



Welding Inspection Terms & Definitions

Terminology and Definitions

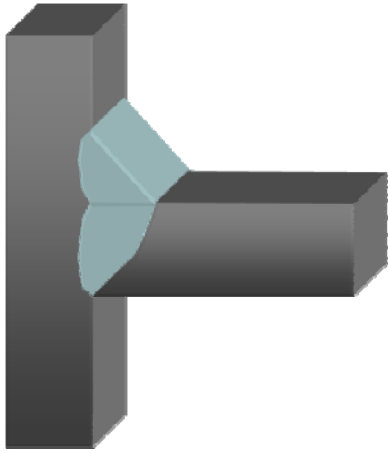
A Weld:

A union between materials caused by heat, and or pressure

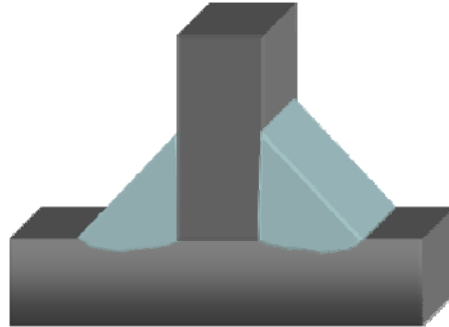
A Joint:

A configuration of members

Terminology Joint Welds



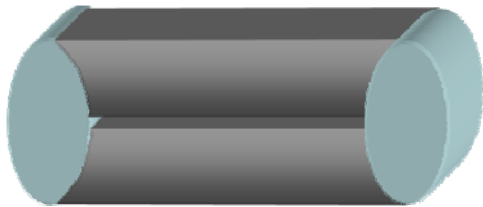
Compound



Fillet



Butt



Edge



Spot

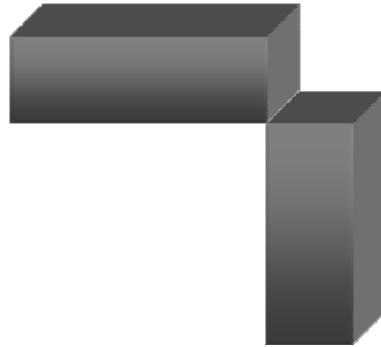


Plug

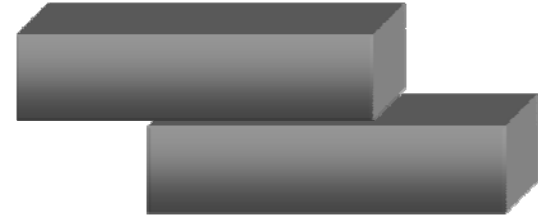
Terminology Joint Types



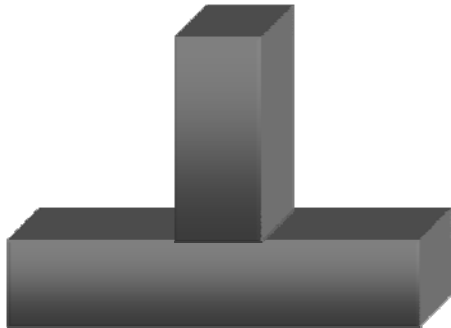
Edge



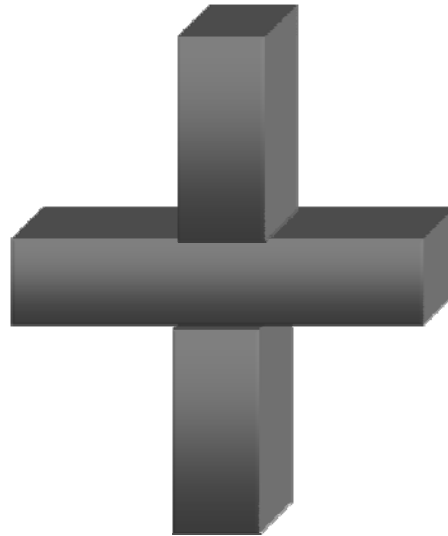
Open & Closed Corner



Lap



Tee

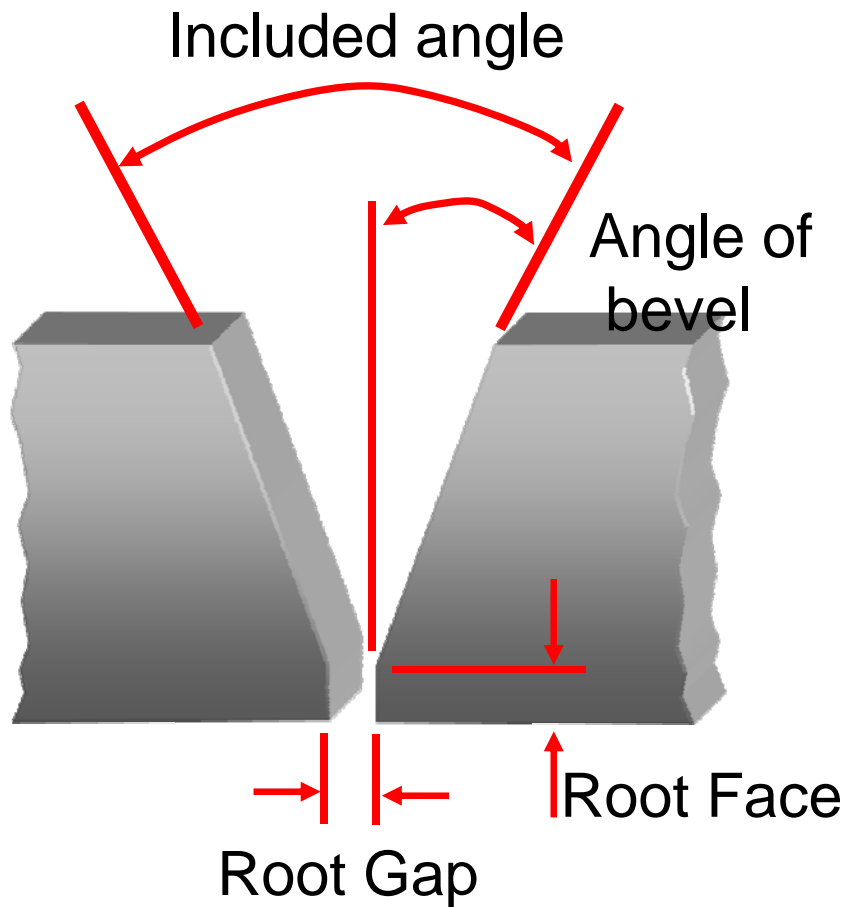


Cruciform

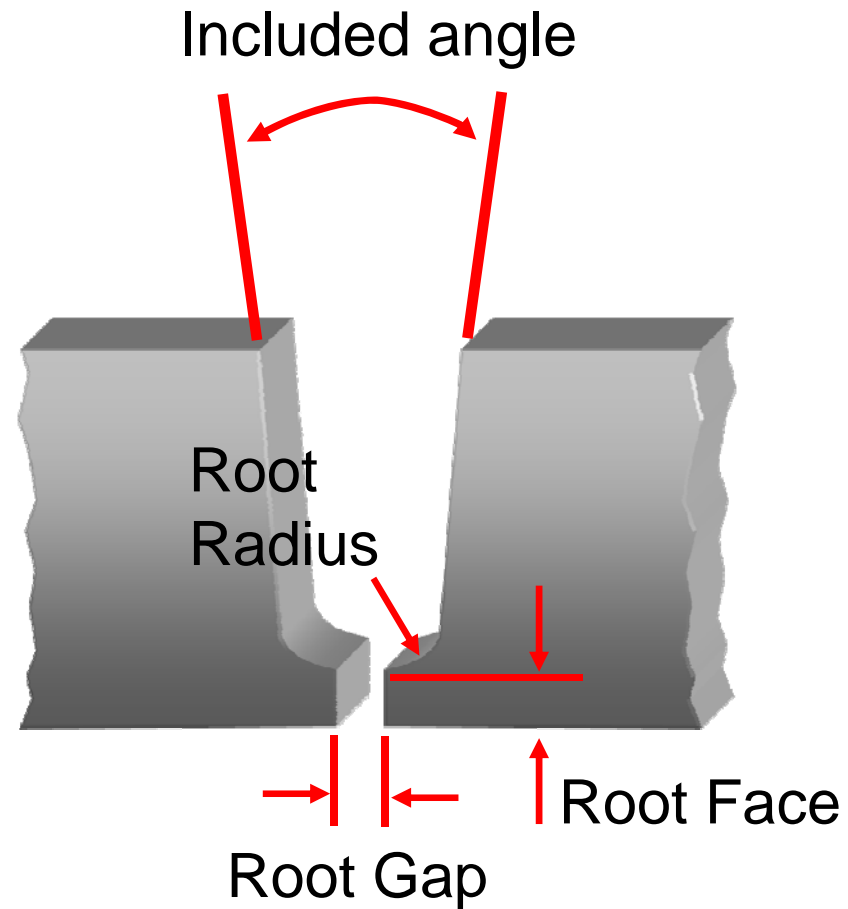


Butt

Types of Joint Preparation

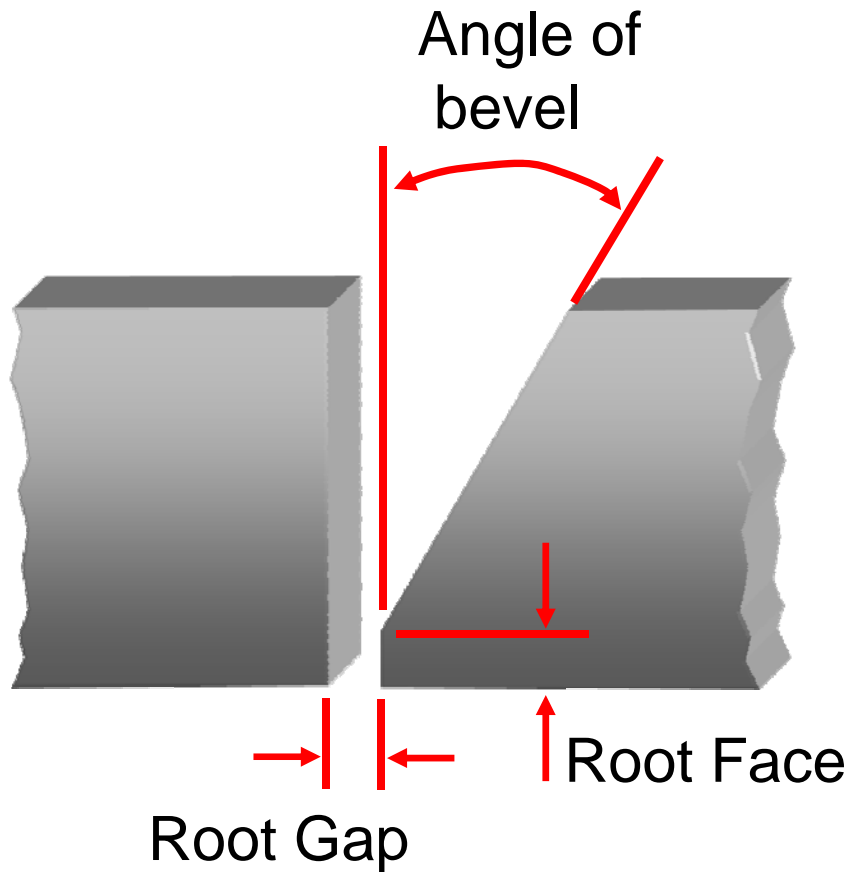


Single - V Butt

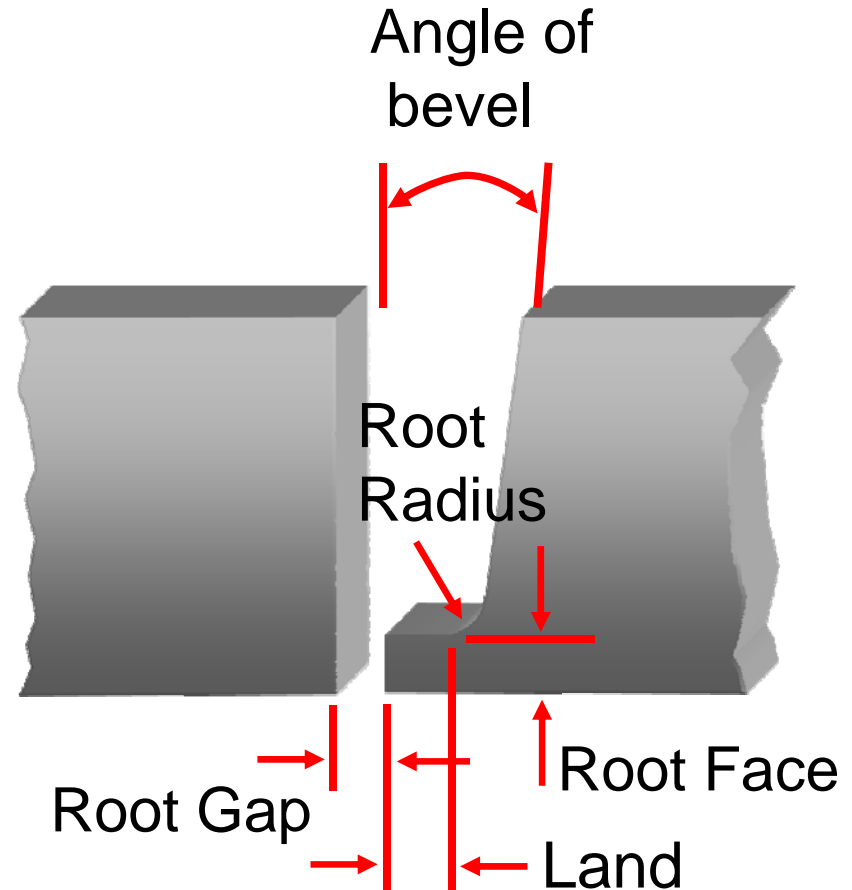


Single - U Butt

Types of Joint Preparation



Single Bevel Butt



Single J Butt

Single Butt Weld Preparations

Single sided preparations are normally made on thinner materials, or when access from both sides is restricted



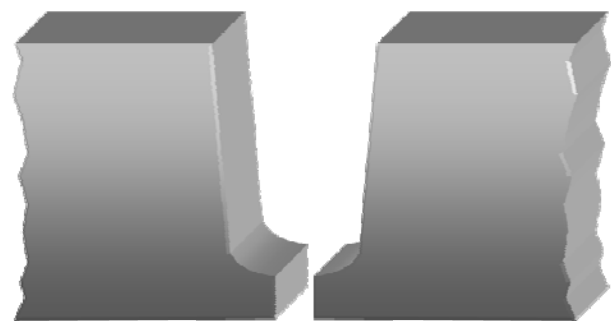
Single Bevel



Single Vee



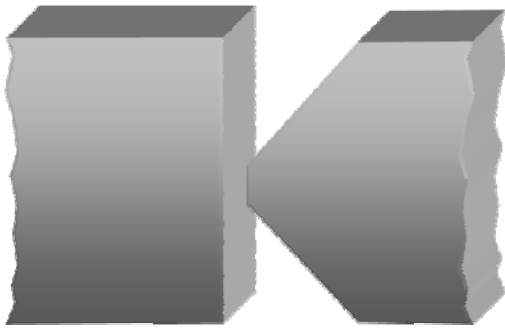
Single J



Single U

Double Butt Weld Preparations

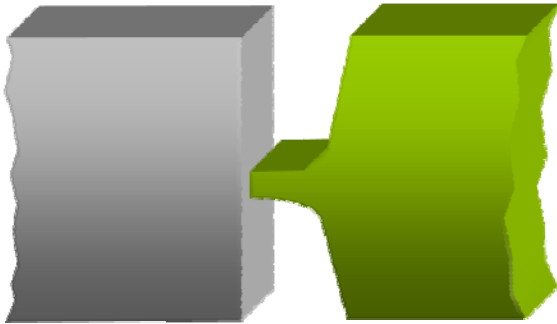
Double sided preparations are normally made on thicker materials, or when access from both sides is unrestricted



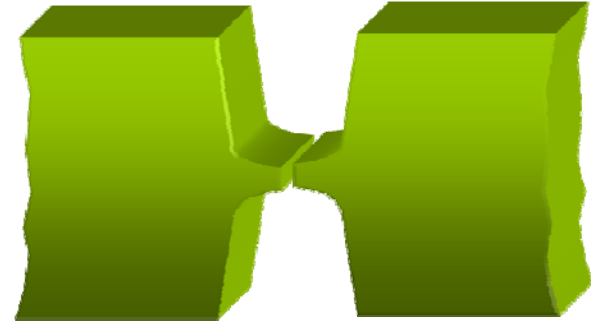
Double Bevel



Double Vee

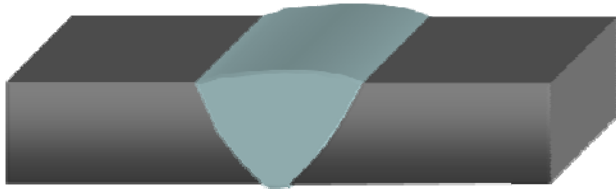


Double J

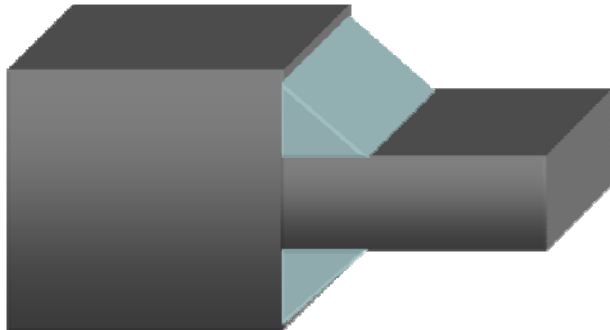


Double U

Welded Butt Joints



A **Butt** Welded butt joint



A **Fillet** Welded butt joint

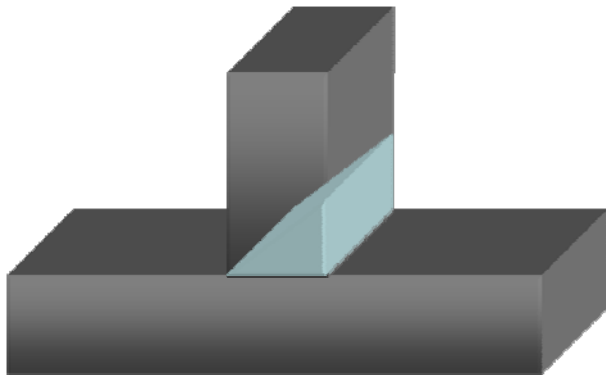


A **Compound** Welded butt joint

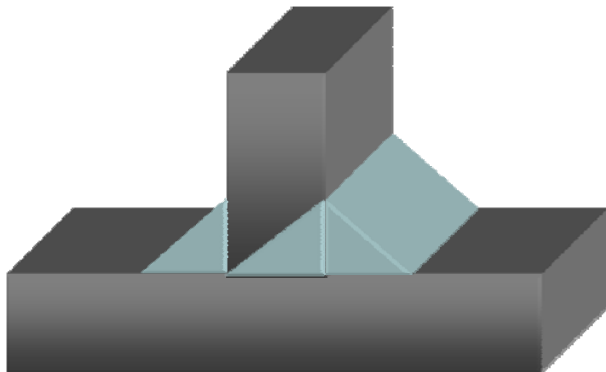
Welded Tee Joints



A **Fillet** Welded T joint



A **Butt** Welded T joint

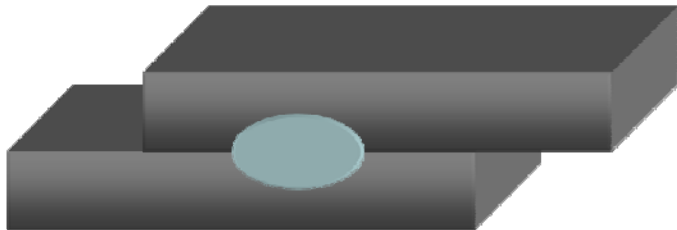


A **Compound** Welded T joint

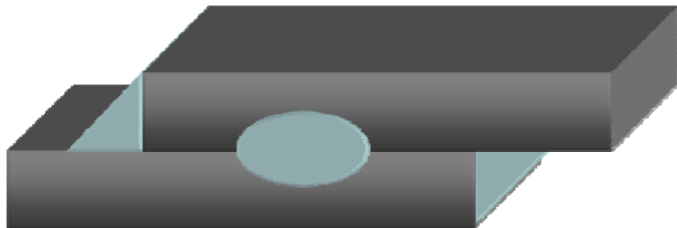
Welded Lap Joints



A **Fillet** Welded lap joint



A **Spot** Welded lap joint



A **Compound** Welded lap joint

Welded Closed Corner Joints



A **Fillet** Welded closed corner joint



A **Butt** Welded closed corner joint

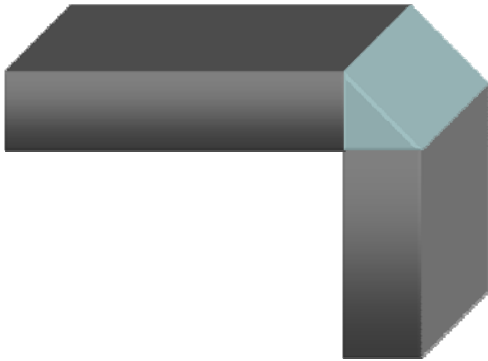


A **Compound** Welded closed corner joint

Welded Open Corner Joints



A *Inside fillet* Welded open corner joint

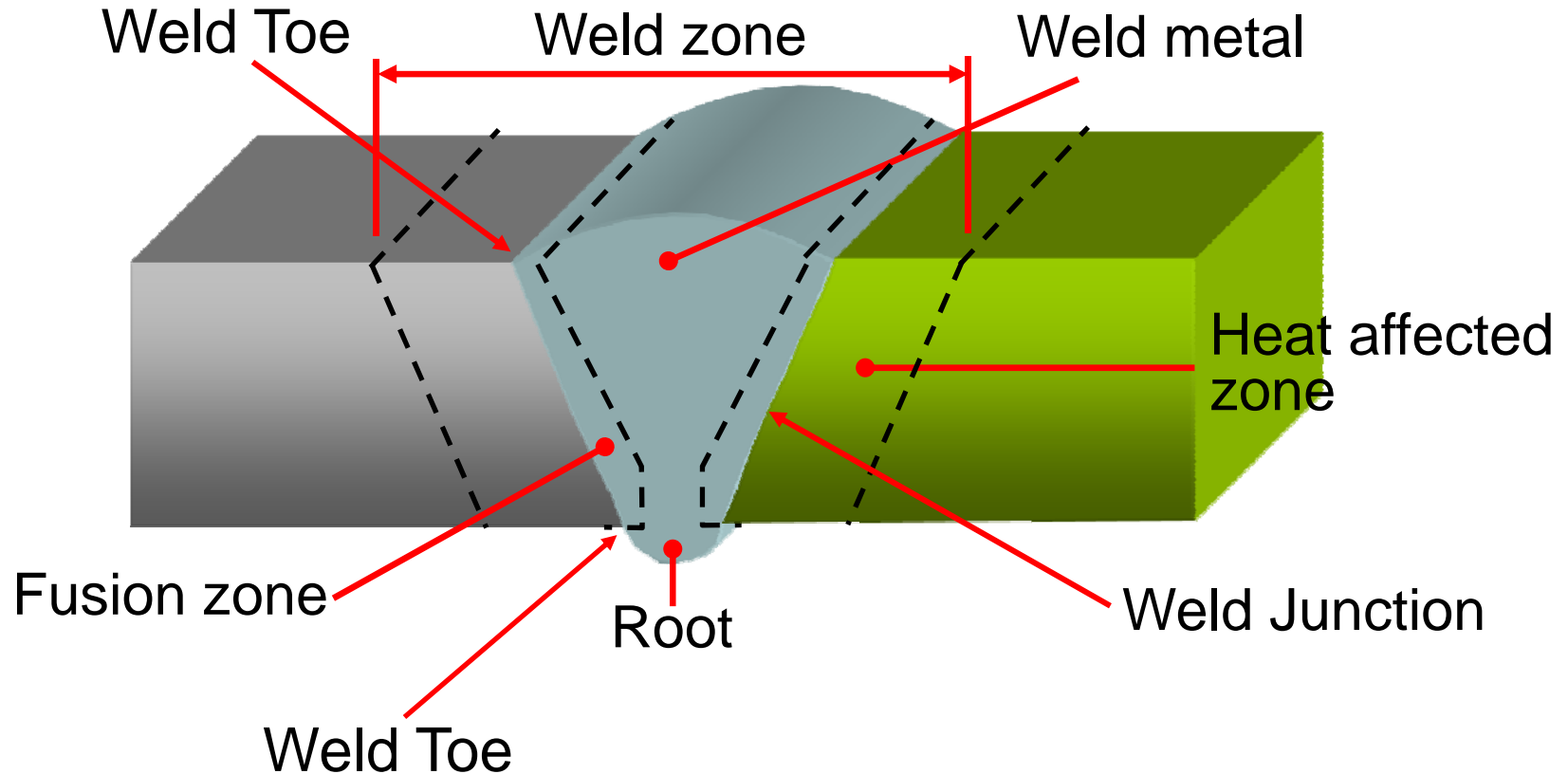


A *Outside fillet* Welded open corner joint

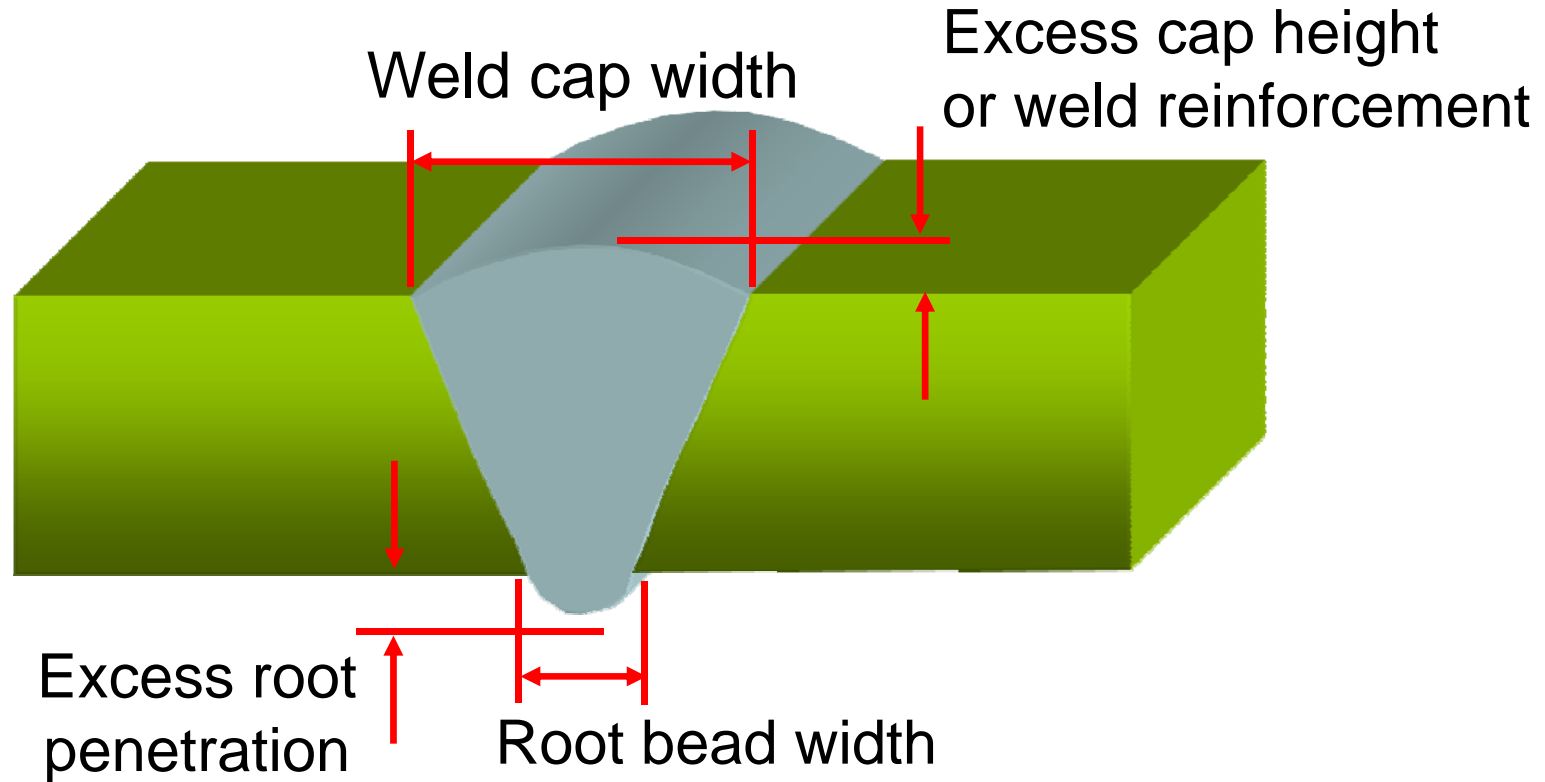


A *Double fillet* Welded open corner joint

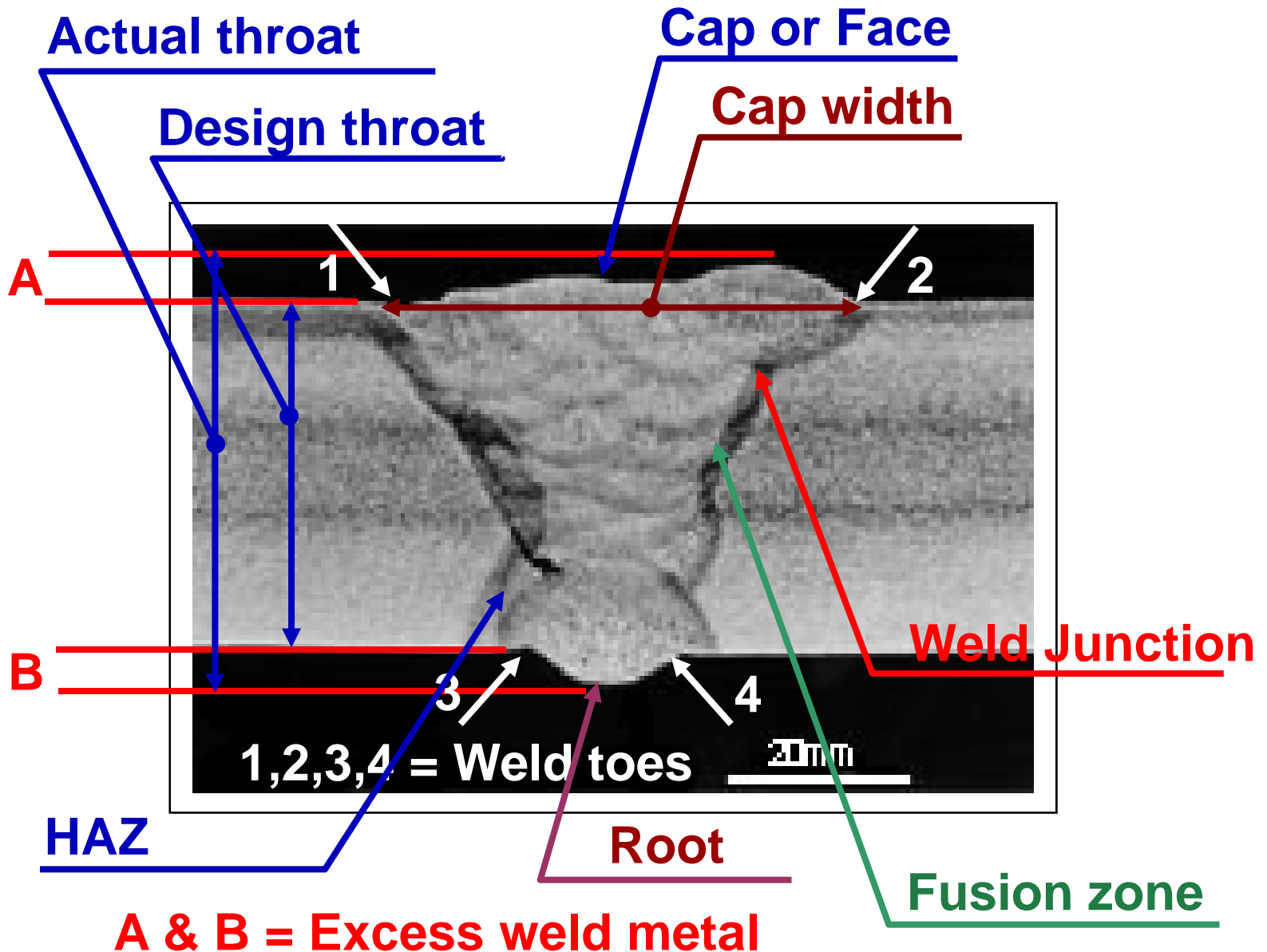
Weld Zone Terminology



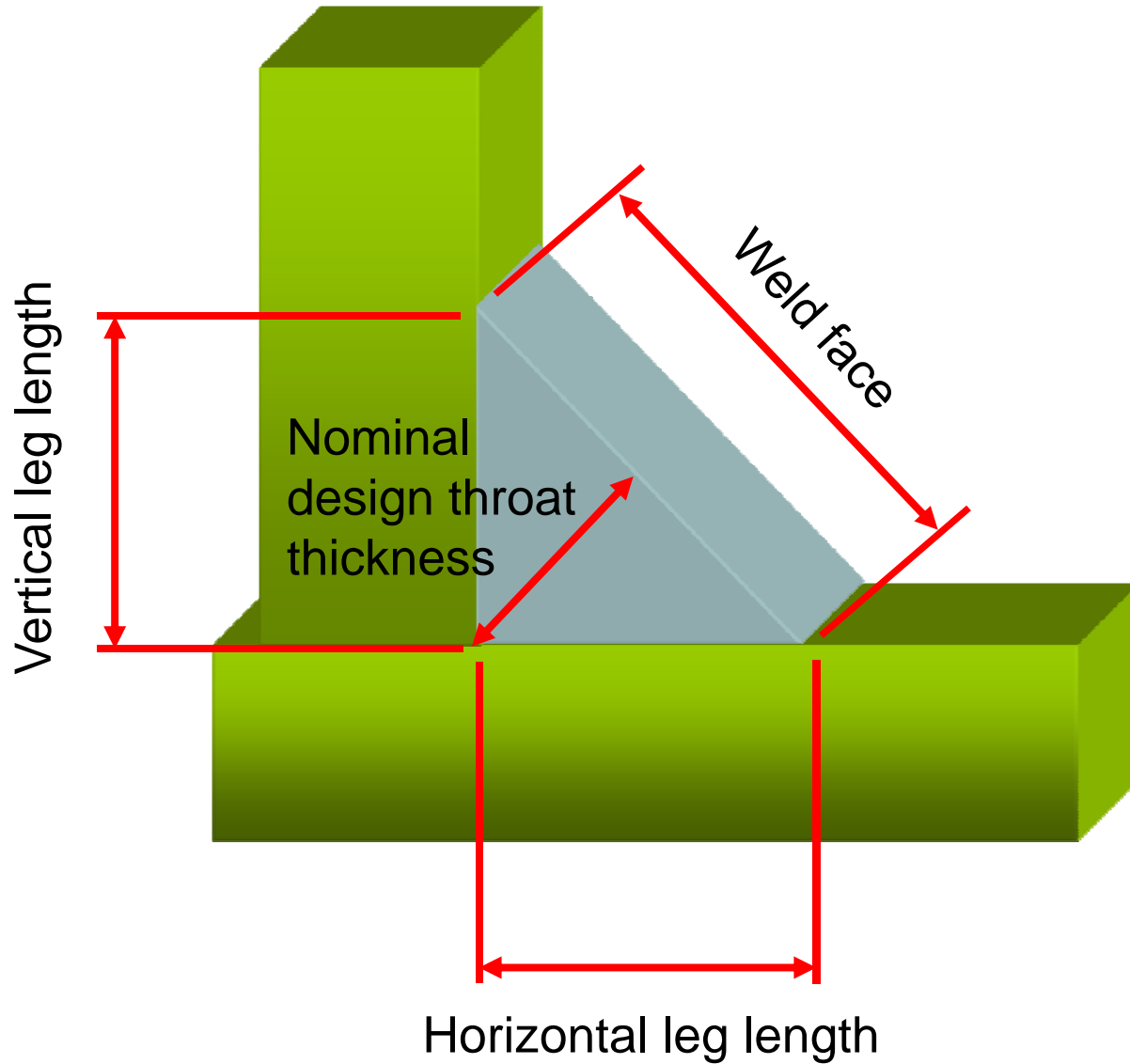
Butt Weld Features



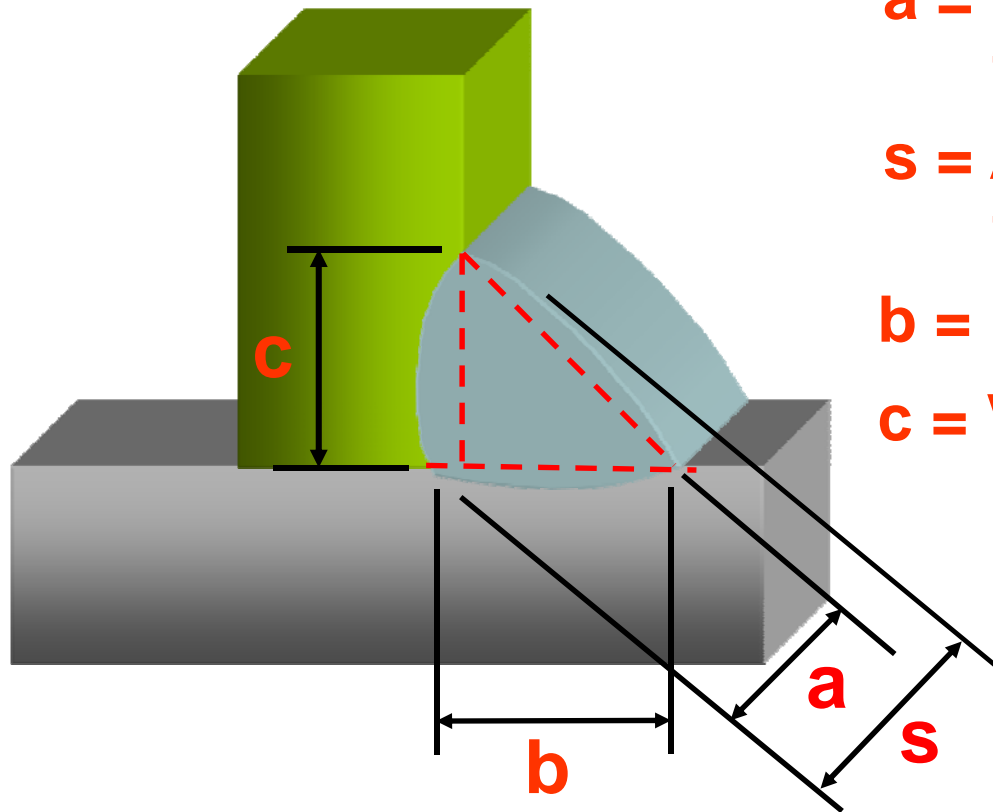
Butt Weld Features



Fillet Weld Features



Fillet Weld Dimensions



a = Nominal design throat thickness

s = Actual throat thickness

b = Horizontal leg length

c = Vertical leg length

e.g

Leg length = 6mm

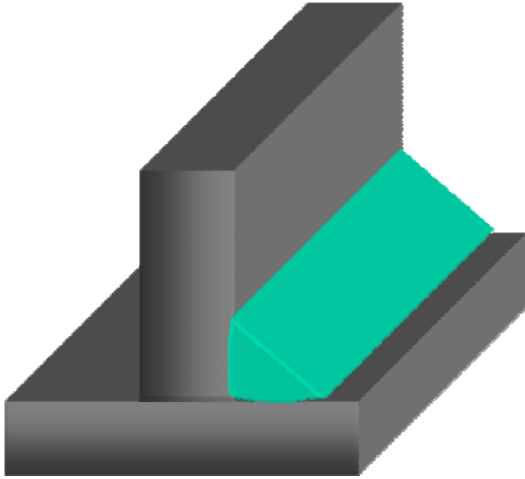
Design Throat = 6mm x 0.7

Design Throat = 4.2mm

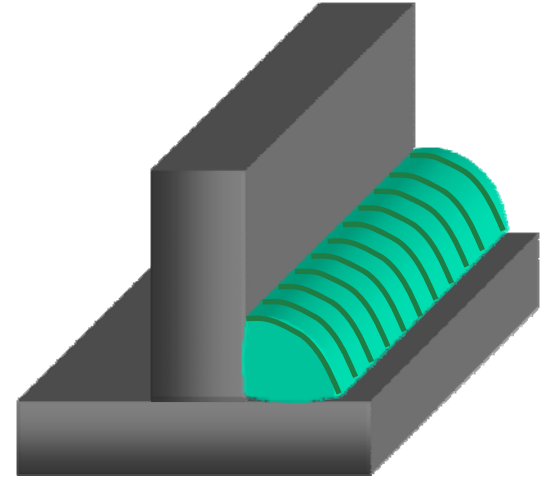
The leg length should be approximately equal to the material thickness

The design throat thickness is 0.7 of the leg length

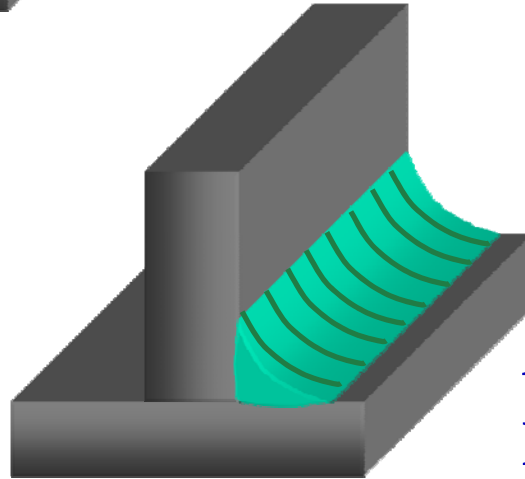
Fillet Weld Profiles



Mitre fillet



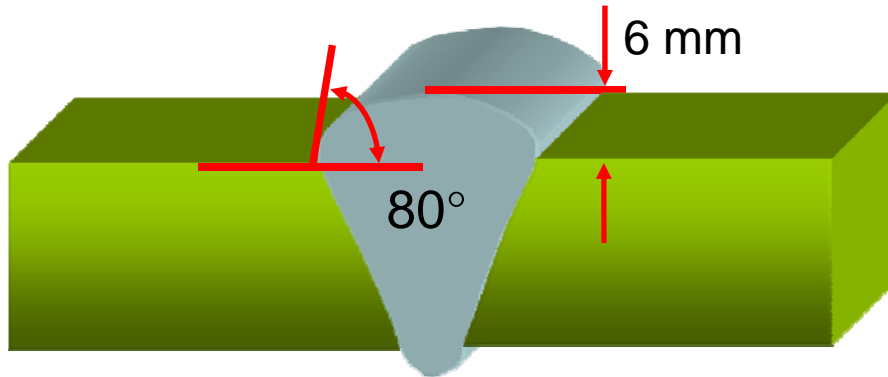
Convex fillet



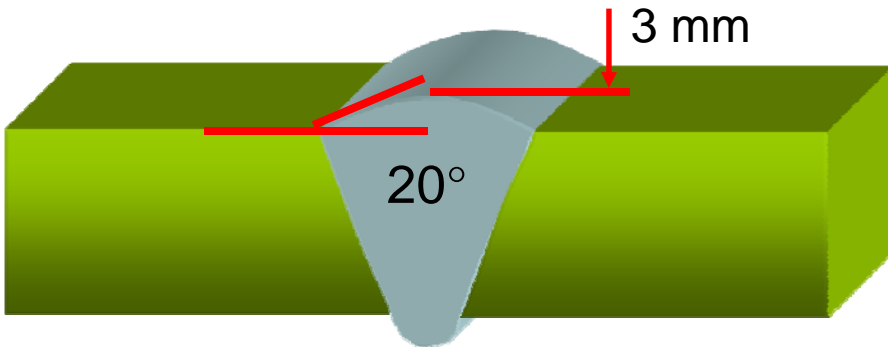
Concave fillet

A concave profile is preferred for joints subjected to fatigue loading

Toe Blend Angle



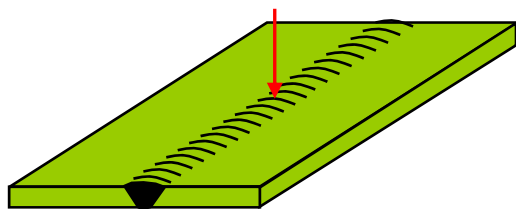
Poor Weld Toe Blend Angle



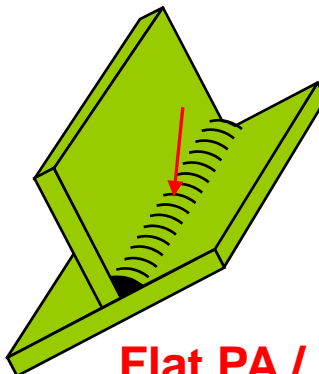
Improved Weld Toe Blend Angle

- Most codes quote the weld toes shall blend smoothly
- This statement is not quantitative and therefore open to individual interpretation
- The higher the toe blend angle the greater the amount of stress concentration
- The toe blend angle should be between 20°-30°

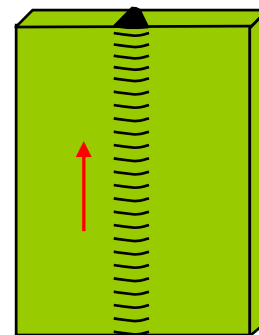
Welding Positions



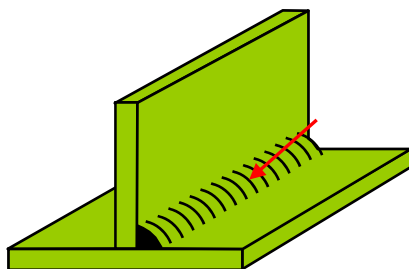
Flat: PA / 1G:



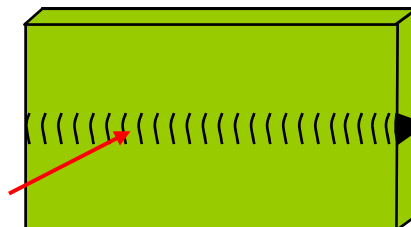
Flat PA / 1F



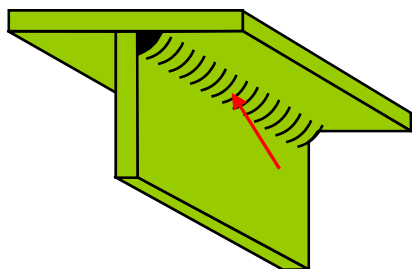
**Vertical upwards
PF / 3G**



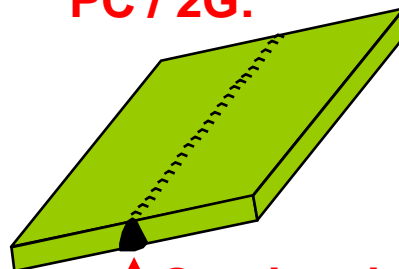
**Horizontal vertical:
PB / 2F:**



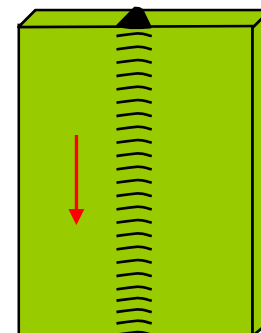
**Horizontal vertical:
PC / 2G:**



**Horizontal overhead
PD / 4F**

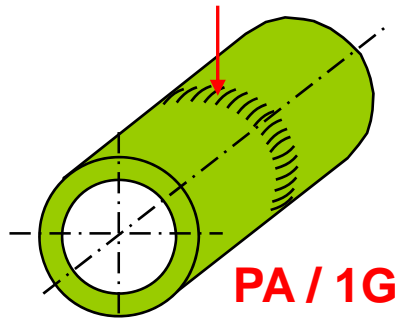


**Overhead
PE / 4G**

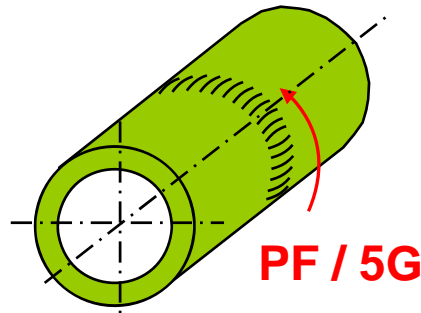


**Vertical downwards
PG / 3G**

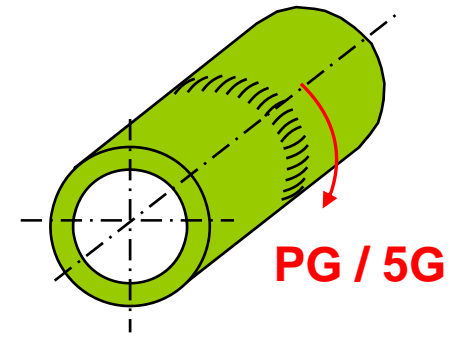
Welding Positions



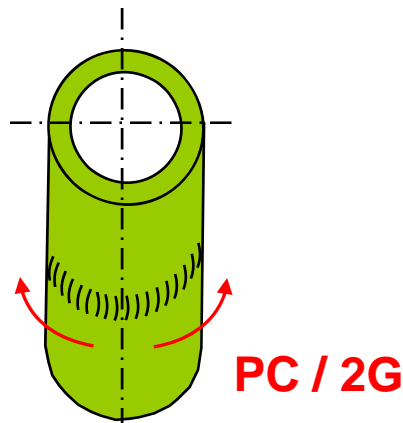
PA / 1G
Weld: Flat
Pipe: rotated
Axis: Horizontal



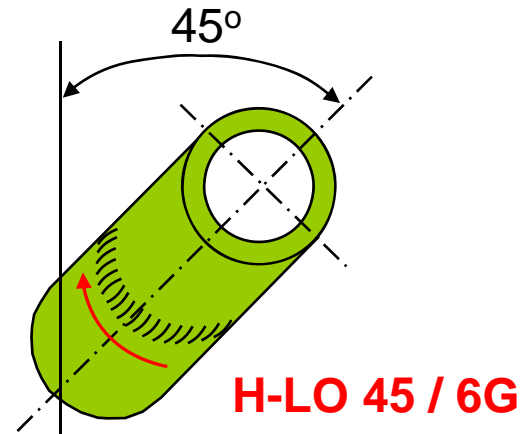
PF / 5G
Weld: Vertical upwards
Pipe: Fixed
Axis: Horizontal



PG / 5G
Weld: Vertical Downwards
Pipe: Fixed
Axis: Horizontal



PC / 2G
Weld: Horizontal vertical
Pipe: Fixed
Axis: Vertical



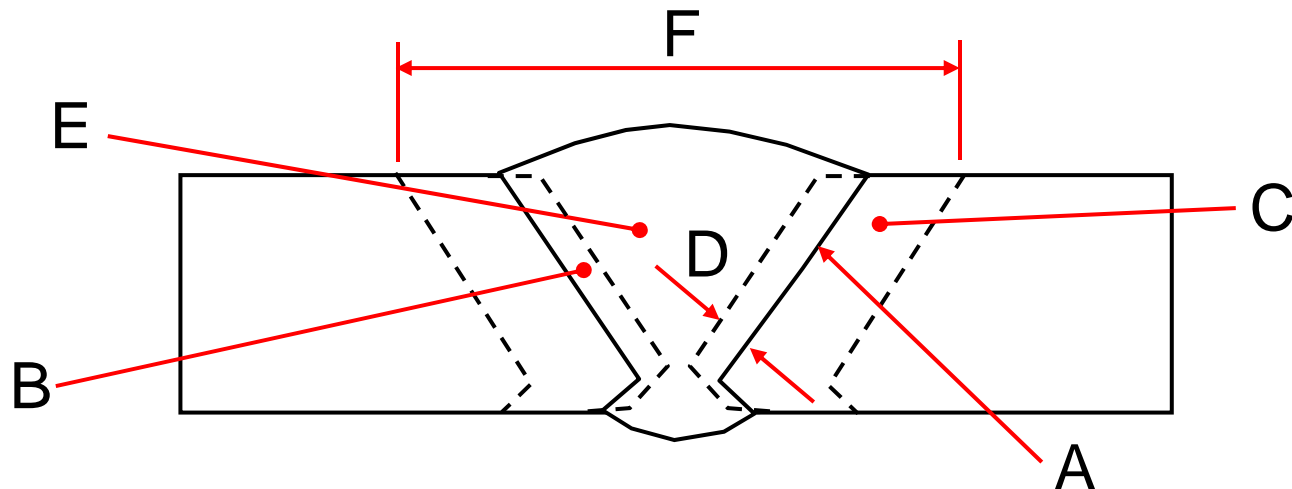
H-LO 45 / 6G
Weld: Upwards
Pipe: Fixed
Axis: Inclined

Any Questions



Questions

- QU 1. Sketch a single-U butt joint and indicate the following
a. Root face b. Root gap c. Included angle d. Root radius
- QU 2. Sketch a tee joint, fillet welded and indicate the following
a. Leg length b. Throat thickness c. Root d. Weld toes
- QU 3. Sketch five joint types in addition to a butt joint
- QU 4. Identify the the following features from the sketch





Welding Inspection

Welding Symbols

BS 499 part 2 Welding Symbols

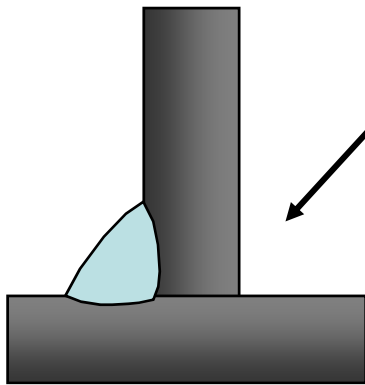
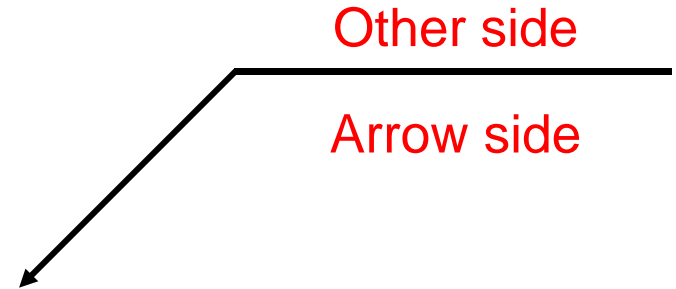
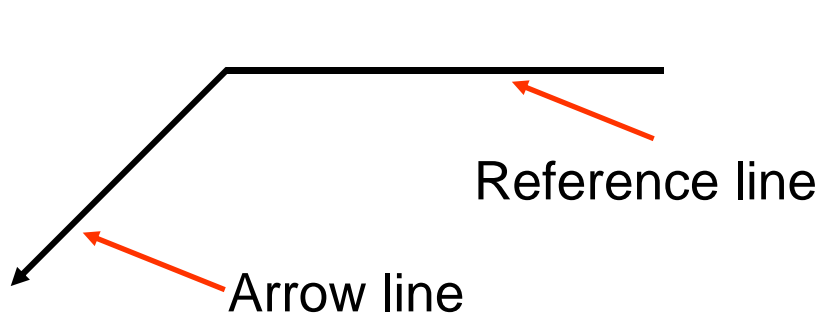


Welding Symbols

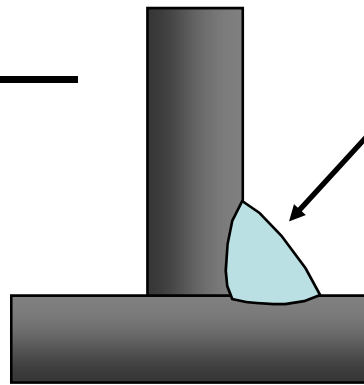
Weld symbols are used to transfer information from the design office to the workshop and contain five basic components

- **The arrow line:** the arrow line must touch the joint reference area on the drawing
- **The reference line:** the reference line must touch the arrow line and is generally parallel with the bottom of the drawing page
- **The symbol:** the vertical line in the symbols for a fillet weld, single/double bevel butts and a J-butt welds must always be on the left side.
- **The dimensions:** In most standards the cross sectional dimensions are given to the left side, and all linear dimensions are give on the right side
- **Supplementary information:** such as welding process, weld profile, NDT and any special instructions

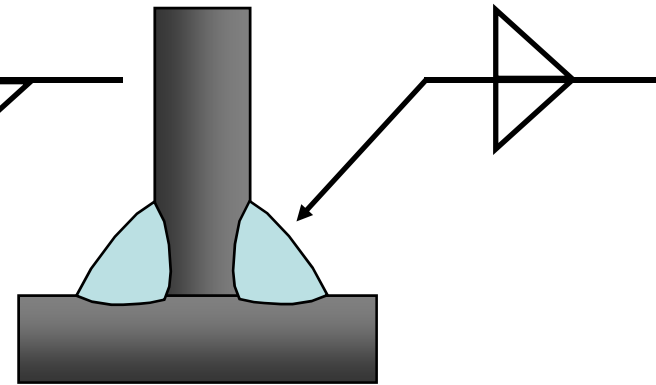
BS 499: part 2. Welding Symbols



Other side

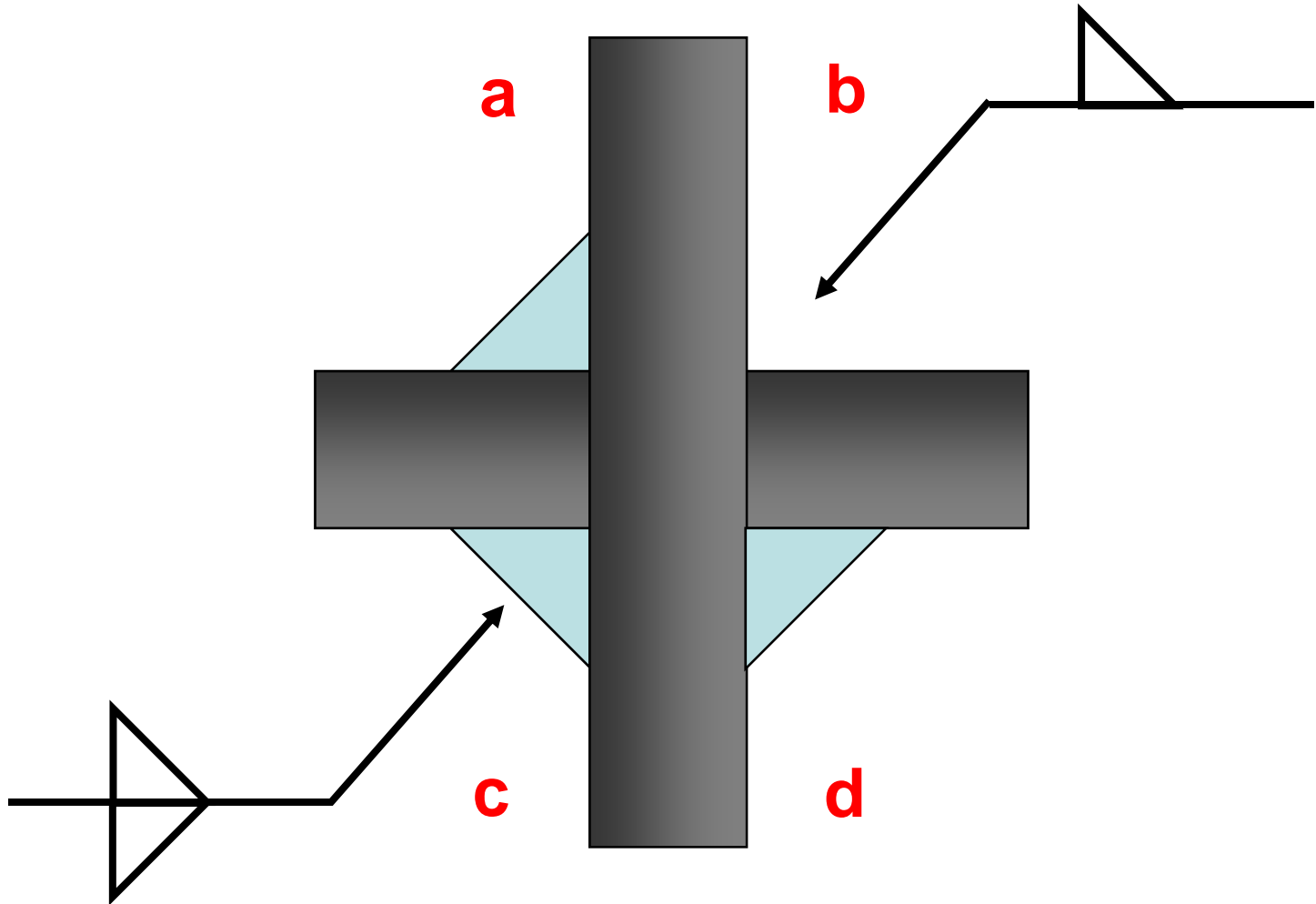


Arrow side

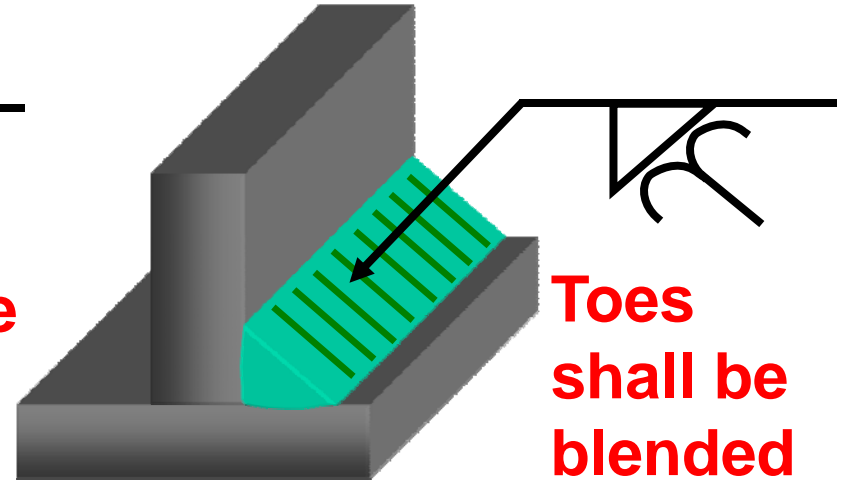
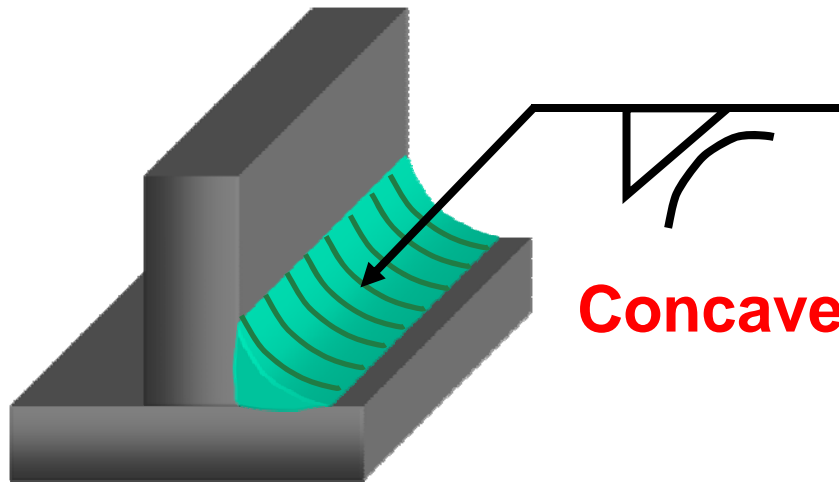
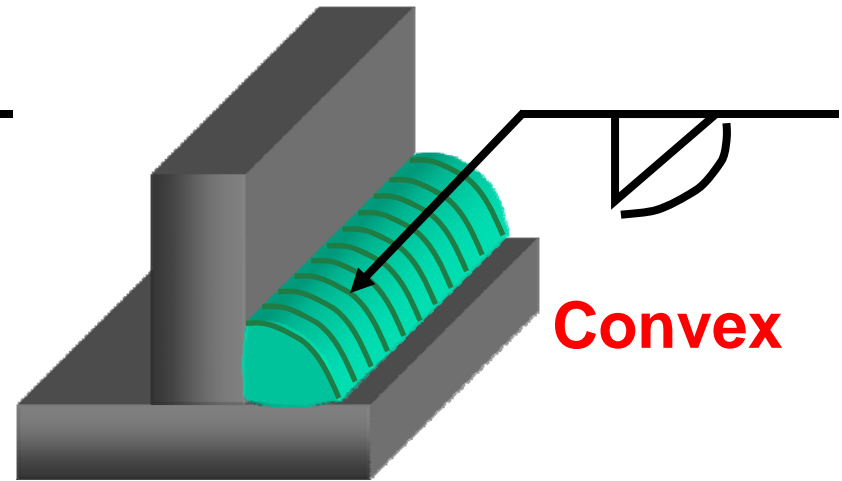
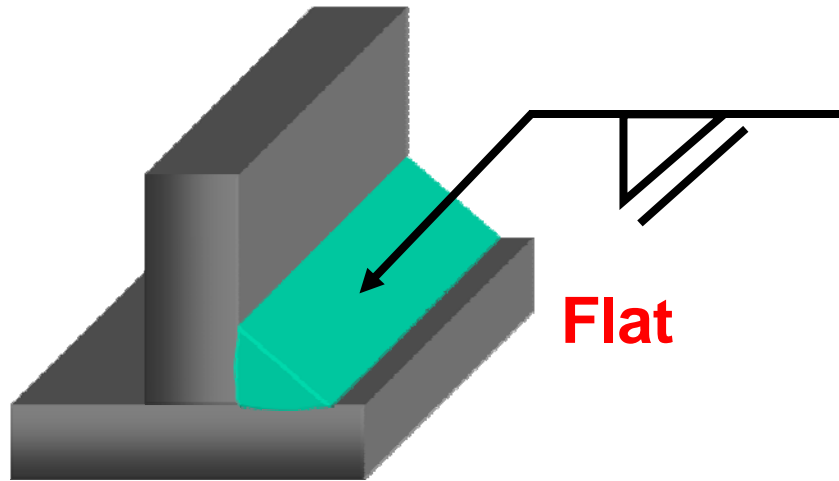


Both sides

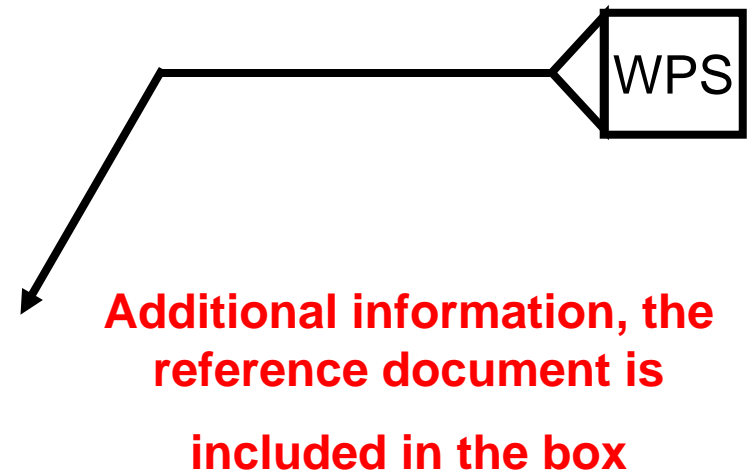
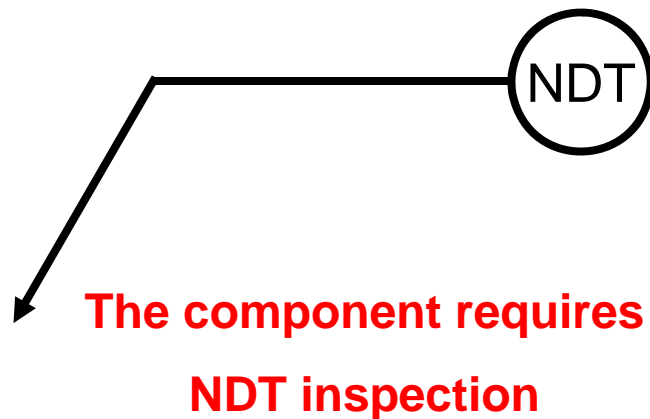
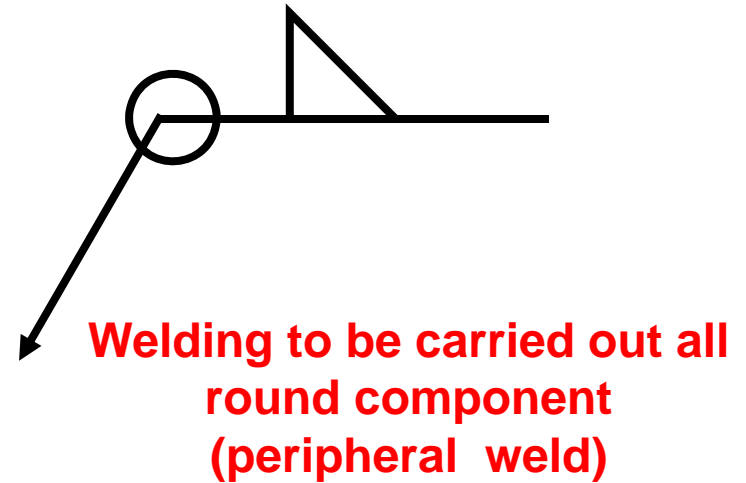
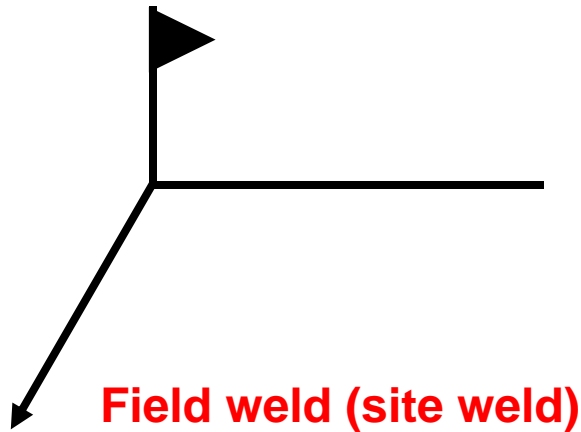
BS 499: part 2. Welding Symbols



BS 499: part 2. Welding Symbols

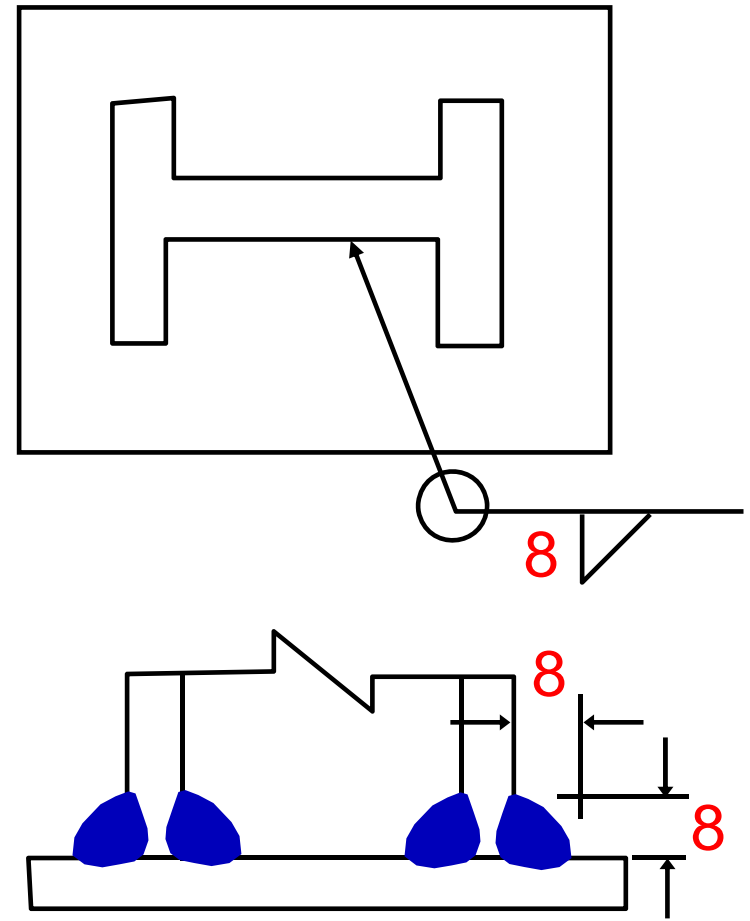
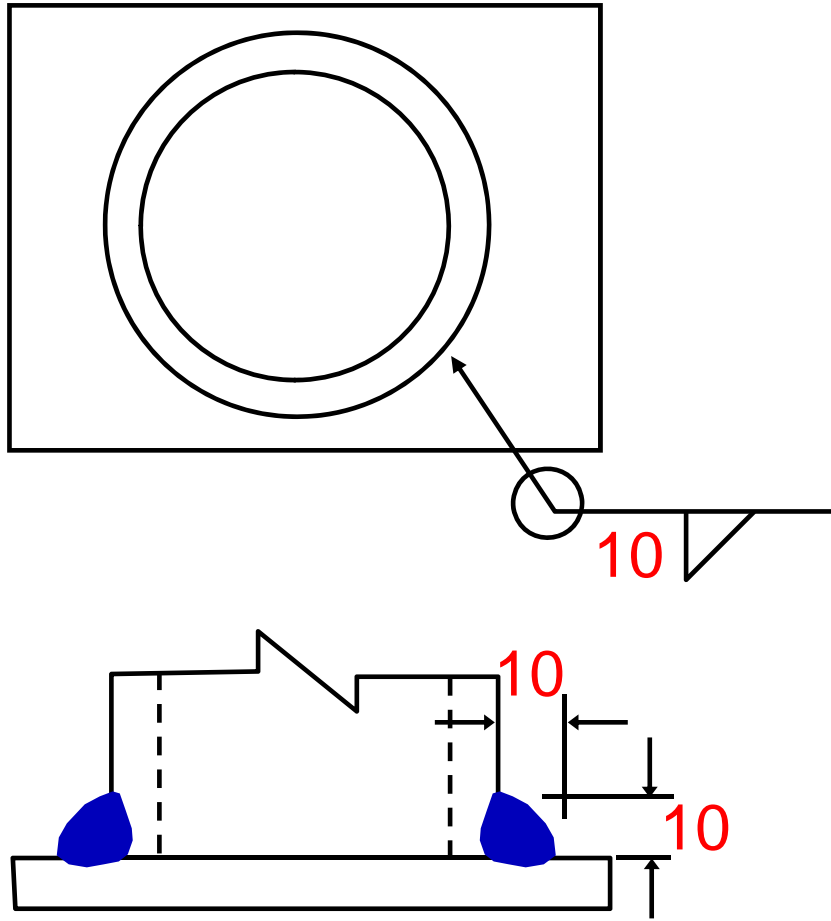


BS 499: part 2. Welding Symbols



BS 499: part 2. Welding Symbols

Peripheral Welds



BS 499: part 2. Welding Symbols

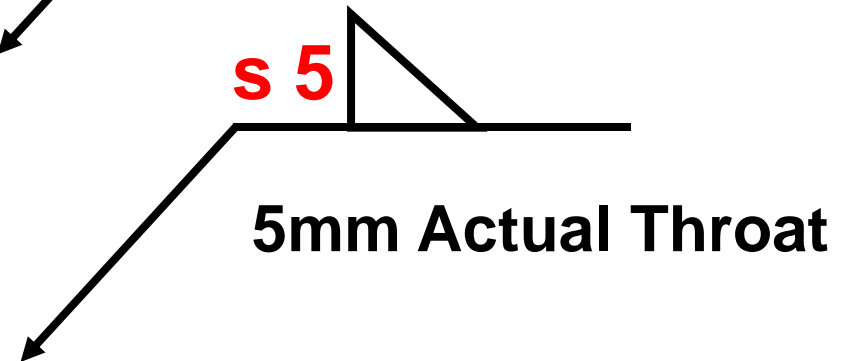
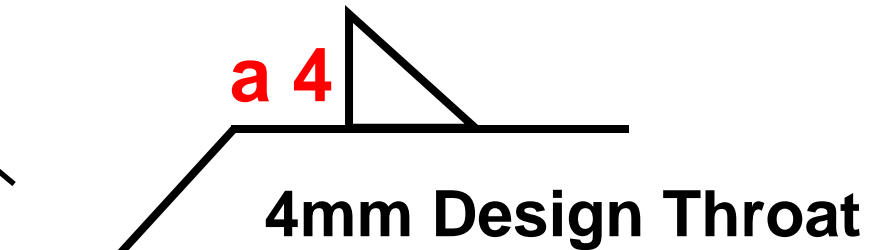
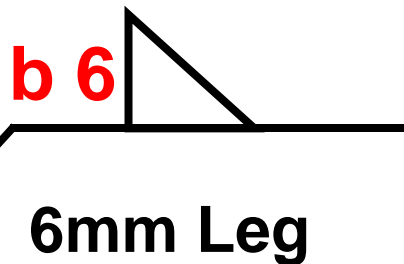
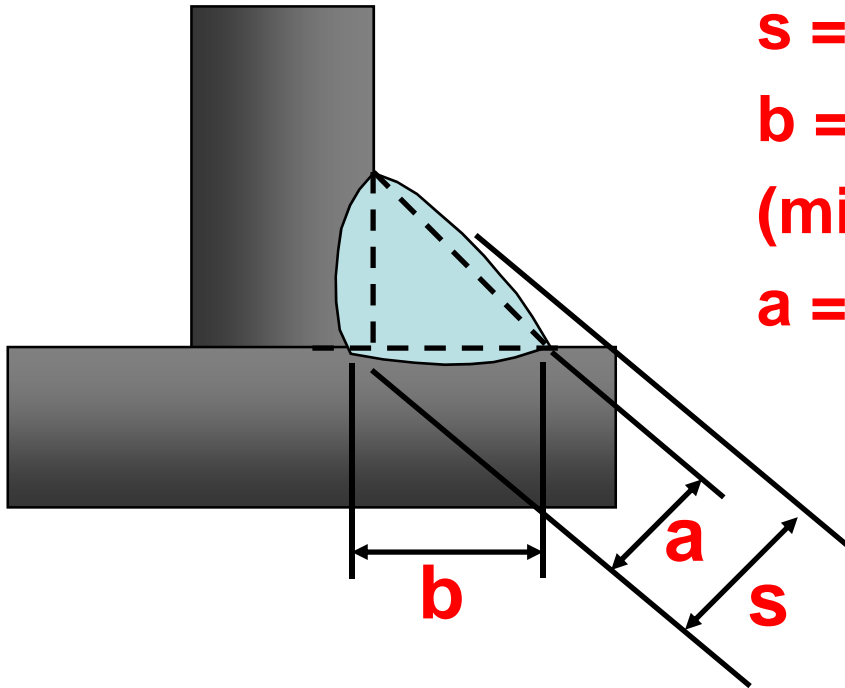
a = Design throat thickness

s = Actual throat thickness

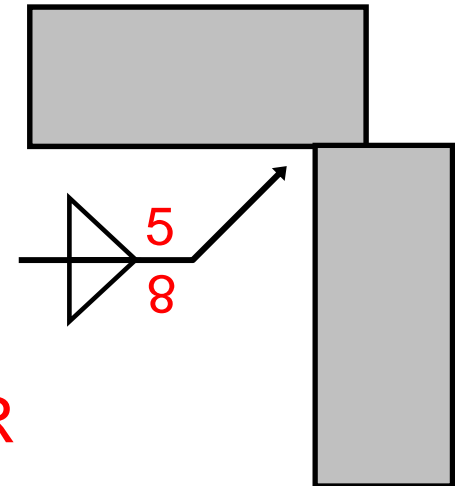
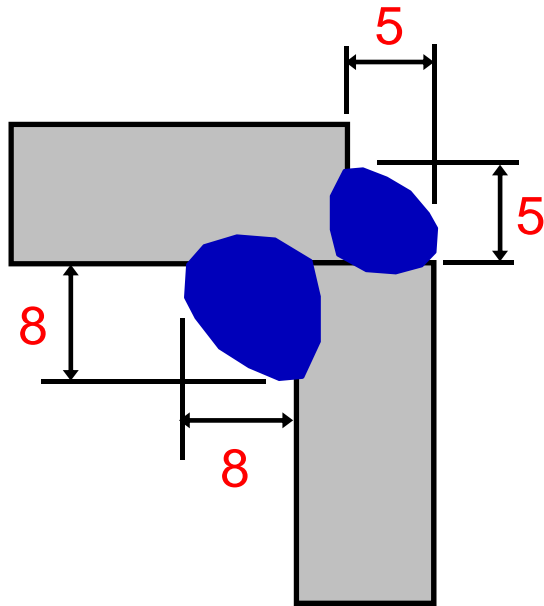
b = Leg length

(min material thickness)

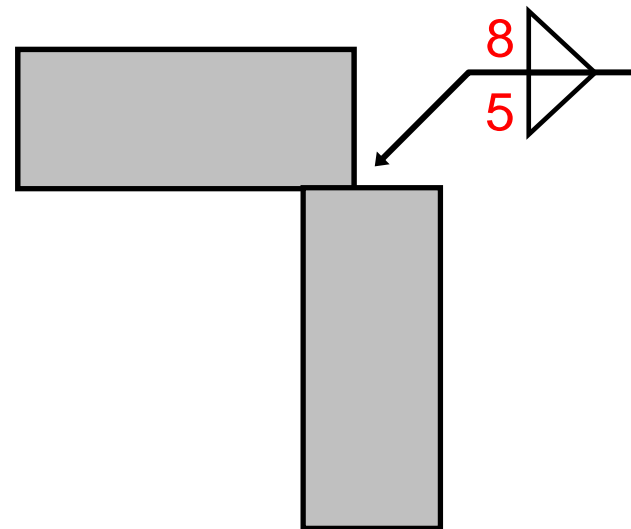
$a = 0.7 \text{ of } b$



BS 499: part 2. Welding Symbols

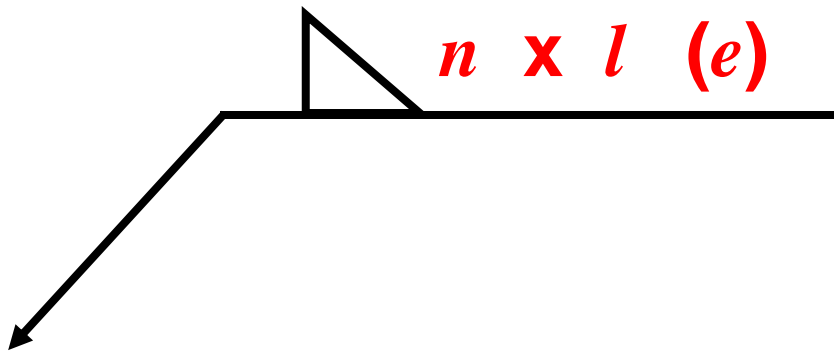


OR

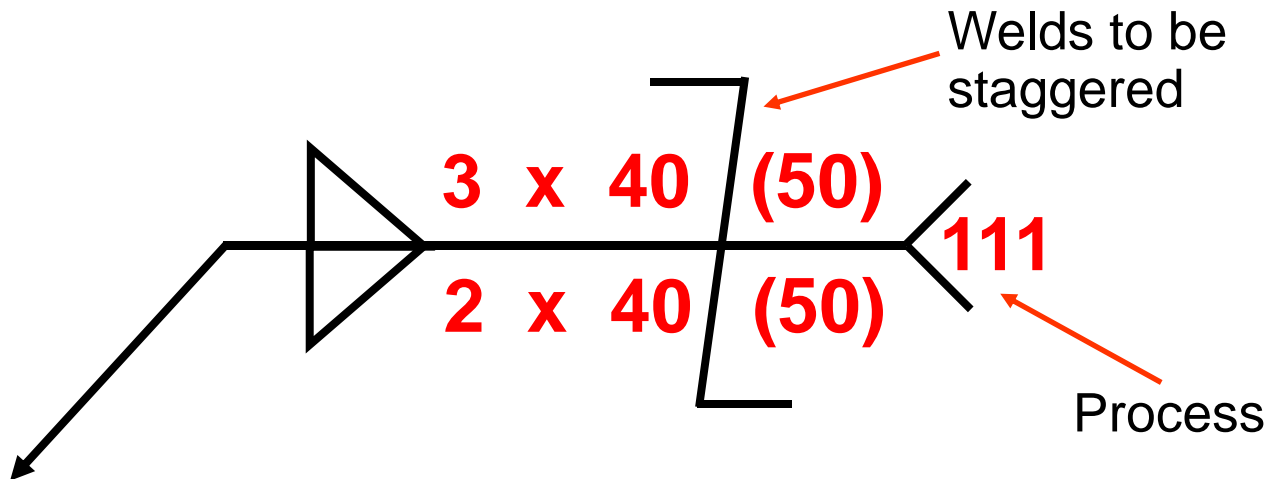


All dimensions in mm

BS 499: part 2. Welding Symbols

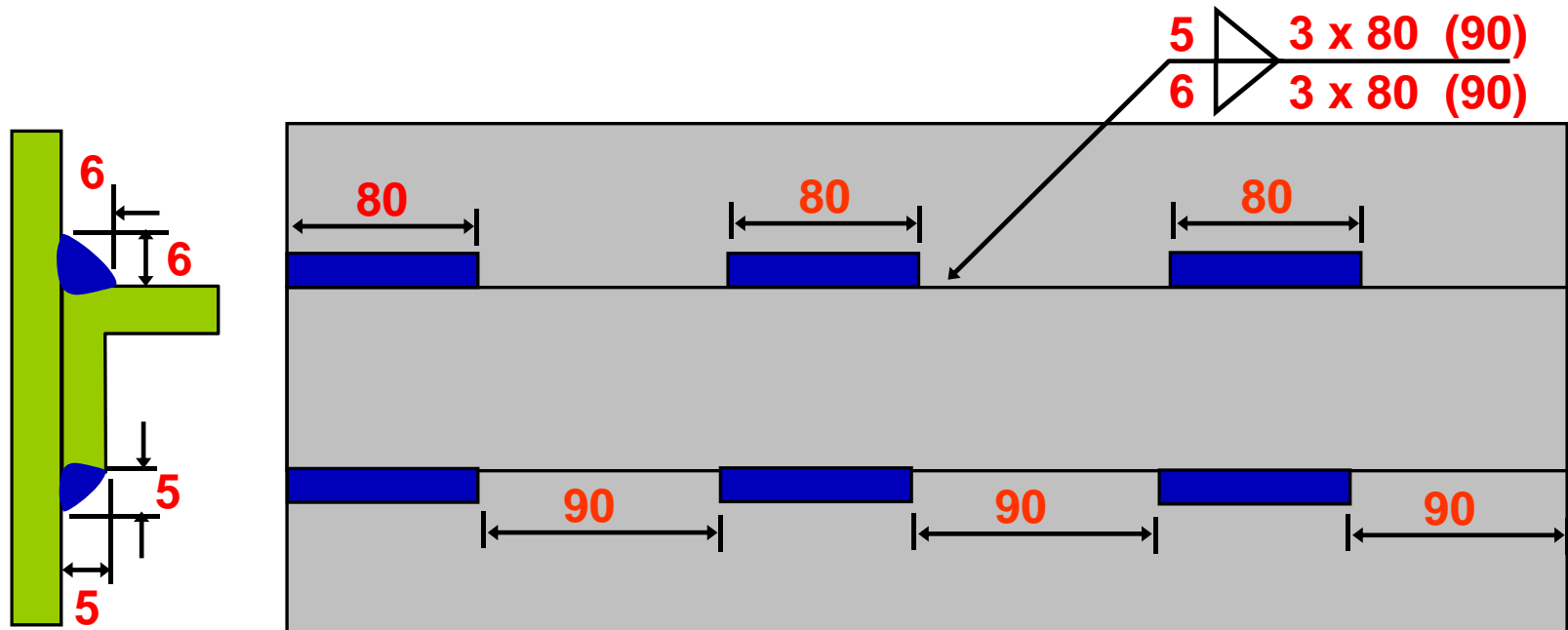
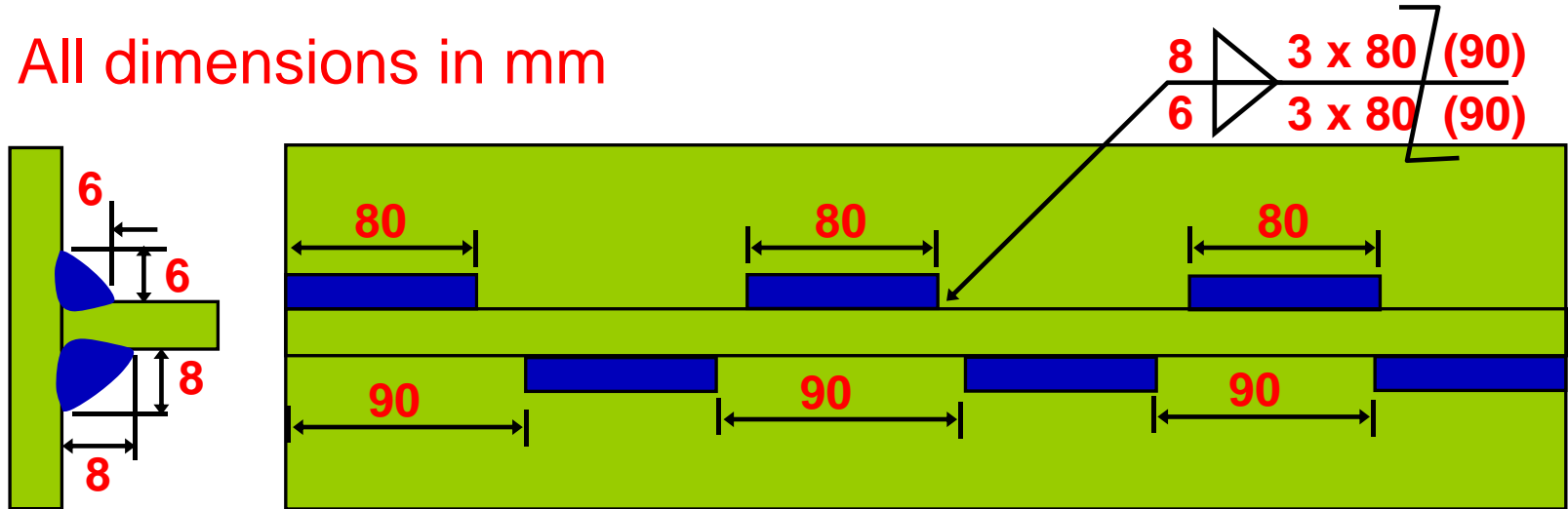


n = number of weld elements
 l = length of each weld element
 (e) = distance between each weld element

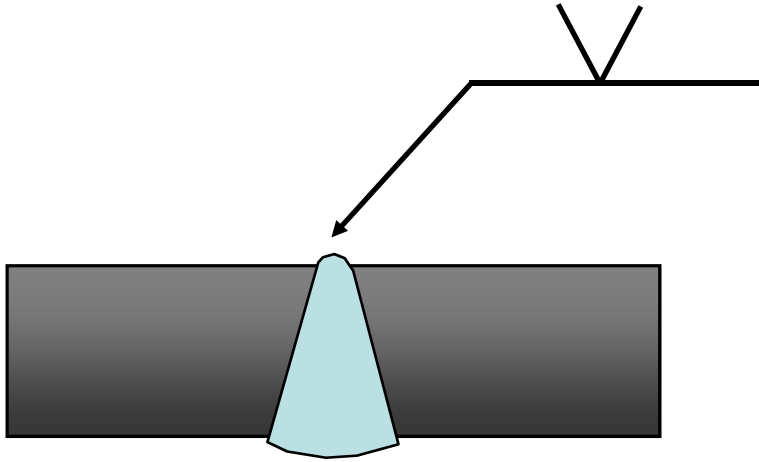


BS 499: part 2. Welding Symbols

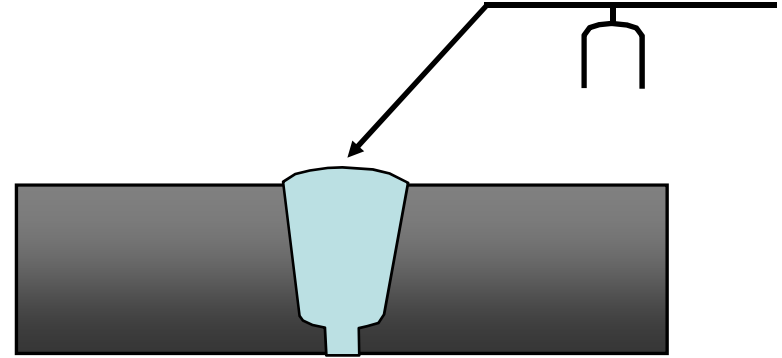
All dimensions in mm



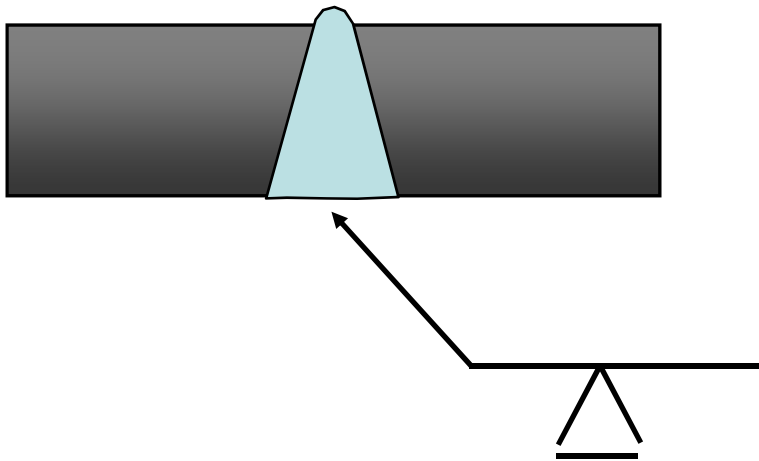
BS 499: part 2. Welding Symbols



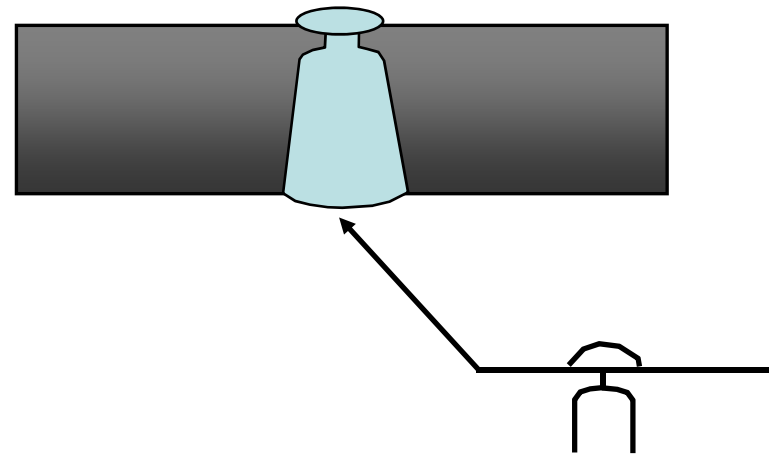
Single-V Butt



Single-U Butt

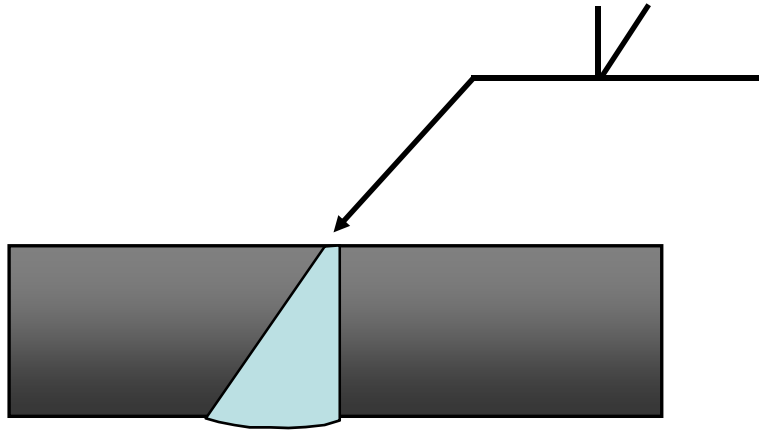


Single-V Butt flush cap

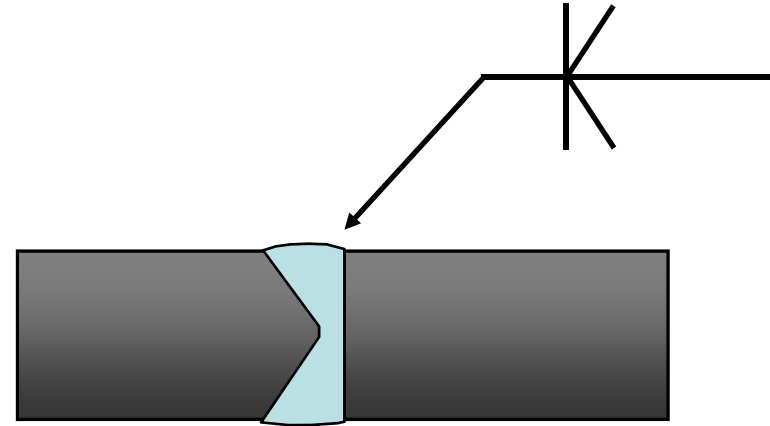


Single-U Butt with sealing run

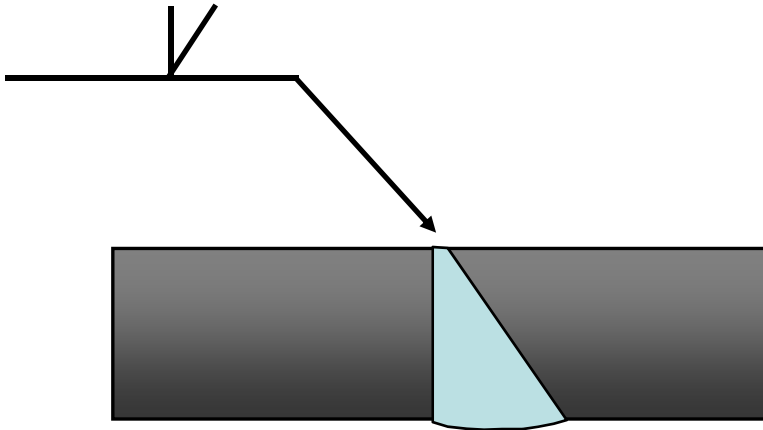
BS 499: part 2. Welding Symbols



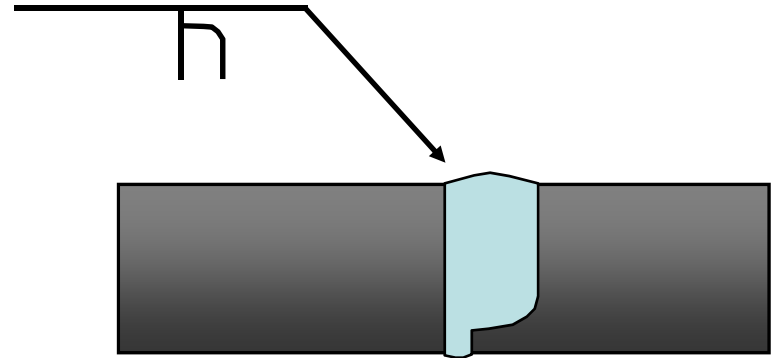
Single-bevel butt



Double-bevel butt

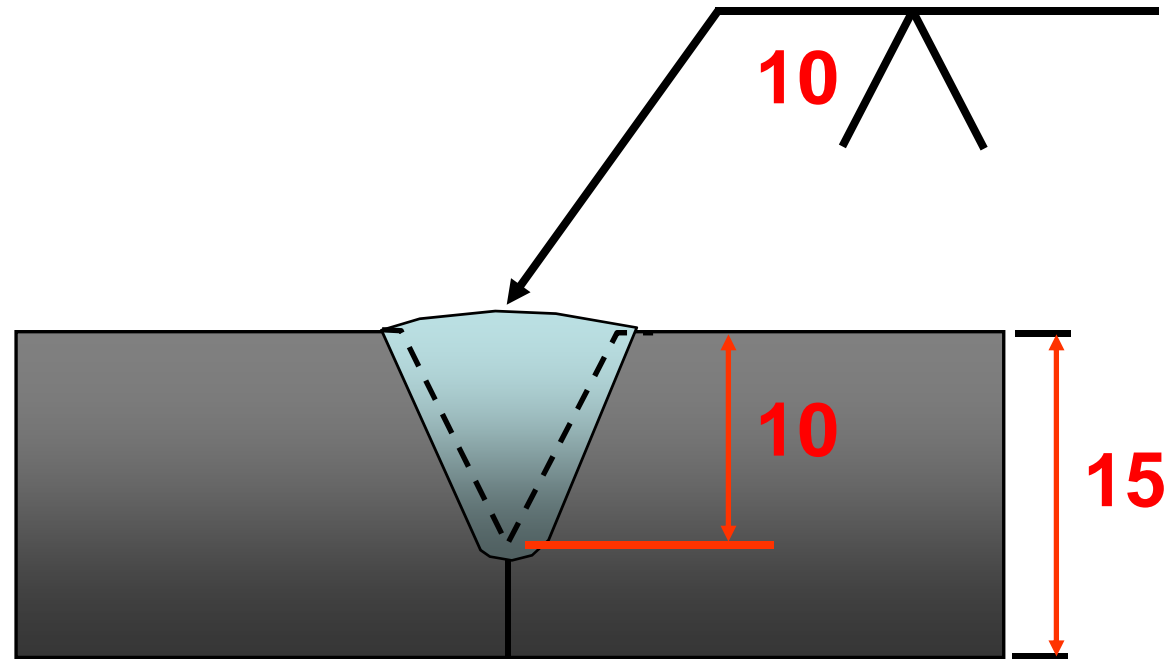


Single-bevel butt



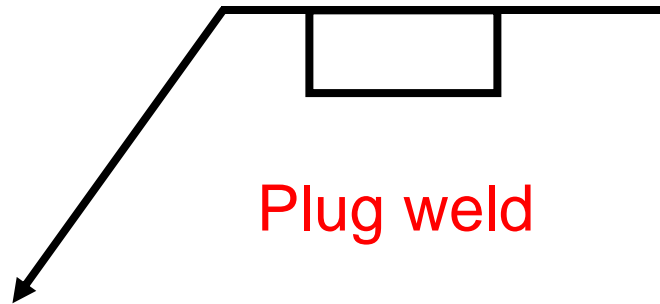
Single-J butt

BS 499: part 2. Welding Symbols

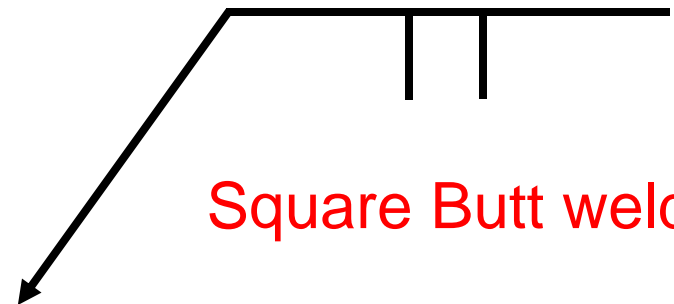


Partial penetration single-V butt

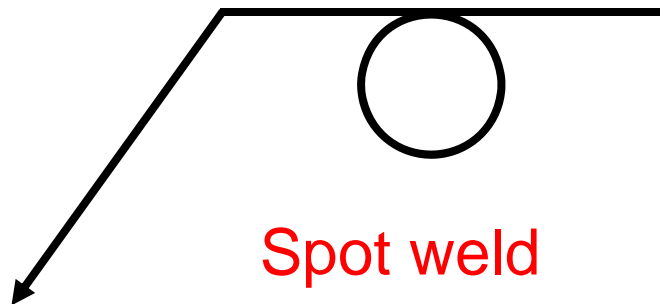
BS 499: part 2. Welding Symbols



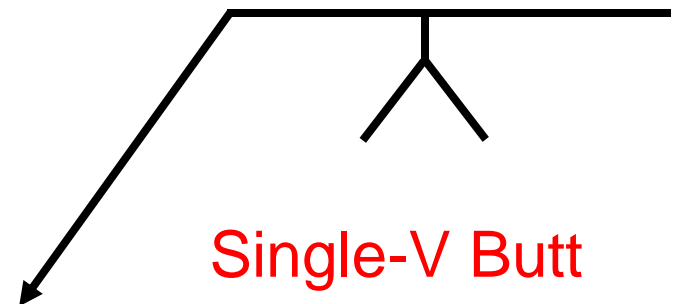
Plug weld



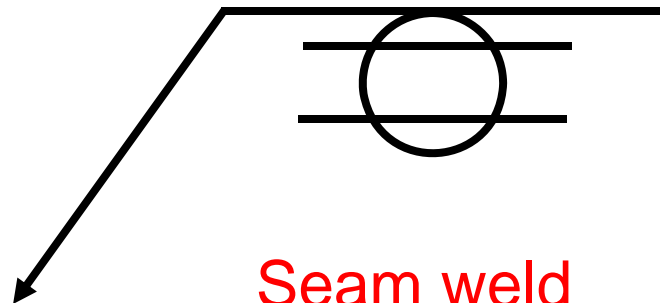
Square Butt weld



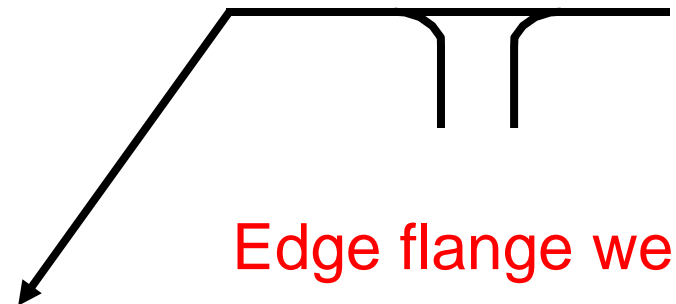
Spot weld



Single-V Butt
broad root face

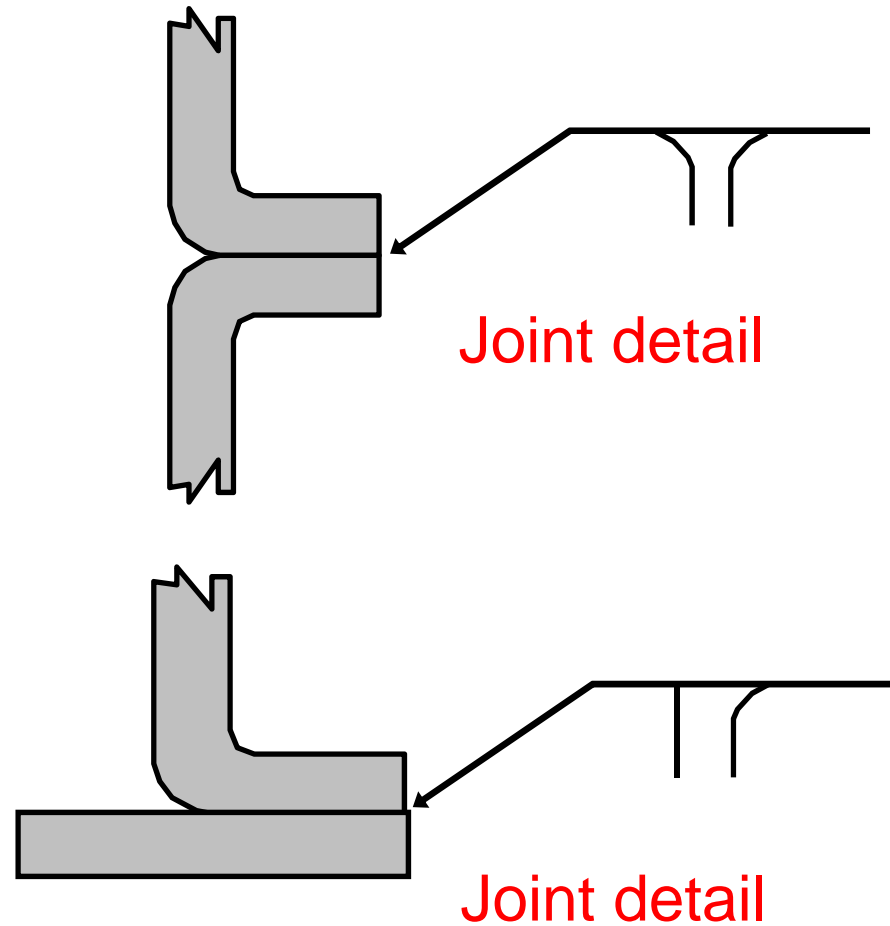
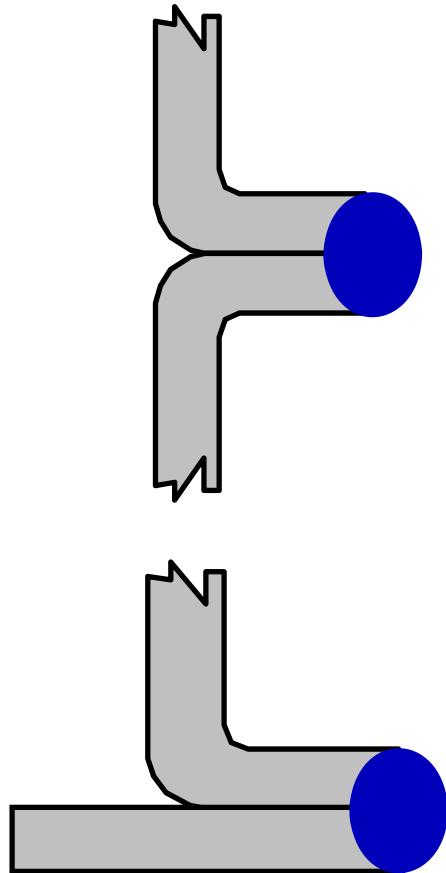


Seam weld



Edge flange weld

BS 499: part 2. Flared flange Welding Symbols



BS 499: part 2. Numerical Indication of Process

111: MMA welding with covered electrode

121: Sub-arc welding with wire electrode

131: MIG welding with inert gas shield

135: MAG welding with non-inert gas shield

136: Flux core arc welding

141: TIG welding

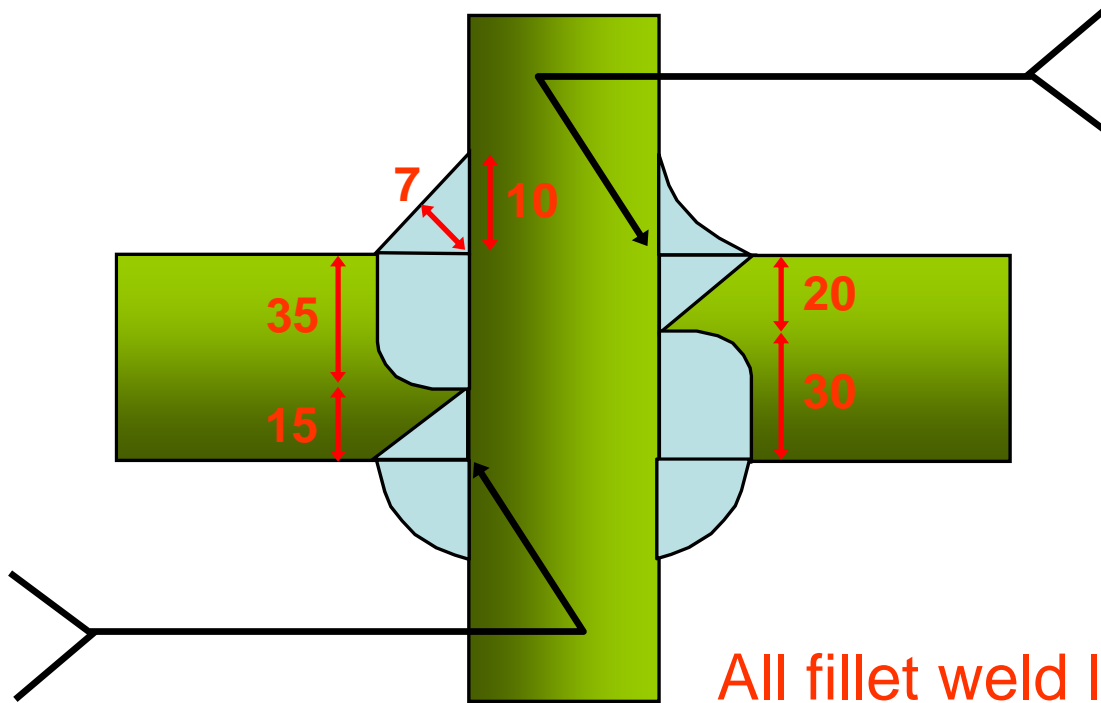
311: Oxy-acetylene welding

72: Electro-slag welding

BS 499: prt. 2 Butt Weld ex: 1

Complete the symbol drawing for the welded cruciform joint provided below

All welds are welded with the MIG process and fillet welds with the MMA process

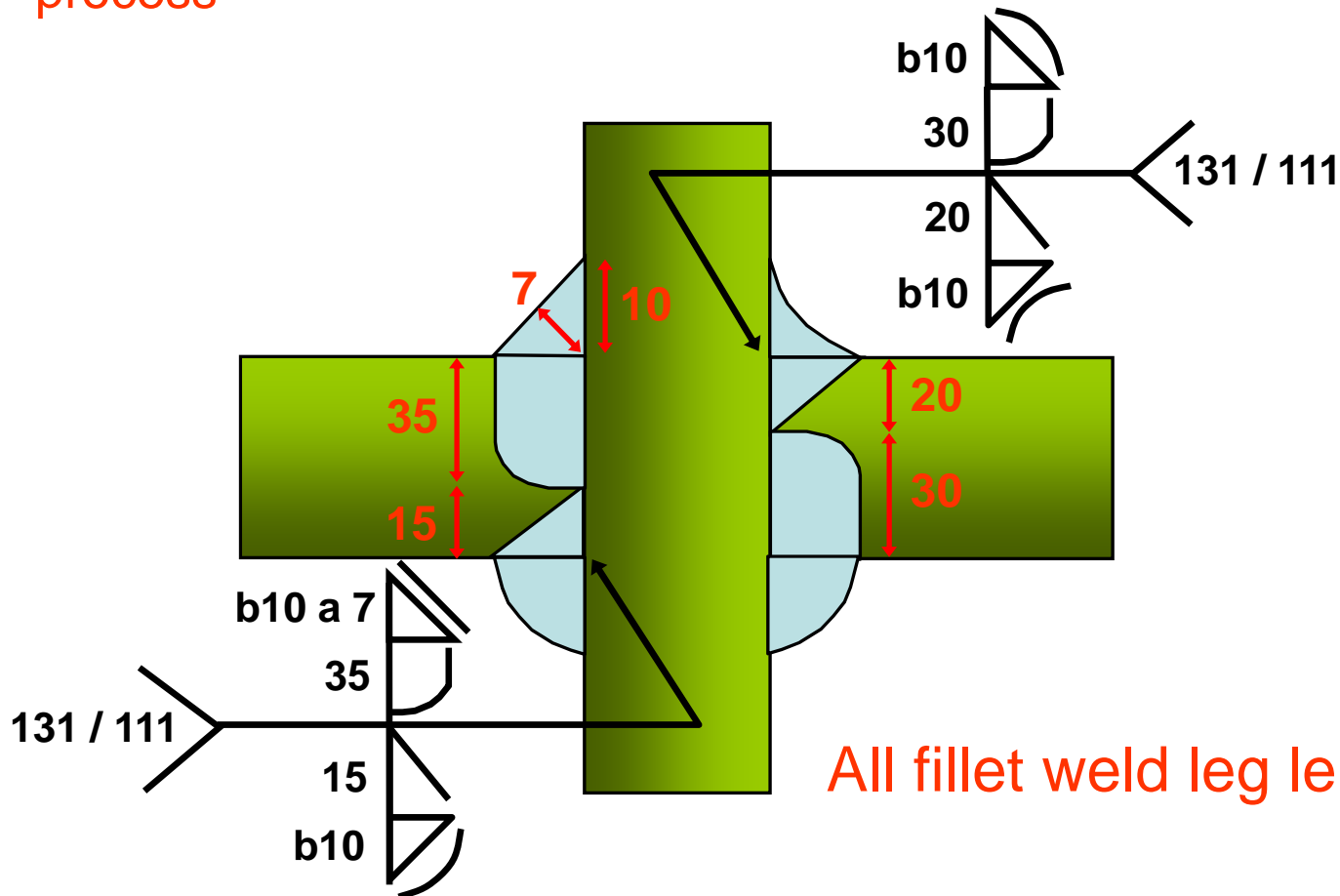


All fillet weld leg lengths 10 mm

BS 499: prt. 2 Butt Weld ex: 1

Complete the symbol drawing for the welded cruciform joint provided below

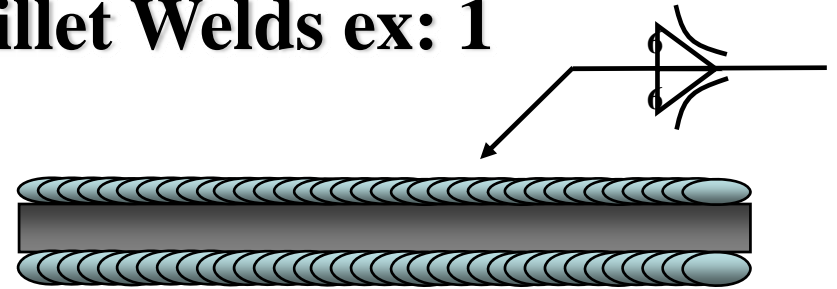
All welds are welded with the MIG process and fillet welds with the MMA process



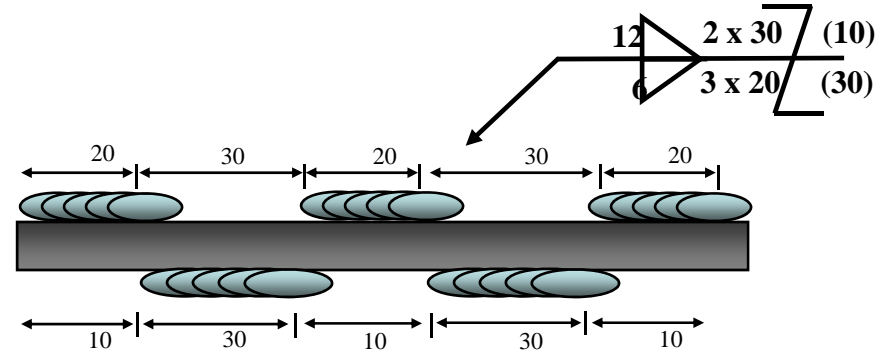
All fillet weld leg lengths 10 mm

BS 499: prt. 2 Fillet Welds ex: 1

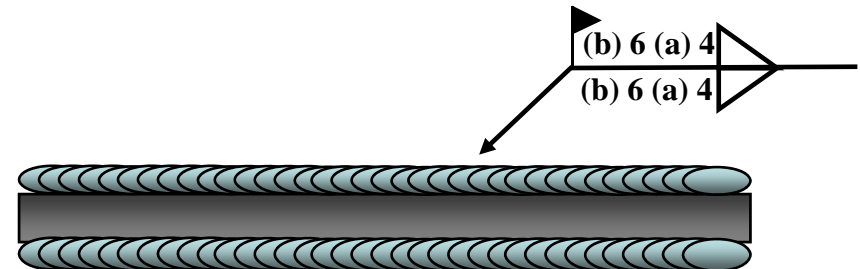
1. Welded both sides: A continuous concave fillet weld 6mm leg lengths.



2. Welded arrow side: Three intermittent fillet welds, 6 mm leg lengths, the length of each weld 20 mm, the distance between each weld 30 mm.
Welded other side: Two intermittent fillet welds 12 mm leg lengths, the length of each weld 30 mm, the distance between each weld 10 mm. Welds to be staggered.

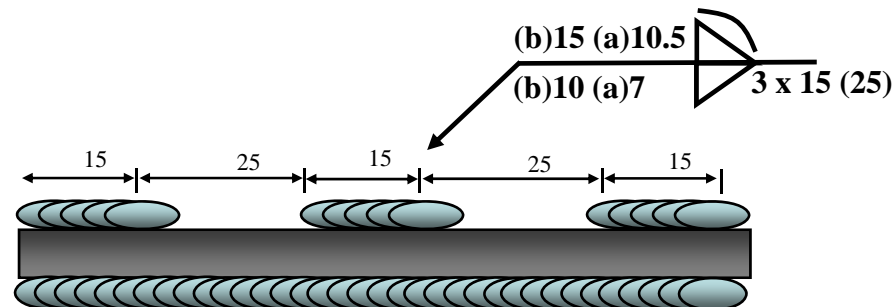


3. Welded both sides. A continuous fillet weld, 6 mm leg lengths, 4 mm throat thickness, welds to be carried out on site.



4. Welded arrow side: Three intermittent fillet welds 10 mm leg lengths, 7mm throat thickness, length of each weld 15 mm, the distance between each weld 25 mm.

Welded other side: A continuous convex fillet weld, 15 mm leg length, 10.5 mm throat thickness.

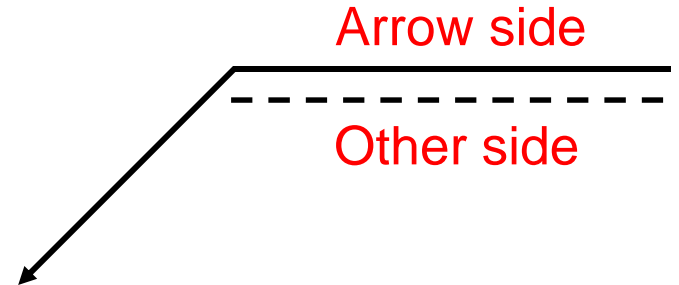
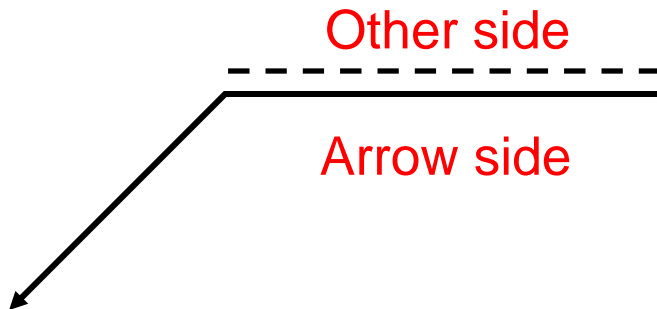
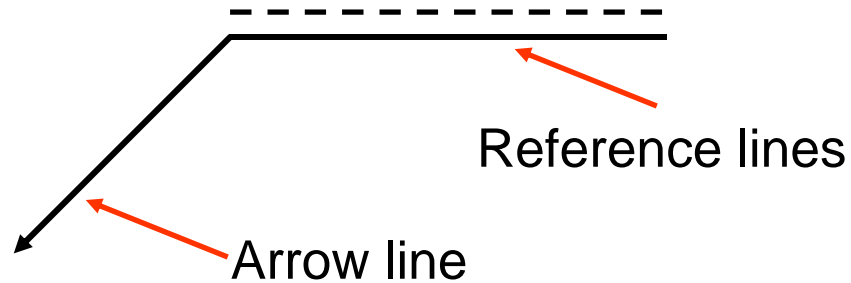


BS EN 22553 (ISO 2553)

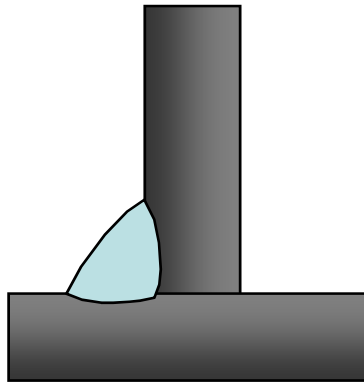
Welding Symbols



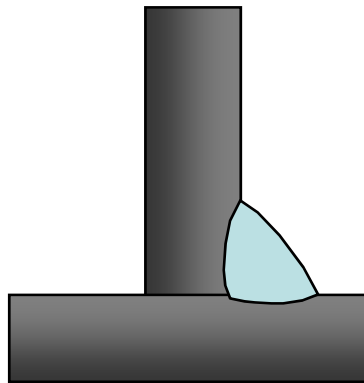
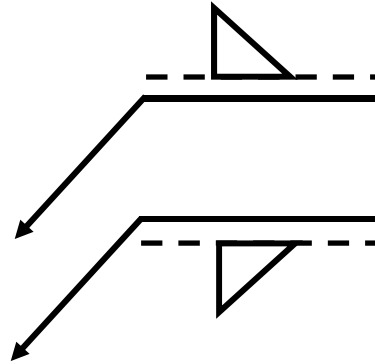
BS EN 22553 (ISO 2553) Welding Symbols



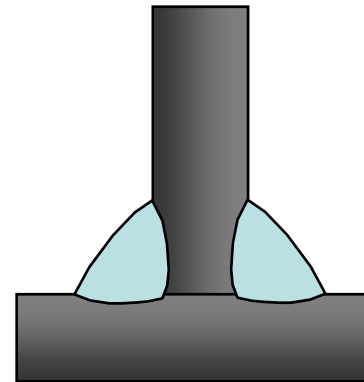
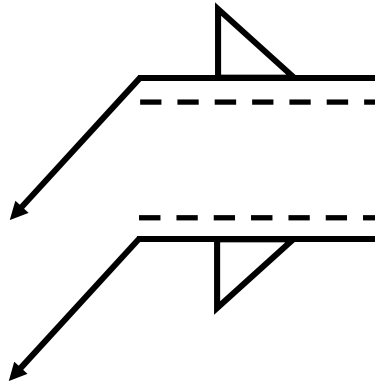
BS EN 22553 (ISO 2553) Welding Symbols



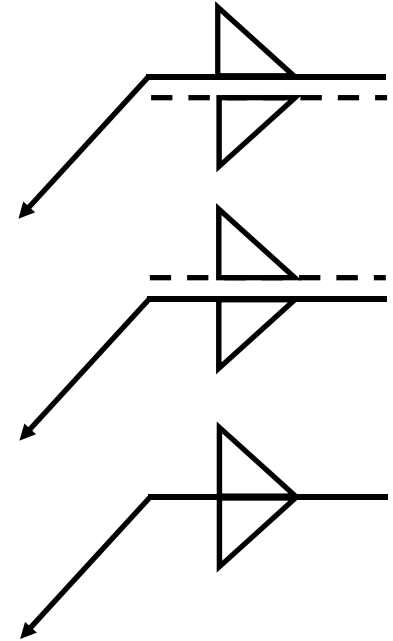
Other side



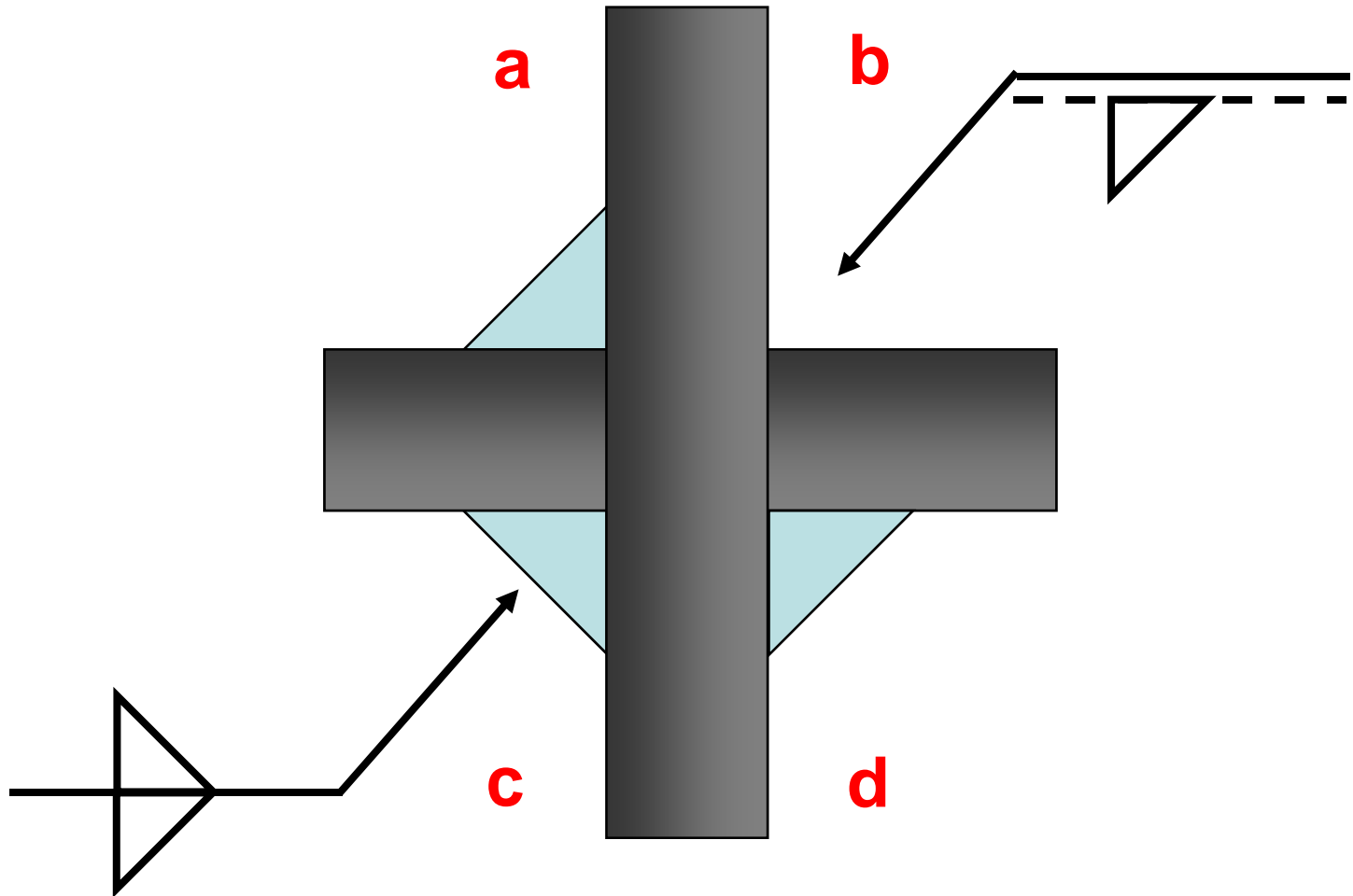
Arrow side



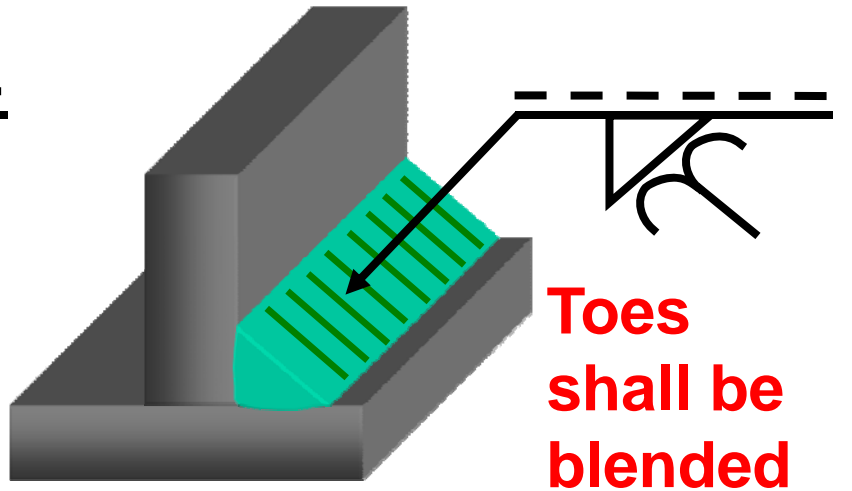
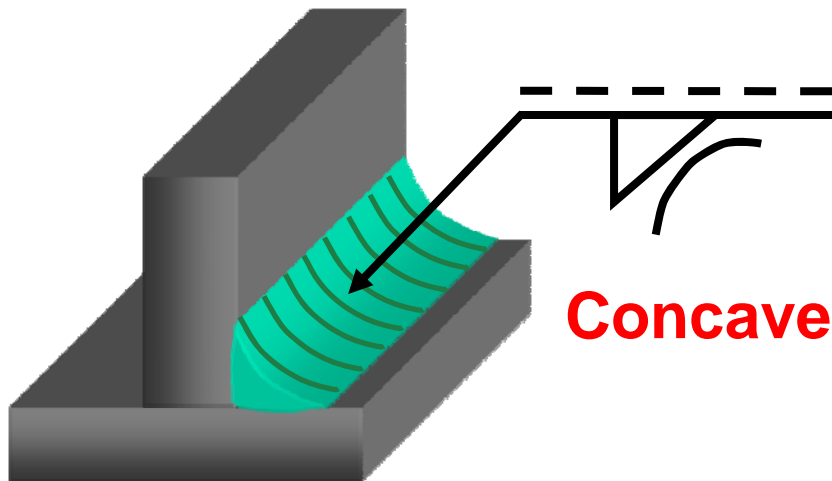
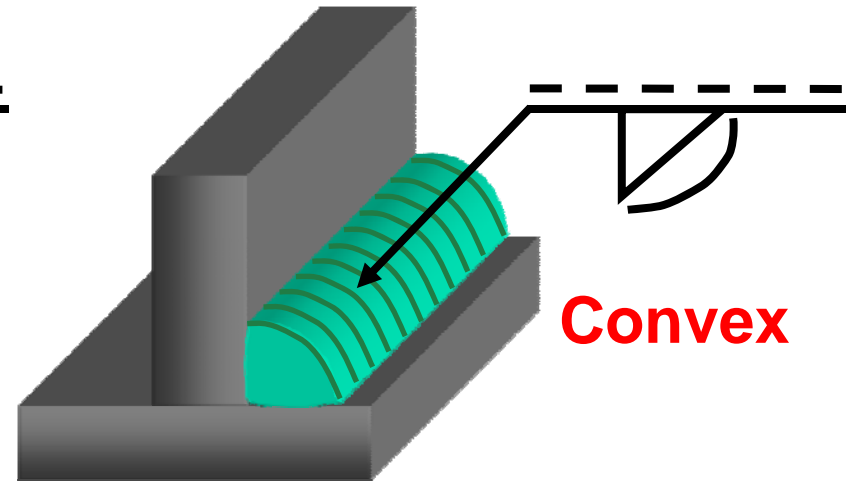
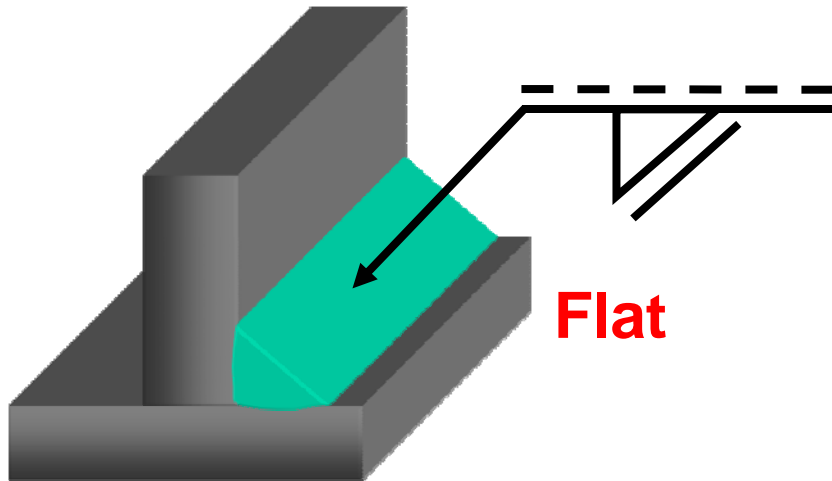
Both sides



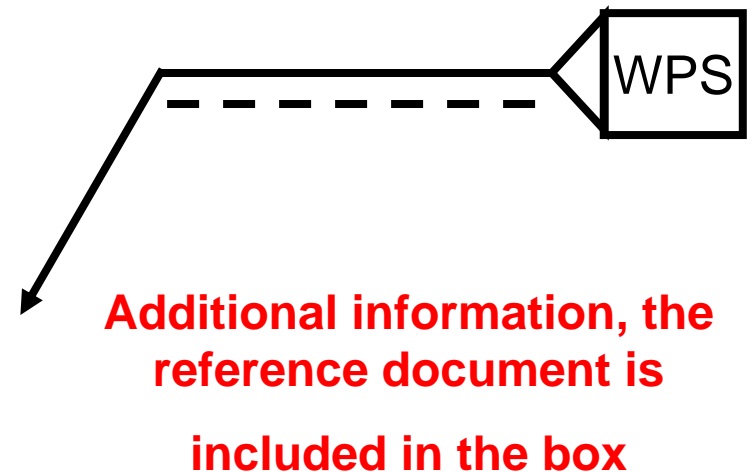
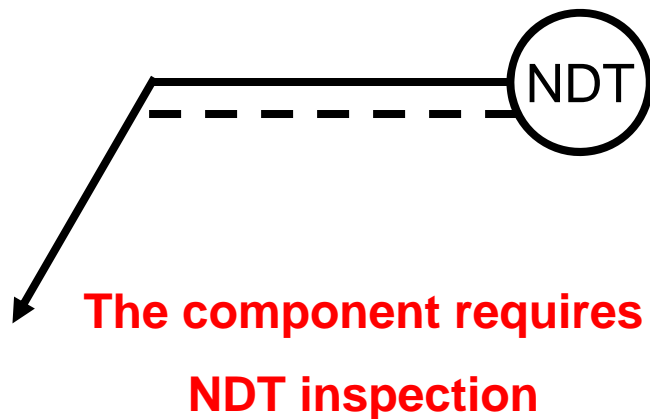
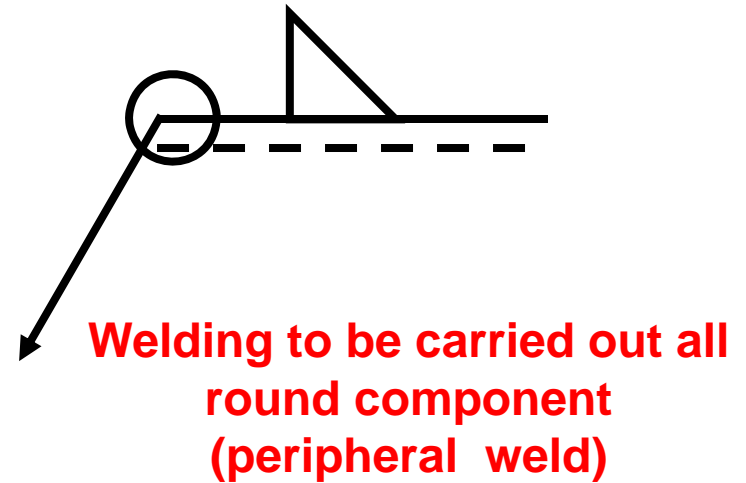
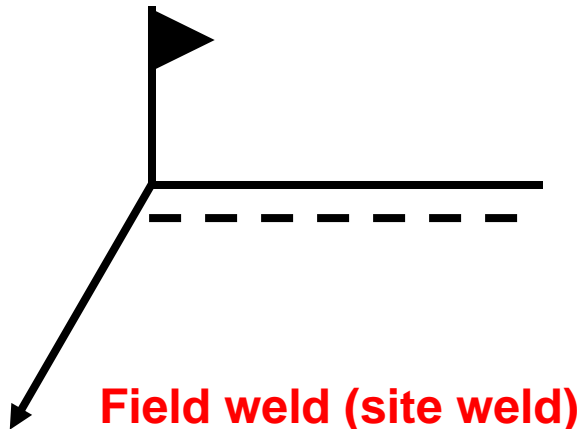
BS EN 22553 (ISO 2553) Welding Symbols



BS EN 22553 (ISO 2553) Welding Symbols

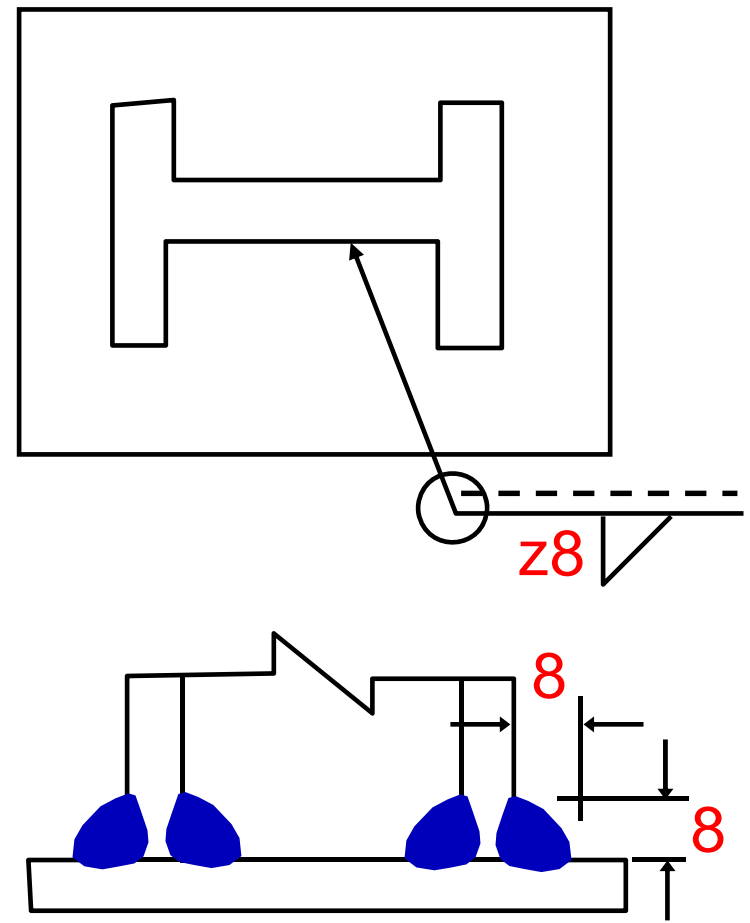
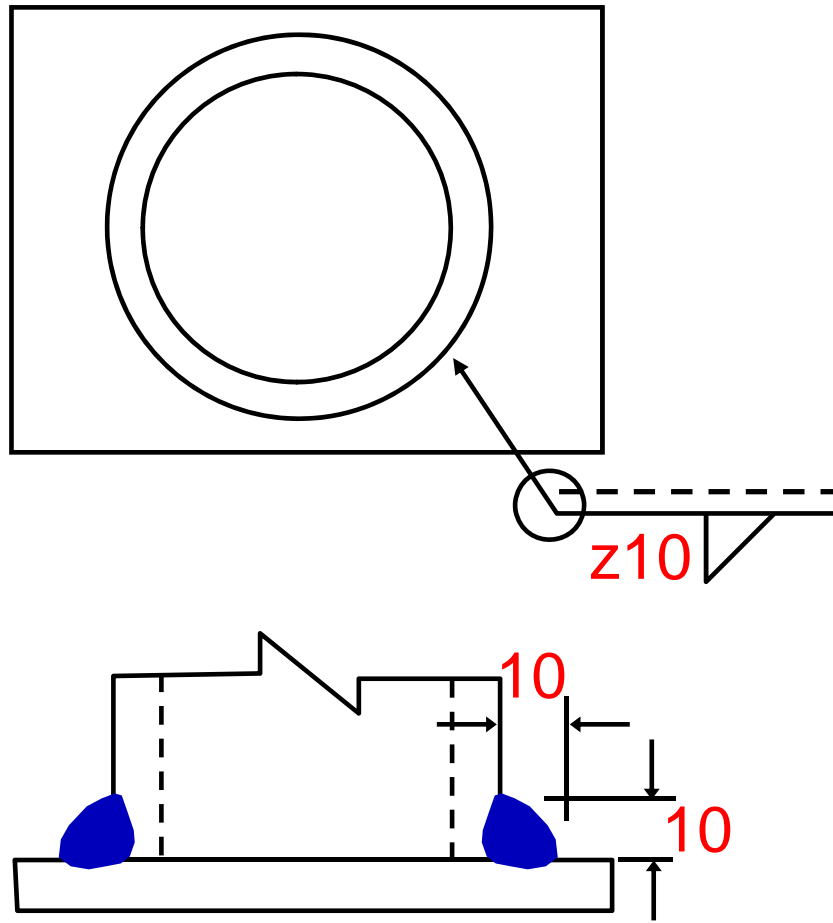


BS EN 22553 (ISO 2553) Welding Symbols



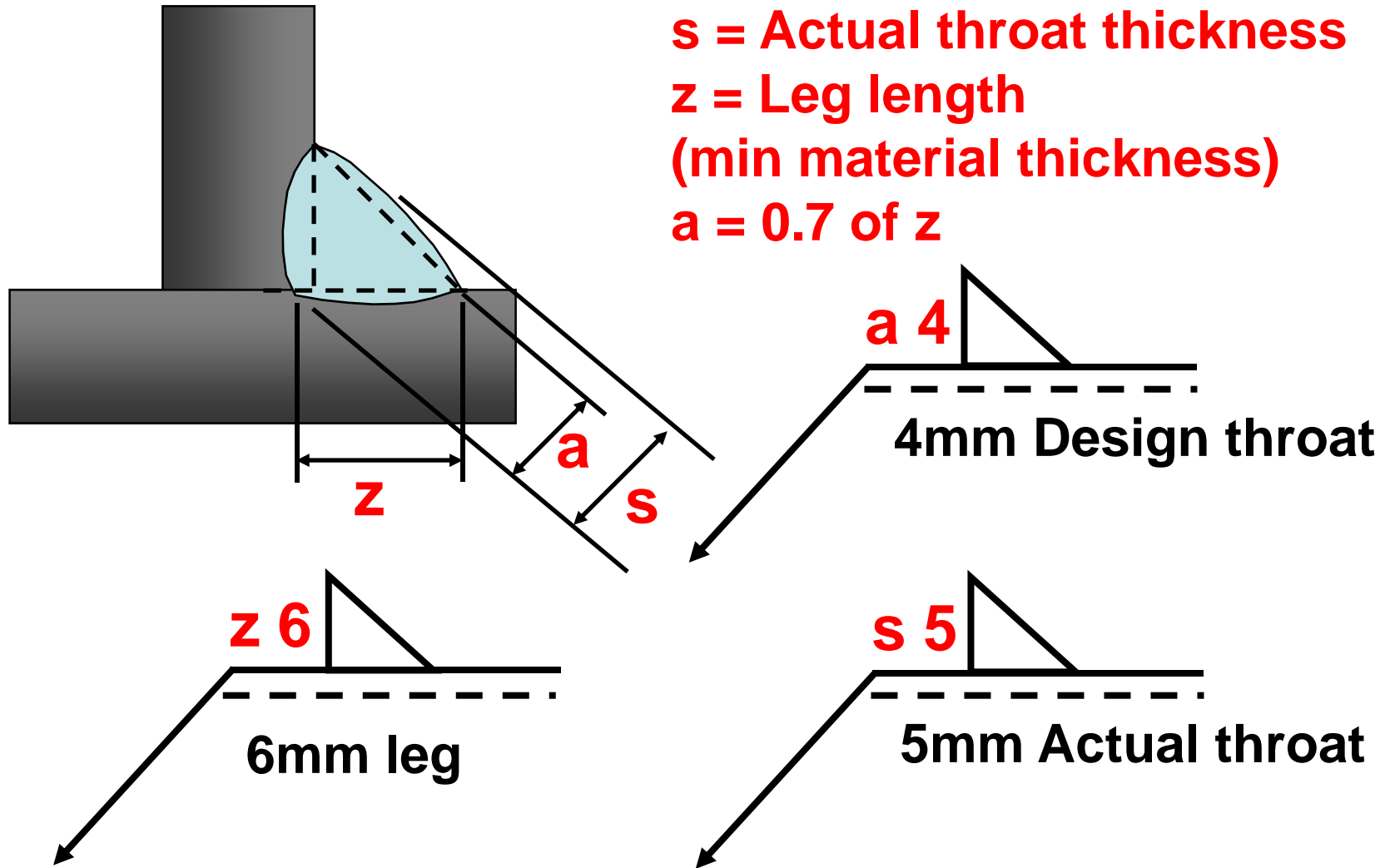
BS EN 22553 (ISO 2553) Welding Symbols

Peripheral Welds

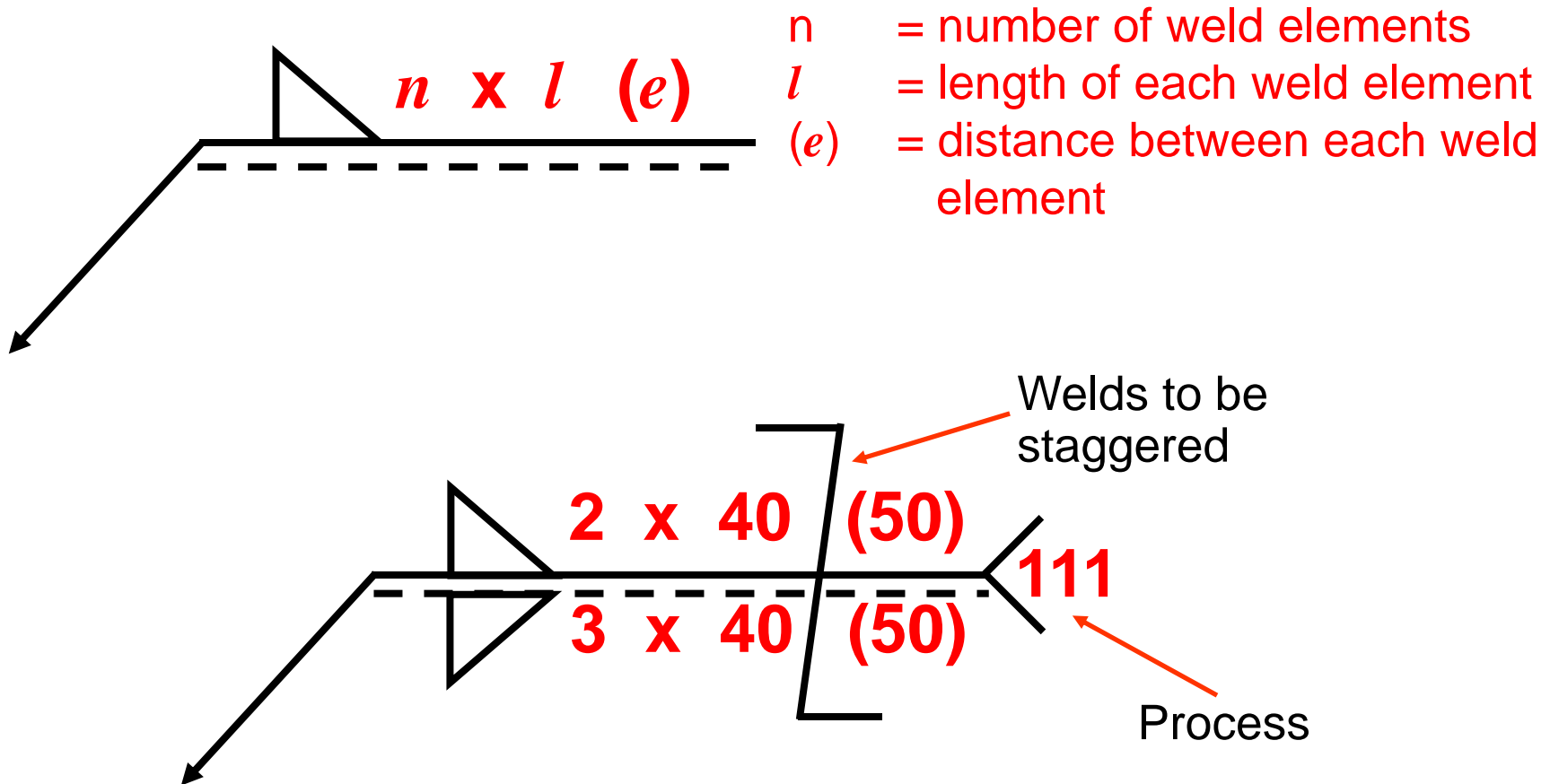


BS EN 22553 (ISO 2553) Welding Symbols

a = Design throat thickness
s = Actual throat thickness
z = Leg length
(min material thickness)
 $a = 0.7 \text{ of } z$

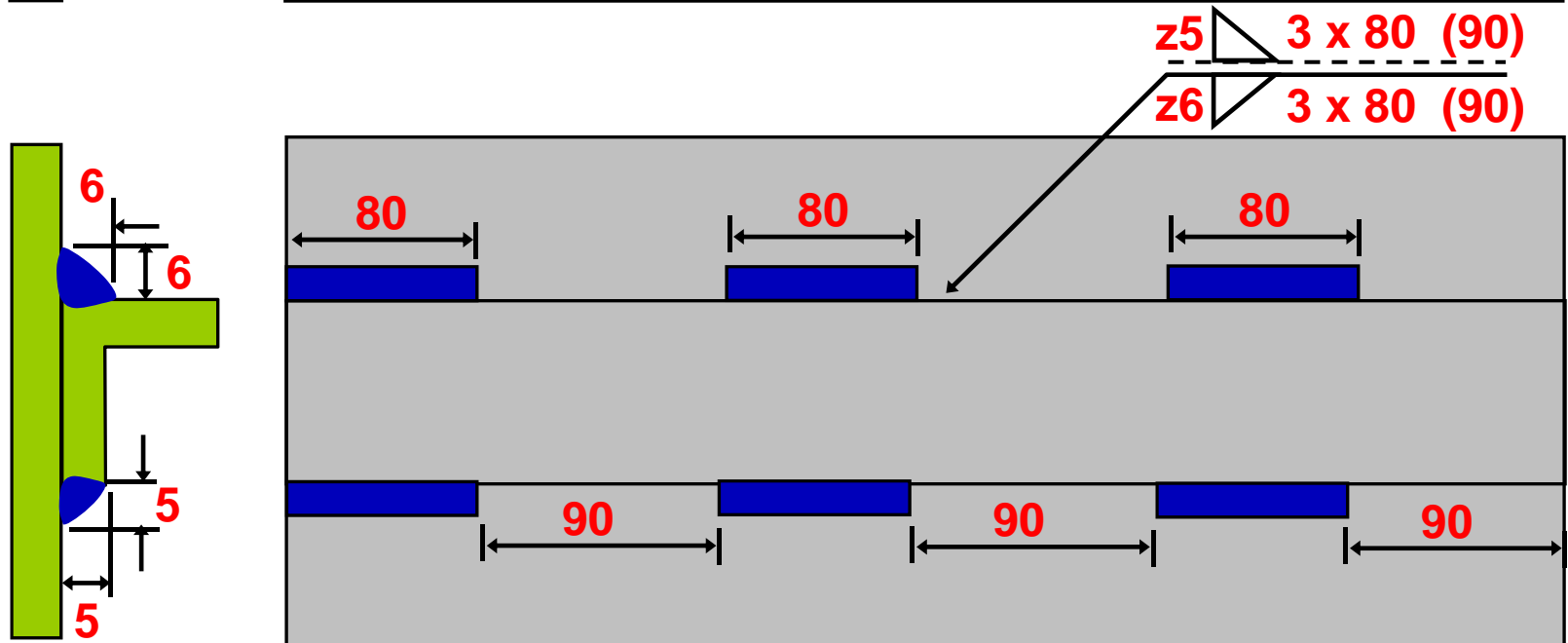
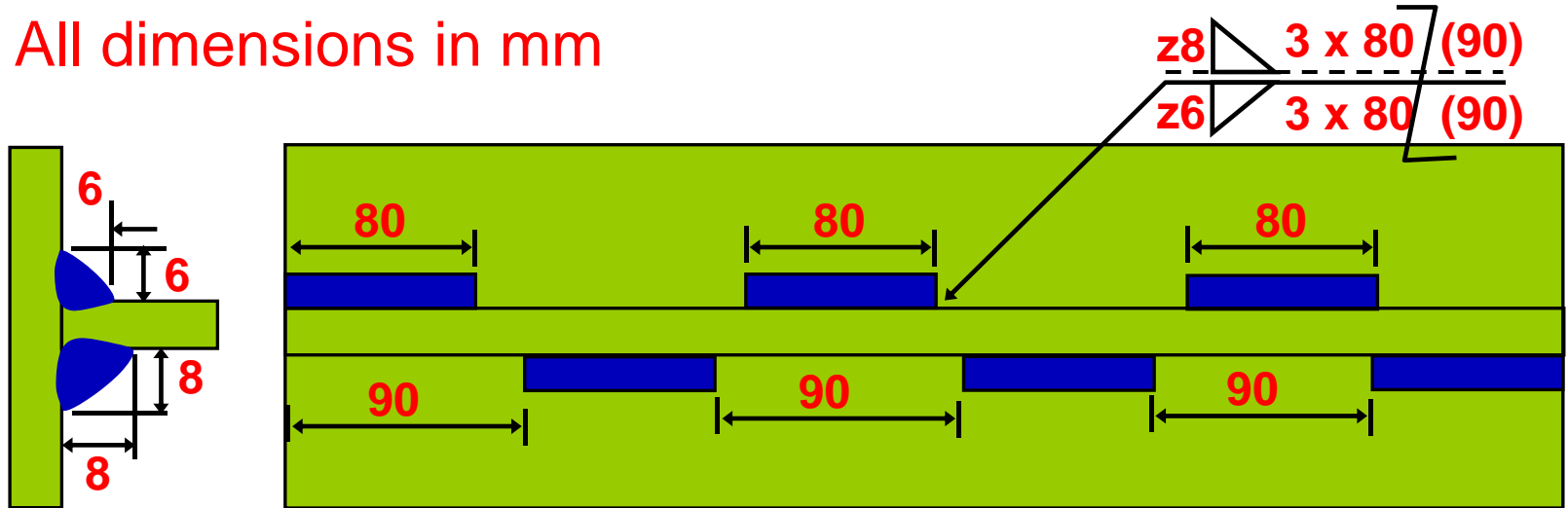


BS EN 22553 (ISO 2553) Welding Symbols

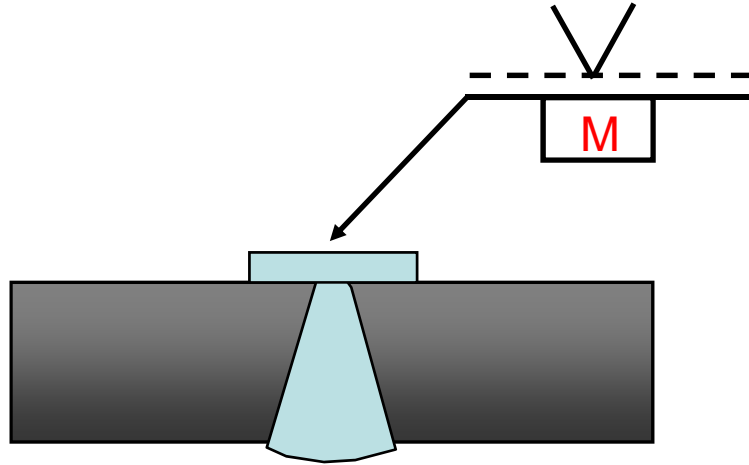


BS EN 22553 (ISO 2553) Welding Symbols

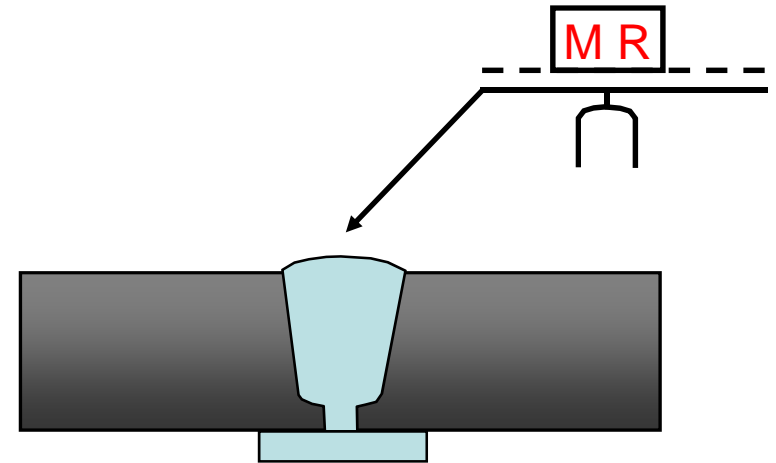
All dimensions in mm



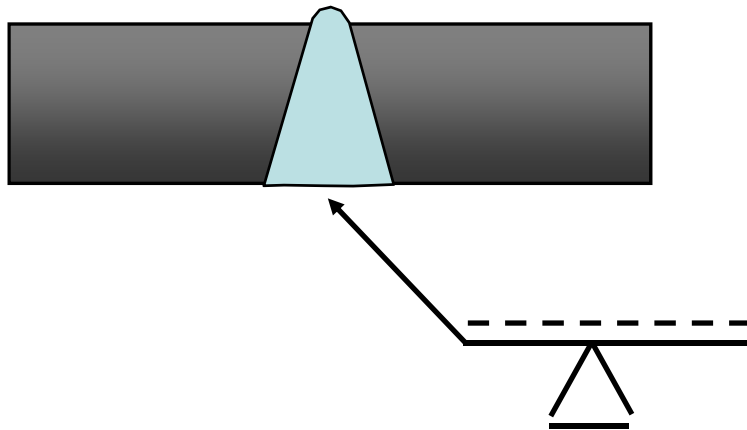
BS EN 22553 (ISO 2553) Welding Symbols



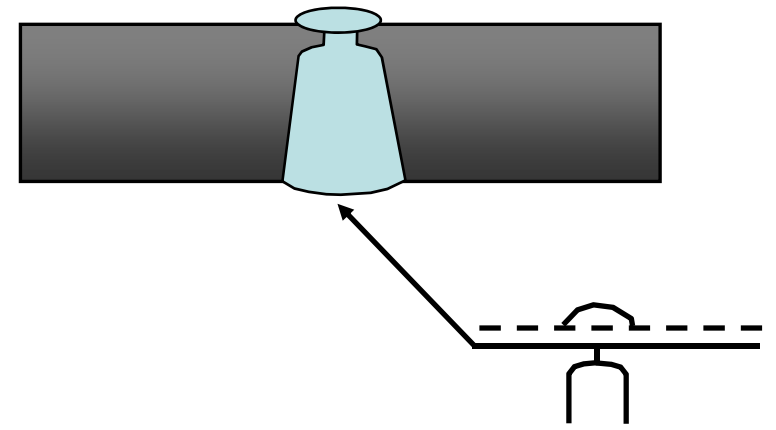
Single-V Butt with permanent backing strip



Single-U Butt with removable backing strip

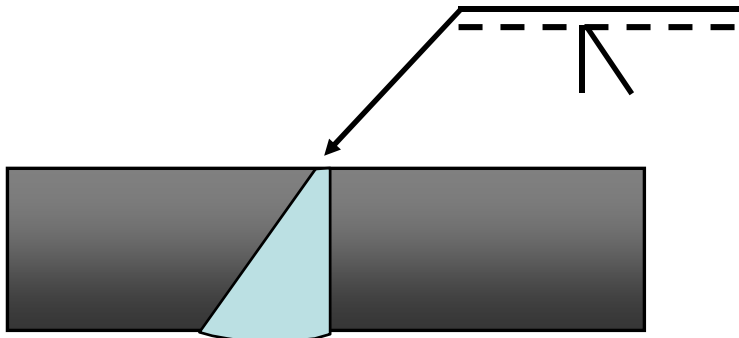


Single-V Butt flush cap

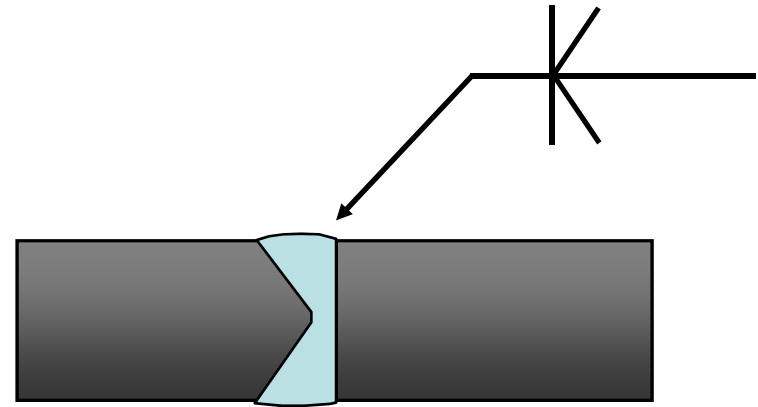


Single-U Butt with sealing run

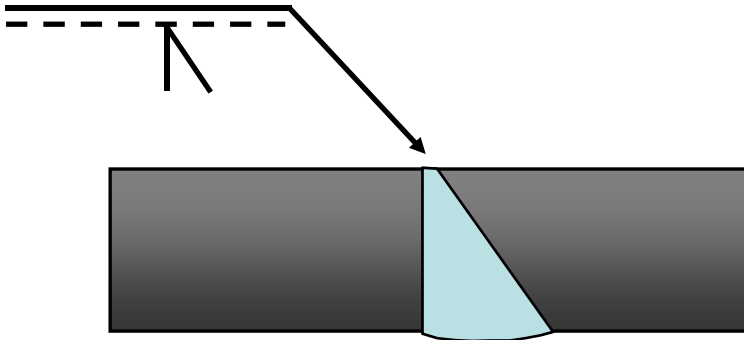
BS EN 22553 (ISO 2553) Welding Symbols



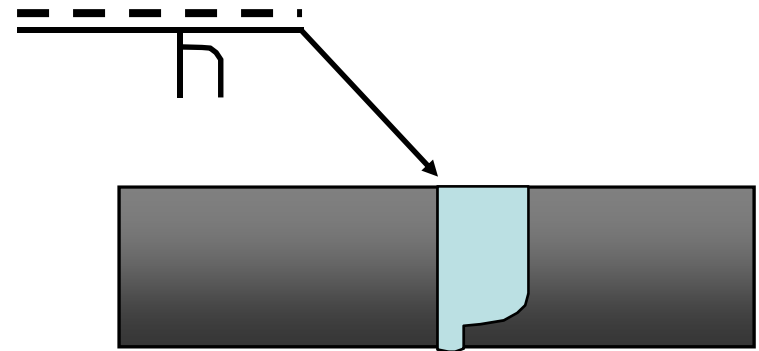
Single-bevel butt



Double-bevel butt

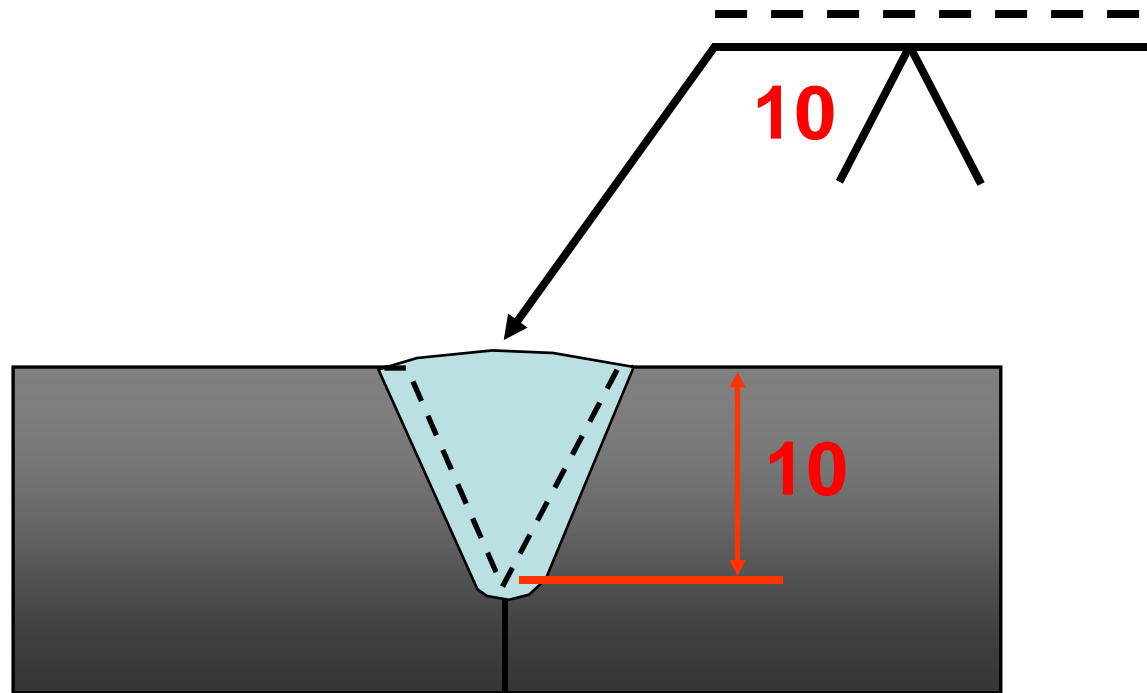


Single-bevel butt



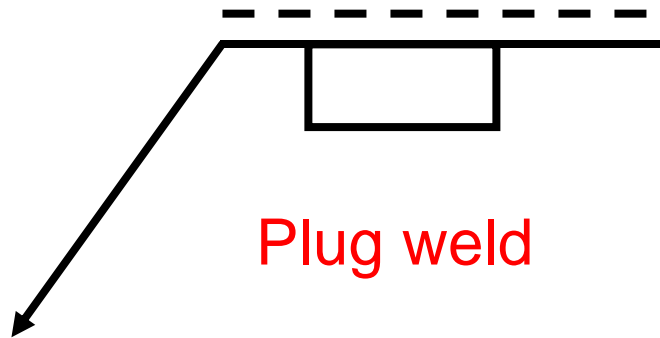
Single-J butt

BS EN 22553 (ISO 2553) Welding Symbols

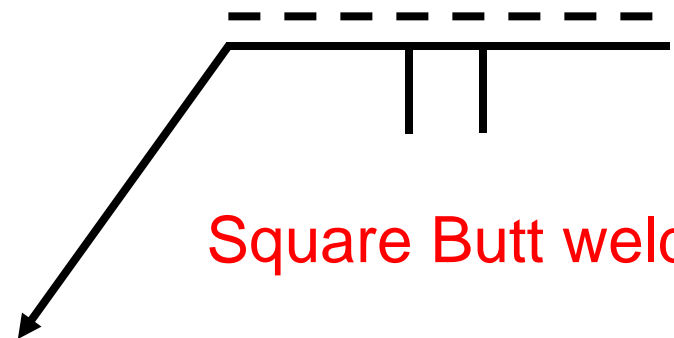


Partial penetration single-V butt

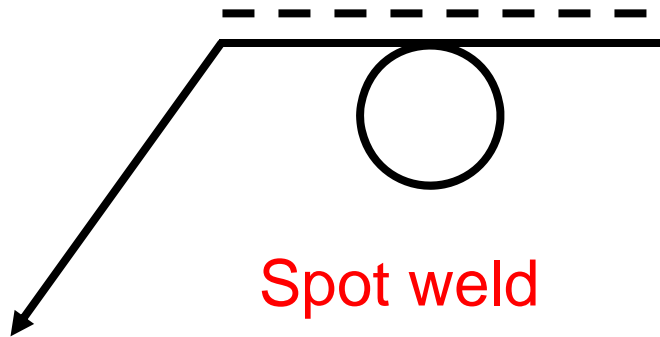
BS EN 22553 (ISO 2553) Welding Symbols



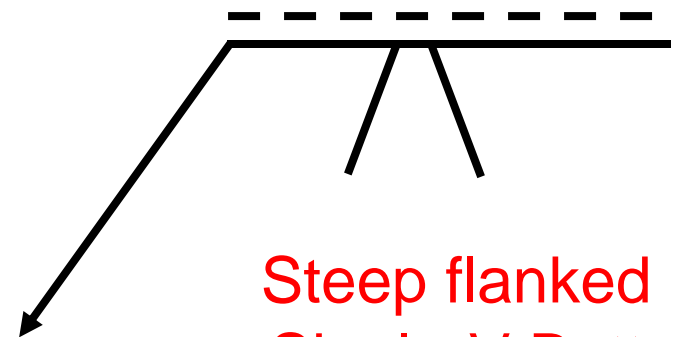
Plug weld



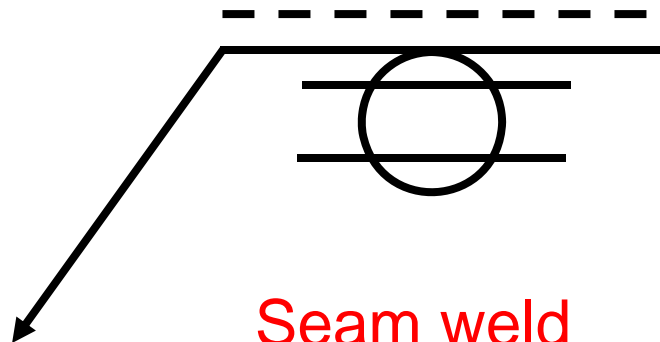
Square Butt weld



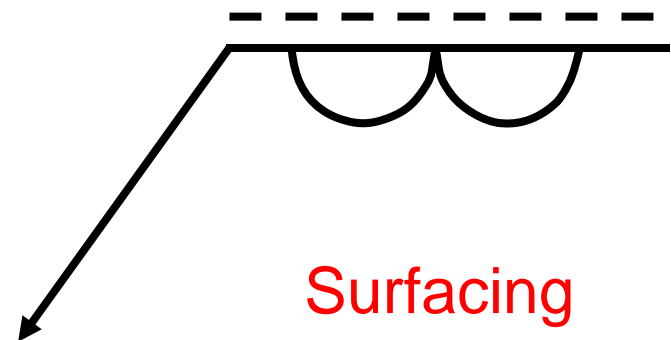
Spot weld



Steep flanked
Single-V Butt

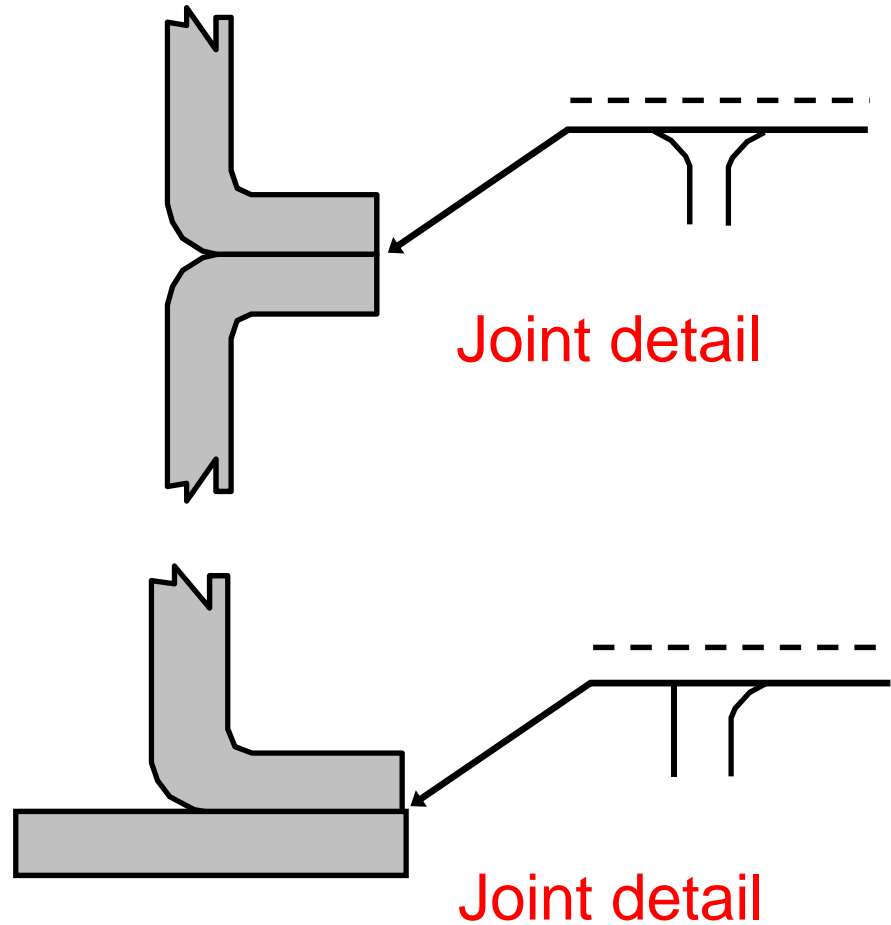
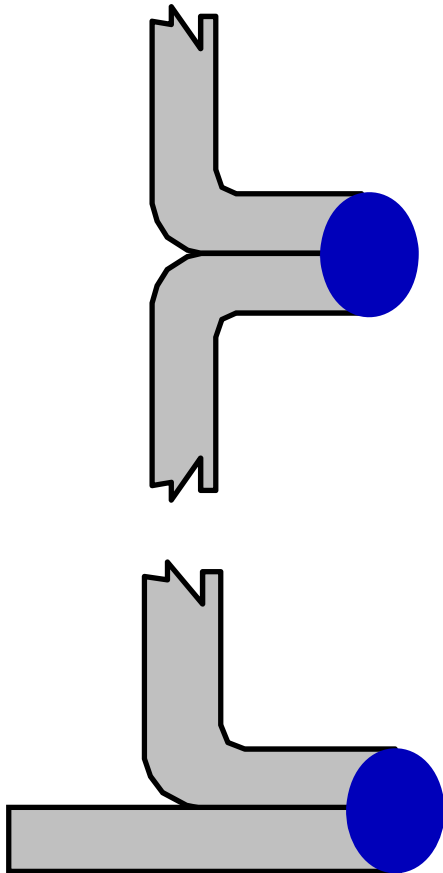


Seam weld



Surfacing

BS EN 22553. Flared flange Welding Symbols



BS EN 22553. Numerical Indication of Process

111: MMA welding with covered electrode

121: Sub-arc welding with wire electrode

131: MIG welding with inert gas shield

135: MAG welding with non-inert gas shield

136: Flux core arc welding

141: TIG welding

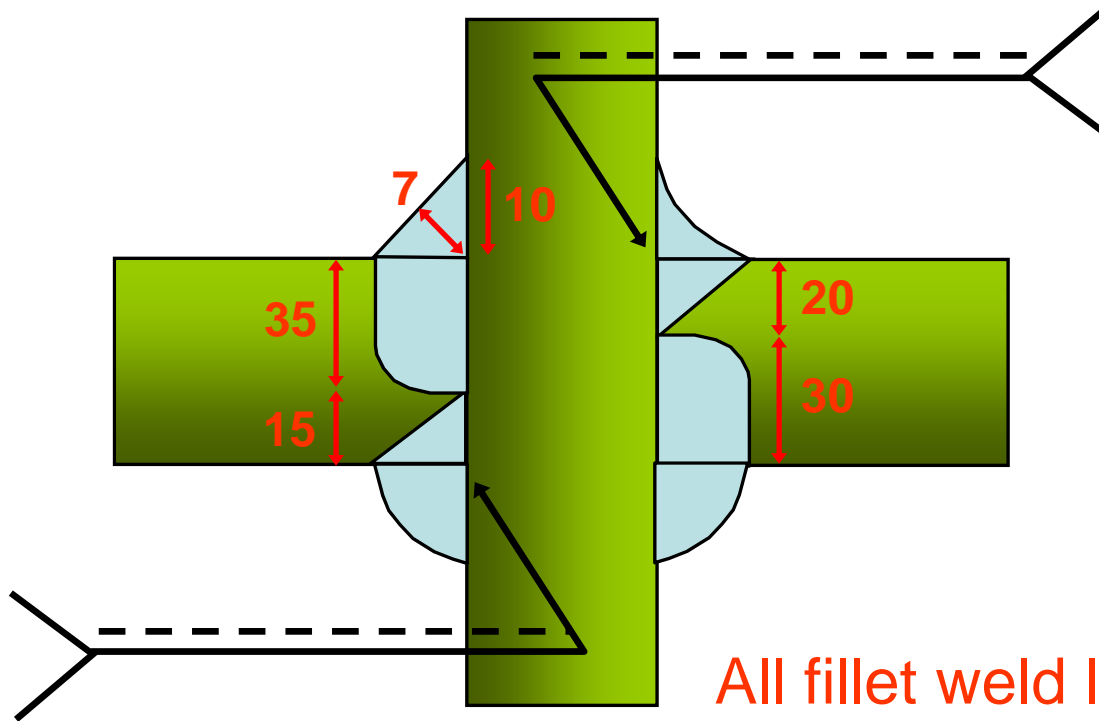
311: Oxy-acetylene welding

72: Electro-slag welding

BS EN 22553: Butt Weld ex: 2

Complete the symbol drawing for the welded cruciform joint provided below

All welds are welded with the MIG process and fillet welds with the MMA process

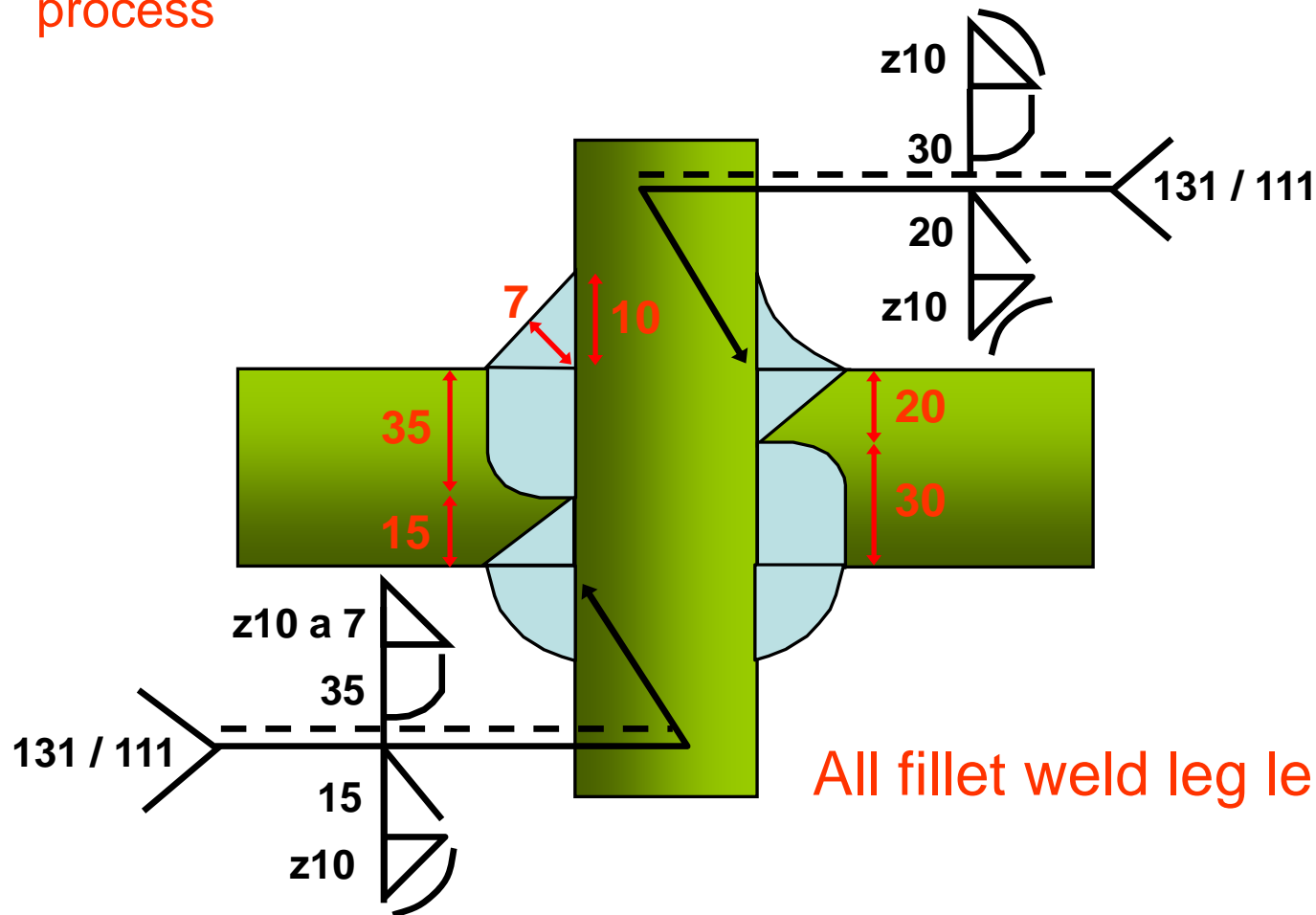


All fillet weld leg lengths 10 mm

BS EN 22553: Butt Weld ex: 2

Complete the symbol drawing for the welded cruciform joint provided below

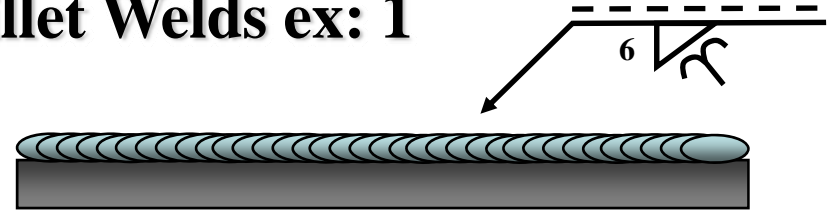
All welds are welded with the MIG process and fillet welds with the MMA process



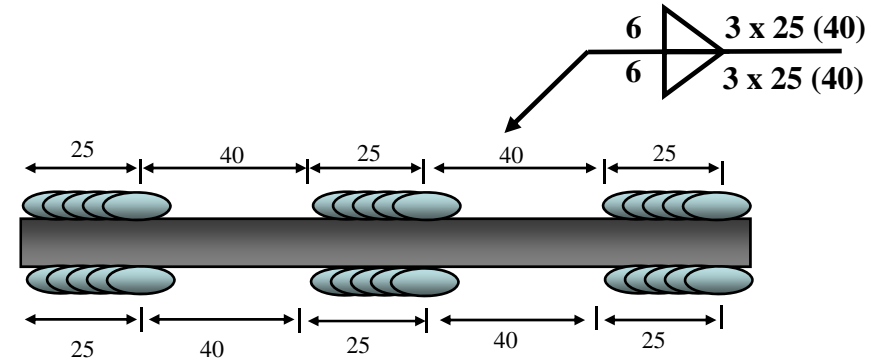
All fillet weld leg lengths 10 mm

BS EN 22553 Fillet Welds ex: 1

1. Welded arrow side: A continuous fillet weld with a 6 mm leg length, toes to be blended smoothly.

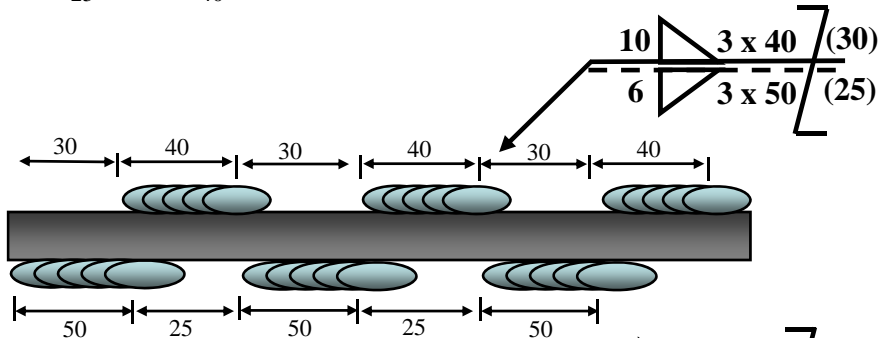


2. Welded both sides: Three intermittent fillet welds with 6 mm leg lengths, the length of each weld 25 mm and the distance between each weld 40 mm.



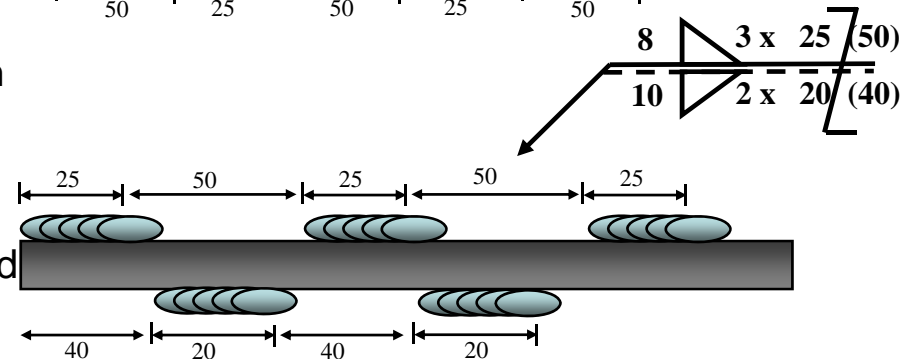
3. Welded arrow sides: Three intermittent fillet welds with 10 mm leg lengths, the length of each weld 40 mm, the distance between each weld 30mm.

Welded other side: Three intermittent fillet welds 6 mm leg lengths, the length of each weld 50mm and the distance between each weld 25mm, welds to be staggered.



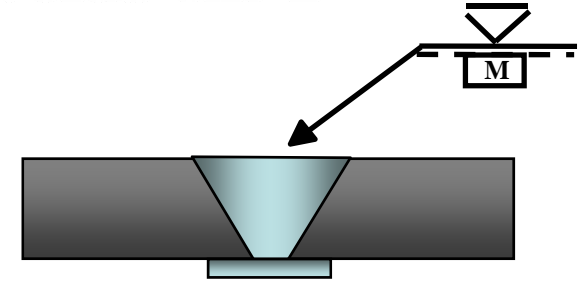
4. Welded arrow side: Three intermittent fillet welds with 8 mm leg lengths, the length of each weld 25 mm and the distance between each weld 50 mm.

Welded other side: Two intermittent fillet welds with 10 mm leg lengths, the length of each weld 20 mm and the distance between each weld 40mm, welds to be staggered.

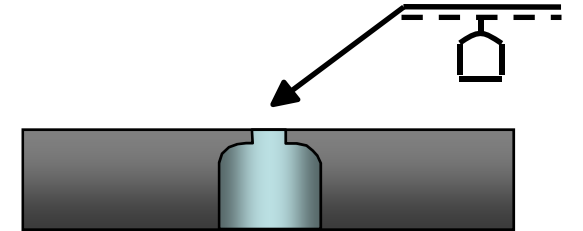


Ans to BS EN 22553 Butt Welds ex: 1

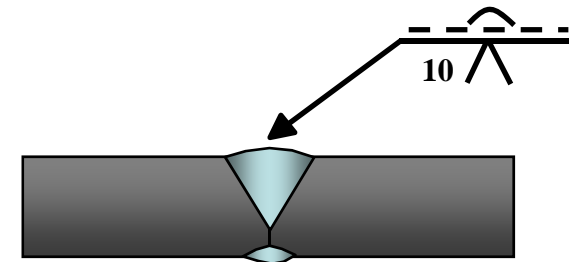
1. Welded arrow side: Single-V butt weld with permanent backing strip, flat weld profile.



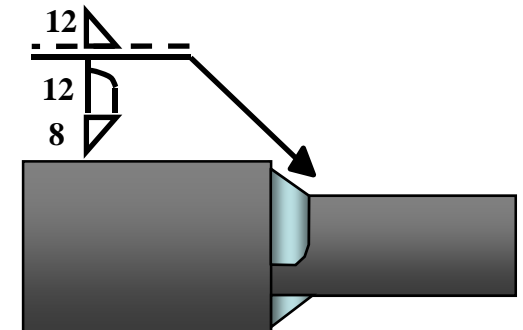
2. Welded other side: Single-U butt weld, flat weld profile



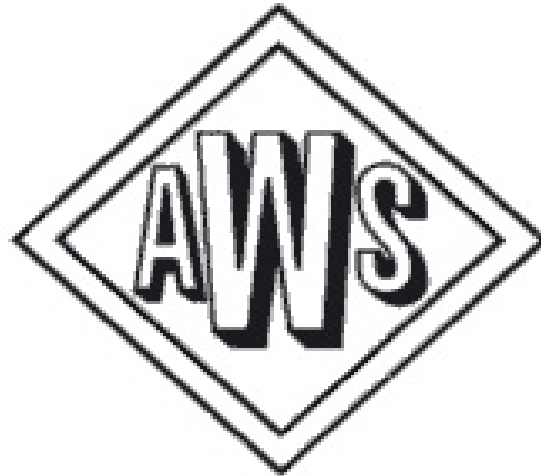
3. Welded arrow side: Single-V butt weld depth of preparation 10 mm
Welded other side: Backing run. (Plate thickness 15 mm.)



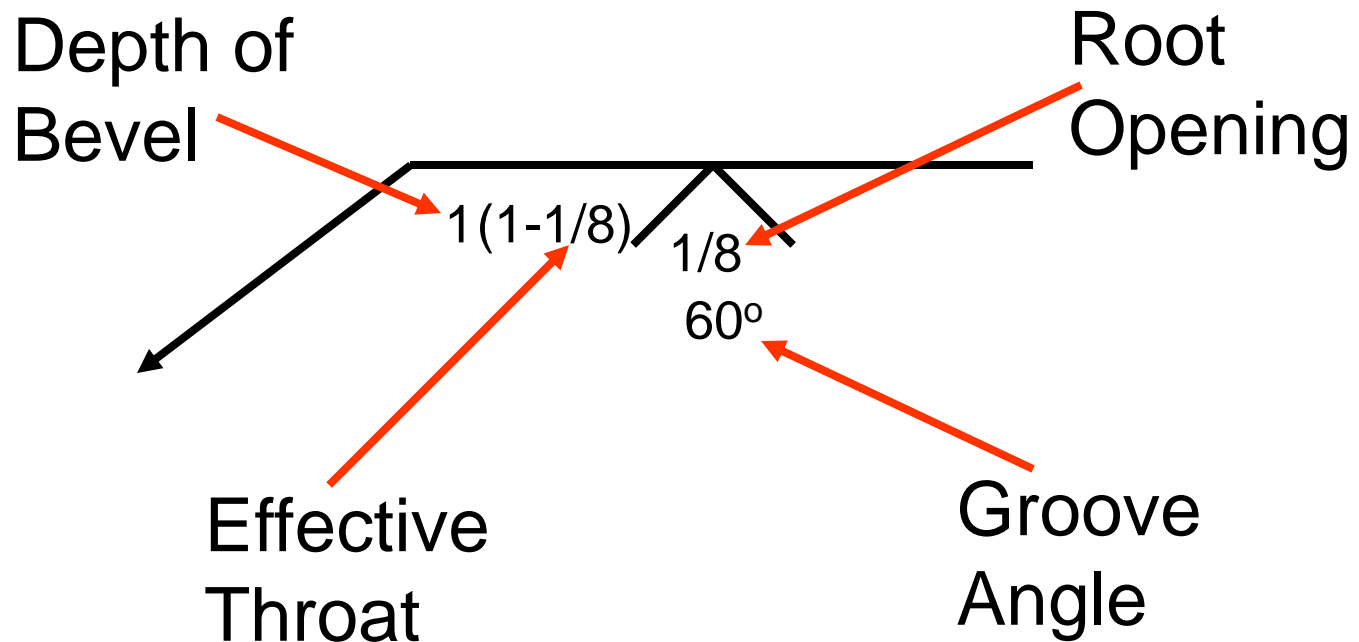
4. Welded arrow side: Single-J butt weld, depth of preparation 12 mm with a 8 mm fillet weld superimposed. (plate thickness 15 mm.)
Welded other side: 12 mm leg length fillet weld.



AWS Welding Symbols

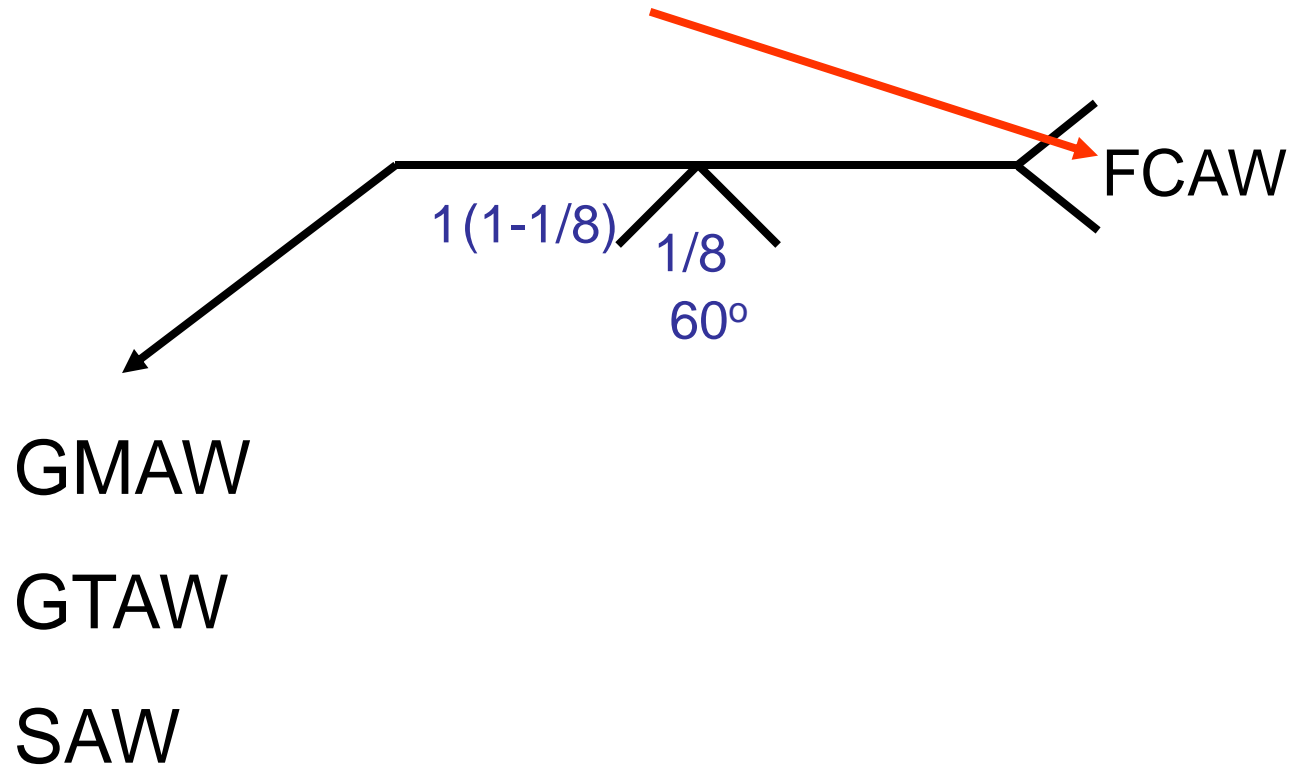


AWS. Welding Symbols

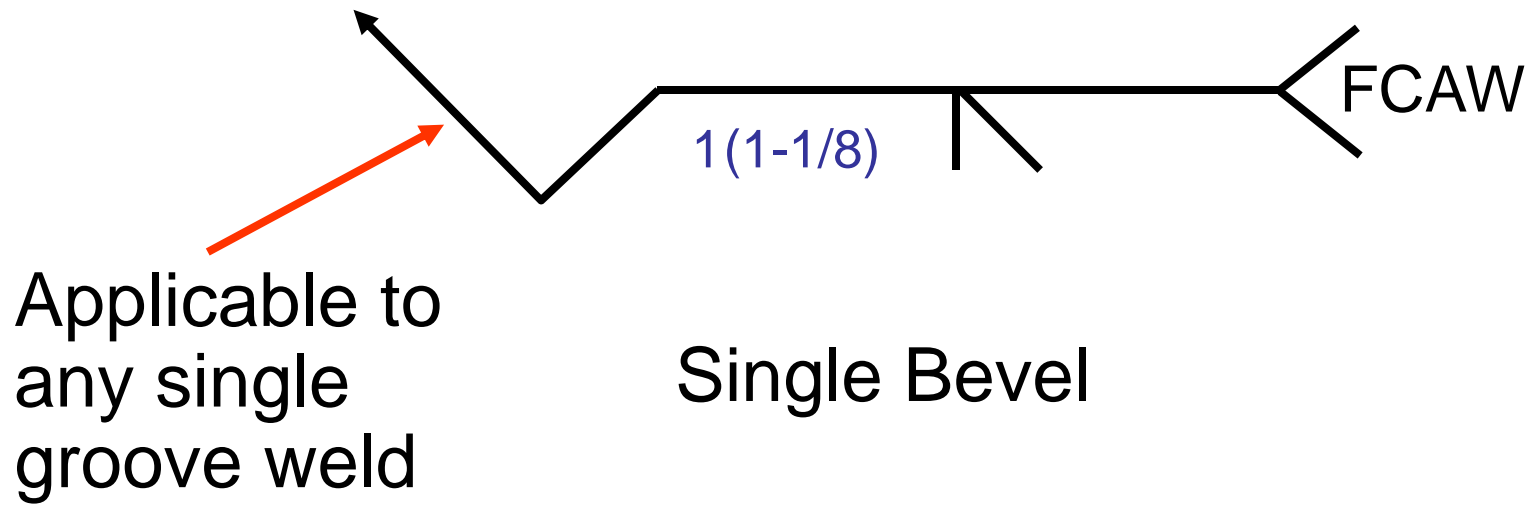


AWS. Welding Symbols

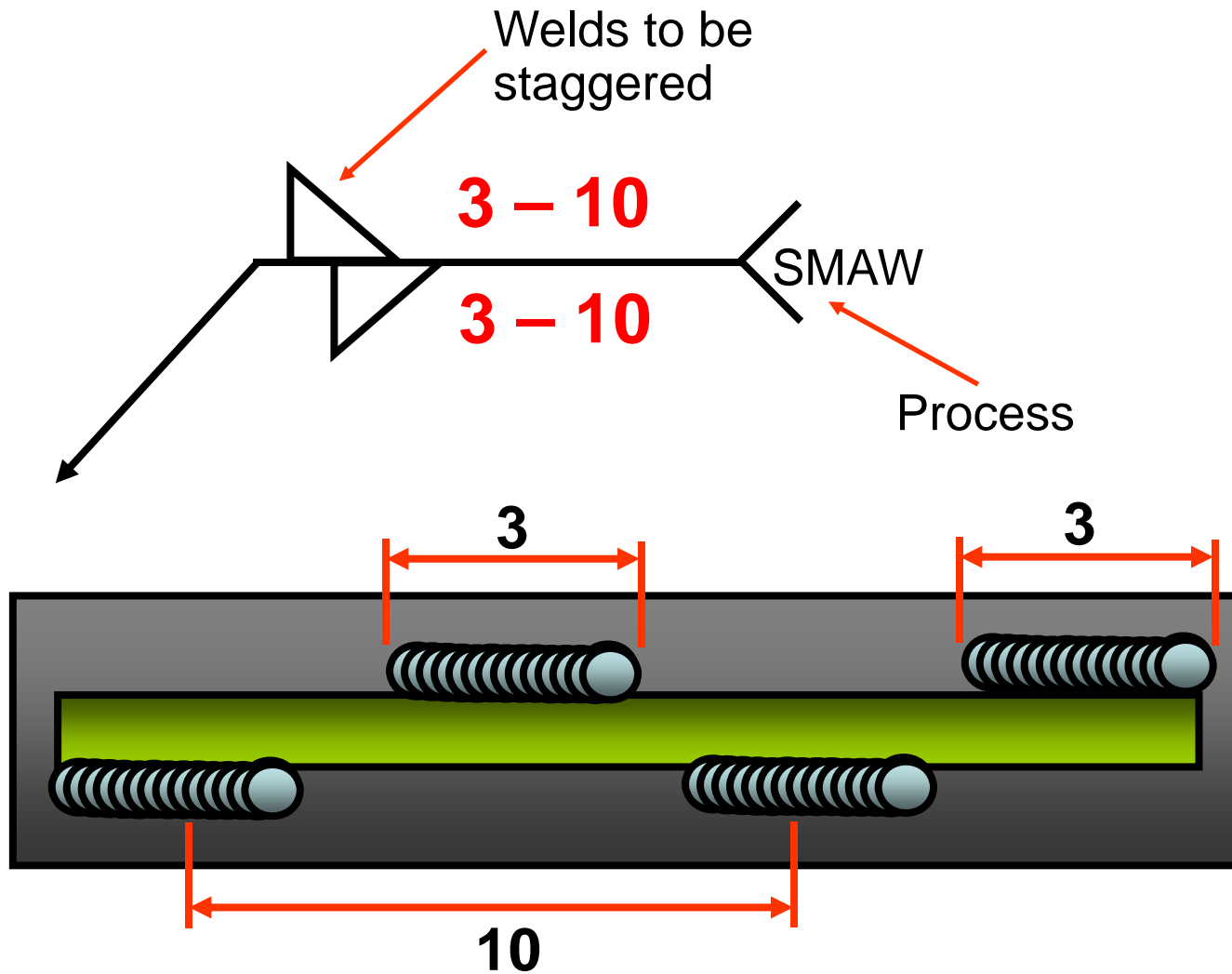
Welding Process



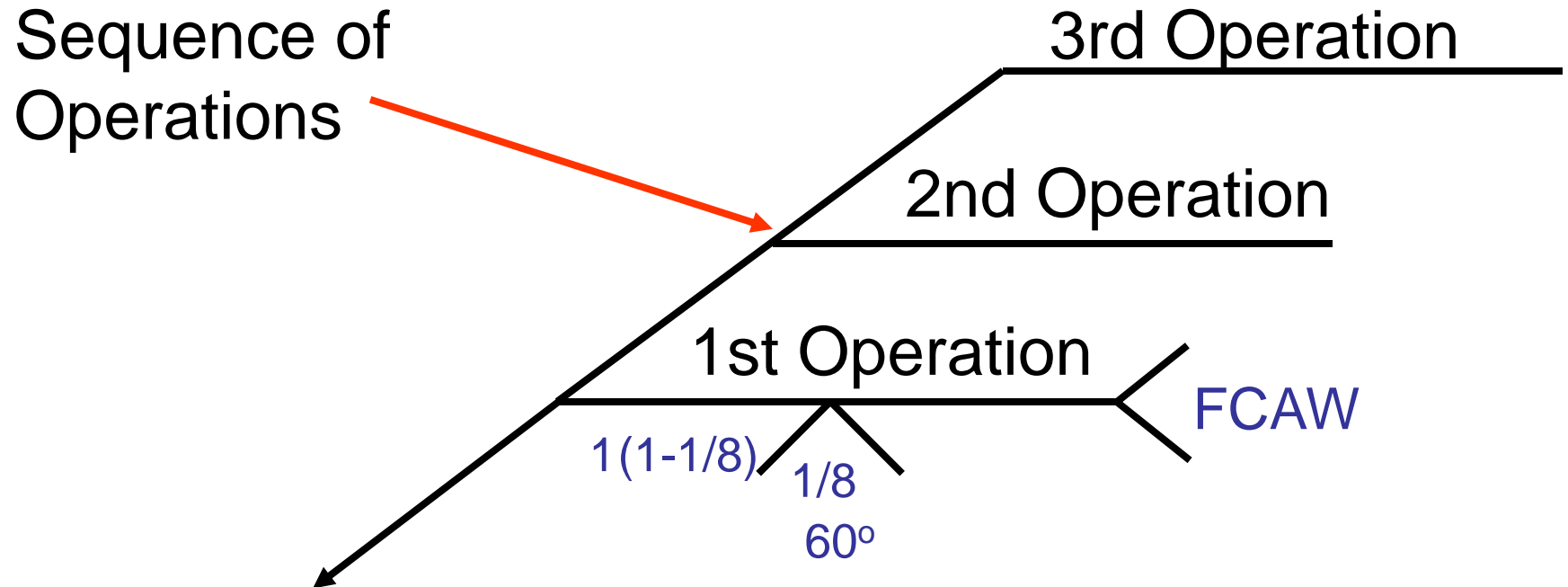
AWS. Welding Symbols



AWS. Welding Symbols

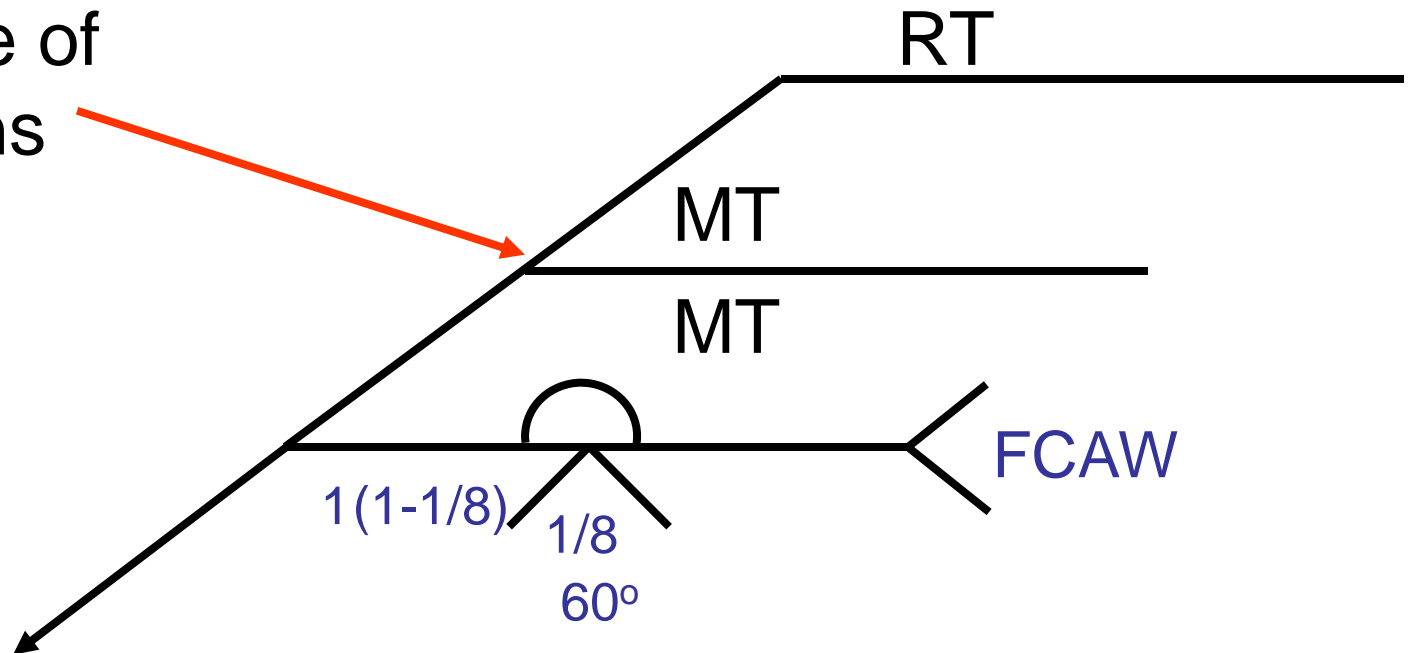


AWS. Welding Symbols



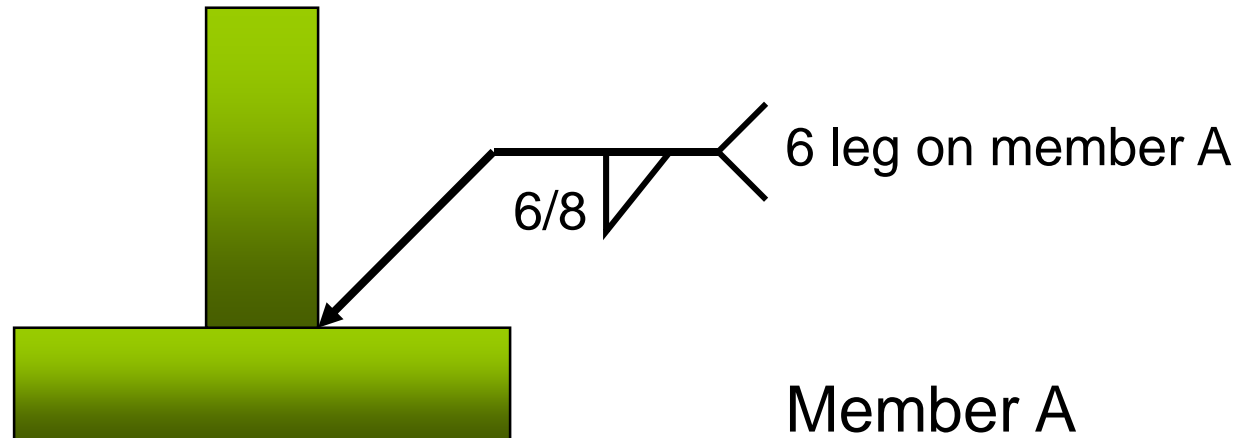
AWS. Welding Symbols

Sequence of
Operations



AWS. Welding Symbols

Dimensions- Leg Length



=

Member B

