

---

---

वेल्डिंग और संबद्ध प्रक्रियाएं —  
वेल्डिंग स्थिति

**Welding and Allied Processes —  
Welding Positions**

ICS 25.160.40

© BIS 2024

© ISO 2019



भारतीय मानक ब्यूरो  
BUREAU OF INDIAN STANDARDS  
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI - 110002  
[www.bis.gov.in](http://www.bis.gov.in) [www.standardsbis.in](http://www.standardsbis.in)

## NATIONAL FOREWORD

This Indian Standard which is identical to ISO 6947 : 2019 'Welding and allied processes — Welding positions' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Welding General and its Applications Sectional Committee and approval of the Metallurgical Engineering Division Council.

Welding positions are an important factor which is to be taken into consideration during the welding process for production as well as testing and this standard lays down different welding positions depending on orientation of weld pieces. Welding positions are not dependent on the geometrical arrangement of the joint, for example, butt or fillet joint, or that of the semi-finished product. Welds of all types and in all directions are covered. The direction of welding (that is, upwards or downwards) can also contribute to defining welding positions.

The main positions have been given symbols which can easily be used for designation purposes; these symbols were not derived from any particular language. The concept of a special test position, not covered by the existing and well-defined positions, has been included so that testing can be carried out in positions that do not meet the standard requirements.

The relationship between testing positions and production welding positions is specified elsewhere, for example, in the ISO 9606 series or ISO 15614 series.

The Committee decided to adopt ISO 6947 : 2019 standard under dual numbering system.

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminologies and conventions are, however, not identical with those used in Indian Standard. Attention is especially drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, it should be read as 'Indian Standard'; and
- b) Comma (,) has been used as a decimal marker, while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical-values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

# Contents

Page

<b>Introduction</b> .....	<b>iv</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Welding positions</b> .....	<b>2</b>
4.1 Main welding positions.....	2
4.2 Welding positions and allowable deviations for testing.....	5
4.3 Welding positions and ranges in production.....	5
<b>5 Designation</b> .....	<b>6</b>
<b>Annex A (informative) Limits of the slope of a weld axis and the rotation of the weld face about the weld axis for welding positions in production welds</b> .....	<b>8</b>
<b>Annex B (informative) Comparison of this document and US designation systems for welding positions</b> .....	<b>15</b>
<b>Bibliography</b> .....	<b>19</b>

## **Introduction**

This document specifies positions for standard discrete test piece orientation, e.g. PA, PB, H-L045, that have been included in this document since the third edition (ISO 6947:2011).

Since the third edition was published, positions for production welding are also defined. These positions are flat, horizontal, vertical, and overhead. Unlike discrete testing positions, these positions are contiguous.

Welding position are not dependent on the geometrical arrangement of the joint, e.g. butt or fillet joint, or that of the semi-finished product. Welds of all types and in all directions are covered.

The direction of welding (i.e. upwards or downwards) can also contribute to defining welding positions.

The main positions have been given symbols which can easily be used for designation purposes; these symbols were not derived from any particular language.

The concept of a special test position, not covered by the existing and well-defined positions, has been included so that testing can be carried out in positions that do not meet the standard requirements.

The relationship between testing positions and production welding positions is specified elsewhere, e.g. in the ISO 9606 series or ISO 15614 series.

*Indian Standard*

# WELDING AND ALLIED PROCESSES — WELDING POSITIONS

## 1 Scope

This document defines welding positions for testing and production, for butt and fillet welds, in all product forms.

[Annex A](#) gives examples of the limits of the slope of a weld axis and the rotation of the weld face about the weld axis for welding positions in production welds.

[Annex B](#) gives a comparison of this document and US designation systems for welding positions.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.1

#### **welding position**

position of a weld defined relative to the slope of the axis and rotation of the face of the weld relative to the horizontal plane

### 3.2

#### **main welding position**

*welding position* (3.1) designated PA, PB, PC, PD, PE, PF, PG, PH, PJ or PK

Note 1 to entry: See [Figure 1](#) and [Figure 2](#) for welding position designations.

### 3.3

#### **special test position**

##### **SP**

any *welding position* (3.1) that is not covered by one of the *main welding positions* (3.2) (see 4.3)

### 3.4

#### **slope**

##### **S**

<welding positions> angle of the axis of the weld relative to the *main welding position* (3.2)

### 3.5

#### **rotation**

##### **R**

<welding positions> angle of the face of the weld relative to the *main welding position* (3.2)

### 3.6

#### **inclined angle**

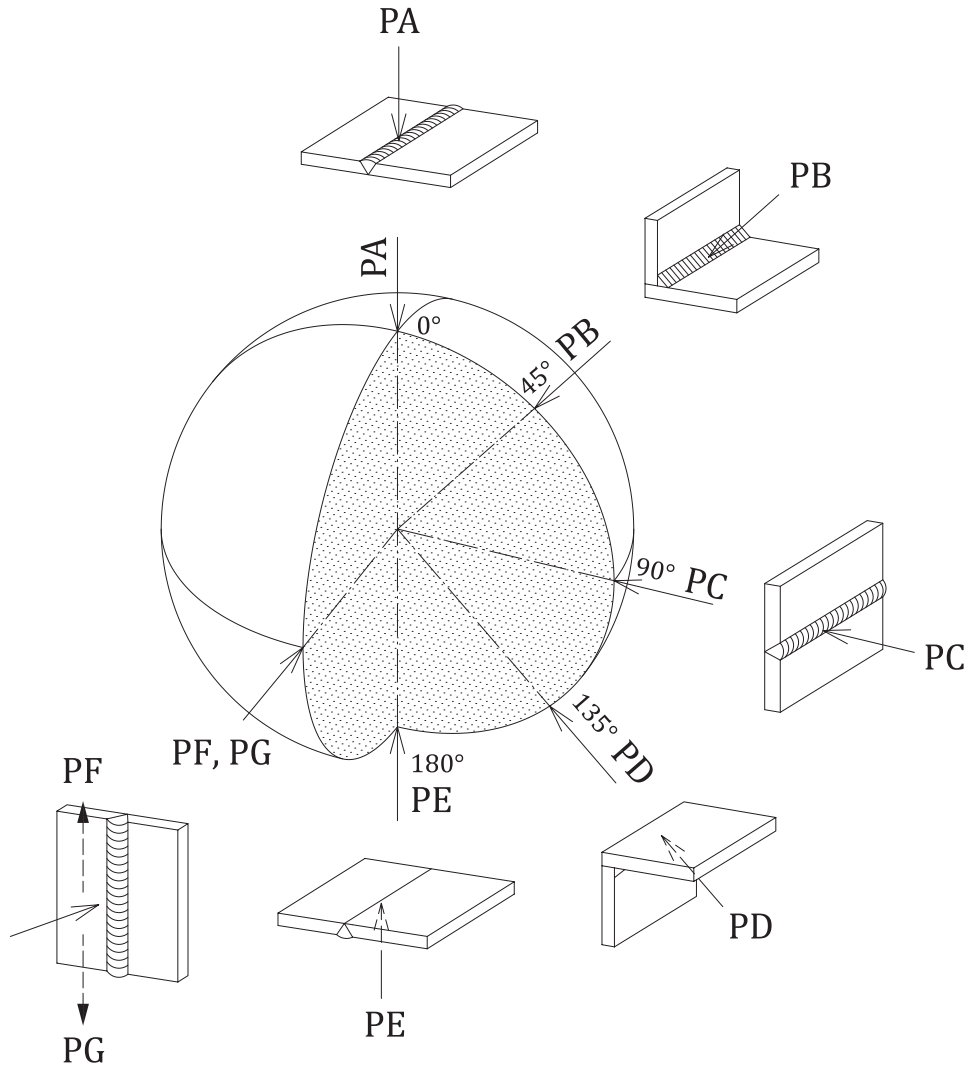
##### **L**

<welding positions> angle of the axis of the pipe

## 4 Welding positions

### 4.1 Main welding positions

The main welding positions PA to PG are illustrated in [Figure 1](#).



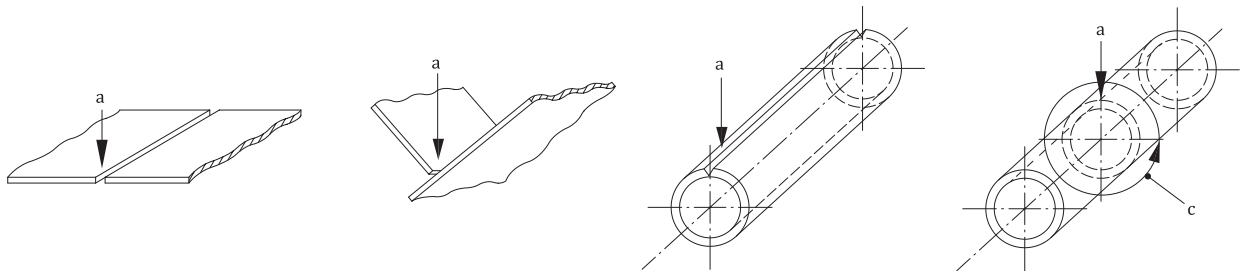
#### Key

- A flat position
- PB horizontal vertical position
- PC horizontal position
- PD horizontal overhead position
- PE overhead position
- PF vertical position (welding upwards)
- PG vertical position (welding downwards)

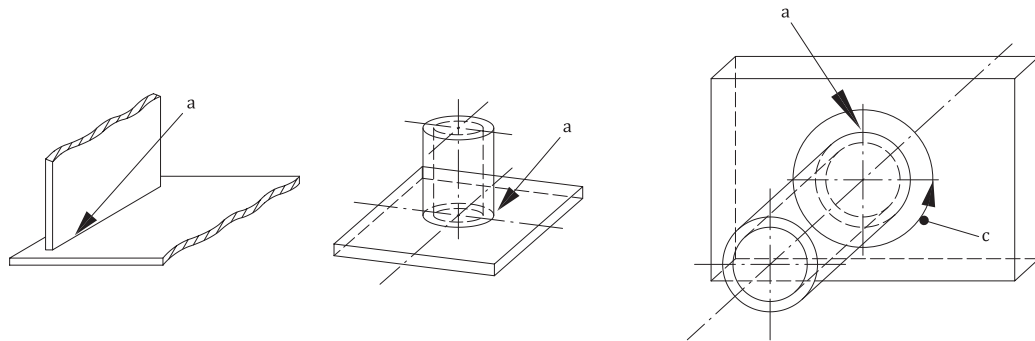
NOTE Solid arrows show the welding position with respect to the face of the weld. Dashed arrows for PF (upwards) and PG (downwards) represent the direction of welding.

**Figure 1 — Main welding positions — PA to PG**

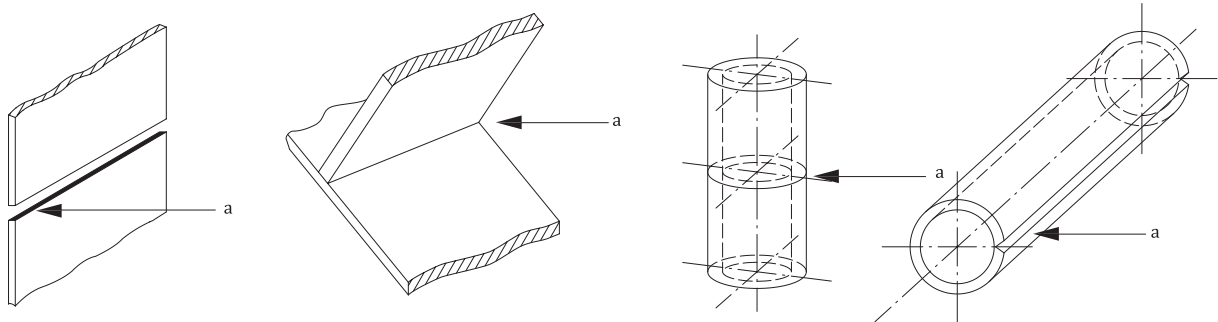
Illustrations of main welding positions for butt and fillet welds are given in [Figure 2](#).



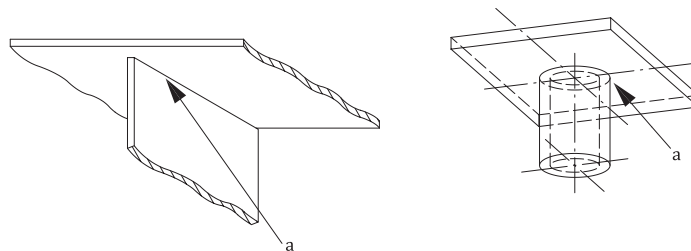
**a) PA: flat position**



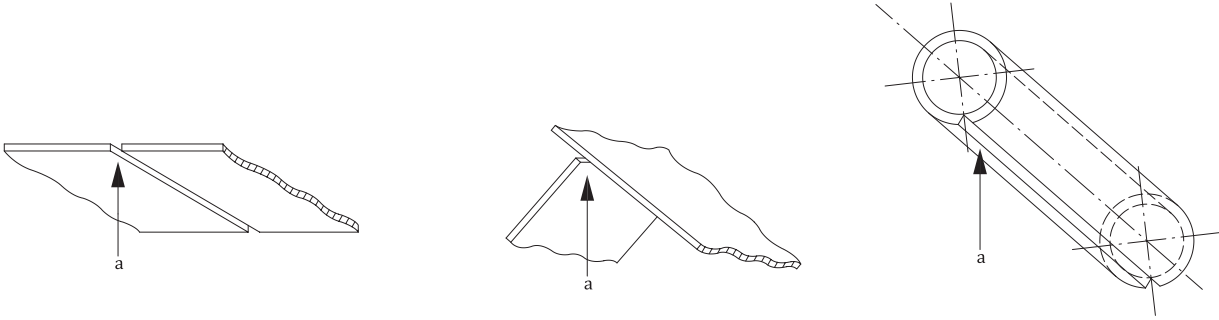
**b) PB: horizontal vertical position**



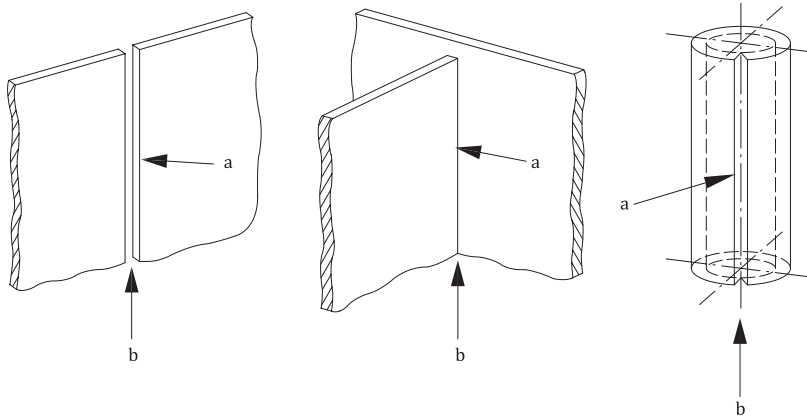
**c) PC: horizontal position**



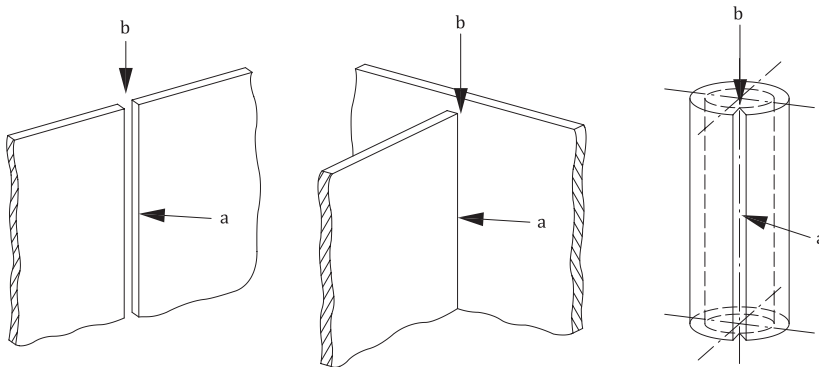
**d) PD: horizontal overhead position**



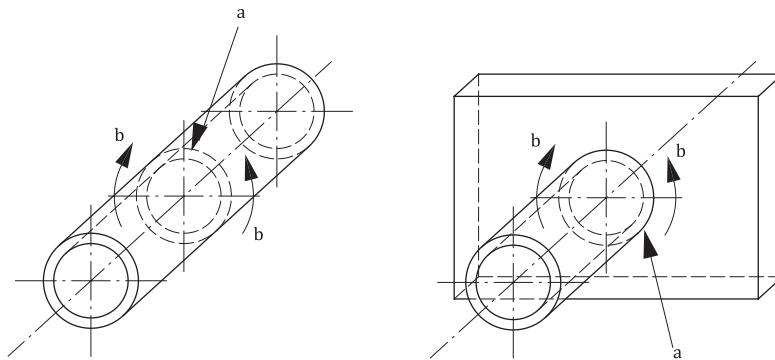
**e) PE: overhead position**



**f) PF: vertical position (welding upwards)**

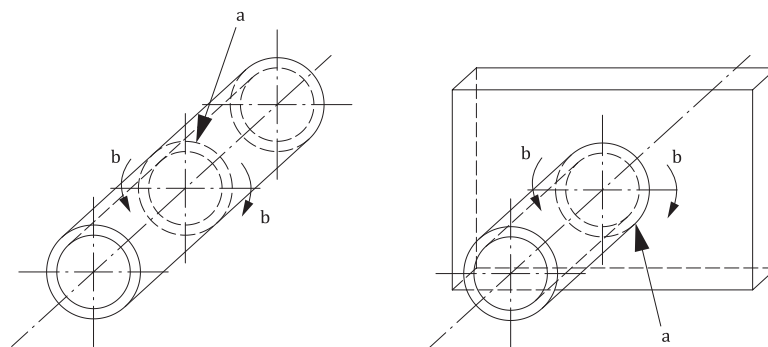


**g) PG: vertical position (welding downwards)**

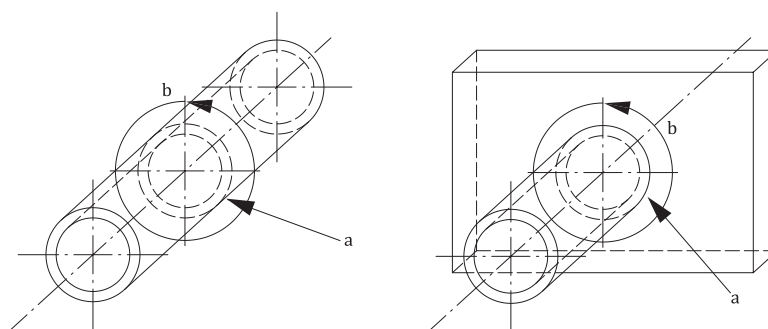


**h) PH: pipe position for welding upwards**





**i) PJ: pipe position for welding downwards**



**j) PK: pipe position for orbital welding**

**Key**

- a The arrow indicates the face of the weld and thus the welding position.
- b The arrow indicates the direction of welding along the joint.
- c The arrow indicates the rotation of the workpieces when welding a pipe in a positioner.

**Figure 2 — Illustrations of main welding positions PA, PB, PC, PD, PE, PF, PG, PH, PJ and PK**

**4.2 Welding positions and allowable deviations for testing**

Welding positions used during welding of a test piece shall not exceed  $\pm 5^\circ$  in slope and  $\pm 10^\circ$  in rotation from the main welding position.

**4.3 Welding positions and ranges in production**

The main welding positions are referenced in other standards, e.g. the ISO 9606 series for qualification of welders, and the ISO 15614 series for qualification of welding procedures.

For production welding, the allowable deviations from the main positions used for qualification of welders and welding procedures are given in [Table 1](#) for butt welds and in [Table 2](#) for fillet welds (see also examples in [Annex A](#)). Application standards may extend or restrict the ranges qualified, e.g. an application standard could limit PA to  $15^\circ$  of face rotation rather than  $30^\circ$ .

NOTE For asymmetric tolerances, “plus” means revolving the weld surface towards the main welding position PA and “minus” means revolving the weld surface towards the main welding position PE.

When a test piece is welded using a position outside of the limits (see [3.3](#)) of the main welding positions, the slope and rotation shall be recorded in accordance with [Clause 5](#). The allowable range in production shall be  $\pm 15^\circ$  in slope and in rotation.

**Table 1 — Slope and rotation ranges for welding positions in production butt welds**

elding position	Main welding position	Slope	Rotation
		<i>S</i>	<i>R</i>
Flat	PA	±15°	±30°
Horizontal	PC	±15°	+60° -10°
Overhead	PE	±80°	±80°
Vertical	PF, PG	+10° to +75°	±100°
		±10°	±180°

**Table 2 — Slope and rotation ranges for welding positions in production fillet welds**

elding position	Main welding position	Slope	Rotation
		<i>S</i>	<i>R</i>
Flat	PA	±15°	±30°
Horizontal vertical	PB	±15°	+15° -10°
Horizontal	PC	±15°	+35° -10°
Horizontal overhead	PD	±80°	+35° -10°
Overhead	PE	±80°	±35°
Vertical	PF, PG	+10° to +75°	±100°
		±10°	±180°

## 5 Designation

Main welding positions shall be designated by the appropriate symbol in accordance with [Figure 1](#) and [Figure 2](#) (see EXAMPLE 1). The symbol for the main welding position may be supplemented by the values for slope and rotation, given in three digits (see EXAMPLE 2).

When a test piece is welded in a position outside of the limits of the main welding positions, the allowable range in production is ±15° in slope and in rotation. These supplementary values are mandatory when the test piece used for qualification was outside of the slope and rotation limits specified in [4.2](#).

For circumferential welds in pipes with inclined axes, the indication of slope and rotation shall be simplified in accordance with [Figure 2](#) (see EXAMPLES 3 and 4).

EXAMPLE 1 The main welding position “horizontal vertical” (PB) is:

PB

This is a standard test position and the range qualified is in accordance with [Table 2](#).

EXAMPLE 2 The main welding position “horizontal vertical” (PB), with slope of 15° and rotation of 10°, is:

PB 015-010

This is a special position for which the range qualified is from 0° to 30° of slope and -5° to 25° of face rotation unless specified otherwise in the application standard.

EXAMPLE 3 The welding position on pipes with inclined axes, with welding direction “welding upwards” (PH) and an inclined angle of 45°, is:

PH-L045

This is a special position for which the range qualified is all slopes and to 45° of face rotation with upward progression. The application standard can specify a different range.

EXAMPLE 4 The welding position on pipes with inclined axes, with welding direction “welding downwards” (PJ) and an inclined angle of 45°, is:

PJ-L045

This is a special position for which the range qualified is all slopes and from 30° to 60° of face rotation with downward progression. The application standard may specify a different range.

NOTE In EXAMPLES 3 and 4, the inclined angle given is an example.

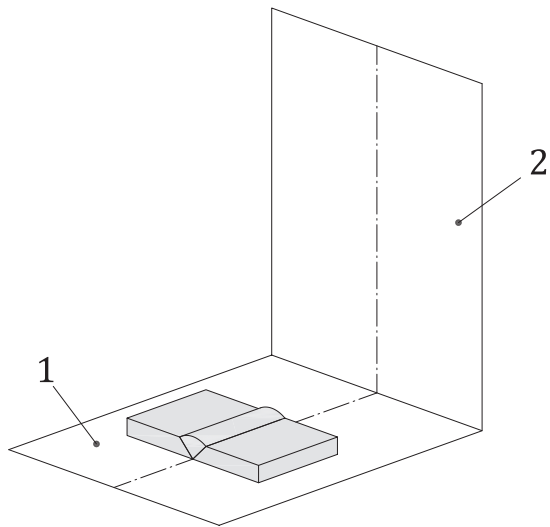
## Annex A (informative)

### Limits of the slope of a weld axis and the rotation of the weld face about the weld axis for welding positions in production welds

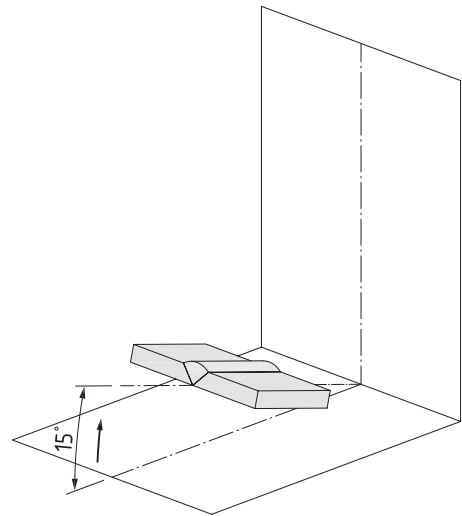
This annex describes, through a series of sketches, the limits of the slope of a weld axis and the rotation of the weld face about the weld axis for welding positions in production welds (see [Table 1](#) and [Table 2](#)).

[Figures A.1](#) to [A.4](#) show sketches for butt welds and [Figures A.5](#) and [A.6](#) show sketches for fillet welds.

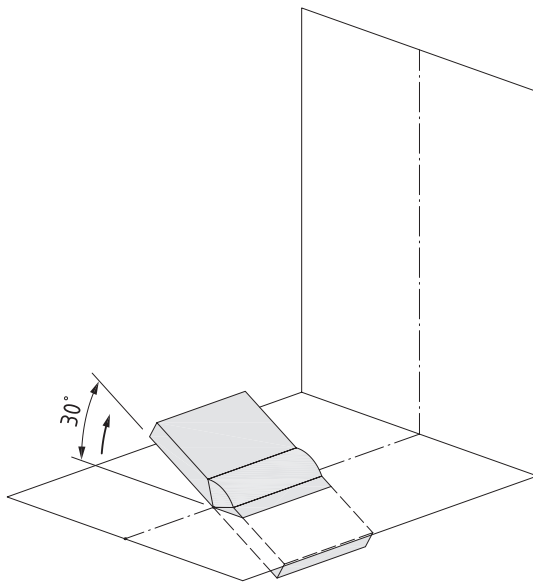
NOTE The convention shown in [Figure A.1](#) a) for horizontal plane and vertical plane applies to all figures in [Annex A](#).



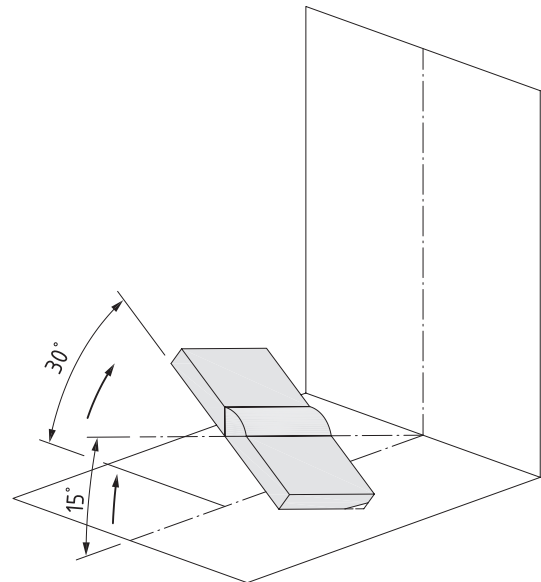
**a) Main welding position (PA)**



**b) Flat position (PA) slope limit**



**c) Flat position (PA) rotation limit**

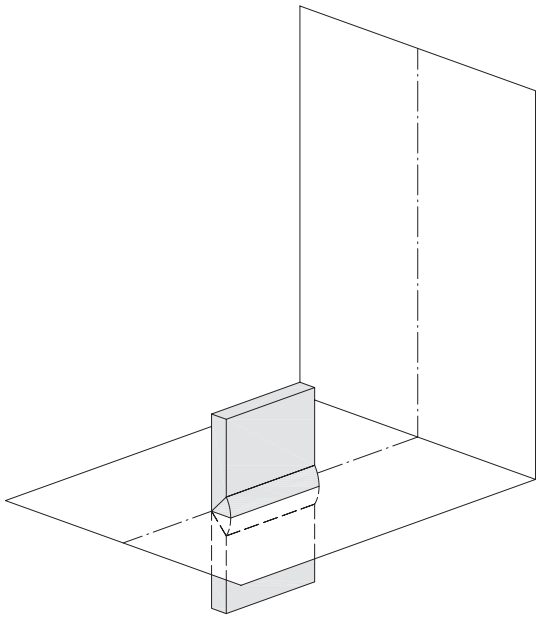


**d) Flat position (PA) slope limit and rotation limit**

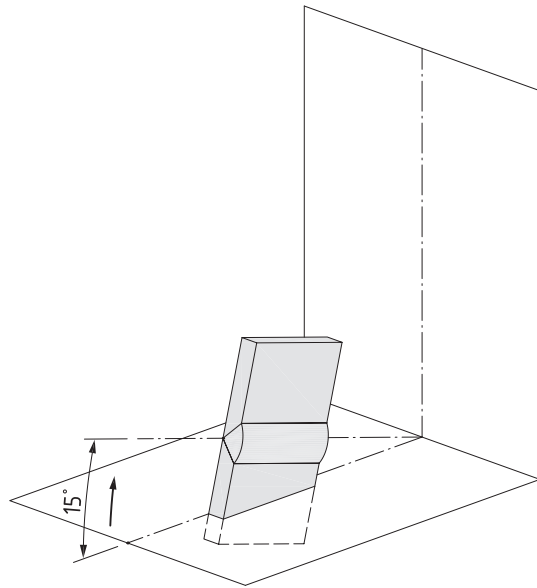
**Key**

- 1 horizontal plane
- 2 vertical plane

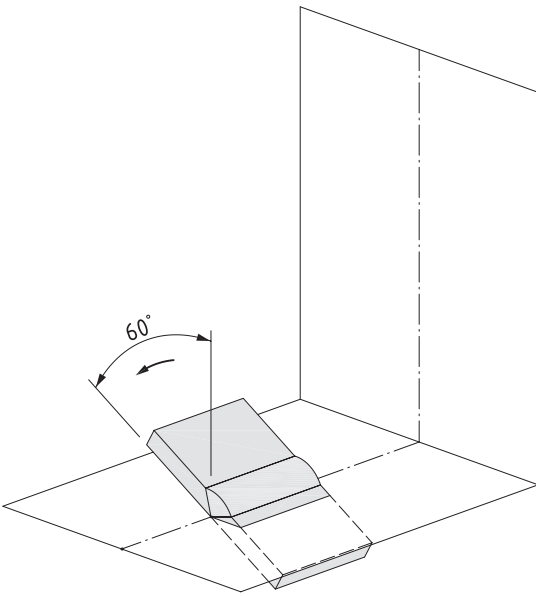
**Figure A.1 — Welding position PA slope and rotation limits for butt welds**



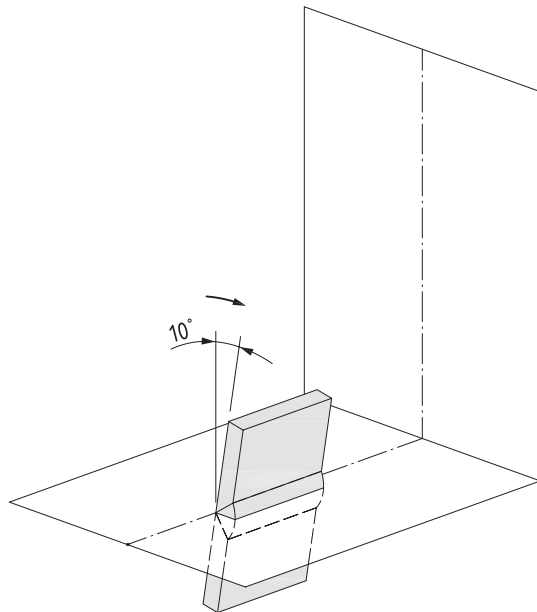
**a) Main welding position (PC)**



**b) Horizontal position (PC) slope limit**

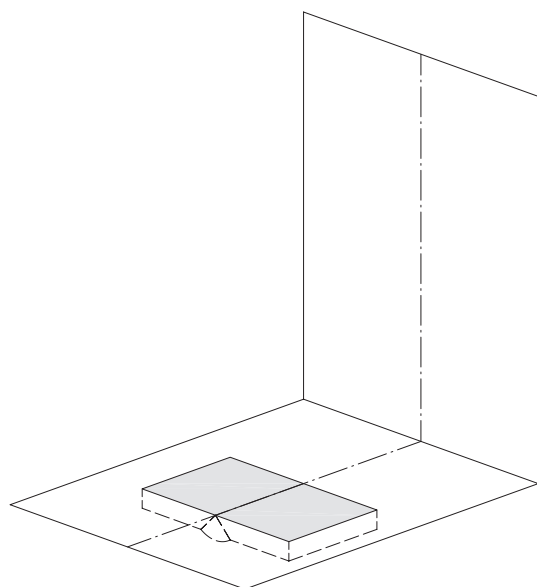


**c) Horizontal position (PC)  
rotation limit (+60°)**

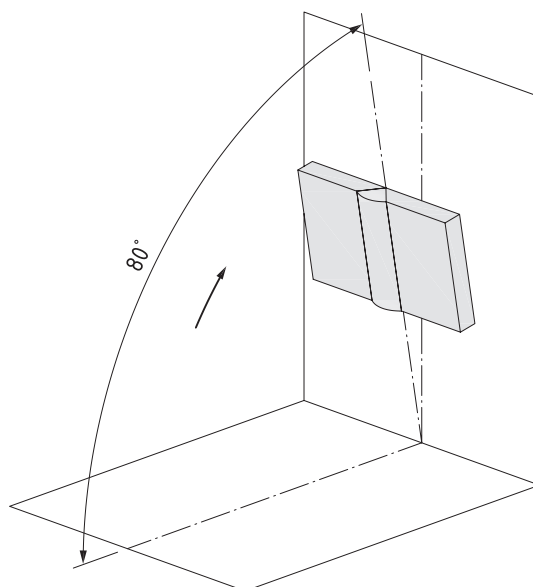


**d) Horizontal position (PC)  
rotation limit (-10°)**

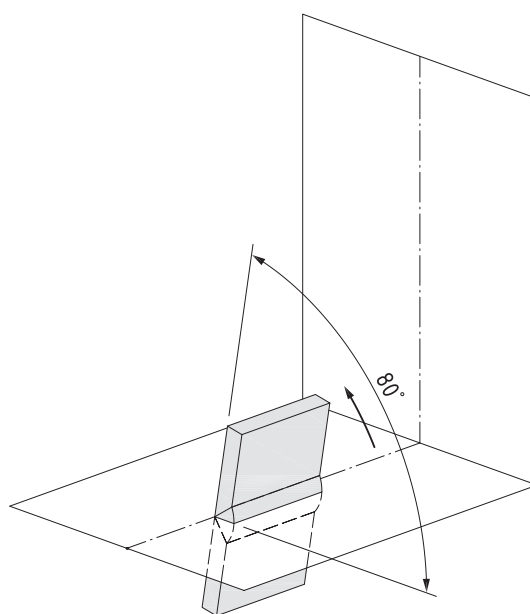
**Figure A.2 — Welding position PC slope and rotation limits for butt welds**



**a) Main welding position (PE)**

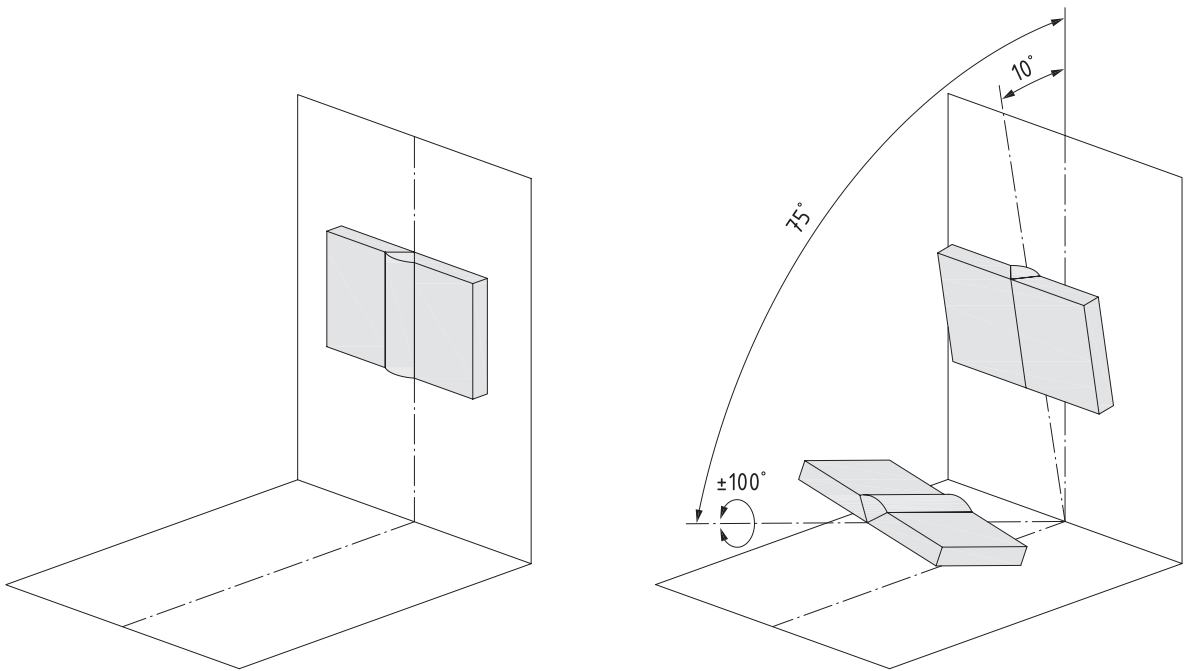


**b) Overhead position (PE) slope limit**



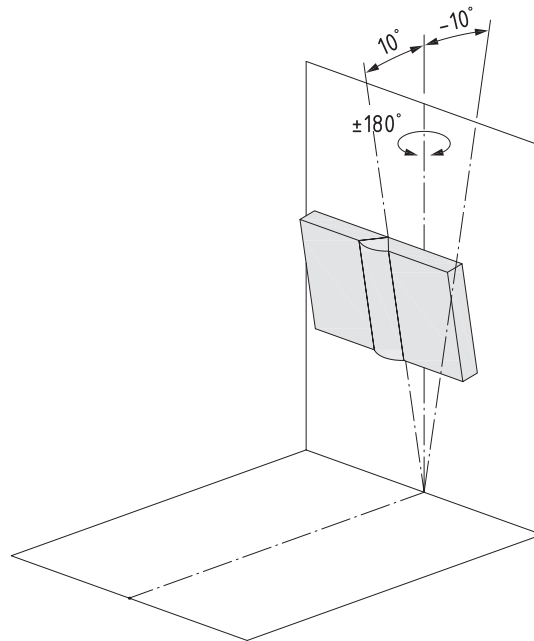
**c) Overhead position (PE)  
rotation limit**

**Figure A.3 — Welding position PE slope and rotation limits for butt welds**



**a) Main welding position (PF, PG)**

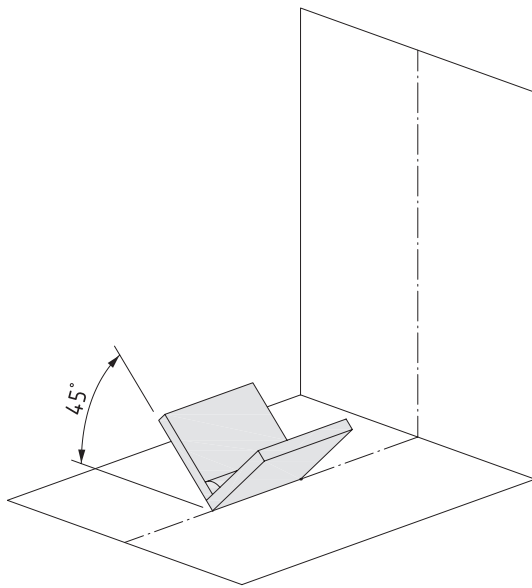
**b) Vertical position (PF, PG) slope limit and rotation limit**



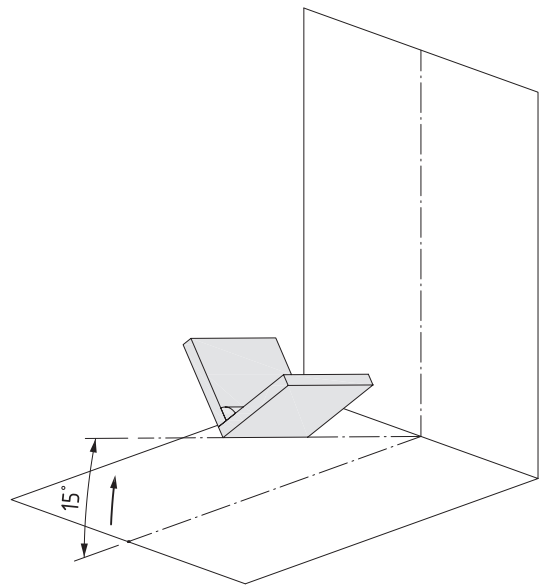
**c) Vertical position (PF, PG) slope limit and rotation limit**

**Figure A.4 — Welding position PF, PG slope and rotation limits for butt welds**

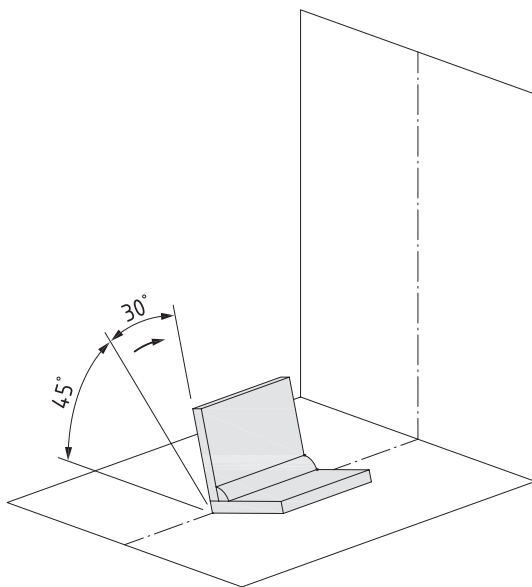




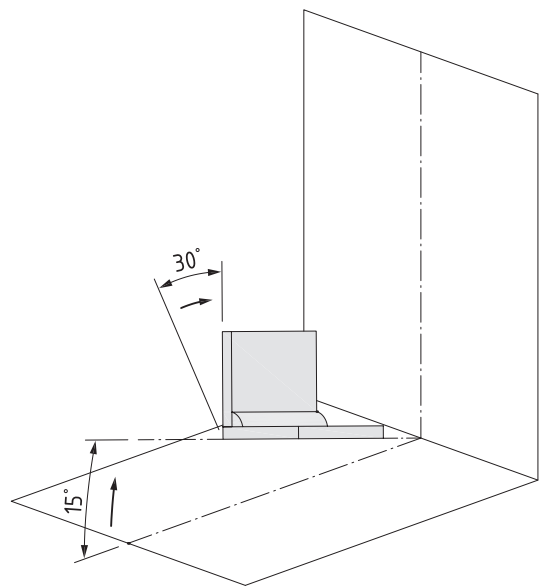
**a) Main welding position (PA)**



**b) Flat position (PA) slope limit**

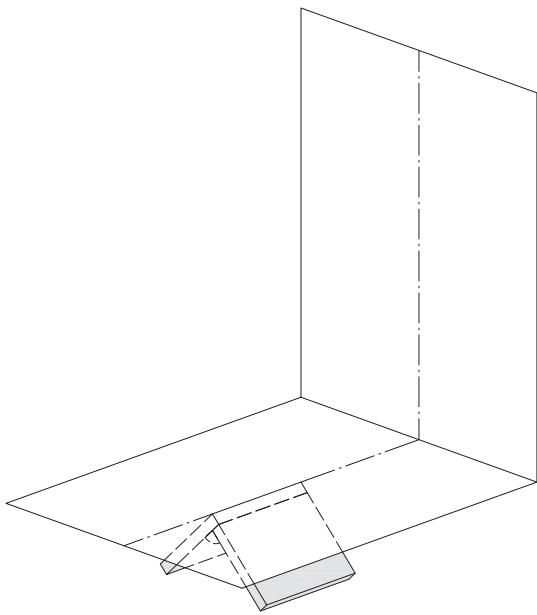


**c) Flat position (PA) rotation limit**

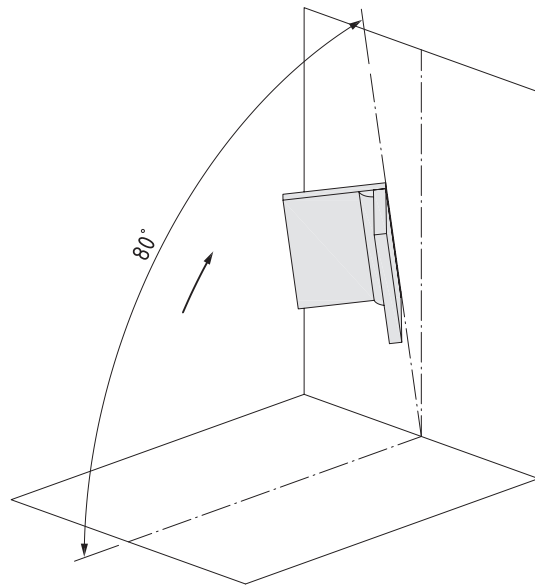


**d) Flat position (PA)  
slope limit and rotation limit**

**Figure A.5 — Welding position PA slope and rotation limits for fillet welds**



**a) Main welding position (PE)**



**b) Overhead welding position (PE) slope limit**

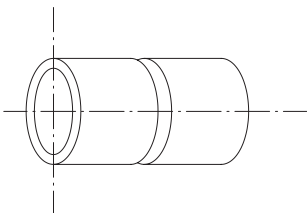
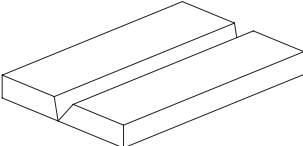
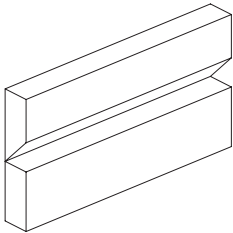
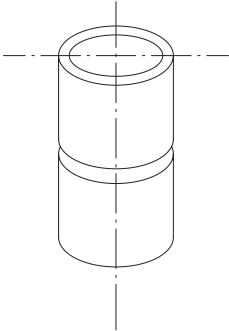
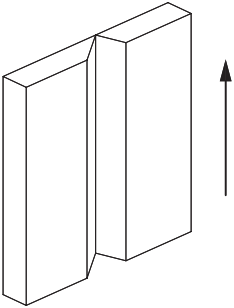
**Figure A.6 — Welding position PE slope and rotation limits for fillet welds**

## Annex B (informative)

### Comparison of this document and US designation systems for welding positions

Table B.1 provides a comparison of this document and US designation systems for welding positions<sup>[3][4]</sup>.

**Table B.1 — Comparison of this document and US designation systems for welding positions**

Illustration	Welding position in accordance with AWS A3.0M/A3.0 and ASME Section IX	Welding position in accordance with this document
 flat position (pipe rotating)	 flat position	1G  PA
 horizontal position	 horizontal position	2G  PC
 vertical up position	3G uphill	PF

<sup>a</sup> The inclined angle is an example only.

Table B.1 (continued)

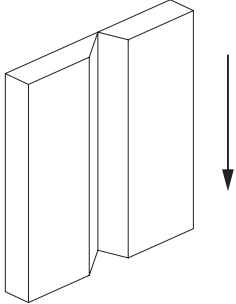
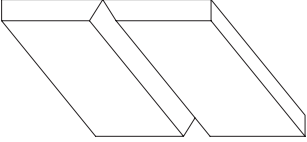
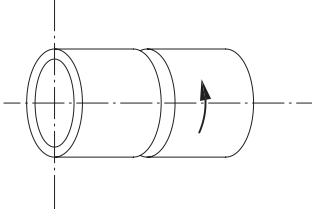
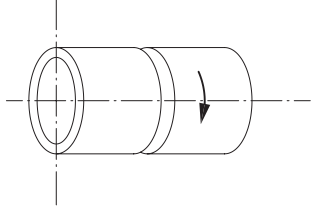
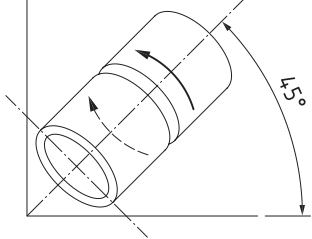
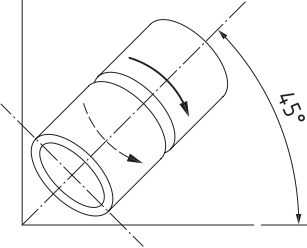
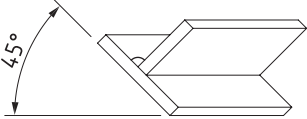
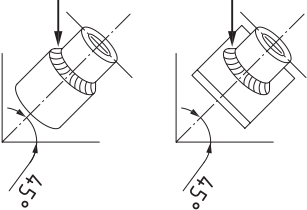
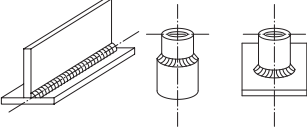
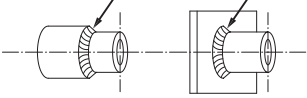
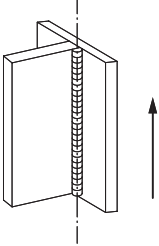
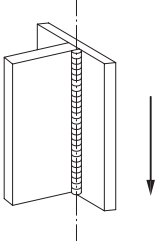
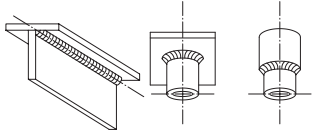
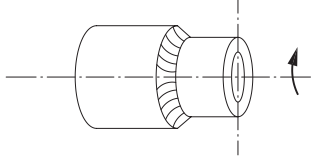
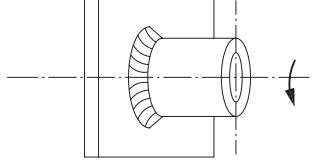
Illustration	Welding position in accordance with AWS A3.0M/A3.0 and ASME Section IX	Welding position in accordance with this document
 <p data-bbox="387 763 655 797">vertical down position</p>	3G downhill	PG
 <p data-bbox="416 969 628 1003">overhead position</p>	4G	PE
 <p data-bbox="336 1249 703 1283">vertical up position (pipe fixed)</p>	5G uphill	PH
 <p data-bbox="320 1525 724 1559">vertical down position (pipe fixed)</p>	5G downhill	PJ
 <p data-bbox="248 1839 794 1872">inclined position (pipe fixed) welding upwards</p>	6G uphill	PH-L045 <sup>a</sup>
<p data-bbox="98 1879 549 1906"><sup>a</sup> The inclined angle is an example only.</p>		

Table B.1 (continued)

Illustration	Welding position in accordance with AWS A3.0M/A3.0 and ASME Section IX	Welding position in accordance with this document
 <p>inclined position (pipe fixed) welding downwards</p>	6G downhill	PJ-L045 <sup>a</sup>
 <p>flat position</p>	1F	PA
 <p>flat position (pipe rotating)</p>	1FR	PA
 <p>horizontal vertical position</p>	2F	PB
 <p>horizontal vertical position (pipe rotated)</p>	2FR	PB
 <p>vertical up position</p>	3F uphill	PF

<sup>a</sup> The inclined angle is an example only.

Table B.1 (continued)

Illustration	Welding position in accordance with AWS A3.0M/A3.0 and ASME Section IX	Welding position in accordance with this document
 <p data-bbox="389 703 655 736">vertical down position</p>	3F downhill	PG
 <p data-bbox="352 898 689 934">horizontal overhead position</p>	4F	PD
 <p data-bbox="336 1122 703 1158">vertical up position (pipe fixed)</p>	5F uphill	PH
 <p data-bbox="320 1346 719 1382">vertical down position (pipe fixed)</p>	5F downhill	PJ

<sup>a</sup> The inclined angle is an example only.

## Bibliography

- [1] ISO 9606 (all parts), *Qualification testing of welders — Fusion welding*
- [2] ISO 15614 (all parts), *Specification and qualification of welding procedures for metallic materials — Welding procedure test*
- [3] ASME Section IX, ASME boiler and pressure vessel code — Section IX: Welding and brazing qualifications
- [4] AWS A3.0M/A3.0, *Standard welding terms and definitions including terms for adhesive bonding, brazing, soldering, thermal cutting, and thermal spraying*







## Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 2016* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

### Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

### Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website- [www.bis.gov.in](http://www.bis.gov.in) or [www.standardsbis.in](http://www.standardsbis.in).

This Indian Standard has been developed from Doc No.: MTD 11 (22957).

### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

## BUREAU OF INDIAN STANDARDS

### Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002  
Telephones: 2323 0131, 2323 3375, 2323 9402

Website: [www.bis.gov.in](http://www.bis.gov.in)

### Regional Offices:

	Telephones
Central : 601/A, Konnectus Tower -1, 6 <sup>th</sup> Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	{ 2323 7617
Eastern : 8 <sup>th</sup> Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	{ 2367 0012 2320 9474
Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	{ 265 9930
Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	{ 2254 1442 2254 1216
Western : Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	{ 2821 8093

**Branches :** AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.