                                    | Page |
|-----|----------------------------------------------------|------|
| 1   | Scope .....                                        | 1    |
| 2   | Normative references .....                         | 1    |
| 3   | Terms and definitions .....                        | 1    |
| 4   | Principle .....                                    | 1    |
| 5   | Test specimen .....                                | 1    |
| 5.1 | Structure of test specimen .....                   | 1    |
| 5.2 | Shape and dimension of test specimen and jig ..... | 2    |
| 5.3 | Material of jig .....                              | 2    |
| 5.4 | Surface condition .....                            | 2    |
| 5.5 | Fixing a test specimen to a jig .....              | 2    |
| 5.6 | Cooling of jig .....                               | 2    |
| 6   | Test method .....                                  | 3    |
| 6.1 | Classification of test method .....                | 3    |
| 6.2 | Test equipment .....                               | 3    |
| 6.3 | Test and evaluation .....                          | 7    |
| 7   | Calculation .....                                  | 8    |
| 8   | Report .....                                       | 9    |

## 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.

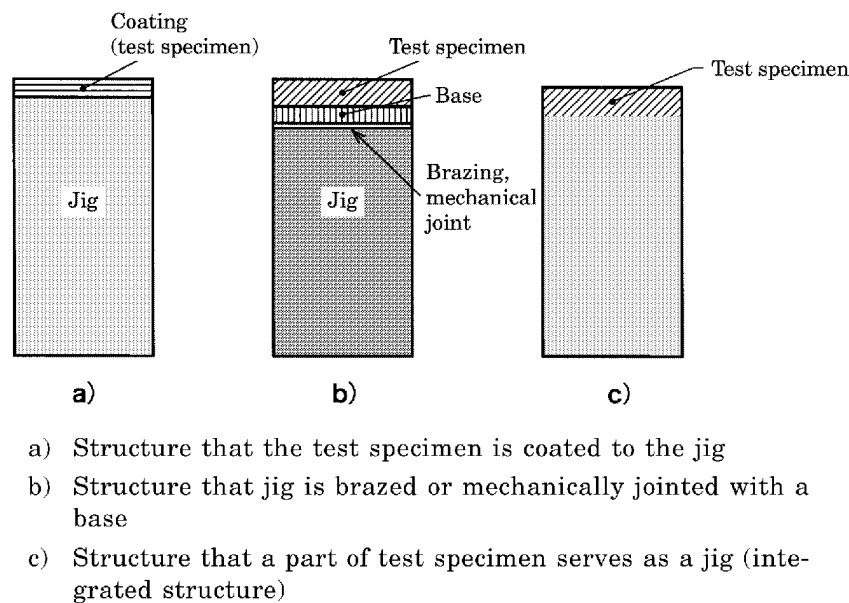
- a) **temperature gradient** field consisting of a heating surface and cooling surface to give temperature gradient
- b) **test for heat resistance** to estimate the condition for the test specimen to break such as peel-off and crack under the imposition or repeated imposition of temperature gradient
- 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).