



JAPANESE  
INDUSTRIAL  
STANDARD

Translated and Published by  
Japanese Standards Association

---

---

**JIS Z 3198-5** : 2003  
(JWES)

**Test methods for lead-free solders—  
Part 5 : Methods for tensile tests  
and shear tests on solder joints**

---

ICS 25.160.50

Reference number : JIS Z 3198-5 : 2003 (E)

PROTECTED BY COPYRIGHT

## 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 according to the proposal of establishing a Japanese Industrial Standard from The Japan Welding Engineering Society (JWES), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

Soldering is called HANDAZUKE (Japanese), a technique to be used for mounting electronic and electrical machinery and apparatus, communication equipment and the like and its use field is wide and expectation for high reliability of the connection is large.

Though there are standards inside and outside Japan as well as International Standards like IEC or ISO, this Standard uses results of "standardization of test methods and the like necessary for solder connection corresponding to the reduction of an environmental load" based on the research and development by contract of New Energy and Industrial Technology Development Organization.

This Standard concerns the methods for tensile tests and shear tests on solder joints of lead-free solders which are environmentally friendly and is positioned as a standard for considering environment.

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.

**JIS Z 3198** includes the following 7 parts with the general title *Test methods for lead-free solders*

*Part 1 : Methods for measuring of melting temperature ranges*

*Part 2 : Methods for testing of mechanical characteristics—tensile test*

*Part 3 : Methods for spread test*

*Part 4 : Methods for solderability test by a wetting balance method and a contact angle method*

*Part 5 : Methods for tensile tests and shear tests on solder joints*

*Part 6 : Methods for 45° pull test of solder joints on QFP lead*

*Part 7 : Methods for shear strength of solder joints on chip components*

Date of Establishment: 2003-06-20

Date of Public Notice in Official Gazette: 2003-06-20

Investigated by: Japanese Industrial Standards Committee  
Standards Board

Technical Committee on Welding

---

JIS Z 3198-5:2003, First English edition published in 2003-12

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 2003

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 |
|--------------------------------------------------------------|------|
| Introduction .....                                           | 1    |
| 1 Scope .....                                                | 1    |
| 2 Normative references .....                                 | 1    |
| 3 Definitions .....                                          | 1    |
| 4 Test piece .....                                           | 2    |
| 4.1 Classification of test piece .....                       | 2    |
| 4.2 Shape and dimensions of test piece .....                 | 2    |
| 5 Test material, solder, flux and soldering atmosphere ..... | 3    |
| 5.1 Test material .....                                      | 3    |
| 5.2 Solder .....                                             | 4    |
| 5.3 Flux and soldering atmosphere .....                      | 4    |
| 6 Soldering of test material .....                           | 4    |
| 7 Heat treatment of test material .....                      | 5    |
| 8 Test method .....                                          | 5    |
| 8.1 Tensile test .....                                       | 5    |
| 8.2 Shear test .....                                         | 5    |
| 9 Method for obtaining measured value .....                  | 6    |
| 9.1 For tensile test method .....                            | 6    |
| 9.2 For shear test method .....                              | 7    |
| 10 Recording of test results .....                           | 7    |

## Test methods for lead-free solders— Part 5 : Methods for tensile tests and shear tests on solder joints

**Introduction** This Japanese Industrial Standard specifies the methods for tensile tests and shear tests on lead-free solder joints which are based on occupational results by contract of New Energy and Industrial Technology Department Organization concerning “the standardization of test methods and the like necessary for a solder connection corresponding to the reduction of an environmental load” carried out in 2000 and 2001.

**1 Scope** This Standard specifies the methods for tensile tests and shear tests of lead-free solder to be used principally for wiring connection, components connection and the like of electrical machinery and apparatus, electronic apparatus, communication equipment and the like.

**2 Normative references** The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

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

JIS K 8034 *Acetone*

JIS K 8180 *Hydrochloric acid*

JIS Z 2241 *Method of tensile test for metallic materials*

JIS Z 3001 *Welding terms*

JIS Z 3282 *Soft solders—Chemical compositions and forms*

**3 Definitions** For the purposes of this Standard, the definitions given in **JIS G 0202**, **JIS Z 3001**, **JIS Z 3282** and the following definitions apply.

- a) **lead-free solder** The generic term of “a tin based solder” not containing lead as an alloy component. It is “a solder not containing lead” for a use corresponding to that of “a tin-lead based solder”, which is used for mounting an electrical, electronic, communication equipment and the like.
- b) **fillet** A solder part swollen out from a clearance of a joint in a solder joint.
- c) **void** A hollow wherein a solder does not spread in a solder joint.
- d) **tensile strength** A value of dividing the maximum tensile load in a tensile test by the cross section of a test piece.
- e) **shear strength** A value of dividing the maximum shear load of a solder joint by a soldered joint area.
- f) **soldered joint area** The cross section of a soldered joint part.