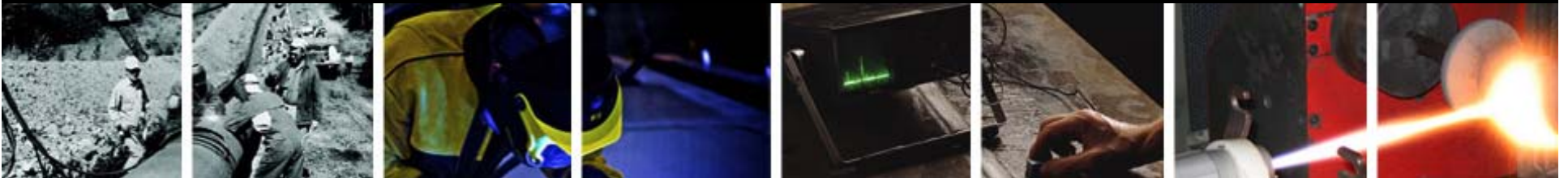


By: Kamran Khodaparasti

WELDING & NDT SYMBOLS

May 2012



Preface

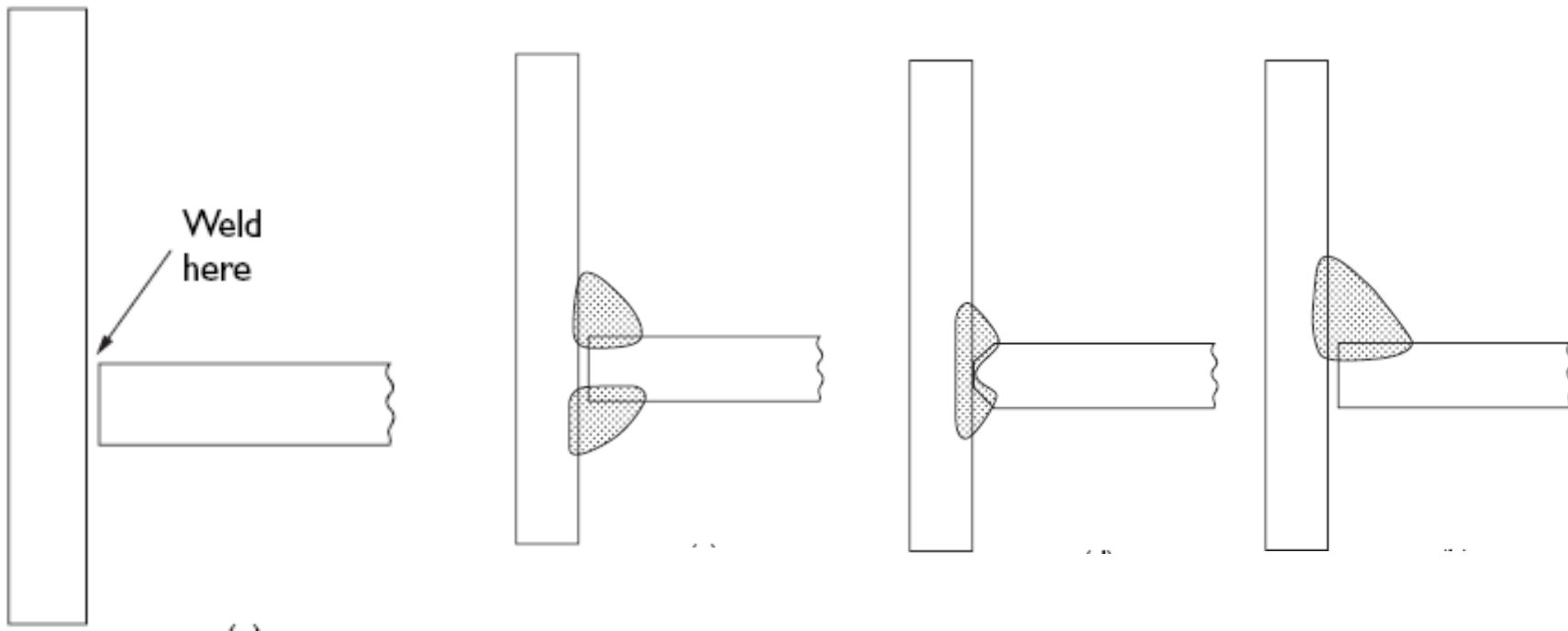
- This presentation was developed to provide readers with a general introduction to welding & NDT symbols.
- Comments are welcome at kkhodaparasti@yahoo.com
- Please ask your questions about this topic and all aspects of welding via:
 - <http://forum.weldeng.net>
- References:
 - R.S. Parmar, *Welding Engineering and Technology*, 2005, pp.837-866
 - AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination*, 2007
 - ISO 2553, *Welded, Brazed and Soldered Joints- Symbolic Representation on Drawings*, 1992
 - E. N. Gregory and A. A. Armstrong, *Welding Symbols on Drawings*, CRC Press, 2005

The need to specify welds

- It is sometimes argued that it is unnecessary to specify welds on drawings and that the welder should be relied upon to deposit a suitable weld. This practice can be extremely risky because the type and size of the weld must be appropriate for the parent material and service conditions of the fabrication, and the necessary information and data are normally available only in the design office.
- that major problems will arise unless welded joints are carefully specified by the design office. The situation is particularly critical where, for example, work is placed with a subcontractor and the instructions need to be especially precise.

Weld here!!

- The instruction 'weld here' is rarely seen on a drawing because it is open to a number of different interpretations.

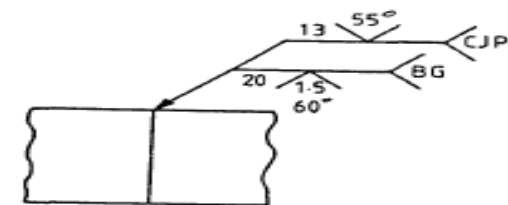


The advantages of symbols

- When it is required to indicate desired welding information on engineering drawings, it may seem that the weld can simply be drawn as it will appear. In the majority of cases, symbolic representation can be used to cut down the time needed to complete the drawing and improve clarity.

Symbols

- Symbols are used to convey the design requirements to the shop in a **concise** manner.
 - American (AWS A2.4)
 - International (ISO 2553)
 - Also EN 22553 (identical to ISO 2553)



- In the UK '**weld symbol**' and '**welding symbol**' are interchangeable by common usage but in the American standard on symbols they have different meanings.
- A **weld symbol** required type of weld, and the basic weld symbols.(basic V, U or triangle, representing, respectively, single-V, single-U or fillet welds)
- The **welding symbol** includes the weld symbol and supplementary information.(a reference line to which the weld symbols can be added and an arrow line pointing to the position of the welded joint. Additional elements may be added such as weld sizes and lengths, welding process and non-destructive testing requirements, which all contribute to the welding symbol)

Basic weld symbols (AWS A2.4)

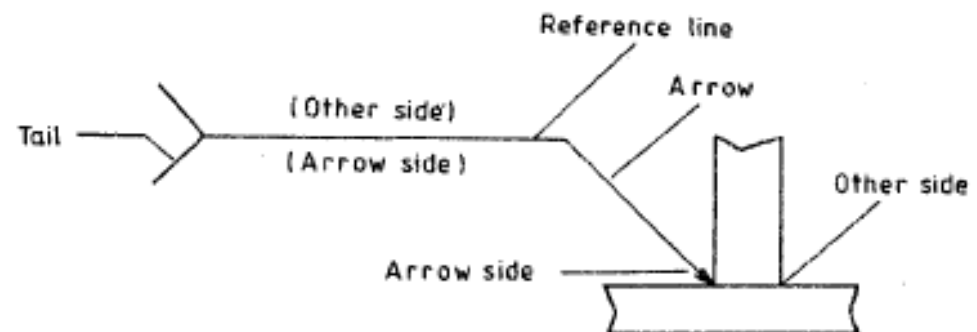
GROOVE							
SQUARE	SCARF	V	BEVEL	U	J	FLARE-V	FLARE-BEVEL

FILLET	PLUG	SLOT	STUD	SPOT OR PROJECTION	SEAM	BACK OR BACKING	SURFACING	EDGE

NOTE: The reference line is shown as a dashed line for illustrative purposes.

Elements of welding symbol (AWS A2.4)

- All welding symbols have 2 basic parts:
 - A reference line (is always horizontal)
 - An arrow (is always inclined to the reference line at one end)
 - The tail of the symbol is used for designating the welding and cutting process as well as the welding specifications, procedures, or the supplementary information to be used in making the weld (omitted when reference is not used)
- The arrow points to a spot on drawing where the welding is to be done.
- The reference line has two side:
 - Other side, above the line
 - Arrow side, below the line



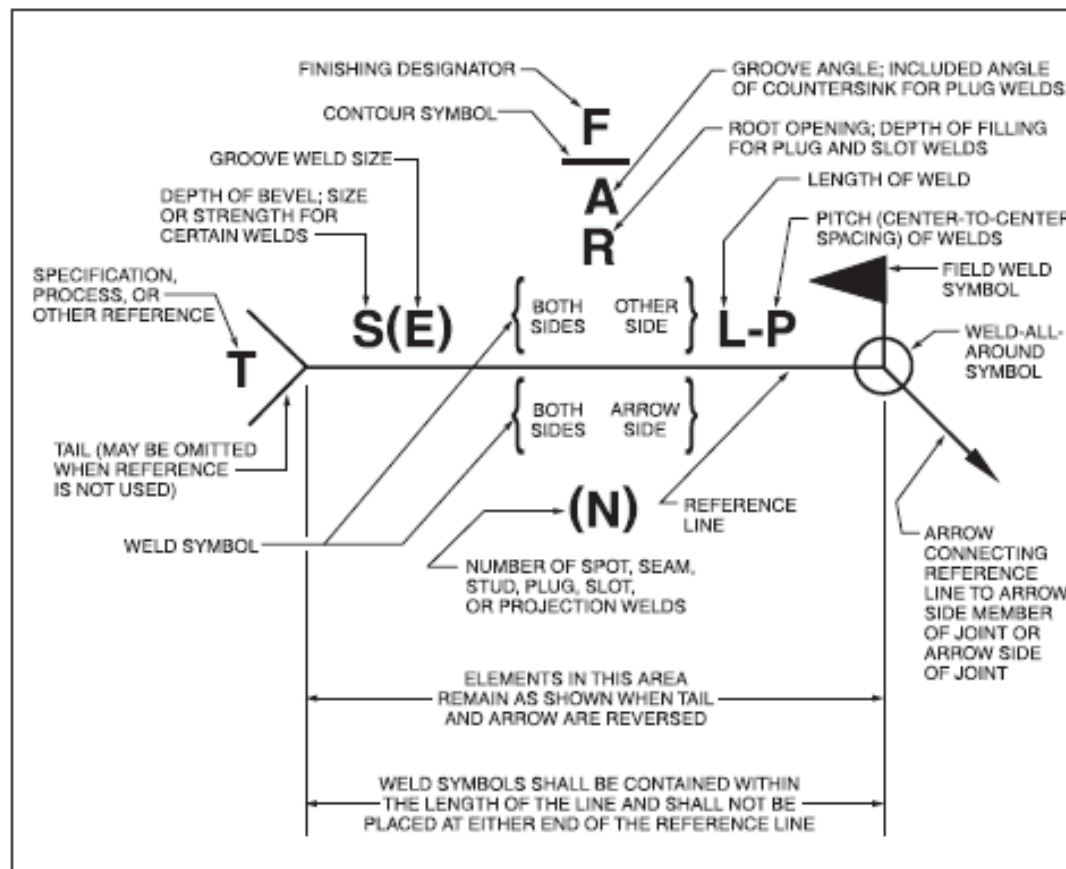
Tail

- When a specification, process, test or other references is needed to clarify a welding symbol, the reference is placed in a tail on the welding symbol.

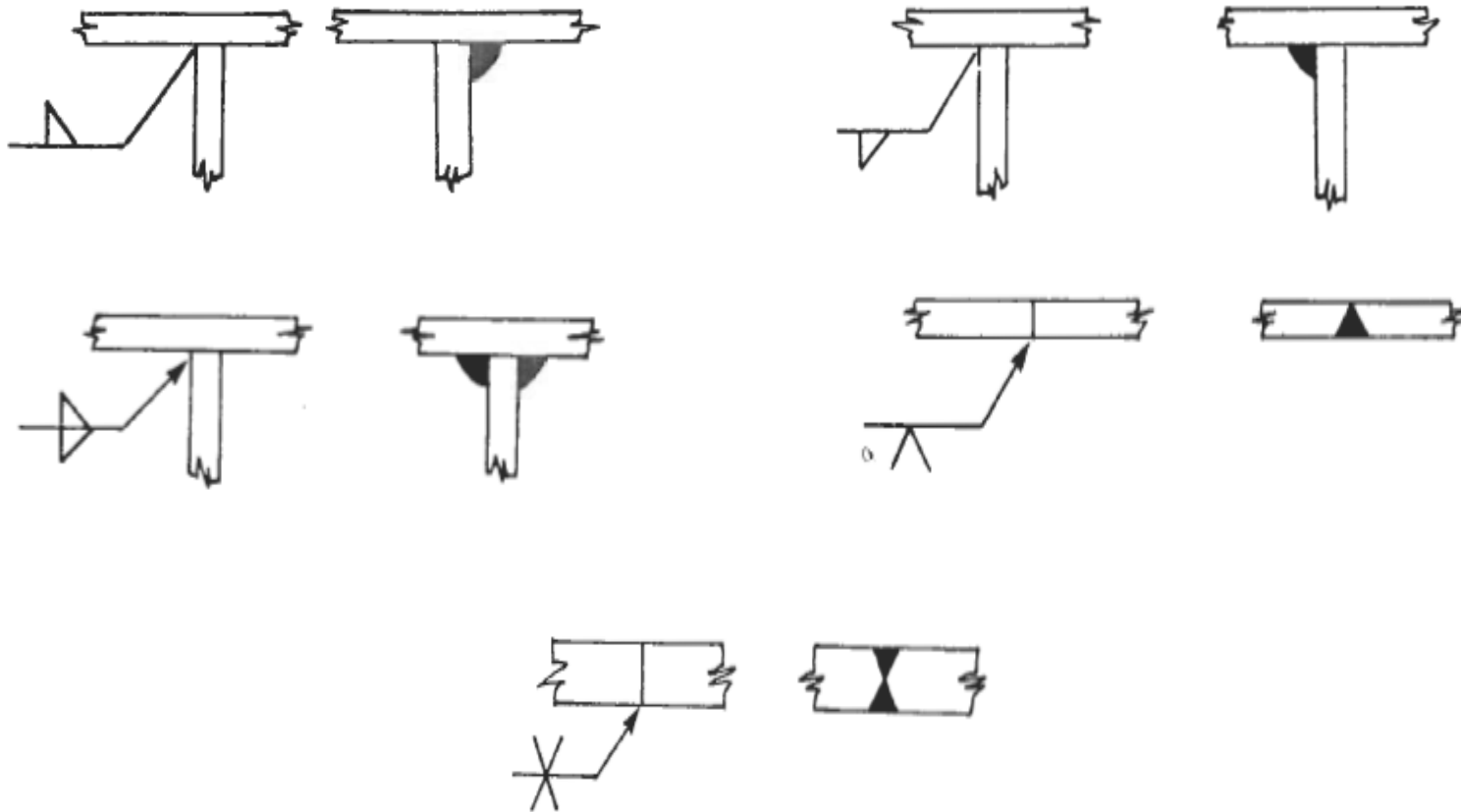


- Including the basic 2 elements (reference line & arrow) , a welding symbol may consist of the following 8 elements:
 - A reference line
 - An arrow
 - A tail
 - Basic weld symbol
 - Dimensions and other data
 - Supplementary symbols
 - Finish symbols
 - Specification, process or other references.

Standard location of elements of a welding symbol

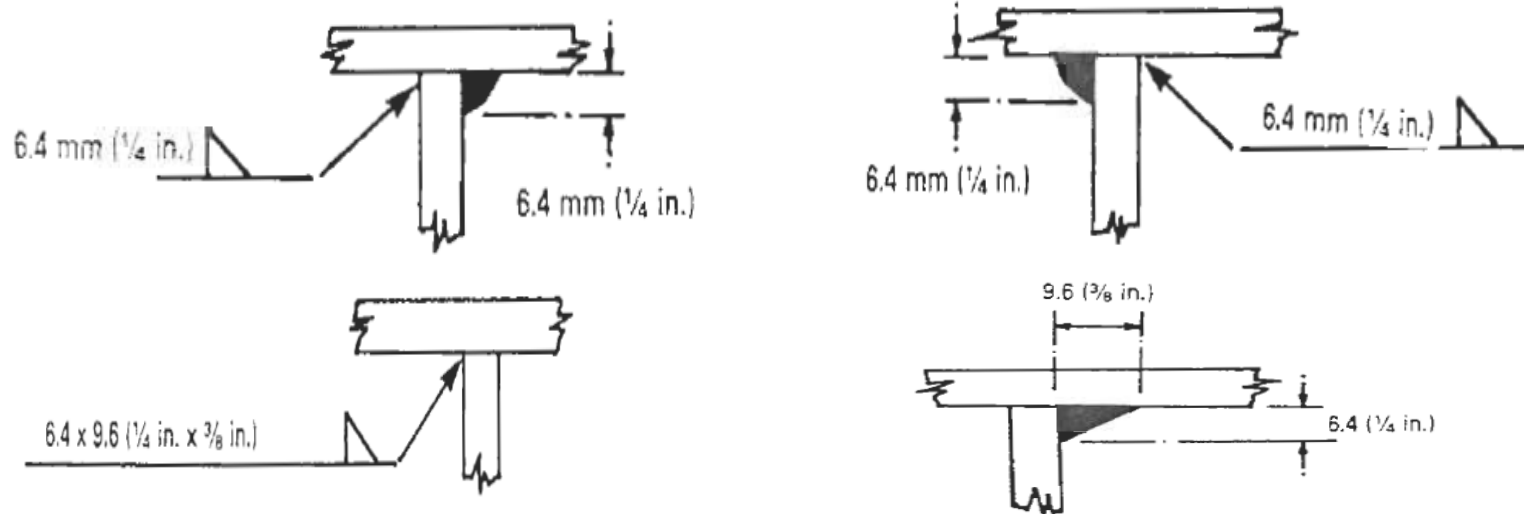


Some examples

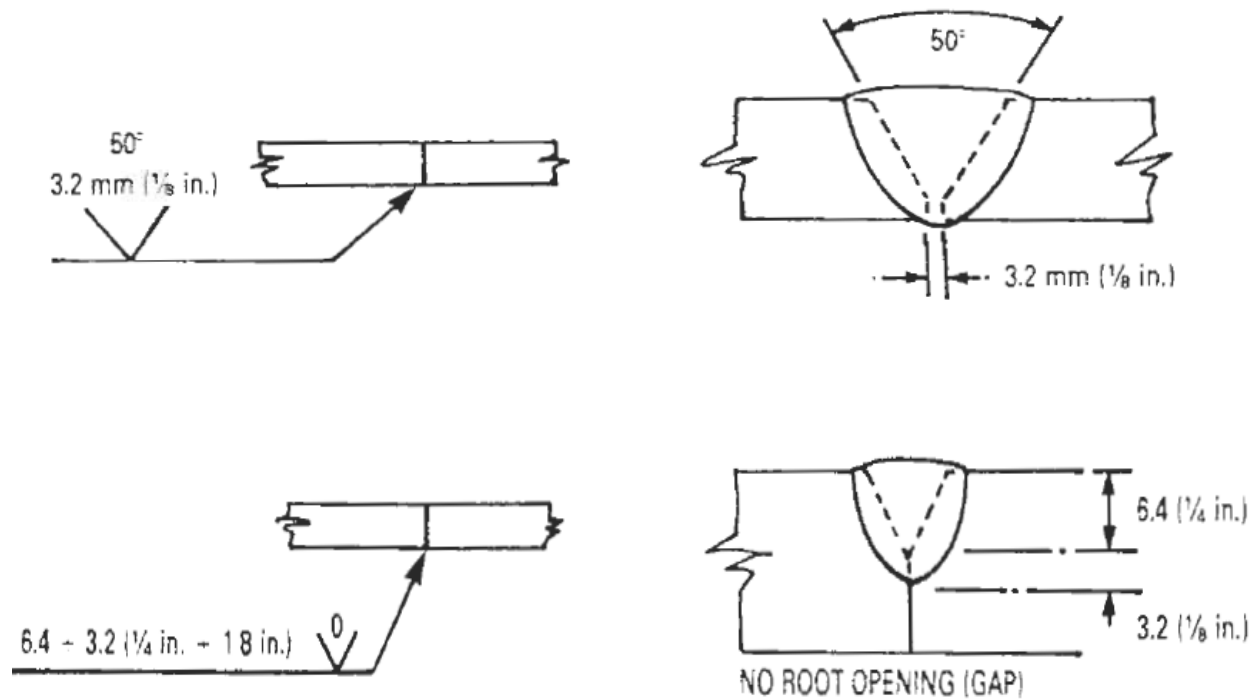


Weld size

- The **size** of the weld is shown to the **left** of the weld symbol, and the **length** of the weld is shown on the **right** of the weld symbol.
- If the length is not given, the weld symbols applies to that portion of the joint between abrupt changes in the direction of welding or between specified dimension lines.
- If a weld symbol is shown on both sides of the reference line, dimensions must be given for each weld even though both welds are **identical**.

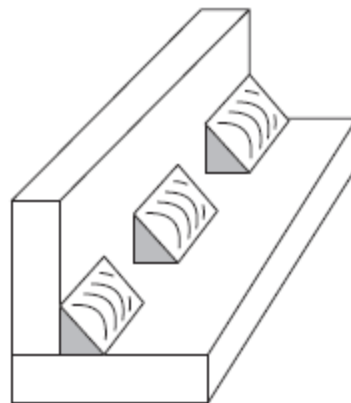


Groove weld symbol



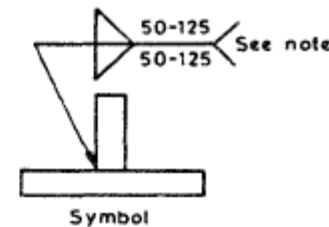
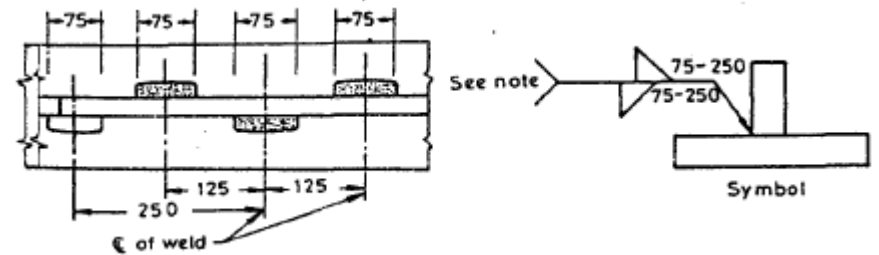
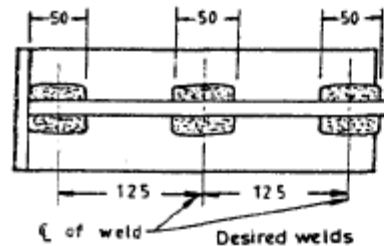
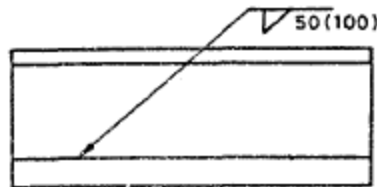
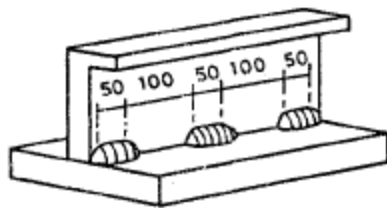
Intermittent weld

- Intermittent fillet welds are used in situations where it is necessary to use a weld, the size of which would give a higher load-bearing capacity than required if used for the whole length of a joint, with consequent extra cost of weld metal.
- The use of a smaller weld might not be possible because of limitations of a particular welding process or because of poor fit-up of the joint. Small welds of some alloy compositions may crack under conditions of high restraint. Low heat input associated with such welds can increase the risk of the heat affected zone (HAZ) cracking in steel fabrications.



Intermittent weld symbol

- Desired intermittent welds: Chain weld and Staggered weld
- For intermittent welds, the length of the weld and the space between the welds are placed to the right of the weld symbol with the latter in the parenthesis.
- Alternatively the length of the weld and the pitch(center-to-center spacing) are placed to the right of the weld symbol.



Supplementary symbols

- They complement the basic symbols and provide additional requirements or instructions to the welder.

WELD ALL AROUND	FIELD WELD	MELT-THROUGH	CONSUMABLE INSERT (SQUARE)	BACKING (RECTANGLE)	SPACER (RECTANGLE)	CONTOUR		
						FLUSH OR FLAT	CONVEX	CONCAVE

Convex contour

- The symbol for a convex weld is rather mysterious because it is difficult to imagine a case where a convex profile would be specified for either a butt/groove weld or a fillet weld. All welds are normally deposited with a slightly convex profile to provide the minimum required throat thickness without excess weld metal. This symbol, without further instructions, could cause confusion in a welding shop because it would encourage a welder to deposit excess weld metal, which would create potential problems and additional costs.
- It is worth noting that AWS D1.1 specifies limits to convexity of welds depending on the width of the weld face as follows:

Width of weld face

$W \leq 8 \text{ mm}$

$W > 8 \text{ to } < 25 \text{ mm}$

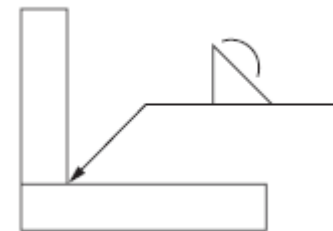
$W \geq 25 \text{ mm}$

Maximum convexity

2 mm

3 mm

5 mm

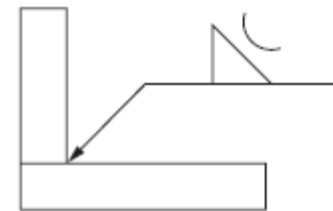


Convex contour(cont.)

- Excess weld metal refers to the metal that lies outside the surface of a mitre fillet or outside a straight line between the toes of the butt/groove weld. This excess metal is sometimes wrongly called reinforcement. This is incorrect because in only very rare cases would it increase the static strength of a joint and in many cases it would reduce the fatigue strength.

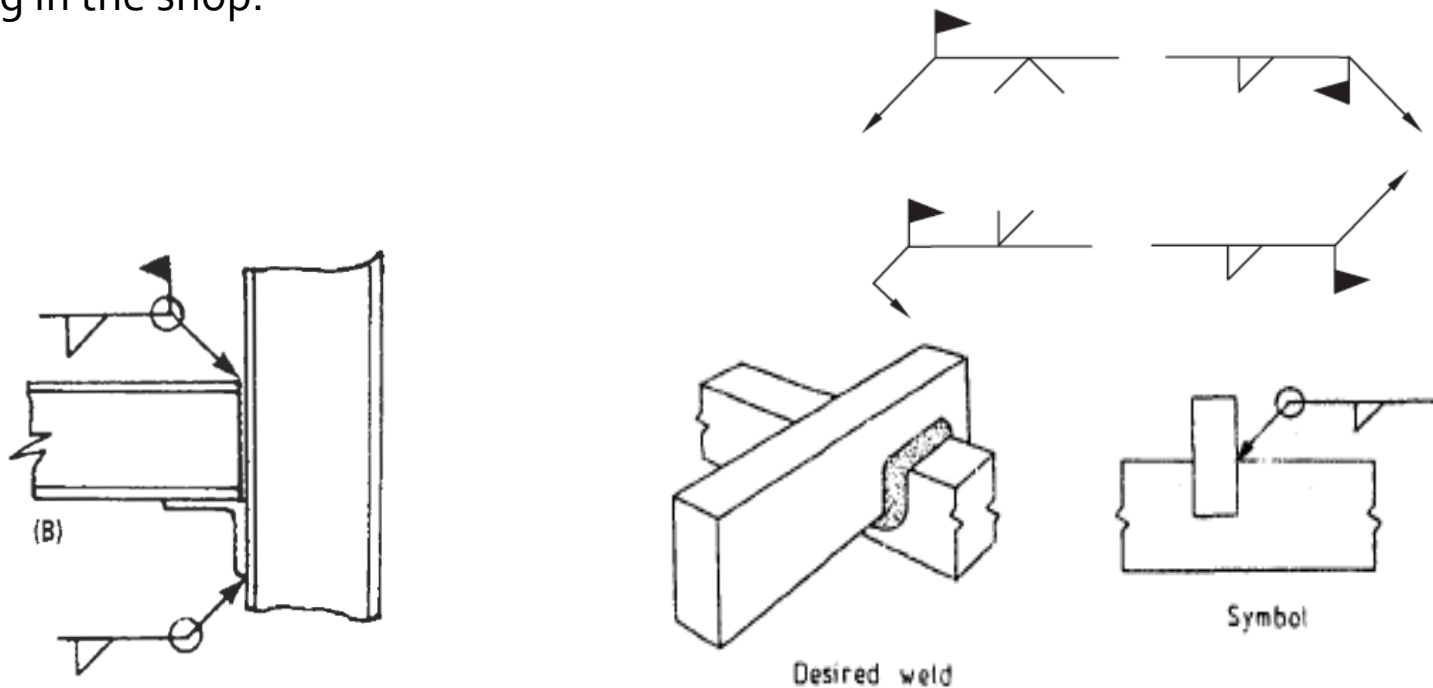
Concave contour

- The symbol for a concave weld is only used in special cases, for example, if a welded vessel requires smooth surfaces for ease of cleaning or for surface treatment such as painting.
- A concave weld profile reduces stress concentration at the toes of a fillet weld and thus gives a slight improvement in the fatigue strength.]
- The ability to obtain a concave weld profile in the as-welded condition depends on the parent metal and the welding process and consumable as well as the expertise of the welder. In mechanized welding processes it is sometimes possible to produce a concave weld profile by using suitable welding parameter settings.



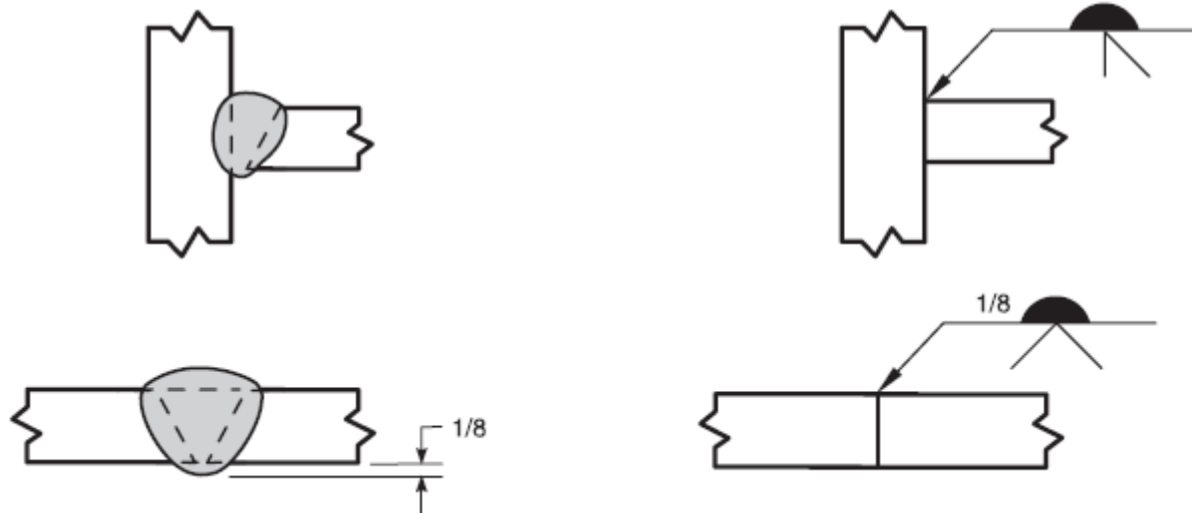
Circle and flag

- A circle at the tangent of the arrow and the reference line means welding to be all around.
- A flag at the tangent of the reference line and arrow means Field (site) weld not welding in the shop.



Melt-through symbol

- The melt-through symbol shall be used only when complete joint penetration (CJP) plus visible root reinforcement is required in welds made from one side.
- The melt through symbol shall be placed on the side of the reference line opposite the weld symbol
- The height of root reinforcement can be specified to the left of the symbol, if this amount is critical.

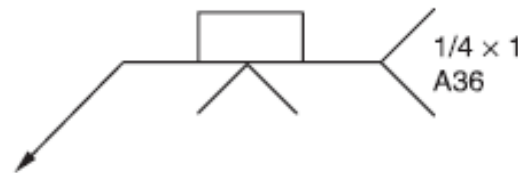
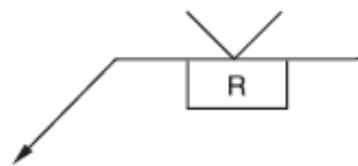


Melt-through symbol(cont.)

- it is possible to specify the size of the penetration bead, for example 1/16 in or 1/8 in.
- **The reason for this** is difficult to fathom because complete penetration is always visible and cannot be improved on by specifying its size. It would be unfortunate if a product was rejected because, on inspection, penetration was found to be 1/16 in when 1/8 in was specified. Remedial action would be expensive and unnecessary.
- If the size of a penetration bead were to be restricted to a certain dimension for clearance purposes this would be an important requirement for which instructions should be given in notes on the drawing.

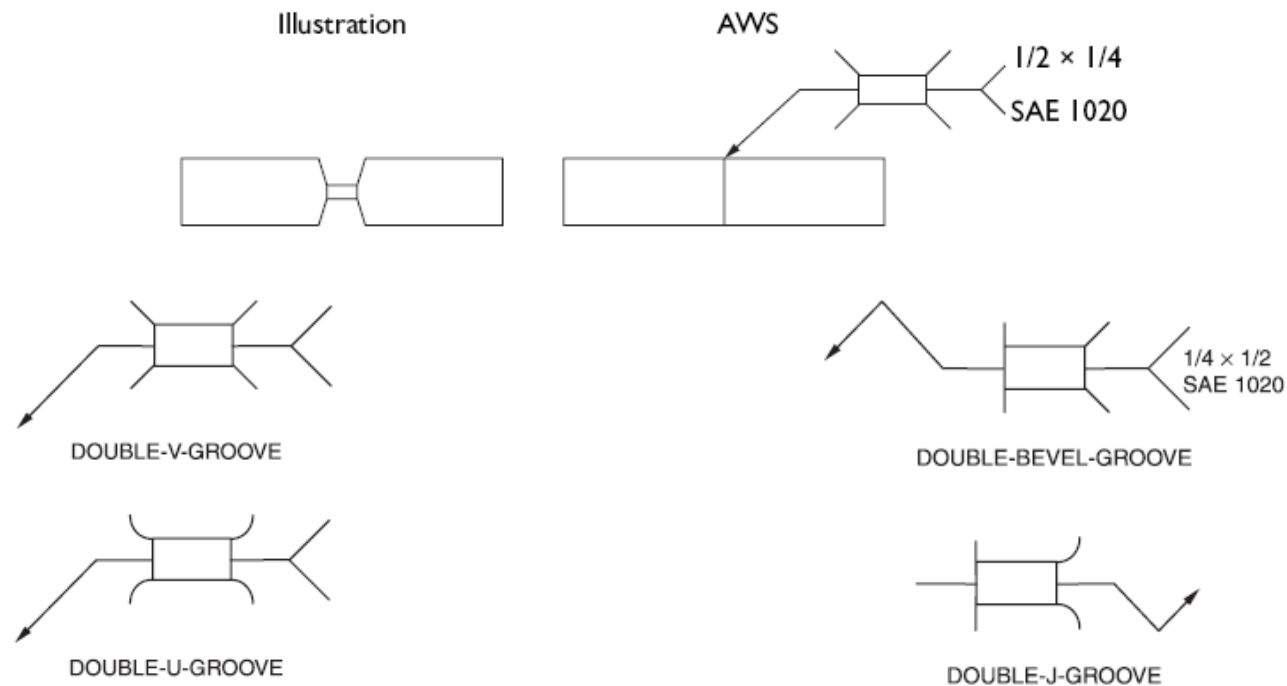
Backing symbol

- A backing symbol is placed above or below the reference line to indicate that a backing ring, strip or a consumable insert is to be used.
- It must be used in combination with a groove weld symbol **to avoid** mix up with a plug or slot weld.
- An **R** shall be placed within the backing symbol if the backing is to be removed after welding.
- The backing type, material and dimensions shall be specified in the tail of the welding symbol or on the drawing.



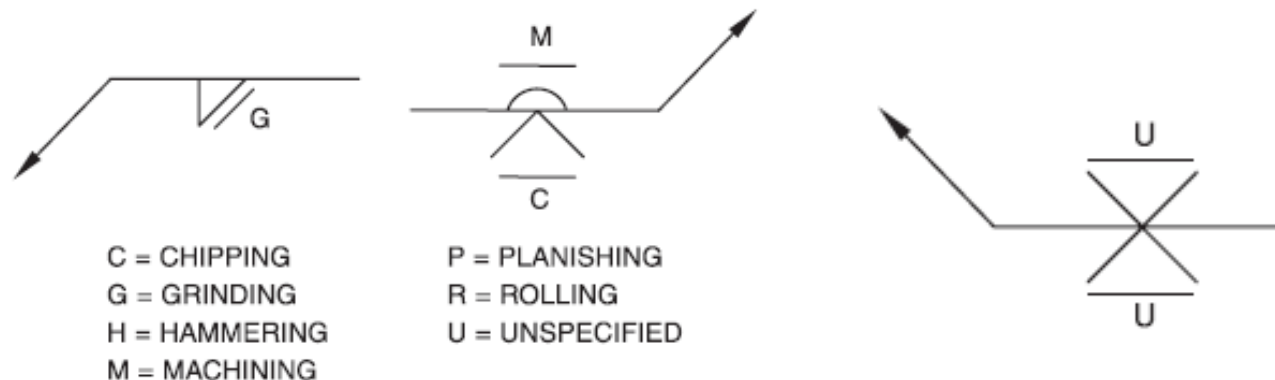
Spacer symbol

- It is a modified groove weld symbol having a rectangle within it. The material and the dimensions of the spacer shall be specified in the tail of the welding symbol or on the drawing.



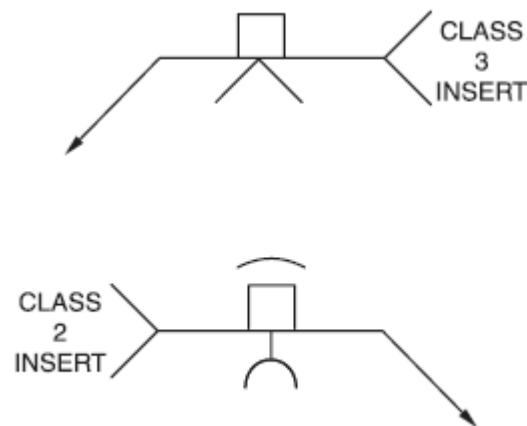
Contour symbol

- This is used to indicate the shape of the finished weld.
- Welds that are to be made approximately flat, convex or concave without subsequent finishing are represented by adding the symbol. Finishing designators are not to be used when the required weld contour is to be obtained by welding.
- Welds that are to be finished by mechanized means are depicted by adding **both** the appropriate contour symbol and the required finish symbol.
- Welds to be finished approximately flush, flat, convex, or concave with the method unspecified shall be indicated by adding the letter "U" to the appropriate contour



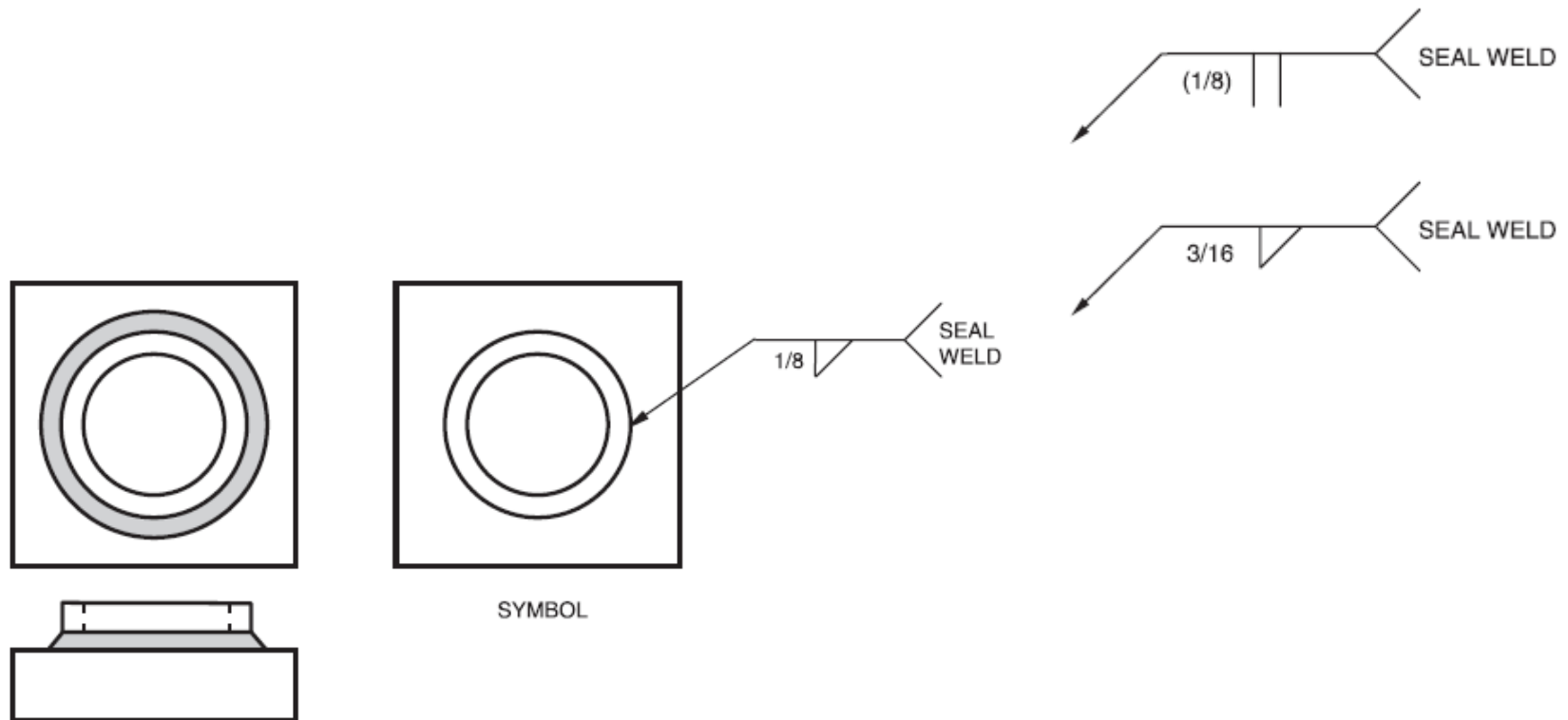
Consumable inserts

- Consumable inserts shall be specified by placing the consumable insert symbol on the side of the reference line opposite the groove weld symbol. The AWS consumable insert class shall be placed in the tail of the welding symbol (for the AWS insert classes, see AWS A5.30/A5.30M, *Specification for Consumable Inserts*).



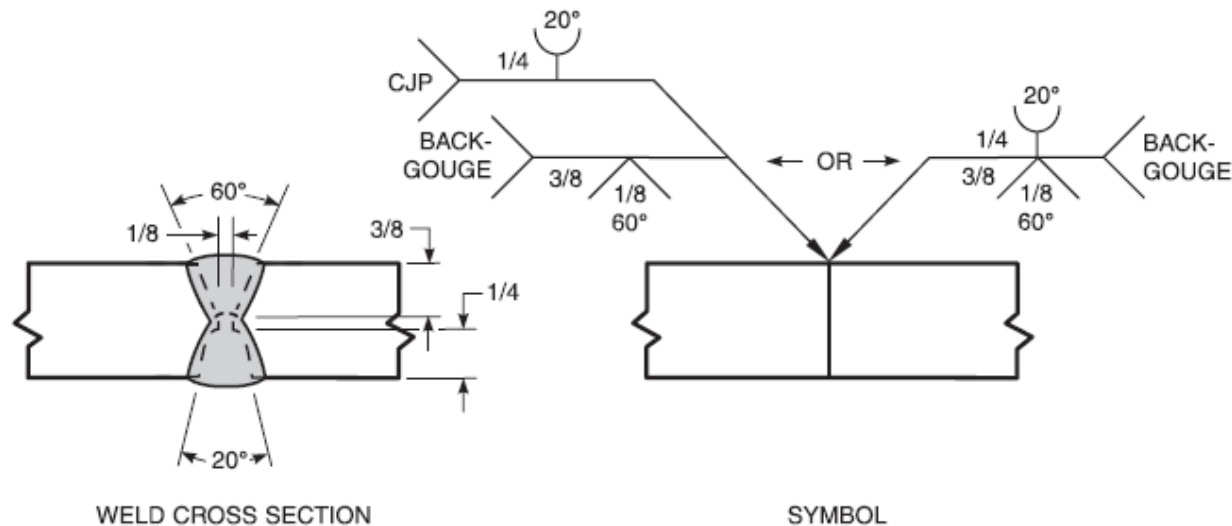
Seal welds

- When the intent of the weld is to fulfill a sealing function only, the weld shall be specified in the tail of the welding symbol as a seal weld



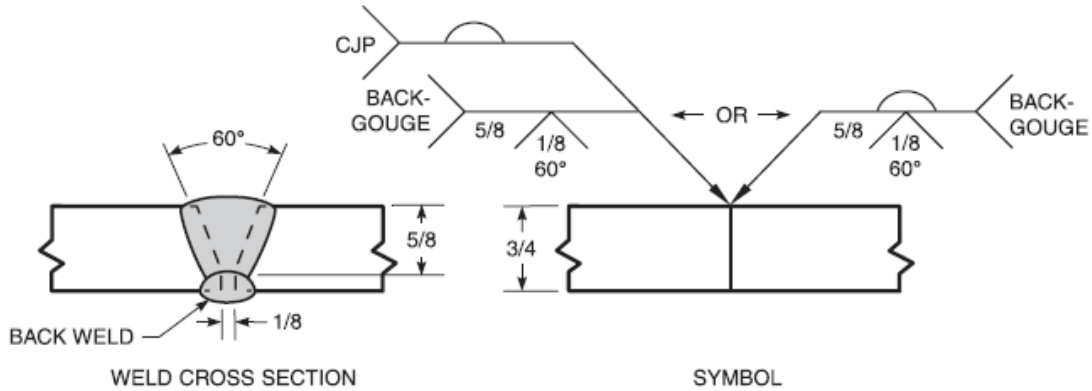
Backgouging

- Along with other joint details, the welding symbol shall include a reference to backgouging in the tail. In the case of nonsymmetrical double-groove welds, the symbol shall show the required depth of groove for each side of the joint, together with the required groove angles. In the case of single-groove welds without a root face or symmetrical double-groove welds without a root face, the welding symbol need not include the depth of groove dimension.

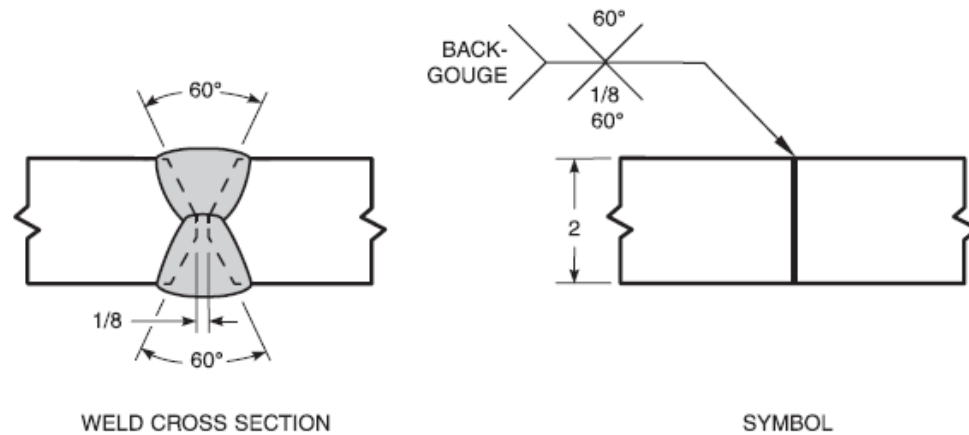


(A) BACKGOUGING AFTER WELDING FROM ONE SIDE WITH BOTH SIDES GROOVED

Backgouging(cont.)



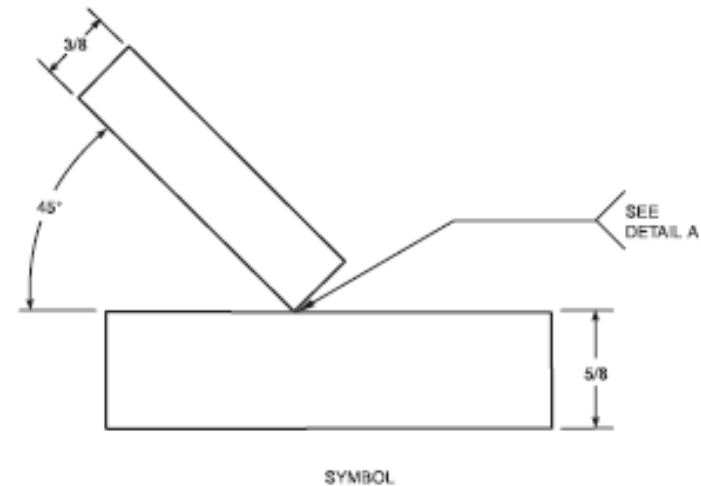
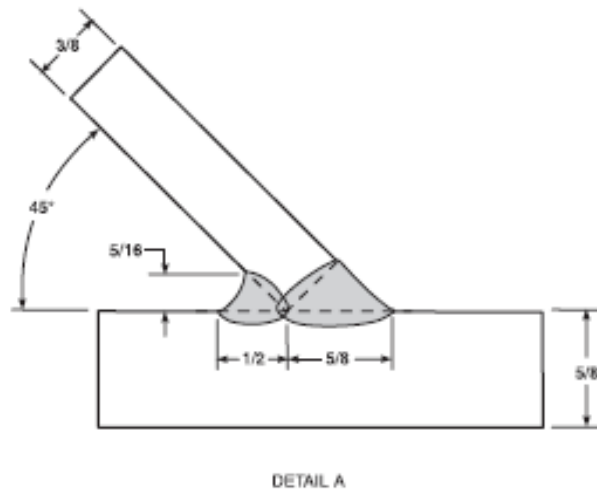
(B) BACKGOUGING AFTER WELDING FROM ONE SIDE WITH ONE SIDE GROOVED



(C) SYMMETRICAL GROOVE WELDS WITH BACKGOUGING

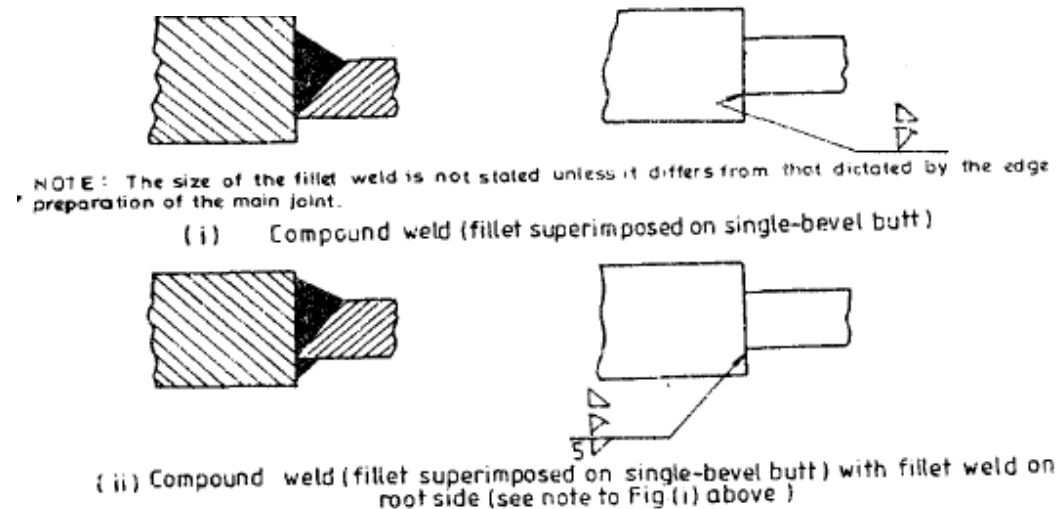
Skewed joints

- When the angle between the fusion faces is such that the identification of the weld type and, hence, proper weld symbol is in question, the detail of the desired joint and weld configuration shall be shown on the drawing with all necessary dimensions.

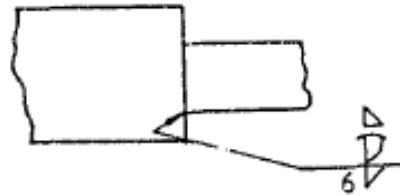
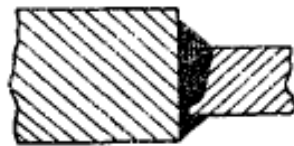


Combination of welds

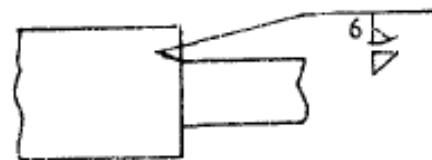
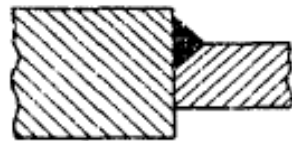
- When combination of welds is to be specified to make a joint, the weld symbol for each weld is placed on the welding symbol.
- The size of the weld is not stated unless it differs from that dictated by the edge preparation of the main joint.



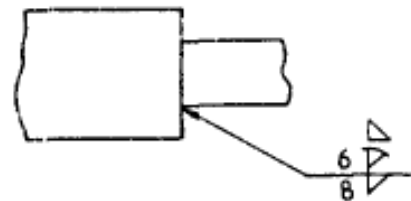
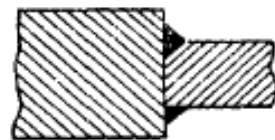
Combination of welds(cont.)



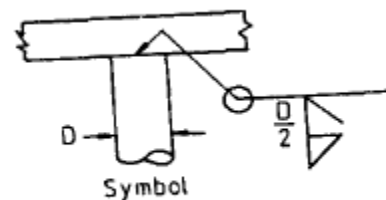
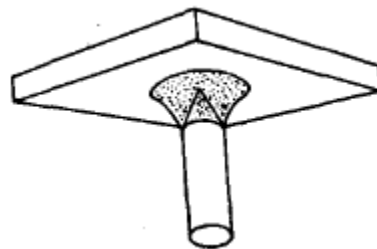
(iii) Compound weld (fillet superimposed on single-J butt) fillet weld on root side (see note to Fig.(i) above)



(iv) Partially-penetrated single-bevel butt with superimposed fillet (see note to Fig.(i))

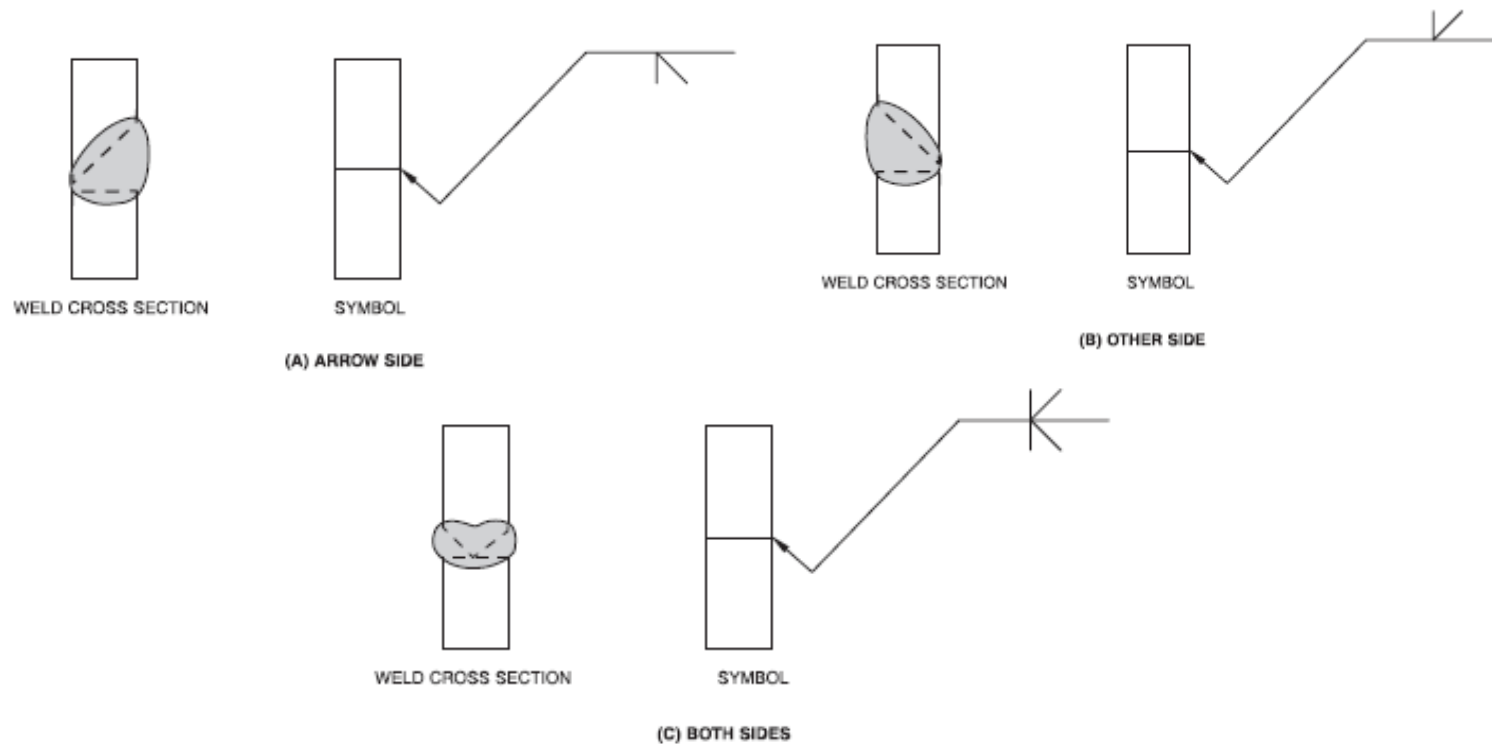


(v) Compound weld (fillet superimposed on partially penetrated single-bevel butt)



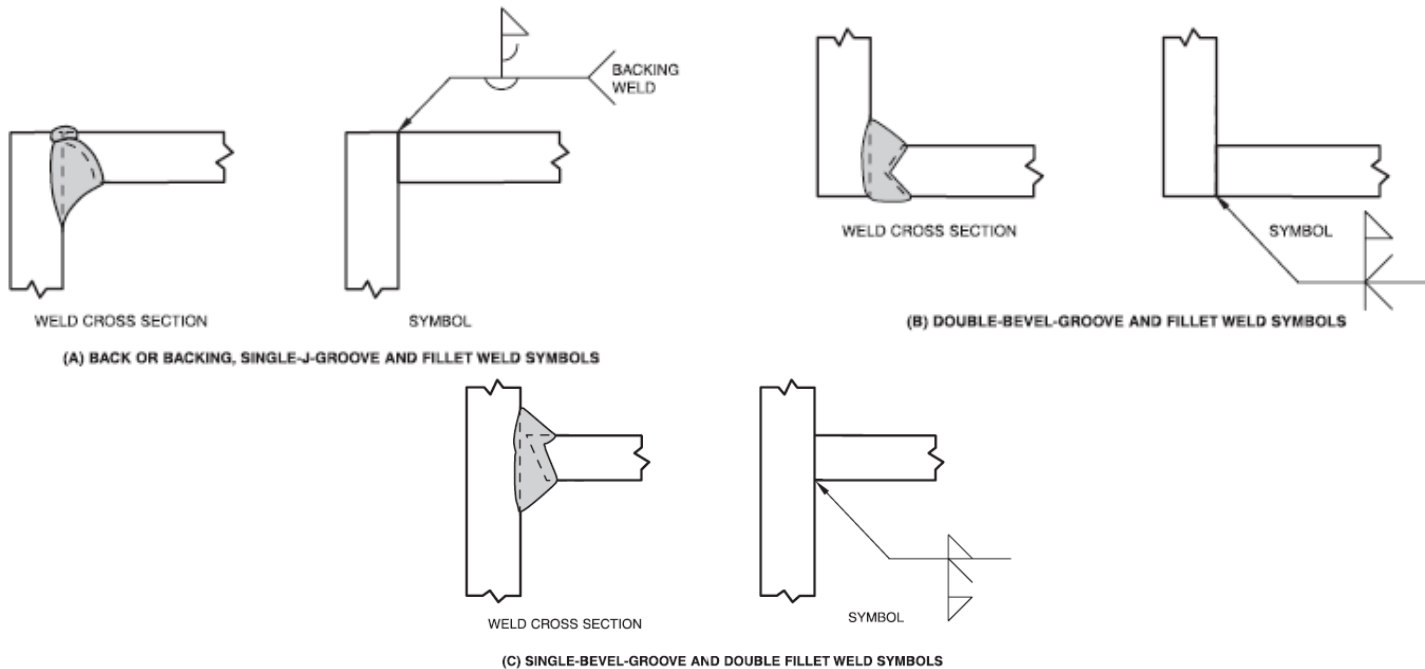
Break in the arrow

- **Groove Welds:** When only one joint member is to have a **bevel-groove** or a **J-groove** or both, the arrow shall have one break and point toward that member (see Figures).



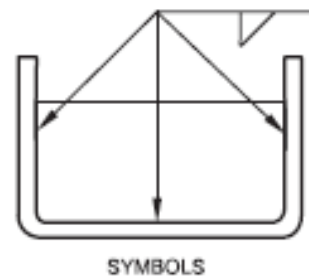
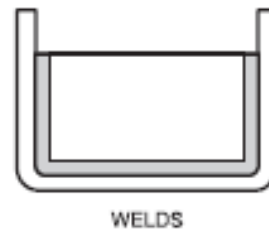
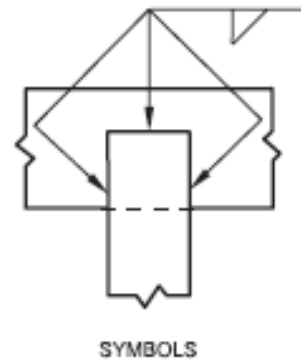
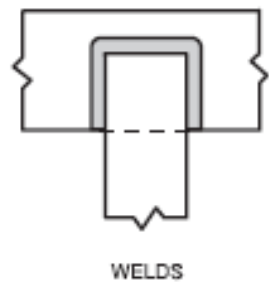
Break in the arrow(cont.)

- The arrow need not be broken if it is apparent which member is to have the bevel- or J-groove (see Figures). It shall not be broken if there is no reference as to which member is to have the bevel- or J-groove. A broken arrow need not be used for joints in which combined welds are to be specified and it is apparent which member is to be beveled.



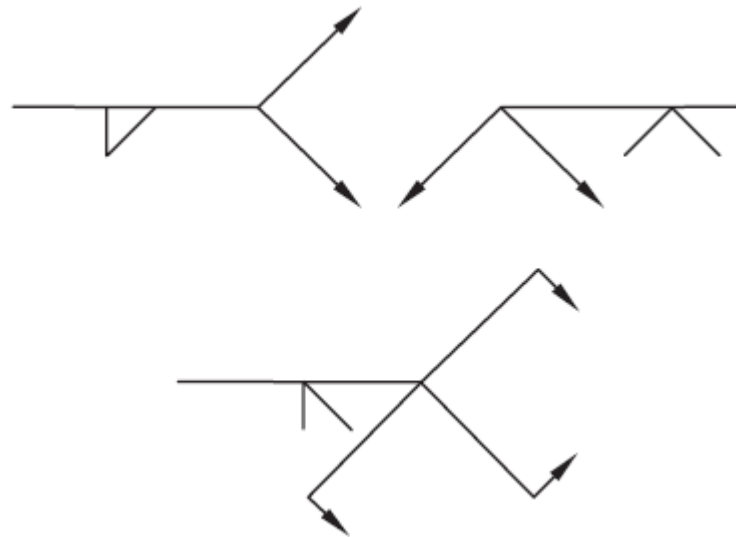
Break in the arrow(cont.)

- **Fillet Welds:** The arrow may or may not be broken to indicate fillet weld locations



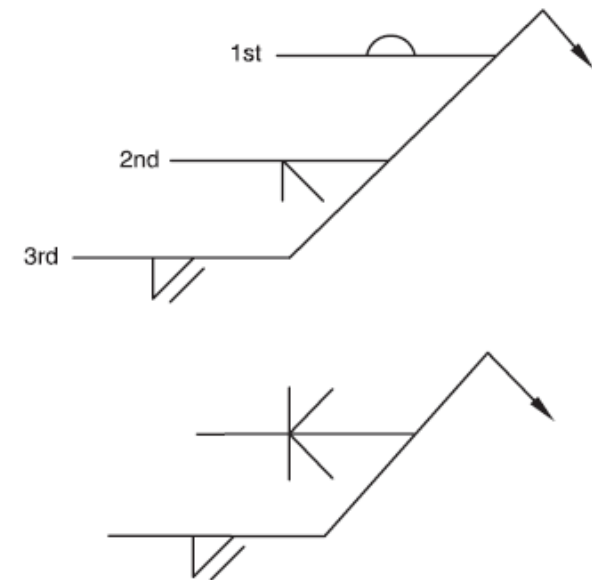
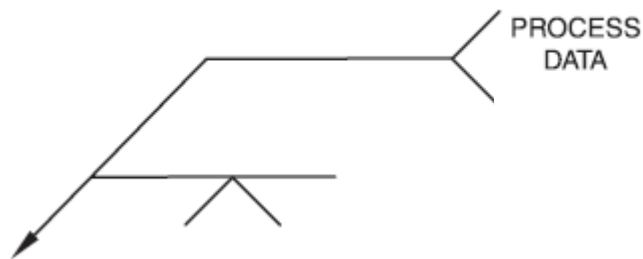
Multiple arrow lines

- Two or more arrows may be used with a single reference line to point to locations where identical welds are specified.



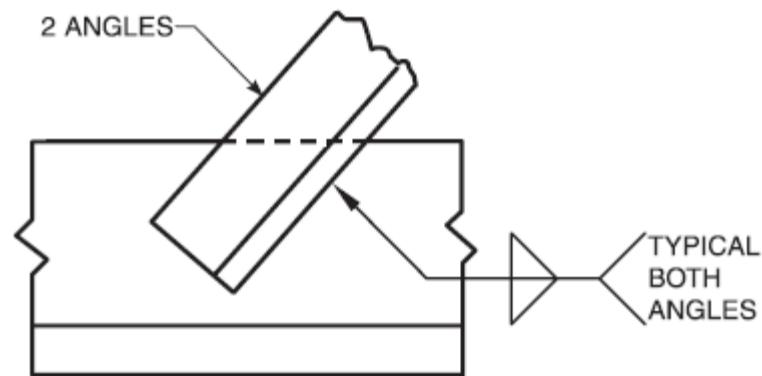
Multiple reference lines

- Two or more reference lines may be used with a single arrow to indicate a sequence of operation. The first operation is specified on the reference line nearest the arrow. Subsequent operations are specified sequentially on additional reference lines.
- The tail of additional reference lines may be used to specify data supplementary to welding symbol information.



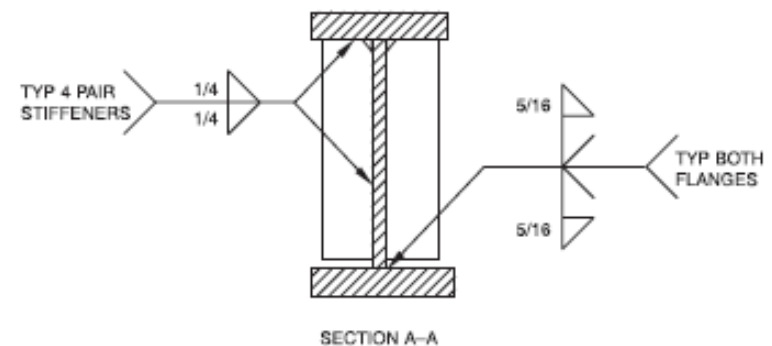
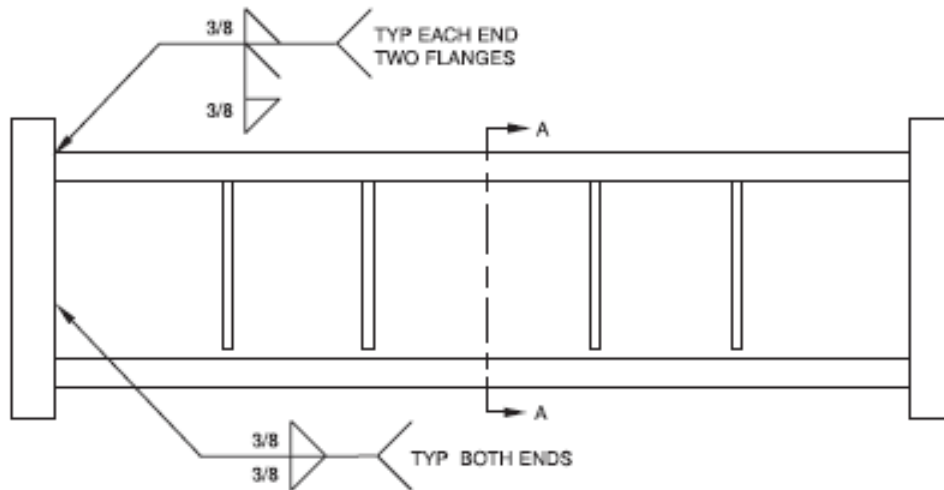
Hidden members

- When the welding of a hidden member is to be the same as that of a visible member, it may be specified as shown below. If the welding of a hidden member is to be different from that of a visible member, specific information for the welding of both shall be specified. If needed for clarification, auxiliary illustrations or views shall be provided.



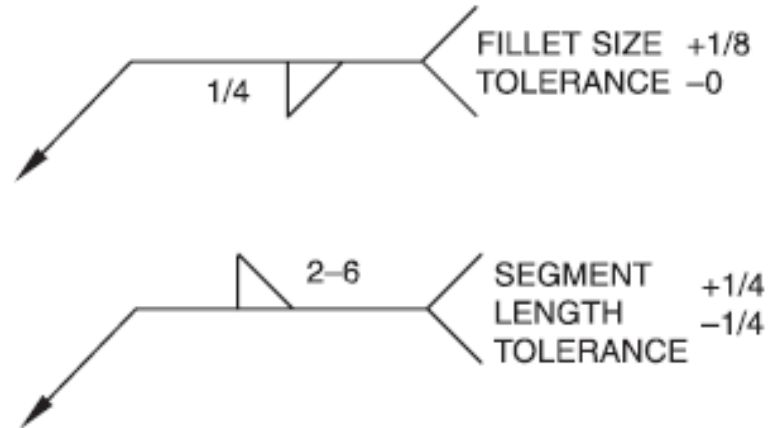
Welding symbols designated "TYPICAL"

- Repetitions of identical welding symbols on a drawing may be avoided by designating a single welding symbol as "TYPICAL" (usually abbreviated "TYP") and pointing the arrow to the representative joint

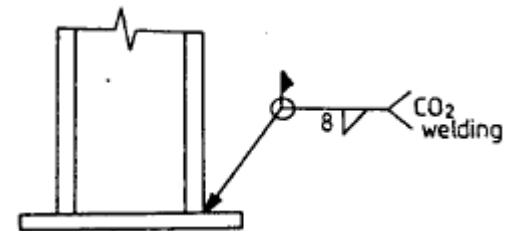
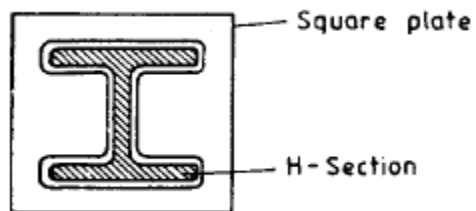
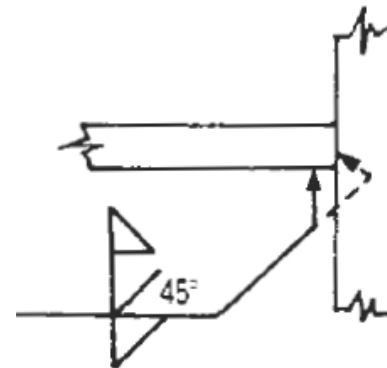
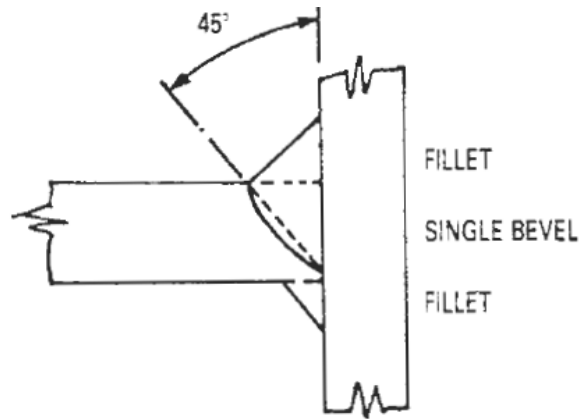


Weld dimension tolerance

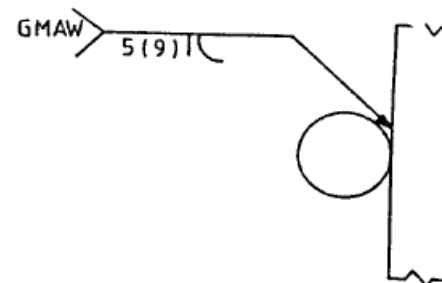
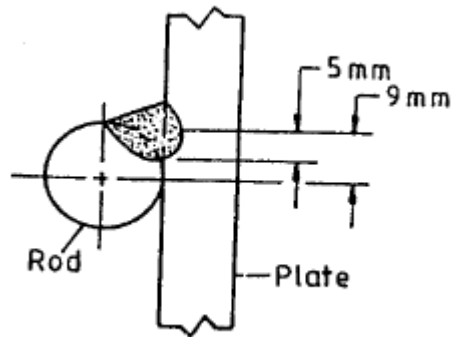
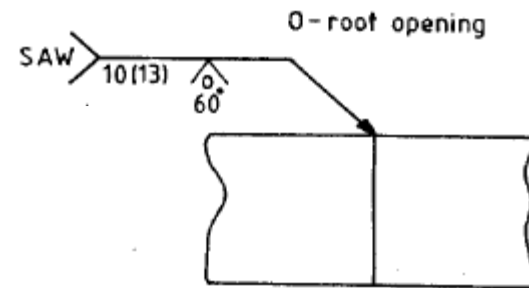
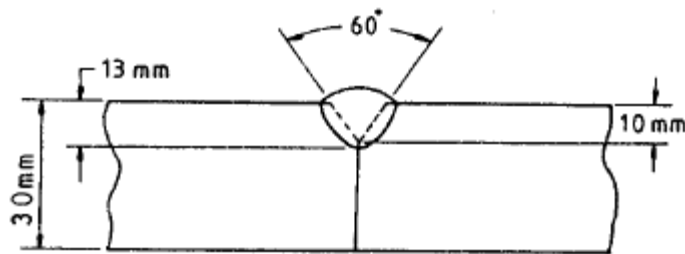
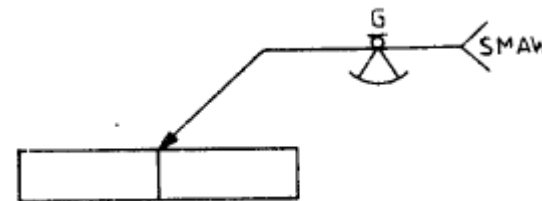
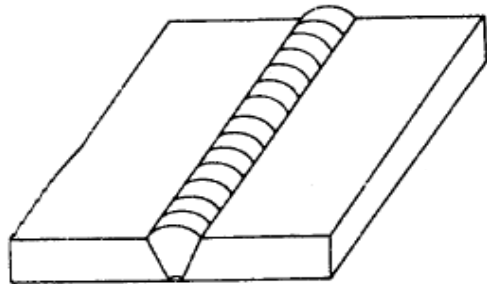
- When a tolerance is applicable to a weld symbol dimension, it may be shown in the tail of the welding symbol or specified by a drawing note, a table, code, or specification. In all cases, a reference must be made to the dimension to which the tolerance applies.



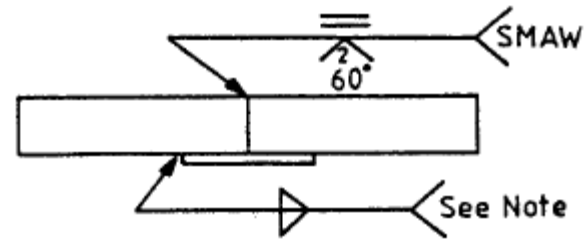
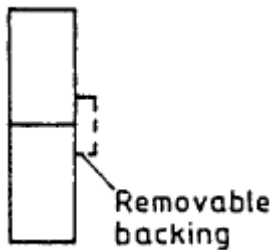
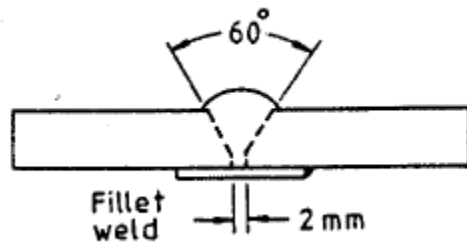
Some examples



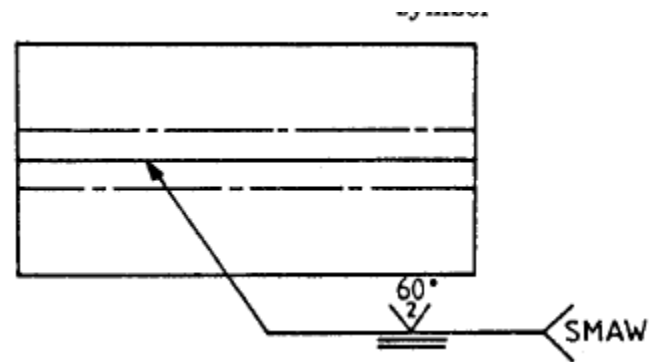
Some examples(cont.)



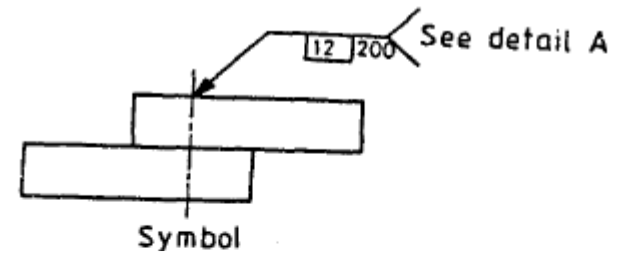
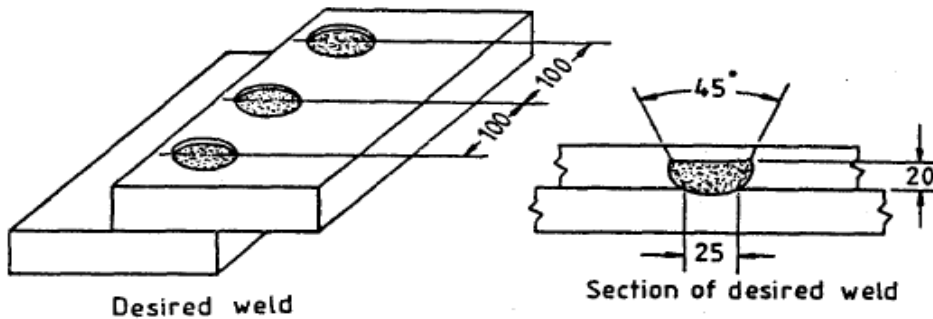
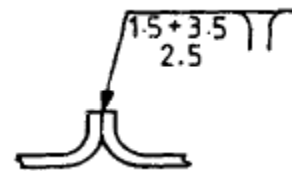
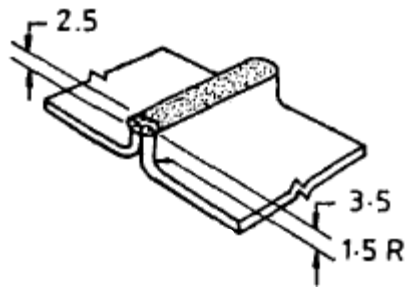
Some examples(cont.)



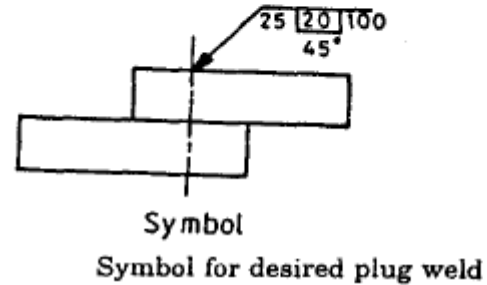
Note : Material and dimensions of backing as specified.



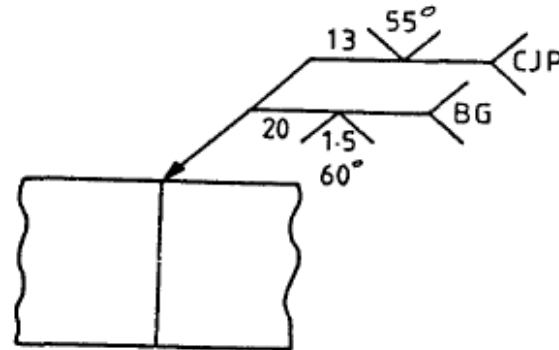
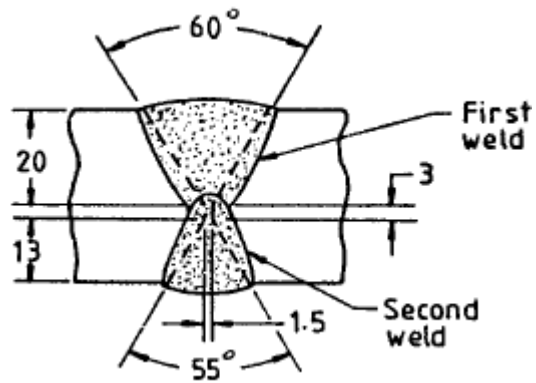
Some examples(cont.)



Symbol for slot welds.

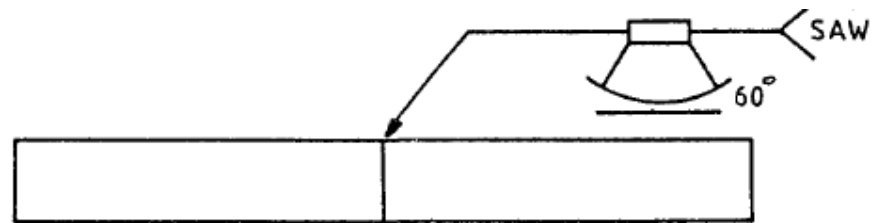
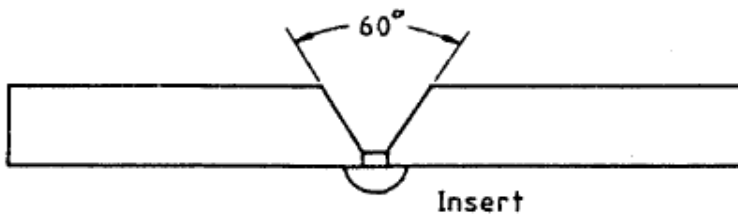


Some examples(cont.)



Symbol

Note: BG - Back gouge to sound metal
CJP - Complete joint penetration

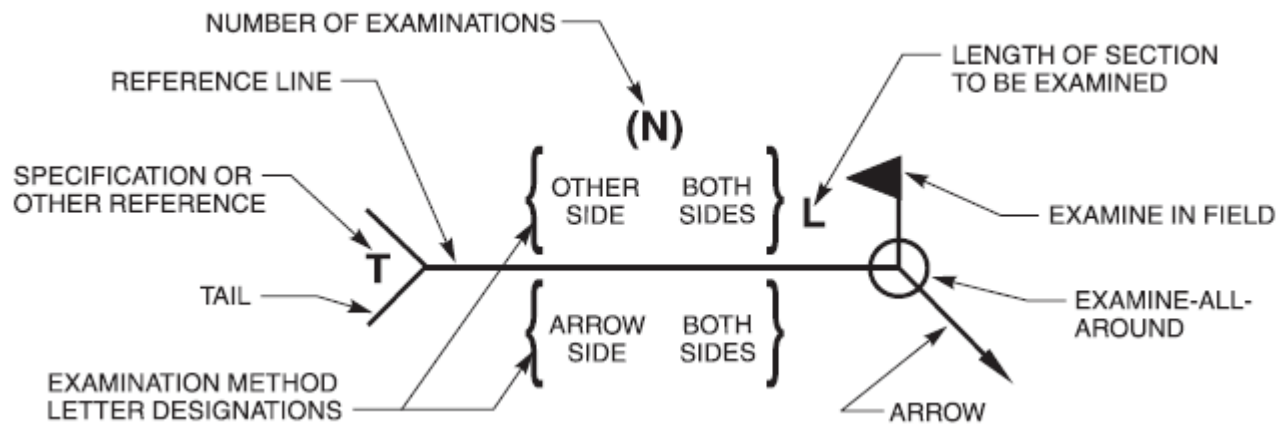


NDT symbols

- NDT symbols are also used on the engineering drawing to specify the method of examination.
- NDT symbols may be combined with welding symbols by using an additional reference line or by specifying the test method in the tail of the welding symbol.

Type of test	Symbol
Acoustic emission	AET
Electromagnetic	ET
Leak	LT
Magnetic particle	MT
Neutron radiographic	NRT
Penetrant	PT
Proof	PRT
Radiographic	RT
Ultrasonic	UT
Visual	VT

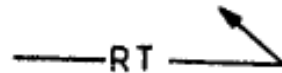
Standard location of elements of a NDT symbol



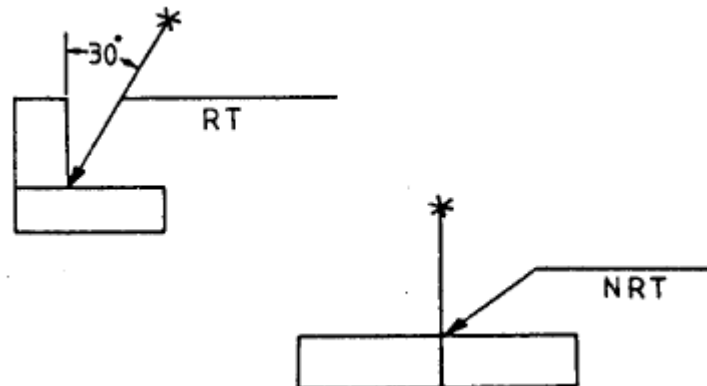
EXAMINE ALL AROUND	FIELD EXAMINATION	RADIATION DIRECTION

No side significance

- When the NDT may be performed from either side or has no arrow or other side significance, the basic examination symbol is centered in the reference line.

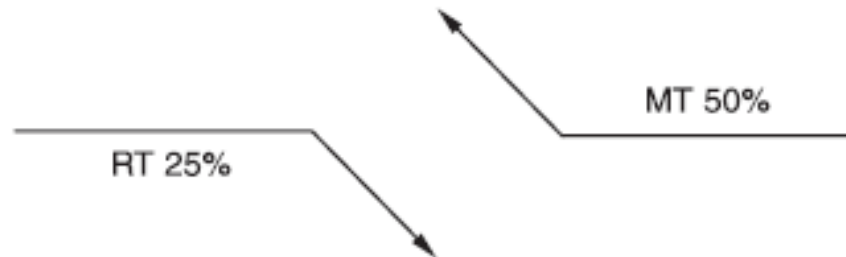


- The direction of radiation (X-rays or Gamma rays) may be shown in conjunction with RT and **neutron** radiographic test (NRT) symbols. The direction of radiation may be indicated by a special symbol and line located on the drawing at the desired angle.



Partial examination

- When less than 100% of the length of a weld or part is to be examined, with locations to be determined by a specified procedure, the length to be examined is specified by placing the appropriate percentage to the right of the letter designation. The selected procedure may be specified by reference in the tail of the nondestructive examination symbol.



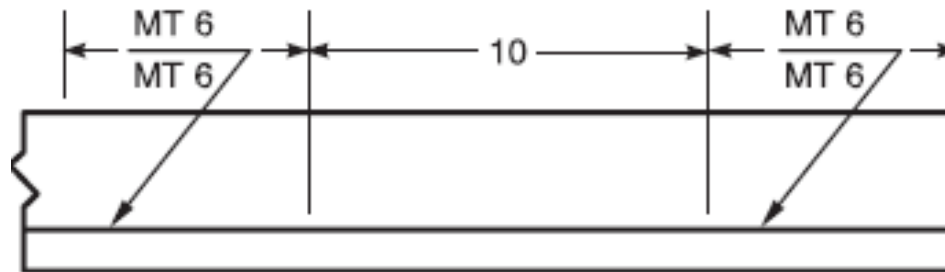
Number of examinations

- To specify a number of examinations to be conducted on a joint or part at random locations, the number of required examinations shall be placed in parentheses either above or below the letter designation away from the reference line.



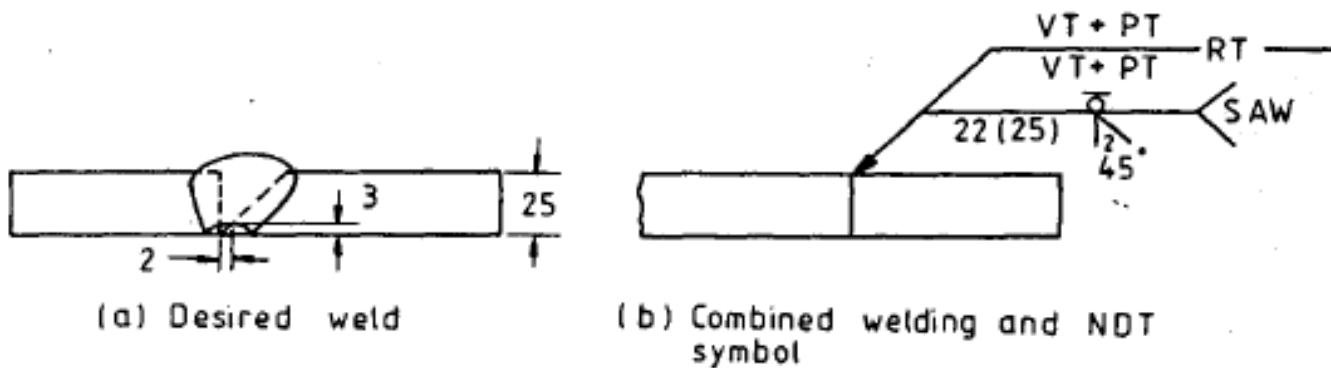
Specifying the length

- To specify the examination of welds or parts where only a portion of the length of a section need be considered, the length dimension shall be placed to the right of the letter designation.
- When the full length of a part is to be examined, no length dimension need be included in the nondestructive examination symbol.



Combined symbol

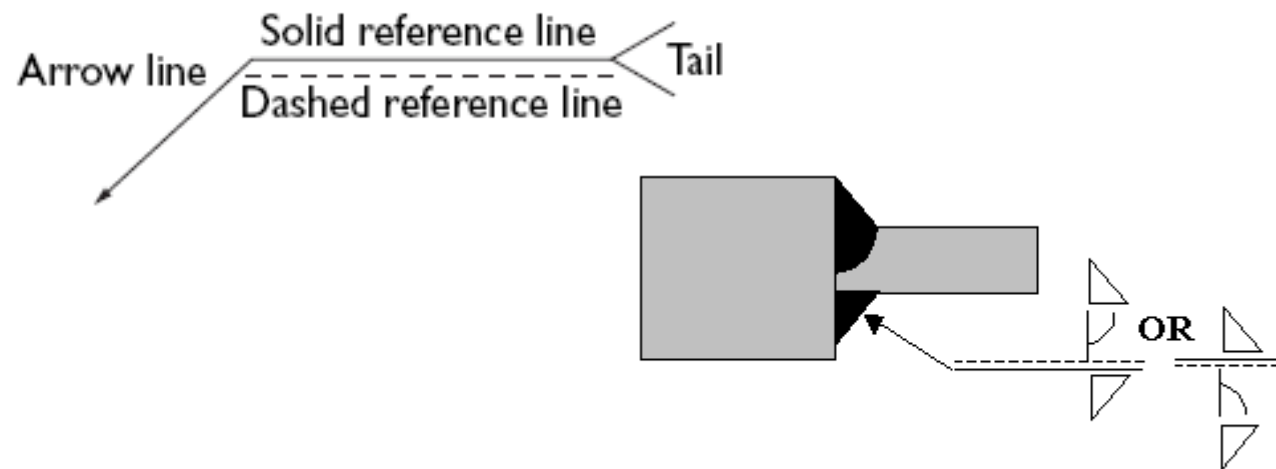
- NDT symbols may be combined with welding symbols.



The weldment is to be examined by three NDT methods viz, visual examination followed by penetrant testing and then the gamma ray radiography. Show the combined welding and NDT symbols.

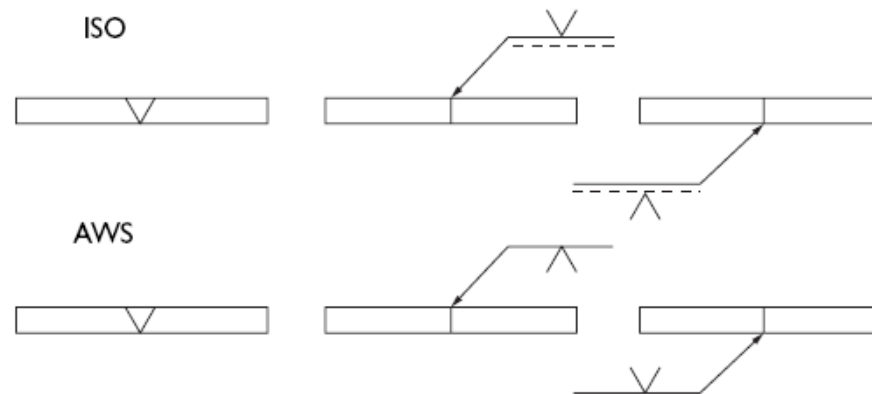
Elements of welding symbol (ISO 2553)

- In the ISO system there are two parallel reference lines, one solid and one dashed.
- In the ISO system the dashed line can be drawn above or below the solid line but It is recommended that the solid line is always drawn above the dashed line as standard practice.



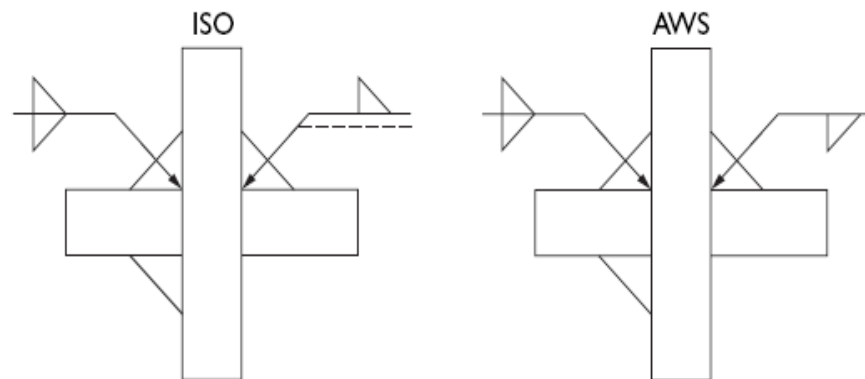
Symbolization of a weld

- In the ISO system a weld on the arrow side is indicated by placing the weld symbol on the solid reference line and a weld on the other side has the symbol on the dashed line. (In this case, the symbol 'hangs' below the dashed line)



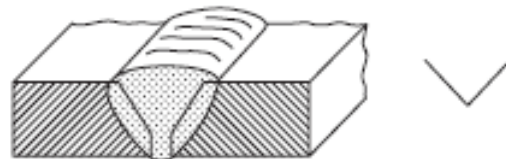
Double weld

- If a weld is made on both sides, as in a double fillet weld, the weld symbol is placed on both sides of the reference line or lines, in which case, in the ISO system, the dashed line can be omitted.

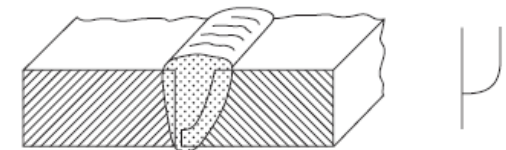


Butt/groove welding symbols

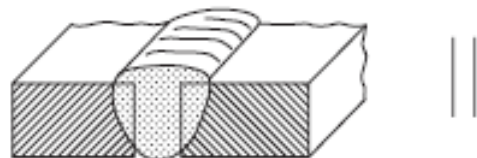
Single-V butt/groove weld



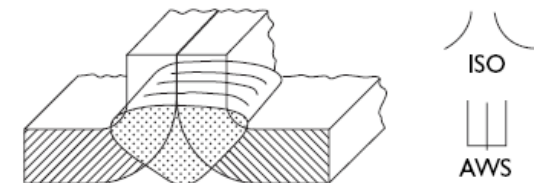
Single-J butt/groove weld



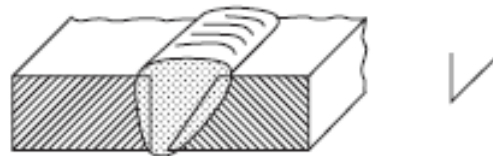
Square butt/groove weld



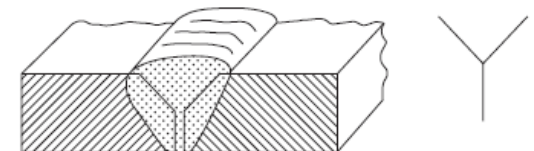
Butt weld between plates with raised edges (ISO)
Edge weld on a flanged groove joint (AWS)



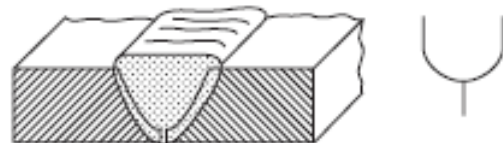
Single bevel butt/groove weld



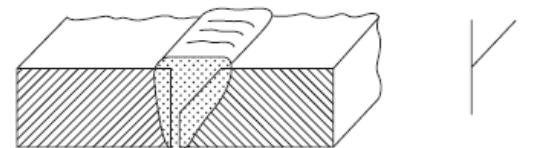
Single-V butt weld with broad root face



Single-U butt/groove weld

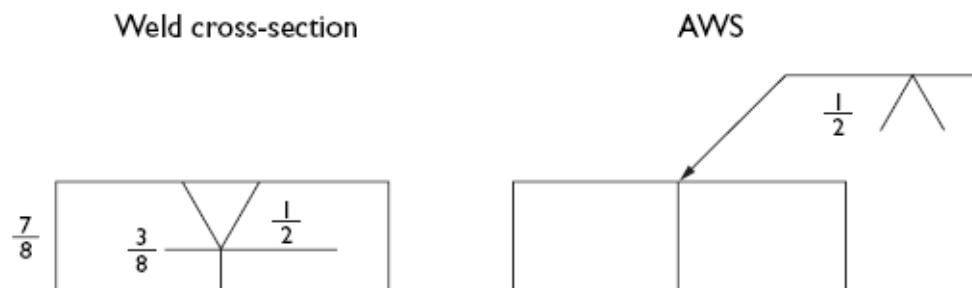


Single bevel butt weld with broad root face



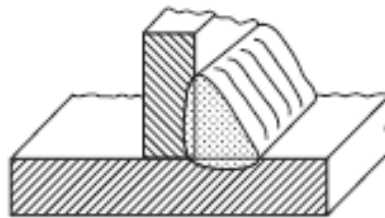
Dimensions

- Dimensions of a broad root face are specified in ISO 9692. A root face of 2–3mm is specified for section thicknesses of 5–40mm.
- This is **unnecessarily confusing** and it is recommended that the broad root face terms and symbols should be avoided.
- when ISO 2553 is used, the dimensions of the edge preparations are not included as part of the welding symbol and should be given as part of the WPS. With the AWS system, the depth of the groove can be specified by a number on the left hand side of the weld symbol. This dimension, subtracted from the section thickness, will indicate the size of the root face.

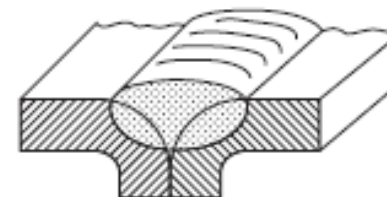


Fillet and other welding symbols

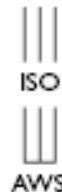
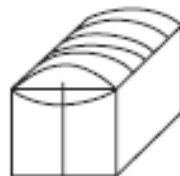
Fillet weld



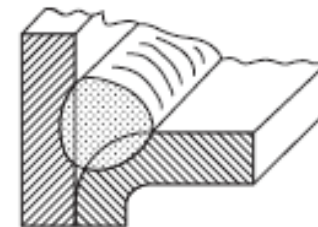
Flare-V-groove weld (AWS)



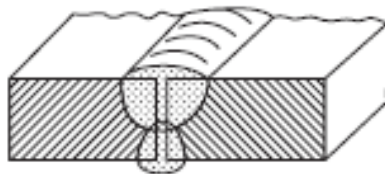
Edge weld



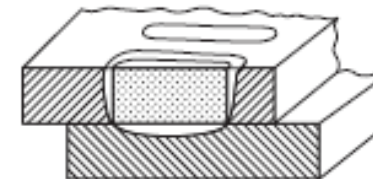
Flare-bevel-groove weld (AWS)



Backing run (ISO)
Back or backing
weld (AWS)

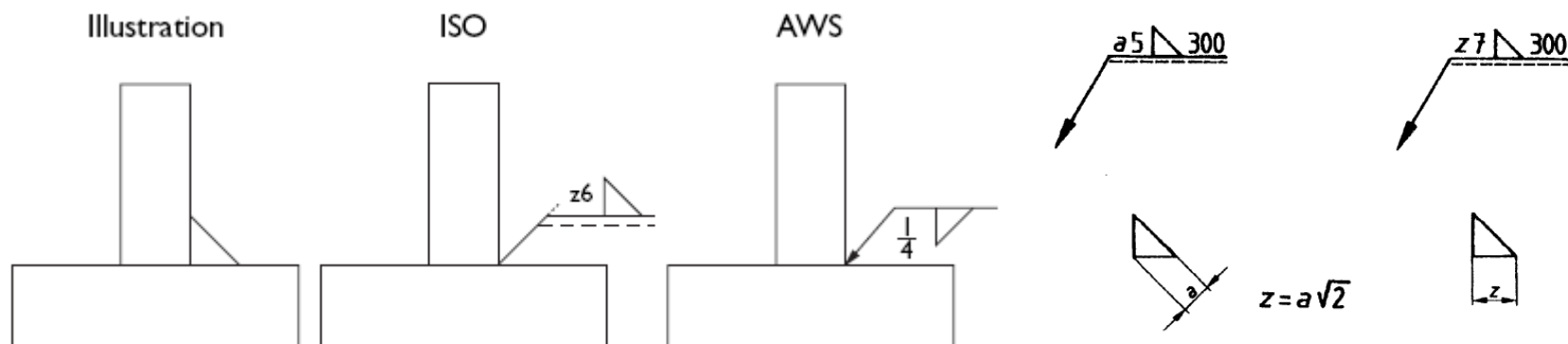


Plug or slot weld



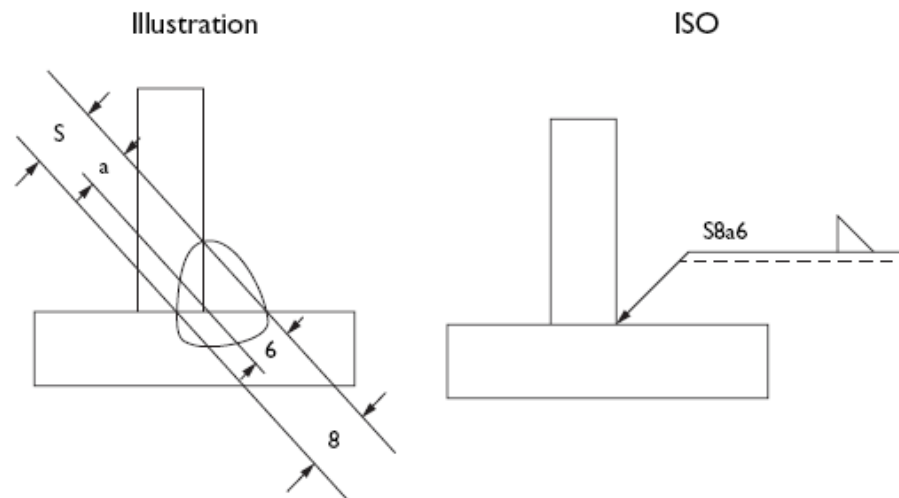
Fillet welds

- The ISO standard includes two methods to indicate fillet weld sizes: leg length (z) and throat thickness (a).
- In the ISO system, to indicate the size of a fillet weld, the dimension is placed to the left of the symbol, preceded by the letter z or a , depending on whether the leg length or throat thickness is to be specified. It is generally the leg length that is specified.



Deep penetration welds

- The ISO standard can specify deep penetration welds, the effective weld throat being indicated by the letter *s* placed in front of the throat thickness dimension, as shown in. This is followed by the nominal throat thickness preceded by the letter *a*.
- The reason for including the nominal throat dimension is not clear because any calculations of weld strength would be based on the '*s*' dimension which is the actual throat thickness.

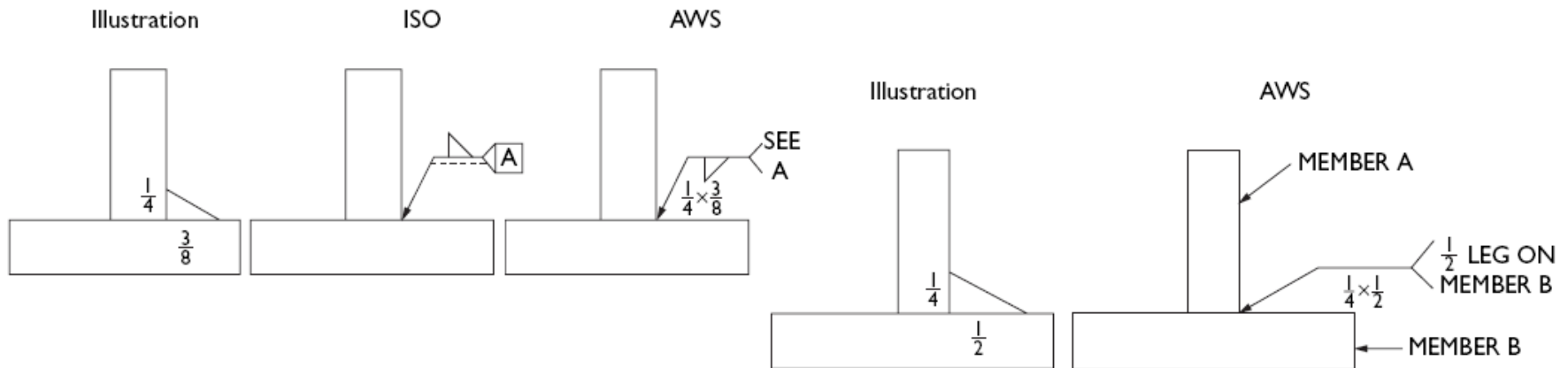


Deep penetration welds(cont.)

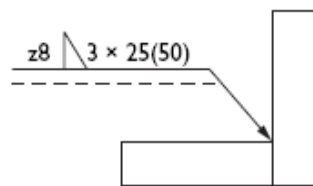
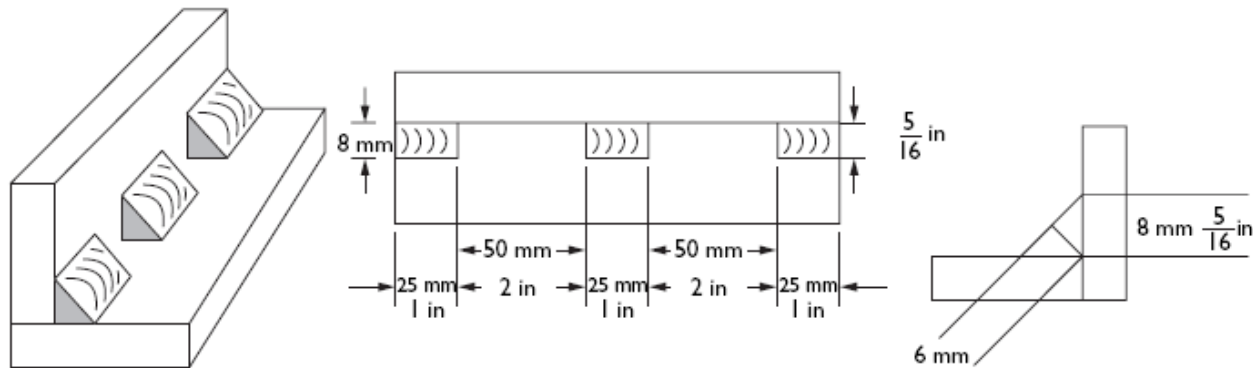
- Deep penetration of a weld can be achieved by high-current submerged arc welding (SAW) or gas shielded metal arc welding (GMAW) and by certain types of electrodes. The depth of penetration must be predetermined by welding procedure testing before the dimension is used for design purposes and is included in the welding symbol.
- In the AWS standard deep penetration fillet welds are not mentioned as such and it is not clear how such a weld would be symbolized.

Unequal leg length fillet welds

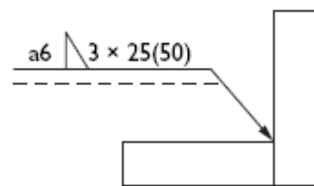
- If it is not obvious which is the short or long leg, identification can be indicated by instructions in the tail of the reference line. The ISO system uses a closed tail with a reference letter which can refer to a specific instruction such as a note on the drawing.
- The direct instruction or an unambiguous note on the drawing is preferable because the AWS standard places the smaller dimension of an unequal leg length fillet weld first whereas the ISO standard does not refer to unequal leg length fillet welds at all.



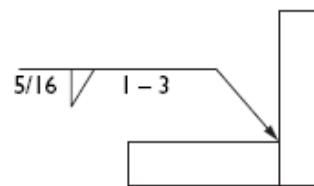
Intermittent fillet welds



ISO (Leg length)



ISO (Throat thickness)



AWS (Leg length)

ISO (mm)

AWS (in)

z8 – leg length

5/16 – leg length

25 – length of each weld

1 – length of each weld

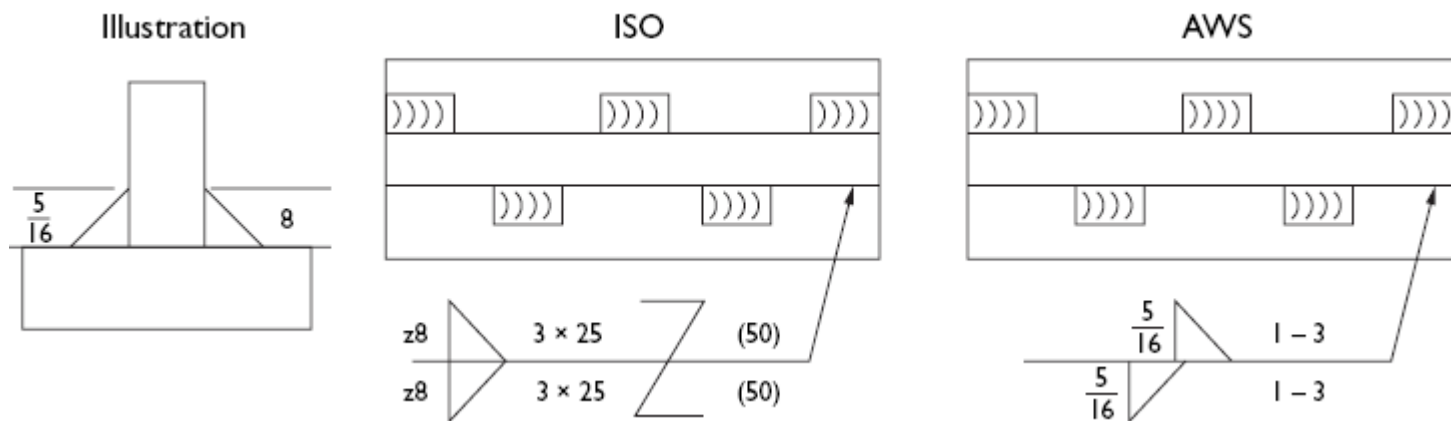
(50) – distance between the ends of adjacent welds

3 – pitch (centre to centre spacing)

3 – number of separate welds

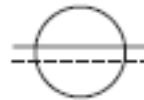
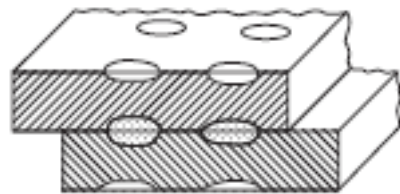
Staggered intermittent fillet welds

- staggered intermittent fillet welds which are indicated on the ISO system by an elongated 'Z'.

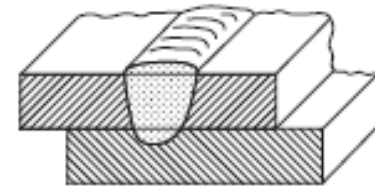


Symbols for ...

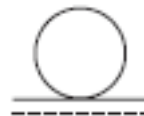
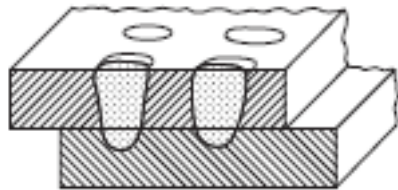
Resistance spot weld
(Reference lines (ISO)
shown for clarity)



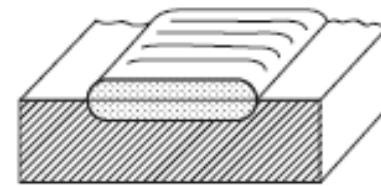
Arc seam weld



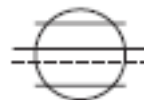
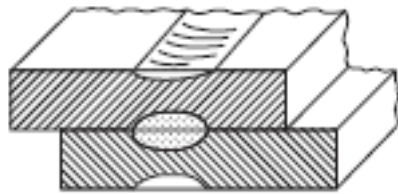
Arc spot weld



Surfacing



Resistance seam weld
(Reference lines (ISO)
shown for clarity)



Steep flanked single-V
butt weld



Steep flanked single-
bevel butt weld

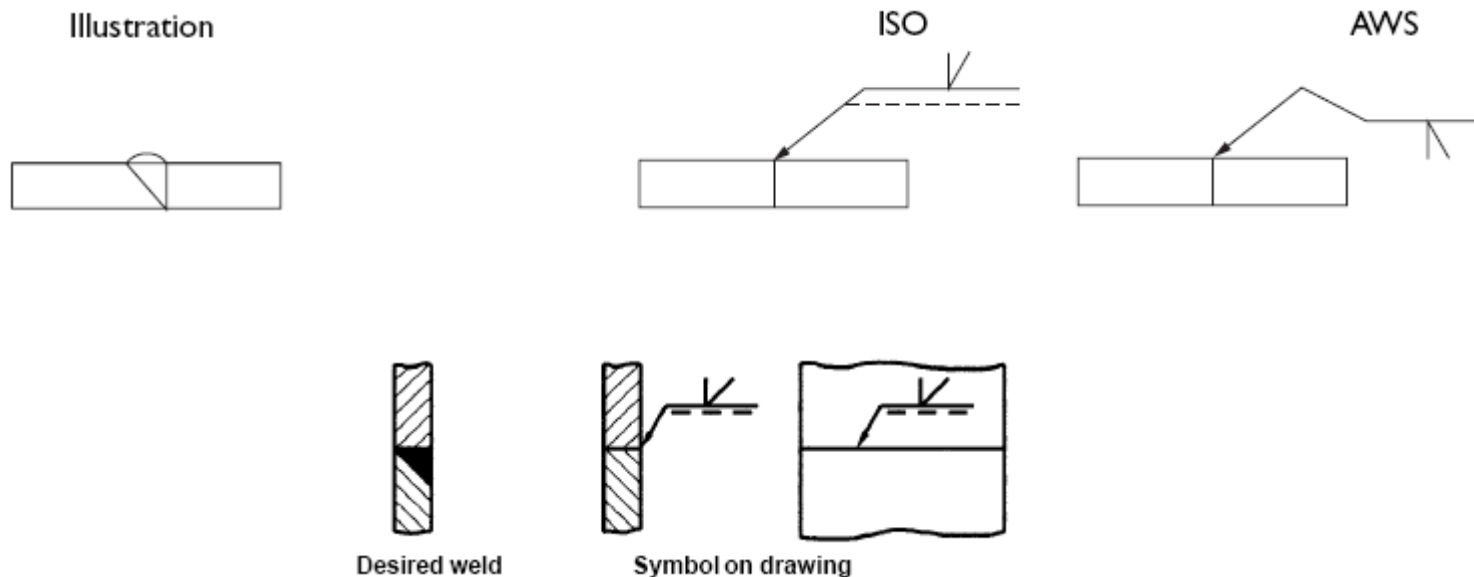


Steep flanked butt welds


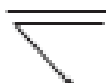








- The edge preparations for these welds are shown in ISO 9692-1 with bevel angles of $5-20^\circ$ for a butt weld and $15-30^\circ$ for a bevel butt weld. The welds have a backing strip. These symbols are not included in the AWS standard and are not really necessary because the welds are, in fact, single-V and single bevel butt welds.
- There are no examples of the application of these symbols in ISO 2553.

No break line in ISO


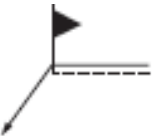







- In ISO system, there is no significance in the position of the arrow line in relation to the weld, except in the case of single bevel butt welds and single-J butt welds where the arrow of the arrow line must point towards the plate that is prepared.



Supplementary symbols

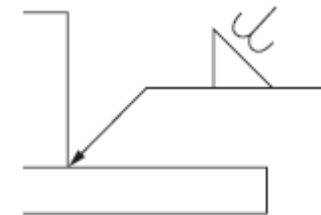
ISO	AWS	ISO	AWS
 Flat (usually finished flush)	 Flush or flat	No symbol	 Melt through
 Convex	 Convex	No symbol	 Consumable Insert
 Concave	 Concave	 Peripheral weld	 Weld all round

Supplementary symbols(cont.)

ISO	AWS	ISO	AWS
 <p>Toes shall be blended smoothly</p>	No symbol	 <p>Field or site weld</p>	 <p>Field weld</p>
No symbol	 <p>Spacer</p>	 <p>Permanent backing strip used</p>	 <p>Backing</p>
No symbol	 <p>Back or backing weld</p>	 <p>Removable backing strip used</p>	 <p>Removable backing</p>

Toes blended smoothly

- The ISO standard includes a symbol for weld toes to be blended smoothly. It can be used to inform the welder that the weld toes are to be ground in order to remove any small slag intrusions that exist at the toes of welds made by SMAW.
- The maximum depth of intrusions is usually 0.4mm and the depth of grinding should be 1–2mm.
- The purpose of weld toe grinding is to increase the fatigue strength of the welded joint. This is important because slag intrusions can act as initiation sites for fatigue cracks. The process of weld toe grinding for fatigue strength improvement is highly skilled and requires training.

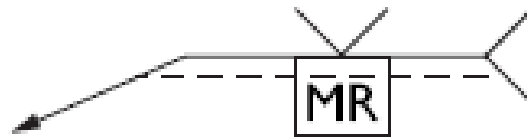


Not melt-through symbol in ISO?

- The ISO standard requires that all butt welds shall have complete penetration unless there are any contrary indications.

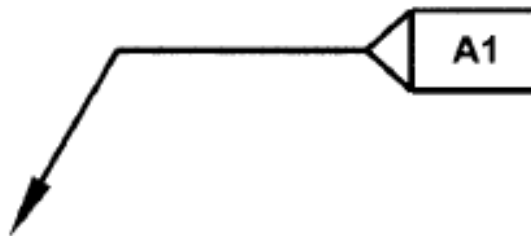
Backing strip or backing

- In ISO 2553, there is no explanation of the meaning of the letter M in the symbol, but it probably originates from previous editions of ISO 2553 or associated standards. The letter M probably refers to the material and dimensions of the backing strip.



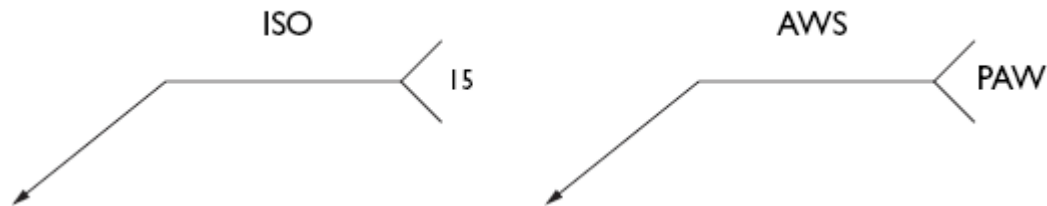
Further information

- Further information can be given after the tail, in the following order:
 - process (e.g. in accordance with ISO 4063);
 - acceptance level (e.g. in accordance with ISO 5817 and ISO 10042);
 - working position (e.g. in accordance with ISO 6947);
 - filler metal (e.g. in accordance with ISO 544, ISO 2560, ISO 3-58 1).



Process identification

- In the ISO system the welding process to be used can be symbolized by a number written within the fork or tail at the end of the reference line, whereas in the AWS system letters are used instead of numbers.
- A complete list of the numbers for different welding processes is given in ISO 4063 and for the letter symbols in ANSI/AWS A2.4

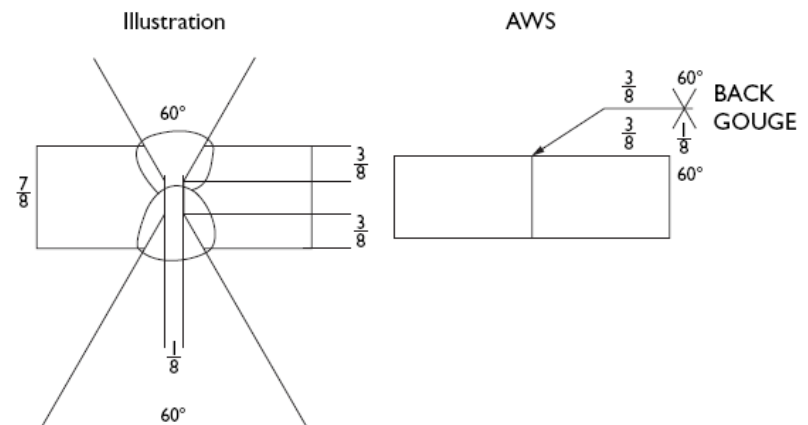


Designations of welding processes

ISO 4063 : 1992		ANSI/AWS A2.4-98			
1	Arc welding	AW	Arc welding		
111	Metal arc welding with covered electrode (manual metal arc welding)	SMAW	Shielded metal arc welding		
114/136	Flux cored metal arc welding	FCAW	Flux cored arc welding		
12	Submerged arc welding	SAW	Submerged arc welding		
13	Gas shielded metal arc welding				
131	MIG welding	GMAW	Gas metal arc welding		
135	MAG welding (non-inert gas)				
141	TIG welding	GTAW	Gas tungsten arc welding		
15	Plasma arc welding	PAW	Plasma arc welding		
2	Resistance welding	RW	Resistance welding		
21	Spot welding	RSW	Resistance spot welding		
22	Seam welding	RSEW	Resistance seam welding		
23	Projection welding	RPW	Projection welding		
24	Flash welding	FW	Flash welding		
3	Gas welding	OPW	Oxyfuel gas welding		
311	Oxy-acetylene welding	OAW	Oxyacetylene welding		
42	Friction welding	FRW	Friction welding		
43	Forge welding	FOW	Forge welding		
71	Thermit welding	TW	Thermit welding		
72	Electroslag welding	ESW	Electroslag welding		
781	Arc stud welding	SW	Stud arc welding	Suffixes	
91	Brazing	B	Brazing	MA	manual
94	Soldering	S	Soldering	SA	semi-automatic
97	Braze welding			AU	robotic
				ME	machine

Comparison

- In the AWS system full details of the groove dimensions can be specified, for example, bevel angles, root face, root gap, as well as the sizes of the welds on each side of the joint.
- The AWS standard describes many examples of combinations of joint edge preparations and weld sizes that can be specified by the welding symbol. In contrast to this, **the ISO system limits the information specified** by the welding symbol to the type of weld and its size. There is a limit to the extent of a welding procedure that can be contained in a welding symbol and it is advisable to supplement this information with additional notes and drawings.



Note that...

- It will be evident from the foregoing descriptions that, if a particular weld profile is desired, it may not be possible to convey all the essential requirements by means of welding symbols. In this case separate, detailed instructions should be given in a Welding Procedure Specification (WPS) or on a note on the drawing.

Non-destructive testing symbols

- AWS A2.4 includes a comprehensive system to indicate the requirements for non-destructive testing (NDT) on a drawing, but in ISO 2553 there is no reference to NDT.

Question?

- Please ask your questions about this topic and all aspects of welding via:
 - <http://forum.weldeng.net>