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Welding terms and symbols

Part 2. Specification for symbols for welding

Termes et symbols relatifs au soudage
Partie 2. Spécification des symboles relatifs au soudage

Begriffe und Symbole der Schweisstechnik
Teil 2. Spezifikation für Symbole der Schweisstechnik

British Standards Institution

Contents

Foreword

The revision of this Part of BS 499 has been carried out under the direction of the Welding Standards Committee to take account of the requirements of ISO 2553-1974 published by the International Organization for Standardization (ISO). As a result the general content and presentation have been changed to align with ISO 2553.

The elementary symbols depict the form of the weld to be made regardless of the welding process to be employed, which was not always the case with the symbols in the previous edition of this standard. These symbols may be qualified by the use of supplementary symbols, dimensional details and complementary indications.

In the absence of a single method being agreed internationally, ISO 2553 provisionally recognizes that the position of the symbol relative to the reference line should depend on the method of drawing projection used in the particular case. It was felt that this situation should not be carried over into this standard and therefore the practice of placing the symbol below the reference line for welds on the 'arrow side' remains unaltered in this revision, for both third and first angle projection. Because of the existence of two systems of positioning the symbol, however, it is strongly recommended that all drawings should clearly state which system has been employed.

In order to simplify drawings, it is recommended that requirements relating to the preparation and making of welds should be included on the welding procedure sheets. For typical information to appear on welding procedure sheets for various processes, reference should be made to the appendices in BS 499 : Part 1, while an example of the layout of a typical welding procedure test record is given in the appendix of BS 4870 : Part 1.

British Standard

Welding terms and symbols

Part 2. Specification for symbols for welding

1. Scope

This Part of BS 499 specifies requirements for the symbolic representation of welds on drawings. For the most common types of weld the scheme provides basic indications regarding the welds to be made without over-burdening the drawing with notes or showing an additional view. The scheme is not intended to apply to complex joints, involving multiple welds for example, for which it may be simpler to show on the drawing a separate detailed view of the joint and welds required.

2. References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

3. Symbols

3.1 Elementary symbols. The various types of weld are each characterized by a symbol which, in general, is representative of the shape of the weld to be made or the edge preparation to be used. The symbol is not to be taken to pre-judge the welding process to be employed.

The type of weld shall be indicated by the appropriate elementary symbol given in table 1. Examples are given in table 5. The vertical portions of the symbols for single-bevel butt, single-J butt and fillet welds shall always be on the left-hand side of the symbol irrespective of the orientation of the weld metal. The symbols shall apply to the respective welds regardless of the number of runs to be deposited, whether or not there is a root gap and whether or not there is backing material, as such details shall be given on the welding procedure sheet.

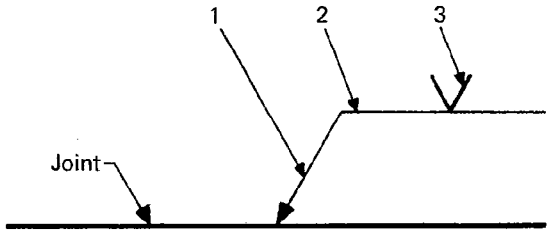
3.2 Combinations of elementary symbols. For welds made from two sides, combinations of elementary symbols shall be used. Examples are given in table 6.

In the case of compound welds, e.g. a fillet weld superimposed on a single-bevel butt weld, the appropriate combination of symbols shall be used, but the scheme of symbols is not intended to apply to complex joints. Examples are given in table 7.

3.3 Supplementary symbols. When the external surface of the weld is required to be of a particular shape, the appropriate supplementary symbol given in table 2 shall be used in conjunction with the relevant elementary symbol. Examples are given in tables 3 and 8.

4. Position of symbols

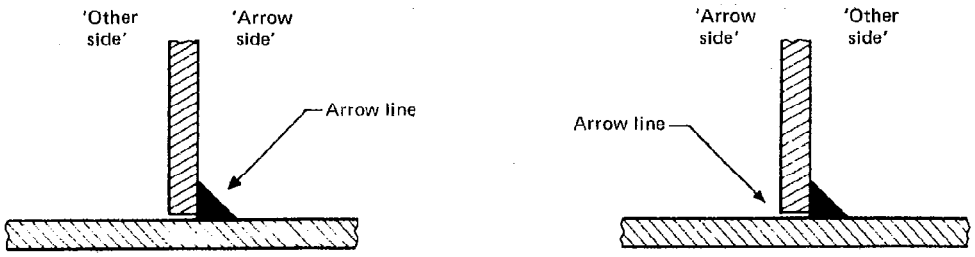
4.1 General. The symbols shall be used in conjunction with an arrow line and a reference line. Their method of representation is shown in figure 1.



1 is the arrow line
2 is the reference line
3 is the symbol

Figure 1. Method of representation

4.2 Arrow line relative to the joint. To indicate the position of a weld in a particular joint relative to the parts being joined, the 'head' of an arrow shall be used to denote the 'reference side' of the joint. The side nearer the arrow head shall be known as the 'arrow side' and the remote side as the 'other side'. Examples are given in figures 2 and 3.

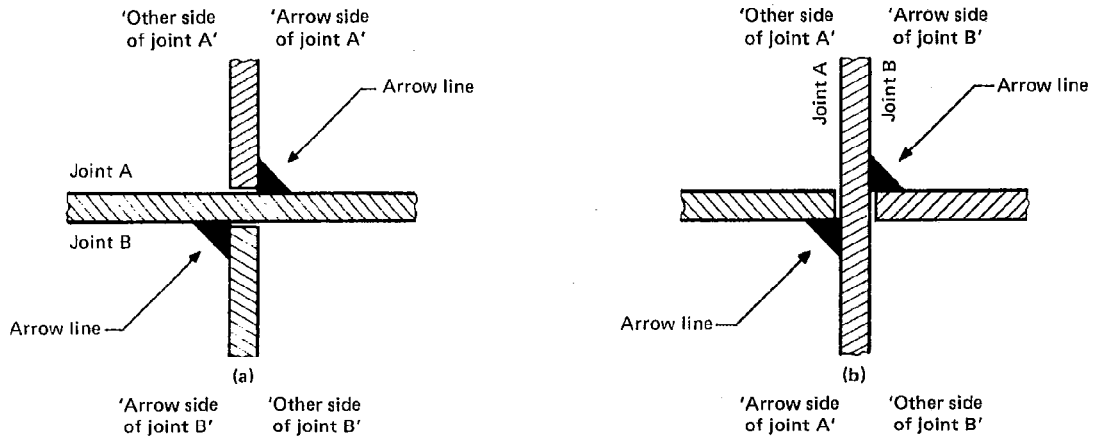


(a) Weld on the arrow side

(b) Weld on the other side

NOTE. The position of the arrow in these sketches is chosen for purposes of clarity. Normally, it would be placed immediately adjacent to the joint.

Figure 2. T-joint with one fillet weld



NOTE. The position of the arrow in these sketches is chosen for purposes of clarity. Normally, it would be placed immediately adjacent to the joint.

Figure 3. Cruciform joint with two fillet welds

4.3 Position of the arrow line. The position of the arrow line with respect to the weld is generally of no special significance, but in the case of joints in which only one part is prepared the arrow shall point towards that part.

The arrow line shall join one end of the reference line such that it forms an angle with it. Examples are given in figure 4.

NOTE. When the arrow cannot point to a joint, symbolic representation cannot be used.

4.4 Position of the reference line. The reference line shall be a straight line preferably drawn parallel to the bottom edge of the drawing.

4.5 Symbol relative to the reference line. The position of the symbol relative to the reference line shall be in accordance with the requirements of table 4, irrespective of the method of drawing projection employed.

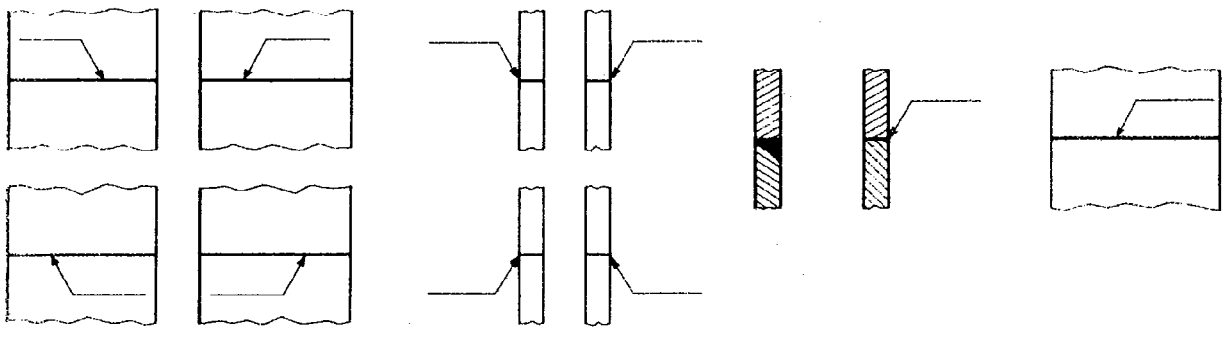


Figure 4. Position of the arrow line

5. Dimensions

5.1 General. Where a symbol is accompanied by a certain number of dimensions, expressed in millimetres, the indication of these dimensions, illustrated in figure 5, shall be as follows:

(a) dimensions relating to the cross section of the weld shall be given on the left-hand side of the symbol;

(b) longitudinal dimensions shall be given on the right-hand side of the symbol; distances between adjacent weld elements shall be indicated in parenthesis.

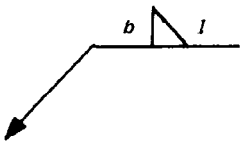


Figure 5. Example of the indication of dimensions

The main dimensions to be indicated, and how they are used, shall be as given in table 9. Any other significant dimensions shall be included on the welding procedure sheets. The dimensions that locate the weld in relation to the edges of the parts being welded shall be given on the drawing.

5.2 Butt welds. In the absence of any dimensional indications to the contrary, it shall be taken that butt welds are intended to have full penetration and to be continuous along the entire length of the joint.

5.3 Fillet welds. In the absence of any dimensional indications to the contrary, it shall be taken that fillet welds are intended to be continuous along the entire length of the joint.

The cross-sectional dimension to be indicated for a fillet weld shall be the leg length. When it is also desired to indicate the design throat thickness, then the leg length dimension shall be prefixed with the letter *'b'* and the design throat thickness dimension shall be prefixed with the letter *'a'*.

In the case of a fillet weld having unequal legs, the orientation of the weld shall be indicated on the drawing, unless the formation of the joint makes this obvious, and both leg length dimensions shall be given, separated by a multiplication sign.

NOTE. The following preferred range of leg length dimensions, in millimetres, should be used for the dimensioning of fillet welds:
3, 4, 5, 6, 8, 10, 12, 16, 18, 20, 22 and 25.

6. Complementary indications

6.1 Peripheral welds. Where a weld is to be made all round a joint, this shall be indicated by a circle placed where the arrow line joins the reference line, as shown in figure 6.

6.2 Site welds. Welds to be made on site shall be differentiated from shop welds by the indication of a flag where the arrow line joins the reference line, as shown in figure 7.

6.3 Non-destructive testing. When it is desired to indicate that non-destructive testing, other than visual examination, of a weld is required, the symbol shown in figure 8 shall be placed near to the end of the reference line.

*Complies with International Standard ISO 4063.

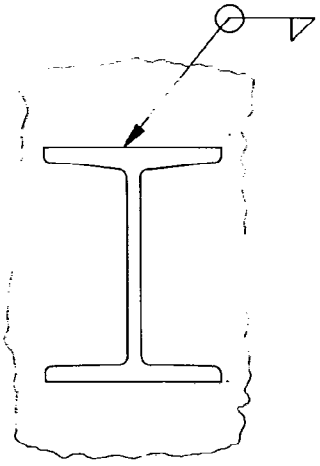


Figure 6. Use of symbol for peripheral welds

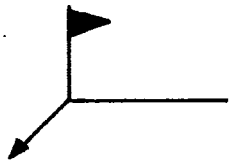


Figure 7. Use of symbol for site welds

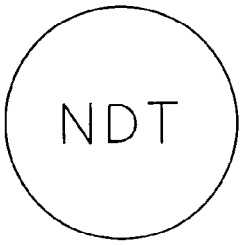


Figure 8. Symbol for non-destructive testing

6.4 Welding process. Information regarding the welding process to be used is given on the welding procedure sheet. When it is also desired to indicate the process as part of the symbolic representation, the appropriate number in table 10* shall be placed within a 'fork' at the end of the reference line as shown in figure 9.

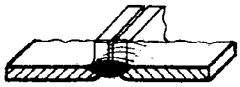
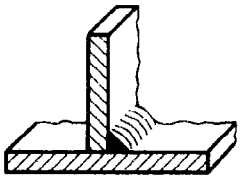
Figure 9. Example of the indication of process

7. Marking

All drawings complying with this standard shall be marked:

'The welding symbols on this drawing comply with BS 499 : Part 2 : 1980'.

Table 1. Elementary symbols

No.	Designation	Illustration	Symbol
1	Butt weld between flanged plates* (the flanges being melted down completely)		
2	Square butt weld†		
3	Single-V butt weld		
4	Single-bevel butt weld		
5	Single-V butt weld with broad root face		
6	Single-bevel butt weld with broad root face		
7	Single-U butt weld		
8	Single-J butt weld		
9	Backing or sealing run		
10	Fillet weld		

*Butt welds between flanged plates (symbol 1) not completely penetrated are symbolized as square butt welds (symbol 2) with the weld thicknesses shown (see table 10).

†This symbol is used to indicate a stud weld when there is no end preparation and no fillet weld.

Table 1. *(concluded)*

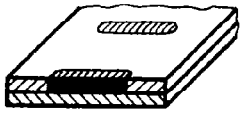
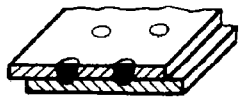
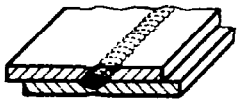
No.	Designation	Illustration	Symbol
11	Plug weld (circular or elongated hole, completely filled)		
12	Spot weld (resistance or arc welding) or projection weld	 (a) Resistance  (b) Arc	
13	Seam weld		

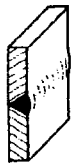
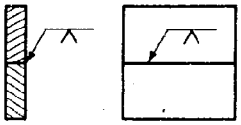
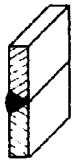
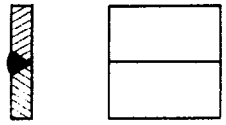
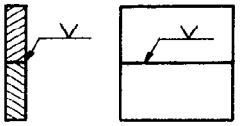
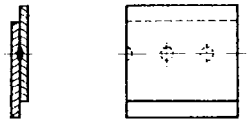
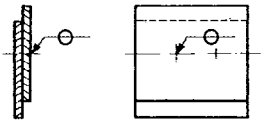
Table 2. Supplementary symbols

Shape of weld surface	Symbol
(a) flat (usually finished flush)	
(b) convex	
(c) concave	

Table 3. Examples of application of supplementary symbols

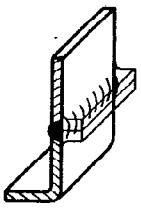
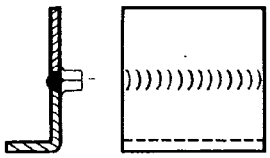
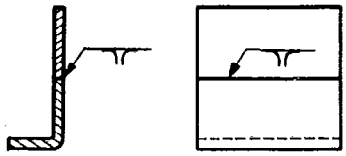
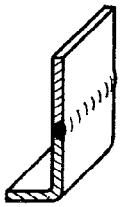
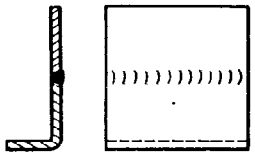
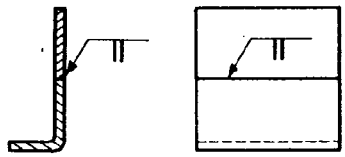
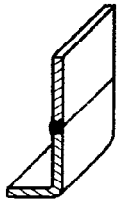
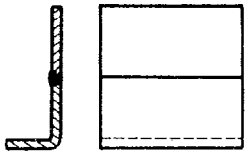
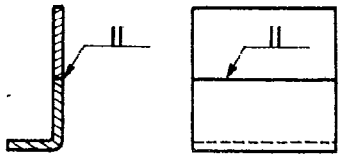
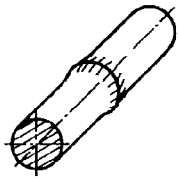
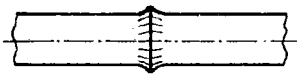
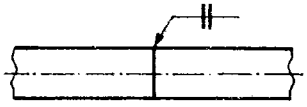
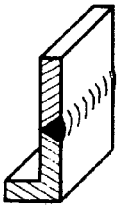
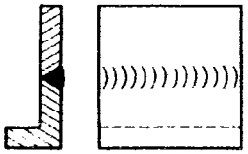
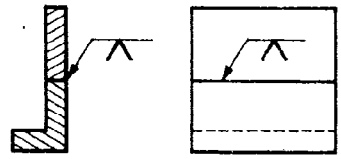
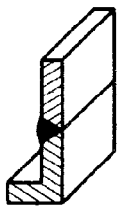
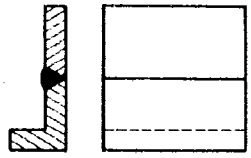
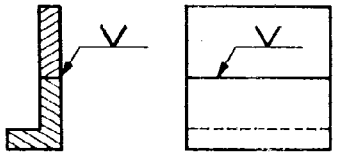
Designation	Illustration	Symbol
Flat (flush) single-V butt weld		
Convex double-V butt weld		
Concave fillet weld		
Flat (flush) single-V butt weld with flat (flush) backing run		

Table 4. Position of the symbol*

Illustration	Graphic representation	Symbolic representation	Description of position
			Below the reference line if the external surface of the weld (weld face) is on the arrow side of the joint.
			Above the reference line if the external surface of the weld (weld face) is on the other side of the joint.
			Across the reference line in the case of welds made within the plane of the joint.

*3rd angle projection.

Table 5. Examples of the use of elementary symbols*

No.	Designation symbol (numbers refer to table 1)	Illustration	Graphic representation	Symbolic representation
1	Butt weld between flanged plates  1			
2				
3	Square butt weld  2			
4				
5	Single-V butt weld  3			
6				

*3rd angle projection.

Table 5. *(continued)*

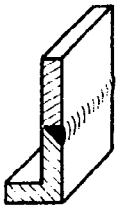
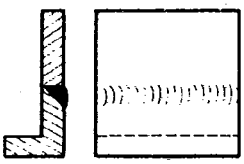
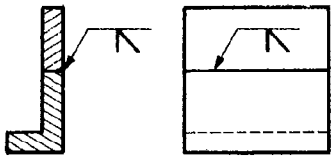
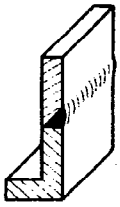
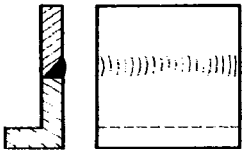
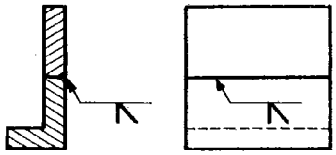
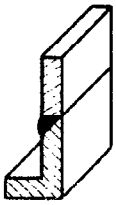
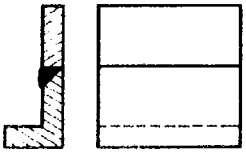
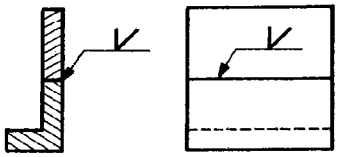
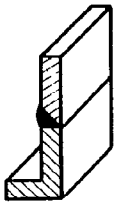
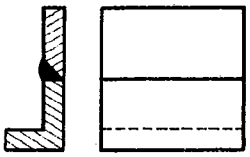
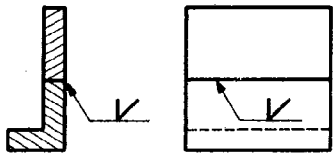
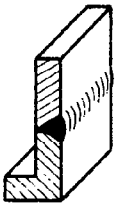
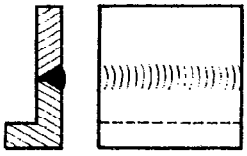
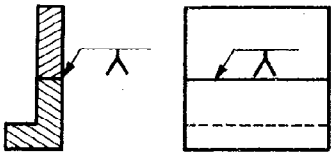
No.	Designation symbol (numbers refer to table 1)	Illustration	Graphic representation	Symbolic representation
7				
8				
9	Single-bevel butt weld  4			
10				
11	Single-V butt weld with broad root face  5			

Table 5. *(continued)*

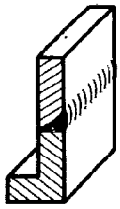
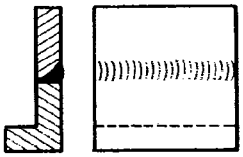
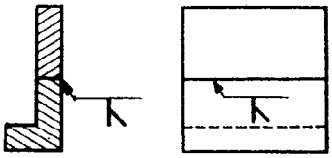
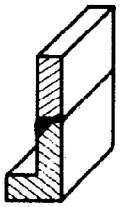
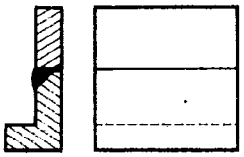
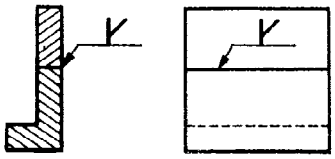
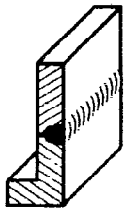
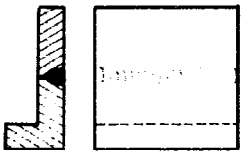
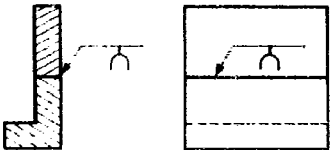
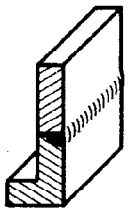
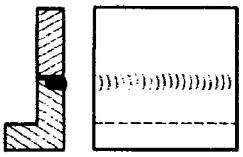
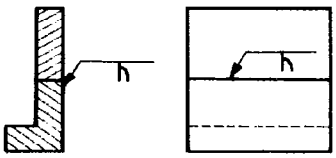
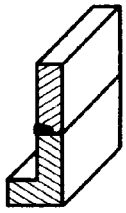
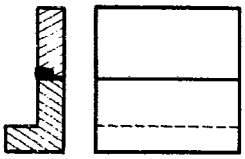
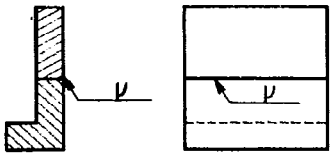
No.	Designation symbol (numbers refer to table 1)	Illustration	Graphic representation	Symbolic representation
12	Single-bevel butt weld with broad root face 6			
13				
14	Single-U butt weld 7			
15	Single-J butt weld 8			
16				

Table 5. *(continued)*

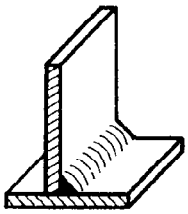
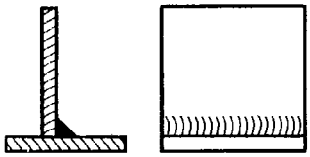
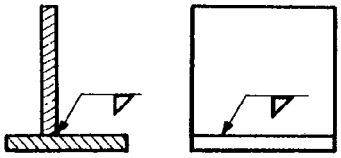
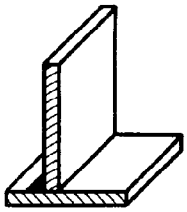
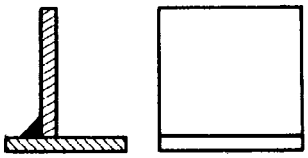
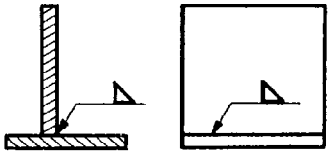
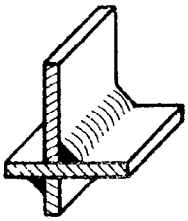
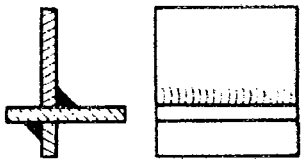
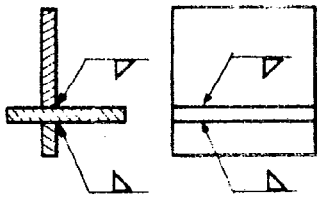
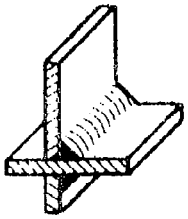
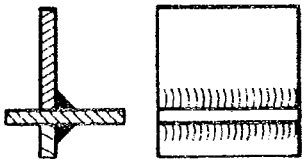
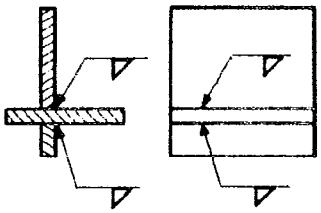
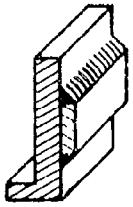
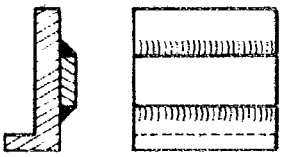
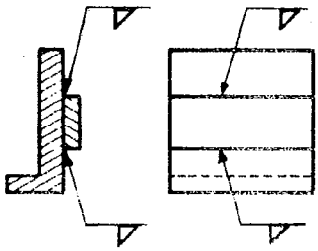
No.	Designation symbol (numbers refer to table 1)	Illustration	Graphic representation	Symbolic representation
17				
18				
19	Fillet weld  10			
20				
21				

Table 5. *(concluded)*

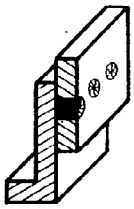
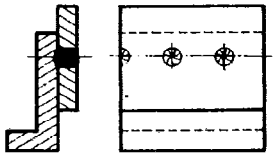
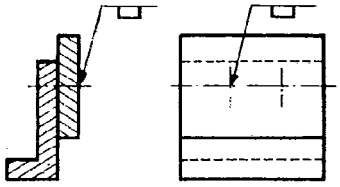
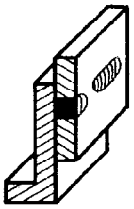
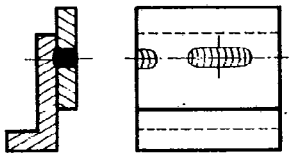
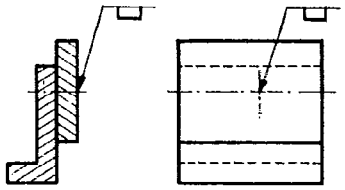
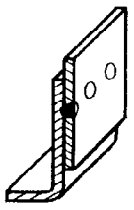
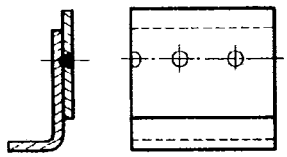
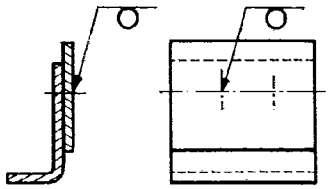
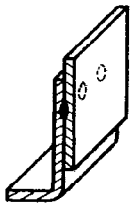
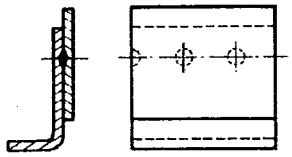
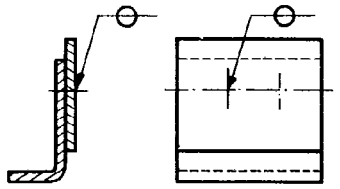
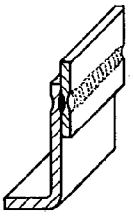
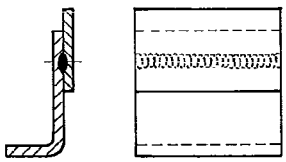
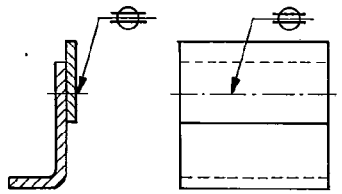
No.	Designation symbol (numbers refer to table 1)	Illustration	Graphic representation	Symbolic representation
22	Plug weld  11			
23				
24	Spot weld  12			
25				
26	Seam weld  13			

Table 6. Examples of combinations of elementary symbols

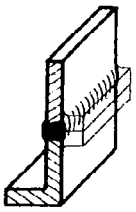
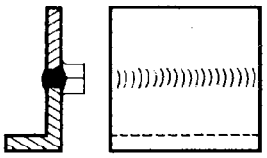
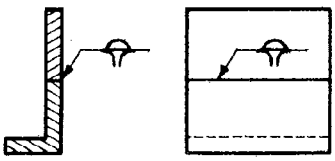
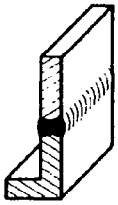
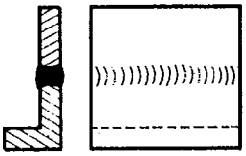
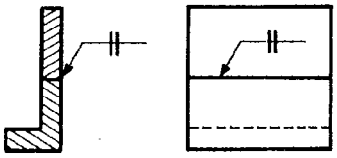
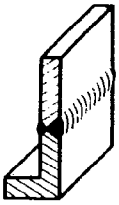
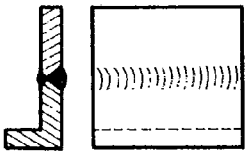
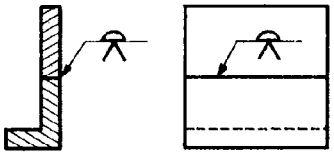
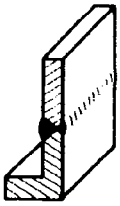
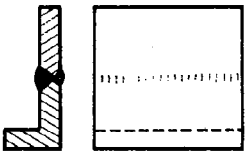
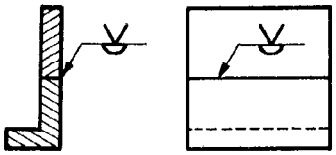
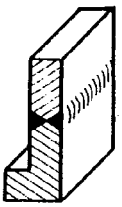
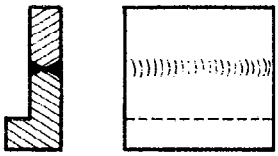
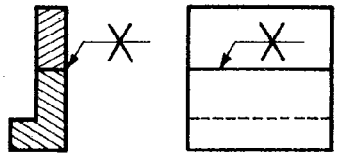
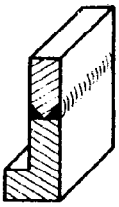
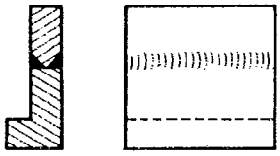
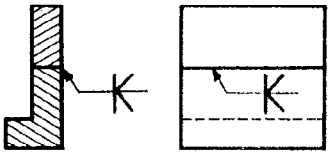
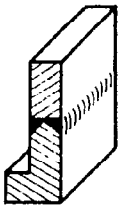
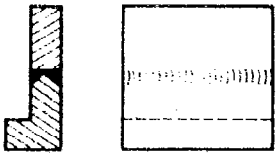
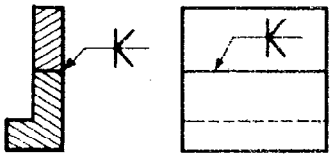
No.	Designation symbol (numbers refer to table 1)	Illustration	Graphic representation	Symbolic representation
1	Butt weld between flanged plates 1 and backing run 9 1 – 9			
2	Square butt weld 2 welded from both sides 2 – 2			
3	Single-V butt weld 3 and backing run 9 3 – 9			
4				
5	Double-V butt weld 3 (X weld) 3 – 3			
6	Double-bevel butt weld 4 (K weld) 4 – 4			
7				

Table 6. *(concluded)*

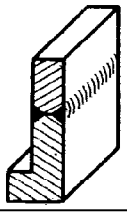
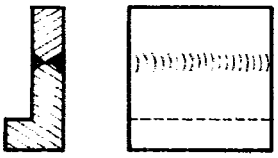
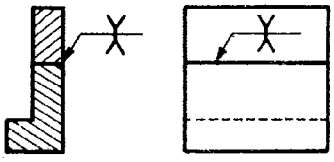
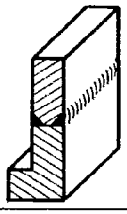
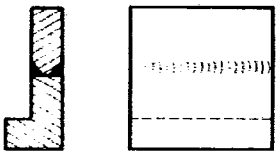
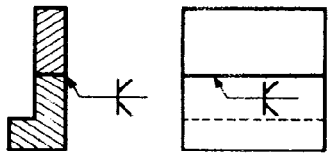
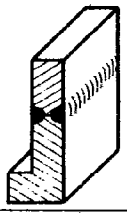
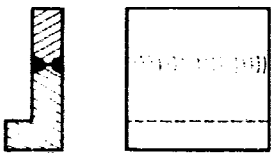
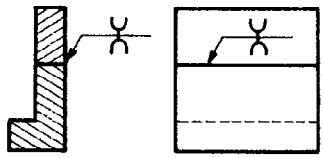
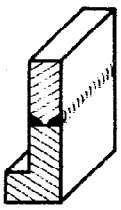
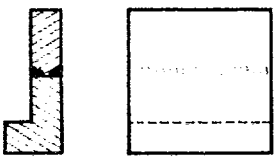
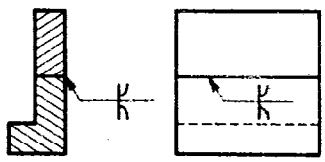
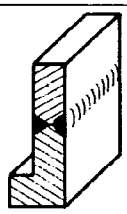
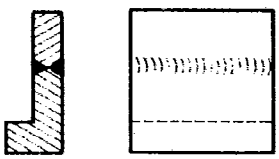
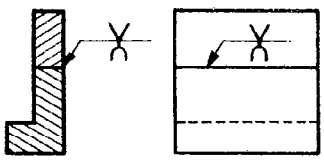
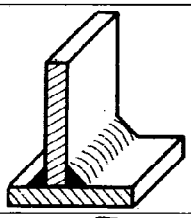
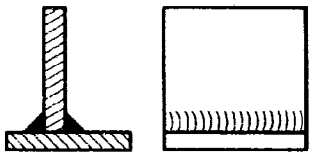
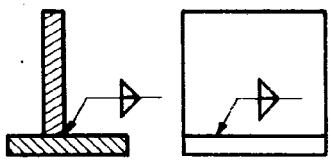
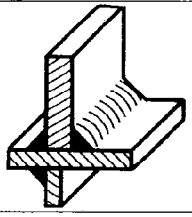
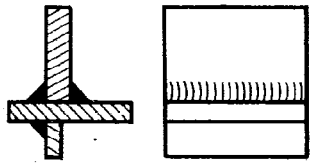
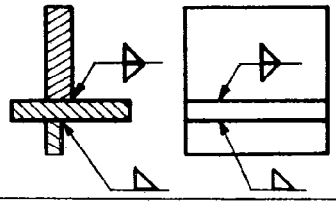
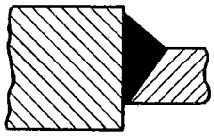
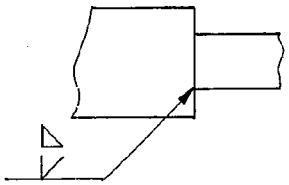
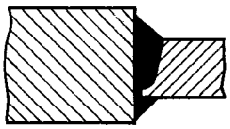
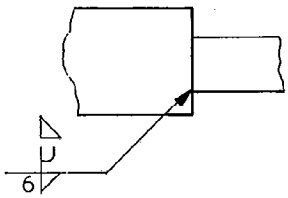
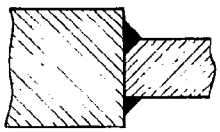
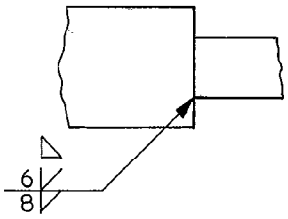
No.	Designation symbol (numbers refer to table 1)	Illustration	Graphic representation	Symbolic representation
8	Double-V butt weld with broad root face 5 5 – 5			
9	Double-bevel butt weld with broad root face 6 6 – 6			
10	Double-U butt weld 7 7 – 7			
11	Double-J butt weld 8 8 – 8			
12	Single-V butt weld 3 and single-U butt weld 7 3 – 7			
13	Fillet weld 10 and fillet weld 10			
14	10 – 10			

Table 7. Examples of use of symbols for compound welds

No.	Designation symbol (numbers refer to table 1)	Graphic representation	Symbolic representation
1	Single-bevel butt weld with fillet weld superimposed 4 10 4 + 10		
2	Single-J butt weld with fillet weld superimposed 8 10 and with fillet weld on root side 10 8 + 10 – 10		
3	Partial penetration single-bevel butt weld with fillet weld superimposed 4 10 and with fillet weld on arrow side 10 4 + 10 – 10		

*For dimensional requirements see table 9.

Table 8. Examples of combinations of elementary and supplementary symbols

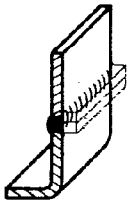
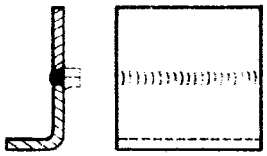
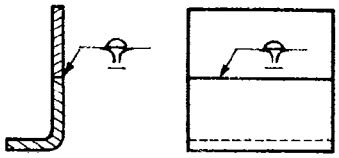
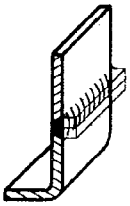
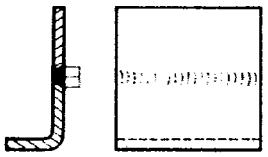
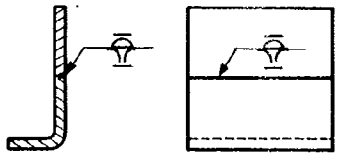
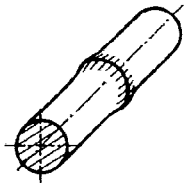
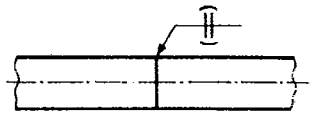
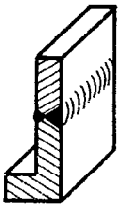
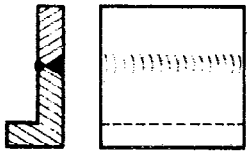
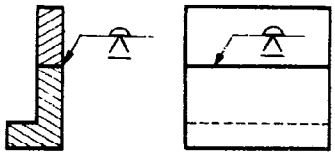
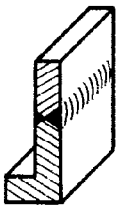
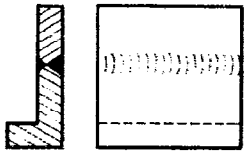
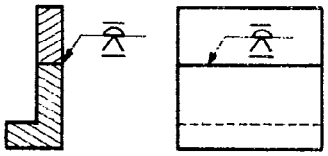
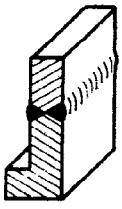
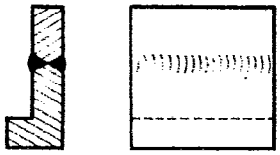
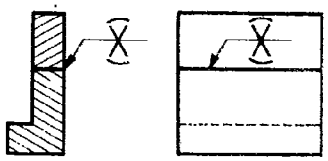
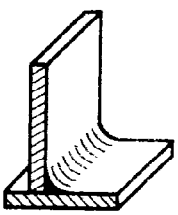
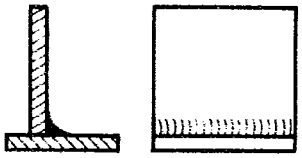
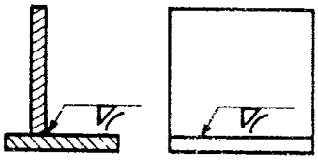
No.	Symbol	Illustration	Graphical representation	Symbolic representation
1				
2				
3				
4				
5				
6				
7				

Table 9. Main dimensions

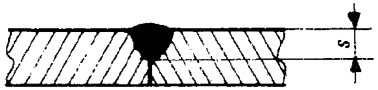
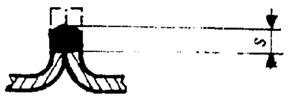
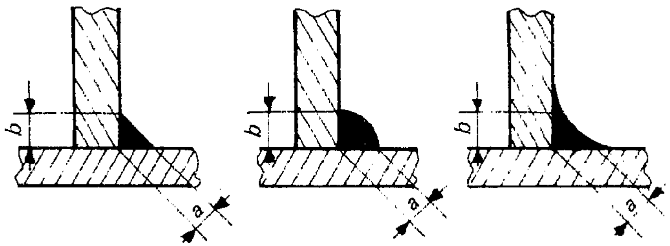
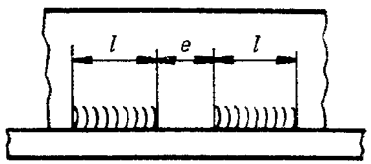
No.	Designation of welds	Definition		Inscription
1	Butt weld		*s* is the minimum distance from the surface of the part to the bottom of the penetration, which cannot be greater than the thickness of the thinner part. In the case of partial penetration double sided welds the appropriate dimension shall be used with each symbol above and below the reference line.	V (see 5.2)
				*s* || (see 5.2)
				*s* Y (see 5.2)
2	Butt weld between plates with raised edges		*s* is the minimum distance from the external surface of the weld to the bottom of the penetration.	*s* || (see 5.2)
3	Continuous fillet weld		*b* is the leg length. *a* is the design throat thickness.	*b* ◺ *b a* ◺ (see 5.3)
4	Intermittent fillet weld		*l* is the length of weld (without end craters). *e* is the distance between adjacent weld elements. *n* is the number of weld elements. *b* *a* (see no. 3)	*b* ◺ *n* × *l*(*e*) *b a* ◺ *n* × *l*(*e*) (see 5.3)

Table 9. *(concluded)*

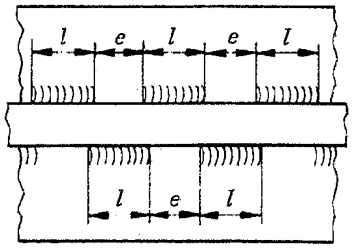
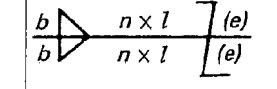
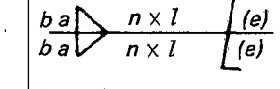
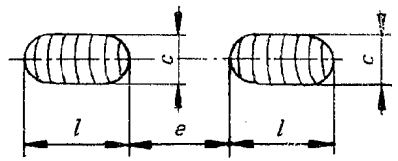
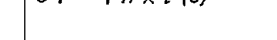
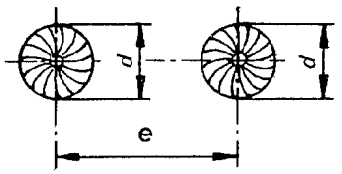
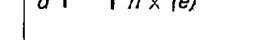
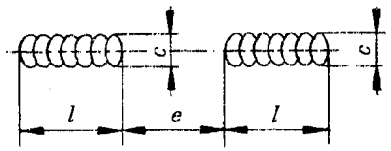
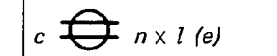
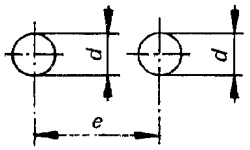
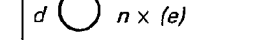
No.	Designation	Definition		Inscription
5	Staggered intermittent fillet weld		*l*, *e*, *n* (see no. 4) *b*, *a* (see no. 3)	  (see 5.3)
6	Plug weld		*e*, *n* (see no. 4) *l* is the length of slot *c* is the width of slot dimensions at base of slot if bevelled sides	
			*n* (see no. 4) *e* is the spacing *d* is the diameter of hole (dimension at base if bevelled side)	
7	Seam weld		*l*, *e*, *n* (see no. 4) *c* is the width of weld	
8	Spot weld		*n* (see no. 4) *e* is the spacing *d* is the diameter of spot	

Table 10.* Numerical indication of process

No.	Process
1	**Arc welding**
11	Metal-arc welding without gas protection
111	Metal-arc welding with covered electrode
112	Gravity arc welding with covered electrode
113	Bare wire metal arc welding
114	Flux cored metal-arc welding
115	Coated wire metal-arc welding
118	Firecracker welding
12	Submerged arc welding
121	Submerged arc welding with wire electrode
122	Submerged arc welding with strip electrode
13	Gas shielded metal-arc welding
131	MIG welding
135	MAG welding: metal-arc welding with non-inert gas shield
136	Flux cored metal-arc welding with non-inert gas shield
14	Gas-shielded welding with non-consumable electrode
141	TIG welding
149	Atomic-hydrogen welding
15	Plasma arc welding
18	Other arc welding processes
181	Carbon arc welding
185	Rotating arc welding
2	**Resistance welding**
21	Spot welding
22	Seam welding
221	Lap seam welding
225	Seam welding with strip
23	Projection welding
24	Flash welding
25	Resistance butt welding
29	Other resistance welding processes
291	HF resistance welding
3	**Gas welding**
31	Oxy-fuel gas welding
311	Oxy-acetylene welding
312	Oxy-propane welding
313	Oxy-hydrogen welding
32	Air fuel gas welding
321	Air-acetylene welding
322	Air-propane welding
4	**Solid phase welding; Pressure welding**
41	Ultrasonic welding
42	Friction welding
43	Forge welding
44	Welding by high mechanical energy
441	Explosive welding
45	Diffusion welding
47	Gas pressure welding
48	Cold welding
7	**Other welding processes**
71	Thermit welding
72	Electroslag welding
73	Electrogas welding
74	Induction welding
75	Light radiation welding
751	Laser welding
752	Arc image welding
753	Infrared welding
76	Electron beam welding
77	Percussion welding
78	Stud welding
781	Arc stud welding
782	Resistance stud welding
9	**Brazing, soldering and braze welding**
91	Brazing
911	Infrared brazing
912	Flame brazing
913	Furnace brazing
914	Dip brazing
915	Salt bath brazing
916	Induction brazing
917	Ultrasonic brazing
918	Resistance brazing
919	Diffusion brazing
923	Friction brazing
924	Vacuum brazing
93	Other brazing processes
94	Soldering
941	Infrared soldering
942	Flame soldering
943	Furnace soldering
944	Dip soldering
945	Salt bath soldering
946	Induction soldering
947	Ultrasonic soldering
948	Resistance soldering
949	Diffusion soldering
951	Flow soldering
952	Soldering with soldering iron
953	Friction soldering
954	Vacuum soldering
96	Other soldering processes
97	Braze welding
971	Gas braze welding
972	Arc braze welding

*This table complies with International Standard ISO 4063.

Standards publications referred to

BS 499*	Welding terms and symbols Part 1 Welding, brazing and thermal cutting glossary
BS 4870*	Approval testing of welding procedures Part 1 Fusion welding of steel
ISO 2553*	Welds — Symbolic representation on drawings
ISO 4063	Welding, brazing, braze welding and soldering of metals — List of processes, for symbolic representation or drawings

*Referred to in the foreword only.

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Committee reference WEE/1 Draft for comment 77/78681 DC

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Amendments issued since publication

Amd. No.	Date of issue	Text affected
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