

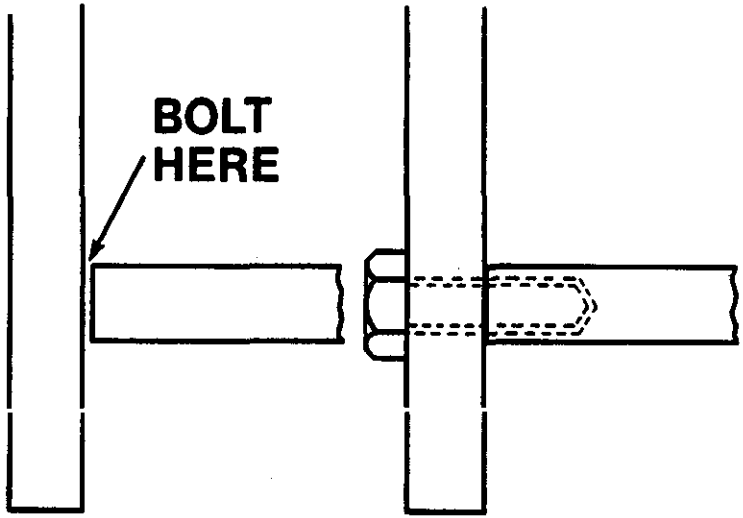
WELD SYMBOLS ON DRAWINGS

Lecture 16

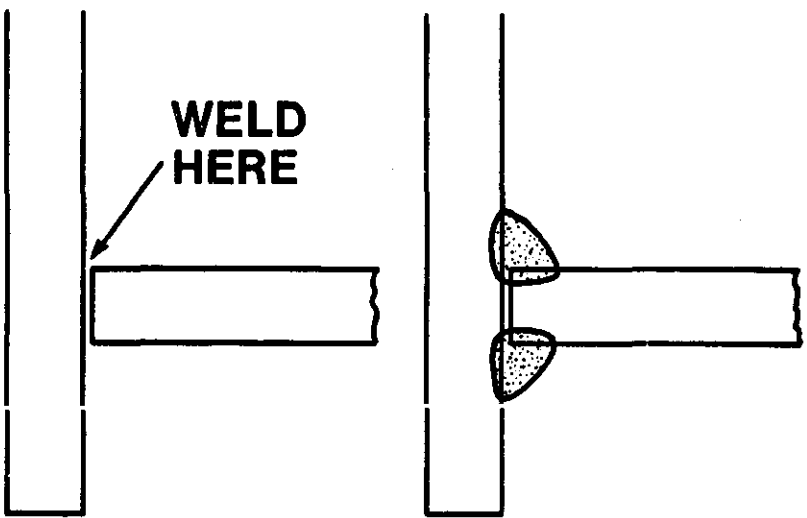
Section

SET D

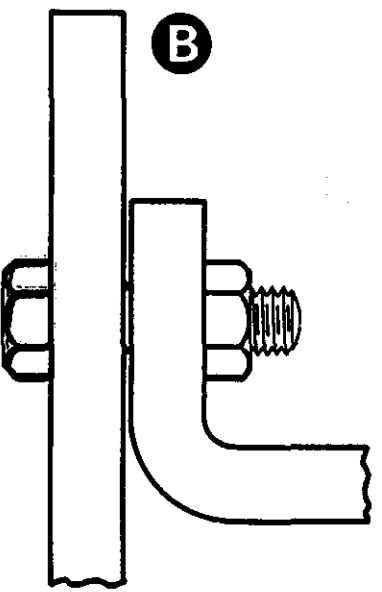
1. THE NEED TO SPECIFY WELDS
2. THE ADVANTAGES OF SYMBOLS
3. WELD SYMBOLS 1, BUTT/GROOVE WELDS
4. WELD SYMBOLS 2, BACKING/SEALING RUN, FILLET, PLUG, SPOT AND SEAM WELDS
5. WELD SYMBOLS 3, ANSI/AWS SPECIALS
6. LOCATION OF SYMBOLS 1, BUTT WELDS
7. LOCATION OF SYMBOLS 2, BUTT WELDS
8. LOCATION OF SYMBOLS 3, FILLET WELDS
9. SUPPLEMENTARY SYMBOLS 1, WELD SURFACE SYMBOLS
10. SUPPLEMENTARY SYMBOLS 2
11. SUPPLEMENTARY SYMBOLS 3, ANSI/AWS
12. DIMENSIONS 1, BUTT WELD METAL
13. DIMENSIONS 2, BUTT WELD PREPARATION, ANSI/AWS
14. DIMENSIONS 3, FILLET WELD, TRANSVERSE
15. DIMENSIONS 4, FILLET WELD, TRANSVERSE
16. DIMENSIONS 5, FILLET WELD, LONGITUDINAL, ISO/BS
17. DIMENSIONS 6, FILLET WELD, LONGITUDINAL, ANSI/AWS
18. PROCESS IDENTIFICATION
19. STUD WELDS
20. SPOT AND SEAM WELDS
21. NONDESTRUCTIVE TESTING SYMBOLS, ANSI/AWS
22. EXERCISE 1, FLANGE ENDED PIPE
23. EXERCISE 2, VESSEL
24. EXERCISE 3, TANK
25. EXERCISE 4, BEAM



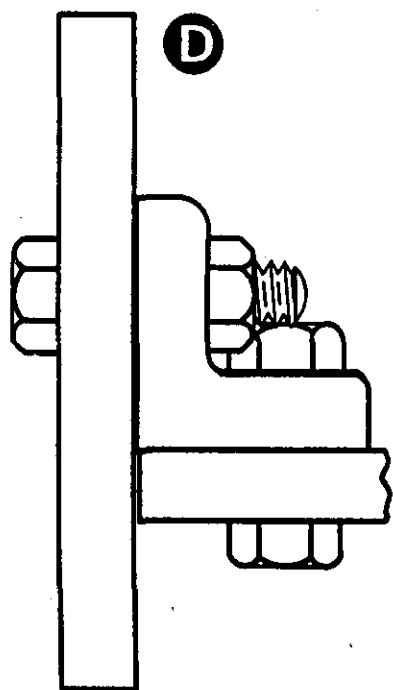
**BOLT
HERE**



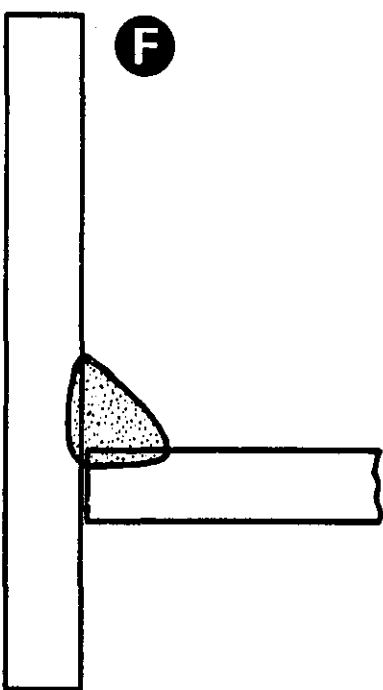
**WELD
HERE**



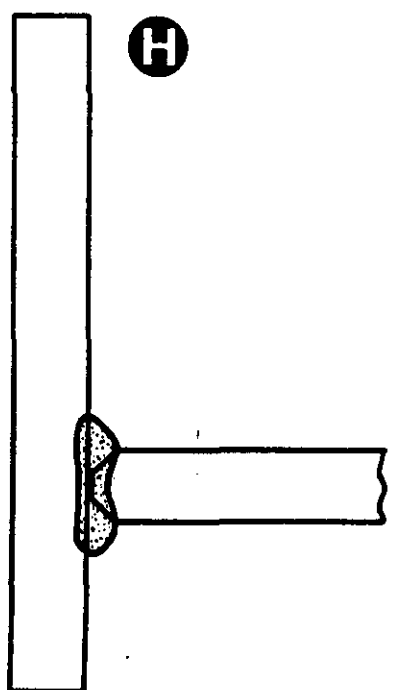
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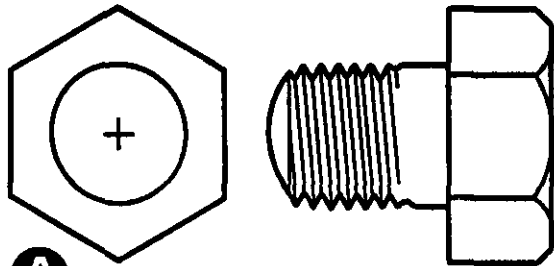
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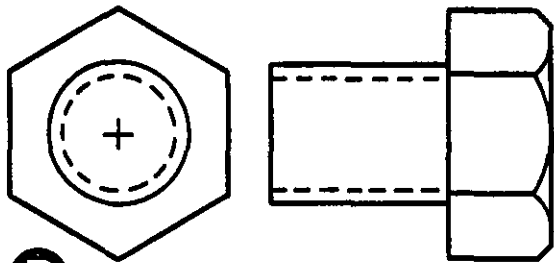
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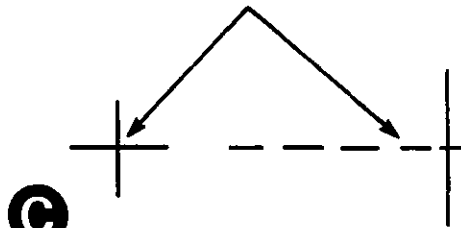


A



B

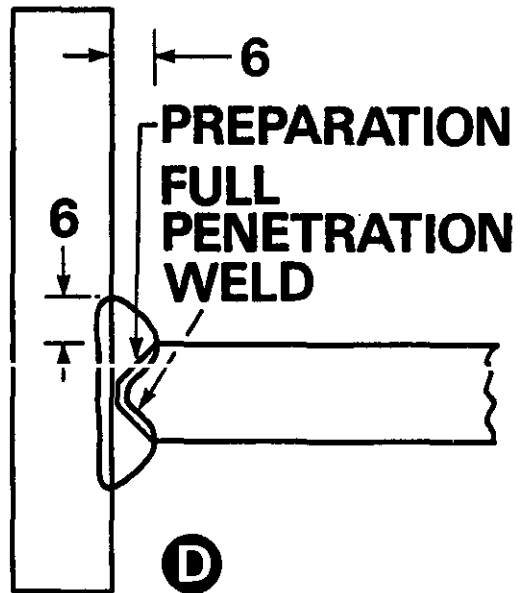
M15 X 25 BOLT



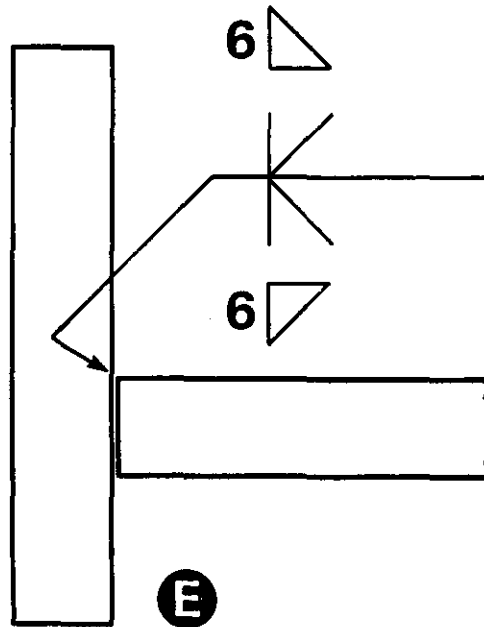
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WI 2

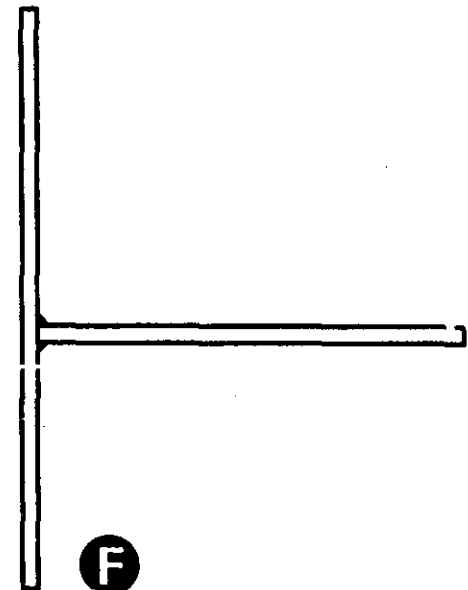
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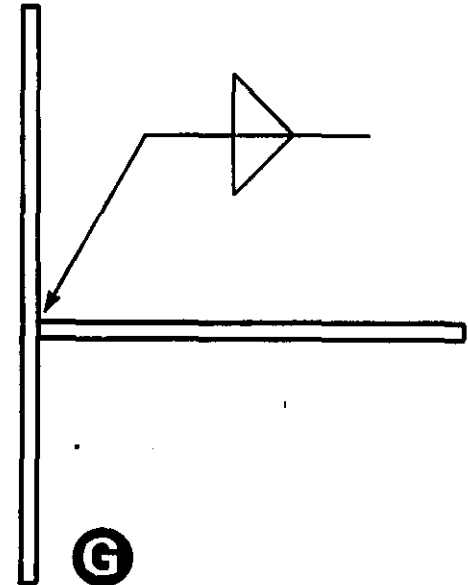
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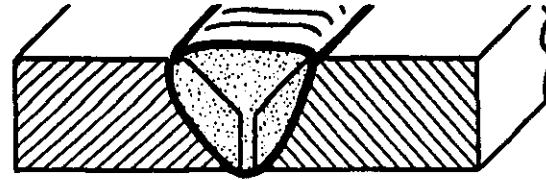
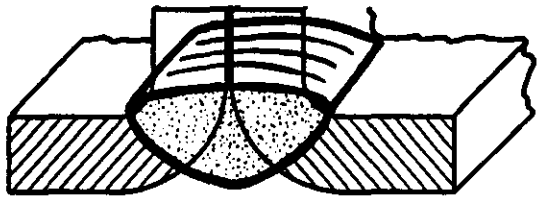
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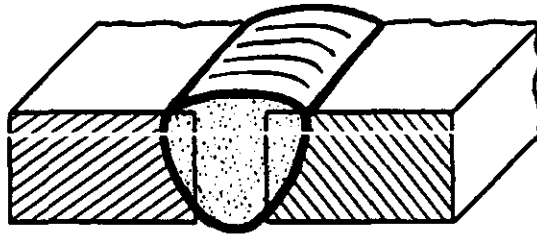
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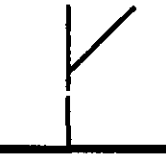
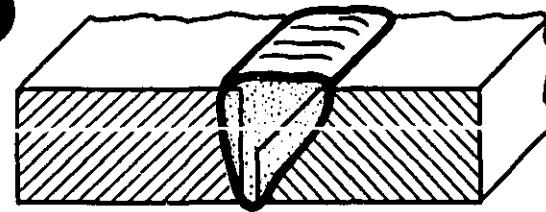
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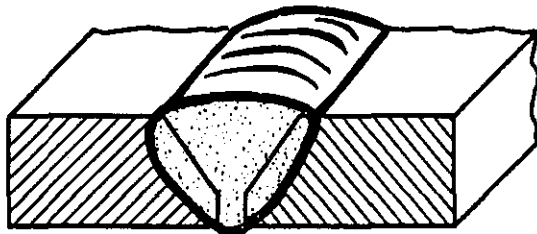
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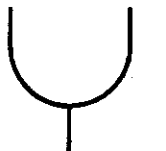
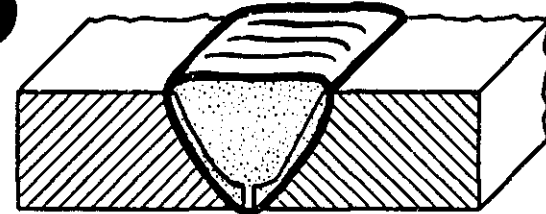
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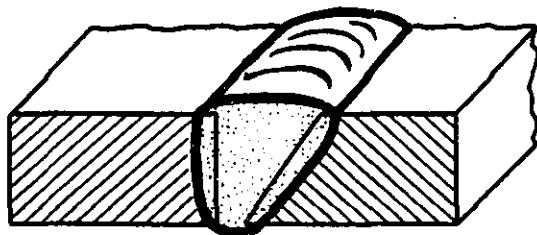
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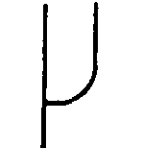
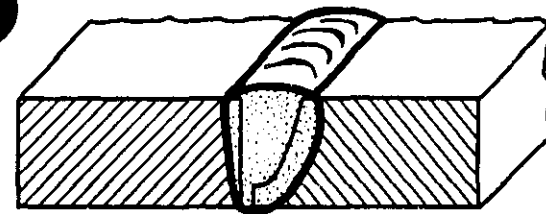
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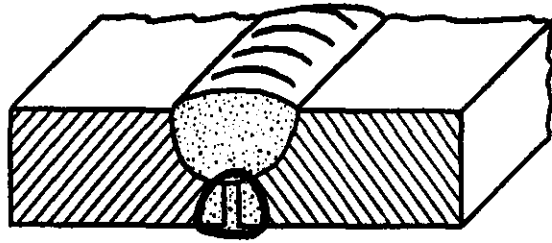
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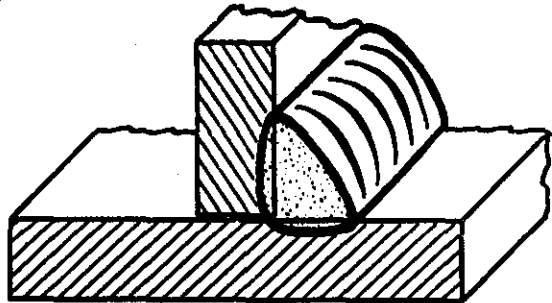
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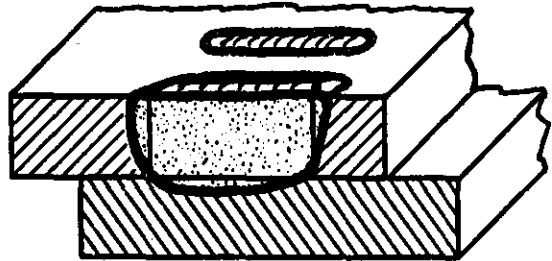
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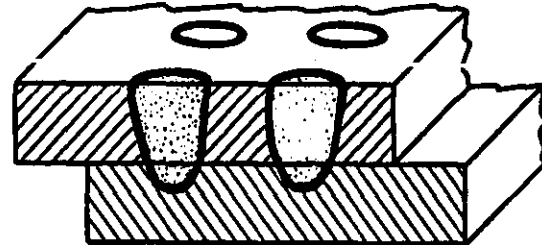
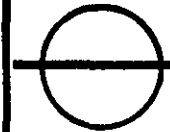
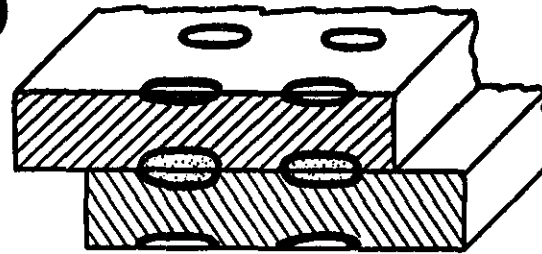
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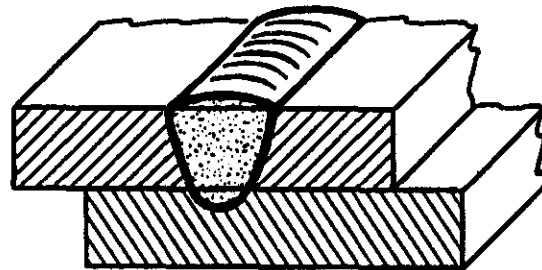
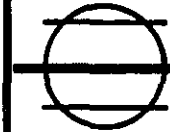
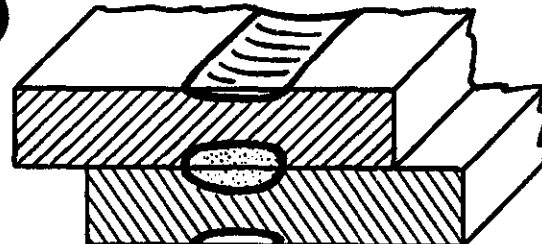
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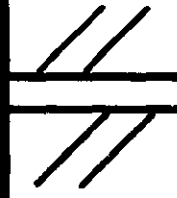
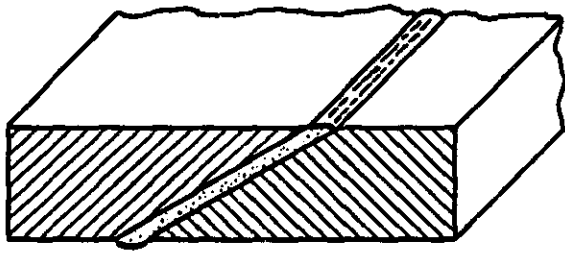
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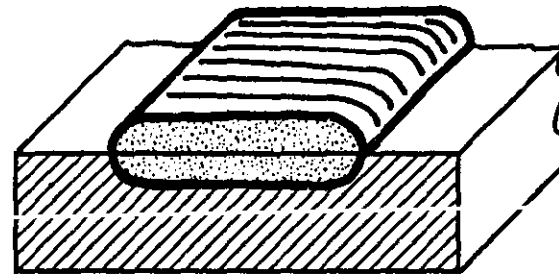
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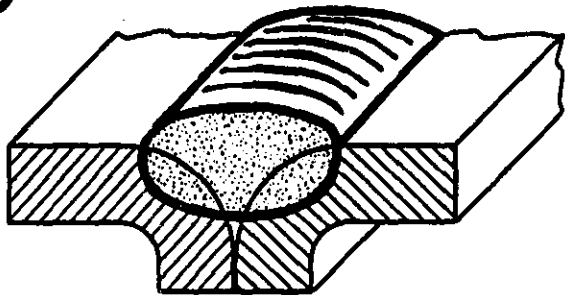
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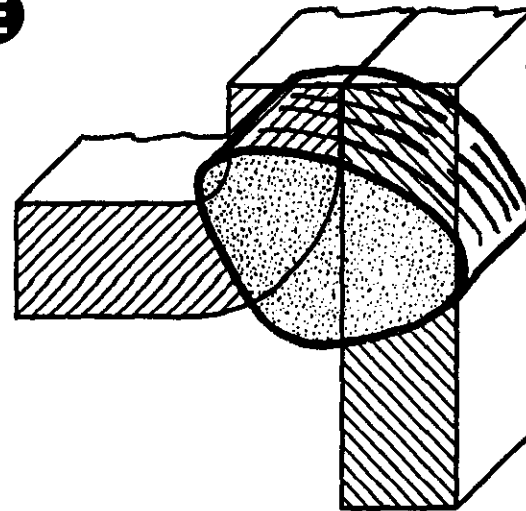
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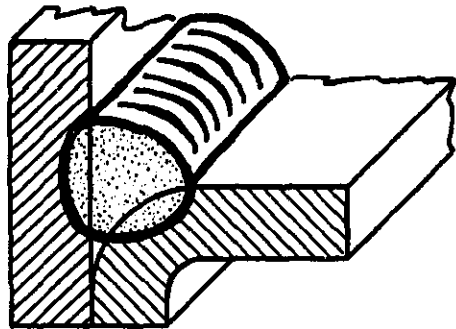
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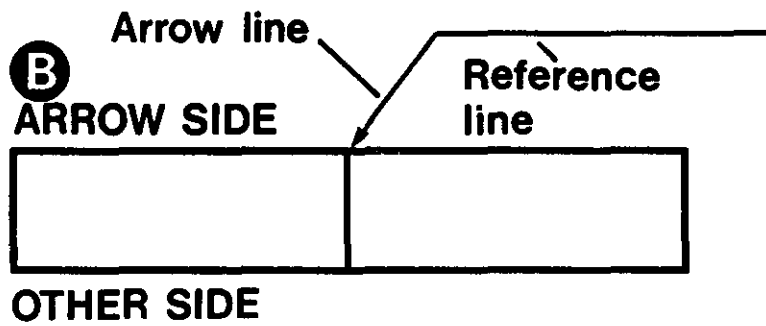
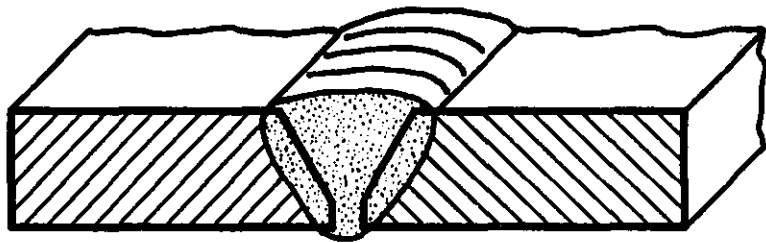
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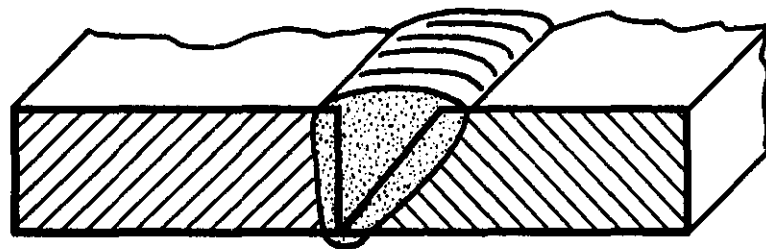
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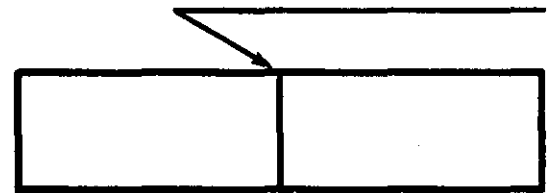
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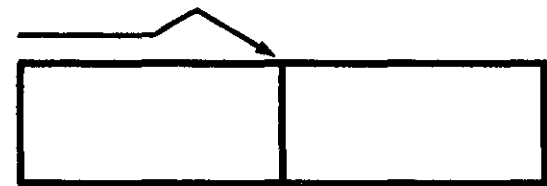
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D



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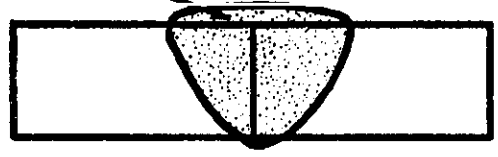
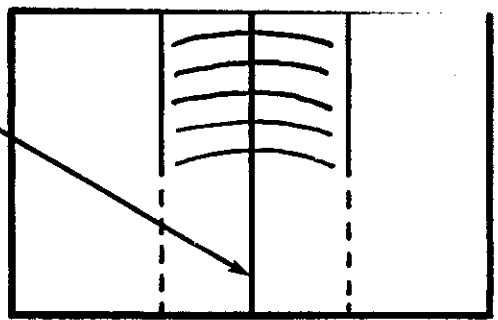


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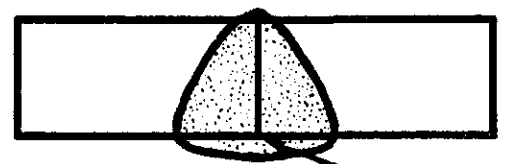


OTHER SIDE SYMBOL

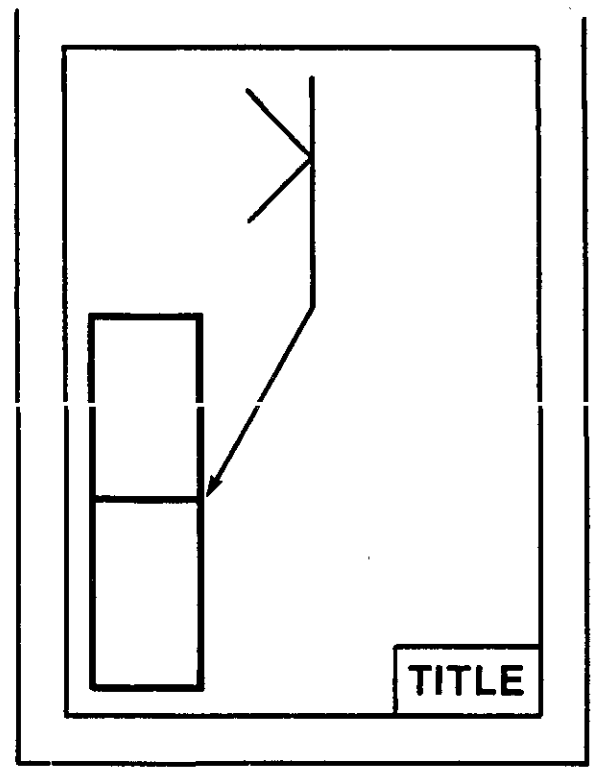
ARROW SIDE SYMBOL



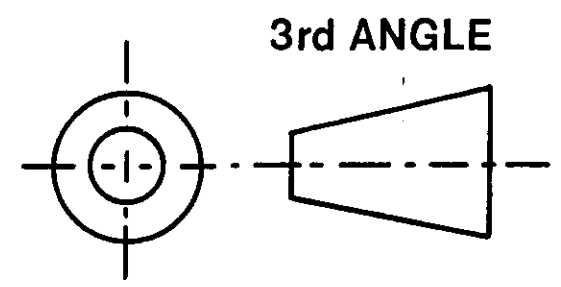
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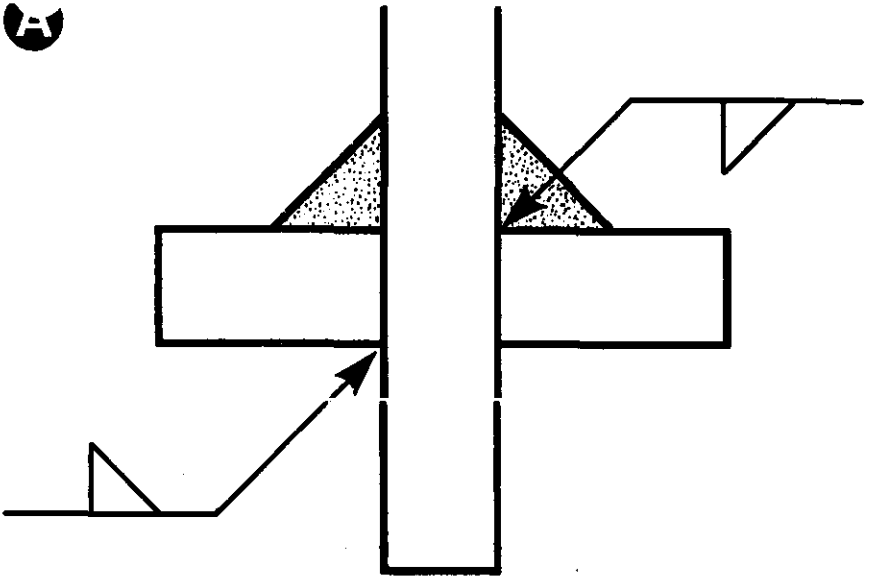
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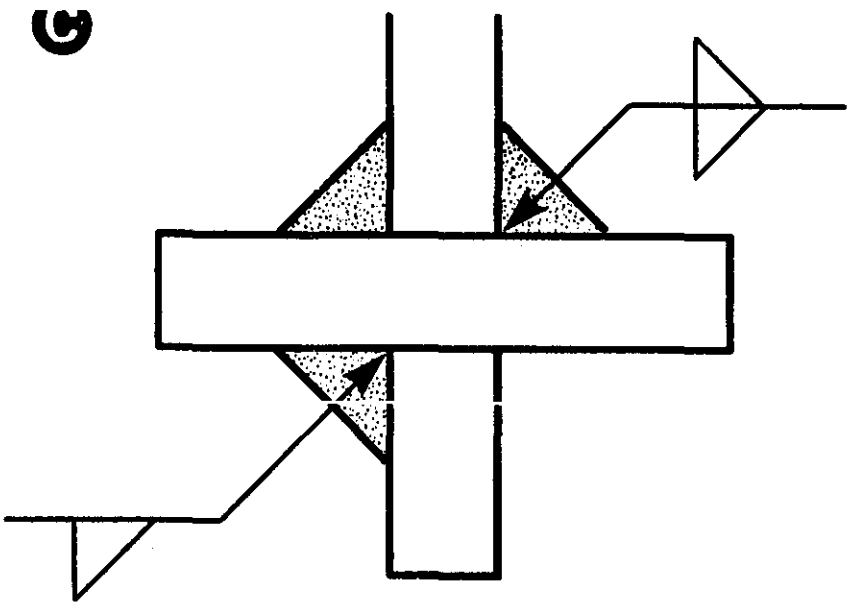
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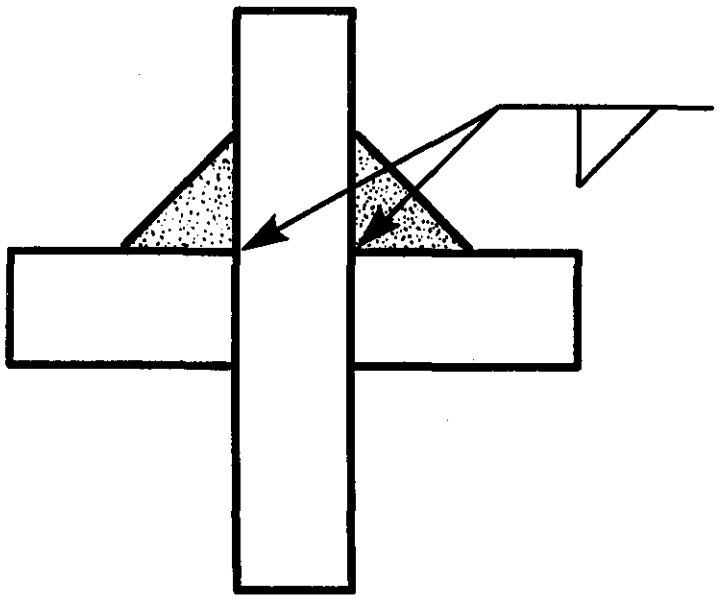
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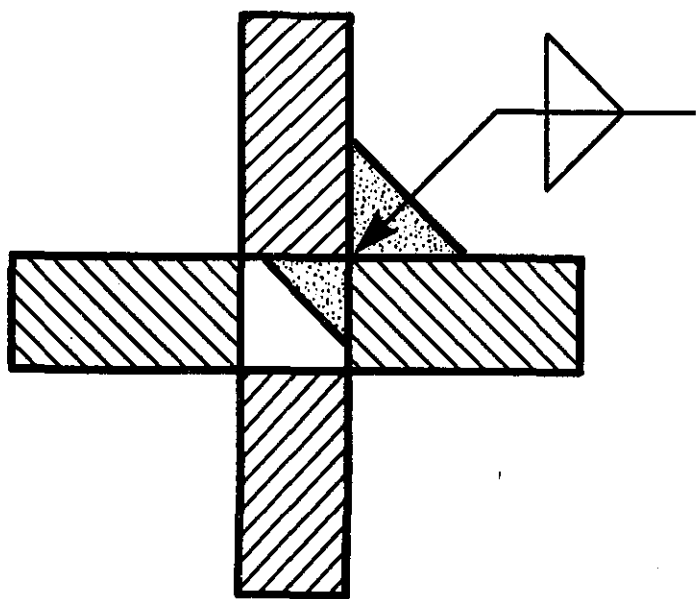
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B



D

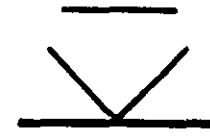
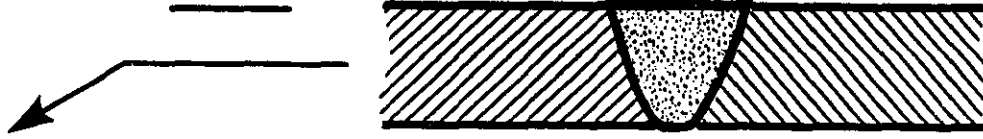


W 8

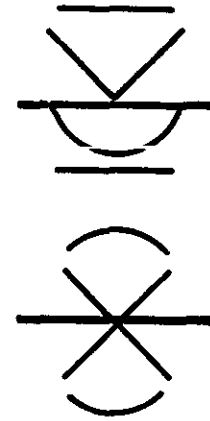
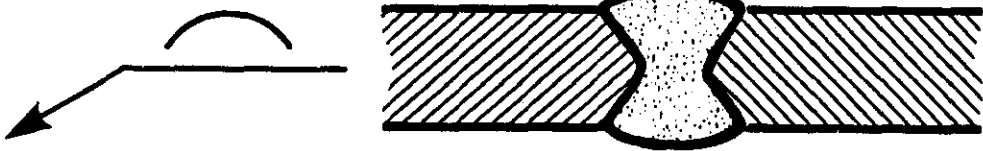
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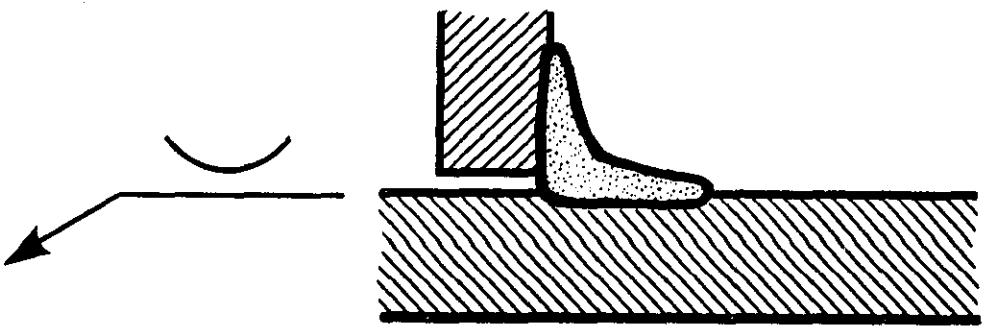
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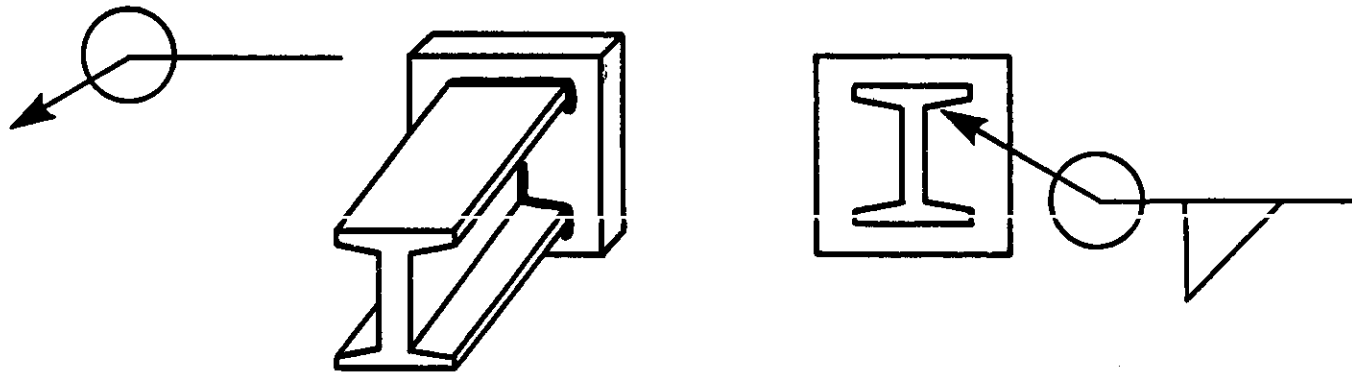
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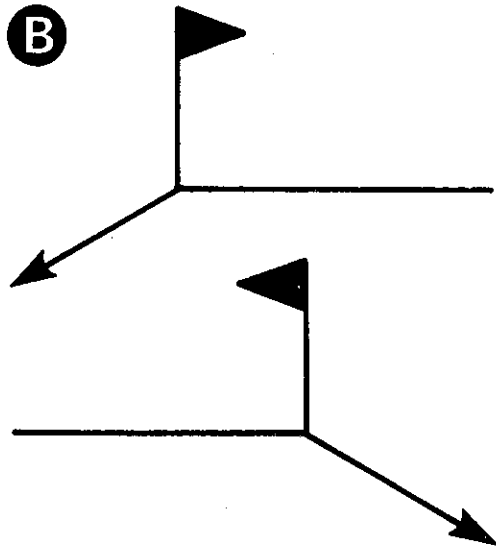
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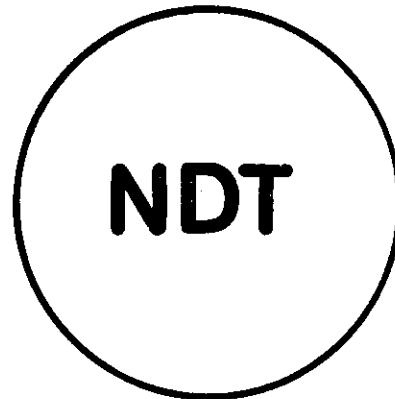
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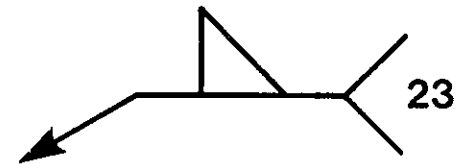
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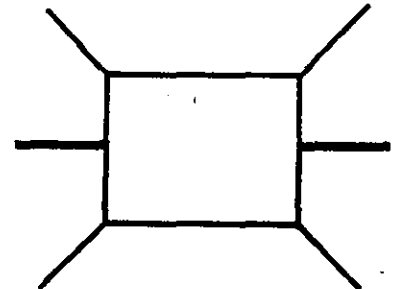
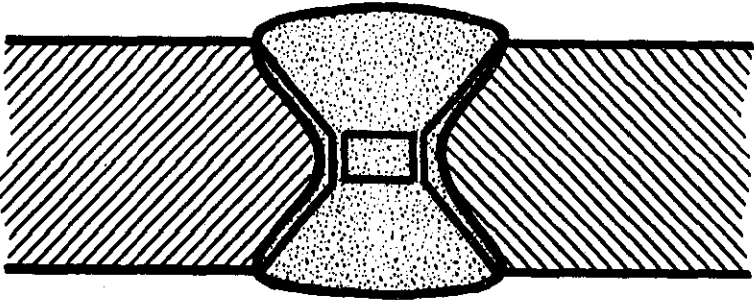
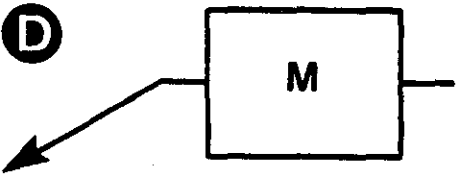
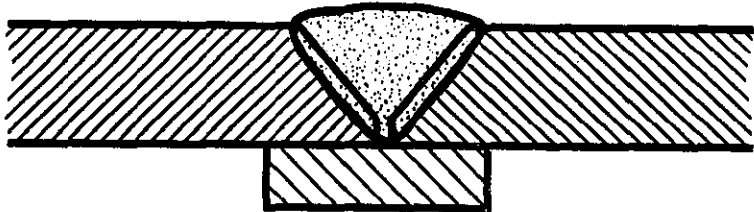
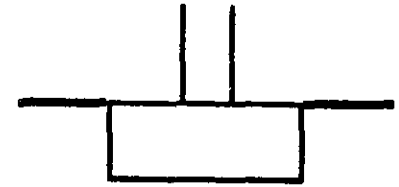
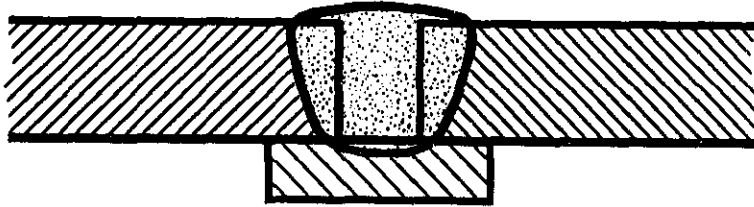
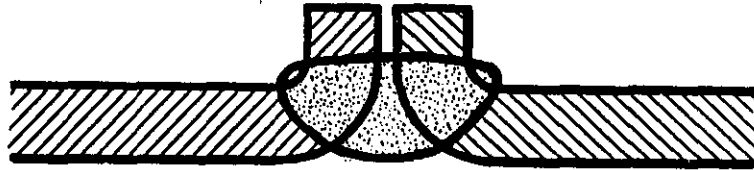


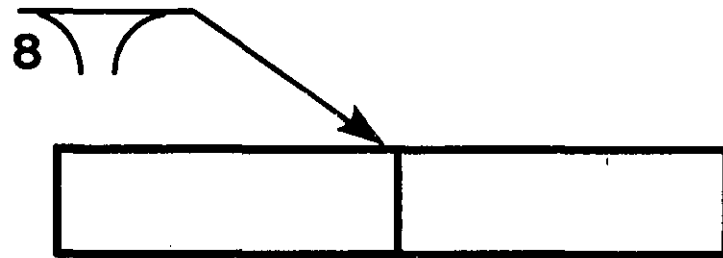
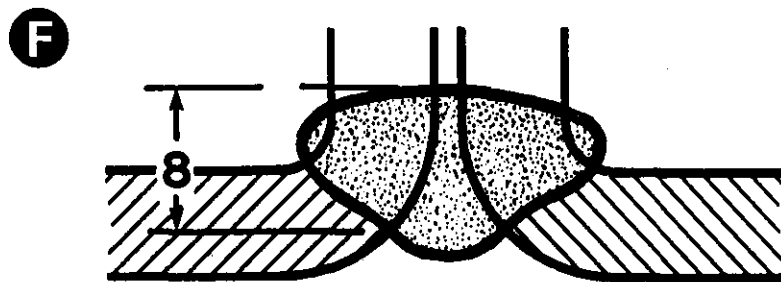
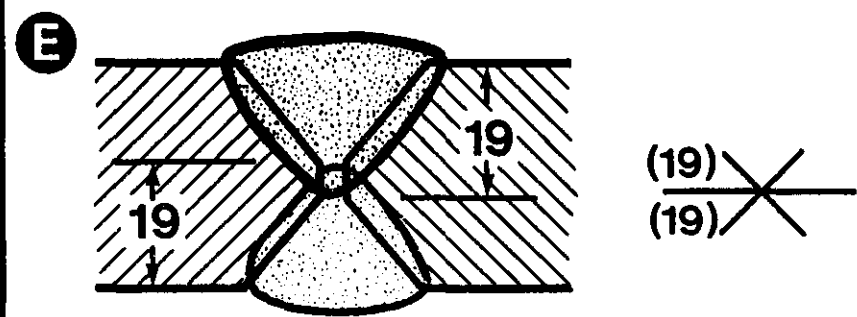
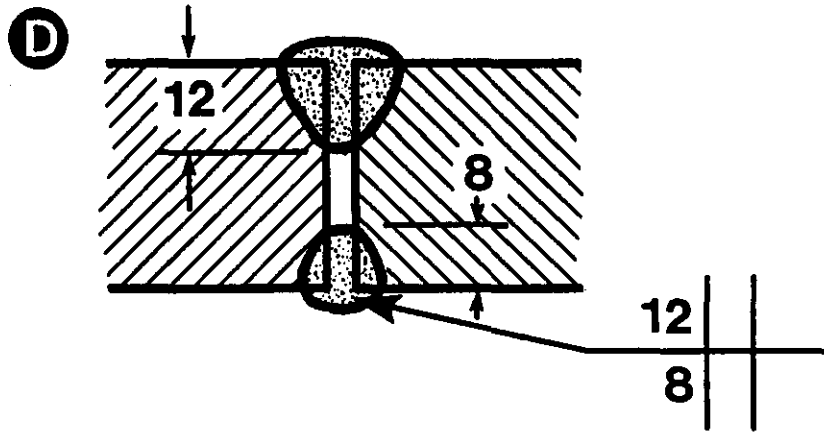
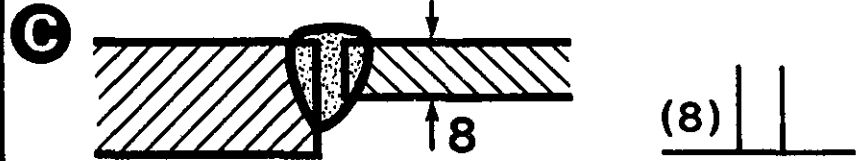
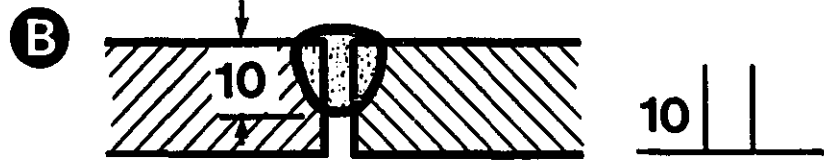
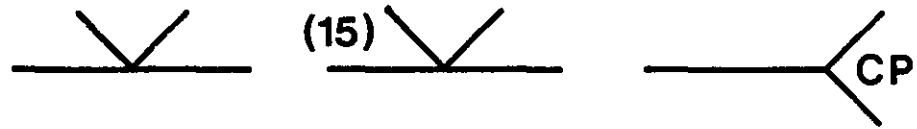
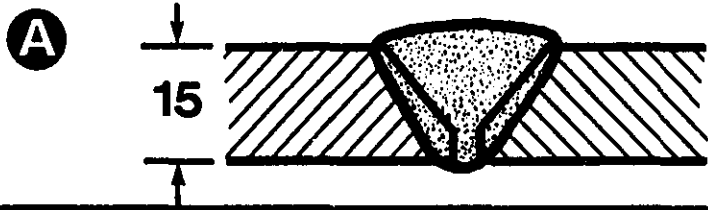
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D





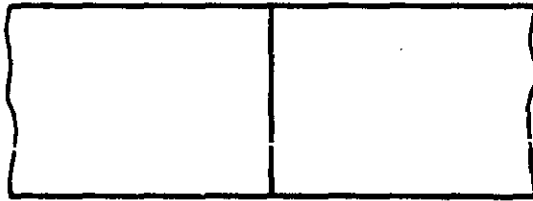
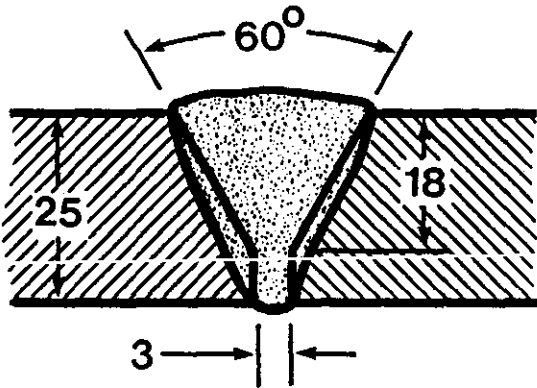


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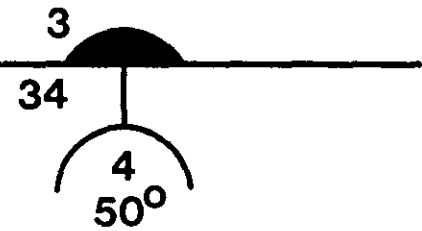
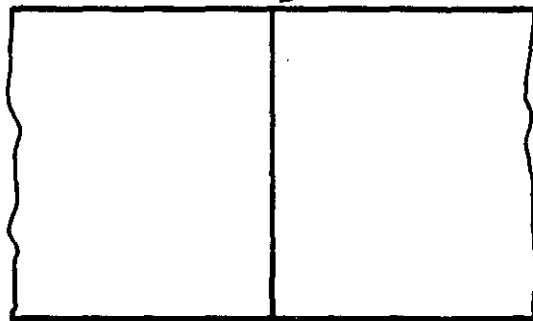
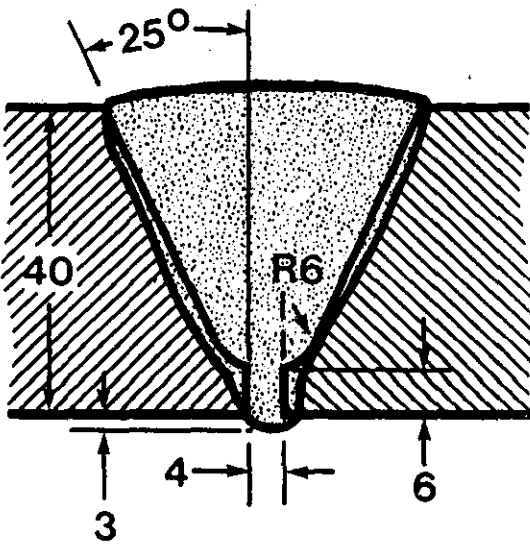


121

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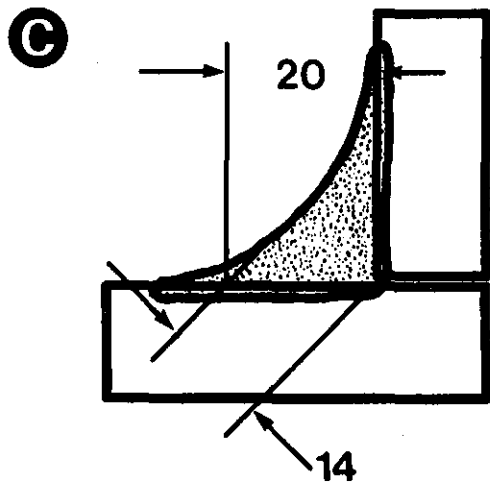
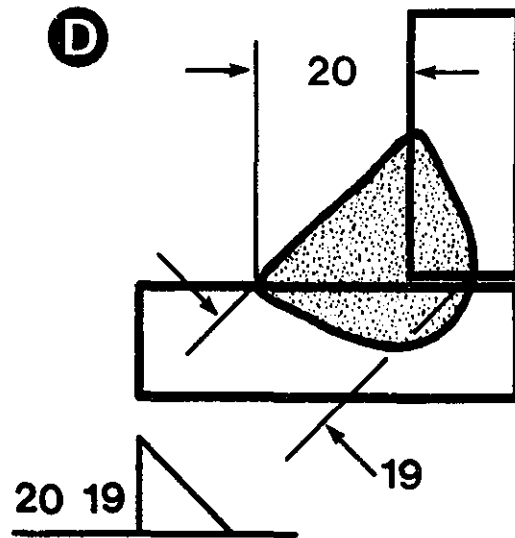
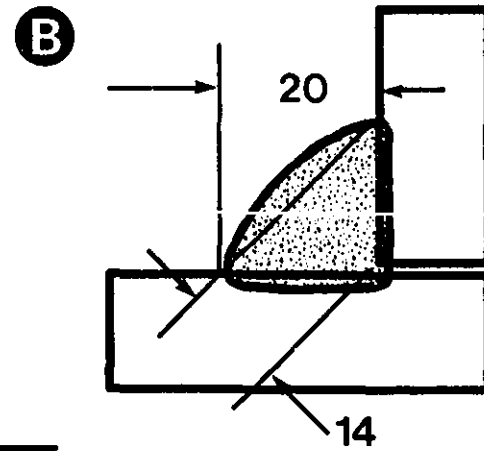
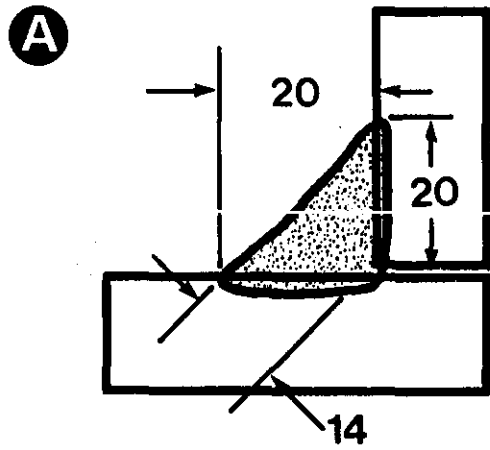


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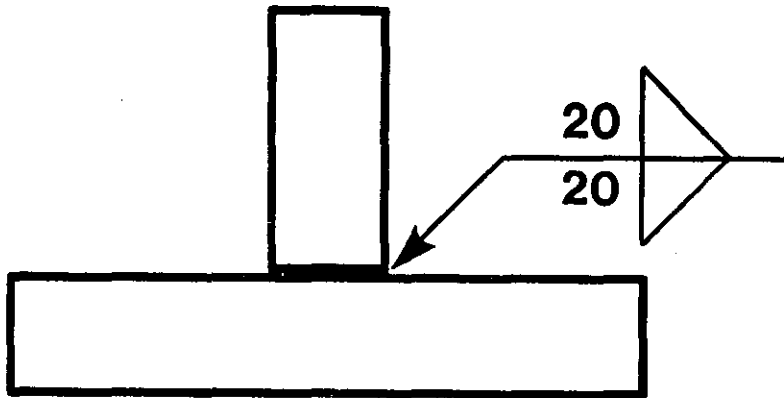


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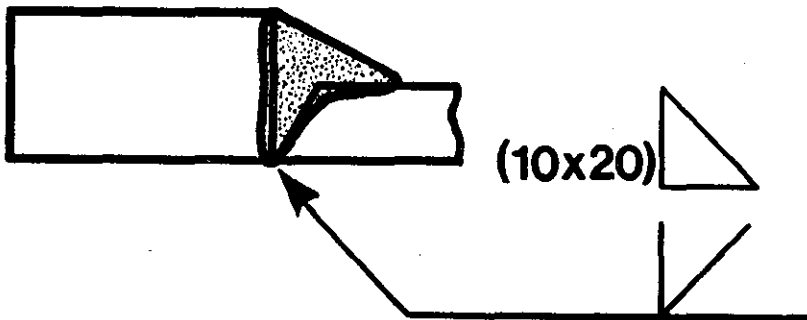
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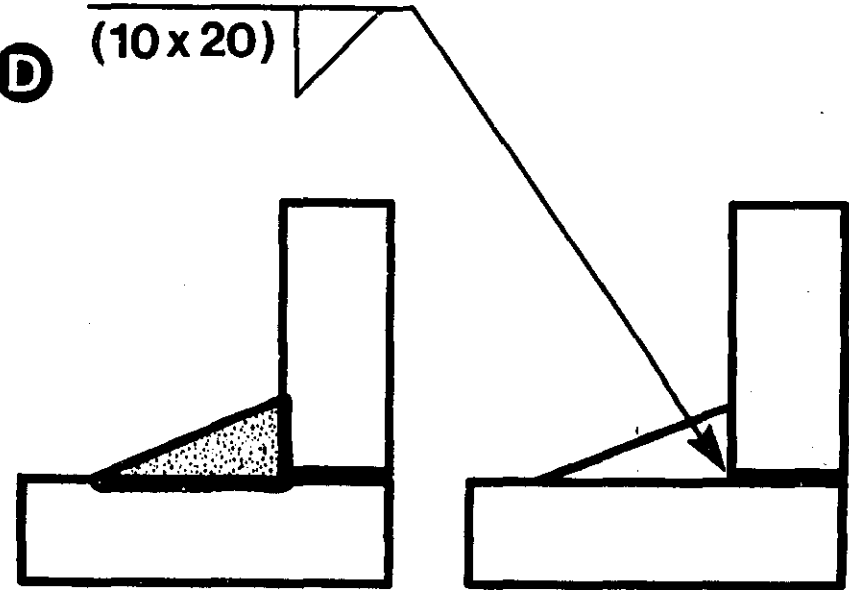
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3, 4, 5, 6, 8, 10, 12, 16, 18, 20, 22, 25

C

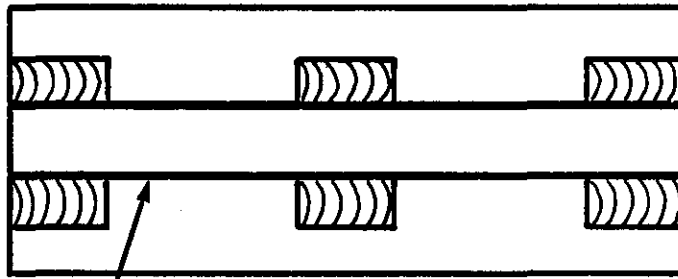
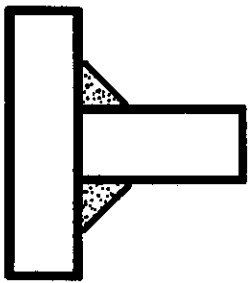
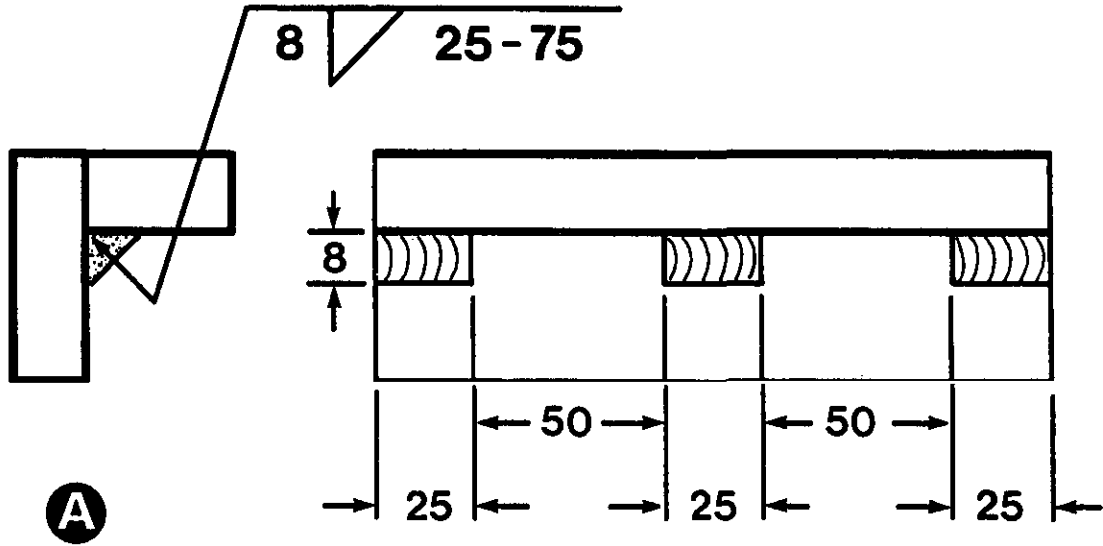
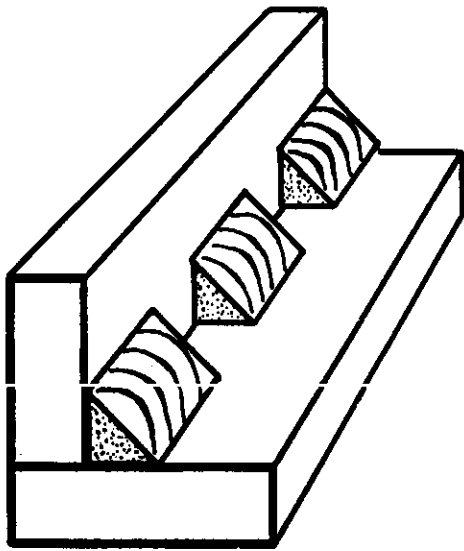


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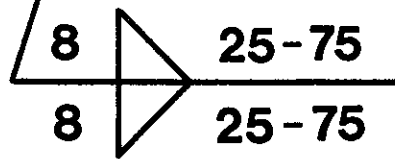


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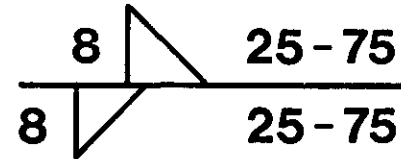
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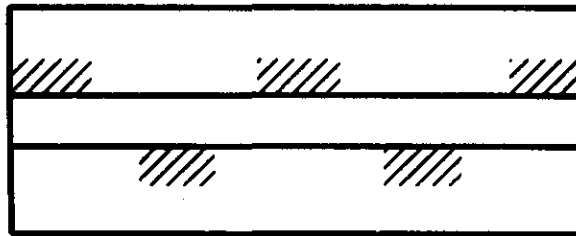
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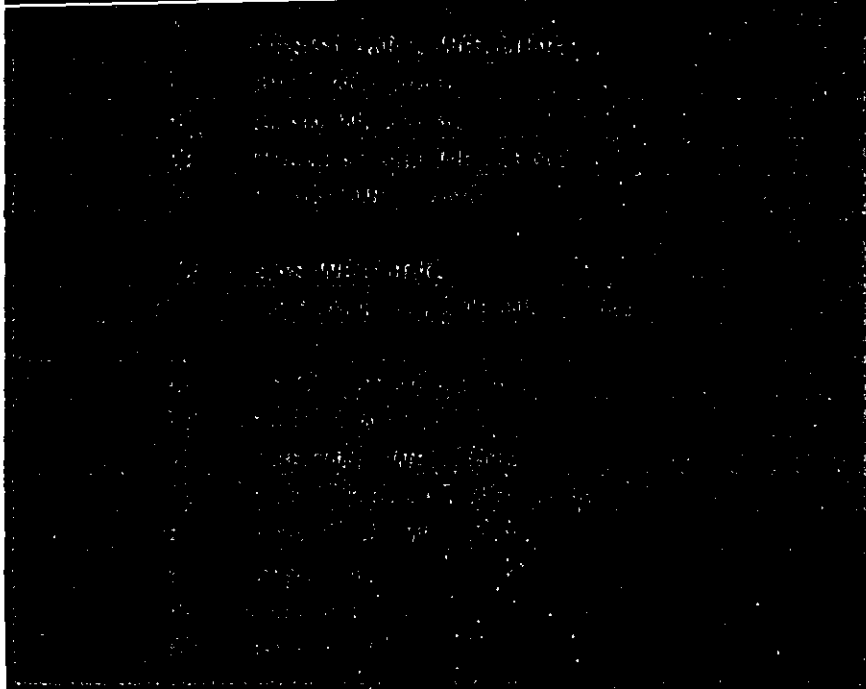
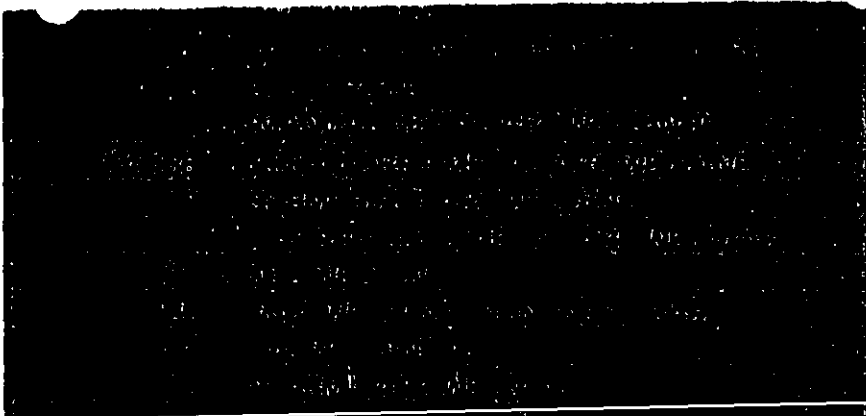


C



D





ARC WELDING	AW
SHIELDED METAL ARC WELDING	SMAW
FLUX CORED ARC WELDING	FCAW
SUBMERGED ARC WELDING	SAW
GAS METAL ARC WELDING	GMAW
GAS TUNGSTEN ARC WELDING	GTAW
PLASMA ARC WELDING	PAW
RESISTANCE WELDING	RW
RESISTANCE SPOT WELDING	RSW
RESISTANCE SEAM WELDING	RSEW
PROJECTION WELDING	RPW
FLASH WELDING	FW
OXYFUEL GAS WELDING	OFW
OXYACETYLENE WELDING	OAW
FRICTION WELDING	FRW
FORGE WELDING	FOW
THERMIT WELDING	TW
ELECTROSLAG WELDING	ESW
STUD ARC WELDING	SW
BRAZING	B
SOLDERING	S

SUFFIXES

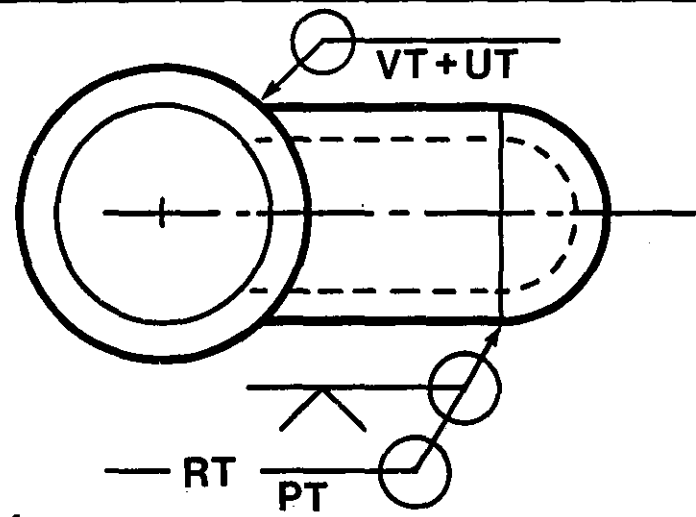
AUTOMATIC MACHINE	AU ME	MANUAL SEMI-AUTOMATIC	MA SA
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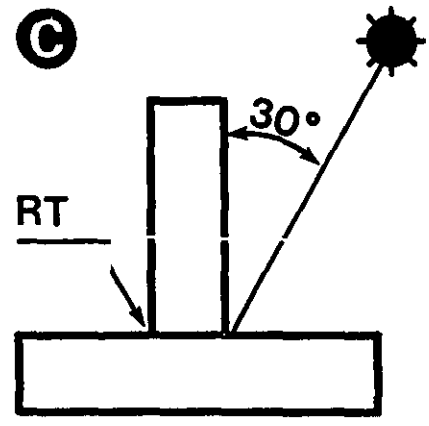
A

Type of test	Symbol
ACOUSTIC EMISSION	AET
EDDY CURRENT	ET
LEAK	LT
MAGNETIC PARTICLE	MT
NEUTRON RADIOGRAPHIC	NRT
PENETRANT	PT
PROOF	PRT
RADIOGRAPHIC	RT
ULTRASONIC	UT
VISUAL	VT

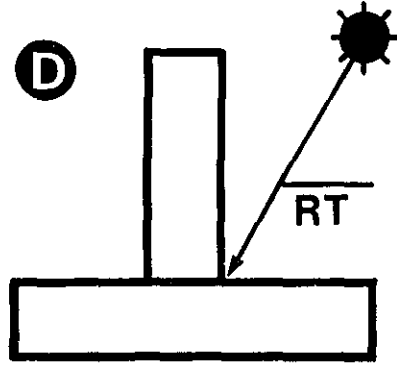
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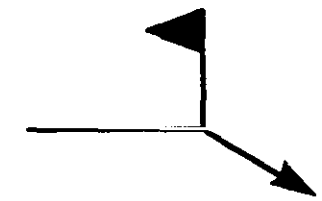
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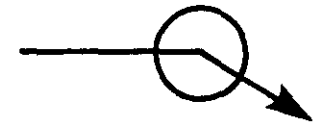
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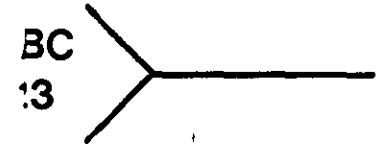
E

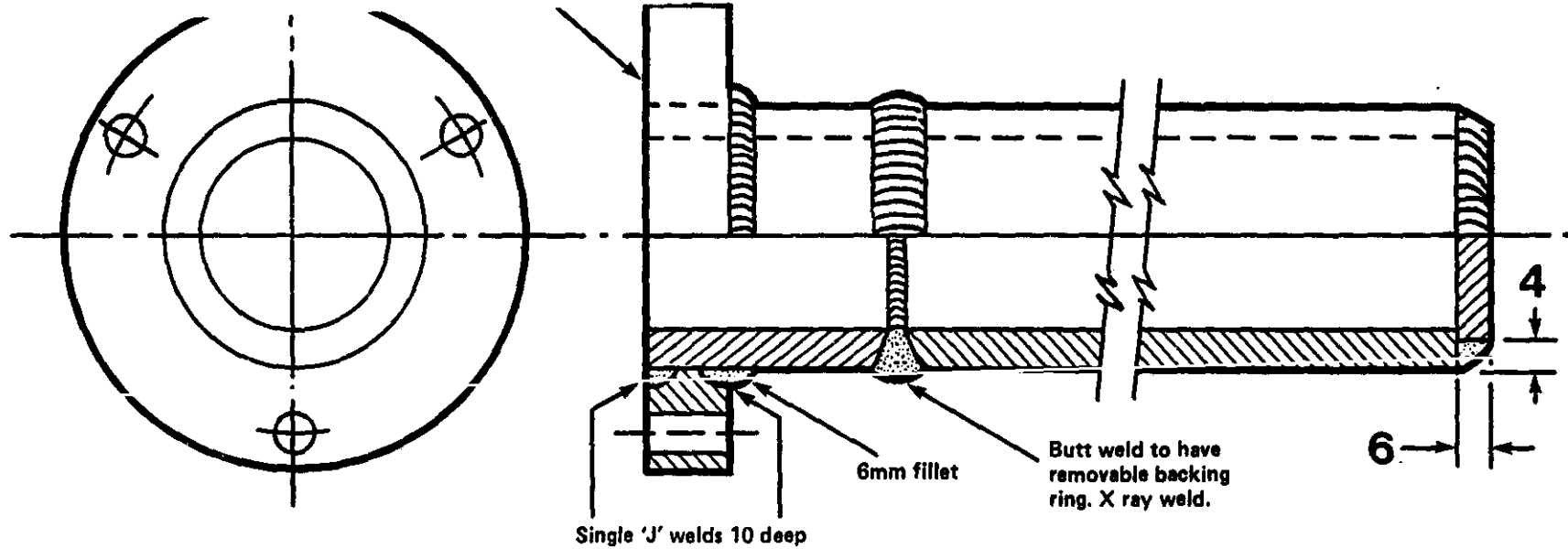


F



G





All dimensions in millimetres

FLANGE ENDED PIPE

SECTION 23: EXERCISE 2, VESSEL

23 (Base transparency
+ 2 overlays)

BASE TRANSPARENCY

Symbols representing welds to be made: letters in circles are for ease of reference below only.

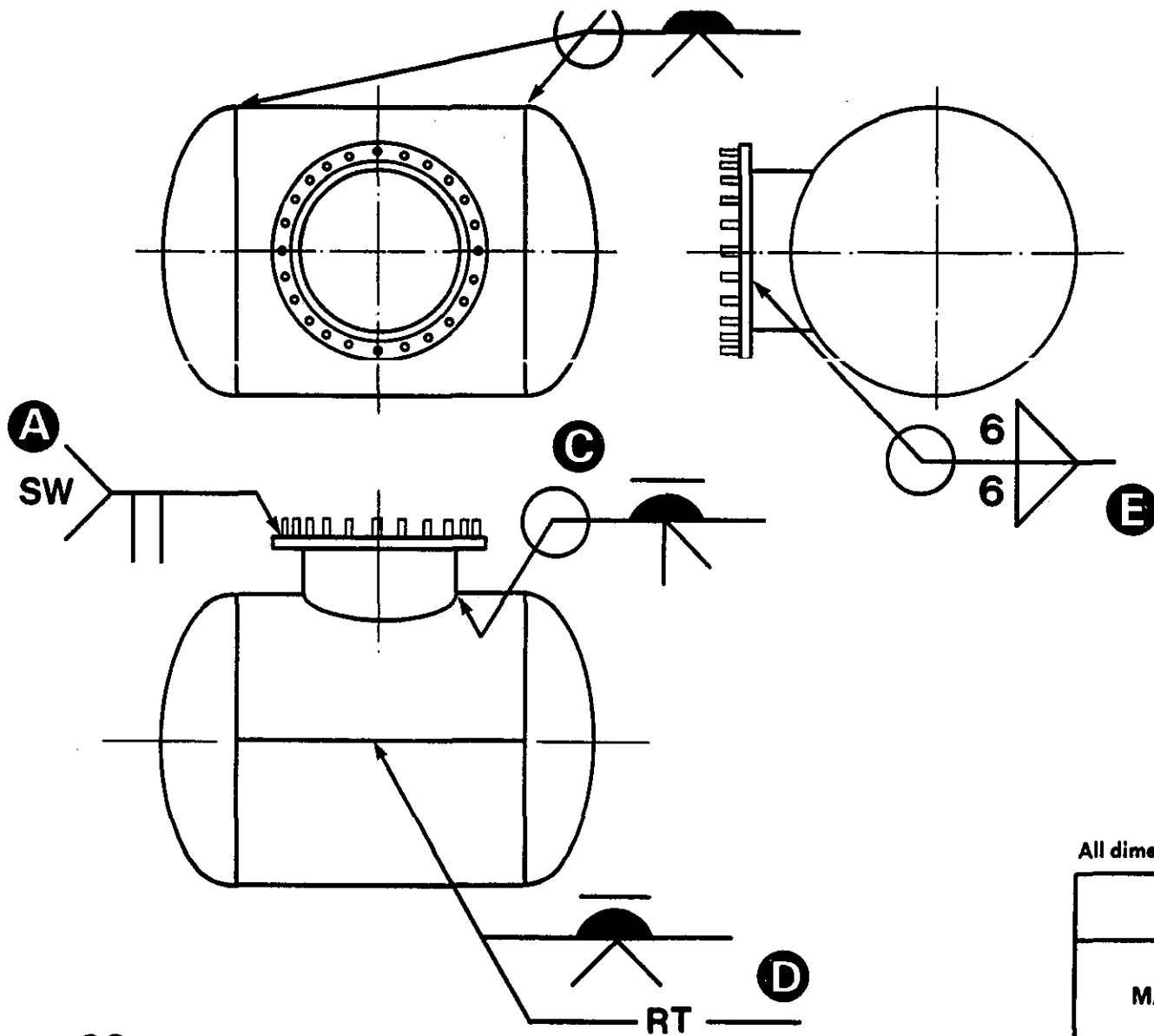
Problem 1. Describe welds to be made, with sketches where necessary.

Comments

- 1 The standard used for welding symbols has not been identified: there are six clear indications that it is to ANSI/AWS.
A: process abbreviation in fork is alphabetical.
B, C, D: 3 x 'melt-thru' symbols.
B and D: 2 x 'radiographic test' symbol.
 - 2 A: stud arc welding, confirmed by studs on drawing.
 - 3 B and D: single-V butt weld with melt-thru, ground flush inside and radiographed.
 - 4 C: single-bevel butt weld, stub pipe only bevelled, (set-on branch), with melt-thru, ground flush inside.
 - 5 E: fillet weld, of 6mm leg length, both sides of joint. See sketches on overlay (a) for interpretation.
- a **OVERLAY:** possible interpretations of flange to tube joint E.
F: this is consistent with the weld symbol, but the view does not show the expected projection of the tube through the flange: also a form unlikely to be used, because of clearance problems.
G, H: consistent with weld symbol and drawing. To decide between these two, it would be necessary to have details of the flange.

Problem 2. Modify symbols to conform to BS 499: Part 2: 1980, with joint as at H.

- b **OVERLAY:** symbols to BS, solution to problem 2.
I: symbol replacing A.
J: symbol replacing B: note that BS can only specify NDT, not specifically radiography. As there is no 'melt-thru' symbol, only full penetration and a flat rear face can be specified: the symbol requirements would be met by welding to produce a substantially flat surface, without further treatment.
K: symbol replacing C
L: symbol replacing D
M: Symbol replacing E } see comments on J above



All dimensions in millimetres

VESSEL

MATERIAL:
STAINLESS STEEL
BODY 6mm
FLANGE 20mm

W 23

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SECTION 25: EXERCISE 4, BEAM

25 (Base transparency and overlay)

BASE TRANSPARENCY

Sketch of beam, not to scale, to be assembled by manual metal arc welding in the shop and on site.

Problem. Sketch in welding details and symbols to BS 499: Part 2: 1980 (or other standard as instructed).

a **OVERLAY: SOLUTION.** (Letters in circles are for reference below only).

Comments

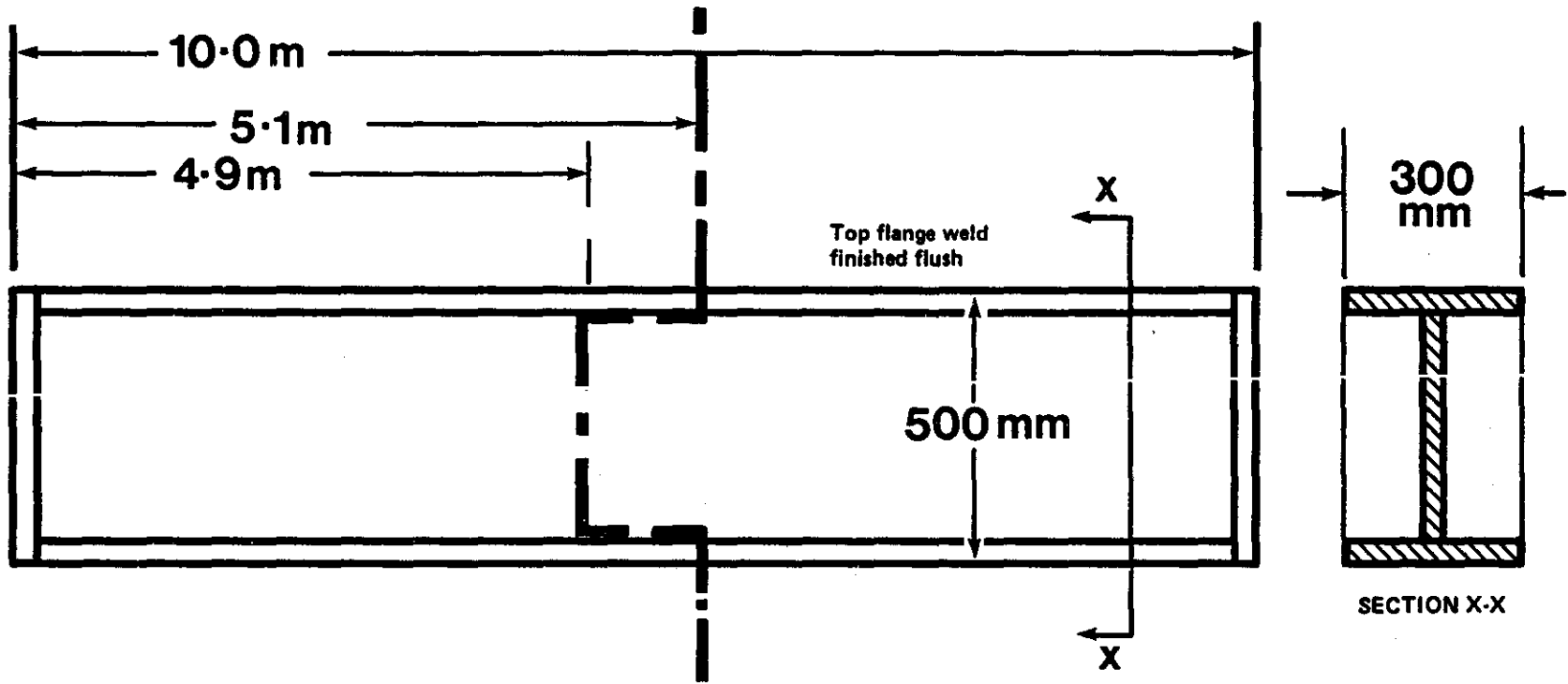
A Cope-holes have been introduced to avoid the need to dress welds where they meet other welds, and to avoid welding up into corners, often a site for defects.

B We cannot use a 'weld all round' symbol for the end flange joints, as it cannot go over top and bottom of the flanges, and it is interrupted by the cope-holes.

C Similarly to B, the web-to-flange joints are in four sections, needing four arrows if they are to be shown individually.

The spacing in BS is not the pitch (here 300mm) but the distance between the ends of weld elements, here $(300-100) = 200\text{mm}$.

D A suggestion to be taken seriously! Apart from simplifying the drawing, complete shop fabrication can considerably reduce the costs of welding and of quality assurance.



FLANGES	15mm
WEB	10mm
END PLATES	20mm

End flanges: 12mm fillet weld
all round (inside)

Flange-to-web: 12mm fillet welds
100mm long, 300mm pitch each
side, alternately each side.

Not to scale

SKETCH FOR BEAM

25

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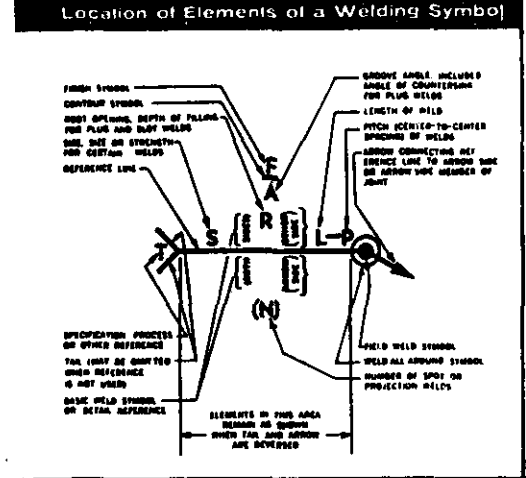
Basic Weld Symbols and Their Location Significance

LOCATION SIGNIFICANCE	FILLET	PLUG OR SLOT	SPOT OR PROJECTION	SEAM	GROOVE						BACK OR BACKING	SURFACING	FLANGE		ARC SPREAD OR ARC SPREAD	RESISTANCE	PROJECTION	RESISTANCE	FLASH UPSET	
					FLASH UPSET SQUARE	V	BEVEL	U	J	FLARE V			FLARE BEVEL	EDGE						CORNER
ARROW SIDE																				
OTHER SIDE																				
BOTH SIDES		NOT USED	NOT USED	NOT USED								NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	
NO ARROW SIDE OR OTHER SIDE SIGNIFICANCE	NOT USED	NOT USED			NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED	NOT USED		NOT USED	NOT USED	NOT USED	NOT USED				

Supplementary Symbols

WELD ALL AROUND	FIELD WELD	MELT-THRU	CONTOUR	
FLUSH	CONVEX	CONCAVE		

Typical Welding Symbols



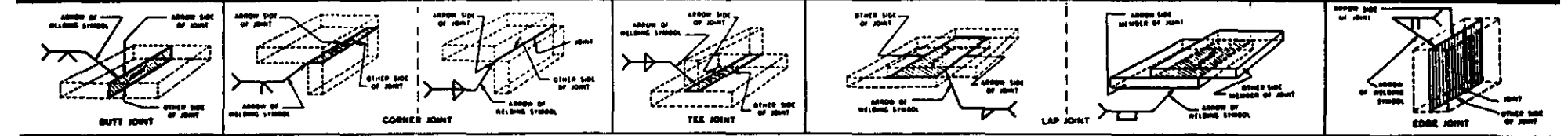
BACK OR BACKING WELD SYMBOL 	SINGLE V-GROOVE WELDING SYMBOL INDICATING ROOT PENETRATION 	PROJECTION WELDING SYMBOL
SURFACING WELD SYMBOL INDICATING BUILT UP SURFACE 	DOUBLE BEVEL-GROOVE WELDING SYMBOL 	SEAM WELDING SYMBOL
DOUBLE FILLET WELDING SYMBOL 	WELDING SYMBOLS FOR COMBINED WELDS 	FLASH OR UPSET WELDING SYMBOL
CHAIN INTERMITTENT FILLET WELDING SYMBOL 	PLUG WELDING SYMBOL 	SQUARE-GROOVE WELDING SYMBOL
STAGGERED INTERMITTENT FILLET WELDING SYMBOL 	SLOT WELDING SYMBOL 	FLARE-V AND FLARE-BEVEL-GROOVE WELDING SYMBOL
SINGLE V-GROOVE WELDING SYMBOL 	SPOT WELDING SYMBOL 	EDGE- AND CORNER-FLANGE WELD SYMBOLS

Supplementary Symbols Used with Welding Symbols

WELD-ALL-AROUND SYMBOL 	FIELD WELD SYMBOL 	MELT-THRU SYMBOL 	FLUSH-CONTOUR SYMBOL 	CONVEX-CONTOUR SYMBOL
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Basic Joints — Identification of Arrow Side and Other Side of Joint and

Arrow-Side and Other-Side Member of Joint



DESIGNATION OF WELDING PROCESSES BY LETTERS

CAW	Carbon-Arc Welding	PA	Plasma Arc Welding	RG	Resistance Brazing
CGW	Cold Chisel Welding	GTAW	Gas Tungsten-Arc Welding	RPW	Resistance Projection Welding
CPW	Cold Chisel Welding	GTAW	Gas Tungsten-Arc Welding	RPW	Resistance Projection Welding
CPW	Cold Chisel Welding	GTAW	Gas Tungsten-Arc Welding	RPW	Resistance Projection Welding
CPW	Cold Chisel Welding	GTAW	Gas Tungsten-Arc Welding	RPW	Resistance Projection Welding
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CPW	Cold Chisel Welding	GTAW	Gas Tungsten-Arc Welding	RPW	Resistance Projection Welding
CPW	Cold Chisel Welding	GTAW	Gas Tungsten-Arc Welding	RPW	Resistance Projection Welding

DESIGNATION OF CUTTING PROCESSES BY LETTERS

AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting
AC	Air Carbon-Arc Cutting

NONPREFERRED SYMBOLS: USE PREFERRED SYMBOL WITH PROCESS REFERENCE IN THE TAIL