

WELD SYMBOLS ON DRAWINGS

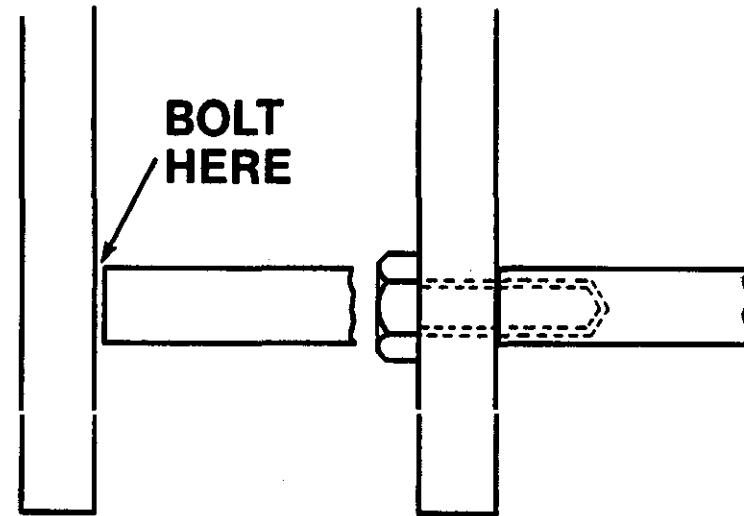
Lecture 16

Section

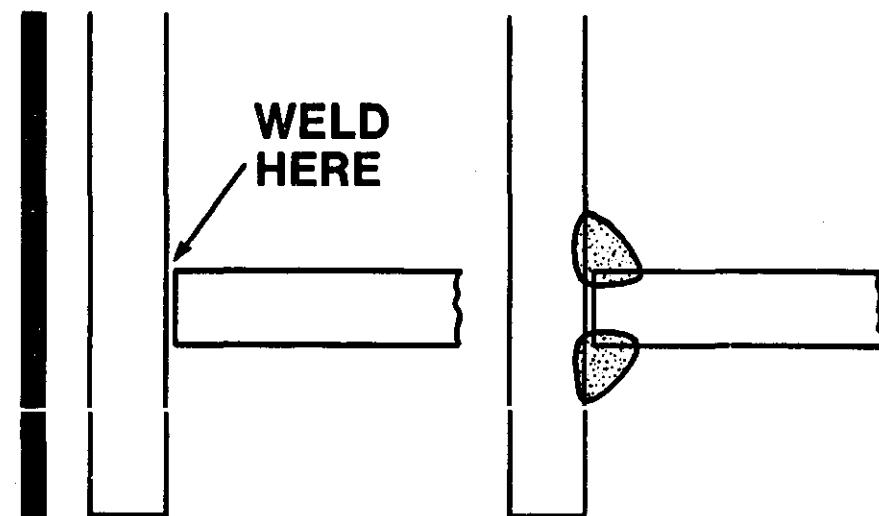
SET D

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

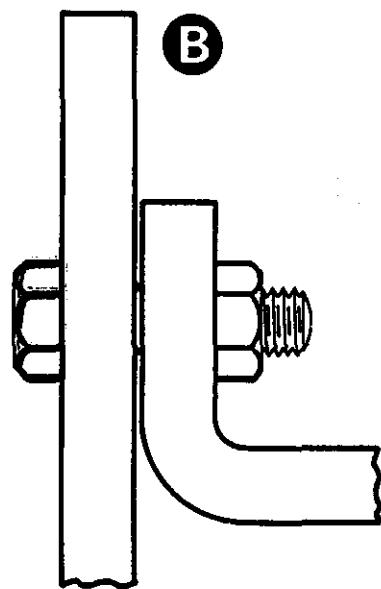
BOLT
HERE



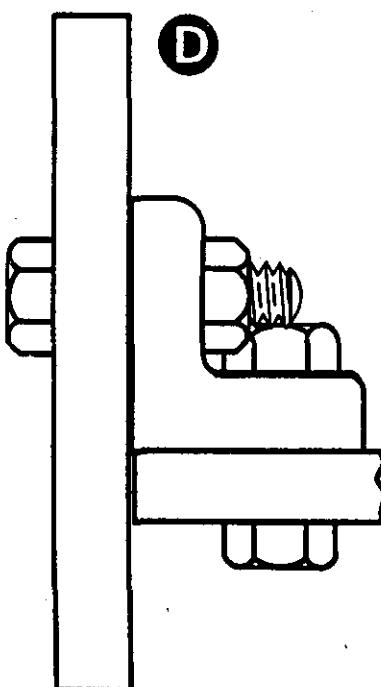
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HERE



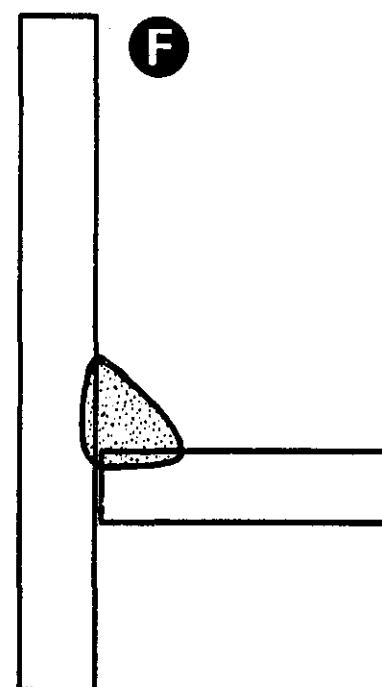
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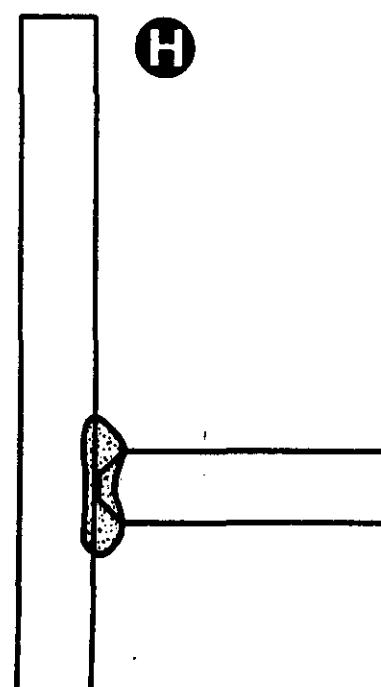
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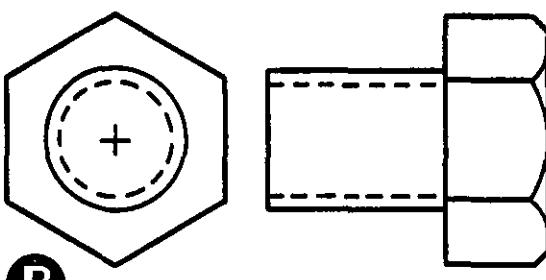
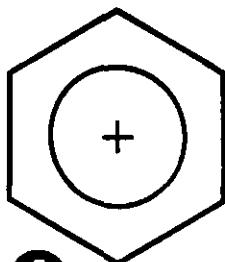
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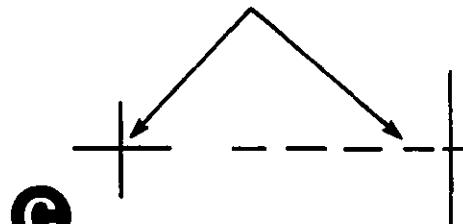
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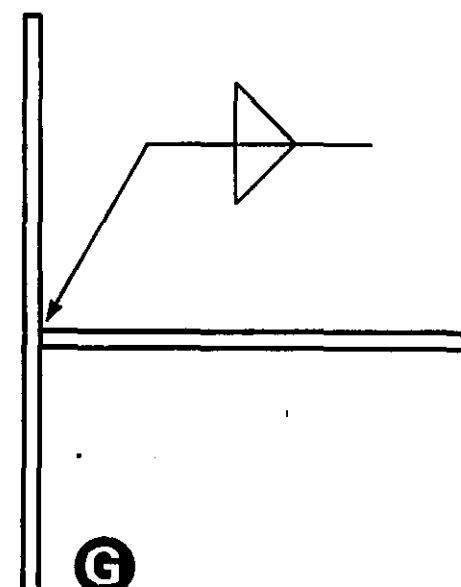
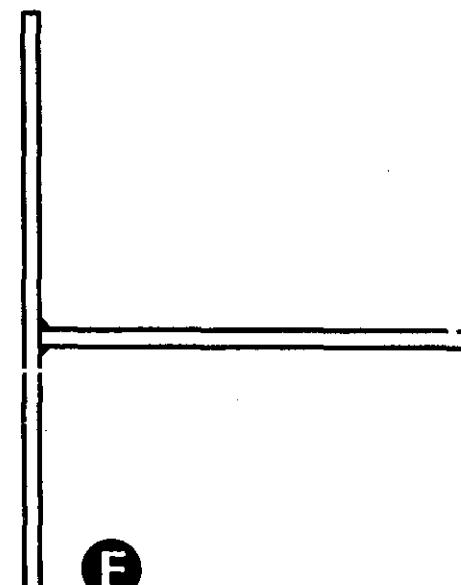
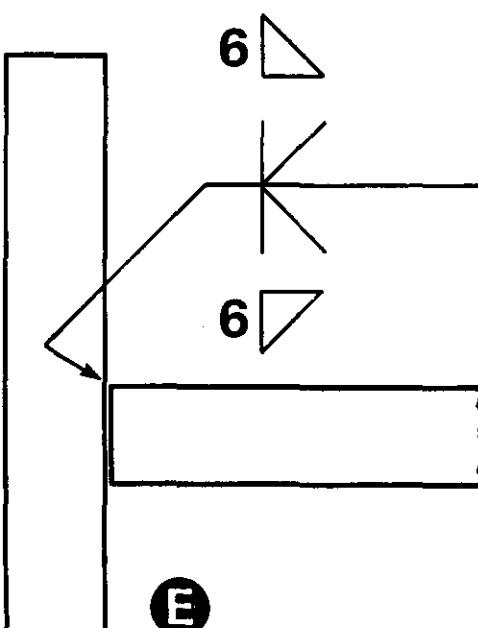
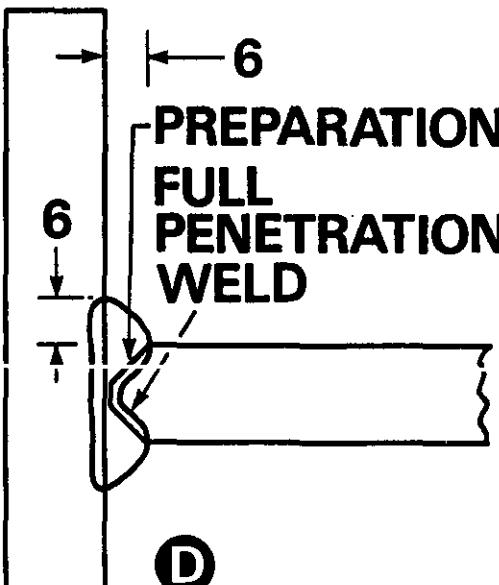


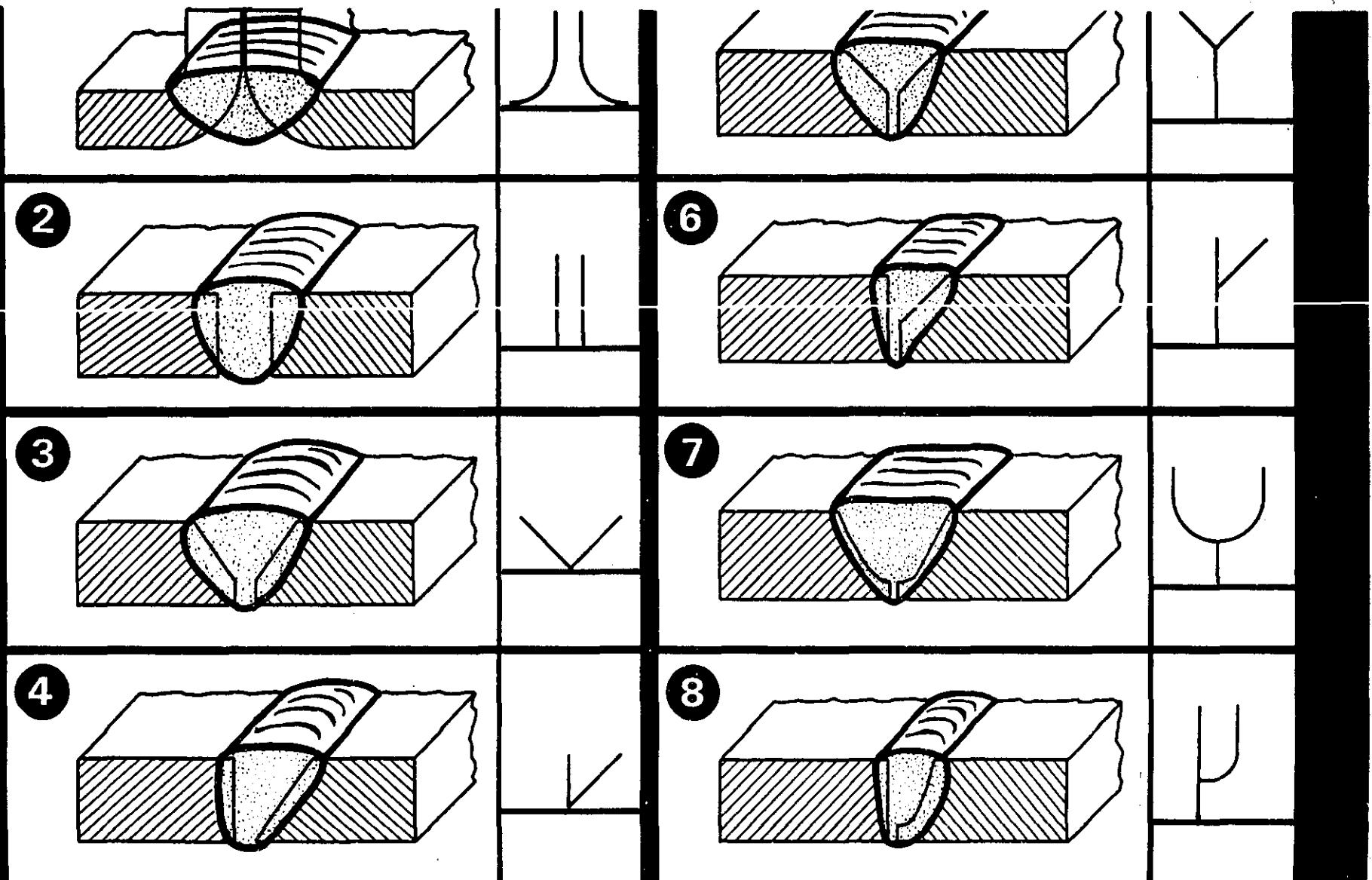


M15 X 25 BOLT



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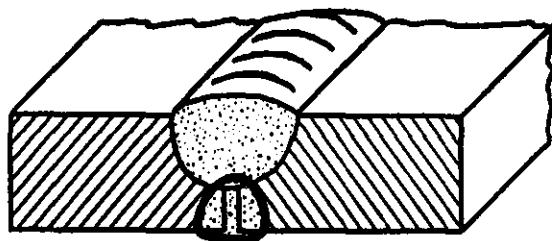




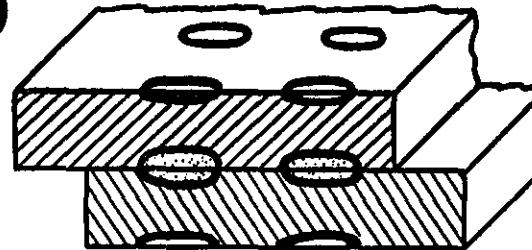
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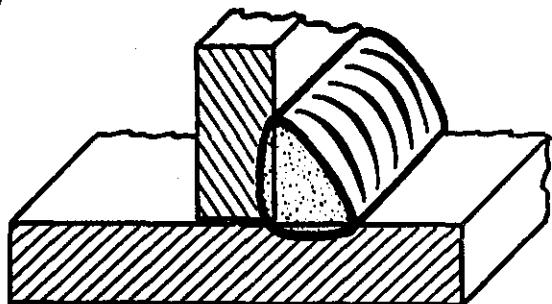
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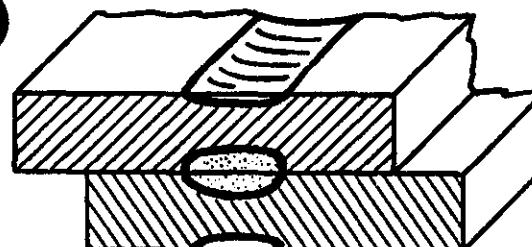
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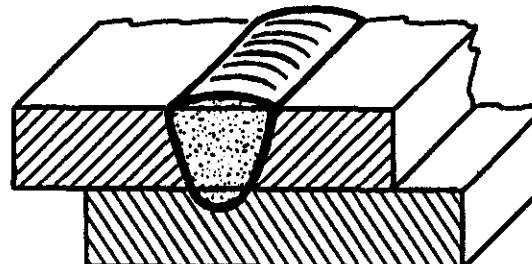
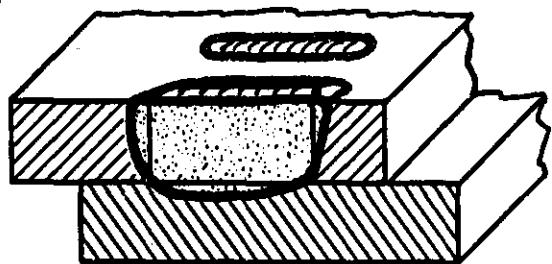
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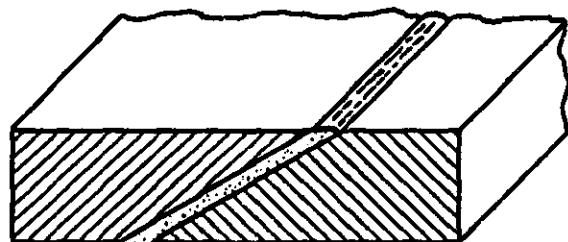
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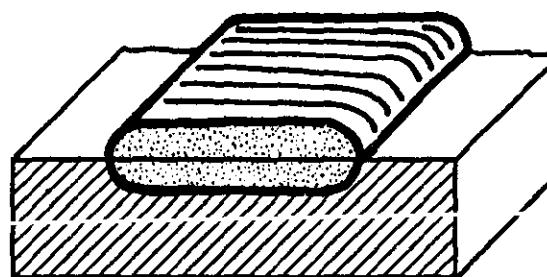
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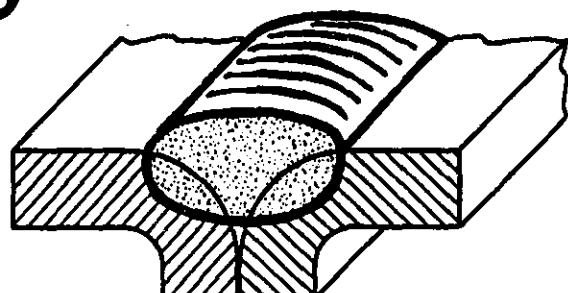
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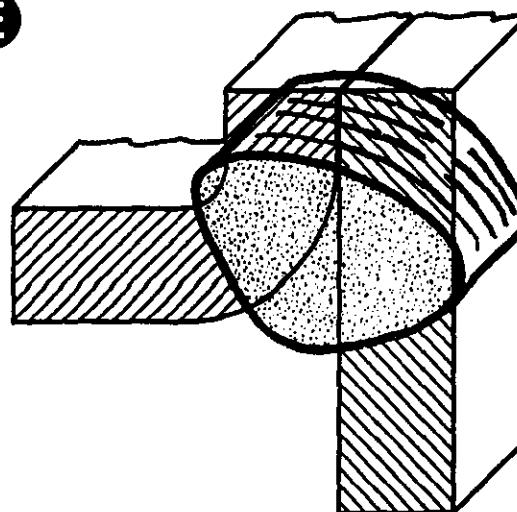
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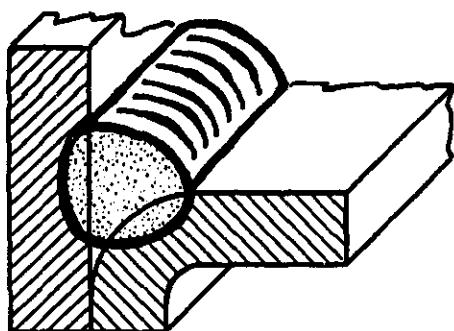
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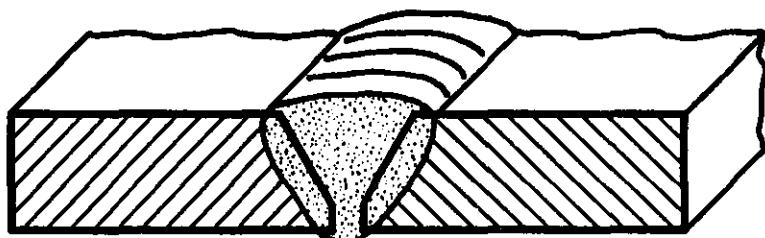
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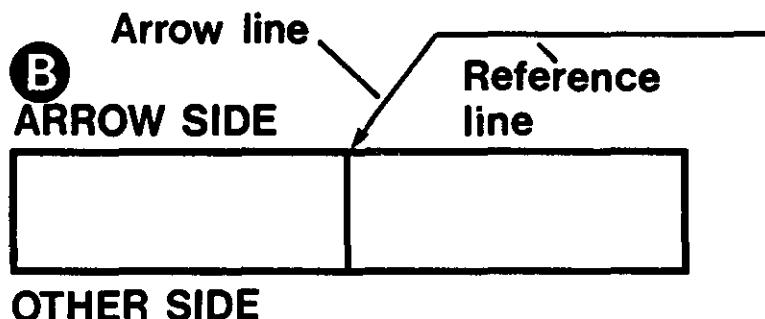
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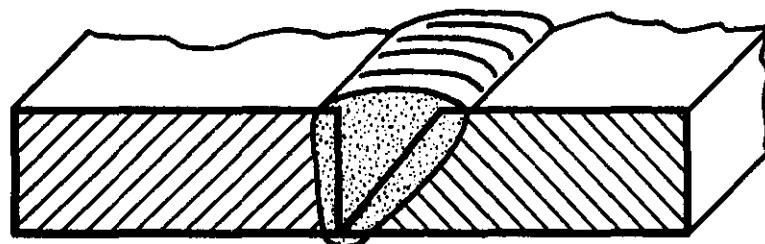
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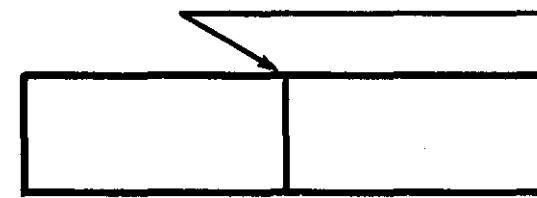
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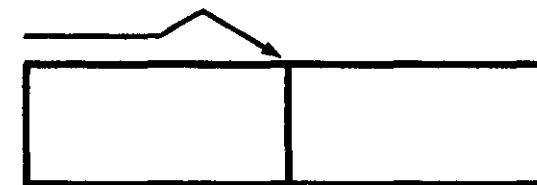
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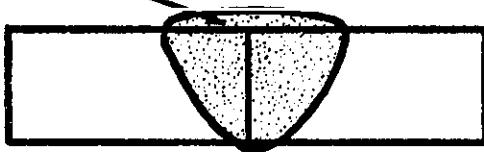
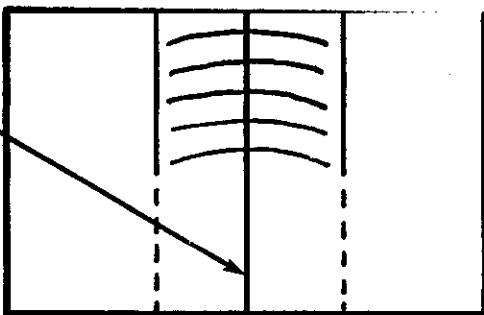


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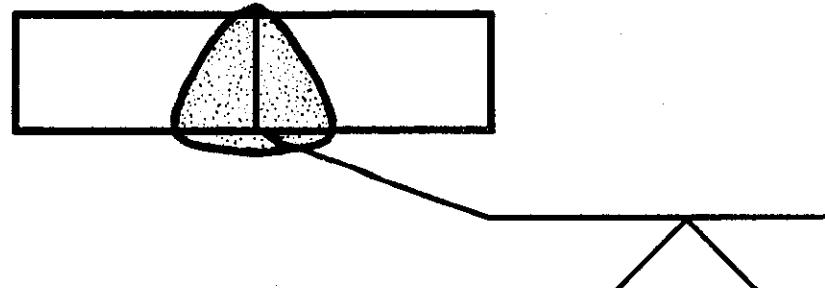


**OTHER SIDE
SYMBOL**

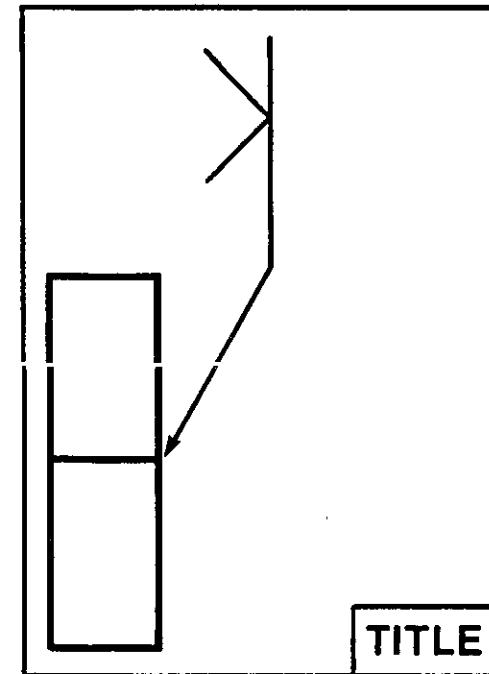
**ARROW SIDE
SYMBOL**



B



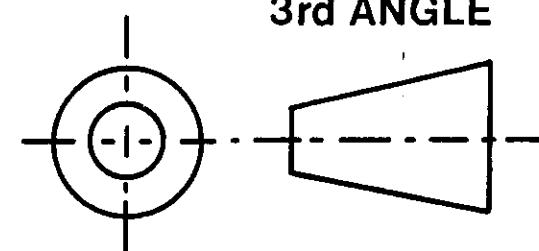
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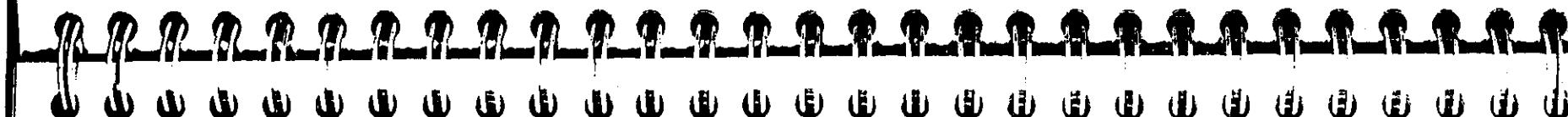
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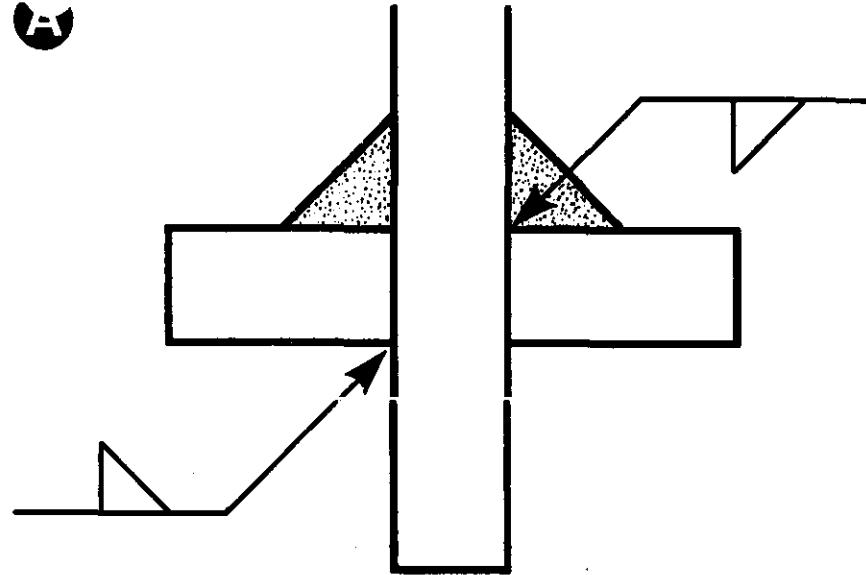
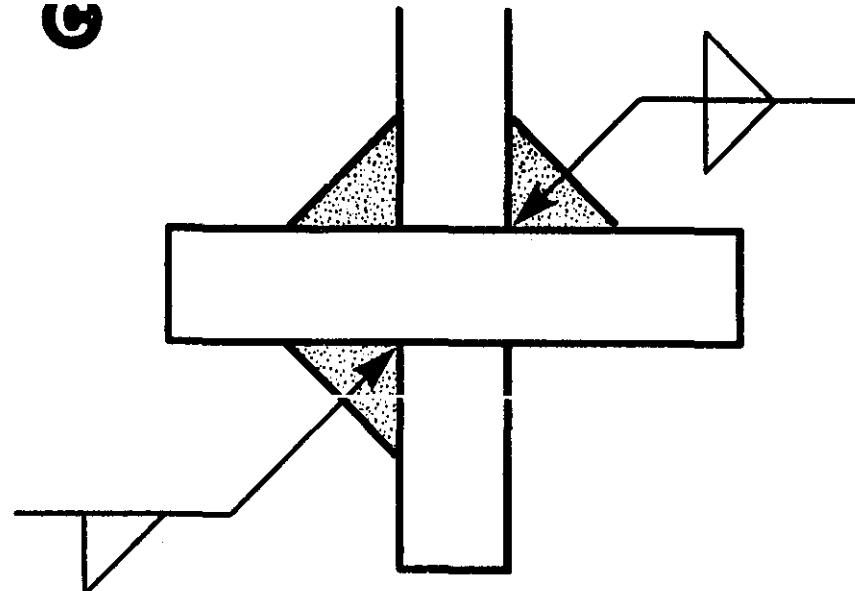
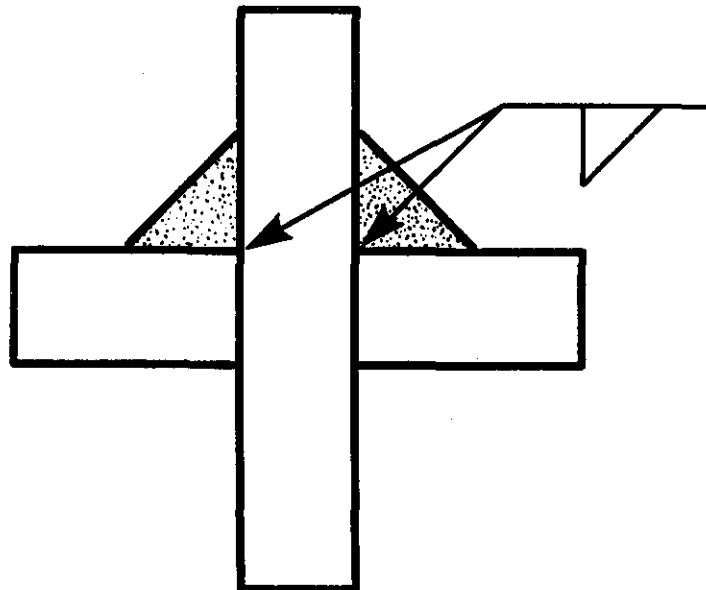
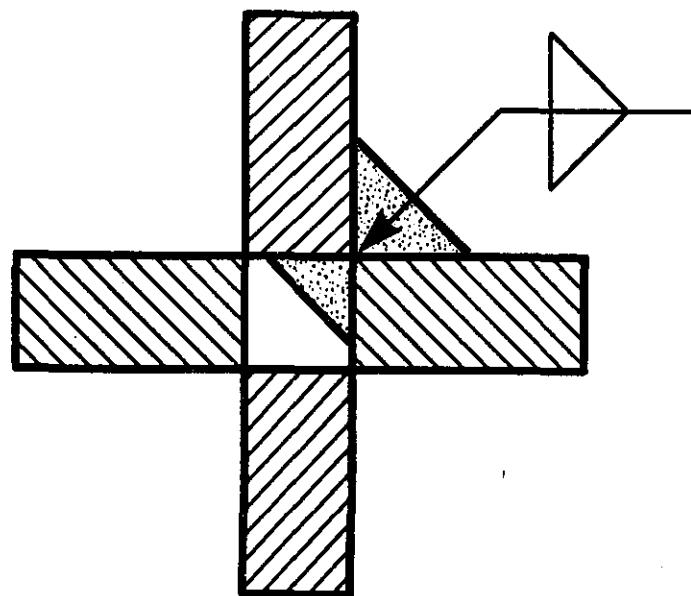
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3rd ANGLE

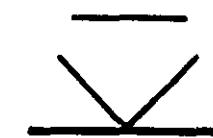
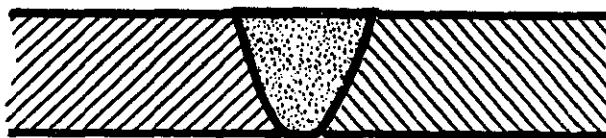


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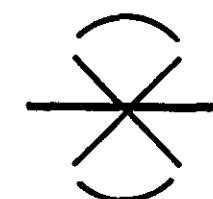


A**C****B****D**

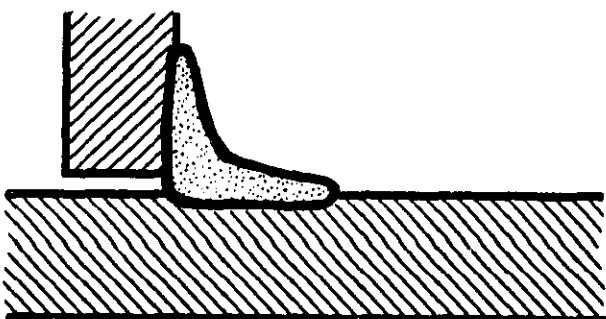
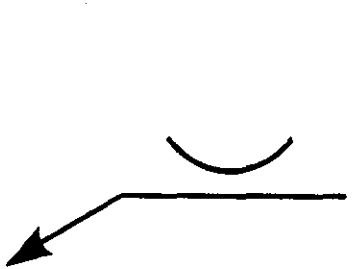
A



B



C

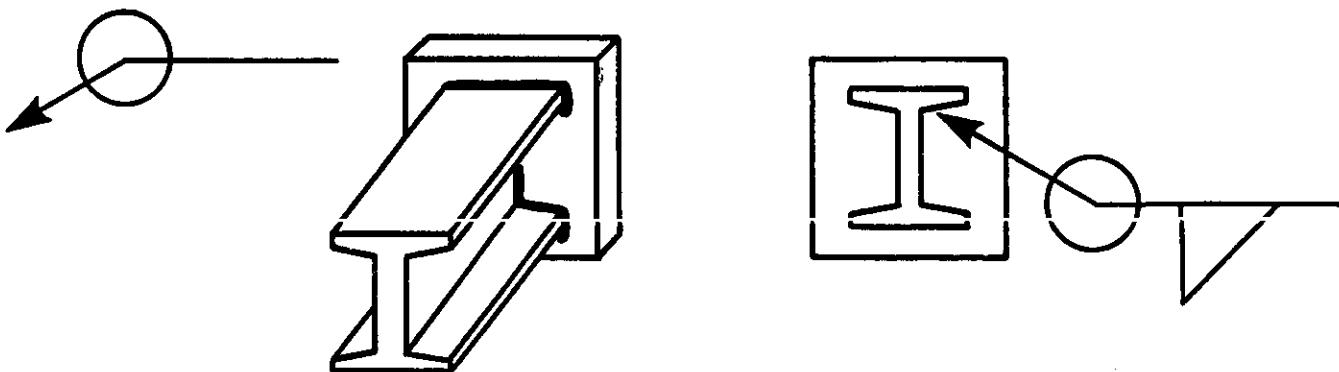


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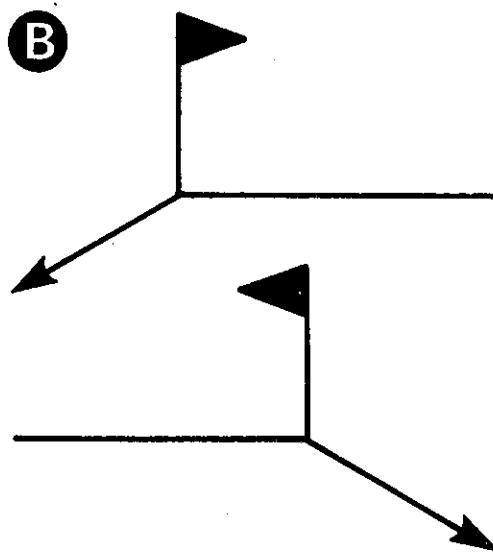
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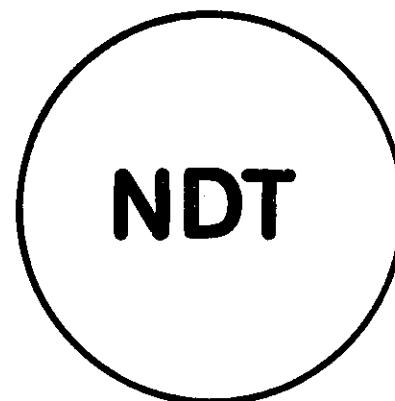
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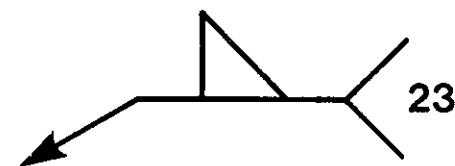
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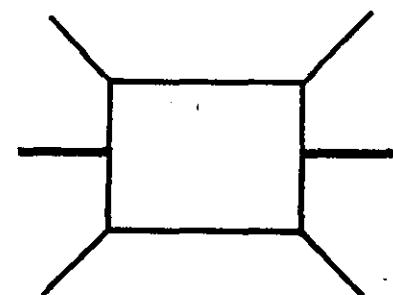
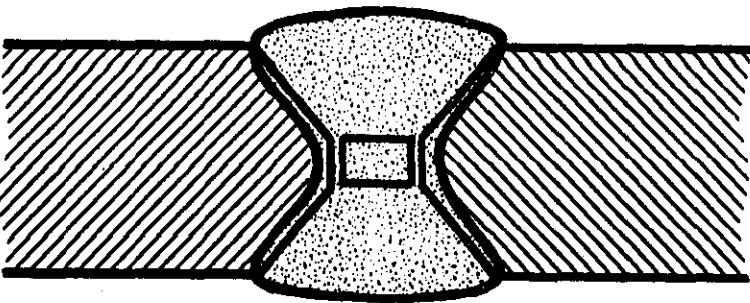
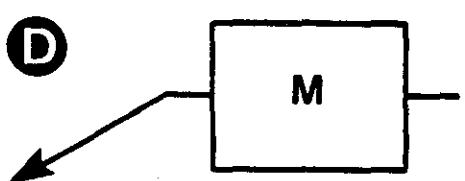
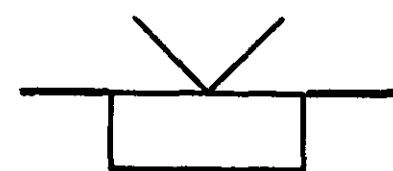
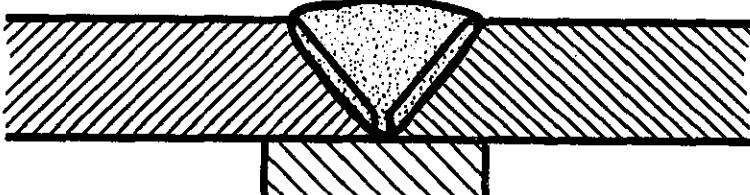
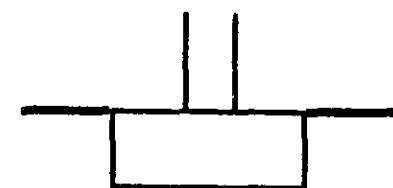
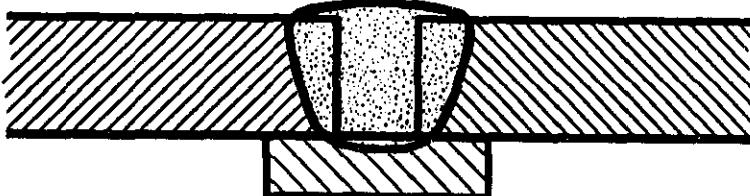
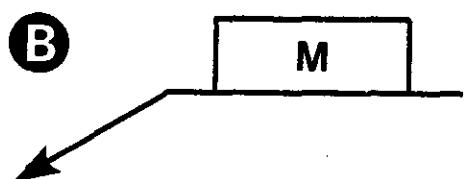
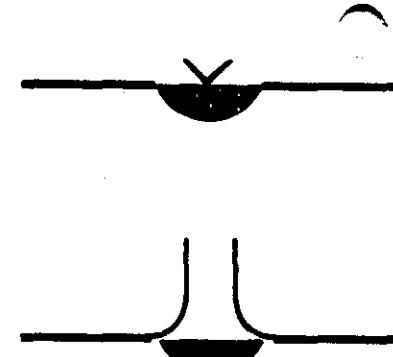
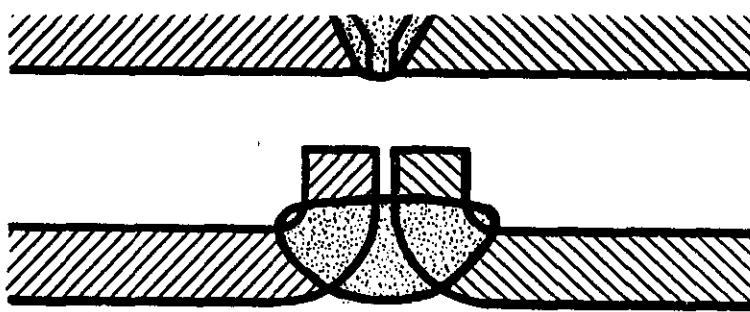


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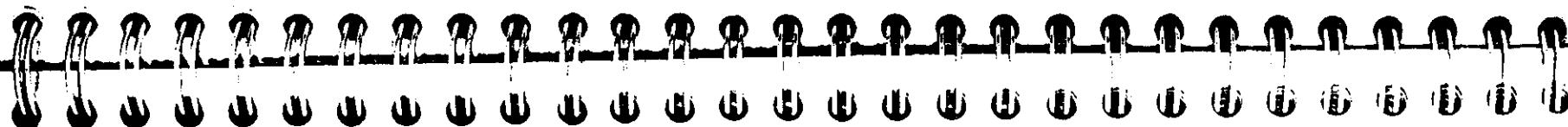


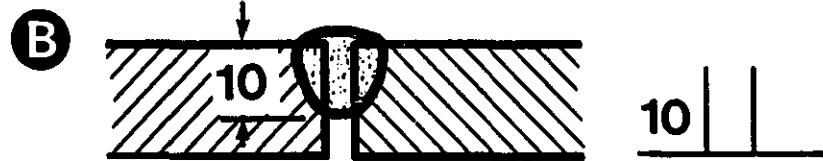
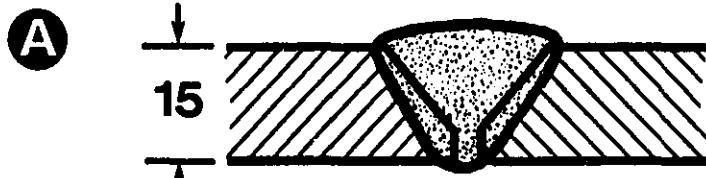
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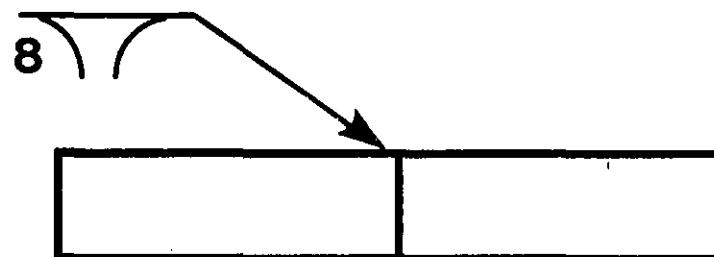
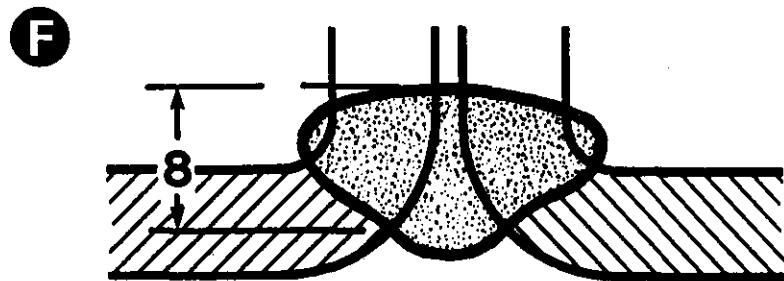
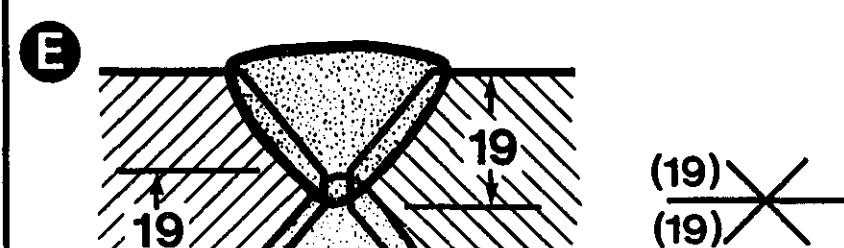
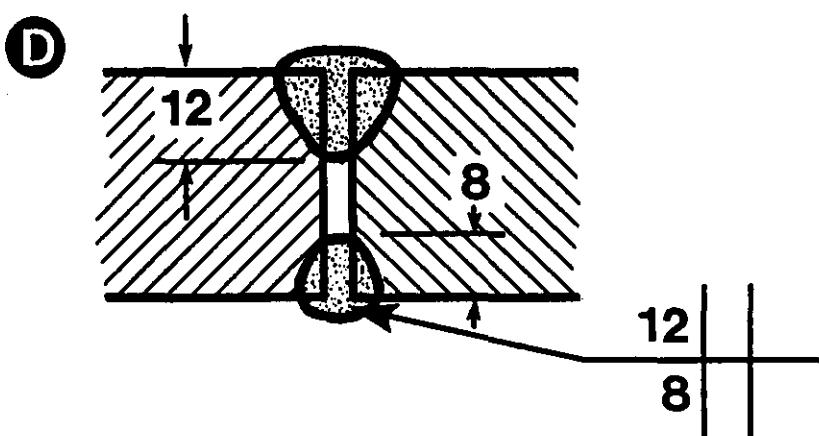
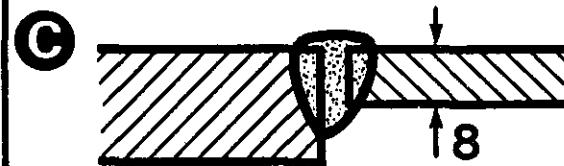


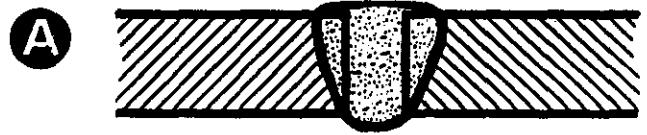
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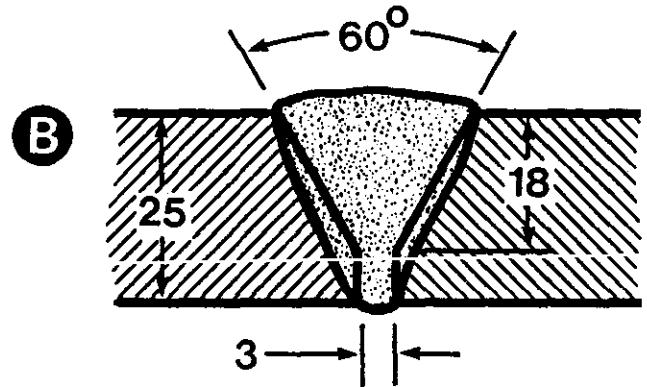


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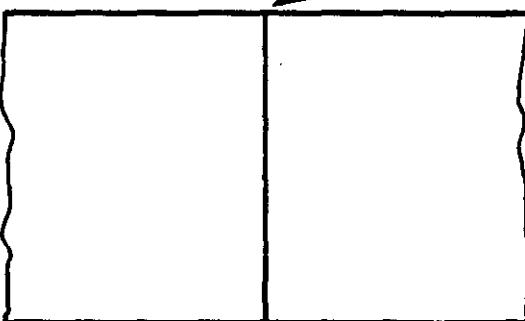
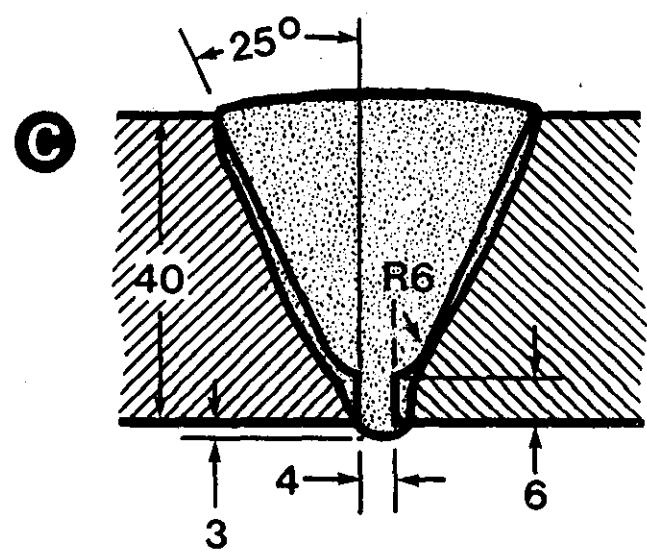




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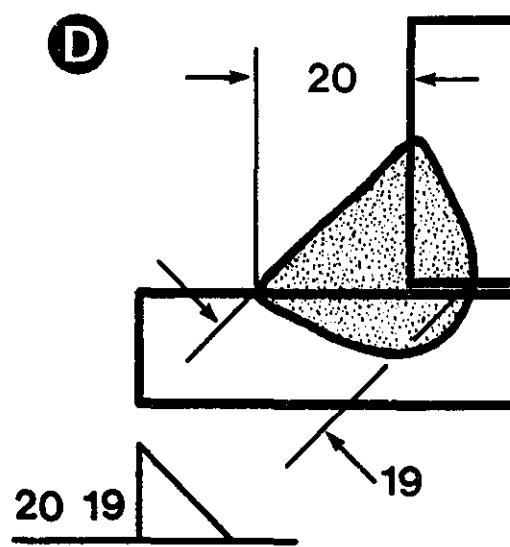
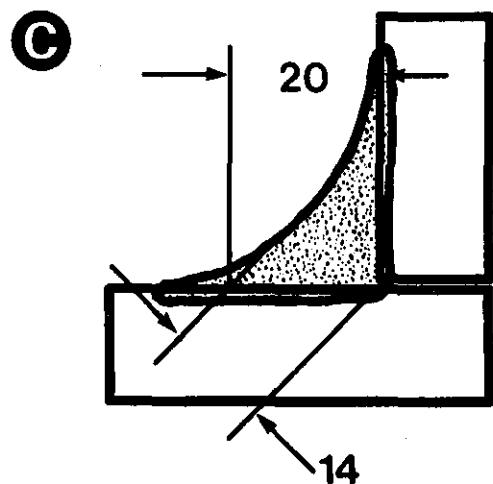
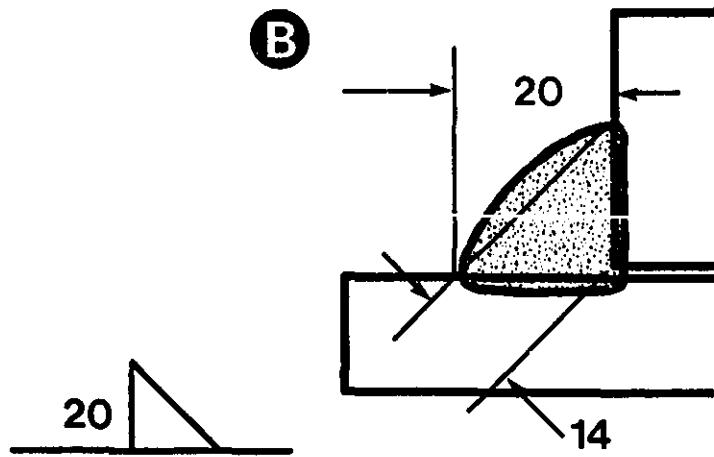
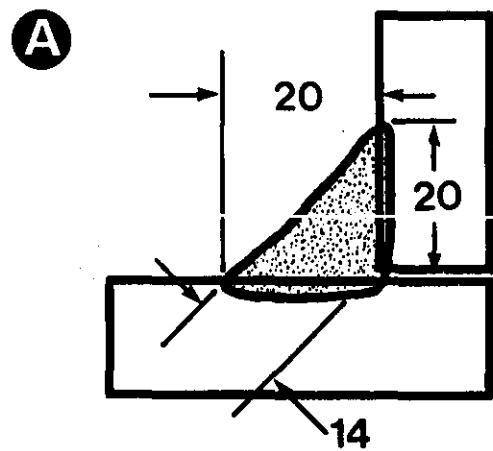


18(25) 3 60°

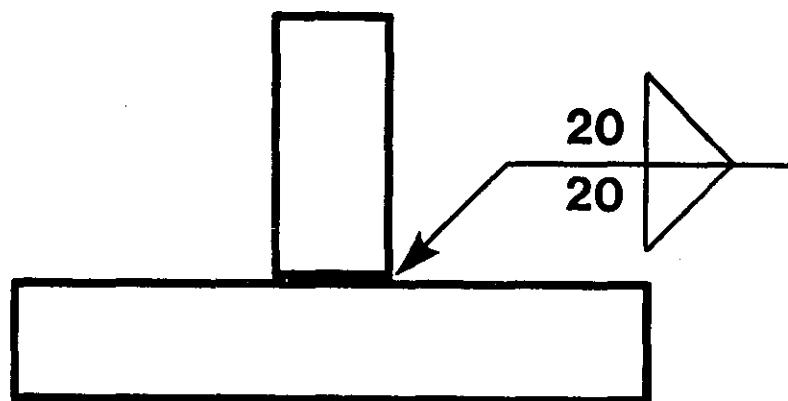


3 34 4 50°





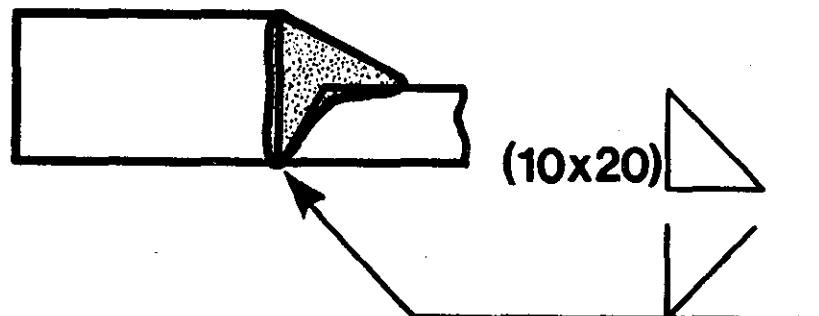
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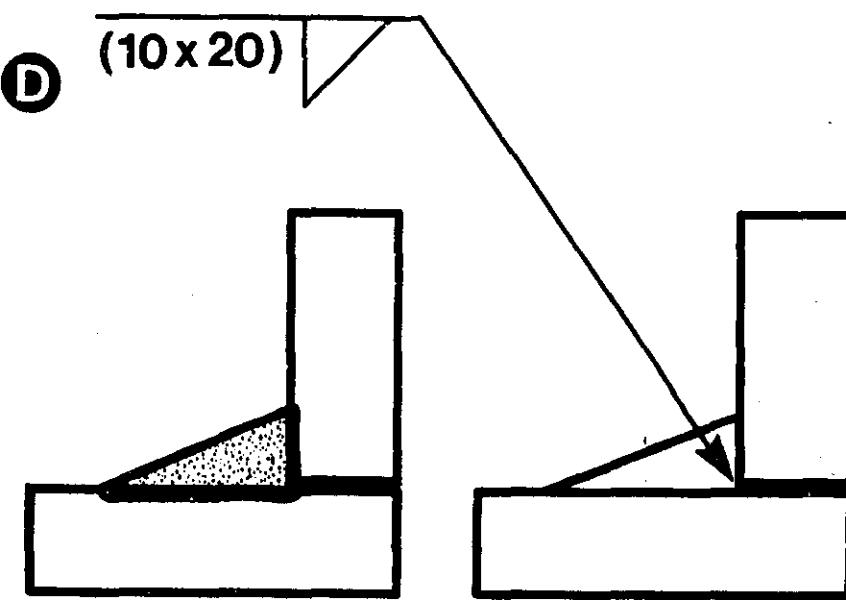
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3,4,5,6,8,10,12,16,18,20,22,25

C



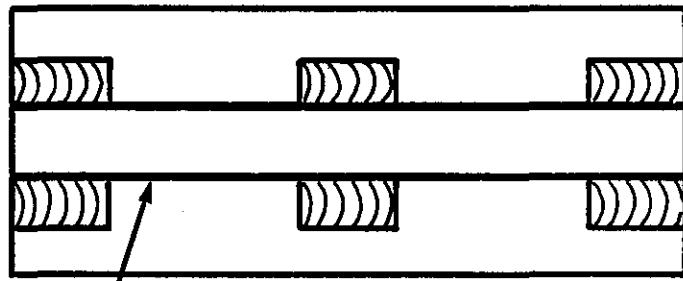
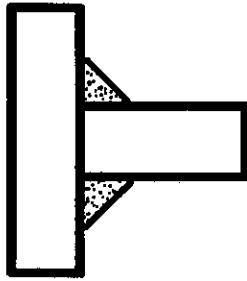
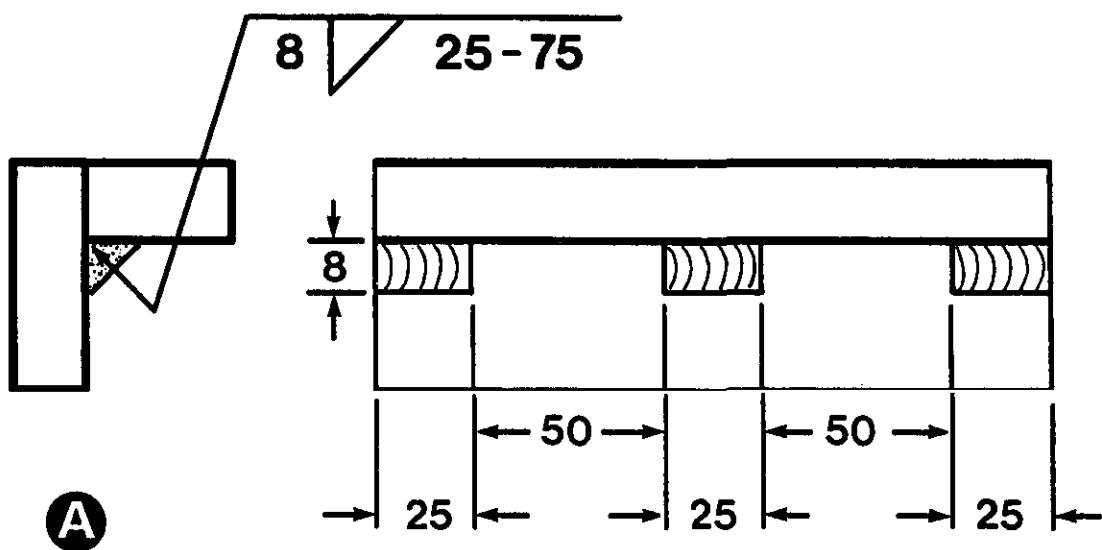
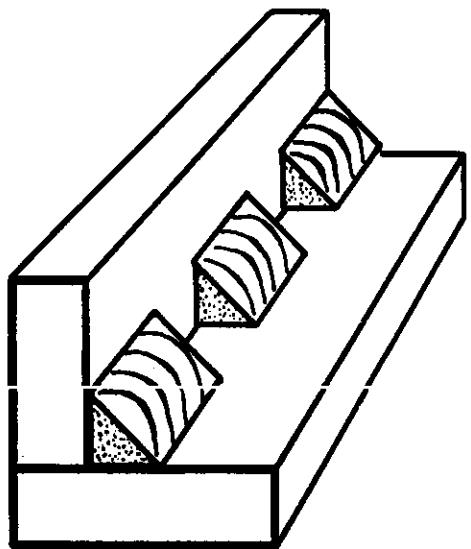
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WI 15

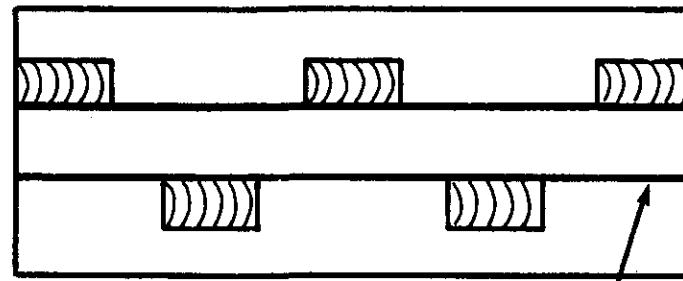
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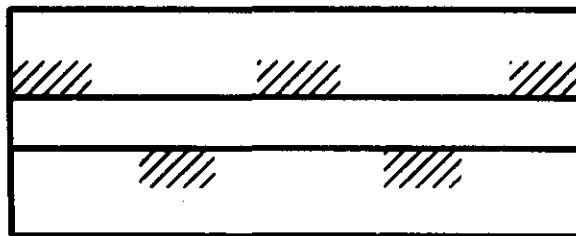
B

8 25-75
8 25-75



C

8 25-75
8 25-75



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

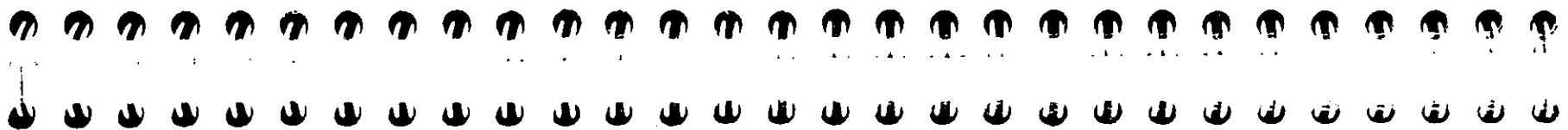
SW

BRAZING

B

SOLDERING

S

SUFFIXESAUTOMATIC
MACHINEAU
MEMANUAL
SEMI-AUTOMATICMA
SA

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

B

VT + UT

PT

— RT

C

30°

RT

D

RT

E

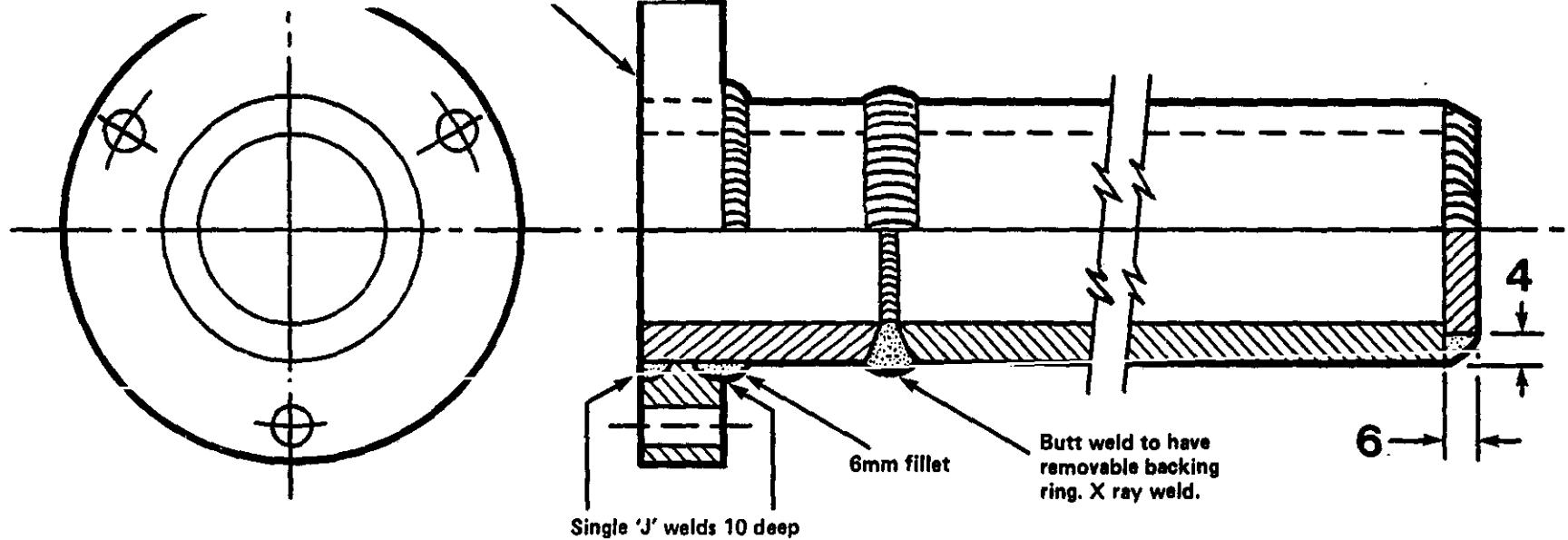
F

G

BC

13





All dimensions in millimetres

FLANGE ENDED PIPE

WI 22

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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.

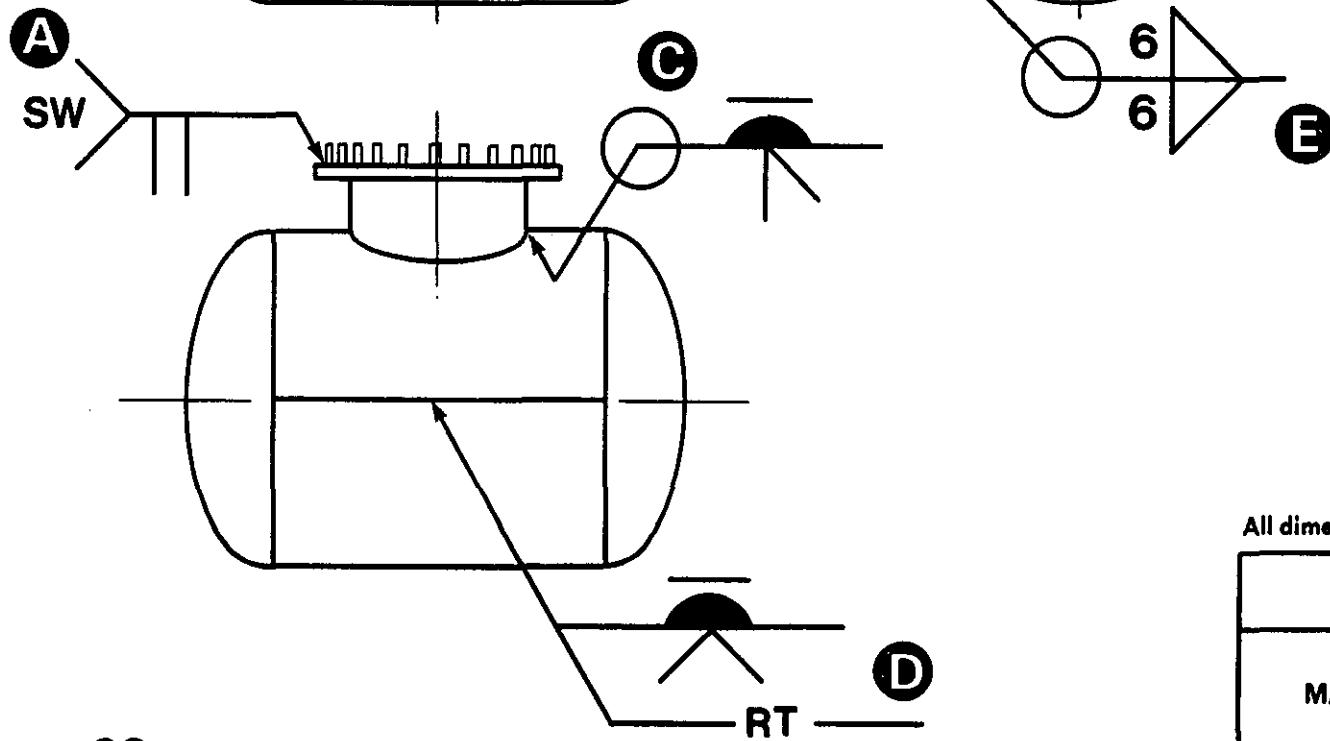
Comments

- 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 } see comments on J above
M: Symbol replacing E }



All dimensions in millimetres

VESSEL

MATERIAL:
STAINLESS STEEL
BODY 6mm
FLANGE 20mm

SECTION 25: EXERCISE 4, BEAM

25 (Base transparency and overlay)

BASE TRANSPARENCY

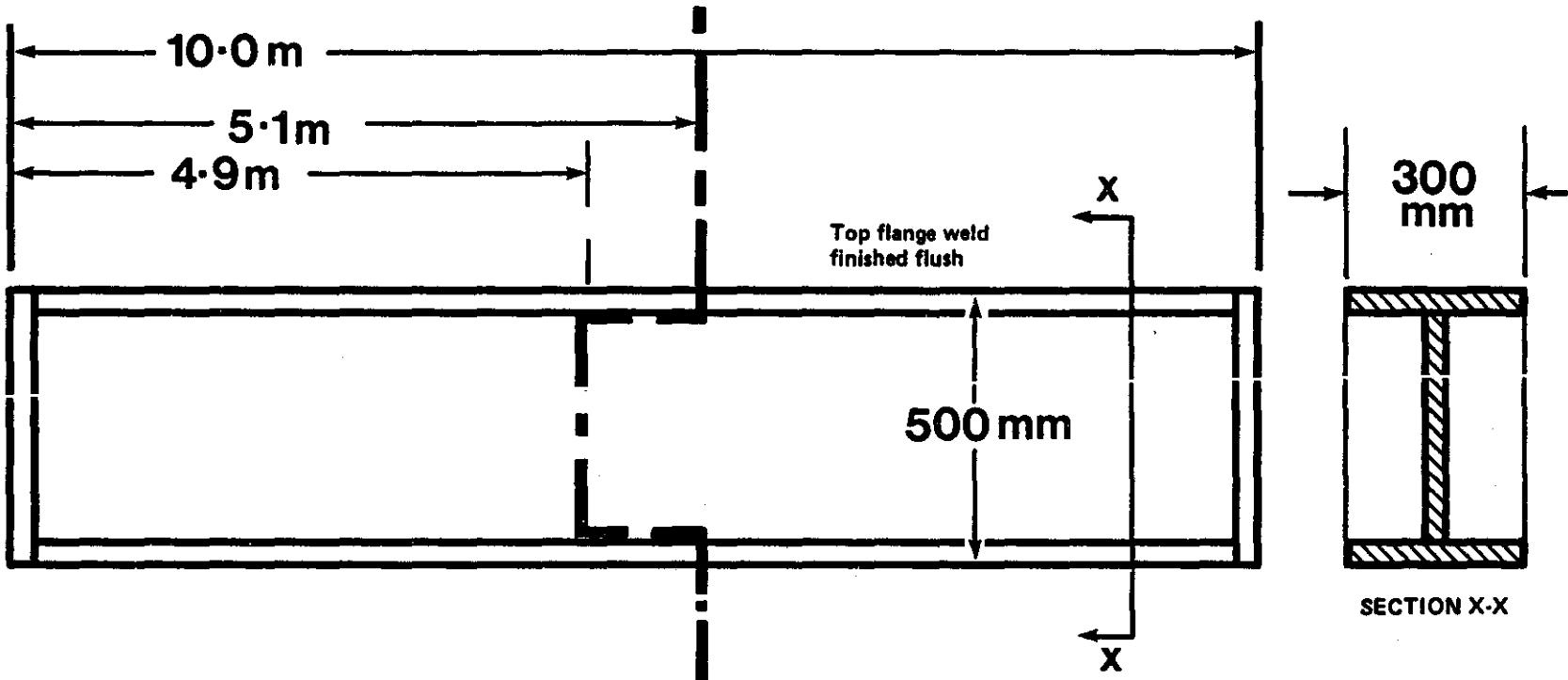
Sketch of beam, not to scale, to be assembled by manual metal arc welding in the shop and on site.

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

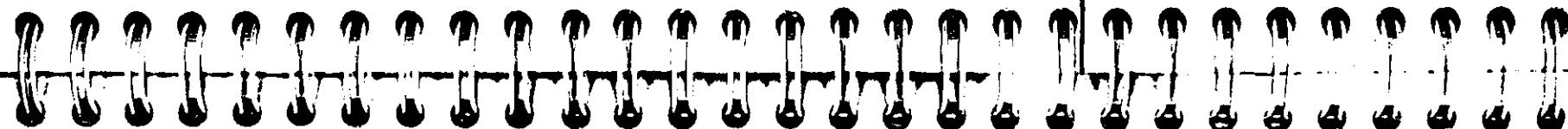
End flanges: 12mm fillet weld
all round (inside)
Flange-to-web: 12mm fillet welds
100mm long, 300mm pitch each
side, alternately each side.

Not to scale

SKETCH FOR BEAM

WI 25

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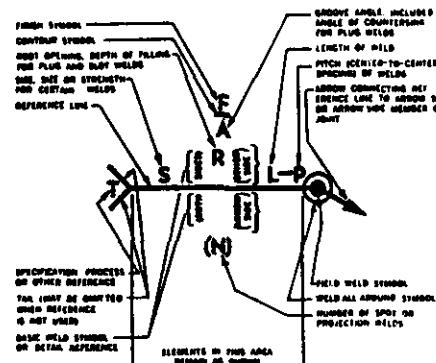
Basic Weld Symbols and Their Location Significance

LOCATION SIGNIFICANCE	FILLET	PLUG OR SLOT	SPOT OR PROJECTION	SEAM	FLASH OR UPSET SQUARE	GROOVE	BACK OR BACKING	SURFACING	FLANGE	RSC SIZE OF ARC (POD)	RESISTANCE SPOT	PROJECTION	RESISTANCE SEAM	FLASH UPSET	
ARROW SIDE															
OTHER SIDE															
BOTH SIDES															
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	NOT USED	NOT USED

Supplementary Symbols

WELD ALL AROUND	FIELD WELD	MELT-THRU	CONTOUR

Location of Elements of a Welding Symbol



Typical Welding Symbols

BACK OR BACKING WELD SYMBOL	SINGLE V-GROOVE WELDING SYMBOL INDICATING ROOT PENETRATION	PROJECTION WELDING SYMBOL
ANT-APPLICABLE VALUE WELD SYMBOL	DEPTH OF CHAMFERING SIZES: 1/8", 1/4", 1/2", 3/4", 1", 1 1/2", 2", 3", 4", 5", 6", 7", 8", 9", 10", 12", 14", 16", 18", 20", 22", 24", 26", 28", 30", 32", 34", 36", 38", 40", 42", 44", 46", 48", 50", 52", 54", 56", 58", 60", 62", 64", 66", 68", 70", 72", 74", 76", 78", 80", 82", 84", 86", 88", 90", 92", 94", 96", 98", 100", 102", 104", 106", 108", 110", 112", 114", 116", 118", 120", 122", 124", 126", 128", 130", 132", 134", 136", 138", 140", 142", 144", 146", 148", 150", 152", 154", 156", 158", 160", 162", 164", 166", 168", 170", 172", 174", 176", 178", 180", 182", 184", 186", 188", 190", 192", 194", 196", 198", 200", 202", 204", 206", 208", 210", 212", 214", 216", 218", 220", 222", 224", 226", 228", 230", 232", 234", 236", 238", 240", 242", 244", 246", 248", 250", 252", 254", 256", 258", 260", 262", 264", 266", 268", 270", 272", 274", 276", 278", 280", 282", 284", 286", 288", 290", 292", 294", 296", 298", 300", 302", 304", 306", 308", 310", 312", 314", 316", 318", 320", 322", 324", 326", 328", 330", 332", 334", 336", 338", 340", 342", 344", 346", 348", 350", 352", 354", 356", 358", 360", 362", 364", 366", 368", 370", 372", 374", 376", 378", 380", 382", 384", 386", 388", 390", 392", 394", 396", 398", 400", 402", 404", 406", 408", 410", 412", 414", 416", 418", 420", 422", 424", 426", 428", 430", 432", 434", 436", 438", 440", 442", 444", 446", 448", 450", 452", 454", 456", 458", 460", 462", 464", 466", 468", 470", 472", 474", 476", 478", 480", 482", 484", 486", 488", 490", 492", 494", 496", 498", 500", 502", 504", 506", 508", 510", 512", 514", 516", 518", 520", 522", 524", 526", 528", 530", 532", 534", 536", 538", 540", 542", 544", 546", 548", 550", 552", 554", 556", 558", 560", 562", 564", 566", 568", 570", 572", 574", 576", 578", 580", 582", 584", 586", 588", 590", 592", 594", 596", 598", 600", 602", 604", 606", 608", 610", 612", 614", 616", 618", 620", 622", 624", 626", 628", 630", 632", 634", 636", 638", 640", 642", 644", 646", 648", 650", 652", 654", 656", 658", 660", 662", 664", 666", 668", 670", 672", 674", 676", 678", 680", 682", 684", 686", 688", 690", 692", 694", 696", 698", 700", 702", 704", 706", 708", 710", 712", 714", 716", 718", 720", 722", 724", 726", 728", 730", 732", 734", 736", 738", 740", 742", 744", 746", 748", 750", 752", 754", 756", 758", 760", 762", 764", 766", 768", 770", 772", 774", 776", 778", 780", 782", 784", 786", 788", 790", 792", 794", 796", 798", 800", 802", 804", 806", 808", 810", 812", 814", 816", 818", 820", 822", 824", 826", 828", 830", 832", 834", 836", 838", 840", 842", 844", 846", 848", 850", 852", 854", 856", 858", 860", 862", 864", 866", 868", 870", 872", 874", 876", 878", 880", 882", 884", 886", 888", 890", 892", 894", 896", 898", 900", 902", 904", 906", 908", 910", 912", 914", 916", 918", 920", 922", 924", 926", 928", 930", 932", 934", 936", 938", 940", 942", 944", 946", 948", 950", 952", 954", 956", 958", 960", 962", 964", 966", 968", 970", 972", 974", 976", 978", 980", 982", 984", 986", 988", 990", 992", 994", 996", 998", 1000", 1002", 1004", 1006", 1008", 1010", 1012", 1014", 1016", 1018", 1020", 1022", 1024", 1026", 1028", 1030", 1032", 1034", 1036", 1038", 1040", 1042", 1044", 1046", 1048", 1050", 1052", 1054", 1056", 1058", 1060", 1062", 1064", 1066", 1068", 1070", 1072", 1074", 1076", 1078", 1080", 1082", 1084", 1086", 1088", 1090", 1092", 1094", 1096", 1098", 1100", 1102", 1104", 1106", 1108", 1110", 1112", 1114", 1116", 1118", 1120", 1122", 1124", 1126", 1128", 1130", 1132", 1134", 1136", 1138", 1140", 1142", 1144", 1146", 1148", 1150", 1152", 1154", 1156", 1158", 1160", 1162", 1164", 1166", 1168", 1170", 1172", 1174", 1176", 1178", 1180", 1182", 1184", 1186", 1188", 1190", 1192", 1194", 1196", 1198", 1200", 1202", 1204", 1206", 1208", 1210", 1212", 1214", 1216", 1218", 1220", 1222", 1224", 1226", 1228", 1230", 1232", 1234", 1236", 1238", 1240", 1242", 1244", 1246", 1248", 1250", 1252", 1254", 1256", 1258", 1260", 1262", 1264", 1266", 1268", 1270", 1272", 1274", 1276", 1278", 1280", 1282", 1284", 1286", 1288", 1290", 1292", 1294", 1296", 1298", 1300", 1302", 1304", 1306", 1308", 1310", 1312", 1314", 1316", 1318", 1320", 1322", 1324", 1326", 1328", 1330", 1332", 1334", 1336", 1338", 1340", 1342", 1344", 1346", 1348", 1350", 1352", 1354", 1356", 1358", 1360", 1362", 1364", 1366", 1368", 1370", 1372", 1374", 1376", 1378", 1380", 1382", 1384", 1386", 1388", 1390", 1392", 1394", 1396", 1398", 1400", 1402", 1404", 1406", 1408", 1410", 1412", 1414", 1416", 1418", 1420", 1422", 1424", 1426", 1428", 1430", 1432", 1434", 1436", 1438", 1440", 1442", 1444", 1446", 1448", 1450", 1452", 1454", 1456", 1458", 1460", 1462", 1464", 1466", 1468", 1470", 1472", 1474", 1476", 1478", 1480", 1482", 1484", 1486", 1488", 1490", 1492", 1494", 1496", 1498", 1500", 1502", 1504", 1506", 1508", 1510", 1512", 1514", 1516", 1518", 1520", 1522", 1524", 1526", 1528", 1530", 1532", 1534", 1536", 1538", 1540", 1542", 1544", 1546", 1548", 1550", 1552", 1554", 1556", 1558", 1560", 1562", 1564", 1566", 1568", 1570", 1572", 1574", 1576", 1578", 1580", 1582", 1584", 1586", 1588", 1590", 1592", 1594", 1596", 1598", 1600", 1602", 1604", 1606", 1608", 1610", 1612", 1614", 1616", 1618", 1620", 1622", 1624", 1626", 1628", 1630", 1632", 1634", 1636", 1638", 1640", 1642", 1644", 1646", 1648", 1650", 1652", 1654", 1656", 1658", 1660", 1662", 1664", 1666", 1668", 1670", 1672", 1674", 1676", 1678", 1680", 1682", 1684", 1686", 1688", 1690", 1692", 1694", 1696", 1698", 1700", 1702", 1704", 1706", 1708", 1710", 1712", 1714", 1716", 1718", 1720", 1722", 1724", 1726", 1728", 1730", 1732", 1734", 1736", 1738", 1740", 1742", 1744", 1746", 1748", 1750", 1752", 1754", 1756", 1758", 1760", 1762", 1764", 1766", 1768", 1770", 1772", 1774", 1776", 1778", 1780", 1782", 1784", 1786", 1788", 1790", 1792", 1794", 1796", 1798", 1800", 1802", 1804", 1806", 1808", 1810", 1812", 1814", 1816", 1818", 1820", 1822", 1824", 1826", 1828", 1830", 1832", 1834", 1836", 1838", 1840", 1842", 1844", 1846", 1848", 1850", 1852", 1854", 1856", 1858", 1860", 1862", 1864", 1866", 1868", 1870", 1872", 1874", 1876", 1878", 1880", 1882", 1884", 1886", 1888", 1890", 1892", 1894", 1896", 1898", 1900", 1902", 1904", 1906", 1908", 1910", 1912", 1914", 1916", 1918", 1920", 1922", 1924", 1926", 1928", 1930", 1932", 1934", 1936", 1938", 1940", 1942", 1944", 1946", 1948", 1950", 1952", 1954", 1956", 1958", 1960", 1962", 1964", 1966", 1968", 1970", 1972", 1974", 1976", 1978", 1980", 1982", 1984", 1986", 1988", 1990", 1992", 1994", 1996", 1998", 2000", 2002", 2004", 2006", 2008", 2010", 2012", 2014", 2016", 2018", 2020", 2022", 2024", 2026", 2028", 2030", 2032", 2034", 2036", 2038", 2040", 2042", 2044", 2046", 2048", 2050", 2052", 2054", 2056", 2058", 2060", 2062", 2064", 2066", 2068", 2070", 2072", 2074", 2076", 2078", 2080", 2082", 2084", 2086", 2088", 2090", 2092", 2094", 2096", 2098", 2100", 2102", 2104", 2106", 2108", 2110", 2112", 2114", 2116", 2118", 2120", 2122", 2124", 2126", 2128", 2130", 2132", 2134", 2136", 2138", 2140", 2142", 2144", 2146", 2148", 2150", 2152", 2154", 2156", 2158", 2160", 2162", 2164", 2166", 2168", 2170", 2172", 2174", 2176", 2178", 2180", 2182", 2184", 2186", 2188", 2190", 2192", 2194", 2196", 2198", 2200", 2202", 2204", 2206", 2208", 2210", 2212", 2214", 2216", 2218", 2220", 2222", 2224", 2226", 2228", 2230", 2232", 2234", 2236", 2238", 2240", 2242", 2244", 2246", 2248", 2250", 2252", 2254", 2256", 2258", 2260", 2262", 2264", 2266", 2268", 2270", 2272", 2274", 2276", 2278", 2280", 2282", 2284", 2286", 2288", 2290", 2292", 2294", 2296", 2298", 2300", 2302", 2304", 2306", 2308", 2310", 2312", 2314", 2316", 2318", 2320", 2322", 2324", 2326", 2328", 2330", 2332", 2334", 2336", 2338", 2340", 2342", 2344", 2346", 2348", 2350", 2352", 2354", 2356", 2358", 2360", 2362", 2364", 2366", 2368", 2370", 2372", 2374", 2376", 2378", 2380", 2382", 2384", 2386", 2388", 2390", 2392", 2394", 2396", 2398", 2400", 2402", 2404", 2406", 2408", 2410", 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2698", 2700", 2702", 2704", 2706", 2708", 2710", 2712", 2714", 2716", 2718", 2720", 2722", 2724", 2726", 2728", 2730", 2732", 2734", 2736", 2738", 2740", 2742", 2744", 2746", 2748", 2750", 2752", 2754", 2756", 2758", 2760", 2762", 2764", 2766", 2768", 2770", 2772", 2774", 2776", 2778", 2780", 2782", 2784", 2786", 2788", 2790", 2792", 2794", 2796", 2798", 2800", 2802", 2804", 2806", 2808", 2810", 2812", 2814", 2816", 2818", 2820", 2822", 2824", 2826", 2828", 2830", 2832", 2834", 2836", 2838", 2840", 2842", 2844", 2846", 2848", 2850", 2852", 2854", 2856", 2858", 2860", 2862", 2864", 2866", 2868", 2870", 2872", 2874", 2876", 2878", 2880", 2882", 2884", 2886", 2888", 2890", 2892", 2894", 2896", 2898", 2900", 2902", 2904", 2906", 2908", 2910", 2912", 2914", 2916", 2918", 2920", 2922", 2924", 2926", 2928", 2930", 2932", 2934", 2936", 2938", 2940", 2942", 2944", 2946", 2948", 2950", 2952", 2954", 2956", 2958", 2960", 2962", 2964", 2966", 2968", 2970", 2972", 2974", 2976", 2978", 2980", 2982", 2984", 2986", 2988", 2990", 2992", 2994", 2996", 2998", 3000", 3002", 3004", 3006", 3008", 3010", 3012", 3014", 3016", 3018", 3020", 3022", 3024", 3026", 3028", 3030", 3032", 3034", 3036", 3038", 3040", 3042", 3044", 3046", 3048", 3050", 3052", 3054", 3056", 3058", 3060", 3062", 3064", 3066", 3068", 3070", 3072", 3074", 3076", 3078", 3080", 3082", 3084", 3086", 3088", 3090", 3092", 3094", 3096", 3098", 3100", 3102", 3104", 3106", 3108", 3110", 3112", 3114", 3116", 3118", 3120", 3122", 3124", 3126", 3128", 3130", 3132", 3134", 3136", 3138", 3140", 3142", 3144", 3146", 3148", 3150", 3152", 3154", 3156", 3158", 3160", 3162", 3164", 3166", 3168", 3170", 3172", 3174",	