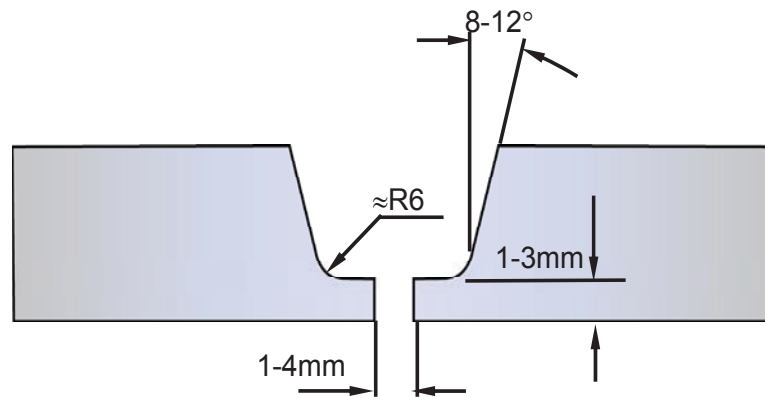


Section 9

Welding Symbols

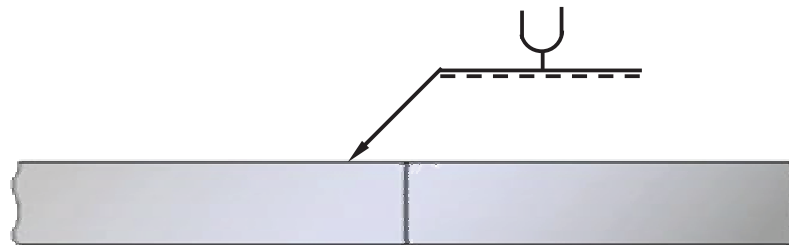
A weld joint can be represented on an engineering drawing by means of a detailed sketch showing every detail and dimension of the joint preparation – as shown below.



Single U preparation

While this method of representation gives comprehensive information, it can be time-consuming and can overburden the drawing.

An alternative method is to use a symbolic representation to specify the required information – as shown below for the same joint detail.



Symbolic representation has the following advantages:

- Simple and quick to put on the drawing.
- Does not overburden the drawing.
- No need for an additional view – all welding symbols can be put on the main assembly drawing.

Symbolic representation has following disadvantages:

- Can only be used for standard joints (eg BS EN ISO 9692).
- There is not a way of giving precise dimensions for joint details.
- Some training is necessary in order to interpret the symbols correctly.

1 Standards for Symbolic Representation of Welded Joints on Drawings

There are two principal standards that are used for welding symbols:

European Standard

EN 22553 – Welded, brazed & soldered joints – Symbolic representation on drawings

American Standard

AWS A2.4 – Standard Symbols for Welding, Brazing, & Non-destructive Examination

These standards are very similar in many respects, but there are also some major differences that need to be understood to avoid misinterpretation.








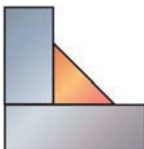

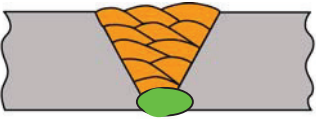

Details of the European Standard are given in the following sub-sections with only brief information about how the American Standard differs from the European Standard.

Elementary welding symbols

Various types of weld joint are represented by a symbol that is intended to help interpretation by being similar to the shape of the weld to be made.

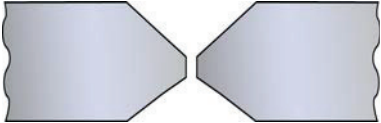

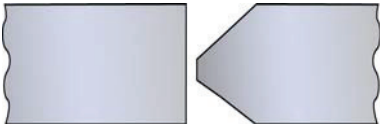

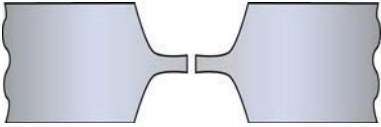

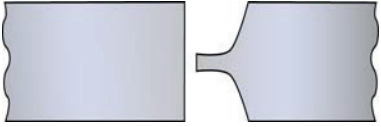

Examples of symbols used by EN 22553 are shown on the following pages.

2 Elementary Welding Symbols

Designation	Illustration of joint preparation	Symbol
Square butt weld		
Single V butt weld		∇
Single bevel butt weld		∇
Single V butt weld with broad root face		Y
Single bevel butt weld with broad root face		Y
Single U butt weld		∩
Single J butt weld		∩
Fillet weld		△
Surfacing (cladding)		3
Backing run (back or backing weld)		∪
Backing bar		—

3 Combination of Elementary Symbols



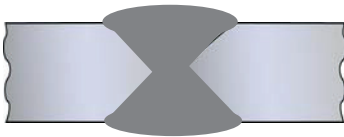

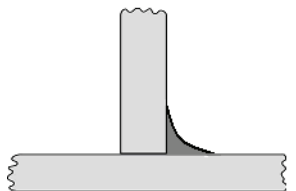

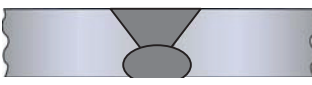



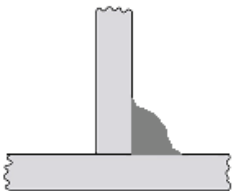

For symmetrical welds made from both sides, the applicable elementary symbols are combined – as shown below.

Designation	Illustration of joint preparation	Symbol
Double V butt weld (X weld)		
Double bevel butt weld (K weld)		
Double U butt weld		
Double J butt weld		

4 Supplementary Symbols

Weld symbols may be complemented by a symbol to indicate the required shape of the weld.

Examples of supplementary symbols and how they are applied are given below.

Designation	Illustration of joint preparation	Symbol
Flat (flush) single V butt weld		
Convex double V butt weld		
Concave fillet weld		
Flat (flush) single V butt weld with flat (flush) backing run		
Single V butt weld with broad root face and backing run		
Fillet weld with both toes blended smoothly		

Note: If the weld symbol does not have a supplementary symbol then the shape of the weld surface does not need to be indicated precisely.

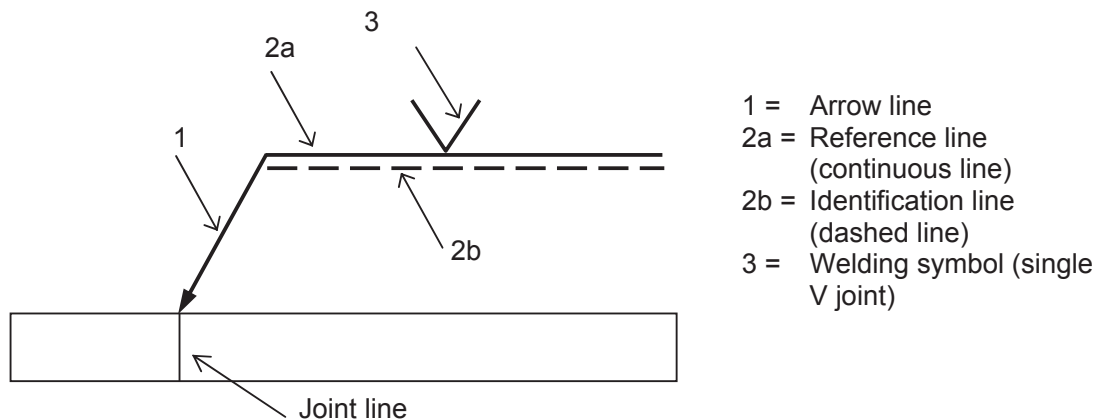
5 Position of Symbols on Drawings

In order to be able to provide comprehensive details for weld joints, it is necessary to distinguish the two sides of the weld joint.

This is done, according to EN 22553, is by:

- An arrow line
- A dual reference line consisting of a continuous and a dashed line

The figure below illustrates the method of representation.



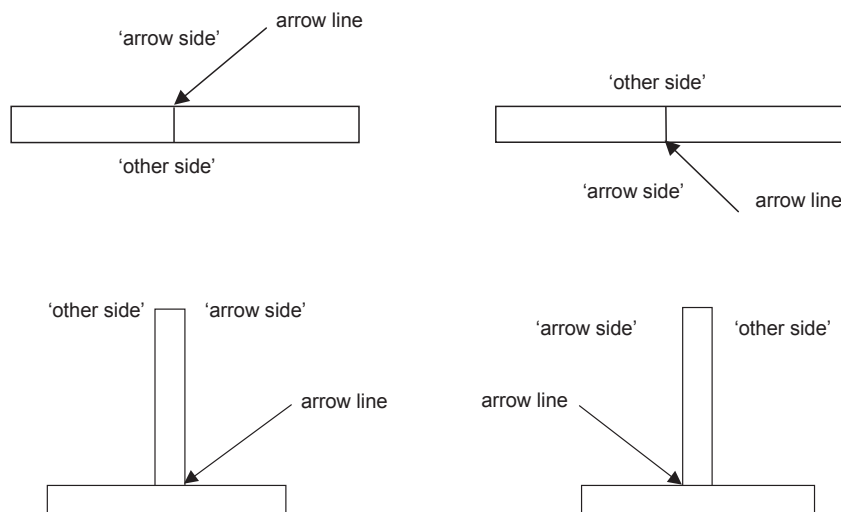
6 Relationship Between the Arrow Line and the Joint Line

One end of the joint line is called the **arrow side** and the opposite end is called **other side**.

The arrow side is always the end of the joint line that the arrow line points to (and touches).

It can be at either end of the joint line and it is the draughtsman who decides which end to make the arrow side.

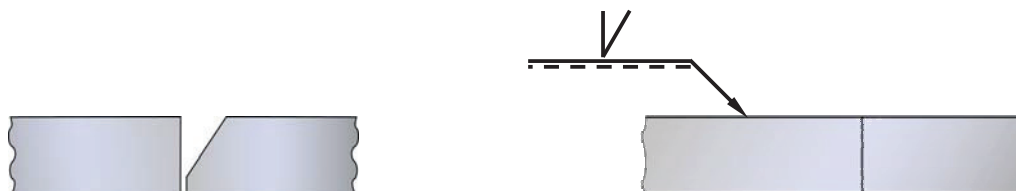
The figure below illustrates these principles.



There are some conventions about the arrow line:

- It must touch one end of the joint line.
- It joins one end of the continuous reference line.
- In case of a **non-symmetrical joint**, such as a single bevel joint, the arrow line must point towards the joint member that will have the weld preparation put on to it (as shown below).

An example of how a single bevel butt joint should be represented.



7 Position of the Reference Line and Weld Symbol

The reference line should, wherever possible, be drawn parallel to the bottom edge of the drawing (or perpendicular to it).

For a non-symmetrical weld it is essential that the arrow side and other side of the weld be distinguished. The convention for doing this is:

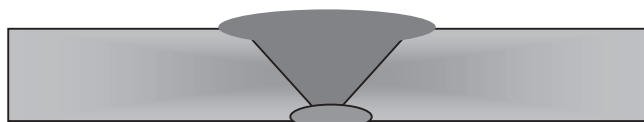
- Symbols for the weld details required on the arrow side must be placed on the continuous line.
- Symbols for the weld details on other side must be placed on the dashed line.

8 Positions of the Continuous and Dashed Lines

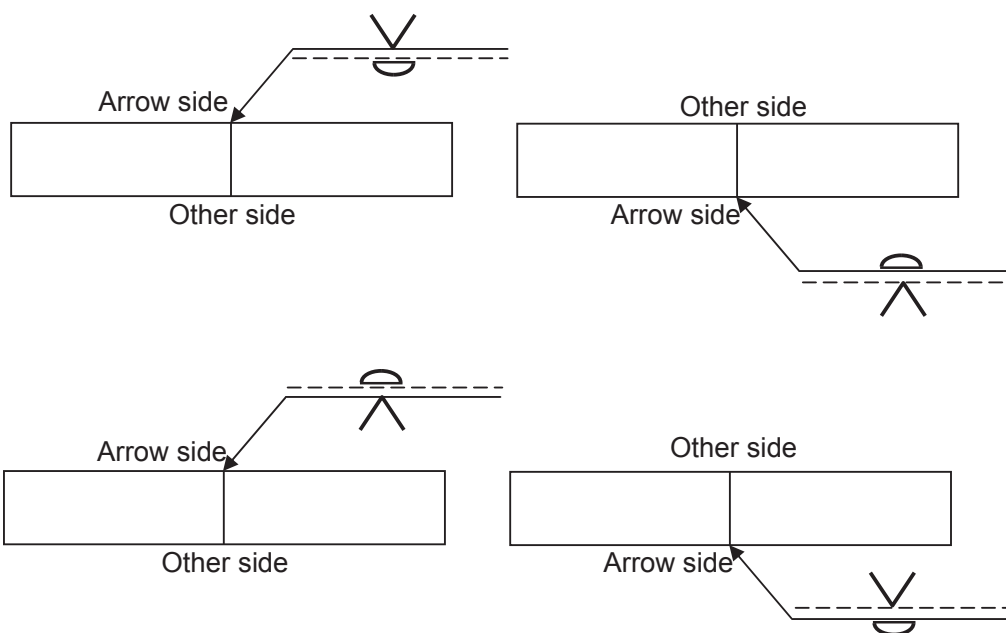
EN 22553 allows the dashed line to be either above or below the continuous line – as shown below.



If the weld is a symmetrical weld then it is not necessary to distinguish between the two sides and EN 22553 states that the dashed line should be omitted. Thus, a single V butt weld with a backing run can be shown by either of the four symbolic representations shown below.



Single V weld with backing run



Note: This flexibility of the position of the continuous and dashed lines is an interim measure that EN 22553 allows so that old drawings (to the obsolete BS 499 Part 2, for example) can be conveniently converted to show the EN method of representation.

9 Dimensioning of Welds

General rules

Dimensions may need to be specified for some types of weld and EN 22553 specifies a convention for this.

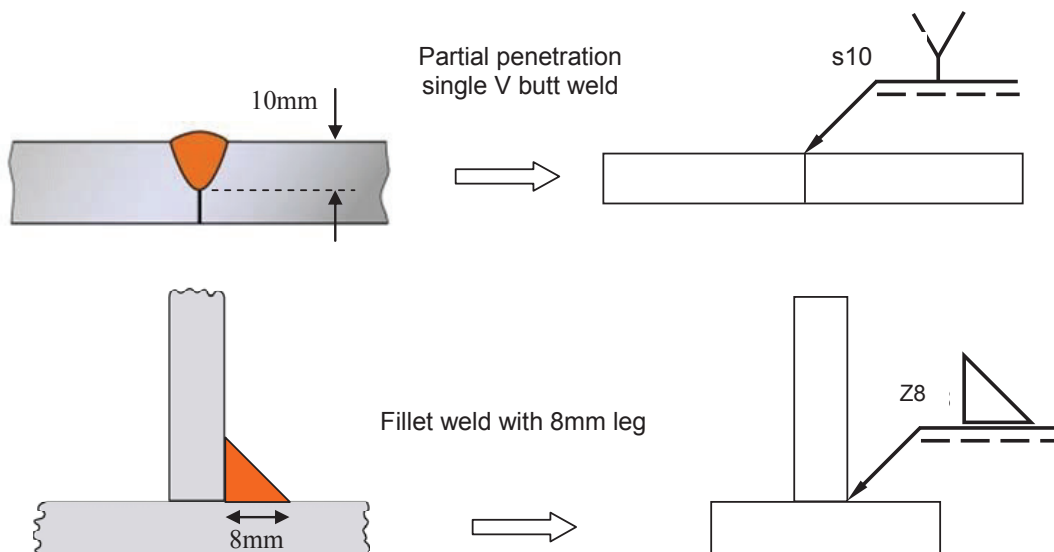
- Dimensions for the cross-section of the weld are written on the left-hand side of the symbol.
- Length dimensions for the weld are written on the right-hand side of the symbol.
- Absence of any indication to the contrary, all butt welds are full penetration welds.

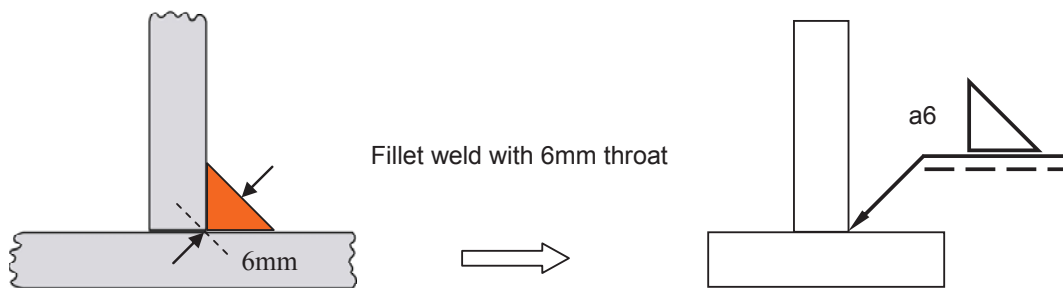
9.1 Symbols for cross-section dimensions

The following letters are used to indicate dimensions:

- a Fillet weld throat thickness.
- Z Fillet weld leg length.
- s Penetration depth.
(applicable to partial penetration butt welds and deep penetration fillets).

Some examples of how these symbols are used are shown below.



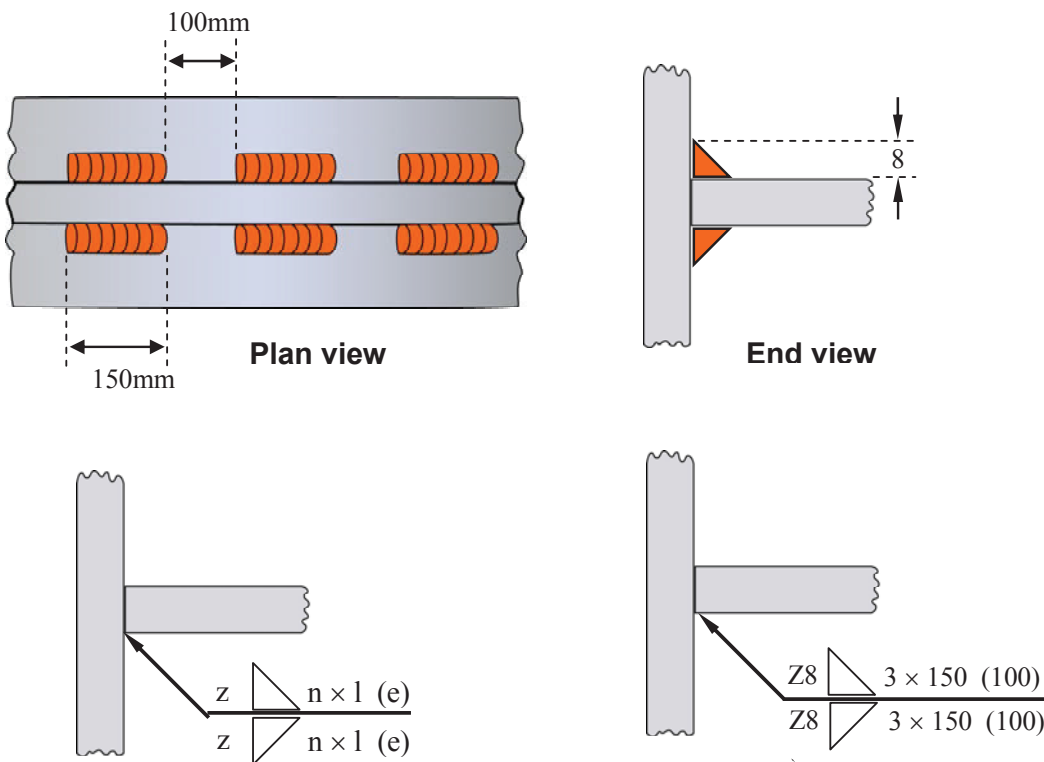


9.2 Symbols for length dimensions

To specify weld length dimensions and, for intermittent welds the number of individual weld lengths (weld elements), the following letters are used:

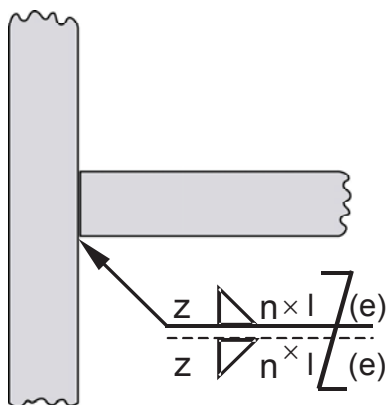
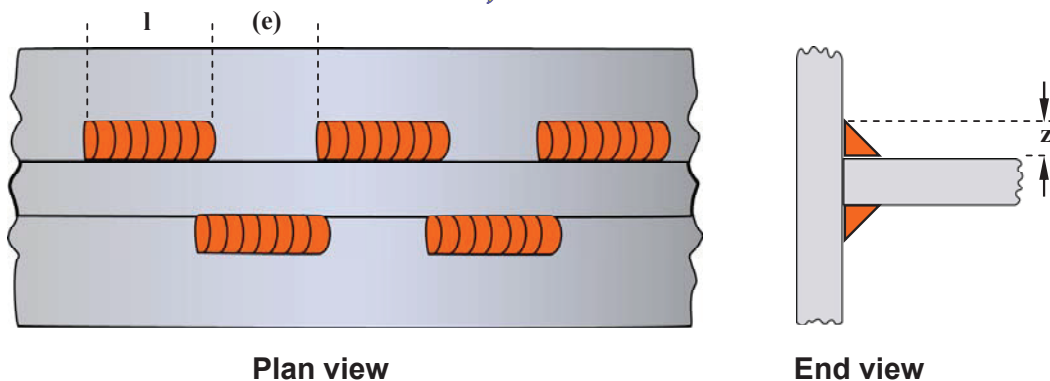
- l length of weld
- (e) distance between adjacent weld elements
- n number of weld elements

The use of these letters is illustrated for the intermittent double-sided fillet weld shown below.



Note: Dashed line not required because it is a symmetrical weld.

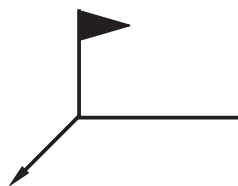
If an intermittent double-sided fillet weld is to be staggered, the convention for indicating this is shown below.



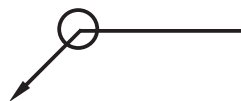
9.3 Complementary indications

Complementary indications may be needed to specify other weld characteristics of welds, eg:

- Field or site welds are indicated by a flag

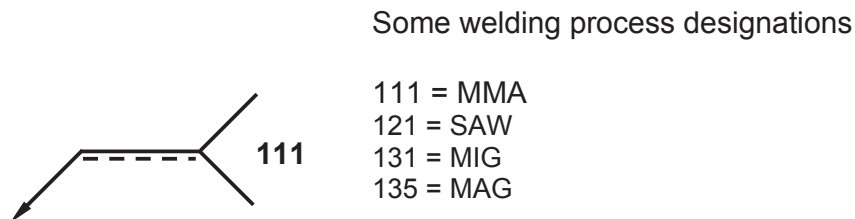


- A peripheral weld, to be made all around a part, is indicated by a circle



10 Indication of the Welding Process

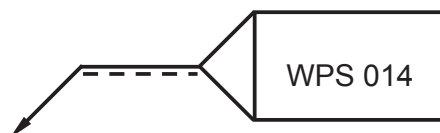
If required, the welding process is symbolised by a number written between the two branches of a fork at the end of the reference line.



11 Other Information in the Tail of the Reference Line

In addition to specifying the welding process, other information can be added to an **open tail** (shown above) such as the NDT acceptance level the working position and the filler metal type and EN 22553 defines the sequence that must be used for this information.

A closed tail can also be used into which reference to a specific instruction can be added.



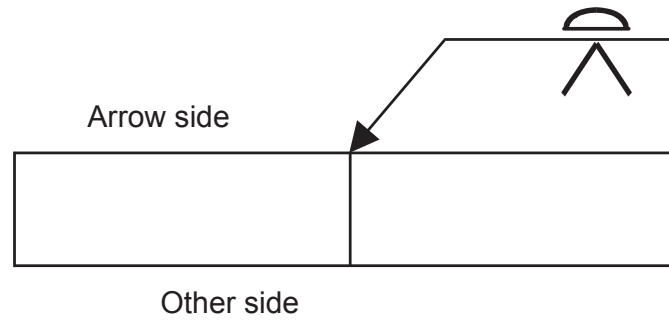
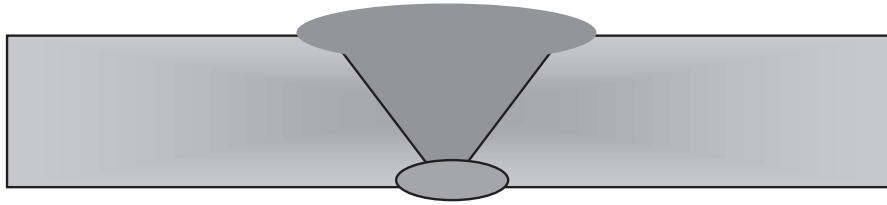
12 Weld Symbols in Accordance with AWS 2.4

Many of the symbols and conventions that are specified by EN 22553 are the same as those used by AWS.

The major differences are:

- Only one reference line is used (a continuous line)
- Symbols for weld details on the **arrow side** go **underneath the reference line**
- Symbols for weld details on the **other side** go **on top of the reference line**

These differences are illustrated by the following example.



Welding positions

PA	1G / 1F	Flat/downhand
PB	2F	Horizontal-vertical
PC	2G	Horizontal
PD	4F	Horizontal-vertical (overhead)
PE	4G	Overhead
PF	3G / 5G	Vertical-up
PG	3G / 5G	Vertical-down
H-L045	6G	Inclined pipe (upwards)
J-L045	6G	Inclined pipe (downwards)