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Methods of bend test for butt
welded joint

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In the event of any doubts arising as to the contents,
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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Welding Engineering Society (JWES) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently, **JIS Z 3122:1990** is replaced with this Standard.

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Methods of bend test for butt welded joint

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **ISO 5173** published in 2009 and Amendment 1 published in 2011 with some modifications of the technical contents. Furthermore, as **JIS**, some items specified in the corresponding International Standard are deleted.

The portions with dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications with the explanations is given in Annex JA.

1 Scope

This Standard specifies the methods of bend test for butt welded joint of metallic materials and butt welded joint of cladding.

This Standard is applicable to all metallic materials in all forms of product with butt welded joint made by any welding process (including friction welding, friction stir welding, diffusion welding, etc.).

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows:

ISO 5173:2009 *Destructive tests on welds in metallic materials—Bend tests* and Amendment 1:2011 (MOD)

The symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

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 standards (including amendments) indicated below shall be applied.

JIS B 0405 *General tolerances—Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

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

JIS G 0601 *Testing methods for clad steels*

JIS Z 2248 *Metallic materials—Bend test*

JIS Z 3001 (series) *Welding and allied processes—Vocabulary*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS G 0202**, **JIS G 0601** and **JIS Z 3001** series, and the following terms and definitions apply.

3.1 surface in tension

surface that comes external after bending, which is a portion where tensile deformation occurs due to bending

3.2 transverse face bend test specimen for a butt weld (TFBB)

test specimen for which the surface in tension is a side that contains the greater width of the weld or a side to which the welding is firstly applied, applicable to transverse (perpendicular to the weld axis) bending of butt weld (see figure 1)

When it is difficult to distinguish the face from the root, it shall be defined between the parties concerned with delivery.

3.3 transverse root bend test specimen for a butt weld (TRBB)

test specimen for which the surface in tension is the opposite side to that of the face bend test specimen, applicable to transverse bending of butt weld (including cladding with a butt weld) (see figure 2)

3.4 transverse side bend test specimen for a butt weld (SBB)

test specimen for which the surface in tension is the cross-section of welded joint (see figure 4)

3.5 longitudinal face bend test specimen for a butt weld (LFBB) and longitudinal root bend test specimen for a butt weld (LRBB)

test specimen parallel to the butt weld direction, applicable to longitudinal face bend test and longitudinal root bend test (see figure 6)

3.6 face bend test specimen for cladding with a butt weld (FBCB)

test specimen for which the surface in tension is the cladding metal in cladding with a butt weld (see figure 7)

3.7 side bend test specimen for cladding with a butt weld (SBCB)

test specimen for which the surface in tension is the cross-section of welded joint in cladding with a butt weld (see figure 8)

4 Symbols

Symbols used in this Standard are as given in table 1.

Table 1 Symbols and meaning thereof

Symbol	Meaning	Unit
A	Minimum elongation after fracture of parent material required by material standard	%
b	Width of test specimen	mm
b_1	Width of external side of fusion line of longitudinal bend test specimen	mm
d	Diameter of tip of former or inner roller in guided bend test with roller	mm
D	Outside diameter of pipe	mm
l	Distance between supporting rollers	mm
L_t	Distance between centres of inner roller and weld at start of bending in guided bend test with roller	mm
L_o	Original gauge length	mm
L_s	Maximum width of weld metal after machining	mm
L_t	Total length of test specimen	mm
r	Roundness (radius) of edge of test specimen	mm
R	Radius of supporting roller and of outer roller in guided bend test with roller	mm
t	Thickness of test piece	mm
t_c	Thickness of cladding metal	mm
t_s	Thickness of test specimen	mm
t_w	Thickness of parent material of cladding	mm
α	Bending angle	°

5 Preparation of test specimens

5.1 General

Test specimens shall be prepared so as not to affect the parent materials or weld metals.

5.2 Location

For the transverse bend test of butt weld, the test specimen shall be taken transversely from the welded joint of the manufactured product or the test piece in such a way that the weld axis remains in the middle of test specimen after working or a suitable position for testing.

For longitudinal bend test of butt weld, the test specimen shall be taken longitudinally from the welded joint of the manufactured product or the test piece.

5.3 Marking

Each test piece shall be marked in order to identify its exact location in the manufactured product or in the joint from which it has been removed.

If required by the relevant application standard, the direction of work (e.g., rolling or extrusion) shall be marked.

Each test specimen shall be marked in order to identify its exact location in the test piece from which it has been removed.

5.4 Heat treatment and ageing

No heat treatment shall be applied to the welded joint or to the test specimen unless it is specified or permitted by the relevant application standard dealing with the welded joint to be tested. Details of any heat treatment shall be recorded in the test report. If natural ageing of aluminium alloys, etc. takes place, the time between welding and testing shall be recorded.

5.5 Extraction

5.5.1 General

The mechanical or thermal processes used to extract the test specimen shall not change the properties of the test specimen in any way. In the finished dimensions of the specimens required by this Standard, any portion affected by thermal cutting shall be mechanically removed.

5.5.2 Steel

Shearing shall not be used when thickness of plate is over 8 mm. If thermal cutting or other cutting methods which could affect the cut surfaces are used to extract the test specimen from the test piece, the cuts shall be made at a distance of 3 mm or over from the test specimen but in any case sufficient not to introduce metallurgical effects which could affect the test results.

5.5.3 Other metallic materials

Shearing and thermal cutting shall not be used, and only machining (e.g., sawing or milling) shall be used.

5.6 Shapes and dimensions of test specimens

5.6.1 Transverse face bend test specimen and transverse root bend test specimen for a butt weld (TFBB and TRBB)

The shapes of transverse face bend test specimen and transverse root bend test specimen for a butt weld are shown in figure 1 and figure 2, respectively.

The face side of the weld in the face bend test and the root side of the weld in the root bend test shall be made as the surface in tension. For transverse face bend and root bend tests, the thickness of test specimen t_s shall be made equal to the thickness of parent material adjacent to the welded joint up to 30 mm in maximum thickness. When the thickness of test piece t is greater than 10 mm, the thickness of test specimen t_s as shown with broken lines in figure 1 and figure 2, may be machined or otherwise equally finished from the opposite side of the surface in tension up to a thickness of $10 \text{ mm} \pm 0.5 \text{ mm}$. However, the limit of $d \geq 1.3L_s - t_s$ shall be satisfied. When the thickness of test piece t is less than 10 mm, the thickness of test specimen shall be that of test piece. For pipes, excess weld metal shall be removed, but the internal surface or the external surface need not be flattened.