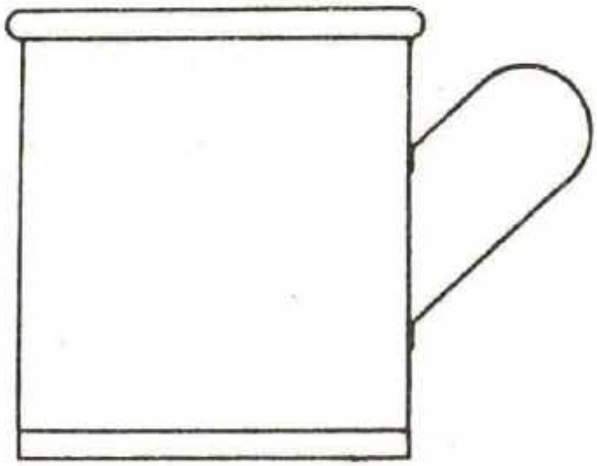
# TRADE TRAINING I - II

## T T C PROGRAMME

# WELDER

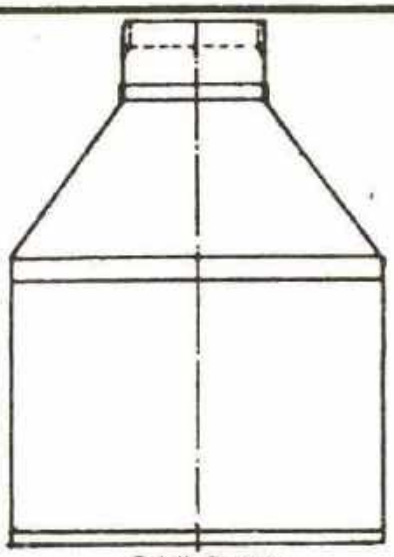
GOVERNMENT OF THE PUNJAB
TECHNICAL EDUCATION VOCATIONAL TRAINING AUTHORITY
PUNJAB BOARD OF TECHNICAL EDUCATION
TRADE TESTING CELL, LAHORE

T.T.P. SERIES No. 29 Price Rs. 41/-



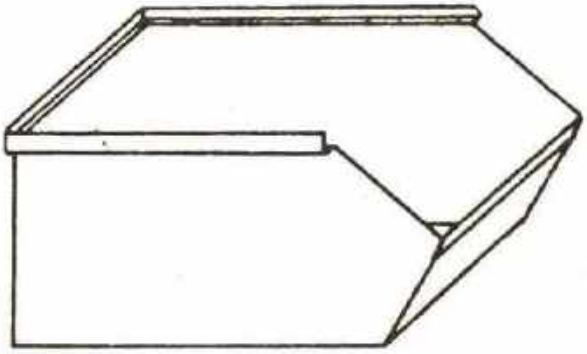
Cup

1



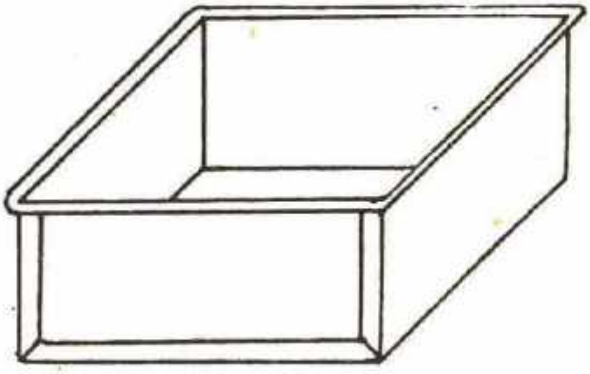
Spirit Bottle

2



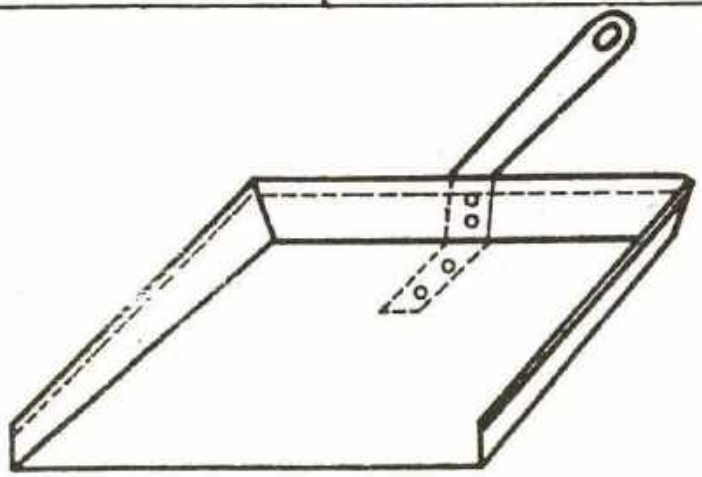
Store Box

3



Sheet Metal Box

4



Dust Pan

5

| | | |
|---|---|---|
| TRADE TRAINING 1 | LAYOUT | MP/2.3/2.6.1 |
| | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

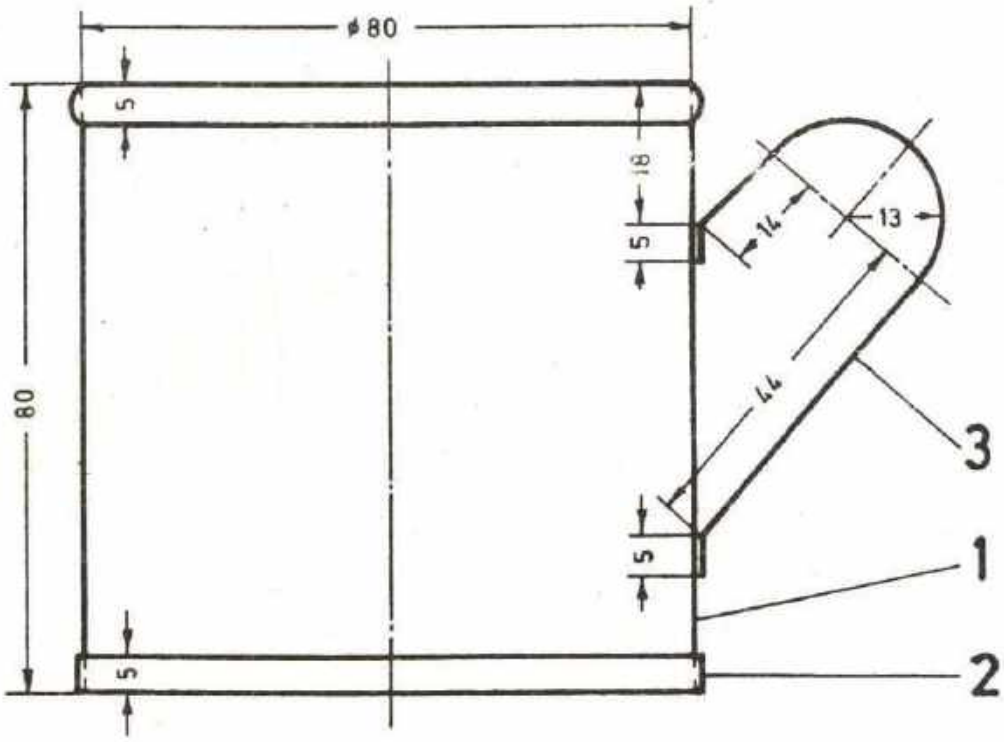
# MATERIAL REQUIRED

(Length given in millimeters)

TRADE TRAINING I

SHEET METAL

| NO.2.6.1/1 TO TEST | 1.2 | 1.3 | 2.2 | 2.3 | 2.4 | 3.2 | 3.3 | 3.4 | 4.1 | Test | Length per trainee | Total length for 16 trainees |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tinned Sheet 85 mm x 30 SWG | 265 | | | | | | | | | | 265 | 4.5 m |
| Tinned Sheet 90 mm x 30 SWG | | 90 | | | | | | | | | 90 | 1.5 m |
| Tinned Sheet 35 mm x 28 SWG | | 110 | | | | | | | | | 110 | 1.8 m |
| G.I. Sheet 85 mm x 28 SWG | | | 200 | 120 | | | | | | | 320 | 5.25 m |
| G.I. Sheet 80 mm x 28 SWG | | | | | 80 | | | | | | 80 | 1.3 m |
| M.S. Pipe Nipple R 3/8" x 20 mm | | | | | 1 | | | | | | 1 No. | 16 Nos. |
| Tinned Sheet 220 mm x 30 SWG | | | | | | 430 | | | | | 430 | 7 m |
| Tinned Sheet 144 mm x 30 SWG | | | | | | | 170 | | | | 170 | 2.75 m |
| Tinned Sheet 80 mm x 30 SWG | | | | | | | | 150 | | | 150 | 2.5 m |
| G.I. Sheet 45 mm x 28 SWG(2 pieces) | | | | | | | | | 150 | | 150 | 2.5 m |
| G.I. Sheet 45 mm x 28 SWG(2 pieces) | | | | | | | | | 160 | | 160 | 2.75 |
| G.I. Sheet 250 mm x 28 SWG | | | | | | | | | | 380 | 380 | 6.25 m |
| G.I. Wire ø 3 mm | | | | | | | | | 400 | 740 | 1140 | 18.25 m |
| M.S. Flat 30 x 3 mm 1½" x 1/8" | | | | | | | | | | 220 | 220 | 3.75 m |




Material: tinned sheet 30 SWG

SEQUENCE OF OPERATIONS

1. Join parts 1 and 2 and solder the bottom joint as well as the folded joint.
   Apply soldering fluid and tin solder sparingly to obtain a clean and proper joint.
2. Place the handle on the folded joint of the body and solder it.

CAUTION

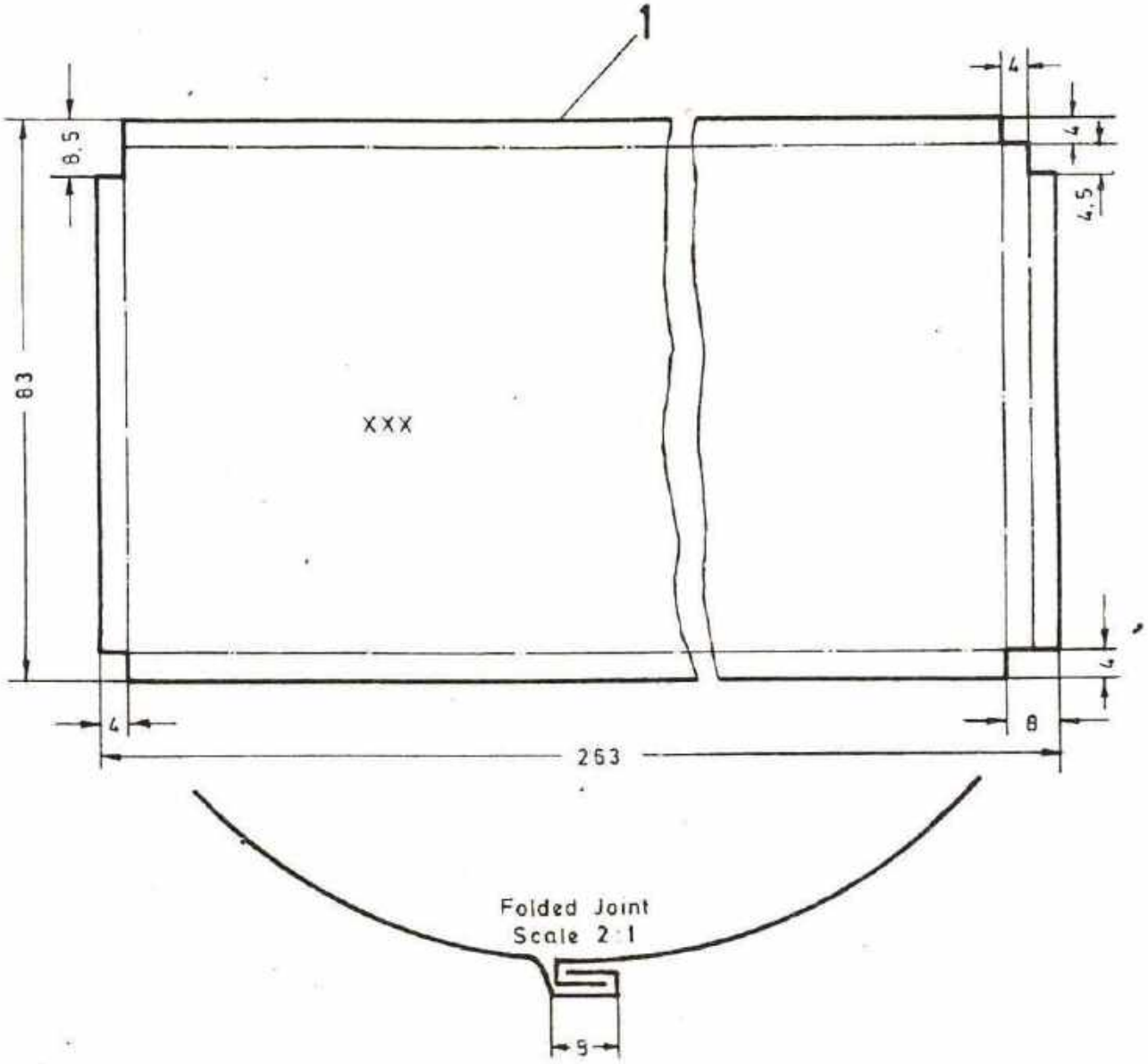
Remove all remains of soldering fluid carefully with water after completing the work. The fluid contains acid and might cause corrosion of the tinned sheet.

| | | |
|---|---|---|
| SCALE 1:1 | Cup | MP/2.3/2.6.1/11 |
| MAT. TINNED SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




Material: tinned sheet 30 SWG

SEQUENCE OF OPERATIONS

1. Mark and cut the job according to the drawing.
2. Bead the upper edge and prepare the joint-edges for folding.
3. Round the job properly (bench number and bead outside!) and fold the joint as shown in the detail 2 : 1.

CAUTION

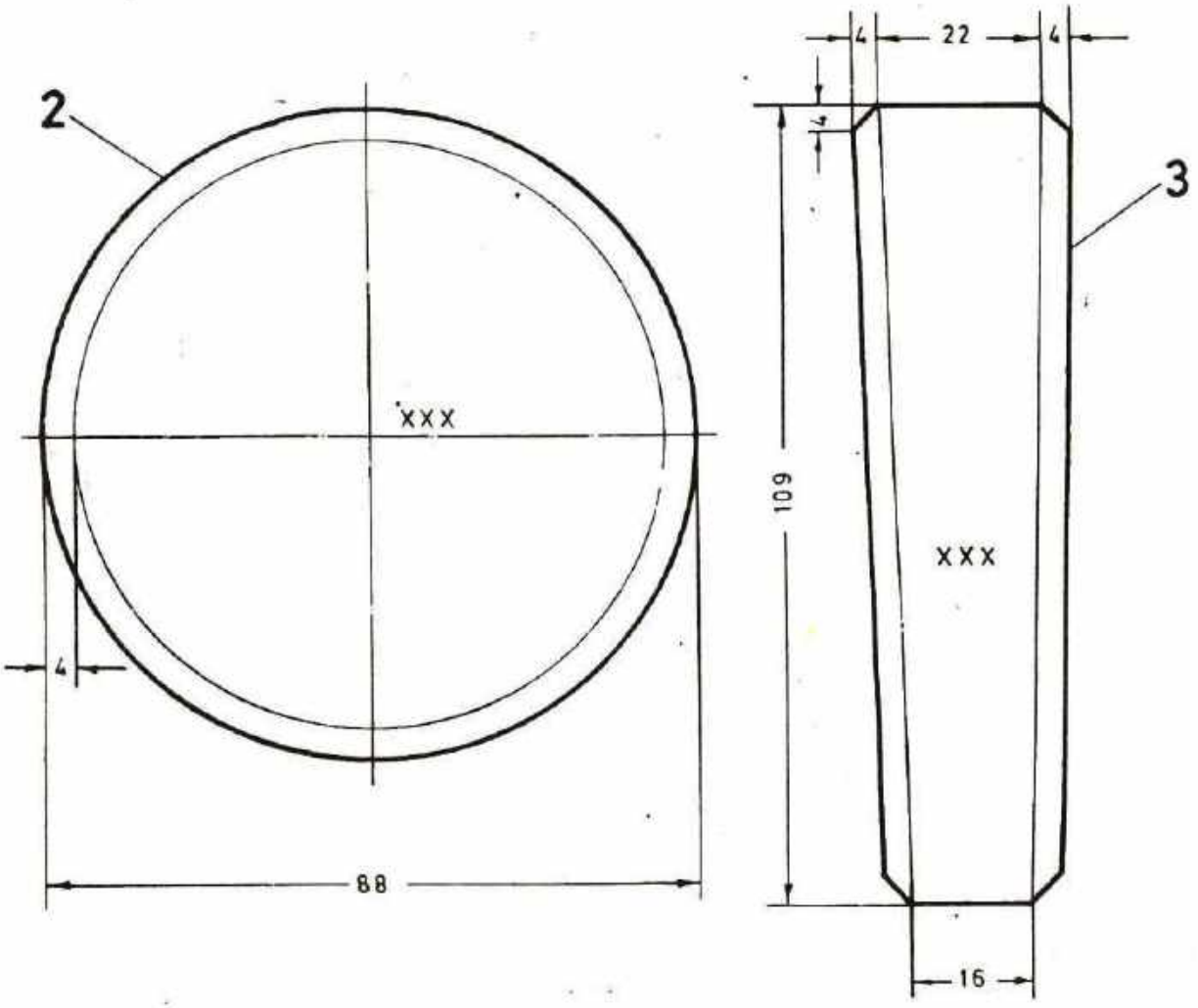
The tin layer on the sheet is thin and soft. Pencils should be used for marking therefore as steel scribers would damage the surface.

| | | |
|---|---|---|
| SCALE 1:1 | Cup Development (Cylinder) | MP/23/2.61/1.2 |
| MAT. TINNED SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




Material: tinned sheet 30 SWG

SEQUENCE OF OPERATIONS

1. Mark and cut both jobs according to drawing.
2. Bead the edges of the handle and bend it as shown in the assembly drawing No. 1.
3. Flange the bottom with the help of the edging tool and make sure that it fits precisely with the already completed part No. 1.

CAUTION

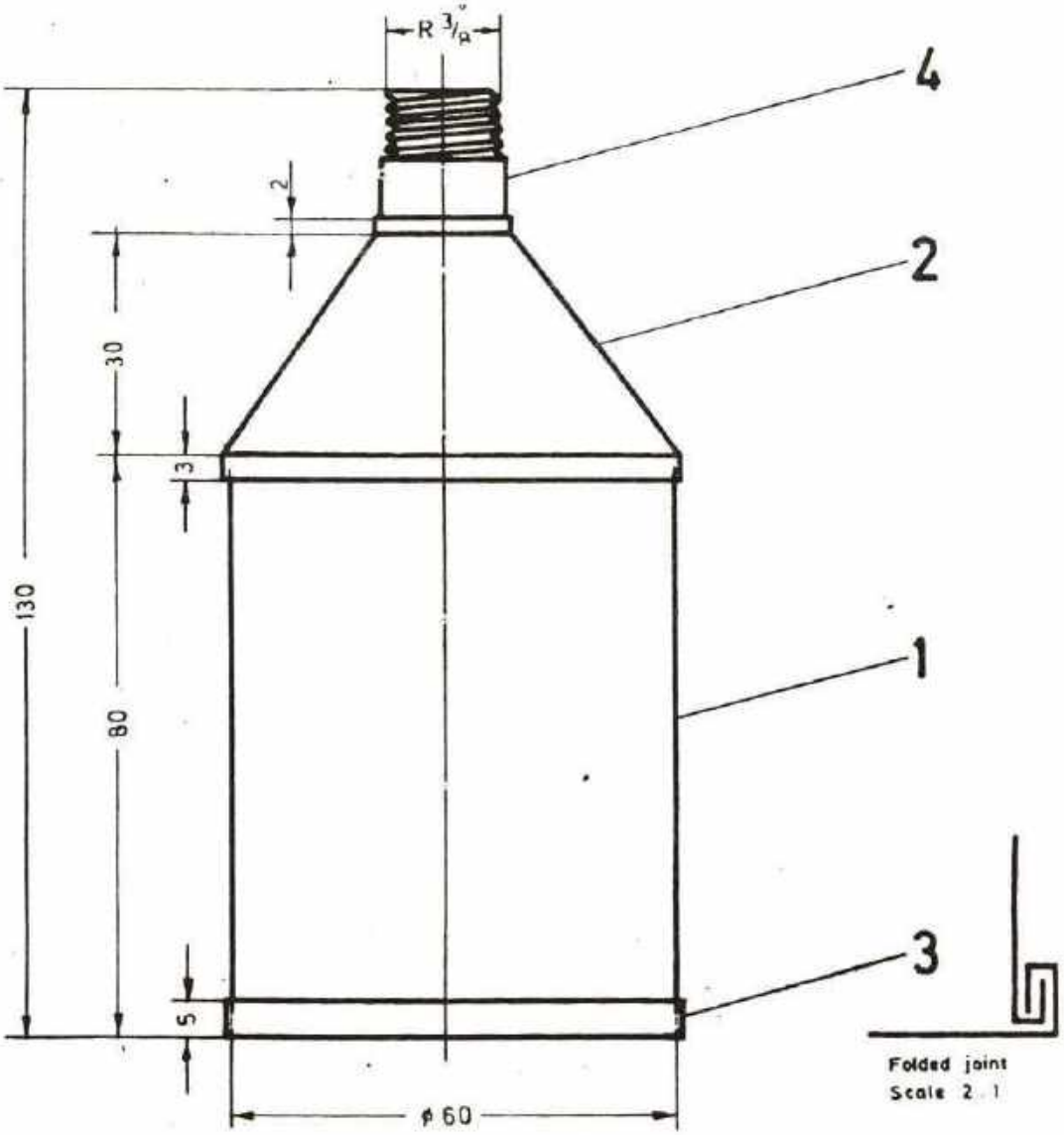
The soft tinned sheet must be handled with care in order to preserve the smooth and shining surface.

| | | |
|---|---|---|
| SCALE 1:1 | Cup Development (bottom and handle) | MP/2.3/2.6.1/1.3 |
| MAT: TINNED SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




SEQUENCE OF OPERATIONS

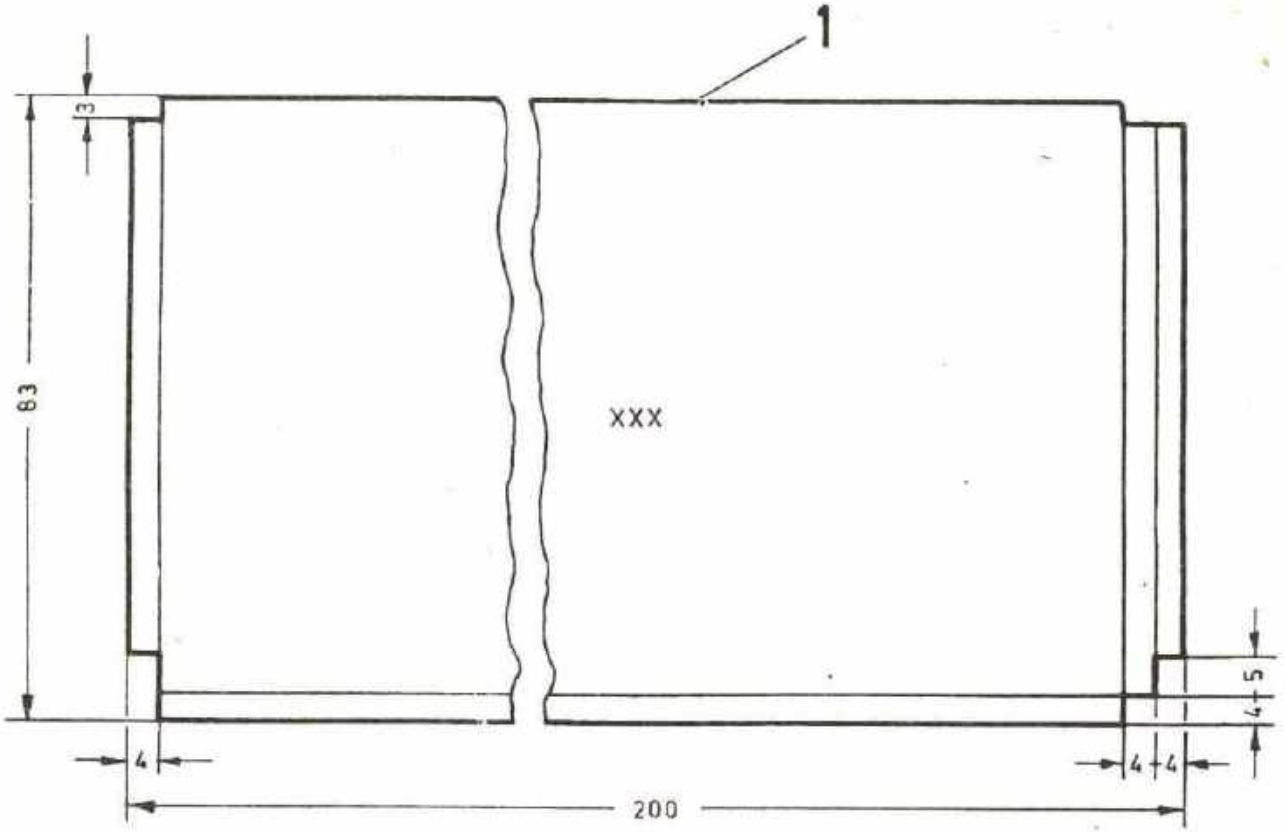
1. Fit bottom and body together and fold the joint as shown in the detail.
2. Add parts No. 2 and 4 and solder all the joints.

| | | |
|---|---|---|
| SCALE 1:1 | Spirit Bottle | MP/2.3/2.61/2.1 |
| MAT. G.I. SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




SEQUENCE OF OPERATIONS

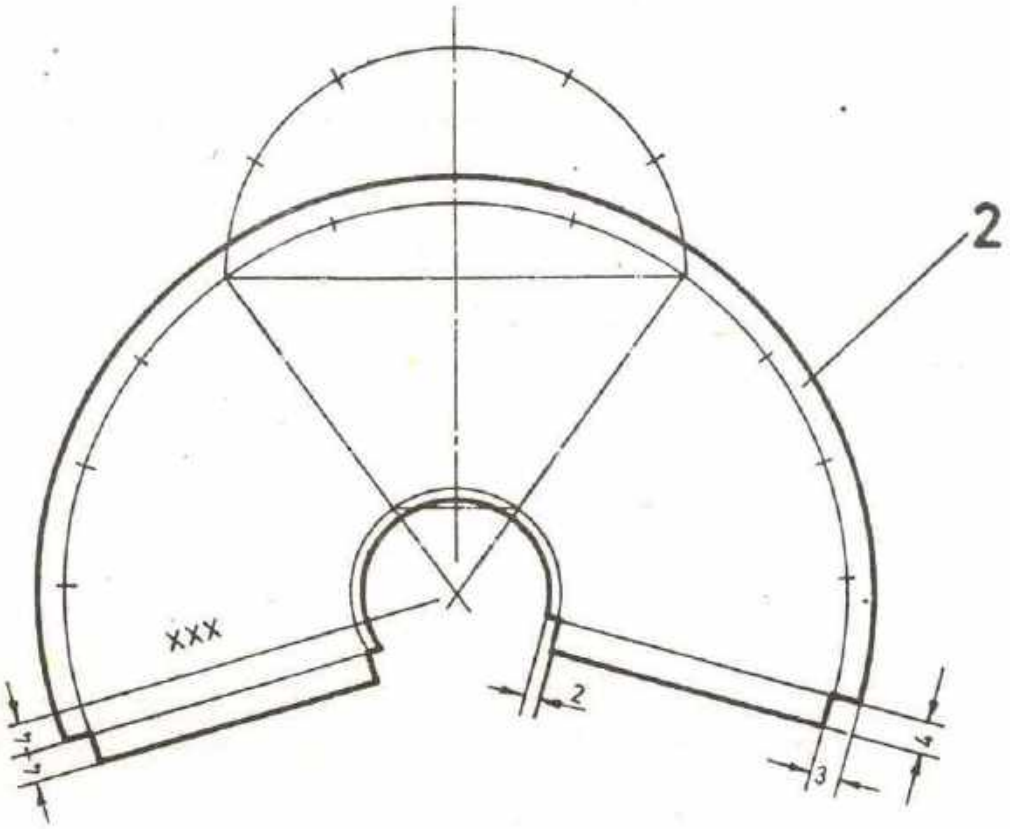
1. Mark and cut the job according to the drawing.
2. Prepare the joint edges for folding.
3. Round the job properly and fold the joint.
4. Prepare the body for joining it with the bottom by flanging its lower edge.

| | | |
|---|---|---|
| SCALE 1:1 | Spirit Bottle Development | MP/2.3/2.6.1/2.2 |
| MAT: G.I SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




SEQUENCE OF OPERATIONS

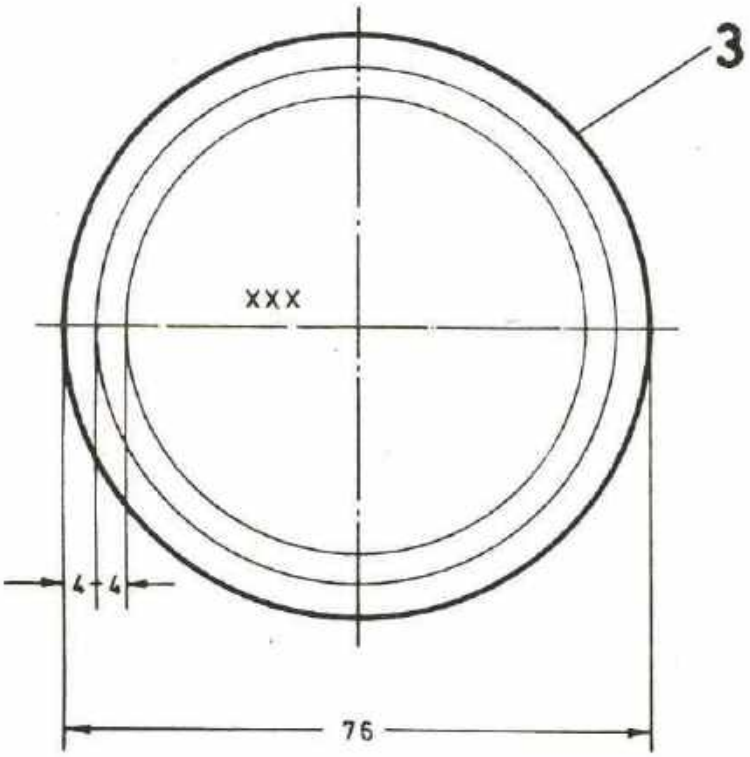
1. Mark the development of the job on the sheet and shear it.
   Mind the margins for the joints.
2. Bend the joint edges 90° and form the job to a cone.
3. Flange the upper and lower edge in the proper angles.

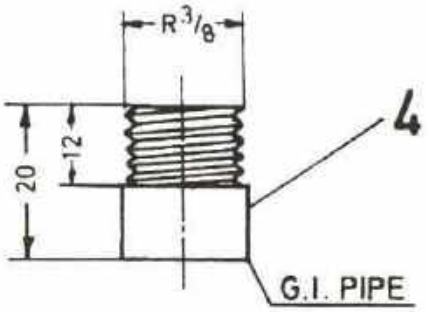
| | | |
|---|---|---|
| SCALE 1:1 | Spirit Bottle Development | MP/23/2.61/2.3 |
| MAT: G.I. SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




SEQUENCE OF OPERATIONS

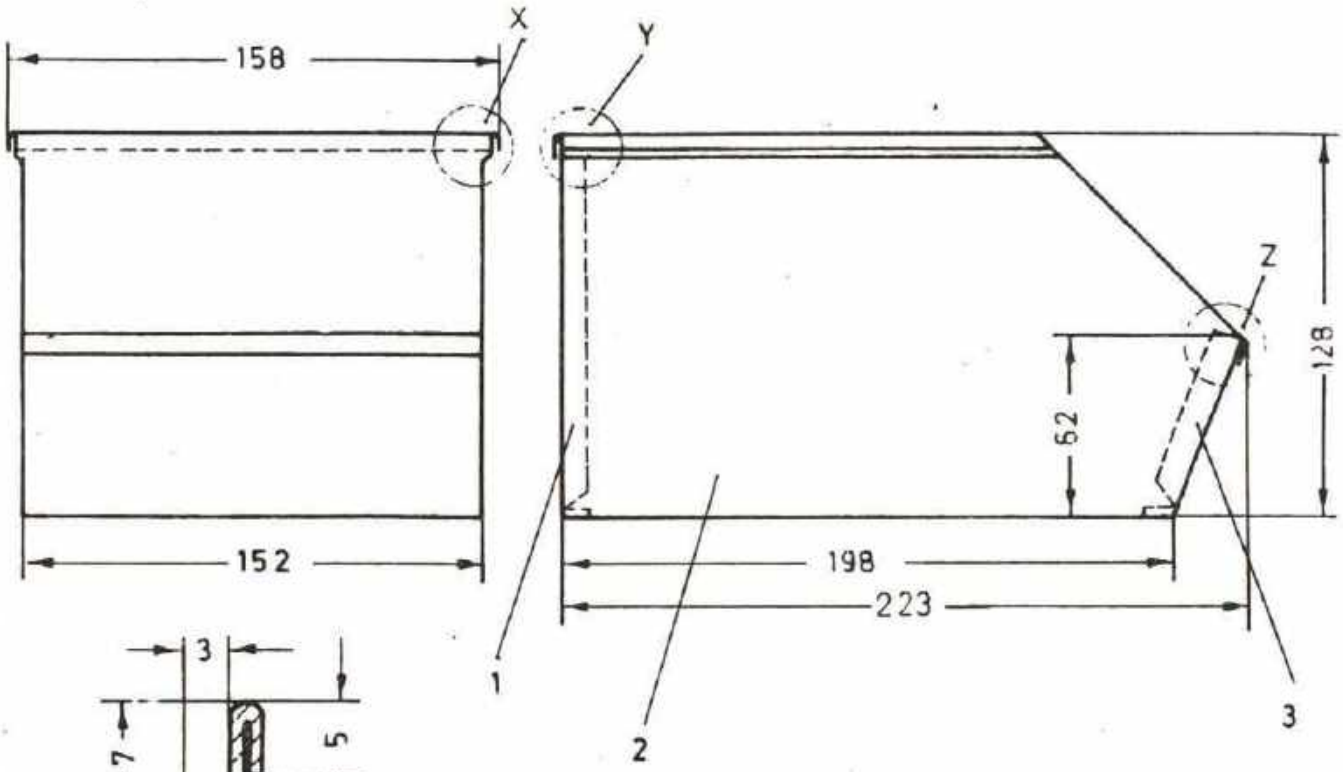
1. Mark out the three diameters of part 3.
2. Cut to Ø 76 mm.
3. Bend the first 90° flange at 4 mm distance from the edge.
4. Cut the thread R 3/8" x 12 on part No. 4.
5. Cut part No. 4 to length 20 mm.

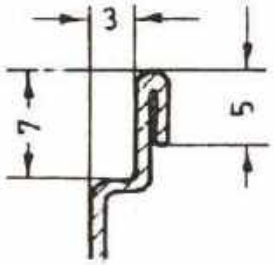
| | | |
|---|---|---|
| SCALE 1:1 | Spirit Bottle Development | MP/23/2.6.1/2.4 |
| MAT: G. I. SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

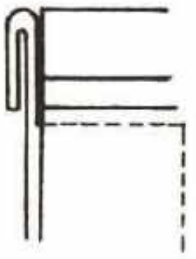
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




Detail X



Detail Y

Detail Z

SEQUENCE OF OPERATIONS

1. Remove the oxide layer from the spotwelding areas.
2. Fit parts 1 and 2 together as shown in detail "Y". Tackweld the corners (gas welding).
3. Fit part 3 as shown in detail "Z". Tackweld the corners.
4. Spotweld the box. Distance of the spots mm; amperage:
5. Finish the corners by filing.

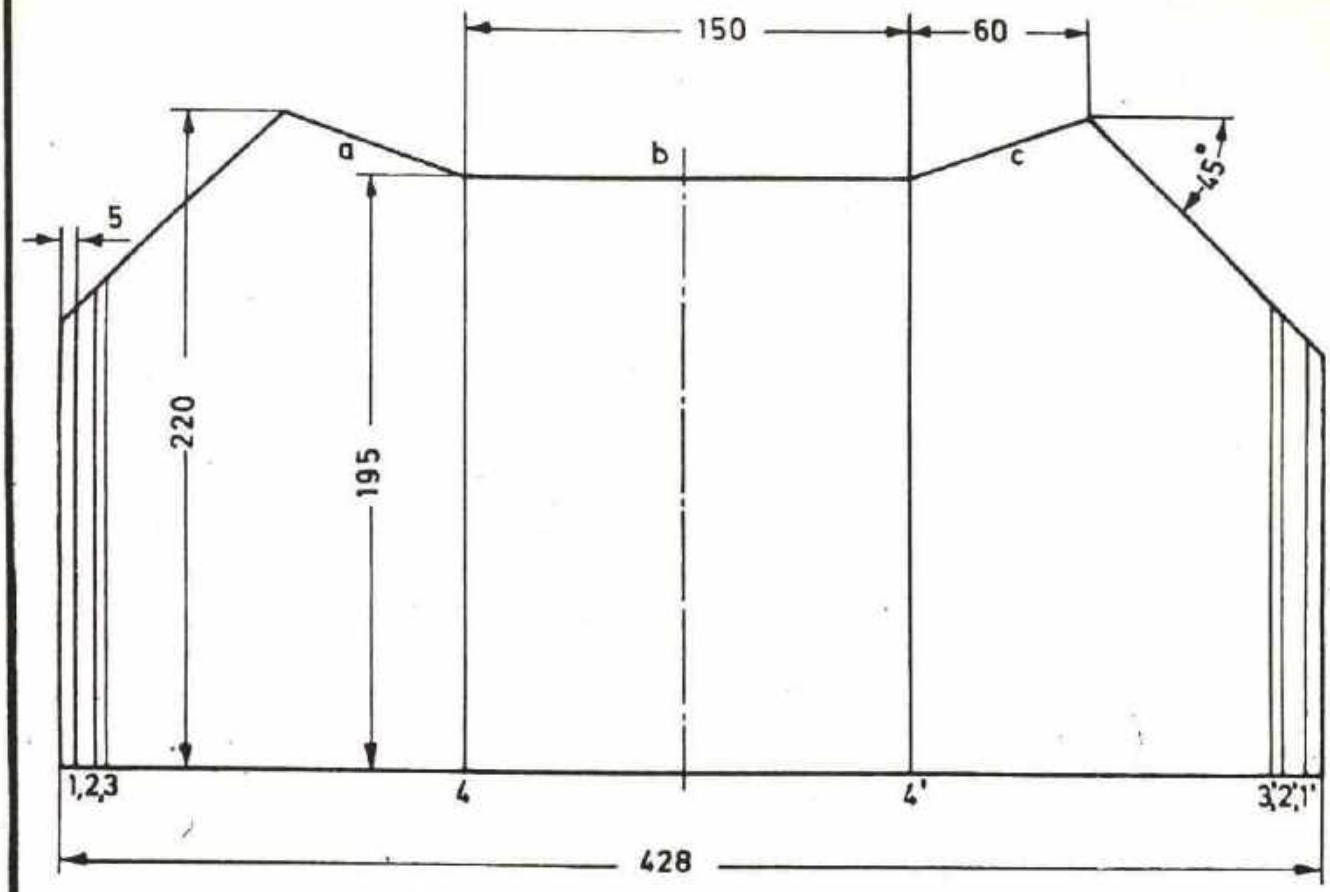
| Qty. | Denomination | Part No. | Remarks/ Material |
|---|---|---|---|
| 1 | Front part | 3 | Tinned sheet SWG 20 |
| 1 | Main body | 2 | Tinned sheet SWG 20 |
| 1 | Back part | 1 | Tinned sheet SWG 20 |

| | | |
|---|---|---|
| SCALE 1:2.5 | STORE BOX | MP/2.3/2.6.1/3.1 |
| FLAT TINNED SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELSER




## SEQUENCE OF OPERATIONS

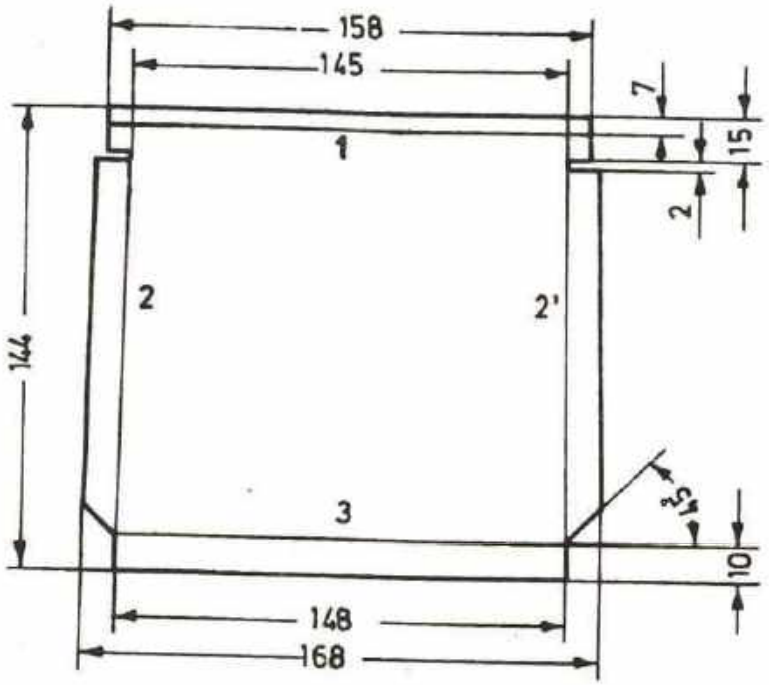
1. Mark all lines forming the perimeter and check them. Take the long (428 mm) edge as the reference line.
2. Cut out the piece, except for the lines a, b and c.
3. Cut at the lines a, b and c with the help of a chisel and finish with the flat file.
4. Mark the bending lines 1 and 1' at the rear, the lines 4 and 4' at the front side of the sheet.
5. Bend at lines 1 and 1' on the bending machine.
6. Bend at lines 2 and 3 (2' and 3') as shown in detail X of the following exercise sheet.
   Use the special bending device provided by your instructor for this operation.
7. Bend at lines 4 and 4'.

| | | |
|---|---|---|
| SCALE 1:1 | MAIN BODY OF STORE BOX | MP/2.3/2.6.1/3.2 |
| MAT. TINNED SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




## SEQUENCE OF OPERATIONS

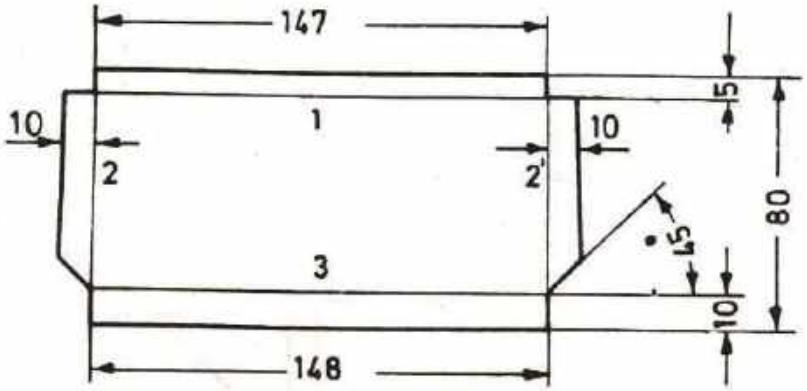
1. Mark out the sheet (line 1 at the rear)
   Punch all corners with the centre punch.
2. Cut along the outer lines (shearing machine).
3. Cut out the corners with the help of hand shears.
4. Cut the 2 mm-gap with the help of a hack saw.
5. Fold the sheet at marking line 1.
6. Bend the sheet at marking lines 2 and 2'.
7. Bend the job at marking line 3.

| SCALE 1: 2,5 | BACK OF STORE BOX | MP/2.3/2.6.1/3.3 |
|---|---|---|
| MAT: TINNED SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




SEQUENCE OF OPERATIONS

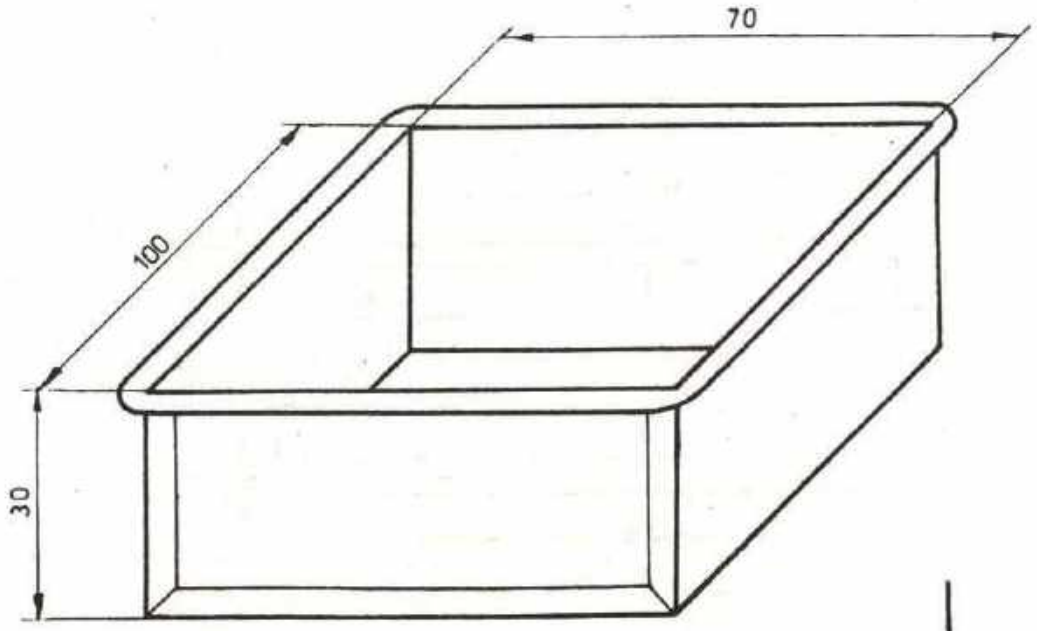
1. Mark all lines of the job.
   (Line 1 at the rear.)
   Punch the corners with a centre punch.
2. Cut along the outer lines (shearing machine).
3. Cut out the corners.
4. Bend at line 1.
5. Bend at lines 2 and 2'.
6. Bend at line 3. Mind the angle.

| | | |
|---|---|---|
| SCALE 1:25 | FRONT OF STORE BOX | MP/2.3/2.6.1/3.4 |
| MAT: TINNED SHEET | | SHEET METAL |

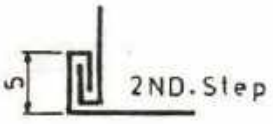
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER








SEQUENCE OF OPERATIONS

Fit sides and body together and fold the joint as shown in the detail.

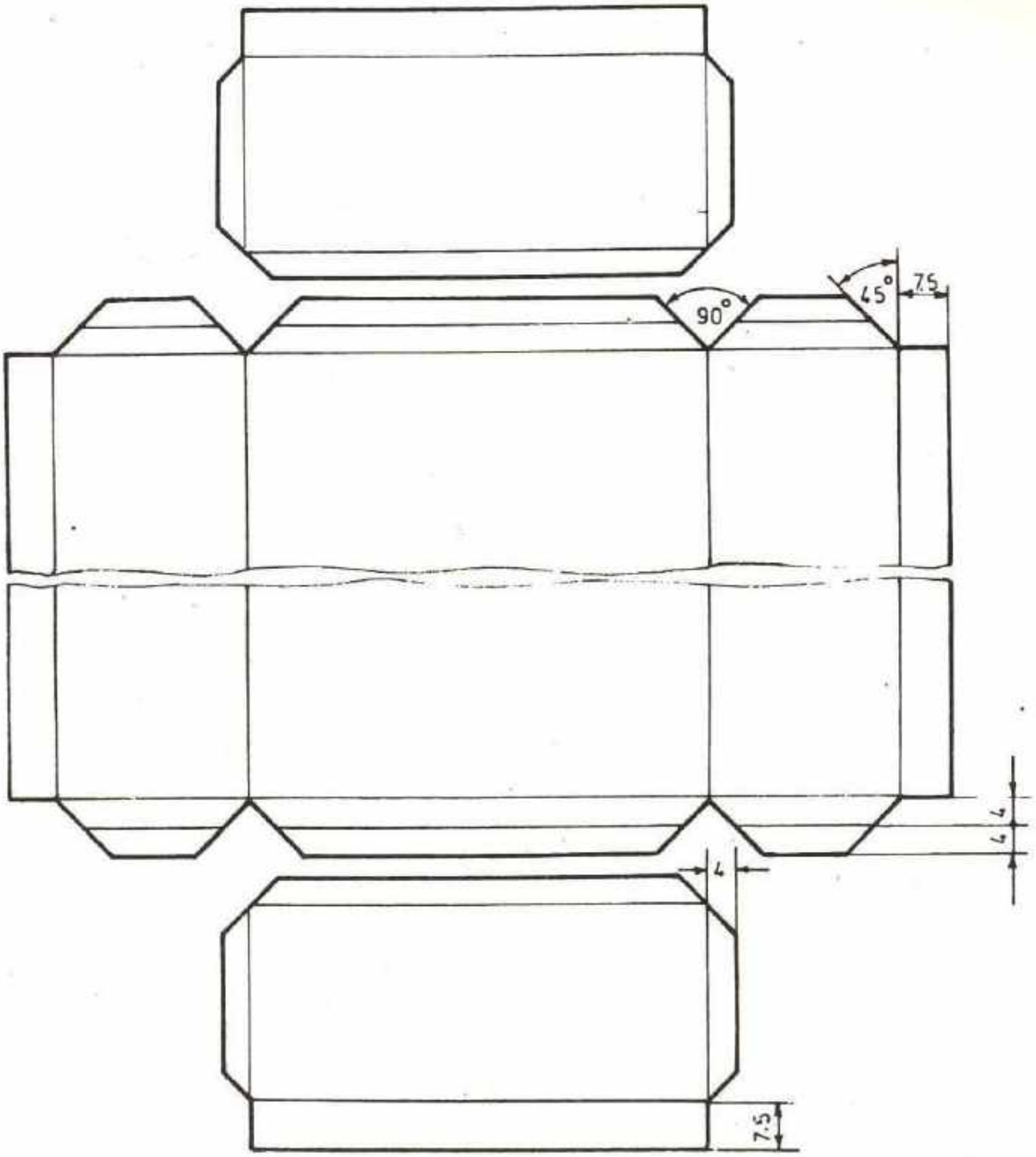
Apply soldering fluid and tin solder sparingly to obtain a clean and proper joint.

| | | |
|---|---|---|
| SCALE 1:1 | SHEET METAL BOX | MP/2.3/2.6.1/4 |
| MAT. G.I. SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




SEQUENCE OF OPERATIONS

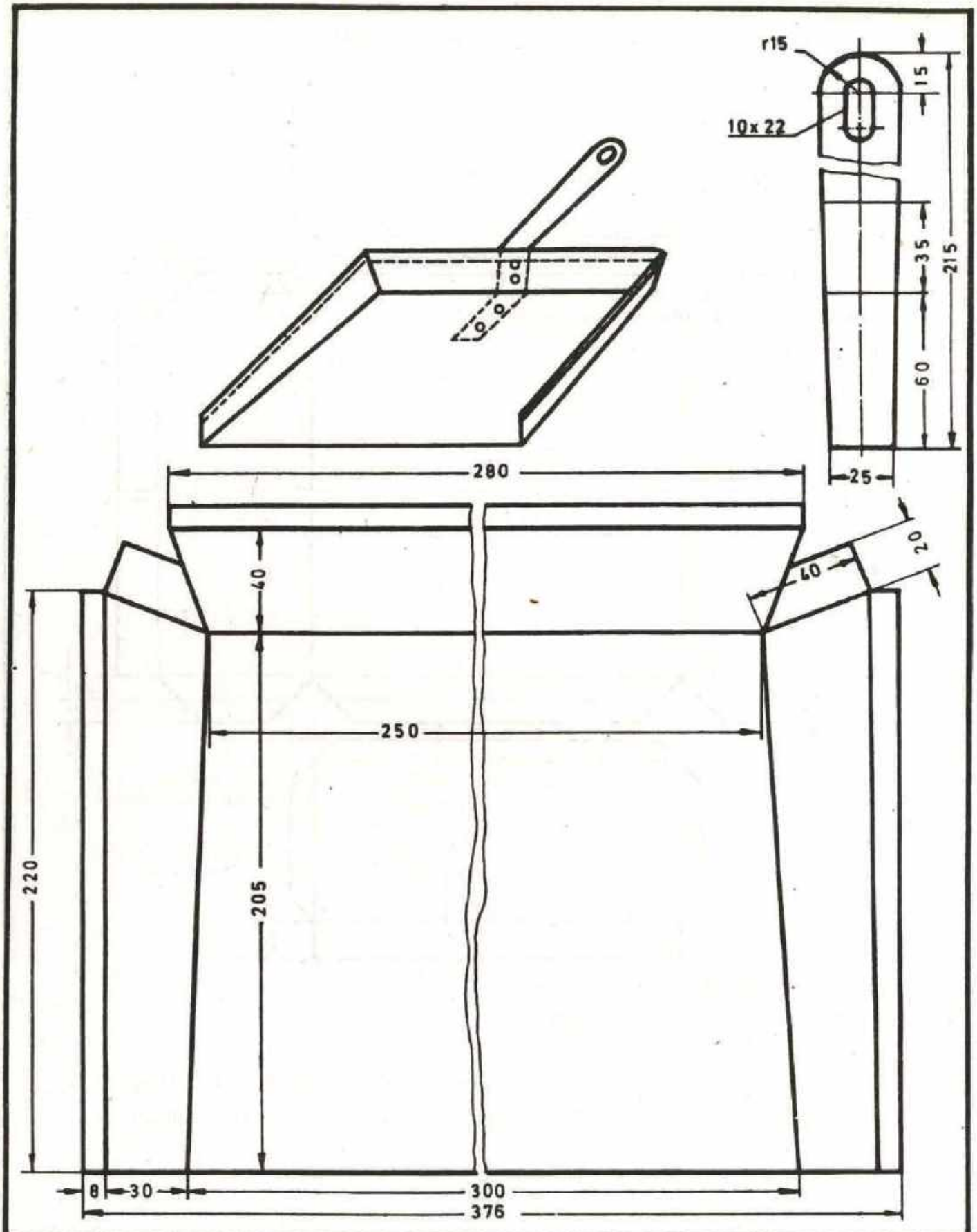
- Mark out and cut the sheet.
- Wire the edges.
- Bend the job after preparing the joint edges for folding.
- Fit the side and body together and press the joint edges according to drawing.
- Apply the solder and clean it.

| | | |
|---|---|---|
| SCALE 1:2 | SHEET METAL BOX DEVELOPMENT | MP/2.3/2.6.1/4.1 |
| MAT. G.I. SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

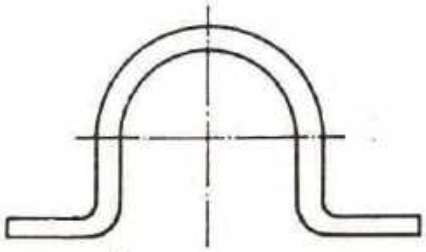



| | | |
|---|---|---|
| SCALE 1:2 | DUST PAN | MP/2.3/2.6.1/Test 1 |
| MAT. G.I. SHEET | | SHEET METAL |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

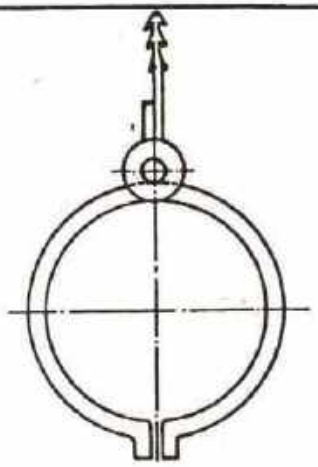


Pipe Clamp

1

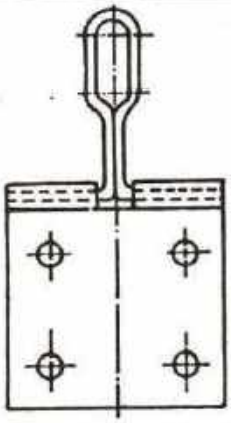
Double Pipe Clamp

2



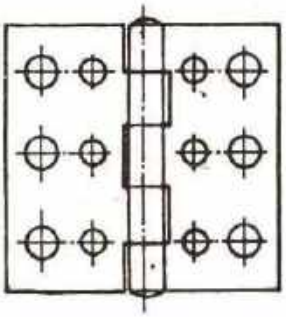
Hinged Pipe Clamp

3



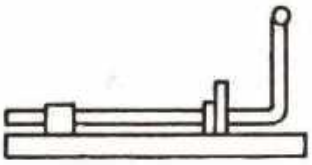
Staple And Hasp

4



Hinge

5



Sliding Bolt Lock

6

| | | |
|---|---|---|
| TRADE TRAINING I | LAYOUT | MP/2.3/2.6.2<br>BENCH WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

# MATERIAL REQUIRED

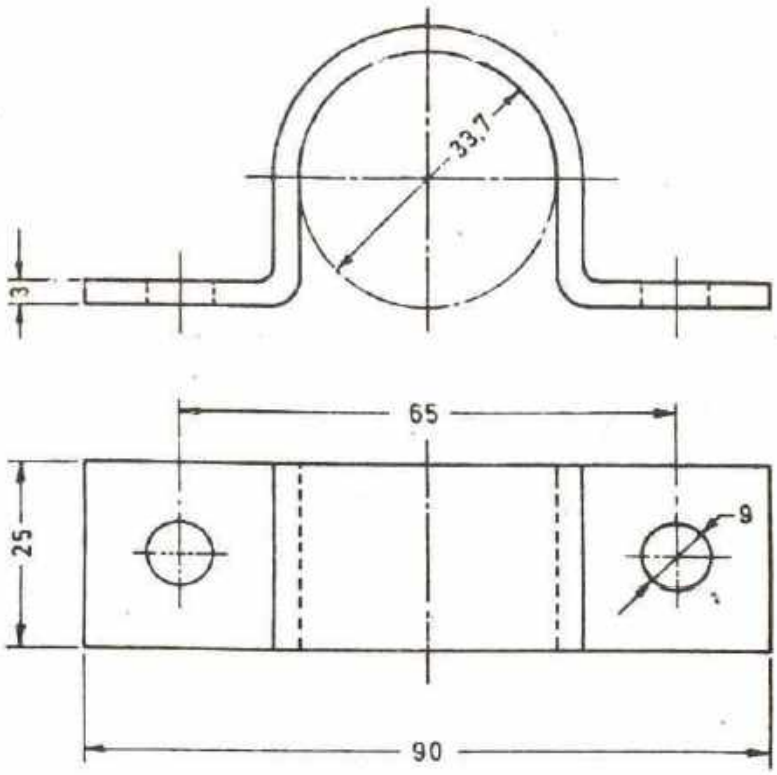
TRADE TRAINING I

BENCH WORK

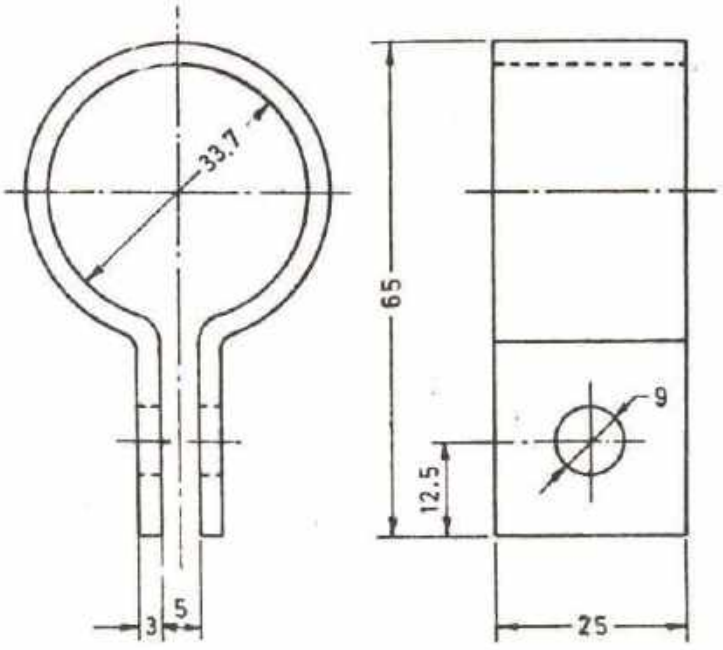
NO. 2.6.2/ 1 TO 4

(Length given in millimeters)

| | 1.1 | 1.2 | 2 | 3.1 | 3.2 | 3.3 | 4.1 | 4.2 | 4.3 | 4.4 | Length per trainee | Total length for 16 trainees |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M.S.Sheet 26 x 3 m m | 142 | 175 | 330 | | | | | | | | 647 | 10.5m |
| M.S.Sheet 25.4 x 4.8 m m I" x 3/16" | | | | 180 x 2 360 | 110 | 105 | | | | | 575 | 9.5m |
| Round "HD" Rivet Ø 8mm x 10 mm | | | | | | | | | | | 1 NO | 18 Nos |
| Round "HD" Rivet Ø 10 mm x 18 mm | | | | | | | | | | | 1 NO | 18 Nos |
| Countersunk Rivet Ø 5 mm x 6.5 mm | | | | | | | | | | | 1 NO | 16 Nos |
| M.S. Sheet 52 x 2 mm 13 SWG | | | | | | | 81 | | | | 81 | 1.3m |
| M.S. Round Ø 5 mm | | | | | | | | 275 | | 75 | 350 | 5.75m |
| M.S. Sheet 37 x 2 mm 13 SWG | | | | | | | | | 67 | | 67 | 1.1m |




2 Pieces

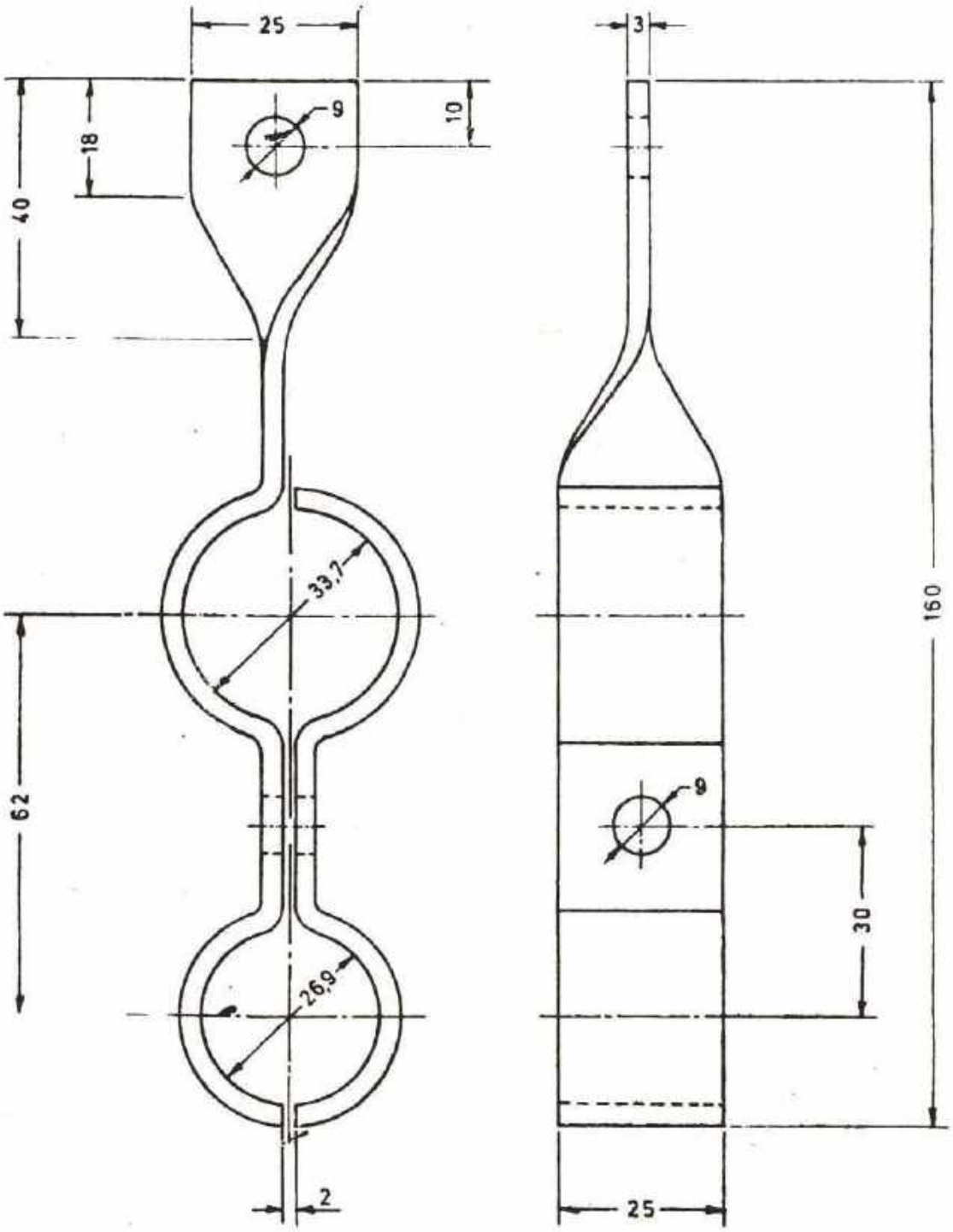



| | | |
|---|---|---|
| SCALE: 1:1 | PIPE CLAMPS | MP/2.3/2.6.2/1 |
| MAT.: MILDSTEEL | | BENCH WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

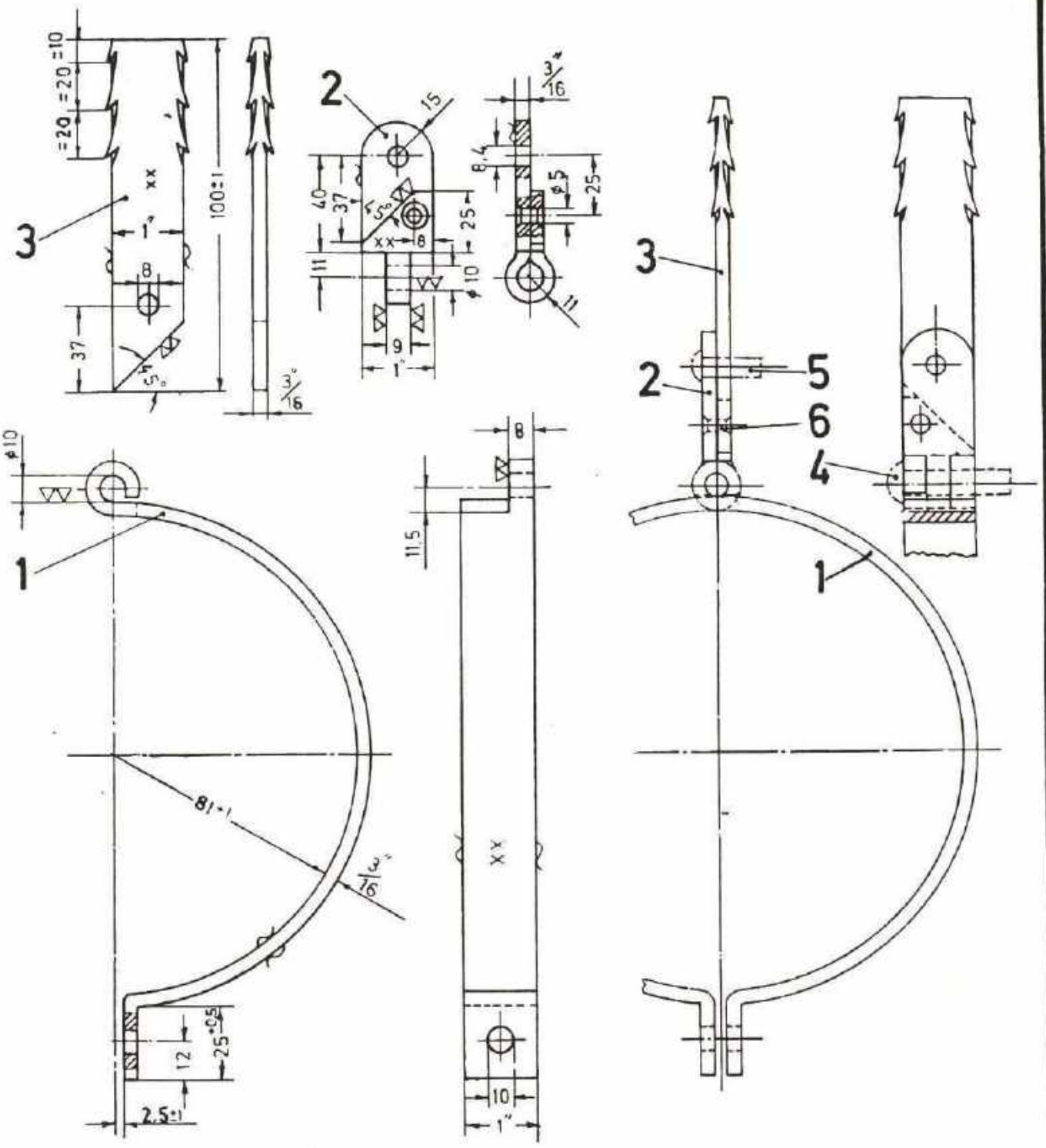



| | | |
|---|---|---|
| SCALE: 1:1 | Double Pipe Clamp | MP/2.3/2.6.2/2 |
| MAT.: MILDSTEEL | | BENCH WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



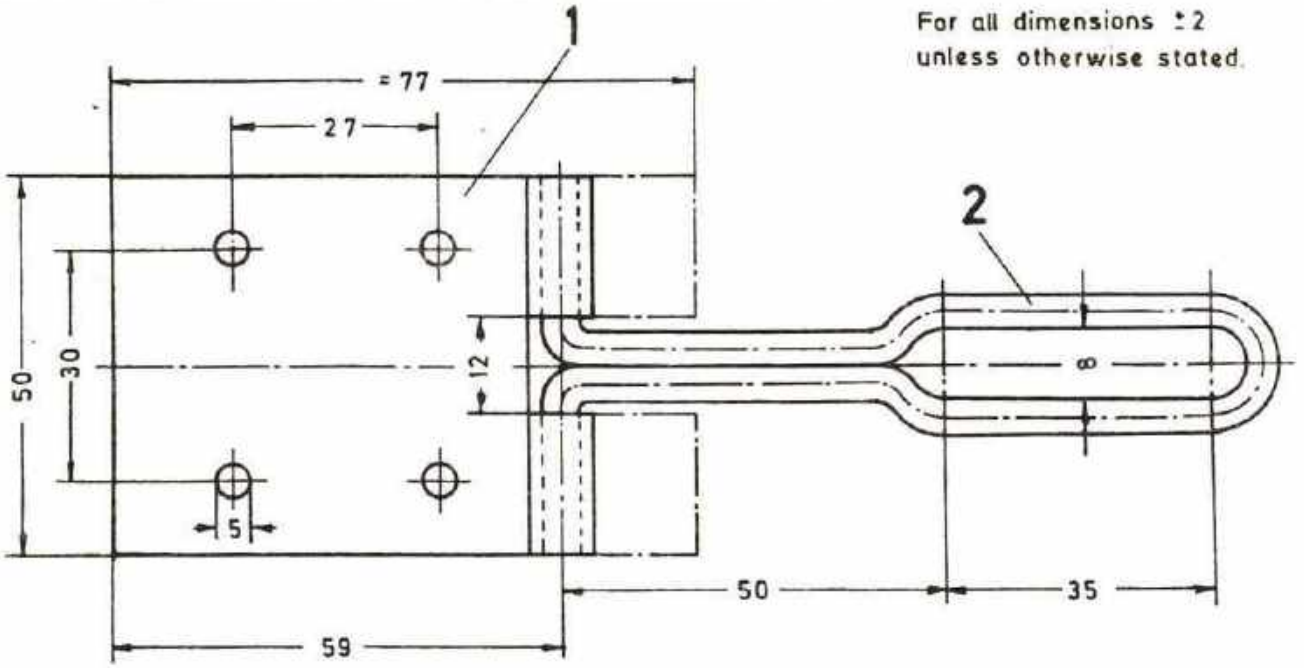

| | | |
|---|---|---|
| SCALE 1:1 | Hinged Pipe Clamp | MP/2.3/2.5.2/3 |
| MAT.: MILD STEEL | | BENCH WORK |

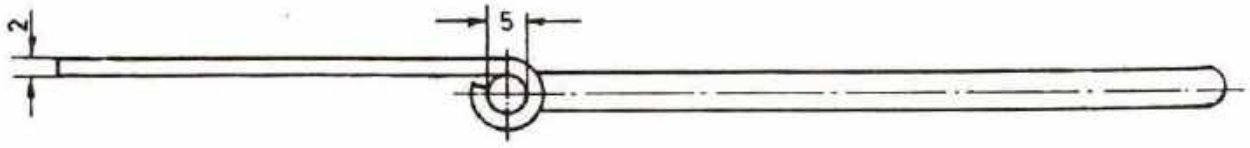
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

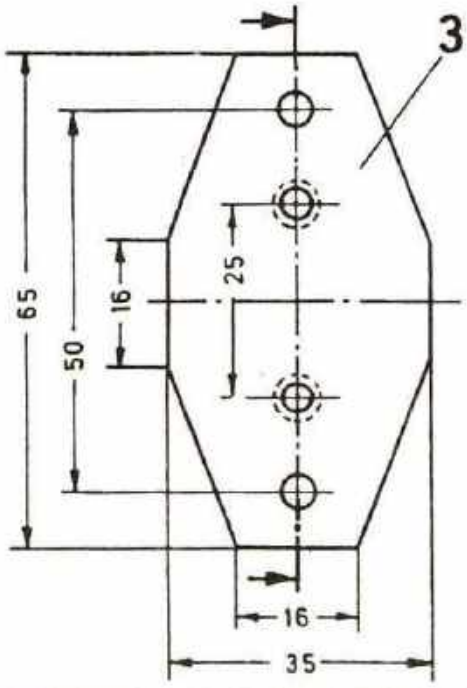
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

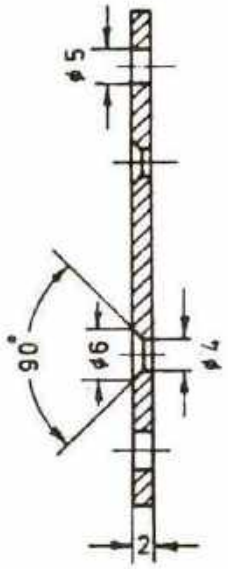
WELDER

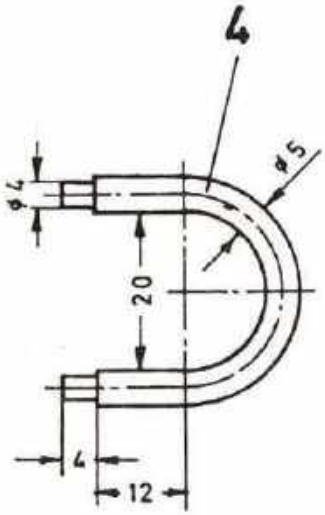
For all dimensions ±2
unless otherwise stated.



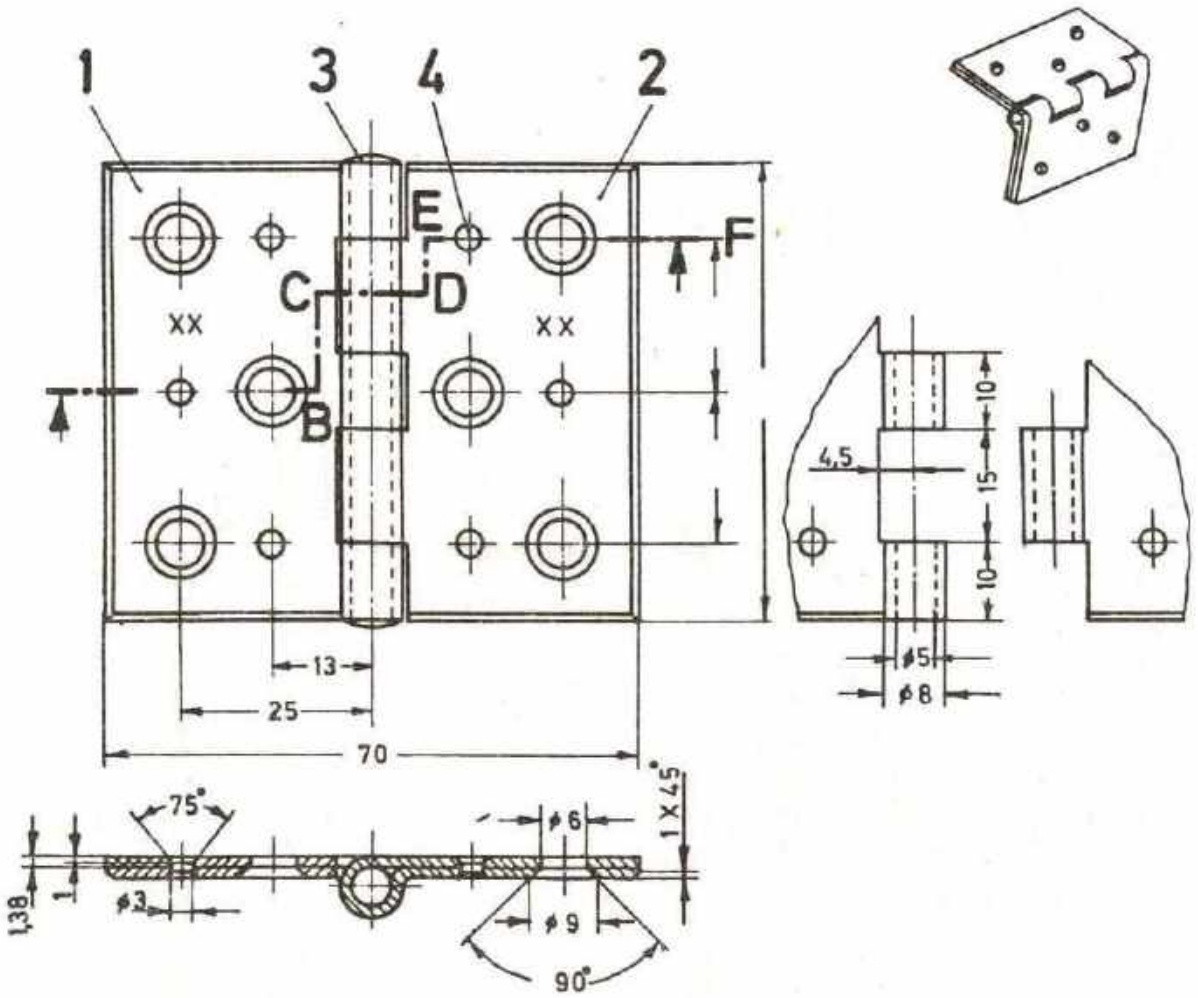

| Nos. | DESCRIPTION | P.No. | MATERIAL | SIZES |
|---|---|---|---|---|
| 1 | Staple | 4 | St 37 | ϕ 5X75 |
| 1 | Base plate | 3 | Mild steel sheet | 2X37X67 |
| 1 | Hasp | 2 | St 37 | ϕ5X275 |
| 1 | Hinge plate | 1 | Mild steel sheet | 2X52X81 |

| | | |
|---|---|---|
| SCALE: 1:1 | STAPLE AND HASP | MP/2.3/2.6.2/4 |
| MAT: MILDSTEEL | | BENCH WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



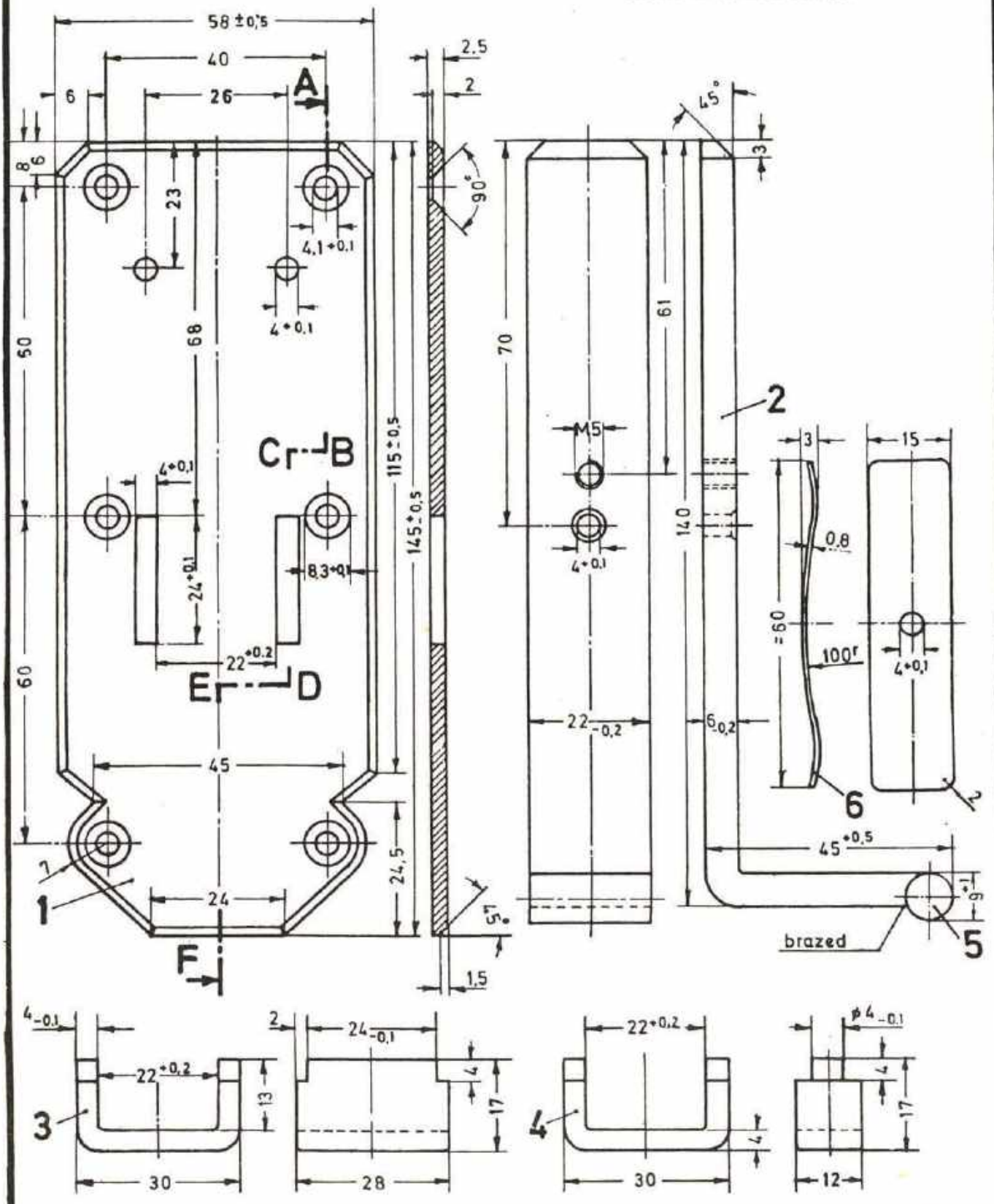

| | | |
|---|---|---|
| SCALE: 1:1 | Hinge | MP/2.3/2.6.2/5 |
| MAT.: MILDSTEEL | | BENCH WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

For all dimensions ±0,1
unless otherwise stated.

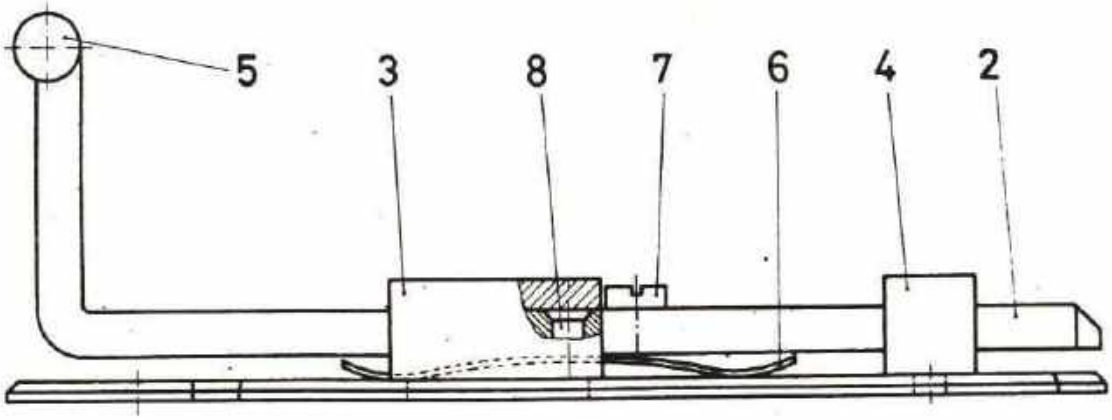


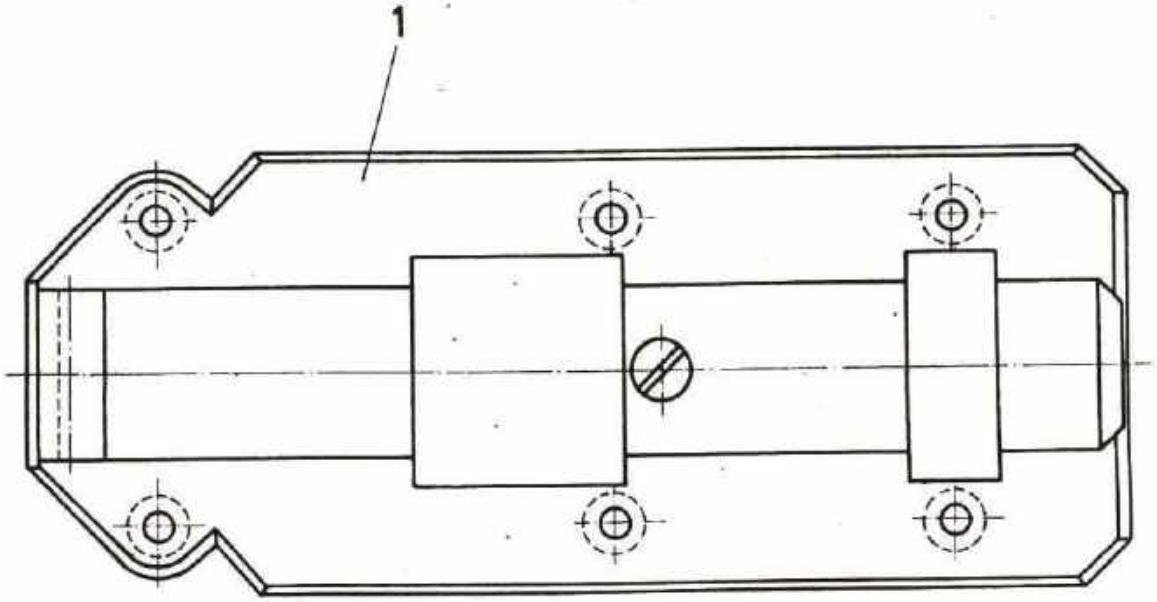

| | | |
|---|---|---|
| SCALE: 1:1 | Sliding Bolt Lock | MP/2.3/26.2/6 |
| MAT.: MILDSTEEL | | BENCH WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Qty. | Denomination | Part No | Material / Remarks |
|---|---|---|---|
| 1 | Counter sunk rivet | 8 | Mild steel |
| 1 | Cylindrical head screw | 7 | M5 x 5 |
| 1 | Flat spring | 6 | Spring steel |
| 1 | Handle | 5 | Mild steel |
| 1 | Bolt guide | 4 | Mild steel |
| 1 | Bolt guide | 3 | Mild steel |
| 1 | Locking bolt | 2 | Mild steel |
| 1 | Base plate | 1 | Mild steel |

SCALE 1 : 1

# SLIDING BOLT LOCK

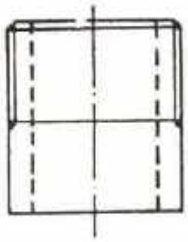
MP/2.3/2.6.2/6.1

BENCH WORK

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

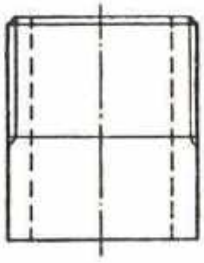
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



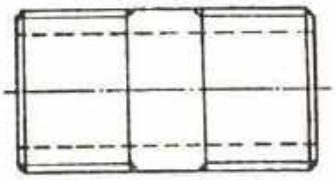
Threading Exercise

1



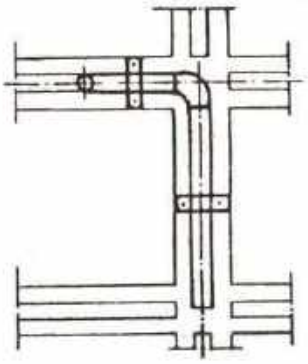
Threading Exercise

2



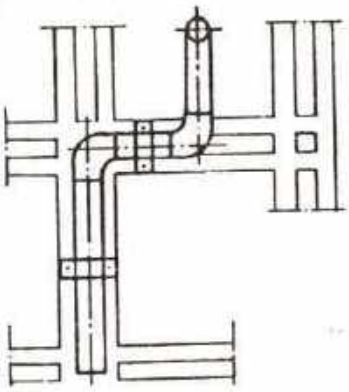
Double Nipple

3



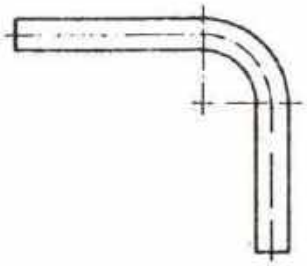
Water Pipe Installation

4



Water Pipe Installation

5

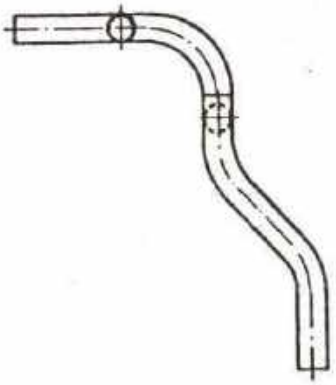


Pipe Bending

6

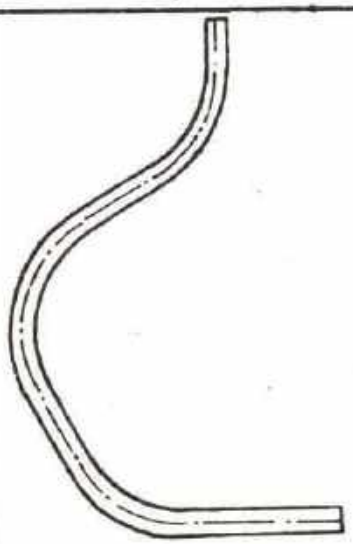
Pipe Bending

7



Branch Pipe

8



Pipe Bending

9

| | | |
|---|---|---|
| TRADE TRAINING 1 | LAYOUT | MP / 2.3 / 2.6.3<br>PIPE BENDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

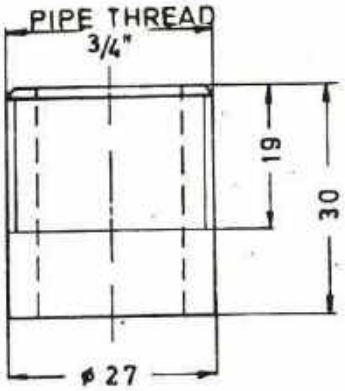
WELDER

# MATERIAL REQUIRED

TRADE TRAINING I
NO. 2.6.3/1 TO 9
PIPE BENDING

(Length given in millimeters)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Length per trainee | Total length for 16 trainees |
|---|---|---|---|---|---|---|---|---|---|---|---|
| G.I PIPE Ø $\frac{3}{4}$" | 32 | | 52 | | | | | | | 84 | 1.4m |
| G.I PIPE Ø 1" | | 34 | | | | | | | | 34 | 0.6m |
| G.I PIPE Ø $\frac{1}{2}$" | | | | 755 | 1020 | | | | | 1775 | 28.4m |
| G.I ELBOW Ø $\frac{1}{2}$" | | | | 1 | 2 | | | | | 3 Nos | 48 Nos |
| M.S PIPE Ø $\frac{3}{4}$" | | | | | | 525 | 525 | 1130 | 1200 | 3380 | 54m |




## SEQUENCE OF OPERATIONS

1. Check the quality of the pipe.
   (Correct weld seam? Properly galvanized?
   Diameter accurate?)
2. Thread the pipe, mind the length of the thread.
3. Cut the pipe and deburr it.

## TOOLS REQUIRED

Measuring and marking tools

Threading die

Hacksaw

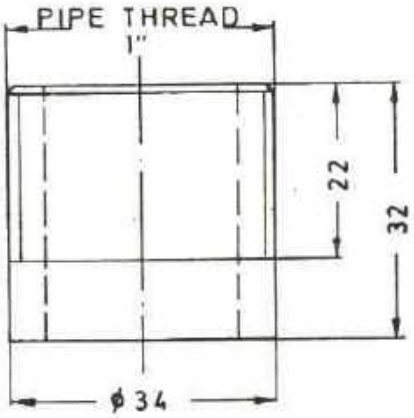
Flat file 200 x 3

Round file 200 x 3

## CAUTION

NEVER THREAD WITHOUT OILING !

| | | |
|---|---|---|
| SCALE: 1:1 | THREADING EXERCISE | MP/2.3/2.6.3/1 |
| MAT: G.I. PIPE | | PIPE-WORK |
| DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING<br>PAK-GERMAN TECHNICAL TRAINING PROGRAMME | | WELDER |




SEQUENCE OF OPERATIONS

1. Check the quality of the pipe as done before.
2. Thread the pipe, mind the length of the thread.
3. Cut the pipe and deburr it.

TOOLS REQUIRED

Measuring and marking tools

Threading die

Hacksaw

Flat file 200 x 3

Round file 200 x 3

CAUTION

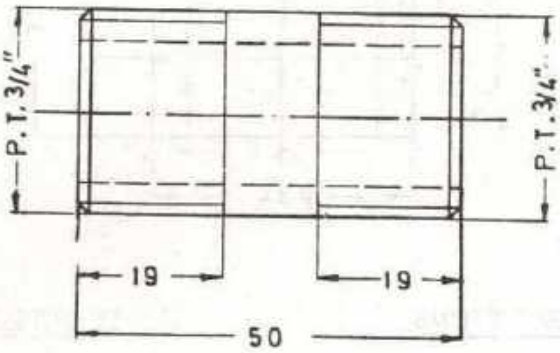
NEVER THREAD WITHOUT OILING !

| | | |
|---|---|---|
| SCALE: 1:1 | THREADING EXERCISE | MP/2.3/2.6.3/2 |
| MAT. G. I. PIPE | | PIPE-WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



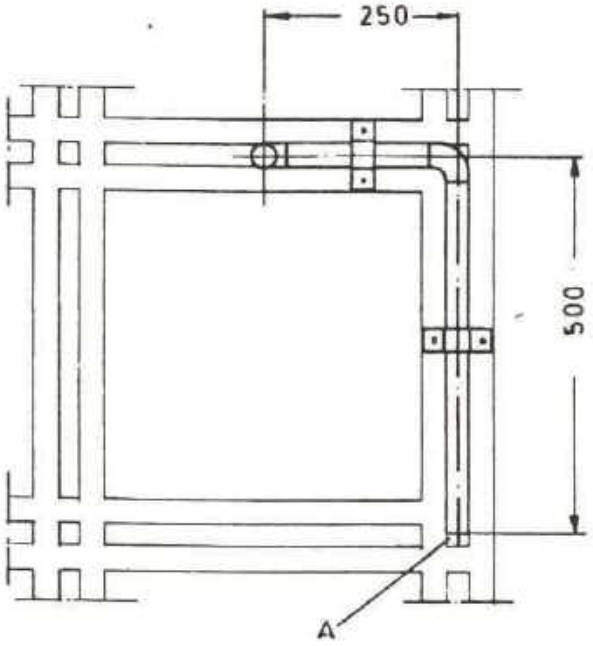

SEQUENCE OF OPERATIONS

1. Cut threads at the end of the pipe.
2. Mark the length of the nipple and cut it off.
3. Thread the other end of the nipple.

   As it is too short to be chucked in the vice directly the nipple must be extended.

   Use a suitable pipe with a socket at the end for this purpose.

| | | |
|---|---|---|
| SCALE: 1:1 | DOUBLE NIPPLE | MP/2.3/2.6.3/3 |
| MAT. G.I. PIPE | | PIPE-WORK |




SEQUENCE OF OPERATION

1. Check the material.
2. Cut the pipes to the length. Deburr the pipes and cut the thread.
3. Join the pipes with the bend.
4. Prepare the horizontal pipe in the same way and join it.
5. Point 'A' will be given by the Instructor.

CAUTION

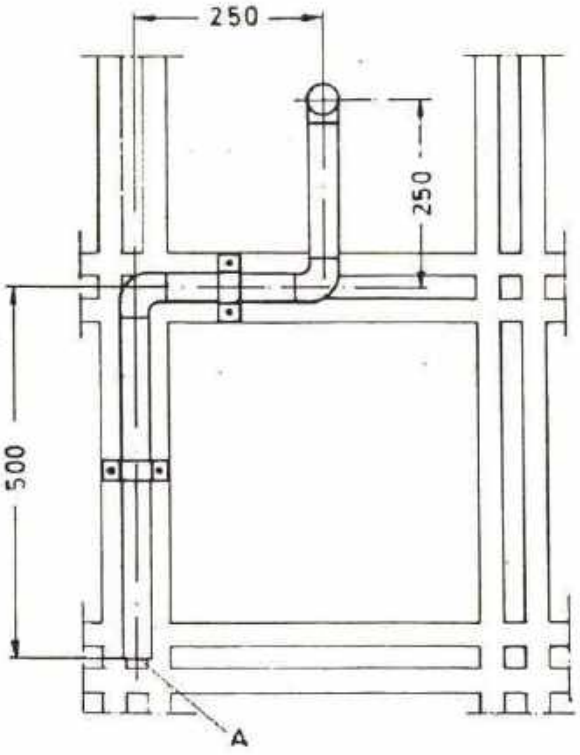
The thread of fittings and pipes are slightly taper. If the thread is cut properly it should be possible to screw 80 % of the threaded portion into a fitting by hand.

| | | |
|---|---|---|
| SCALE: 1:1 | WATER PIPE INSTALLATION | MP/23/26.3/4 |
| MAT: G.I. PIPE | | PIPE-WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




SEQUENCE OF OPERATION

1. Start the work from point 'A' given by the Instructor.
2. Prepare the 3 pieces in the proper sequence and join them with the bends.
3. Fix the pipe line with clamps on the wall.
4. Check finally if all dimensions correspond with the drawing.
5. Check the position of the last bend using pipe nipple and level.

CAUTION

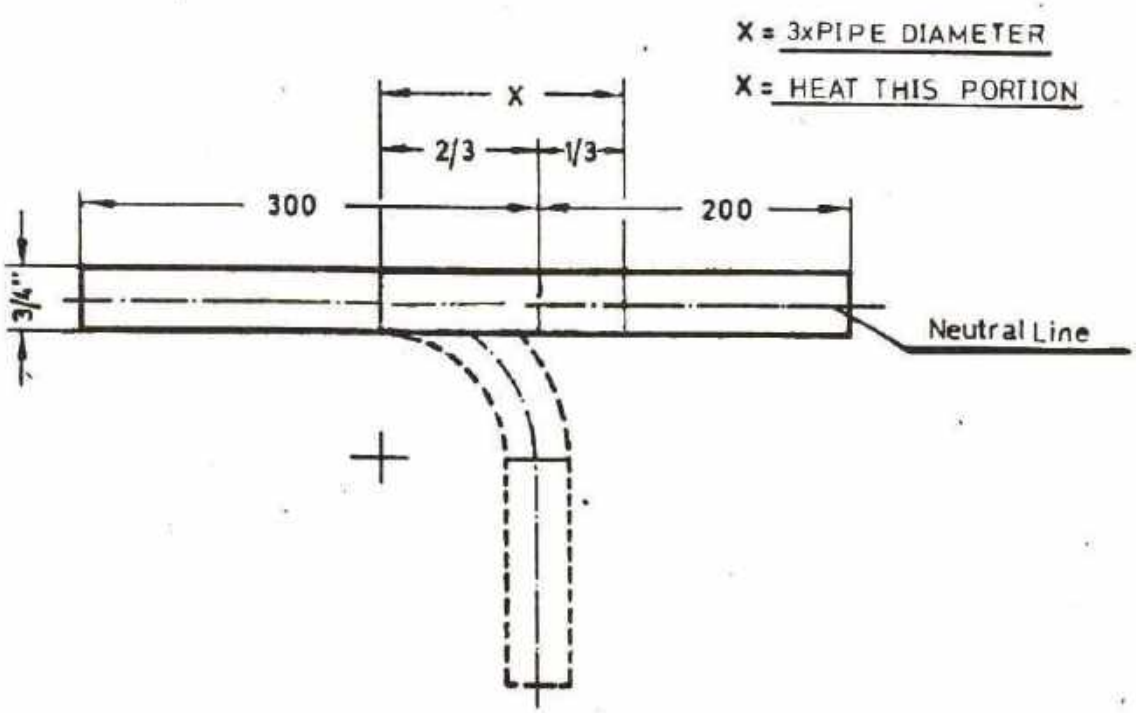
The cut edges of the pipe must be deburred inside and outside.

| | | |
|---|---|---|
| SCALE: 1:1 | WATER PIPE INSTALLATION | MP/2.3/2.6.3/5 |
| MAT: G.I. PIPE | | PIPE-WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




Material: 1 mild-steel pipe 3/4" x 500

SEQUENCE OF OPERATIONS

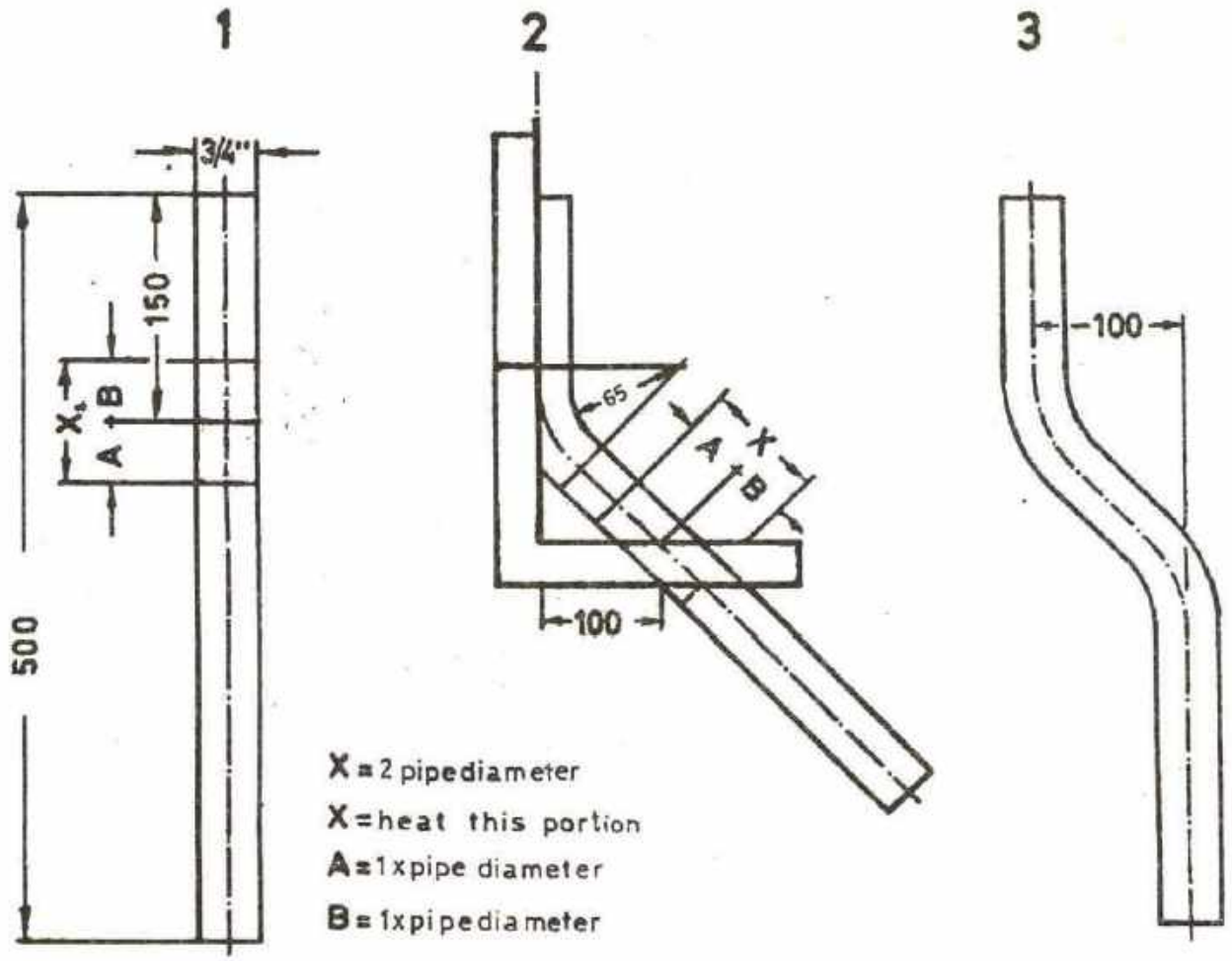
1. Fill the pipe with dry bending sand and close the ends with wooden plugs.
2. Mark the job.
3. Heat portion X and bend.
   Take care that the weld-seam of the pipe is in the neutral line of the bend.

| | | |
|---|---|---|
| SCALE: 1:1 | Pipe Bending 1 | MP/2.3/2.6.3/6 |
| MAT. M.S.PIPE | | PIPE-WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




Material: 1 mild-steel pipe 3/4" x 500

SEQUENCE OF OPERATION

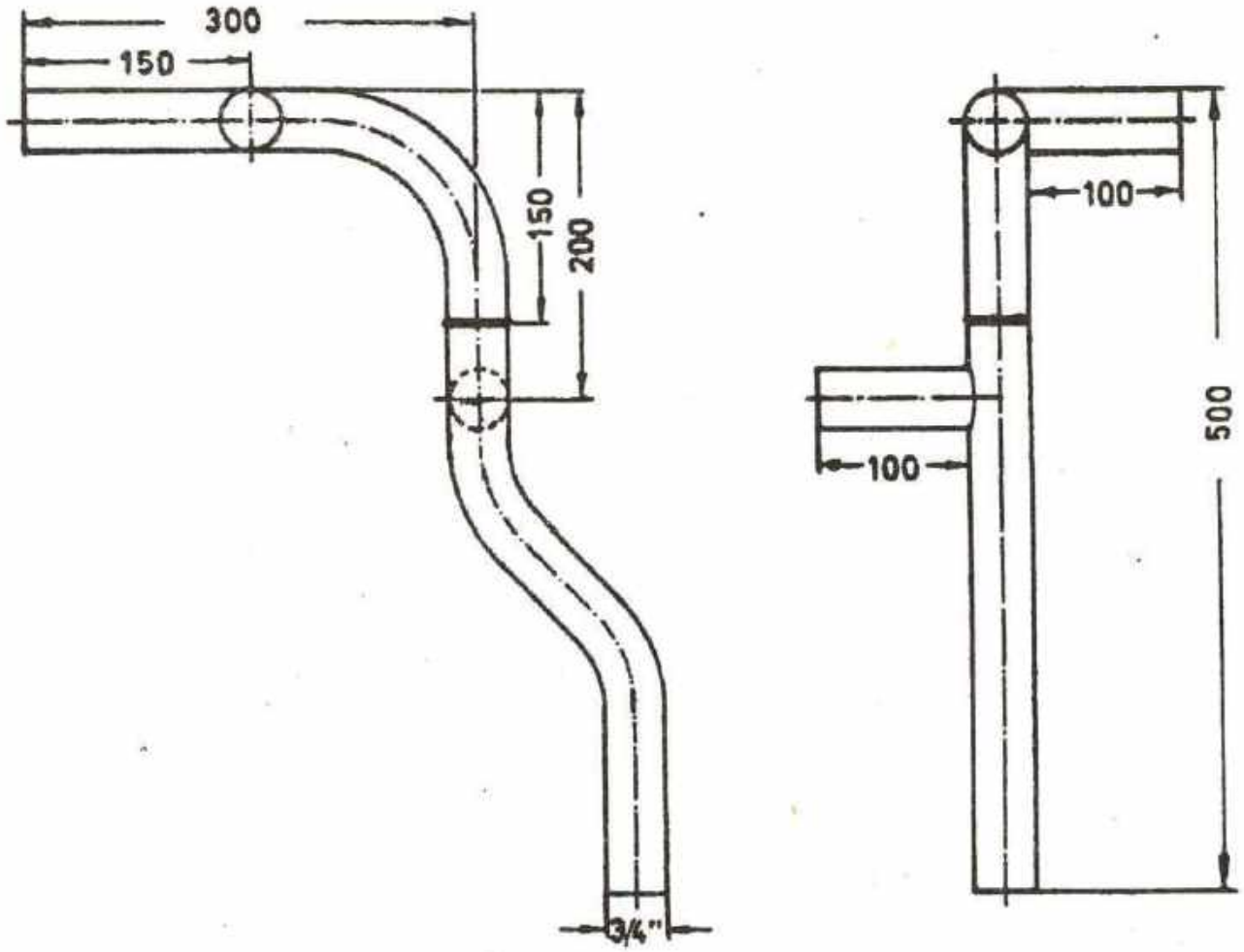
1. Fill the pipe with bending sand and close the ends with wooden plugs.
2. Mark portion X for the upper bend.
3. Heat portion X and bend.
4. Let the first bend cool down before going on with the work
5. Mark portion X for the lower bend.
6. Heat portion X and bend.

| | | |
|---|---|---|
| SCALE: 1:1 | Pipe Bending 2 | MP/2.3/2.6.3/7 |
| MAT: M.S PIPE | | PIPE-WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




**Material: the pipe bends from exercises No. 6 and 7**

SEQUENCE OF OPERATIONS

1. Mark and cut the bends from the previous exercises according to the drawing.
2. Prepare the two T-branches as shown in the drawing.

The Exercise is to be completed during 3rd Semester Gas-welding course by carrying out the following operations:

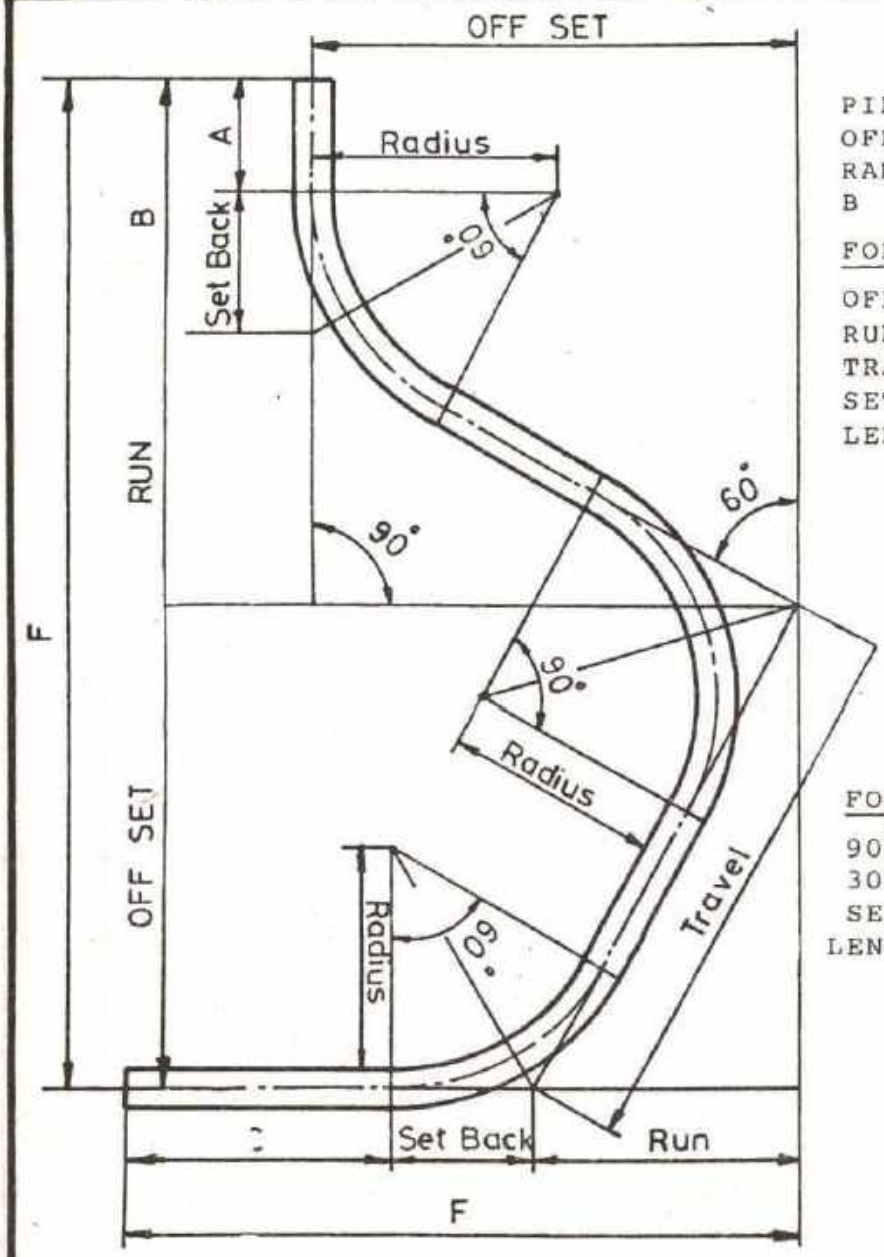
3. Cutting holes for the T-branches with the help of the torch.
4. Joining all four pieces by gas-welding.

| | | |
|---|---|---|
| SCALE: 1:1 | Branch Pipe | MP/2.3/2.6.3/8 |
| MAT: M.S PIPE | | PIPE-WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




PIPE = Ø 3/4"
OFFSET = 240
RADIOUS = 90
B = 150

FOR 60° OFFSET BENDS

| | | |
|---|---|---|
| OFFSET | = RUN | X1.732 |
| RUN | = OFFSET | X .577 |
| TRAVEL | = OFFSET | X1.154 |
| SETBACK | = RADIUS | X .577 |
| LENGTH OF BEND | = RADIUS | X1.047 |

FOR 90° CENTER BEND

| | | |
|---|---|---|
| 90° - 60° | = 30° | |
| 30° + 60° | = 90° | BEND |
| SETBACK | = RADIUS | X1.000 |
| LENGTH OF BEND | = RADIUS | X1.571 |

SEQUENCE OF OPERATIONS

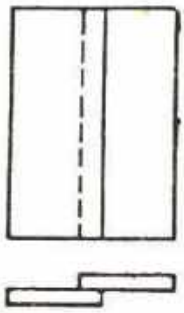
- Calculate the length of pipe according to the drawing and cut it.
- Mark the bending lay out on the plate or floor
- Mark the job.
- Fill the pipe with dry sand and close the ends with wooden plugs.
- Heat the first portion for 60° bend and bend it.
- Let the first bend cool down before going on with the work.
- Complete the job gradually.

| | | |
|---|---|---|
| SCALE 1:4 | PIPE BENDING | MP/2.3/2.6.3/9 |
| MAT. M.S PIPE | | PIPE WORK |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

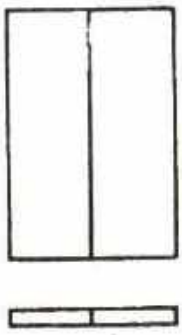
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



Lap Joint

1

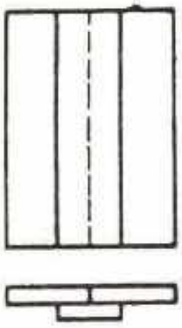


Butt Joint

2

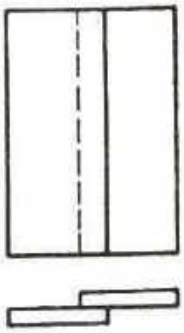
Angle Joint

3



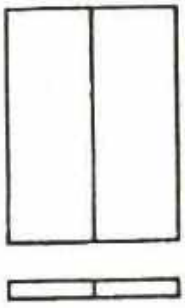
Double Joint

4



Lap Joint

5

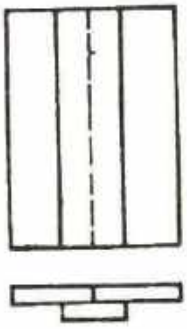


Butt Joint

6

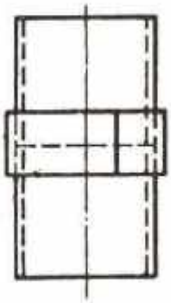
Butt Joint at an angle

7



Double Joint

8



Pipe Joint

9

TRADE TRAINING I

LAYOUT

MP/2.3/2.6.4

SOLDERING/BRAZING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

# MATERIAL REQUIRED

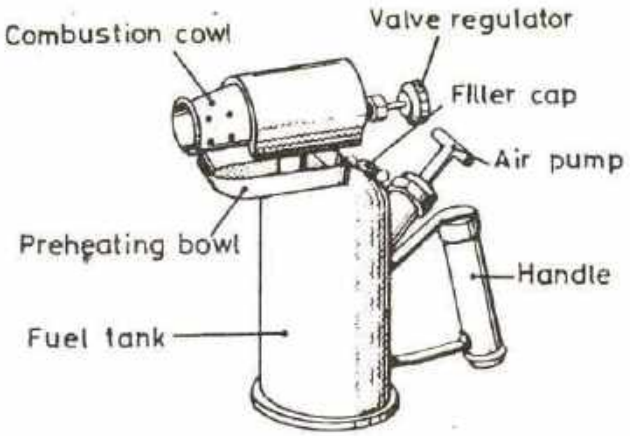
TRADE TRAINING I
SOLDERING/BRAZING
NO:2.6.4/1 TO 9

(Length given in millimeters)

| | 1 | 1a | 1b | 1c | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Length per trainee | Total length for 16 trainees |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M.S. Sheet 56x1 2¼"x19 SWG 2 pieces | 62 x 2 | | | | 62 x 2 | 62 x 2 | | | | | | | 372 | 6m |
| Stainless Steel 56x1 2¼"x19 SWG 2 pieces | | 62 x 2 | | | | | | | | | | | 124 | 2m |
| Copper Sheet 56x1 2¼"x19 SWG 2 pieces | | | 62 x 2 | | | | | | | | | | 124 | 2m |
| Brass Sheet 56x1 2¼"x19 SWG 2 pieces | | | | 62 x 2 | | | | | | | | | 124 | 2m |
| M.S.Sheet 72x1 $2\frac{7"}{8}$ x 19 SWG 3 pieces | | | | | | | 62 x 3 | | | | | | 186 | 3m |
| M.S. Sheet 52x3.2 $2\frac{1"}{8}$ x $\frac{1"}{8}$ 3 pieces | | | | | | | | 122 x 3 | 122 x 3 | 122 x 3 | | | 1099 | 18m |
| M.S. Sheet 75x3.2 3"x$\frac{1"}{8}$ 3 pieces | | | | | | | | | | | 122 x 3 | | 366 | 6m |
| M.S.Sheet 16x2 5/8" x 13 SWG | | | | | | | | | | | | 90 | 90 | 1.5m |
| M.S. Pipe ø 3/4" | | | | | | | | | | | | 65 | 65 | 1m |

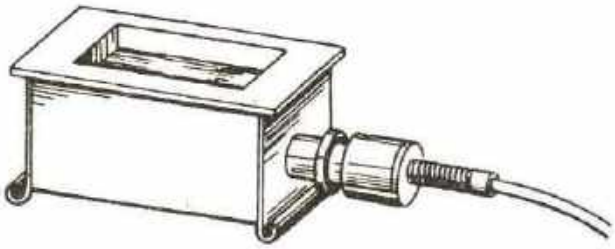
## Blow lamp

The blow lamp is primarily used for larger workpieces such as large cable lugs for tinning and soldering.




## Tinning bath

The tinning bath is used for mass production purposes. It can be heated either with open flame or electrically.



## Solder iron

Electrically heated and used for soldering of small wires in radios or printed circuits.
16 upto 30 Watt

60 upto 150 Watt

200 upto 300 Watt

Note:
The solder iron must be clean and well tinned.

| | | |
|---|---|---|
| TRADE TRAINING! | SOLDERING APPLIANCES | MP/2.3/2.6.4/a<br>Soldering |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

Means for cleaning soldering irons (tinned end of copper bit)

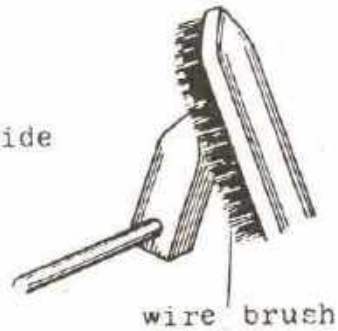
Description and Use

Example

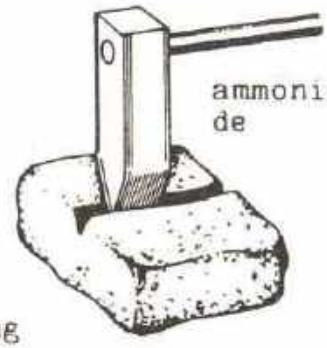
Linen rag
for wiping

Wire brush
for removing scale or oxide layers

Ammonium chloride block
for cleaning soldering iron chemically



wire brush for cleaning



ammonium chloride

File
for smoothing out burnt areas; major damages to copper bit to be repaired by forging

single cut file

Means for cleaning areas to be soldered or brazed. Initiation of the soldering or brazing process requires the area to be perfectly bright

triangular scraper

The area to be soldered or brazed may require cleaning both beforehand and afterwards:

- mechanical cleaning with tools
- chemical cleaning with acids or solvents

wire brush

blade scraper

The choice of the cleaning means depends on the size, number and material of the workpieces and on the type of flux used.

file

After soldering most cleaning acids and fluxes must be carefully washed off to prevent corrosion e.g. neutralising acids and alkalies.

| | | |
|---|---|---|
| TRADE TRAINING I | EQUIPMENT FOR CLEANING SOLDERING IRONS AND SOLDERING AREAS | MP/2.3/2.6.4/b<br>SOLDERING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

Maintenance and Tinning of the Soldering Iron is necessary for guaranteeing a satisfactory transition of the heat stored by the iron to the workpiece. The iron must have a smooth and well tinned soldering surface. All impurities and defects are detrimental to and delay the transition of the heat. More frequent cleaning, refinishing and retinning are therefore required.

Impurities
e.g., burnt flux, etc. must be:

1. wiped off with a linen cloth or
2. removed with a wire brush

while the soldering iron is warm.

Damage to the copper section of the soldering iron is caused by the gradual dissolution of the copper by the solder (corrosion, scouring).

Minor Damage

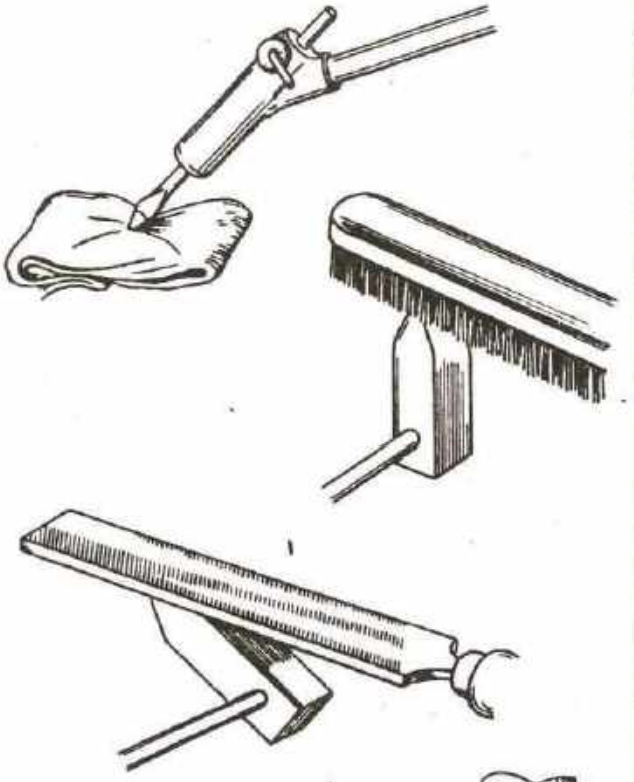
A. Refinish soldering surface of wedge and side faces.

B. Heat and tin soldering iron.

Major Damage

Re-forge copper section. Further refinishing as under steps A and B.

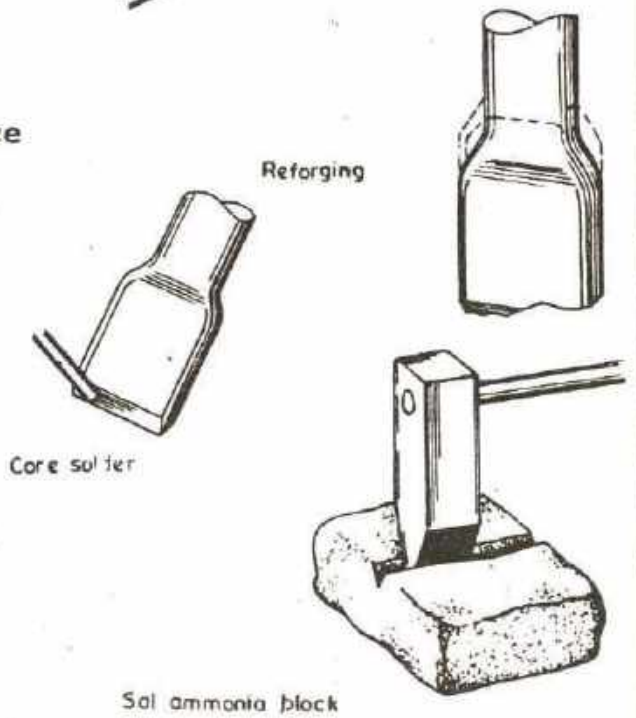
Interchangeable copper sections must be descaled periodically.



The Tinning of the soldering surface can be effected, depending on the type and use of the iron, by one of the following techniques:

1. Rub soldering surface on ammonia stone with the addition of solder.
2. Apply flux on soldering surface (no soldering solution or acid) and add and distribute solder.
3. Apply soldering paste with sticks and distribute.
4. Spread tubular solder on soldering surface.

Care must be taken, that the soldering iron has the proper temperature.




| | | |
|---|---|---|
| TRADE TRAINING I | MAINTENANCE OF SOLDERING IRONS | MP/2.3/2.E.4/c<br>Soldering |

## What is Tinning?

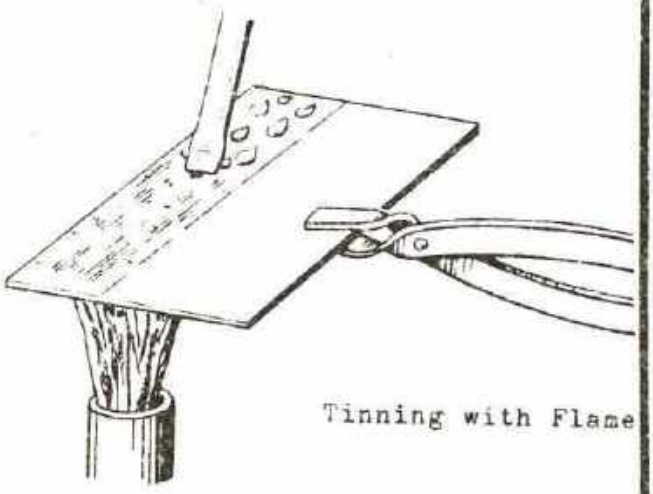
Tinning is a process for coating the surface of a workpiece with an insoluble layer of tin (solder).

## Technique

In tinning the workpiece and the tin (solder) are heated to the required "working temperature" so that the solder can "flow" and "wet" the surface of the workpiece, i.e., that solder and workpiece can be bonded insolubly.

Excessive solder can be removed either by brushing or shaking off.

Tinning is also used as a separate step in all soldering of non-tinned parts.

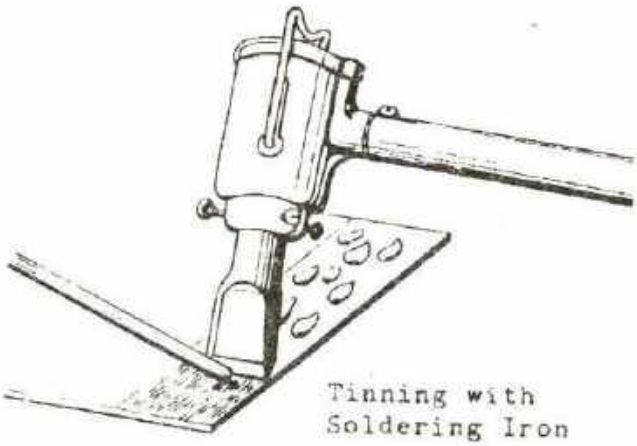


Tinning with Flame

## Requirements

A proper tin coating can be obtained only if

1. the workpiece is free of all impurities and oxydations (combinations of metal with the oxygen of the air), i.e., it must be metalically pure;
2. no fresh oxydations can occur during tinning, these can generally be prevented by using Fluxes; and
3. workpiece and tin have been heated to the required working temperature.



Tinning with Soldering Iron

## Purpose and Use

Tinning is used for

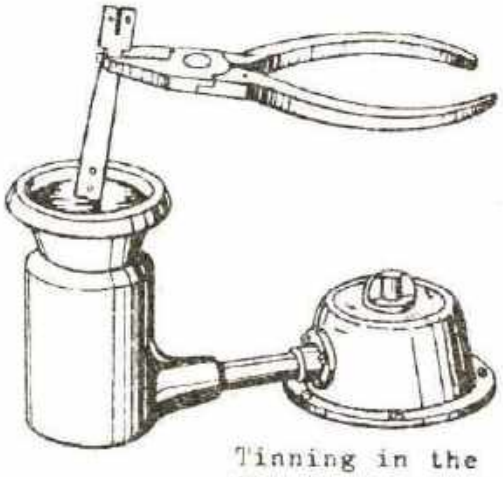
preparing workpieces for soldering,

or

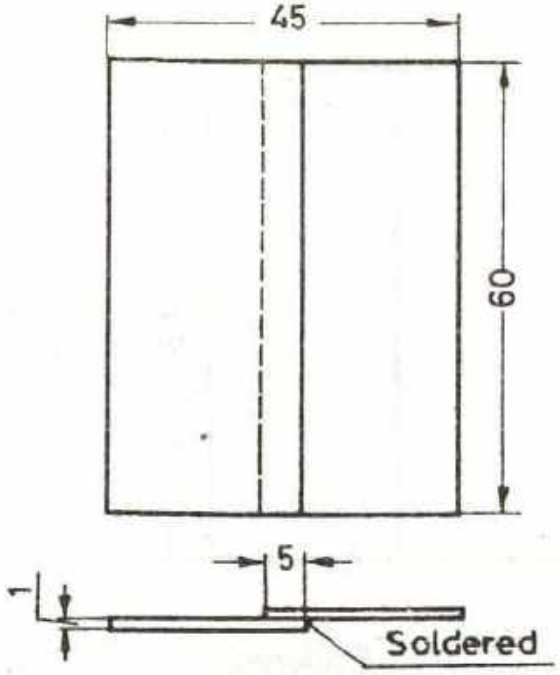
to protect workpieces (especially sheet metal) from corrosion.

## Note:

In these papers, tinning is described in as far as it is used manually as a preliminary to soldering.



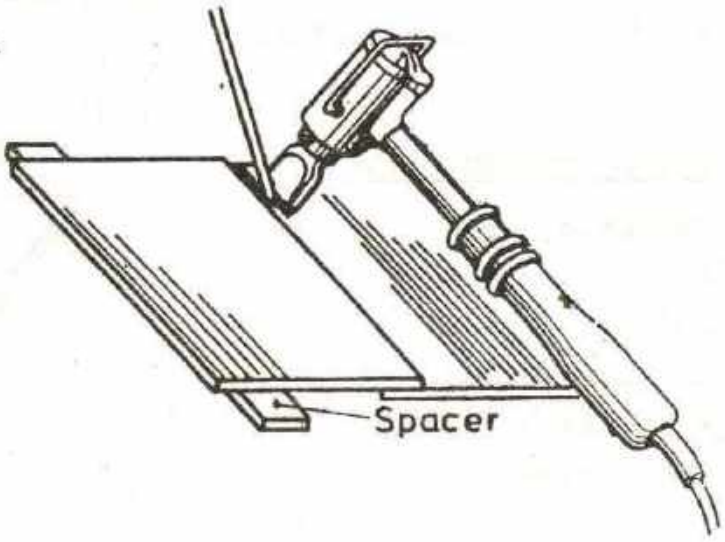
Tinning in the Tin Bath




| S.NO | THICKNESS | MATERIAL | FLUX |
|---|---|---|---|
| 1 | 1mm | Mild Steel | |
| 1a | 1mm | Stainless.S. | |
| 1b | 1mm | Copper | |
| 1c | 1mm | Brass | |

SEQUENCE OF OPERATIONS

- Deburr, straighten and clean the sheet metal plates.
- Mark the plates.
- Add flux and arrange the plates according to the drawing.
- Solder the lap joint.
- Clean the soldered joint.

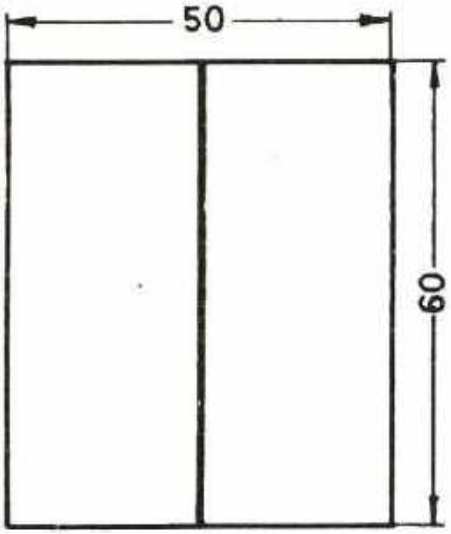


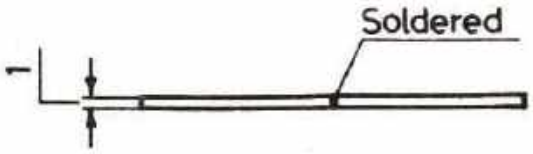

| SCALE | LAP JOINT | MP/2.3/3.5.4/1 |
|---|---|---|
| MAT. MILD STEEL | | Soldering |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

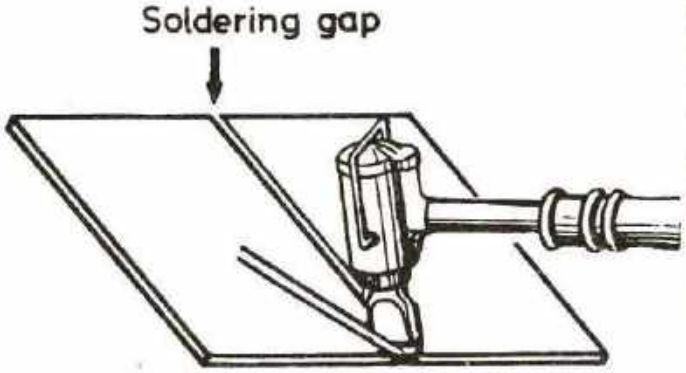
WELDER




SEQUENCE OF OPERATION

1. Take the material from Exercise Lap Joint and use the untinned side face for the butt joint.
2. Clean the sheet metal if necessary.
3. Leave a soldering gap of 0.2 mm between the sheet metal pieces.
4. Add flux and solder the butt joint.
5. Clean the butt joint.

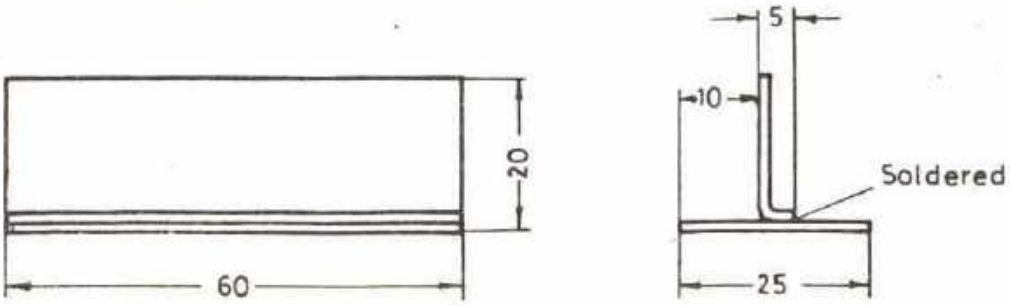



TOOLS AND MATERIALS

Soldering iron
Asbestos plate
Soldering paste
Tubular solder
Wire brush
Emery paper

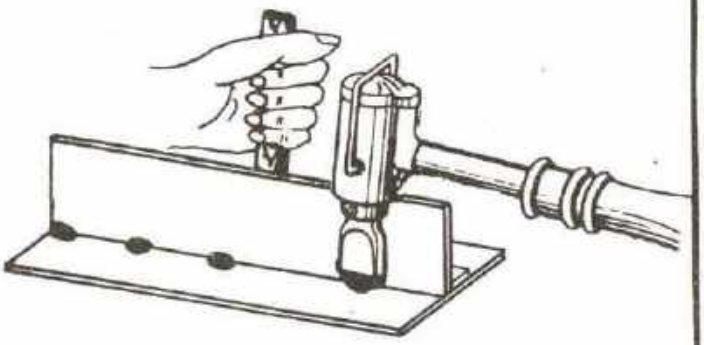
| | | |
|---|---|---|
| TRADE TRAINING I | BUTT JOINT | MP/2-3/2-64/7<br>Soldering |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME




SEQUENCE OF OPERATION

1. Take the material from Exercise Butt Joint, clean off any tin and bend one sheet metal plate according to drawing.
2. Tin the parts to be soldered. See instr. sheet No. 1.5.2/6.
3. Tack the angle with solder to prevent shifting while soldering.
4. Add flux and solder the workpiece by moving the solder iron slowly forward.
5. Clean the workpiece.



TOOLS AND MATERIALS

Soldering iron

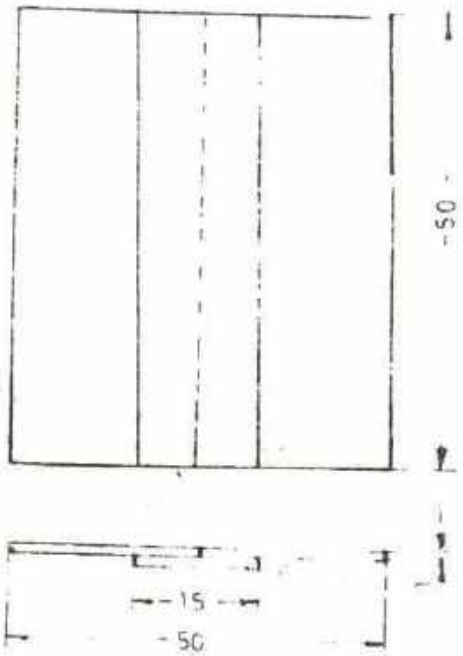
Asbestos plate

Soldering paste

Tubular solder

Wire brush

Emery paper




SEQUENCE OF OPERATIONS

1. Cut strips to ten and deburr the edges
2. Clean the joined surfaces
3. Tin the parts on the joint
4. Lay out the pieces, add flux and solder

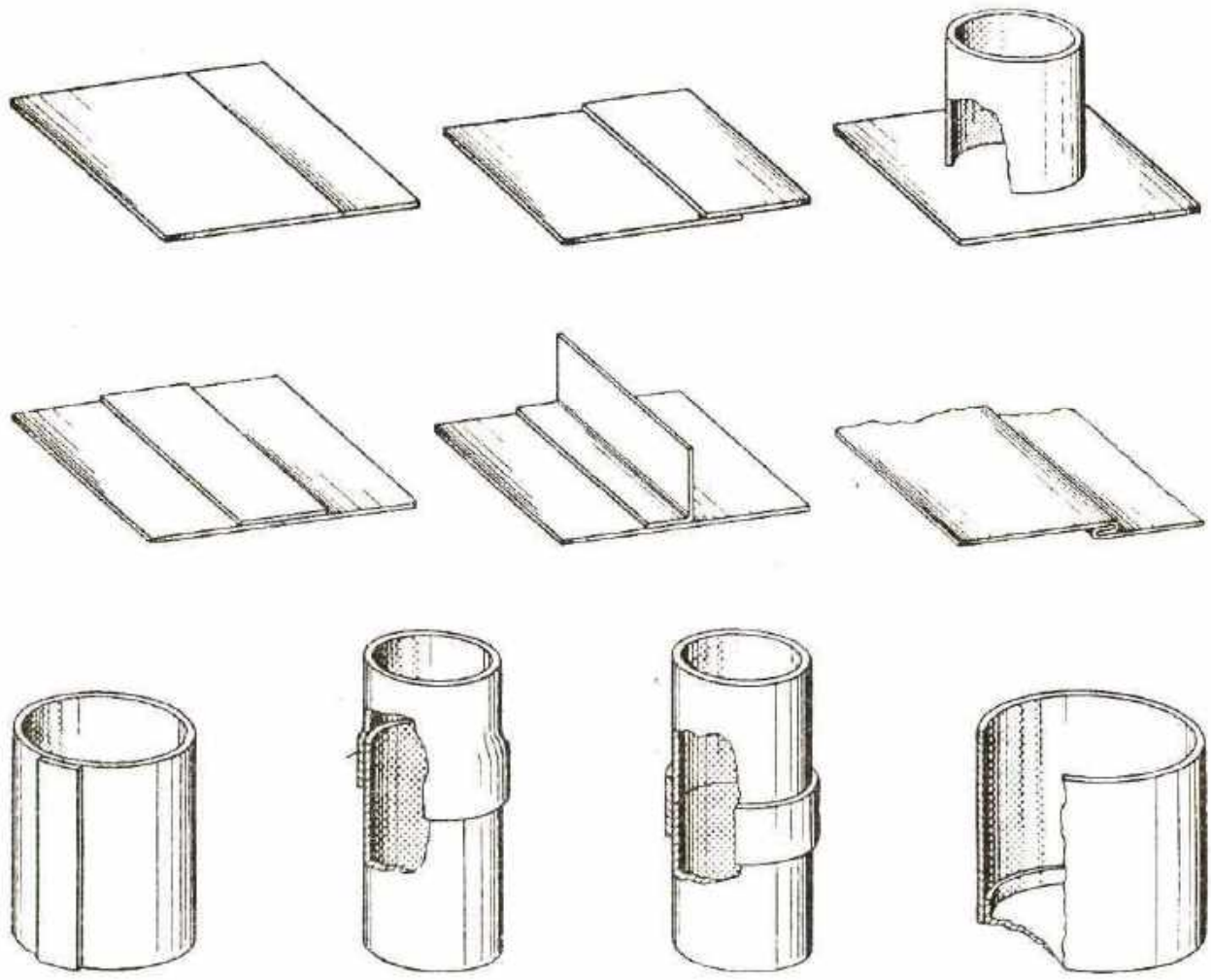
NOTE:

The 15mm cover strip must be concentrically over the joint.

| | | |
|---|---|---|
| SCALE 1:1 | DOUBLE JOINT | MF/2-3/2-E 4/4 |
| MAT-M.S SHEET | | Soldering |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

UNDP/GERMAN TECHNICAL TRAINING PROGRAMME

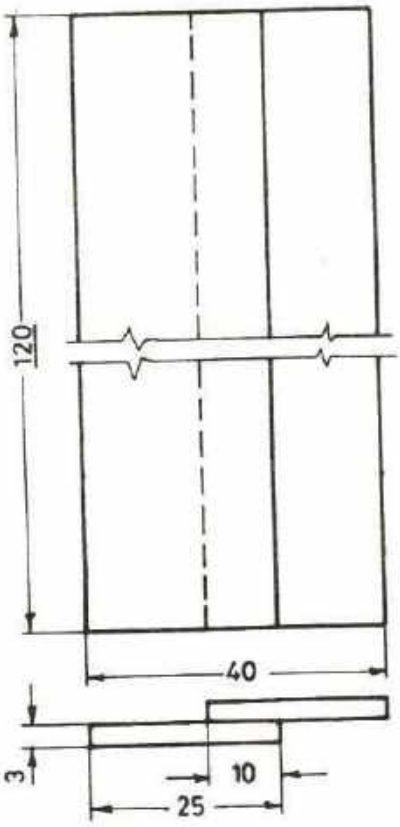


A few examples for training in seam soldering as a suggestion for the selection of workpieces of a productive or unproductive nature for the systematic instruction in seam soldering.

| | | |
|---|---|---|
| TRADE TRAINING I | SUGGESTIONS FOR FURTHER PRACTICE | MP/2.3/2.6.4/4.1 |
| | | SOLDERING |

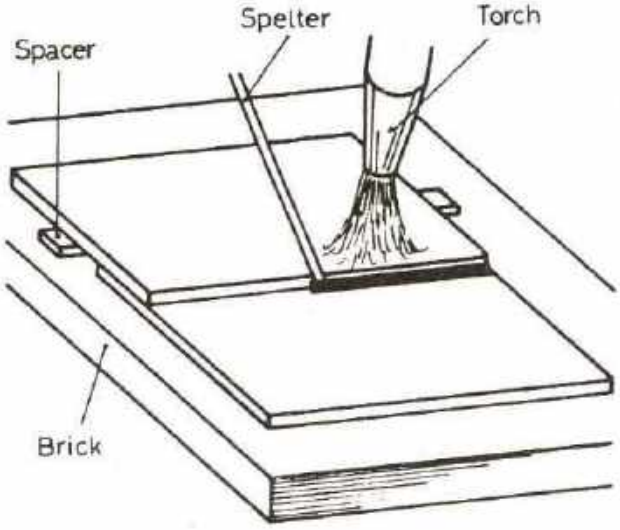
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME




## SEQUENCE OF OPERATION

1. Cut, straighten and deburr the material.
2. Clean the parts thoroughly.
3. Add flux and arrange according to sketch.
4. Heat up to working temperature.
5. Add spelter.
6. Clean the workpiece (no flux should remain on it).



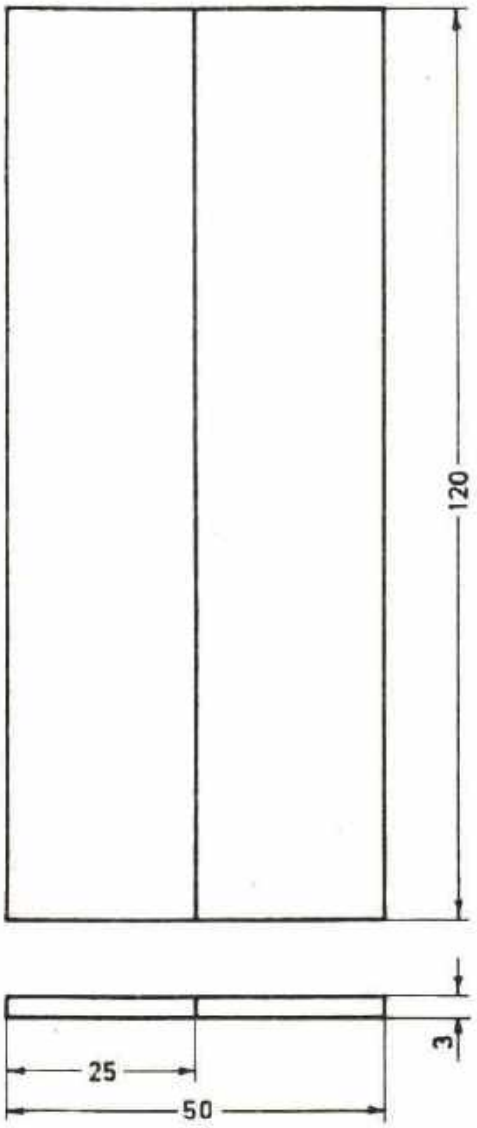

## DIRECTIONS

1. The area which is to be brazed must be clean (no oxide layer).
2. After cleaning don't touch the area with your hands.
3. Don't overheat the workpiece and the flux, use a "soft" flame (slight excess of acetylene).

| | | |
|---|---|---|
| SCALE 1:1 | LAP JOINT | MP/2.3/2.6.4/5 |
| MAT. MILD STEEL | | BRAZING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

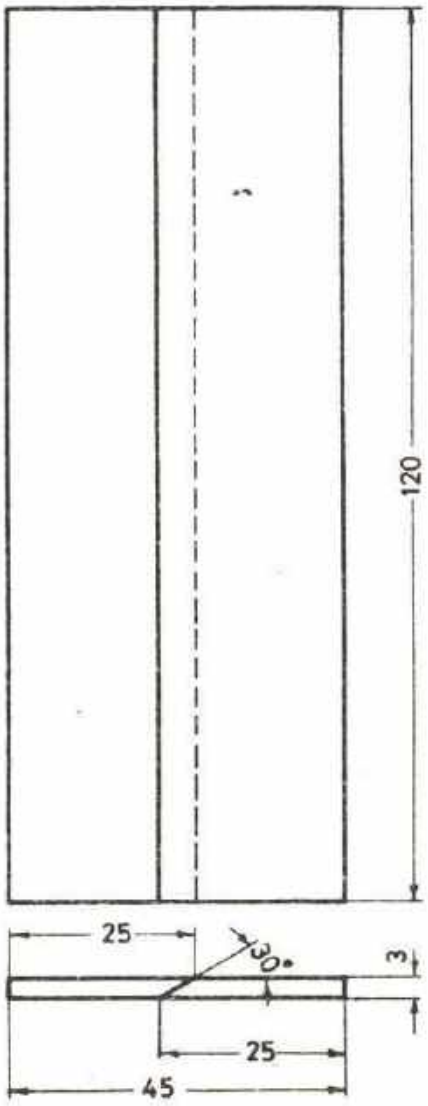



SEQUENCE OF OPERATION

(Refer to previous exercise No. 6)

Note: Brazing requires repeated exercise.
Therefore the joint should be cut and re-brazed again until proper joints are achieved.
The workpiece sizes are only suggested, any suitable scrap material can be used.

| | | |
|---|---|---|
| SCALE 1:1 | BUTT JOINT | MP/2.3/2.6.4/5 |
| MAT. MILD STEEL | | BRAZING |



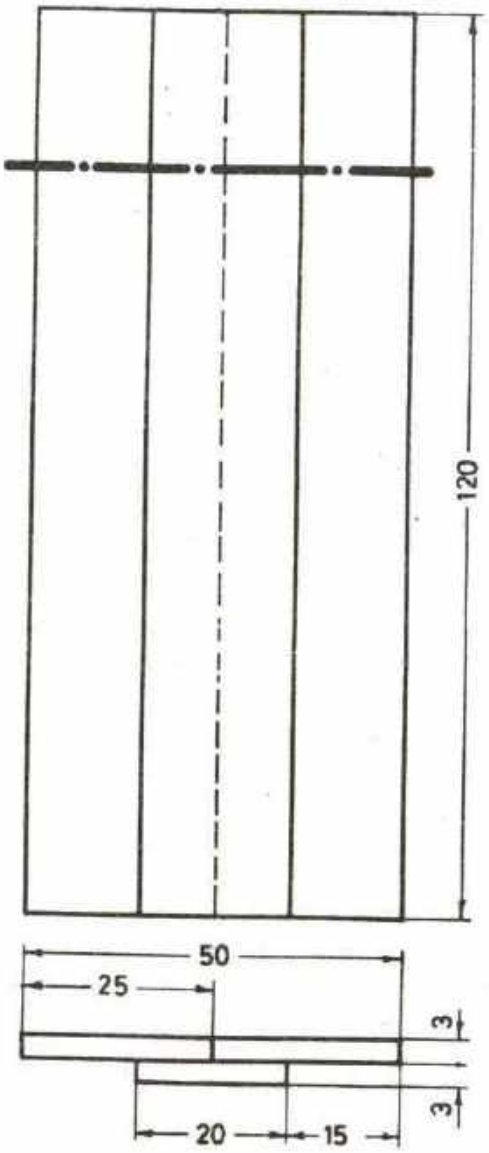

SEQUENCE OF OPERATION

1. File the bevelled edge on both parts.
2. Join two parts by brazing as explained in exercise No. 6.

| | | |
|---|---|---|
| SCALE 1:1 | BUTT JOINT AT AN ANGLE | MP/2.3/2.6.4/7 |
| MAT. MILD STEEL | | BRAZINIG |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME



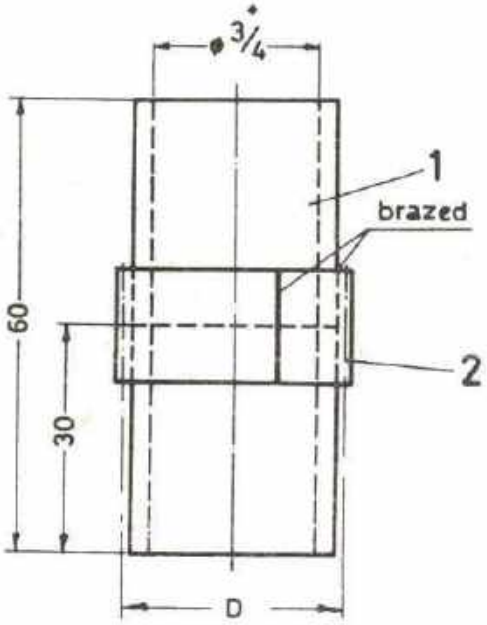

SEQUENCE OF OPERATION

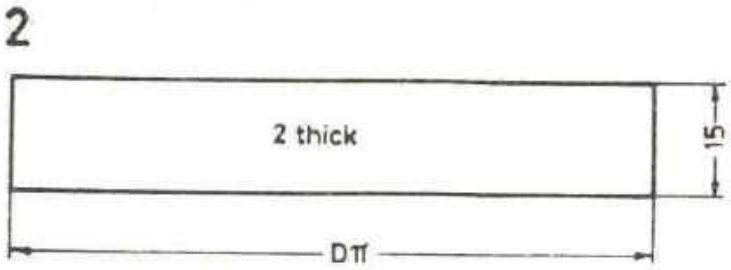
1. Prepare the workpieces for brazing (cut, straighten, deburr and clean).
2. Add flux and arrange according to drawing.
3. Braze.
4. Cut by means of hand hacksaw along the ——·——·—— line and check for full penetration of the spelter.
5. Repeat this exercise several times till a satisfactory skill is achieved.

| | | |
|---|---|---|
| SCALE 1:1 | DOUDLE JOINT | MP/2.3/2.6.4/8 |
| MAT. MILD STEEL | | BRAZING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME



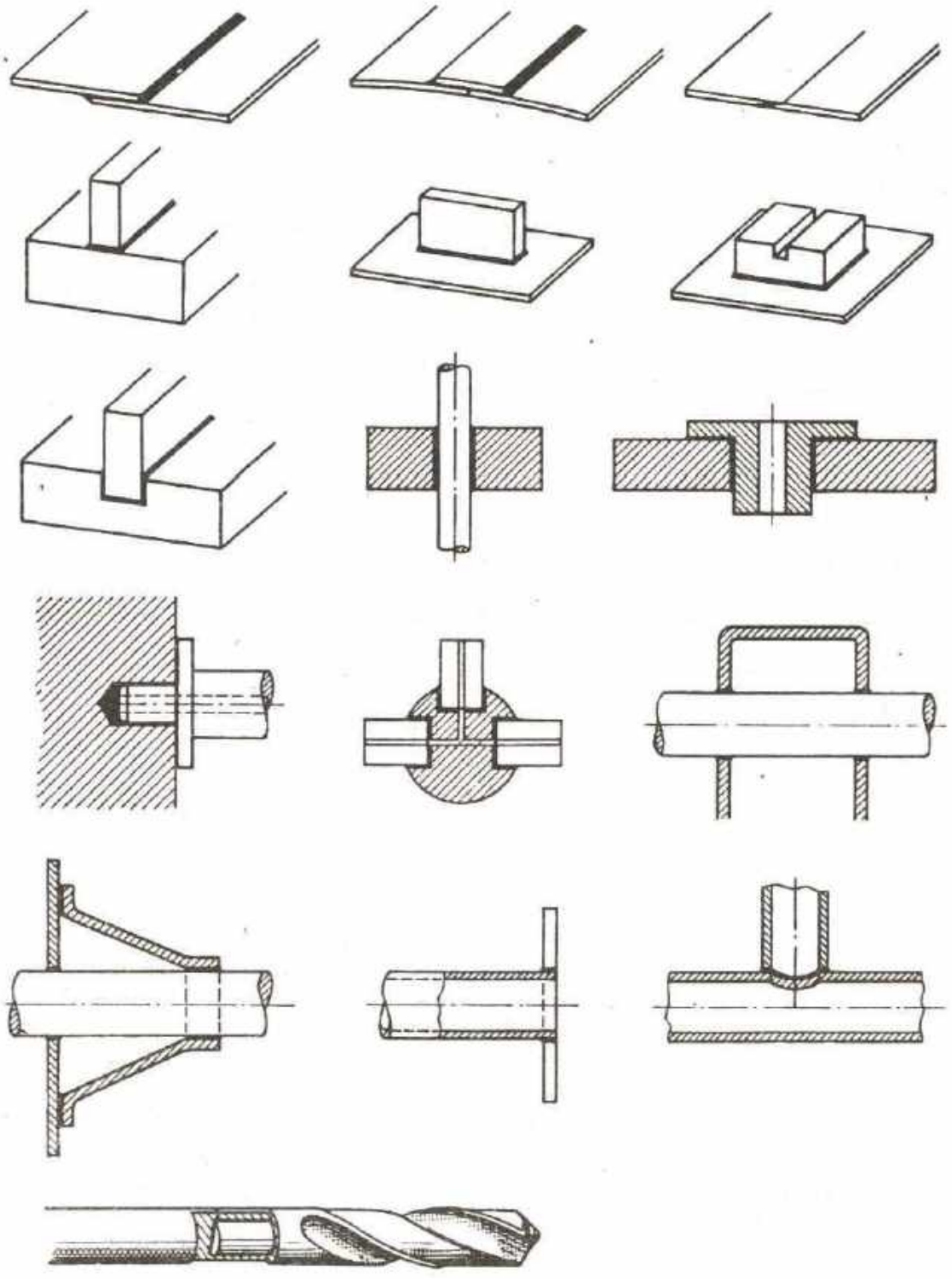

SEQUENCE OF OPERATION

1. Cut the two pipes to length.
2. Calculate the length of part 2 and prepare it accordingly.
3. Clean all parts with emery paper.
4. Add flux and braze the joint.
5. Clean of the remaining flux.

| | | |
|---|---|---|
| SCALE 1:1 | PIPE JOINT | MP/2.3/2.6.4/9 |
| MAT. M.S. PIPE | | BRAZING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

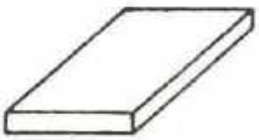


A few examples for training in brazing jobs of increasing difficulty as a suggestion for the selection of workpieces of a productive or unproductive nature for the systematic instruction in brazing.

| | SUGGESTIONS FOR FURTHER PRACTICE | MP/2.3/2.6.4/9.1 |
|---|---|---|
| | | BRAZING |

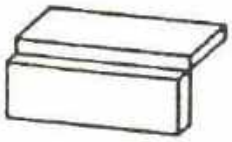
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME



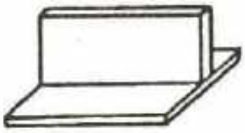
Straight Bead

1



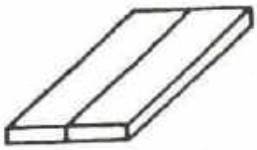
Corner Joint

2



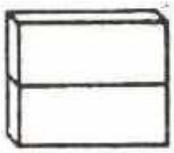
T Joint

3



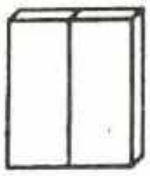
Square Butt Joint

4



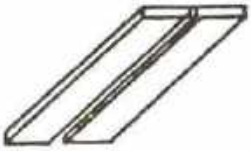
Square Butt Joint

5



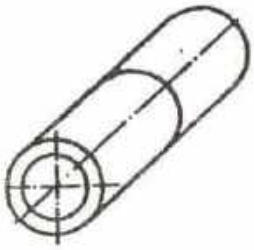
Square Butt Joint

6



Square Butt Joint

7



Square Butt Joint

8

| | | |
|---|---|---|
| TRADE TRAINING I | LAYOUT | MP 2.3/2.6.5<br>GAS WELDING I |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

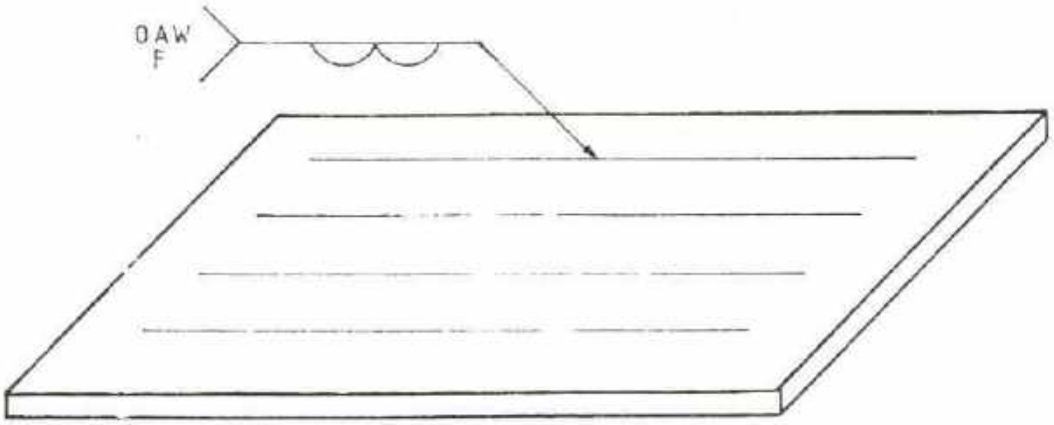
WELDER

# MATERIAL REQUIRED

TRADE TRAINING I

(Length given in millimeters)

| GAS WELDING I NO. 2.6.5/1 TO 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Length per trainee | Total Length for 16 trainees. |
|---|---|---|---|---|---|---|---|---|---|---|
| M.S. Flat 100x2.04 4"x13 SWG | 200 | | | | | | | | 200 | 3.25m |
| M.S. Flat 37 x2.04 1½" x13 SWG | | 800 | 400 | 800 | 800 | 800 | 800 | | 4400 | 70.5m |
| M.S. Flat 50x2.04 2"x13 SWG | | | 400 | | | | | | 400 | 6.5m |
| M.S. Pipe Ø $2\frac{1}{2}$" | | | | | | | | 150 | 150 | 2.5m |




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 1 | 2.04 | | | | Leftward | | |

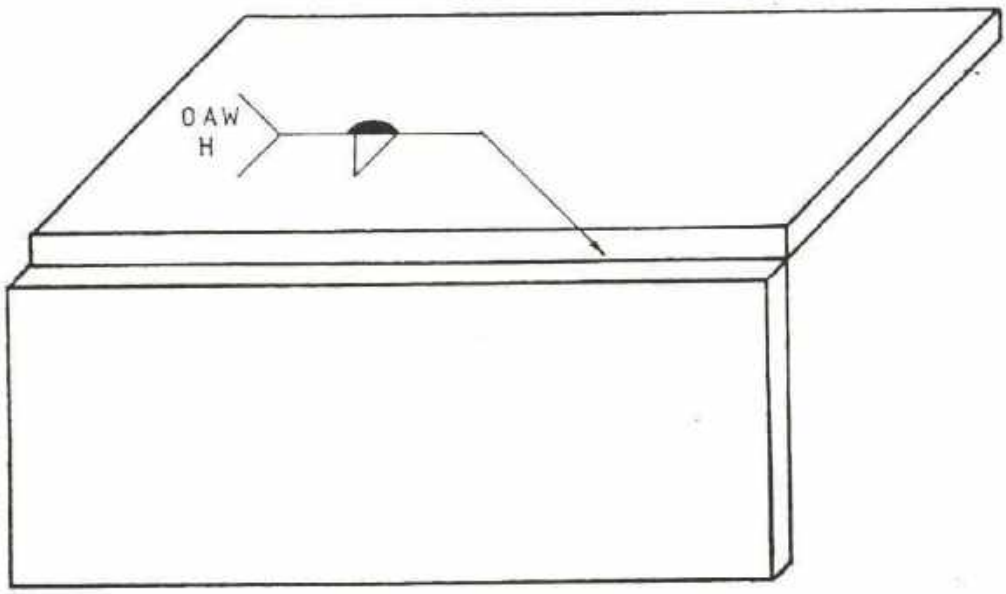
SEQUENCE OF OPERATIONS

- Draw the straight lines on the job.
- Set the neutral flame.
- Keep the distance about 3mm between end of the inner cone and job surface at the right hand edge.
- Establish the weld pool, add filler rod.
- Start the progressive leftward movement of blowpipe and filler rod.
- Slowly withdraw the flame near the left hand edge of the sheet.

CAUTION

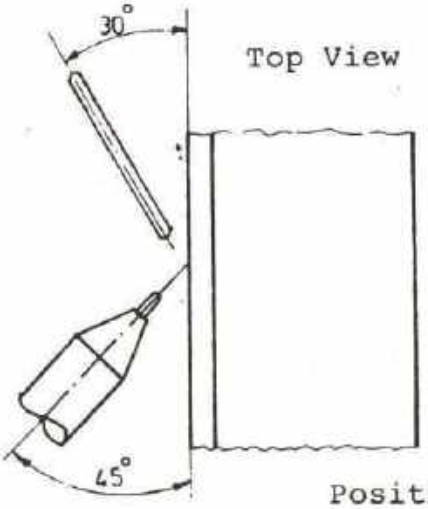
- Keep the end of the filler rod within the flame envelop but not in the hot portion near the cone.
- Apply correctly speed of the travel and the filler rod, the deposition will be of even ripple and uniform width.

| SCALE | Straight Bead ( FLAT ) | MP/2.3/2.6.5/1 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

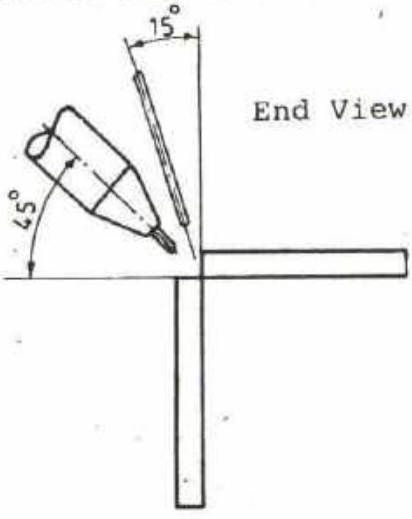



| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 2 | 2.04 | | | | Leftward | | |

Be sure that the tip is always tight in the torch.
Loose tips cause flashback.




Top View




End View

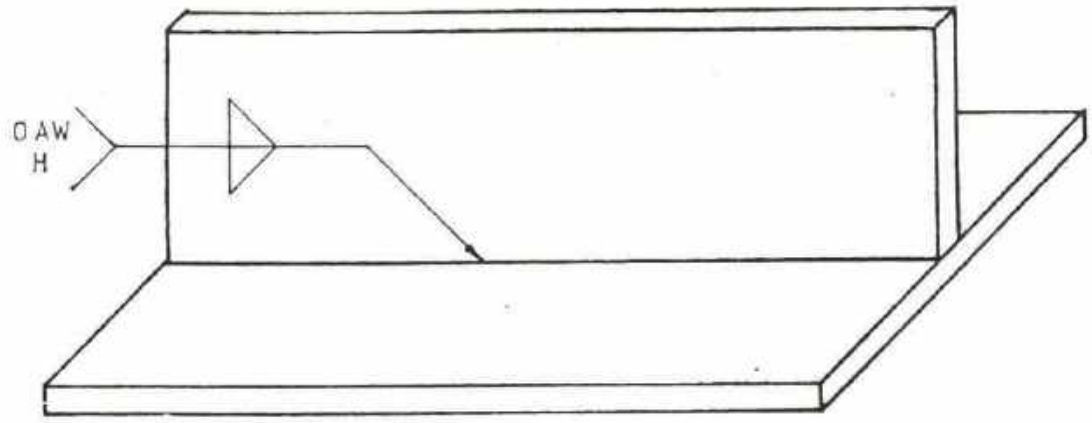
Position of torch and rod when welding a corner weld.

| SCALE | Corner joint (HORIZONTAL) | MP/2.3/2.6.5/2 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

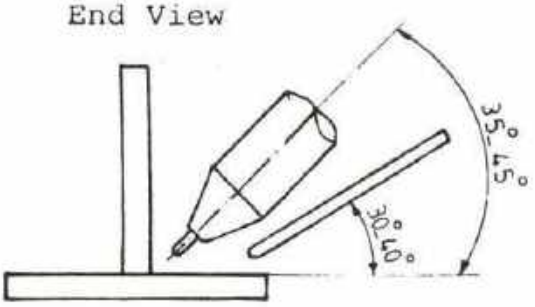



| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 3 | 2.04 | | | | Leftward | | |

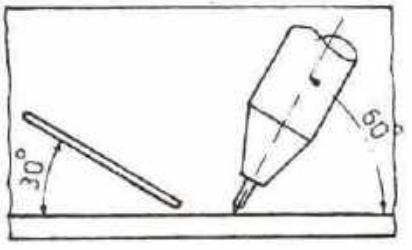
Errect standing gas cylinders have to be prevented from falling down.

Position of torch and rod when welding a tee joint in horizontal position.

End View




Front View

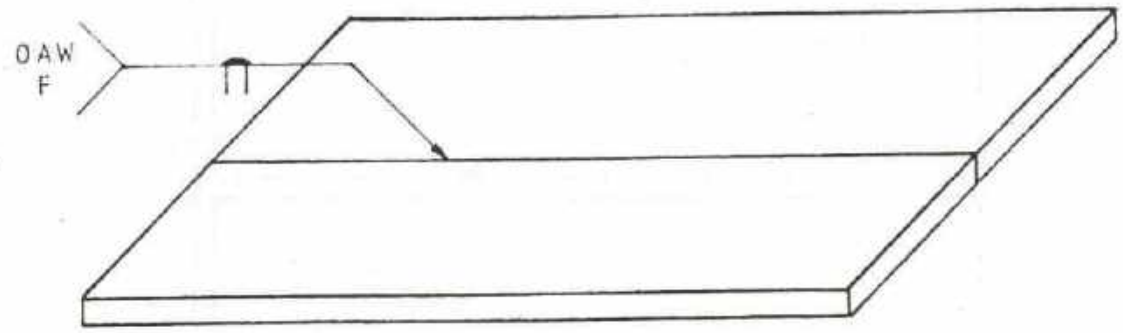



| SCALE | T joint ( HORIZONTAL ) | MP/2.3/26.5/3 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

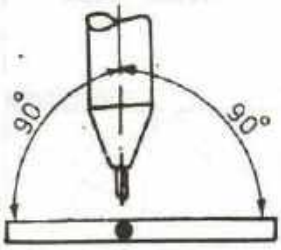



| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 4 | 2.04 | | | | Leftward | | |

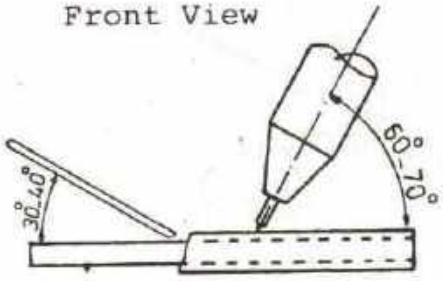
Always wear goggles while welding the ultraviolet rays may lead to blindness, goggles absorb them.

Position of torch and rod when welding a square butt joint in flat position.

End View




Front View

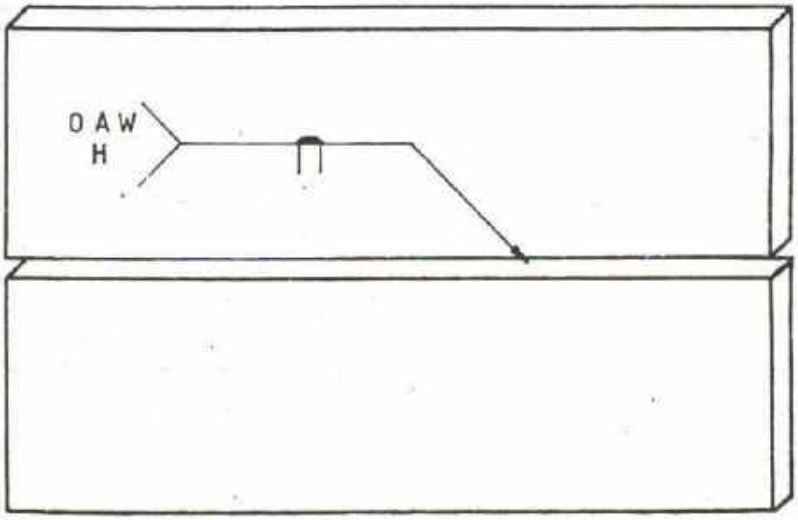



| SCALE | Square butt joint (FLAT) | MP/2.3/2.6.5/4 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

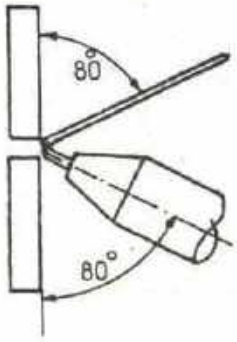



| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 5 | 2.04 | | | | Leftward | | |

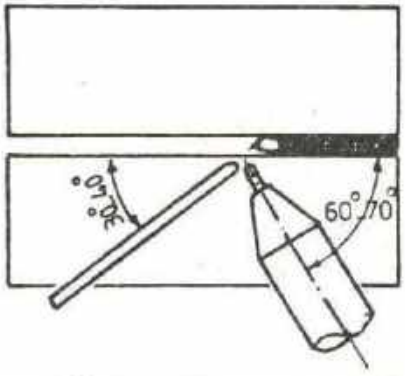
- If the heat build up becomes excessive, remove the point of the cone temporarily from the weld.

Position of torch and rod when welding a square butt joint in horizontal position.

End View




Front View

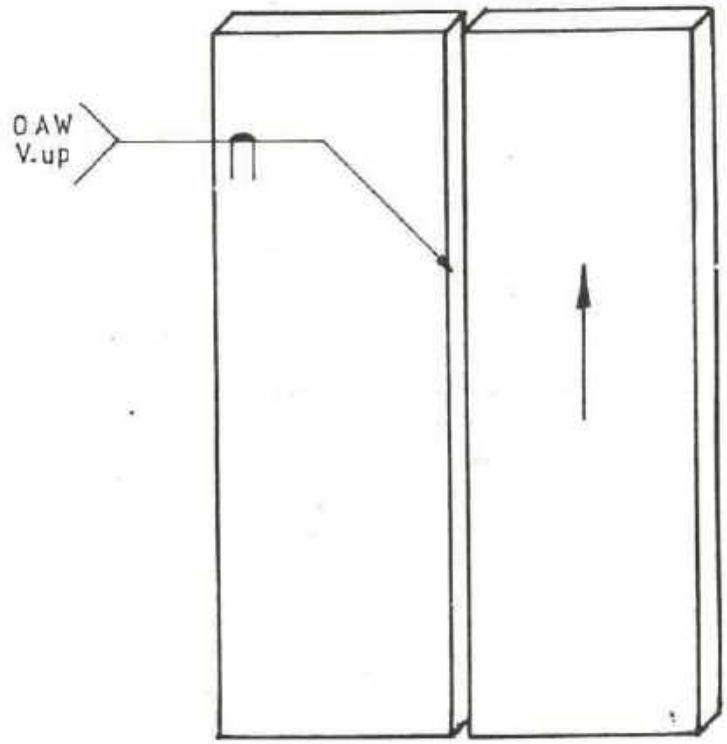



| SCALE | Square butt joint ( HORIZONTAL ) | MP/2.3/2.6.5/5 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

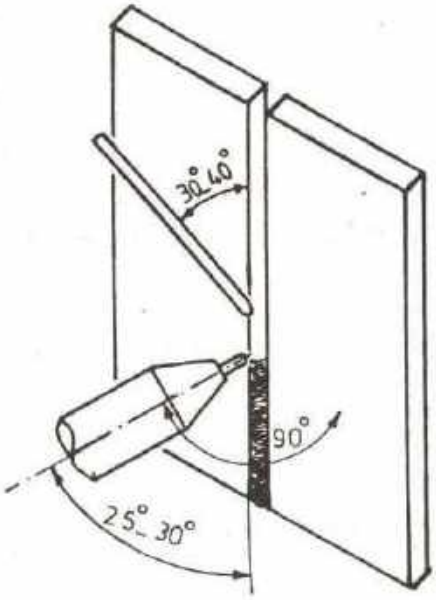
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 5 | 2.04 | | | | Leftward | | |

Position of torch and rod when welding a square butt joint vertical upward position.

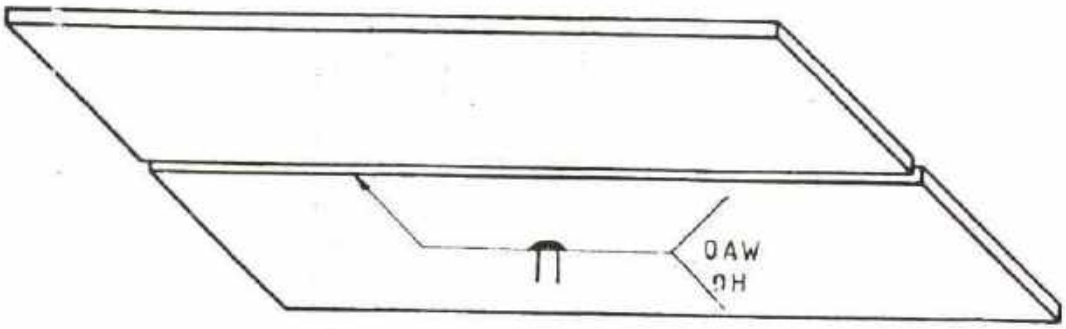



| SCALE | Square butt joint ( VERTICAL UPWARD ) | MP/2.3/2.6.5/6 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

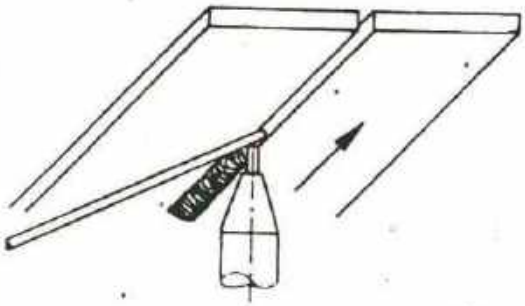
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

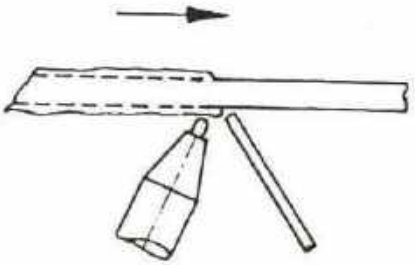
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No | Thickness t | | | Space | Method | Torchsize | Rod Ø |
|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | | mm | mm |
| 7 | | | | | Leftward | | |





## Sequence of operation

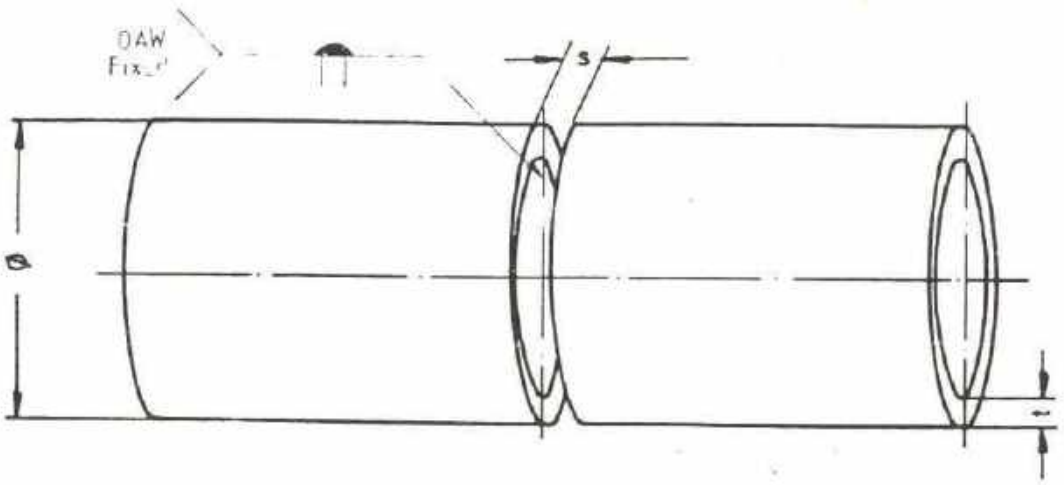
1. Set up the pieces, make sure that the gap is equal all over.
2. Tack the pieces.
3. Clamp the job.
4. Weld the seams in overhead position.

| SCALE: | SQUARE BUTT JOINT (OVER HEAD) | MP/2.3/2.6.5/7 |
|---|---|---|
| MAT: MILDSTEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

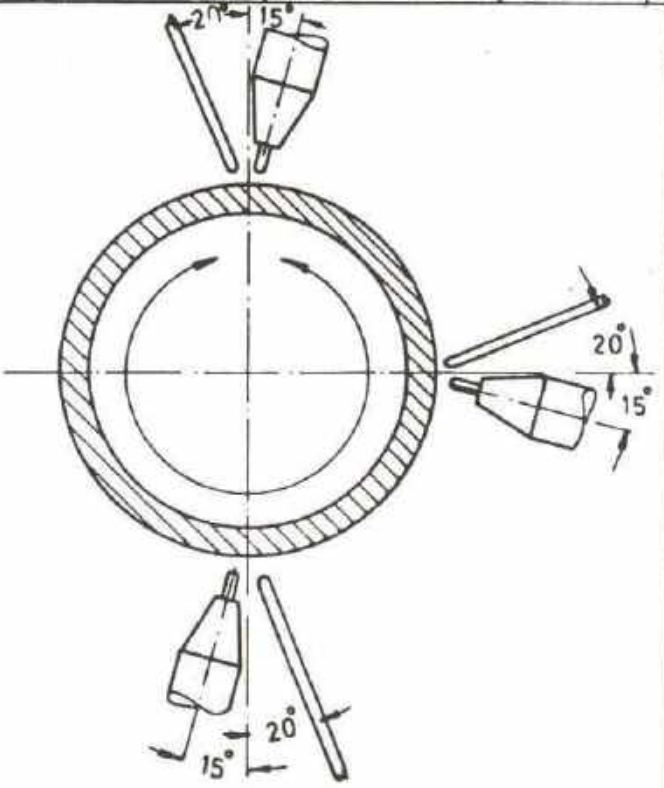
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod Ø mm |
|---|---|---|---|---|---|---|---|
| 8 | | - | | | Leftward | | |

Position of the torch and rod when leftward-welding on pipes in fixed position.

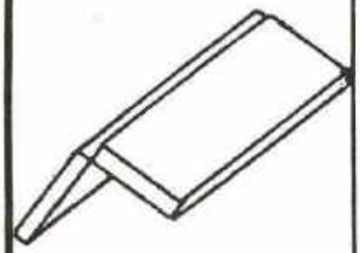
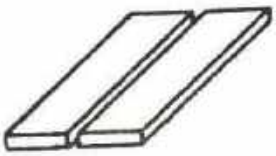
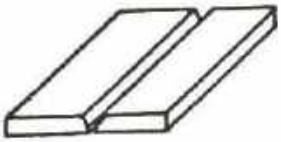
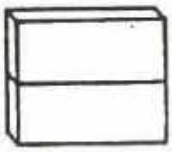
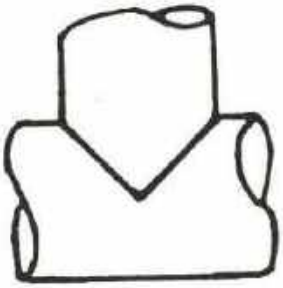
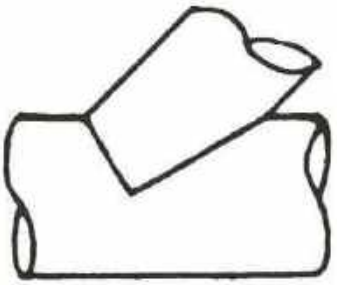
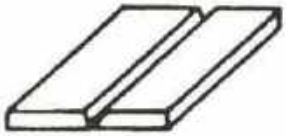
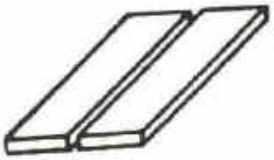
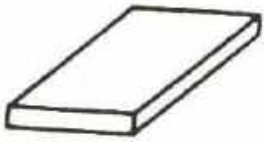



| SCALE | SQUARE BUTT JOINT ON PIPE (FL/V/OH | MP/2.3/2.6.5/8 |
|---|---|---|
| MAT. MILDSTEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

| | | | |
|---|---|---|---|
|  Corner Joint |  Square Butt Joint |  Single V Butt Joint |  Square Butt Joint |
| 1 | 2 | 3 | 4 |
|  Single V Butt Joint |  Single V Butt Joint |  Square Butt Joint |  Pipe V Butt Joint |
| 5 | 6 | 7 | 8 |
|  Single V Butt on Pipe |  T Joint Equal Dia |  Lateral Equal Dia |  Y Joint |
| 9 | 10 | 11 | 12 |
|  Single V Butt Joint |  Square Butt Joint |  Torch Cutting | |
| 13 | 14 | 15 | |

| | | |
|---|---|---|
| TRADE TRAINING II | LAYOUT | MP/2.3/3.6.1<br>GAS WELDING II |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

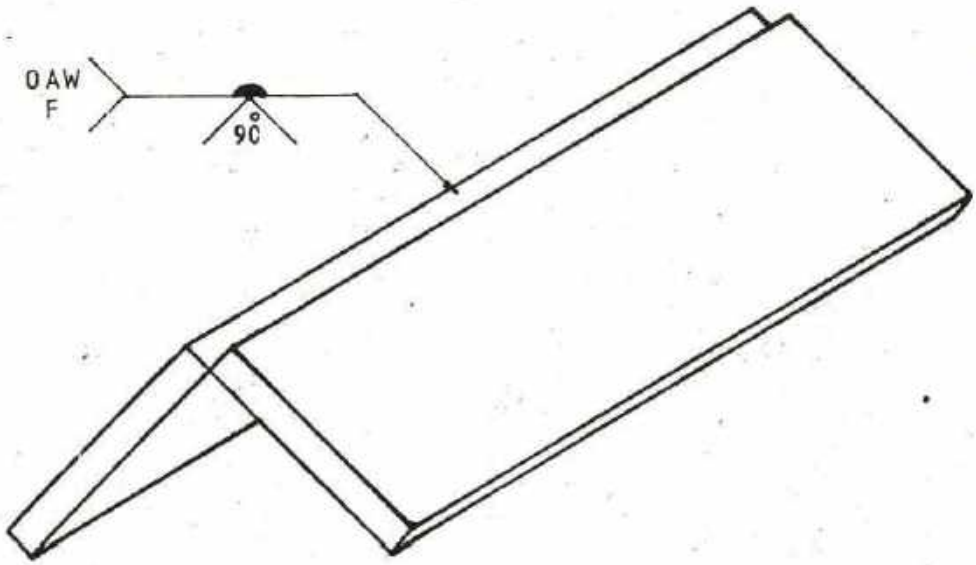
WELDER

TRADE TRAINING II
GAS WELDING
NO.3.6.1/1 TO 15.1

# MATERIAL REQUIRED

(Length given in millimeters)

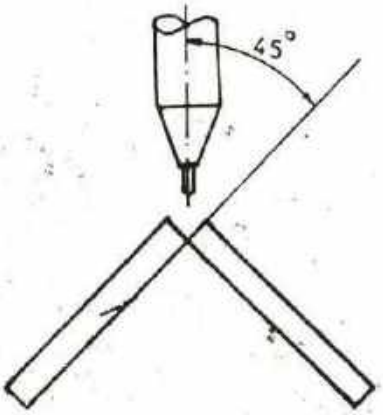
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 14a | 14b | 15 | 15.1 | Length per trainee | Total length for 16 trainees |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M.S.Flat 31x3<br>1¼" x 1/8" | 800 | 800 | | 800 | | | 800 | | | | | | | | | | | | 3200 | 51.25m |
| M.S.Flat 31x4.67<br>1¼" x 3/16" | | | 800 | | 800 | 800 | | | | | | | | | | | | | 2400 | 38.5m |
| M.S.Pipe ø 3" | | | | | | | | 150 | 150 | | | | | | | | | | 300 | 5.0m |
| M.S.Sheet 100x2.04<br>4" x 13 SWG | | | | | | | | | | 205 | 205 | 620 | | | | | | | 1030 | 16.5m |
| M.S.Sheet 150x2.04<br>6" x 13 SWG | | | | | | | | | | 205 | 205 | | | | | | | | 410 | 6.75m |
| Cast Iron 40x10<br>$1\frac{5}{8}$" x 3/8" | | | | | | | | | | | | | 800 | | | | | | 800 | 13 m |
| Al-Sheet 31x2.04<br>1¼" x 13 SWG | | | | | | | | | | | | | | 800 | | | | | 800 | 13 m |
| Copper Sheet 31x2.04<br>1¼" x 13 SWG | | | | | | | | | | | | | | | 800 | | | | 800 | 13 m |
| Brass Sheet 31x2.04<br>1¼" x 13 SWG | | | | | | | | | | | | | | | | 800 | | | 800 | 13 m |
| M.S.Flat 100x10<br>4" x 3/8" | | | | | | | | | | | | | | | | | 200 | 200 | 400 | 6.5m |



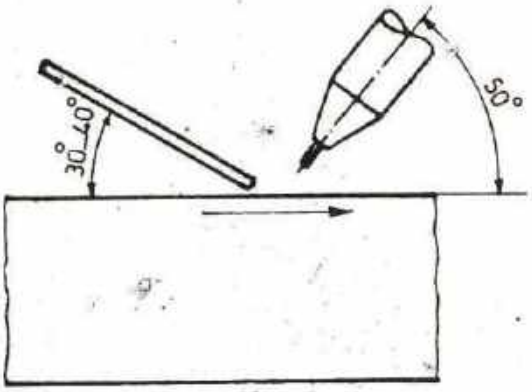

| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 1 | 3 | | | | Rightward | | |

Position of torch and rod when welding a corner joint in flat position

Blow pipe and filler rod




End view



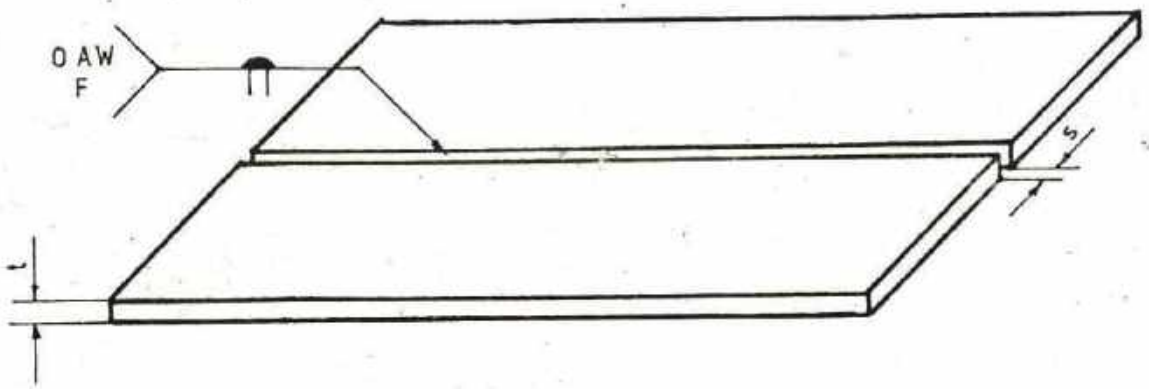

Front view

| SCALE | Corner joint (FLAT) | MP/2.3/3.6.1/1 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

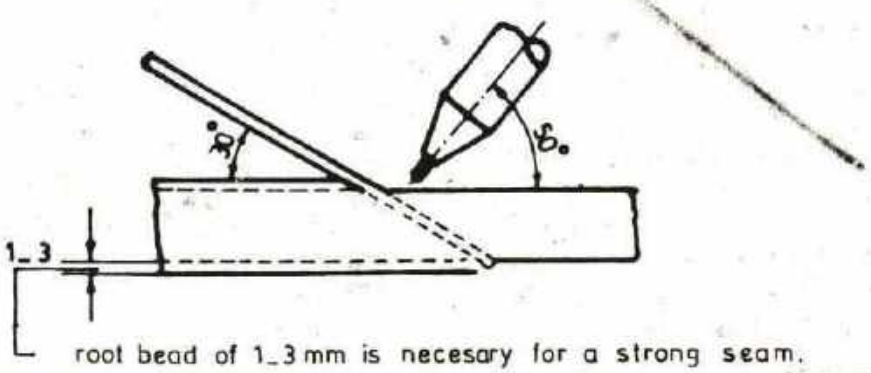
WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 2 | 3 | | | | Rightward | | |

- Ensure adequate heating of the parent metal. Melt the tack and plate to establish the weld pool before adding filler metal.

Position of torch and rod when welding a square butt joint in flat position.



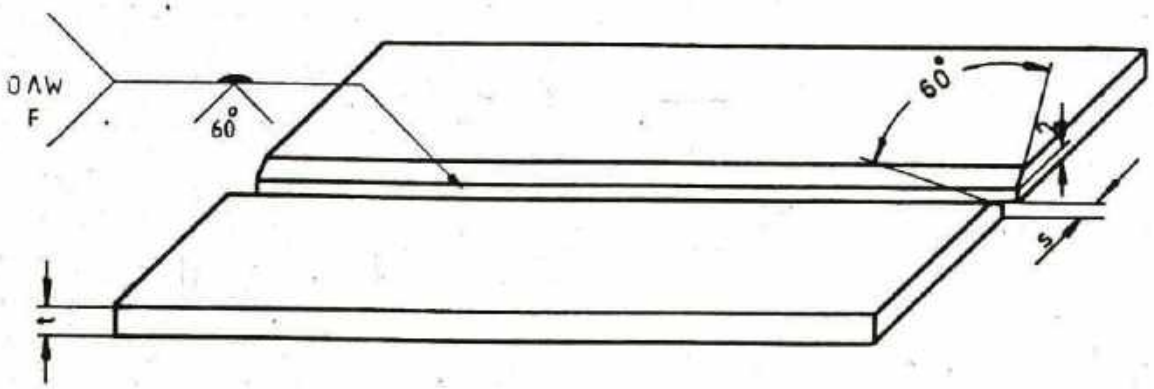

root bead of 1_3 mm is necesary for a strong seam.

| SCALE | Square butt joint ( FLAT ) | MP/2.3/3.6.1/2 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

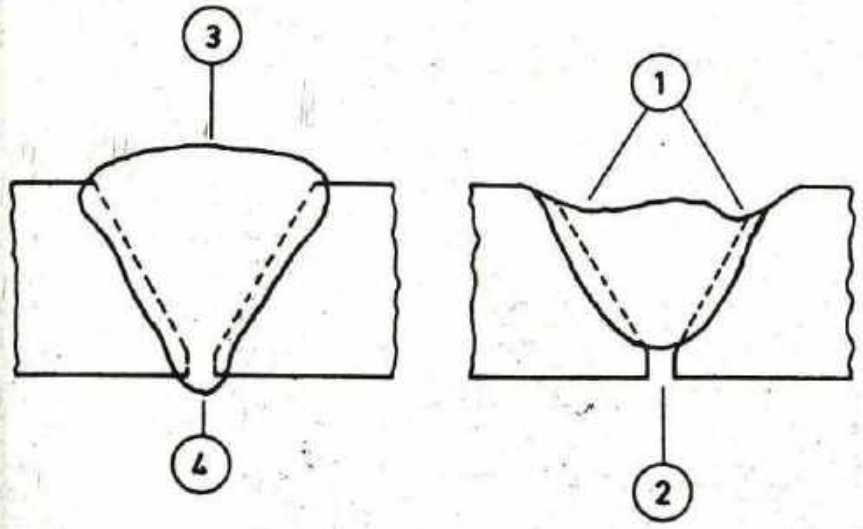
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod Ø mm |
|---|---|---|---|---|---|---|---|
| 3 | | | | | Rightward | | |




Fill in the numbers concerned:

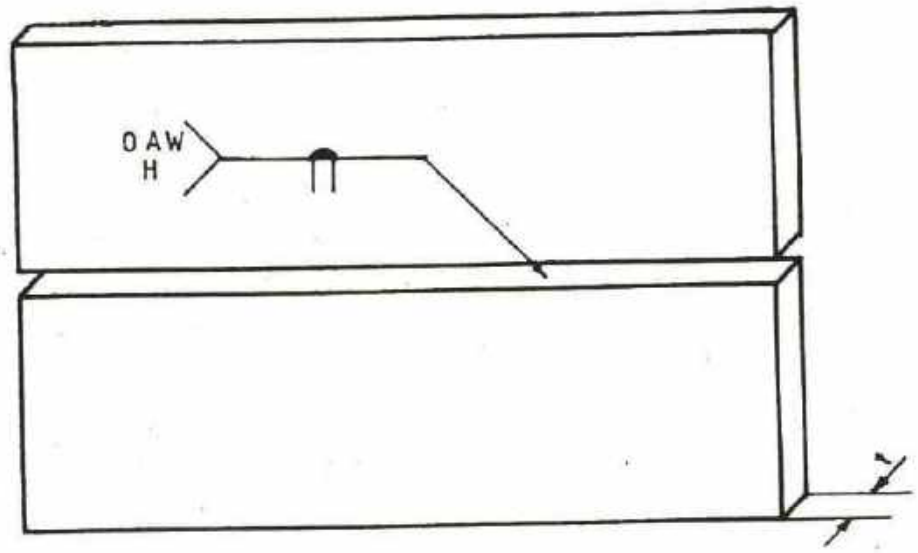
- ○ Correct root bead
- ○ Undercut
- ○ Poor root bead
- ○ Smooth seam

| SCALE: | SINGLE V BUTT WELD (FLAT | MP/2.3/3.6.1/3 |
|---|---|---|
| MAT: MILDSTEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

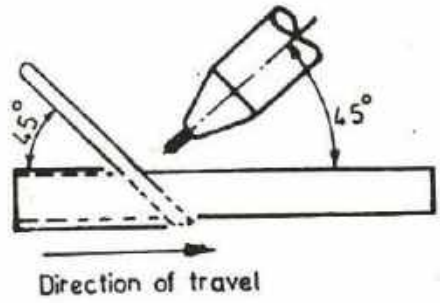
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

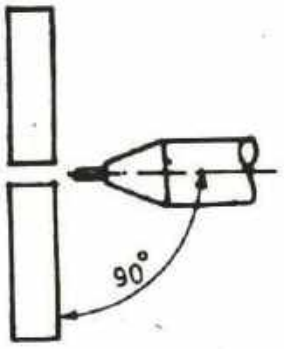
WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 4 | 3 | | | | Rightward | | |

Position of torch and rod when welding square butt joint in horizontal position.



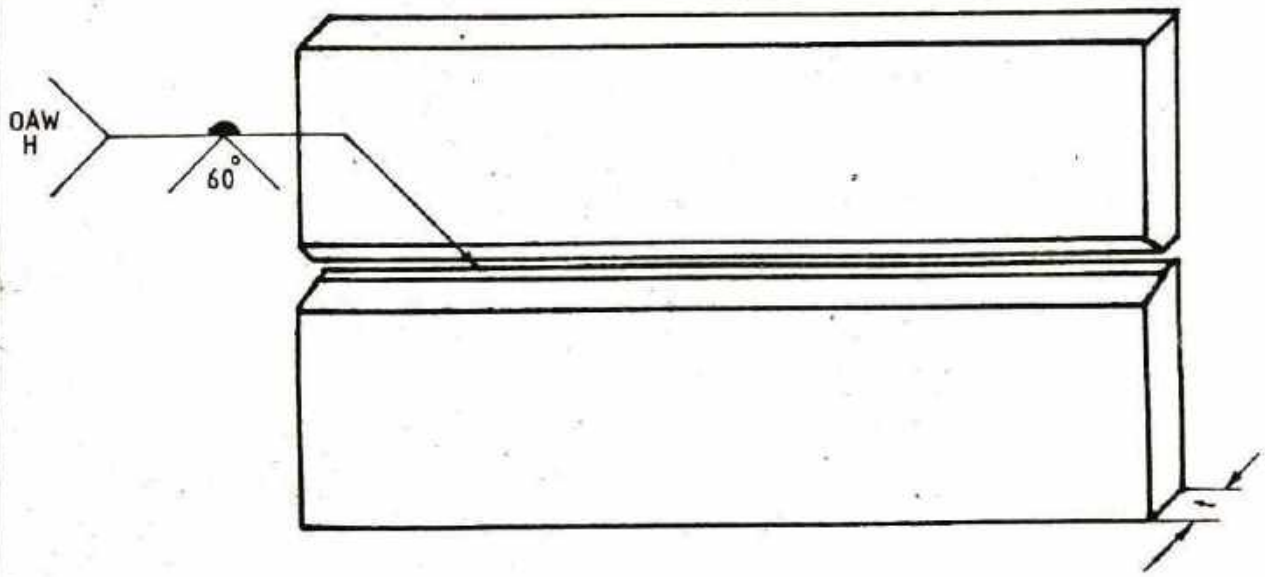




| SCALE | Square butt joint ( HORIZONTAL ) | MP/2.3/3.6.1/4 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

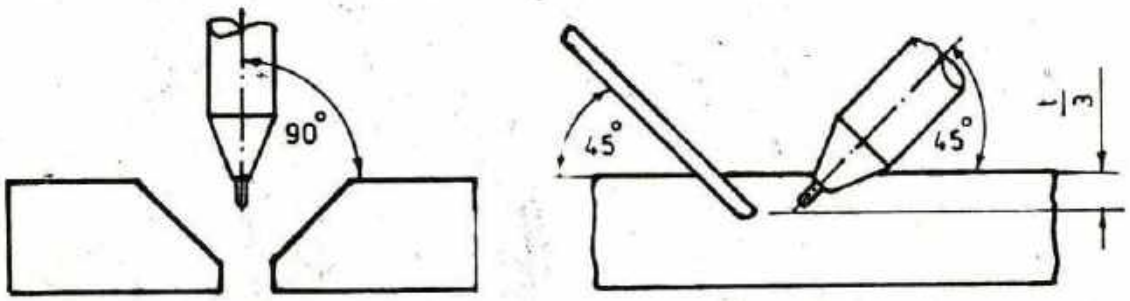
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ⌀ mm |
|---|---|---|---|---|---|---|---|
| 5 | 4.67 | | | | rightward | | |

Position of torch and rod when welding single V butt joint in horizontal position

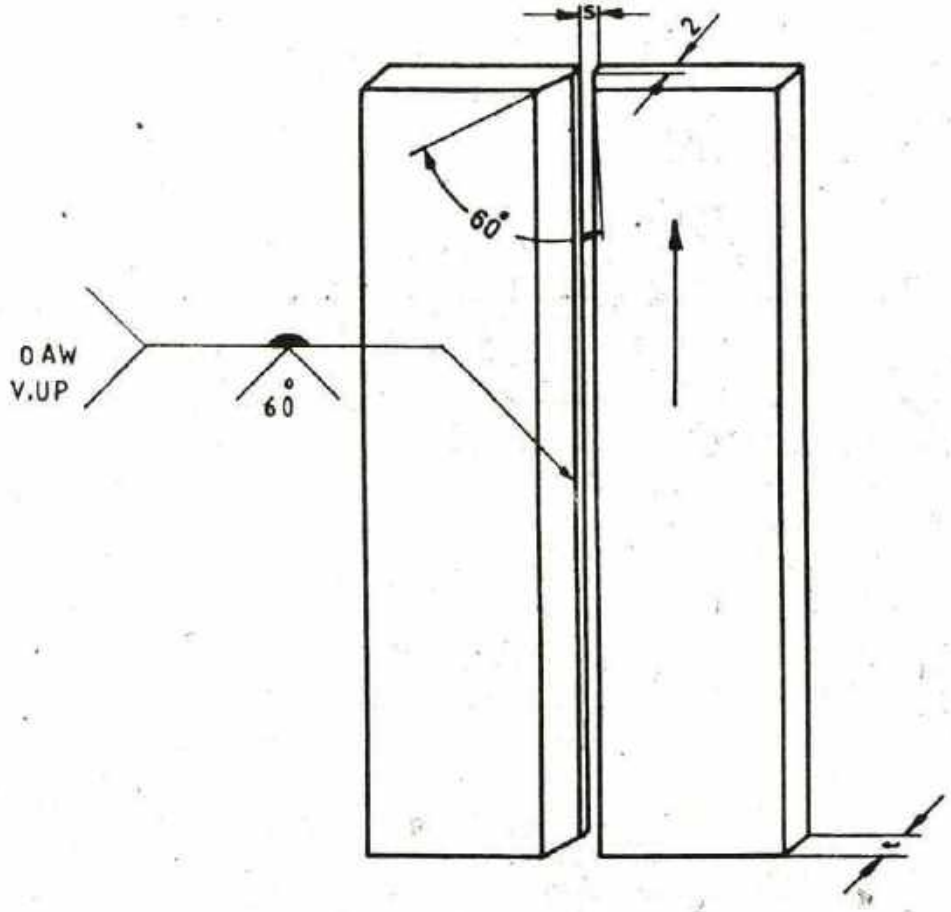



| SCALE | Single V Butt Joint (HORIZONTAL) | MP/2.3/3.6.1/5 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

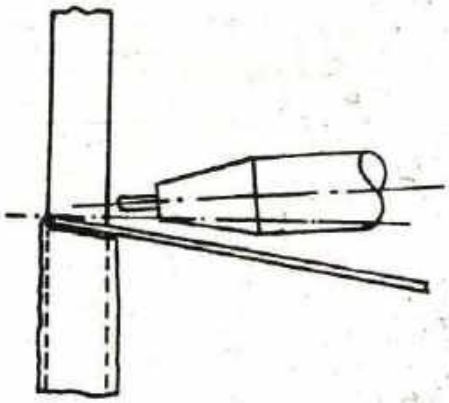
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

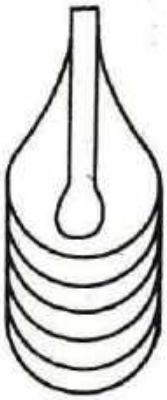
WELDER



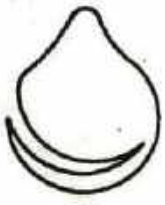

| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod Ø mm |
|---|---|---|---|---|---|---|---|
| 6 | | | | | Rightward | | |



Position of torch and rod when upward welding on a single-V-butt joint.



The puddle



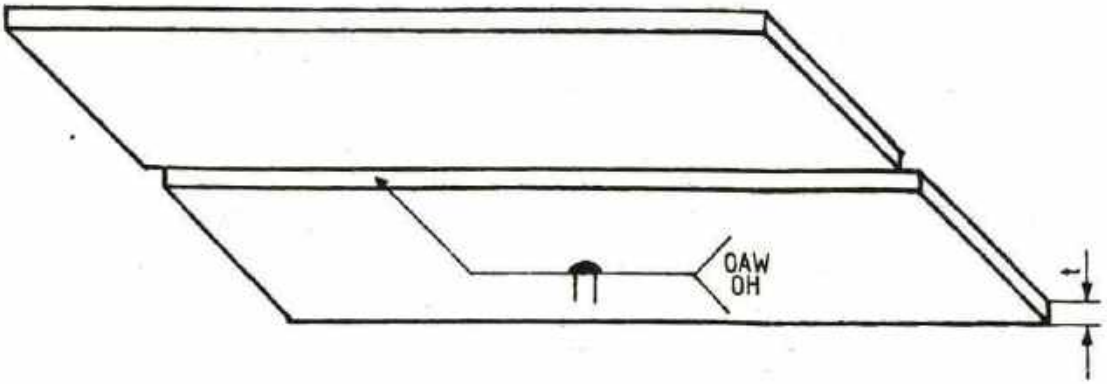
Movement of rod

| | | |
|---|---|---|
| SCALE: | SINGLE V BUTT WELD (VERTICAL) UPWARD | MP/2.3/36.1/6 |
| MAT.: MILDSTEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

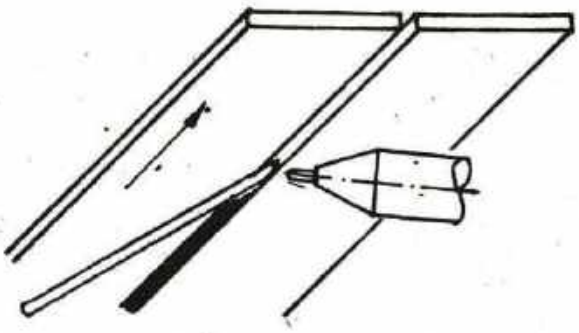
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

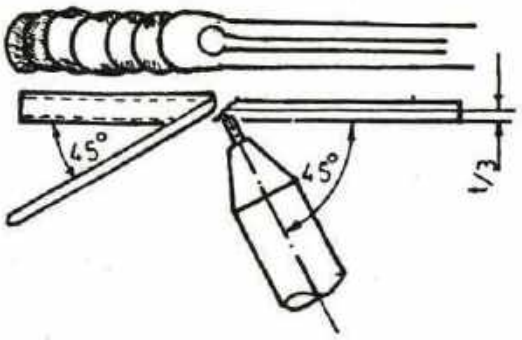
WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 7 | 3 | | | | Rightward | | |

- Use the same semi-circular motion of the torch as previously described. To help keep the puddle shallow, move the filler rod slowly in circular or swinging motion.



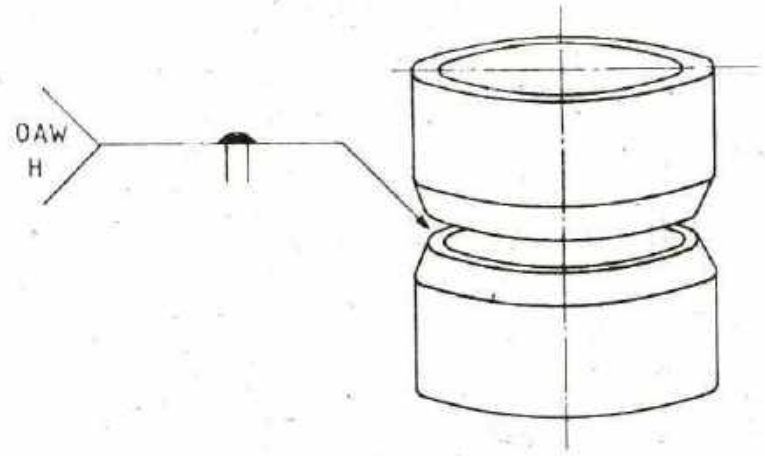



| SCALE | Square butt joint (OVER HEAD) | MP/2.3/3.6.1/7 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

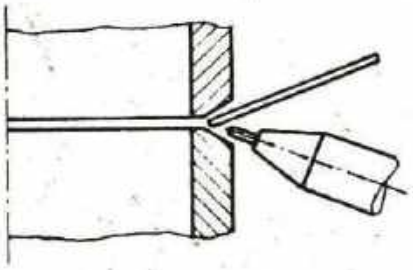
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

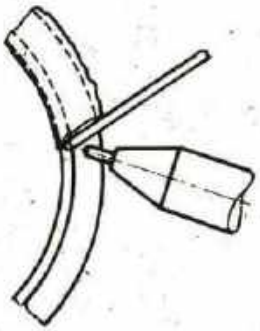
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod Ø mm |
|---|---|---|---|---|---|---|---|
| 8 | | | | | | | |





## Sequence of operation

1. Set the pieces ( space !)
2. Tack the pieces.
3. Clamp the job in vertical postion.
4. Weld the seam in horizontal position.

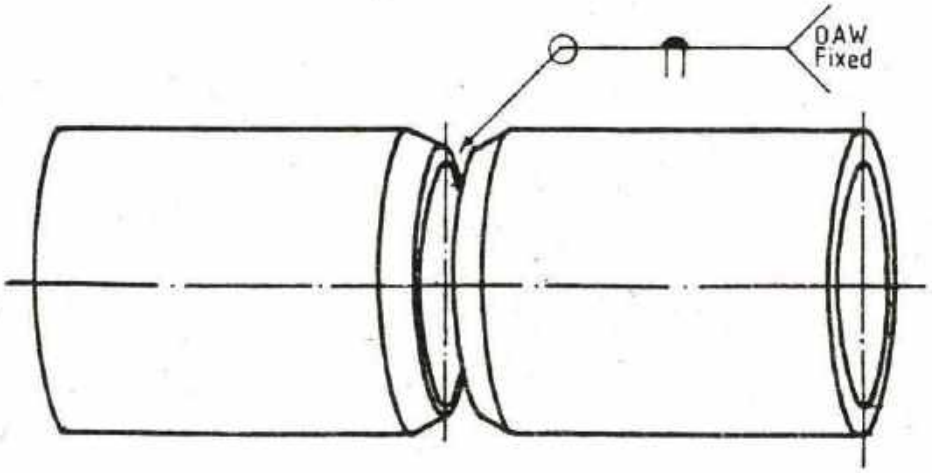
Move around the joint while welding.
Do not turn the pipe.

| SCALE: | PIPE V BUTT WELD (HORIZONTAL) FIXED | MP/2.3/3.6.1/ 8 |
|---|---|---|
| MAT.: MILDSTEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

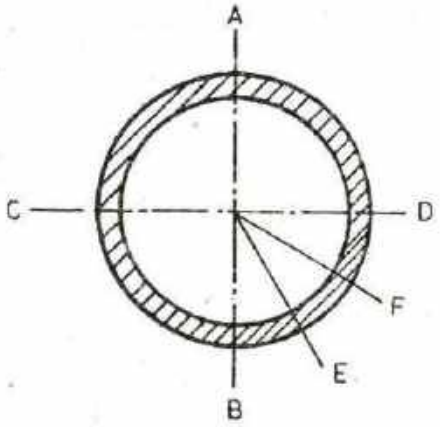
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 9 | | | | | rightward | | |

- Blowpipe nozzle and filler rod are both held at an angle of 45°.
- Bring the flame cone immediately in front of the lower edge of the molten pool and move parallel to the joint edge without any sideways movement of the blowpipe.

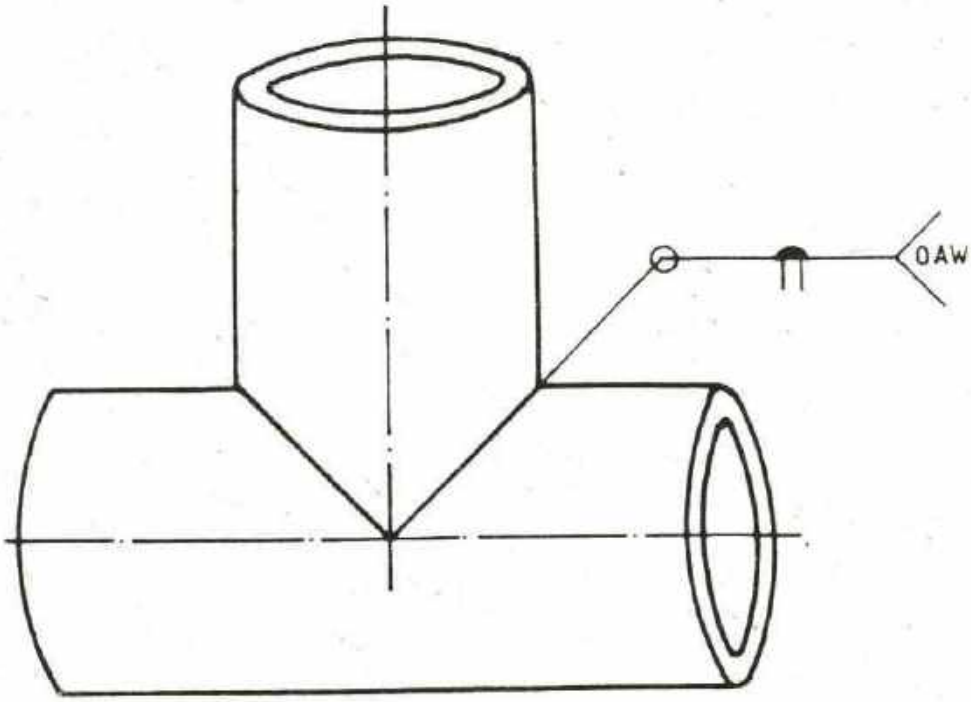



| SCALE | Single V Butt Joint on Pipe FIXED | MP/2.3/3.6.1/9 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

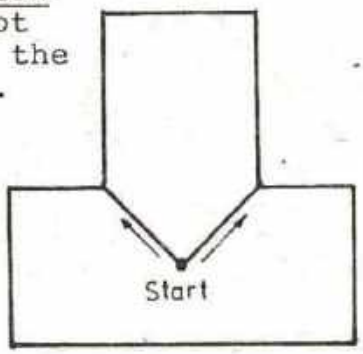


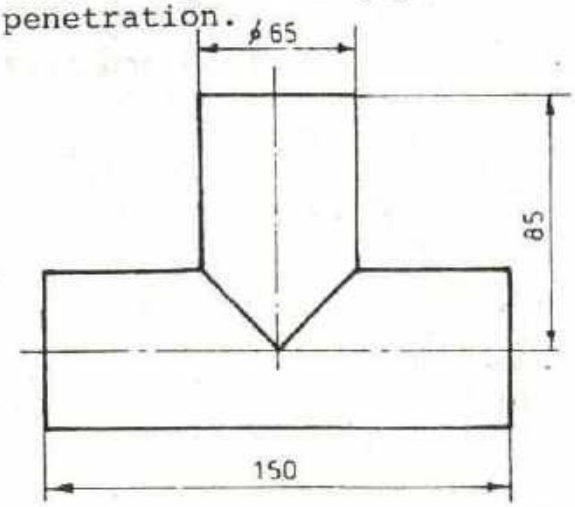

| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 10 | | | | | Leftward | | |

SEQUENCE OF OPERATION

- Mark out the development on the sheet and cut it.
- Round the job properly.
- Fit part No.1 and 2 together and tack the job with gap.
- Deposit the bead and obtain full penetration.

Caution.
Do not turn the pipe.



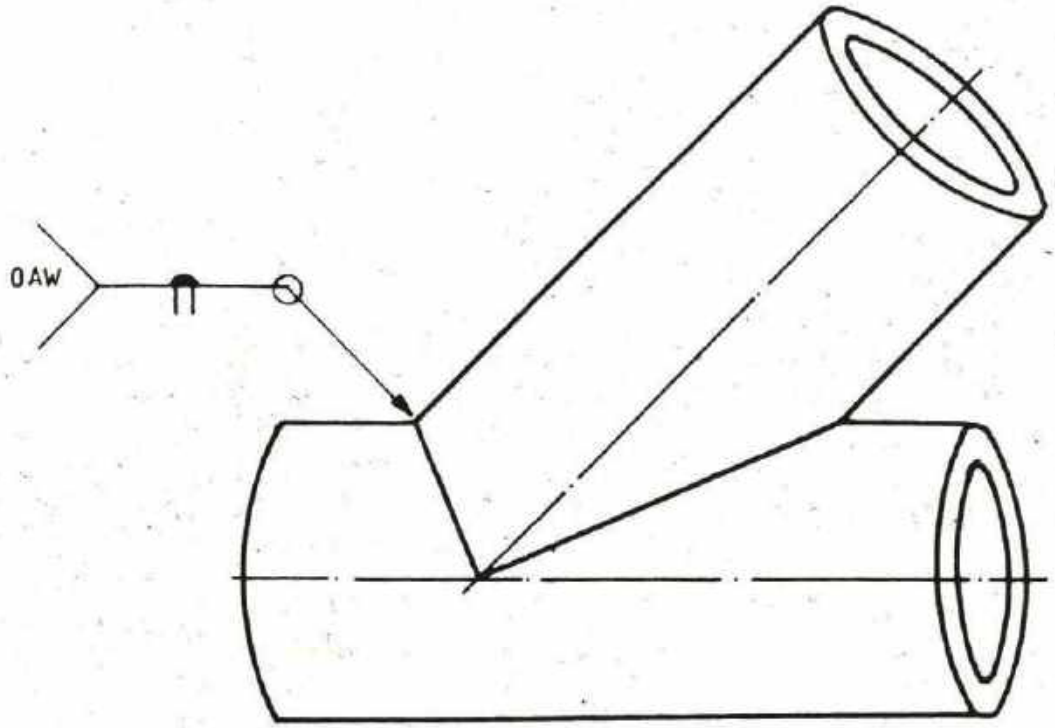




| SCALE | T joint equal dia | MP/2.3/3.61/10 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

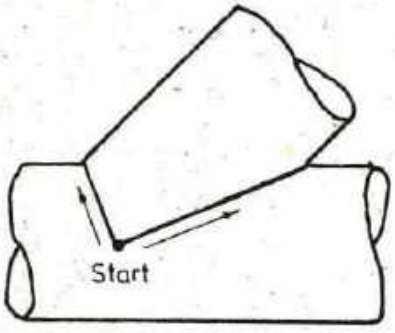
WELDER

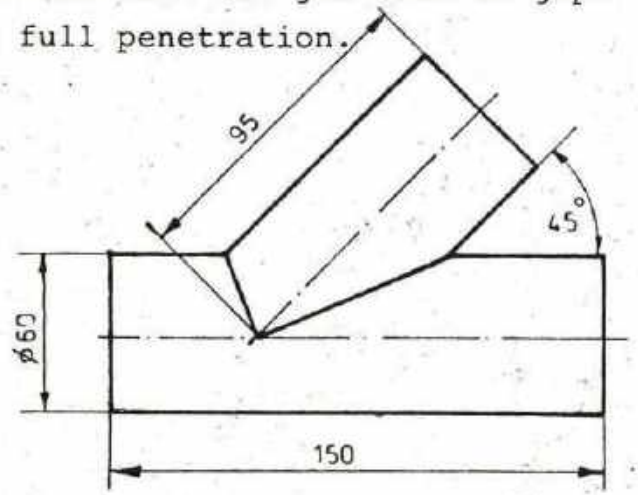



| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 11 | | | | | Leftward | | |

SEQUENCE OF OPERATIONS

- Mark out the development of the job and cut it.
- Round the job properly.
- Fit part No.1 and 2 together and tack the job with no gap.
- Deposit the bead and obtain full penetration.



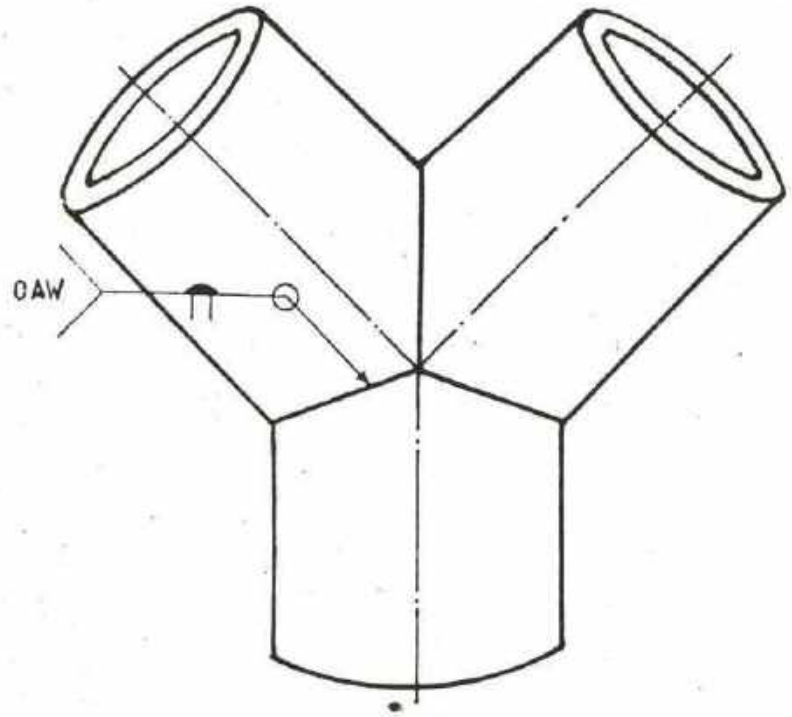




| SCALE | Lateral ( EQUAL DIA ) | MP/2.3/3.6.1/11 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

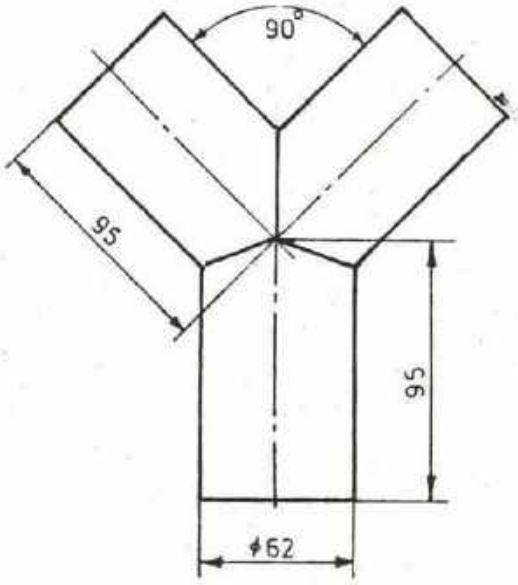
WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Method | Torchsize mm | Rod ø mm |
|---|---|---|---|---|---|---|---|
| 12 | | | | | Leftward | | |

SEQUENCE OF OPERATIONS

- Mark out the development on the sheet and cut it.
- Round the job properly.
- Fit part No.1,2 and 3 together and tack the job with gap.
- Deposit the bead and obtain full penetration.

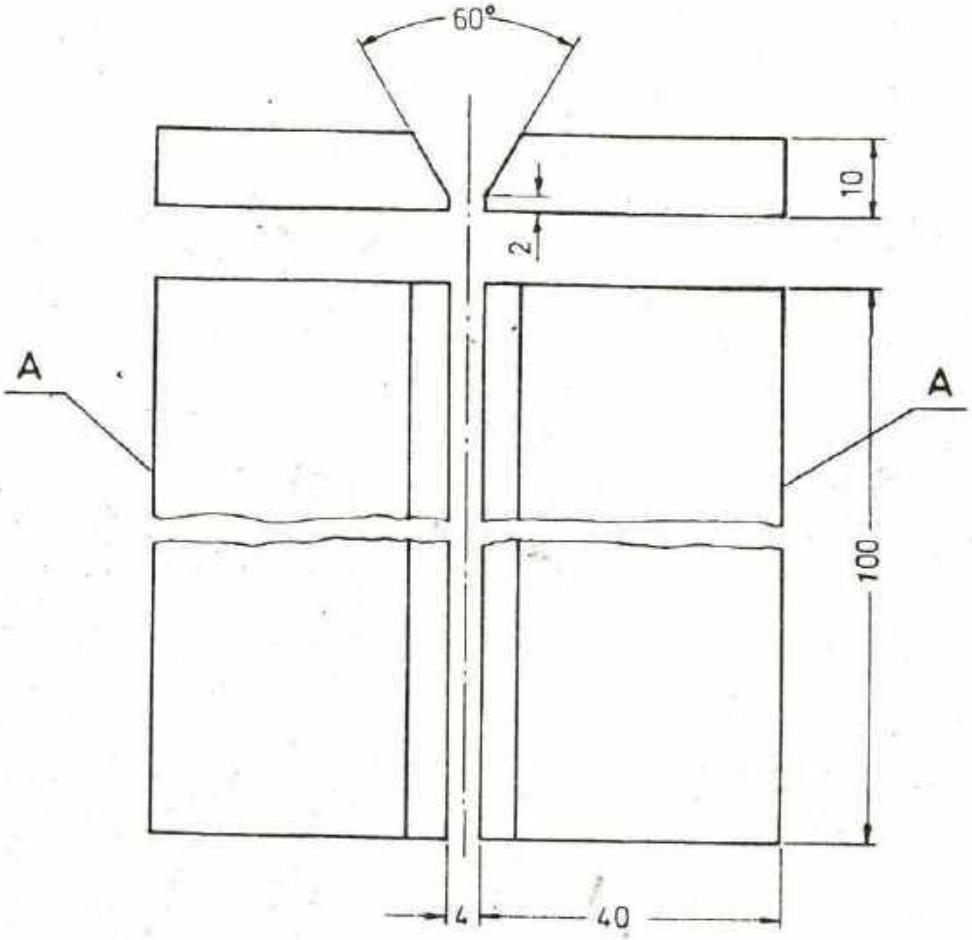



| SCALE | Y_ Joint (EQUAL DIA) | MP/2.3/3.6.1/12 |
|---|---|---|
| MAT. MILD STEEL | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




## Sequence of operation

1. The edges of both pieces are to be bevelled in the machine section.
2. Preheat one piece up to 550°C and weld a 4 mm thick layer on side "A".
3. Cover the piece under dry and warm sand after welding.
4. Repeat operations 2 and 3 at the second piece.
5. Place the two pieces according to drawing.
6. Preheat both pieces equally up to 550°C.
7. Make a strong tack-weld on the right end of the seam.
8. Weld a continuous seam from left to right.
9. Cover the job immediately after welding with dry and warm sand to ensure slow cooling.
10. Clean the piece and punch your bench number.

TOOLS AND WELDING MATERIAL REQUIRED

1. Torch size 6-9 (9-14).
2. Cast iron filler rod 6-8 mm.
3. Cast iron flux.

MATERIAL

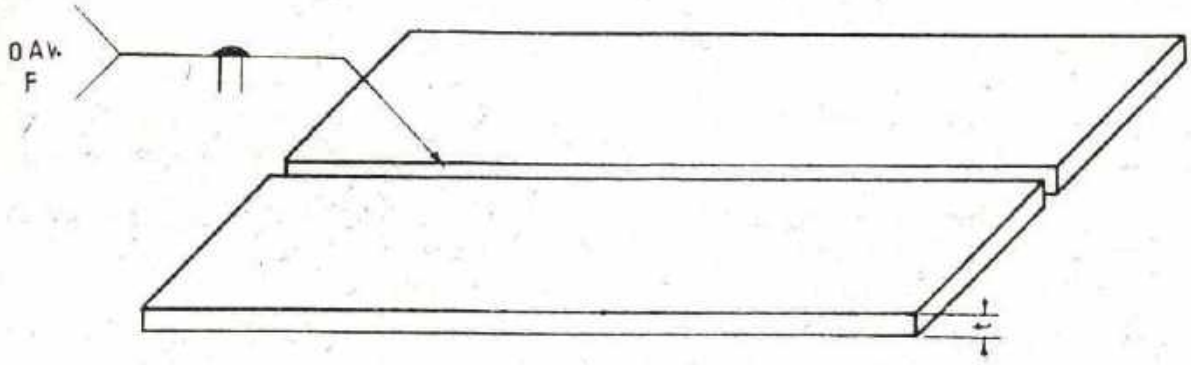
Cast iron

| | | |
|---|---|---|
| SCALE | CAST IRON JOINT | MP/2.3/3.61/13 |
| MAT. CAST IRON | | GAS WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

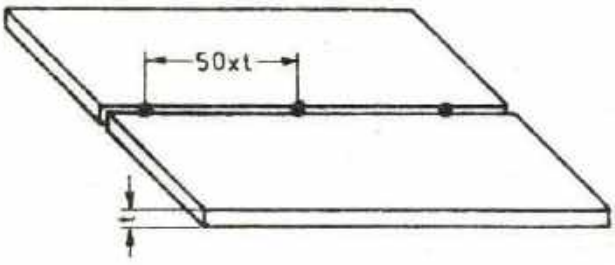
WELDER




| Ex. No. | Thickness mm | SWG | t inch | Material | Space mm | Methode | Torchsize mm | Rod Ø mm |
|---|---|---|---|---|---|---|---|---|
| 14 | 2 | | | Al - Sheet | | Leftward | 2 - 4 | 2 |
| 14a | 2 | | | Cu - Sheet | | Leftward | 4 - 6 | 2 |
| 14b | 2 | | | Brass Sheet | | Leftward | 2 - 4 | 2 |

## Sequence of operation ( 14 )

1. Mark out and cut the strips to size 200 x 20 (Aluminium).
2. Straighten the pieces (use a wooden hammer).
3. Set up the strips and aply flux
   (an equal gap is essential for a good seam).
4. Adjust the torch to a "soft flame" (slightly $C_2H_2$ excess).
5. Tack weld according to the sketch.
6. Preheat to about 550°C.
7. Weld the seam.
8. Remove the remaining flux by
   a. washing in hot water and brush with a wire brush.
   b. washing in diluted nitric acid (10 %).
   c. washing in water.
   d. drying.




| SCALE: | SQUARE BUTT JOINT (FLAT) | MP/2.3/3.61/14 |
|---|---|---|
| MAT.: | | GAS WELDING |

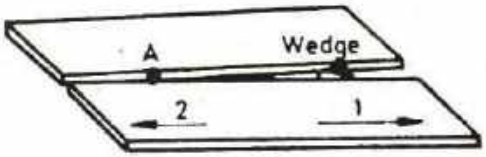
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

## Sequence of operation (14a)

1. Mark out and cut the strips to size 200 x 20 (copper).
2. Straighten the pieces (use a wooden hammer).
3. Set up as shown in the sketch.
   Dont't tack the pieces. Put a small wedge between the strips.




4. Apply flux.
5. Adjust the flame exactly neutral.
   Exceeding $C_2H_2$ results in pores.
   Exceeding $O_2$ results in an oxidized seam.
6. Start welding at point 'A' in direction '1'.
   Move the wedge as the weld progresses.
7. After completion start at point 'A' again and weld in direction '2'.
8. Remove the remaining flux.
9. Heat up the workpiece to about 700°C and hammer the seam with a spherical hammer to increase the tensile strength.

## Sequence of operation (14b)

1. Mark out and cut the strips to size 200 x 20 (brass).
2. Straighten the pieces (use wooden hammer).
3. Set up the strips and apply flux.
4. Adjust the flame

   25 % up to 50 % surplus of oxygen is required to prevent evaporation of the zinc.

5. Tack weld and weld the seam.
6. Remove the remaining flux.

| | | |
|---|---|---|
| SCALE: | SQUARE BUTT JOINT (FLAT) | MP/2.3/3.6.1/14a_14b |
| MAT: COPPER BRASS | | GAS WELDING |

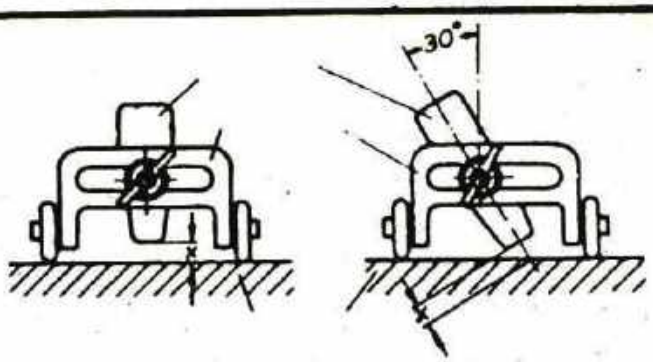
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

SEQUENCE OF OPERATIONS

1. Mount the torch guide on the head of the cutting torch in such a way that the distance between workpiece and torch is about 5 mm.




2. Open Oxygen Valve.

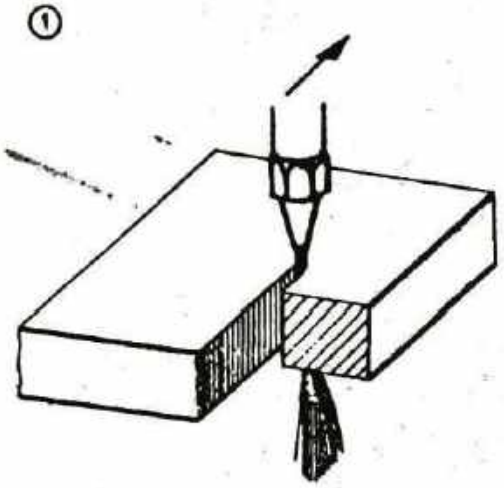
3. Open Acetylen valve and light torch.

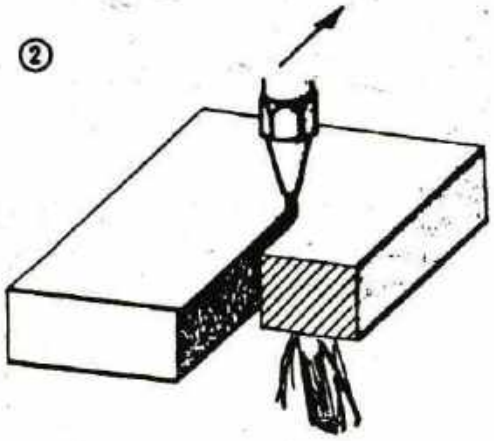
4. Adjust flame - Open cutting valve and re-adjust flame - if necessary - close cutting valve.

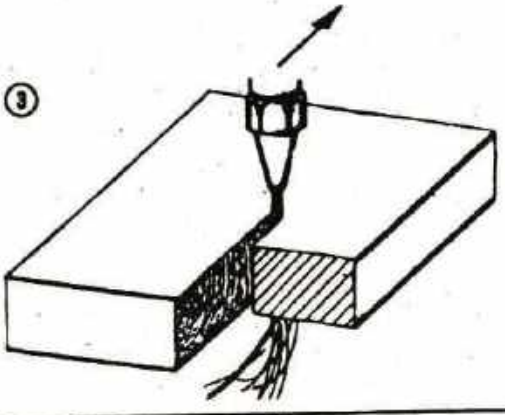
5. Heat starting point to bright read and open cutting valve.

6. Rate of travel. -

   (1) Correct speed.
   (2) Too slow.
   (3) Too fast.



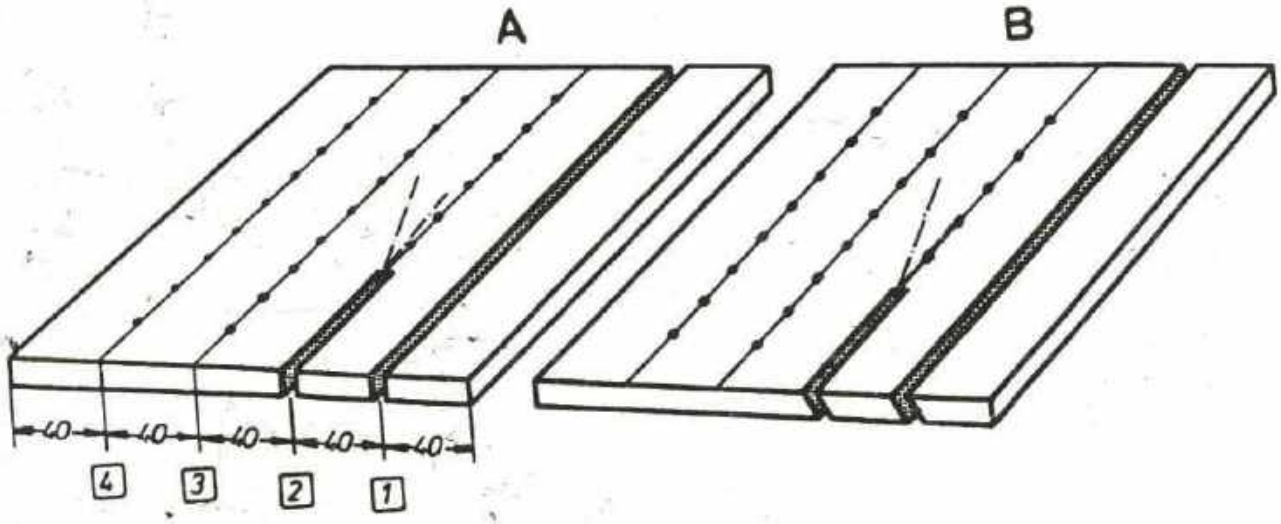




| SCALE | TORCH CUTTING | MP/2.3/3.6.1/15 |
|---|---|---|
| MAT MILD STEEL | | GAS CUTTING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




SEQUENCE OF OPERATIONS

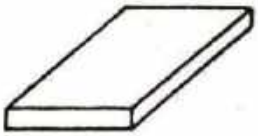
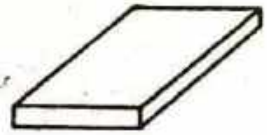
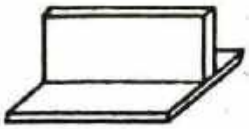
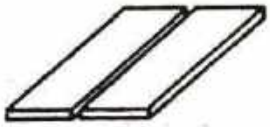
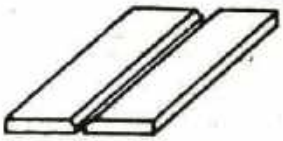
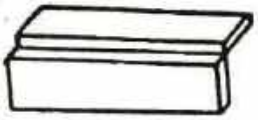
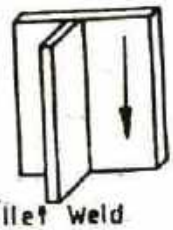
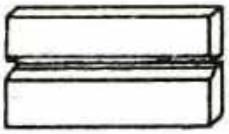
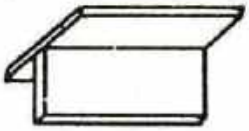
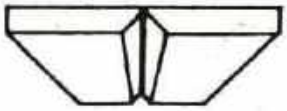
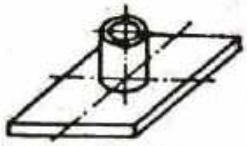
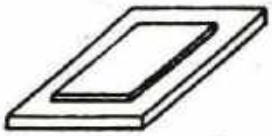
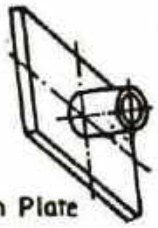
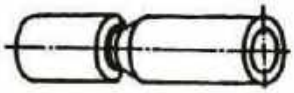
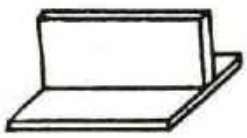
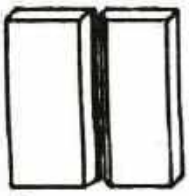
1. Mark out according to sketch A and B.
2. Centre punch the marking line.
3. Adjust torch guide for vertical cut.
4. Slightly open the oxygen valve.
5. Open Acetylen valve.
6. Light torch and adjust flame.
7. Open cutting valve correct flame (if necessary).
8. Close cutting valve.
9. Set torch at the edge of the 1st marking line.
10. Heat to bright red.
11. Open cutting vlave.
12. Pull torch with uniform speed along the marking line.
13. Close cutting valve.
14. Repeat operation 9-13 on marking line 2-4.
15. Close acetylen valve.
16. Close oxygen valve.
17. Adjust torch guide for $30^{\circ}$ bevel cut.
18. Repeat operation 4-16 on workpiece B.

| | | |
|---|---|---|
| SCALE | TORCH CUTTING | MP/2.3/3.6.1/15.1 |
| MAT. MILD STEEL | | GAS CUTTING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

| | | | |
|---|---|---|---|
|  Straight Bead |  Wearing |  T Joint |  Square Butt Joint |
| 1 → 2 | 2 | 3 | 4 |
|  Single V Butt Joint |  Corner Joint |  SingleV Butt joint |  Fillet Weld |
| 5 | 6 | 7 | 8 |
|  Single V Butt Joint |  T Joint |  Single V Butt Joint |  Pipe on Plate |
| 9 | 10 | 11 | 12 |
|  Build up weld |  Pipe on Plate |  Single V Butt Joint on Tube |  Single V Butt Joint |
| 13 | 14 | 15 | 16 |
| |  T Joint |  Single V Butt joint | |
| | 17 | 18 | |

| | | |
|---|---|---|
| TRADE TRAINING II | LAYOUT | MP/2-3/3-6-2 |
| | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

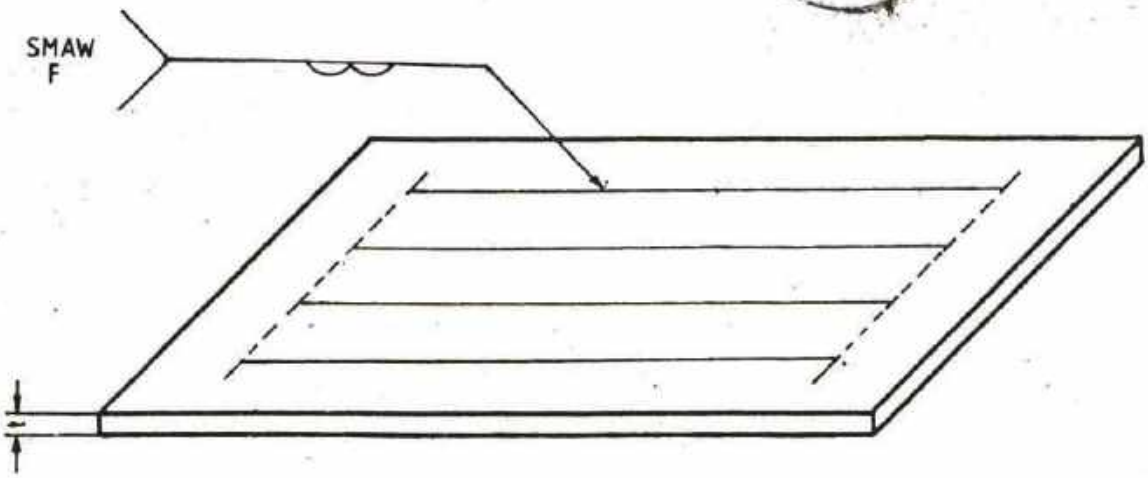
WELDER

TRADE TRAINING II
ARC WELDING
NO.3.6.2/1 TO 18

# MATERIAL REQUIRED

(Length given in millimeters)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | Length per Trainee | Total Length for 16 trainees. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M.S.Flat 100x6.35 4" x ¼" | 200 | | | | | | | | | | | | | | | | | | 200 | 3.25m |
| M.S.Flat 31 x 6.35 1¼"x¼" | | | 400 | | | 800 | | 400 | | 400 | | | | | | | | | 2000 | 32.5m |
| M.S.Flat 50x6.35 2" x ¼" | | Use material of Ex.No. → 1 | 400 | | | | | 400 | | 400 | | | | | | | | | 1200 | 19.25m |
| M.S.Flat 31x2.93 1¼" x 11 SWG | | | | 800 | | | | | | | | | | | | | | | 800 | 13 m |
| M.S.Flat 37x6.35 1½" x ¼" | | | | | 800 | | | | | | | | | | | | | | 800 | 13 m |
| M.S.Flat 37x9.52 1½" x 3/8" | | | | | | | 800 | | 800 | | 800 | | | | | | | | 2400 | 38.5m |
| M.S.Flat 75x4.76 3" x 3/16" | | | | | | | | | | | | 75 | 75 | 75 | | | | | 225 | 3.75m |
| M.S.Pipe ø 2" | | | | | | | | | | | | 30 | 30 | 30 | | | | | 90 | 1.5 m |
| S.S.Sheet 31x6.35 1¼" x ¼" | | | | | | | | | | | | | | | | | 400 | | 400 | 6.5 m |
| M.S.Pipe ø 3" | | | | | | | | | | | | | | | 100 | 100 | | | 200 | 3.25m |
| S.S.Sheet 50x6.35 2" x ¼" | | | | | | | | | | | | | | | | | 400 | | 400 | 6.5 m |
| S.S.Sheet 37x9.52 1½" x 3/8" | | | | | | | | | | | | | | | | | | 800 | 800 | 13 m |

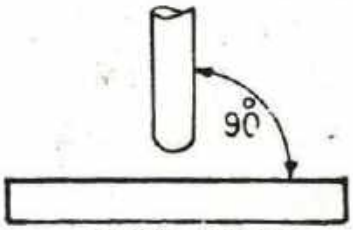



| Ex. No. | Thickness t | | | Space | Electrode ⌀ | | Name of Electrode | Amps recommended | Amps. used. |
|---|---|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | mm | SWG | | | |
| 1 | 6.35 | | | - | 3.25 | | | | |

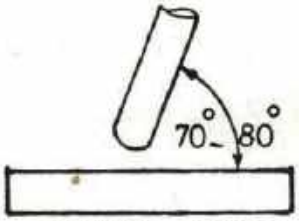
SEQUENCE OF OPERATIONS

- Mark the straight lines on the job.
- Strike the electrode as close as possible to the joint where the weld is started.
- Deposit the continuous bead from left to right end without weaving.
- Do not throw away a stub end which is longer than 35-45mm.

POSITION OF ELECTRODE



WORK ANGLE



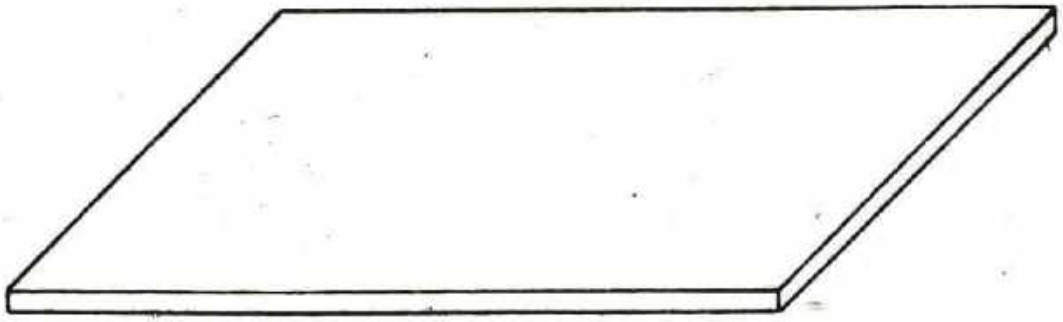
TRAVEL ANGLE

| SCALE | STRAIGHT BEAD (FLAT) | MP/2.3/3.6.2/1 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

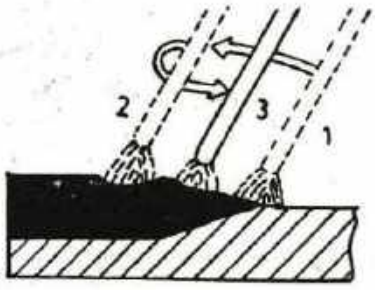


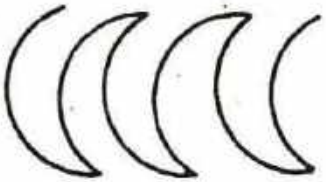
| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode ø mm | SWG | Name of Electrode | Amps recommended | Amps used |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 6.35 | | | - | 3.25<br>4.00 | | | | |

SEQUENCE OF OPERATIONS

- Use any one type of weaving motion to fill the space (preferably crescent motion).
- Make certain that the straight beads are covered half of the width by weaving.

POSITION OF ELECTRODE



CRESCENT MOTION

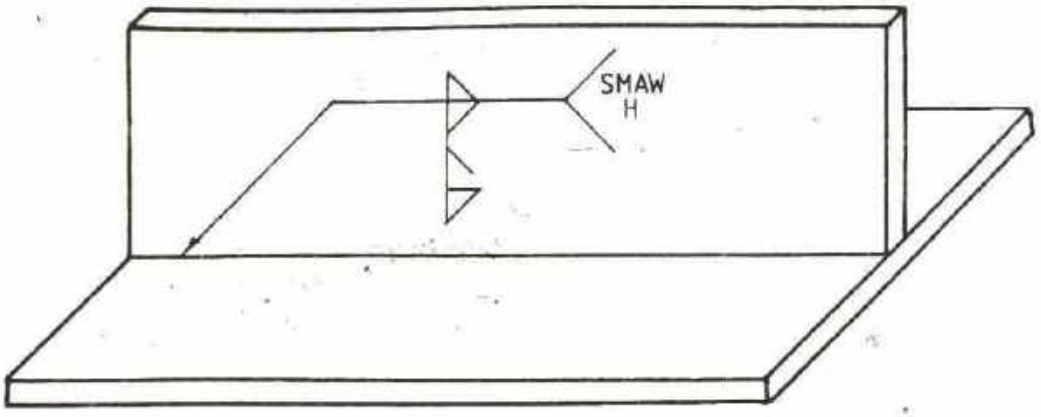
Note. Use material of Ex.No.1.

| SCALE | WEAVING (FLAT) | MP/2.3/3.6.2/2 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

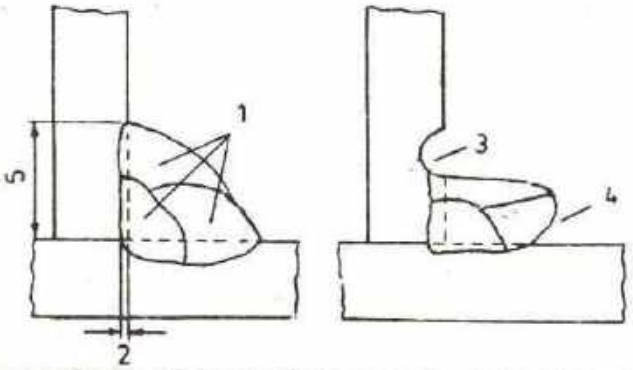
WELDER




| Ex. No. | Thickness t | | | Space | Electrode ø | | Name of Electrode | Amps recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | mm | SWG | | | |
| 3 | 3 8 | | | - | 4mm | | | | |

SEQUENCE OF OPERATIONS

- Set up and tack the pieces.
- Deposit the first bead with sliding likely along the edges of the joint.
- Deposit the second bead which partially covers the first pass.
- Deposit the third bead which covers the first pass and part of the second pass.




FILL IN THE NUMBERS CONCERNED

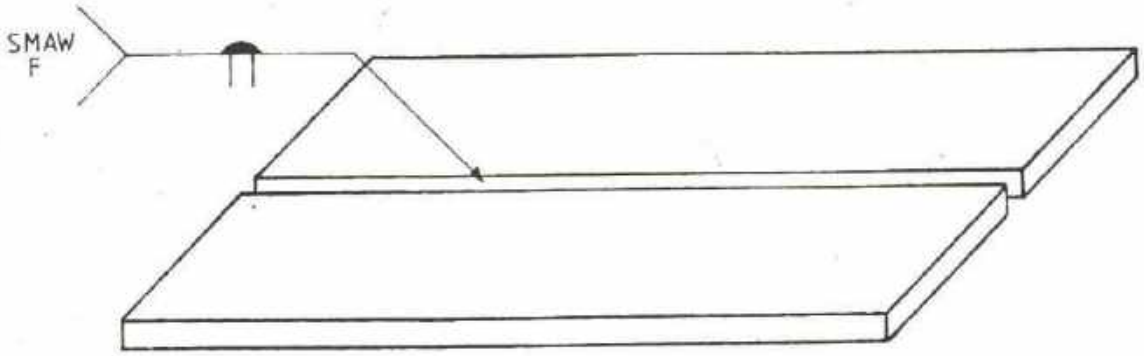
- ○ Proper fusion
- ○ Rolled edges
- ○ Undercut
- ○ Correctly applied seams
- ○ Leg length

| SCALE | T JOINT ( HORIZANTAL ) | MP/2.3/3.6.2/3 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

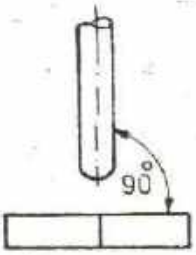



| Ex. No. | Thickness t | | | Space | Electrode ⌀ | | Name of Electrode | Amps recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | mm | SWG | | | |
| 4 | 4mm | | | 2-3 | 3.25 | | | | |

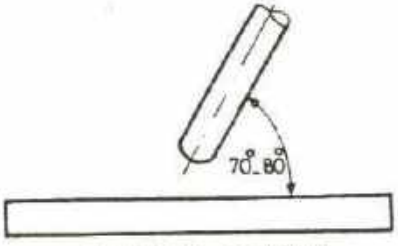
SEQUENCE OF OPERATIONS

- Tack the pieces with root gap about 3mm.
- Strike the electrode as close as possible to the joint where the weld is started.
- Move the electrode steadily forward with slightly weaving motion.
- Make sure that the penetration is fully obtained.

POSITION OF ELECTRODE




WORK ANGLE



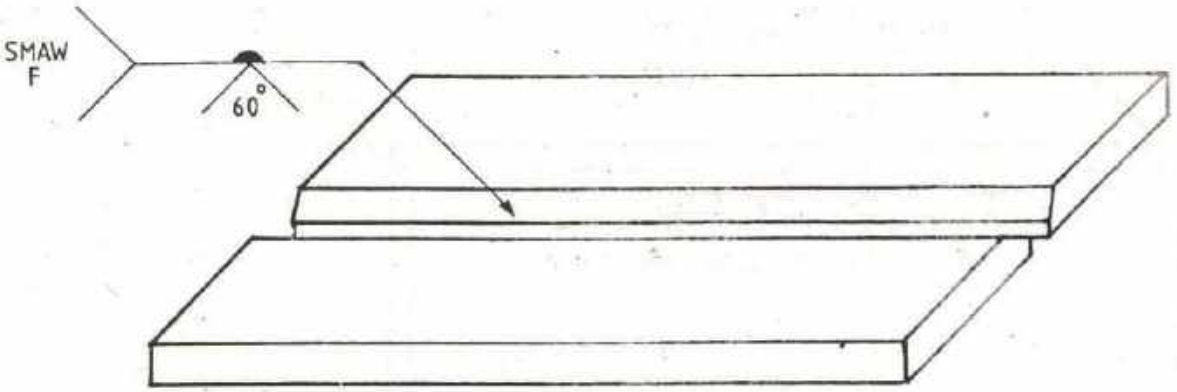

TRAVEL ANGLE

| SCALE | SQUAR BUTT JOINT (FLAT) | MP12.3/3.6.2/4 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t | | | Space | Electrode ø | | Name of Electrode | Amps recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | mm | SWG | | | |
| 5 | 9 | | | 2-3 | 2.5<br>3.25 | | | | |

SEQUENCE OF OPERATIONS

- Bend the parts about 10° before starting the weld to compensate the contraction-action of the weld.
- Move the electrode smoothly forward in the joint with weaving motion.
- Try to keep the pear shaped hole in the root.
- Avoid passing the electrode against the face of the joint.

Work pieces before welding

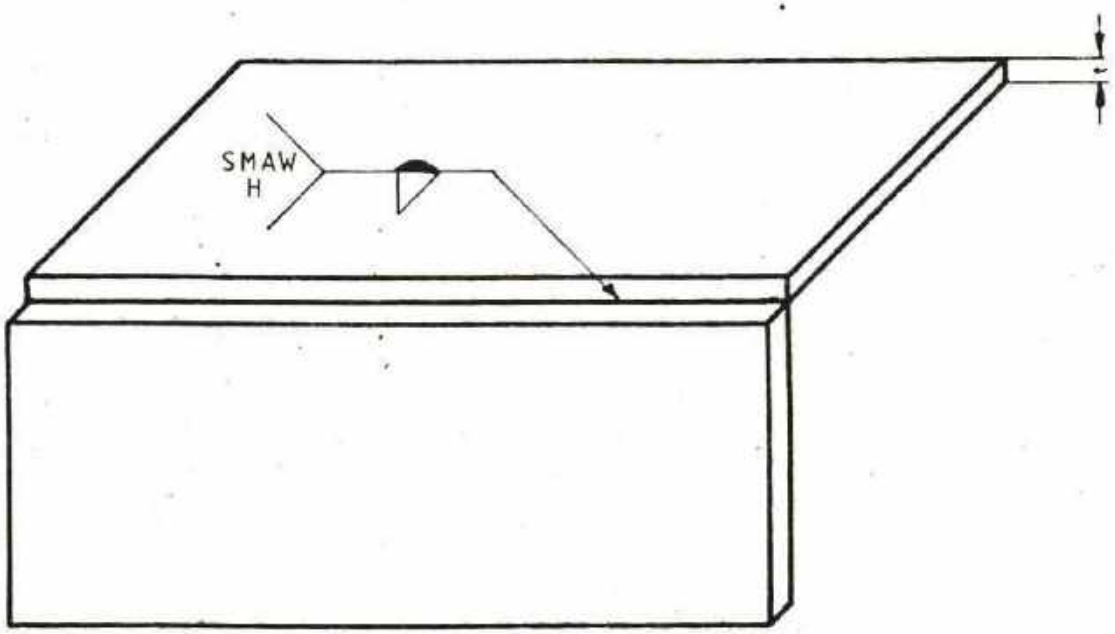
Work pieces after welding

| SCALE | SINGLE BUTT JOINT (FLAT) | MP/2.3/3.6.2/5 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

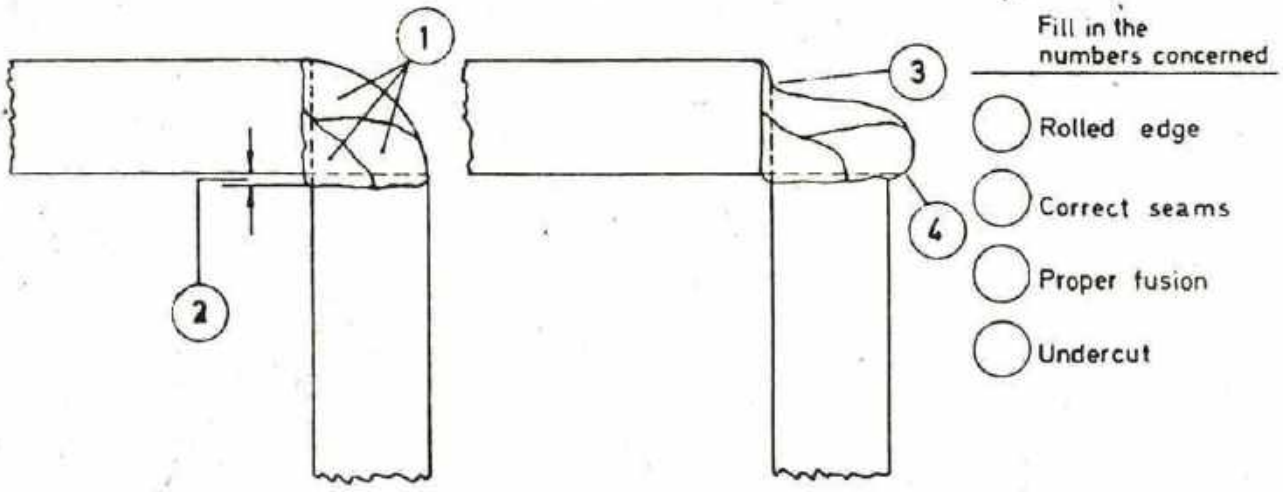
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t | | | Space | Electrode Ø | | Name of Electrode | Amps. recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | mm | SWG | | | |
| 6 | | | 1/4" | | | 10/8 | | | |

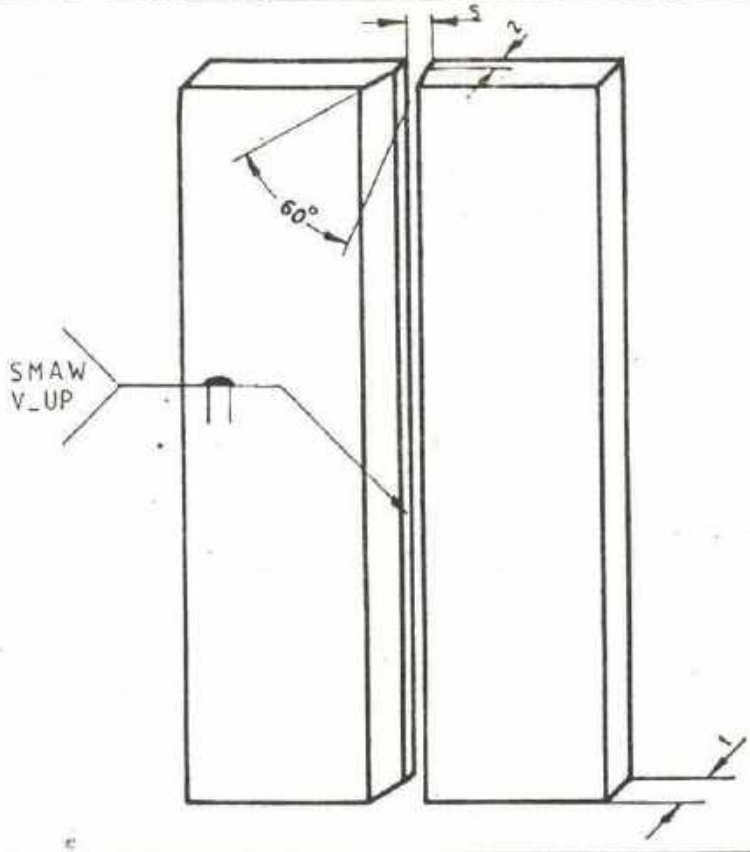



| | | |
|---|---|---|
| SCALE: | CORNER JOINT ( horizontal ) | MP/2.3/3.6.2/6 |
| MAT: MILDSTEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

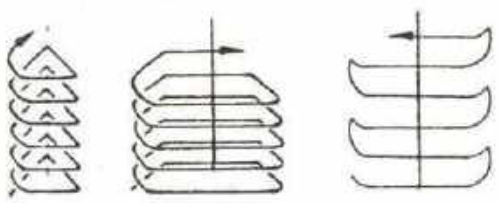
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t | | | Space | Electrode Ø | | Name of Electrode | Amps. recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | mm | SWG | | | |
| 7 | | | 3/8" | | | 10 | | | |

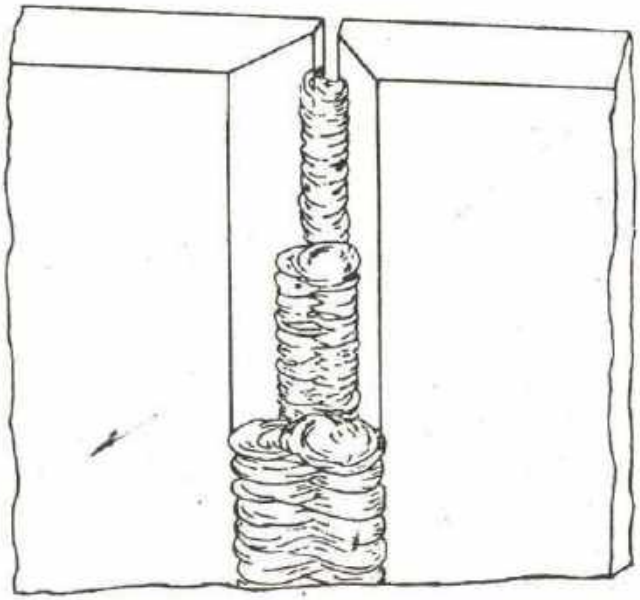
## Movement of electrode for the required layers



Movement for root-bead

Movement for second layer

Movement for top-layer

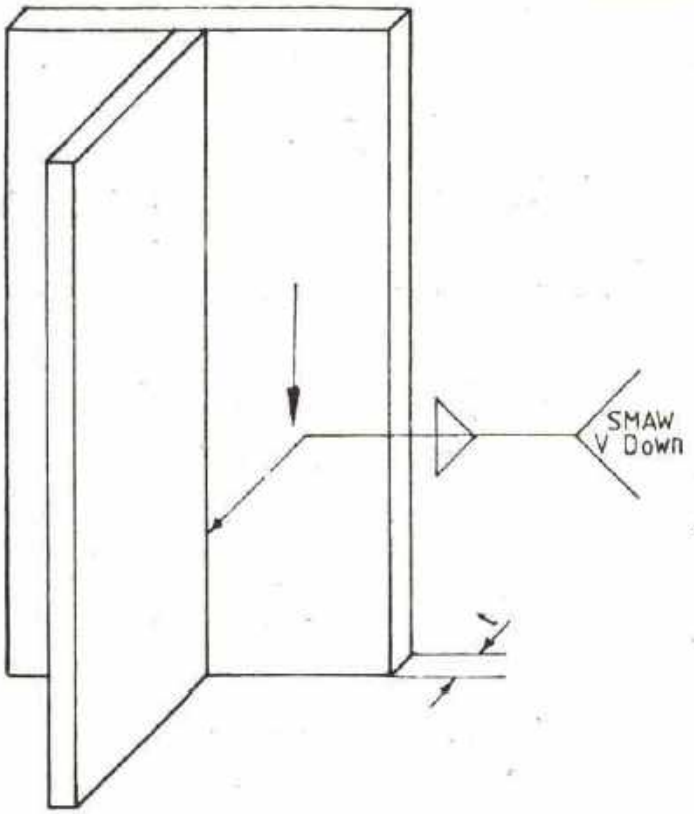


| | | |
|---|---|---|
| SCALE: | SINGLE V BUTT JOINT (VERTICAL UPWARD | MF/2/3/3 S 2/7 |
| MAT: MILDSTEEL | | ARC WEDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

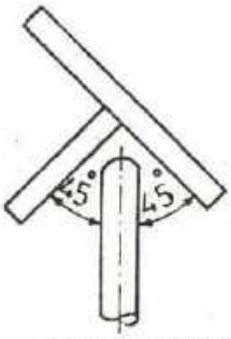
WELDER



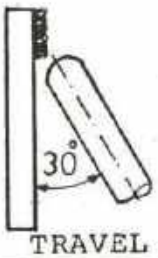

| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode ⌀ mm | SWG | Name of Electrode | Amps recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| 8 | | | 3/16 | - | | 10 | | | |

- When welding downwards, use only straight beads.
- Weaving-motion produces a heavy puddle, which cannot be controlled and will finally drop down.

POSITION OF ELECTRODE




WORK ANGLE



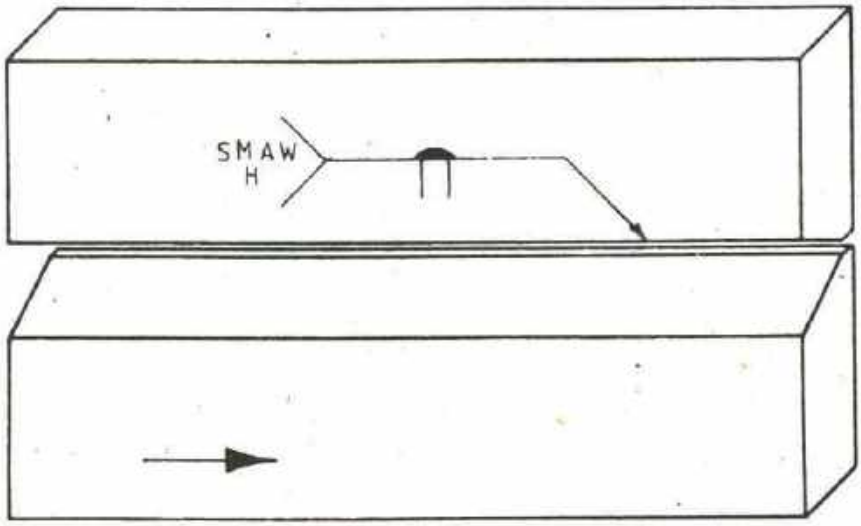

TRAVEL ANGLE

| SCALE | FILLET WELD ( vertical downward ) | MP/2.3/3.6.2/8 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

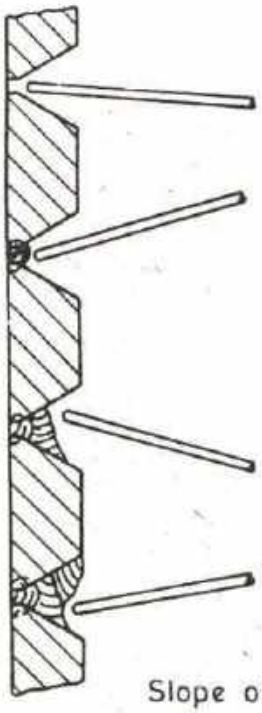
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode Ø mm | SWG | Name of Electrode | Amps recommended | Amps used |
|---|---|---|---|---|---|---|---|---|---|
| 9 | | | 3/8" | | | | | | |




Slope of the electrode ≈70°

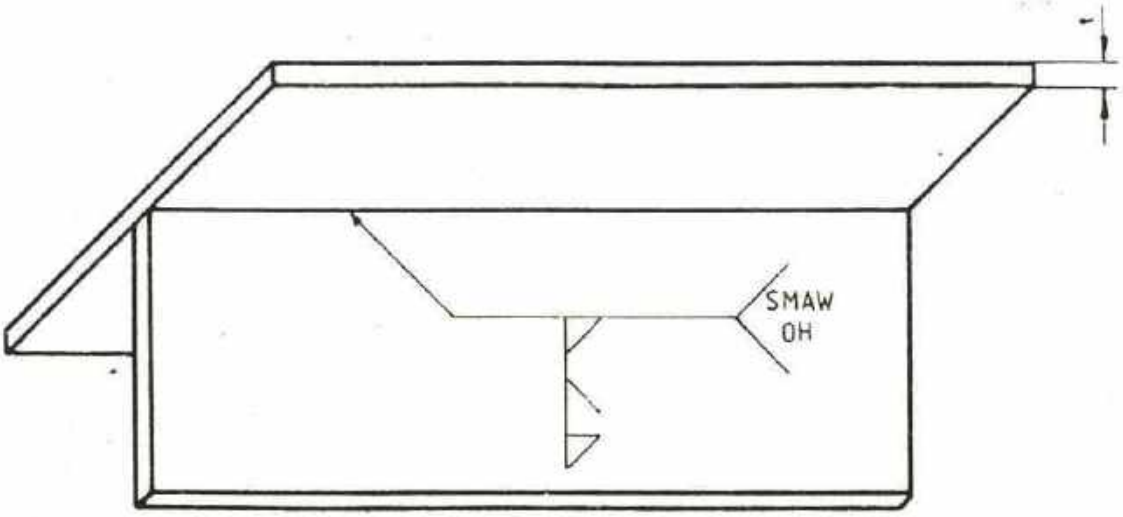
9/3

| SCALE: | S.V - BUTT JOINT (HORIZONTAL) | MP/23/3.6.2/9 |
|---|---|---|
| MAT: MILDSTEEL | | ARC WELDING |

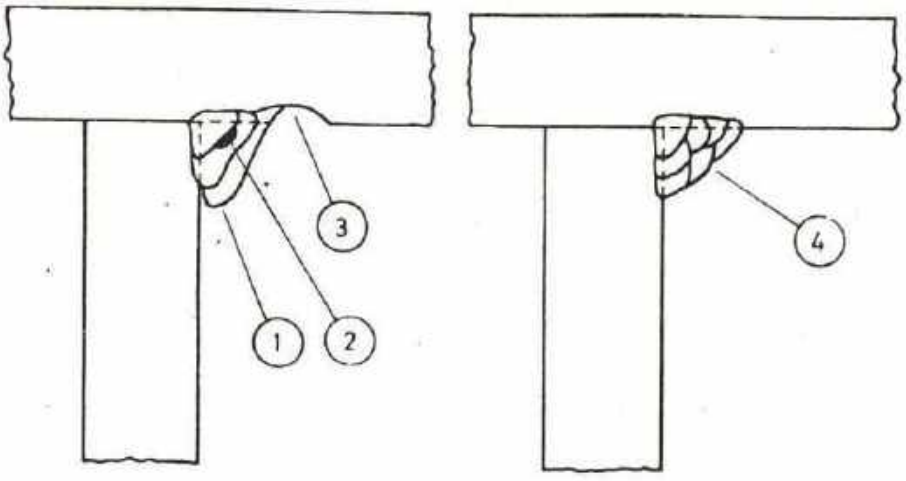
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode Ø mm | SWG | Name of Electrode | Amps. recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| 10 | | | 1/4" | | | 10/8 | | | |




Fill in the numbers concerned

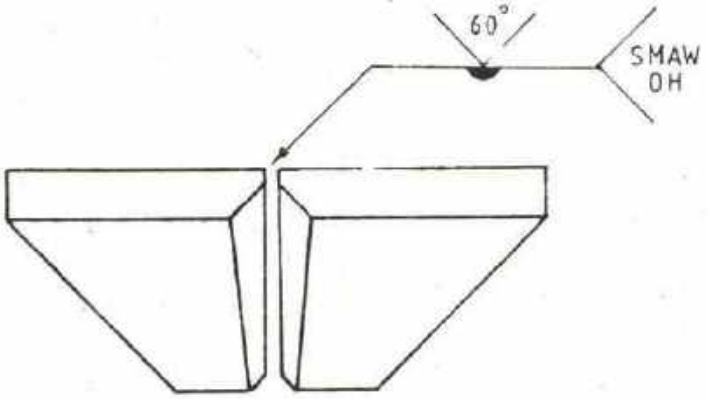
- ○ undercut
- ○ rolled edge
- ○ correct location
- ○ slag inclusion

| SCALE | TEE JOINT ( OVERHEAD ) | MP/23/3.6.2/10 |
|---|---|---|
| MAT. MILDSTEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



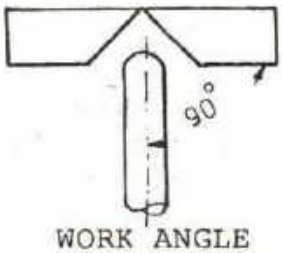

| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode ø mm | SWG | Name of Electrode | Amps recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| 11 | 9.52 | | | | | | | | |

SEQUENCE OF OPERATIONS

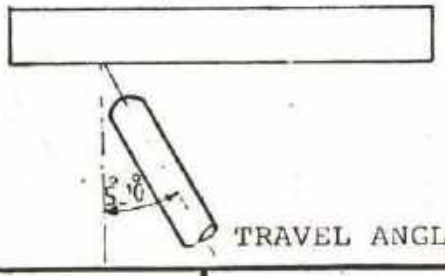
- Bevel and tack the pieces with root gap.
- Tack the job in overhead position.
- Deposit the root pass and obtain complete penetration.
- Remove the slag.
- Deposit additional passes to fill the groove.

Note Keep the arc as short as possible.

POSITION OF ELECTRODE




WORK ANGLE



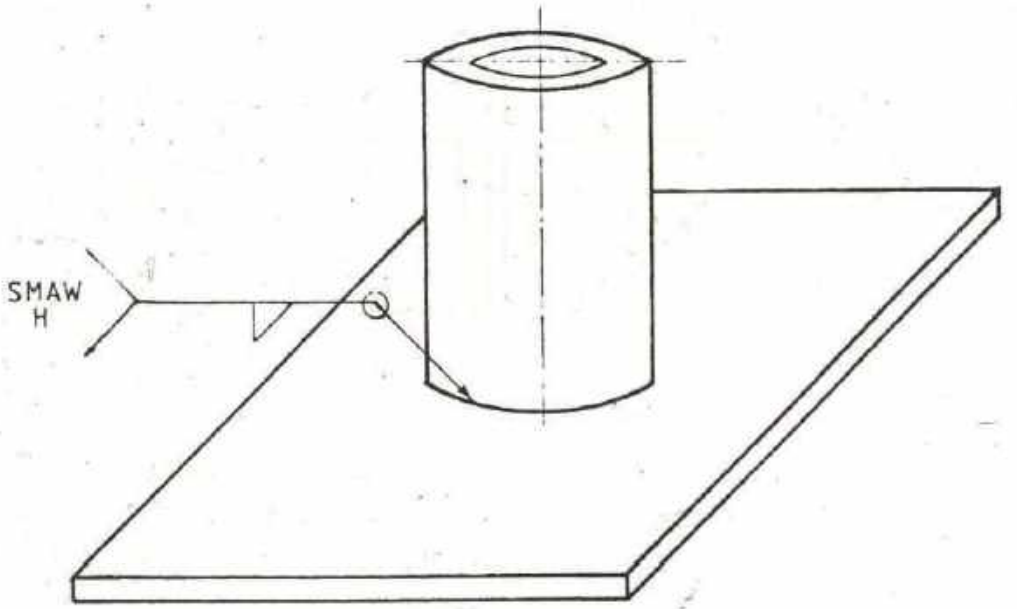

TRAVEL ANGLE

| SCALE | SINGLE V BUTT JOINT (over head) | MP/2.3/3.6.2/11 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

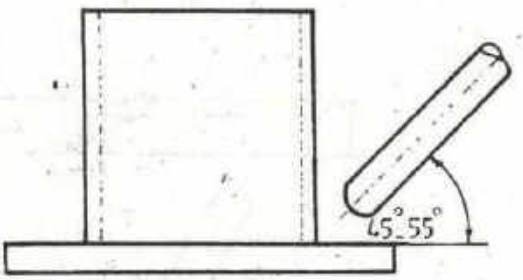
WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode ø mm | SWG | Name of Electrode | Amps recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 4.76 | | | | 3.25 | | | | |

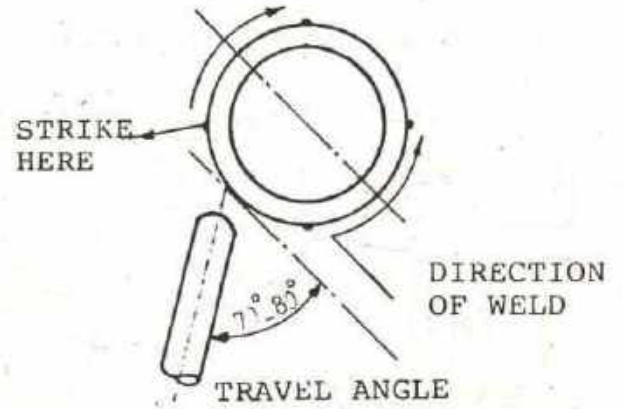
## POSITION OF ELECTRODE

WORK ANGLE 45°




WORK ANGLE

TRAVEL ANGLE 70°-80°

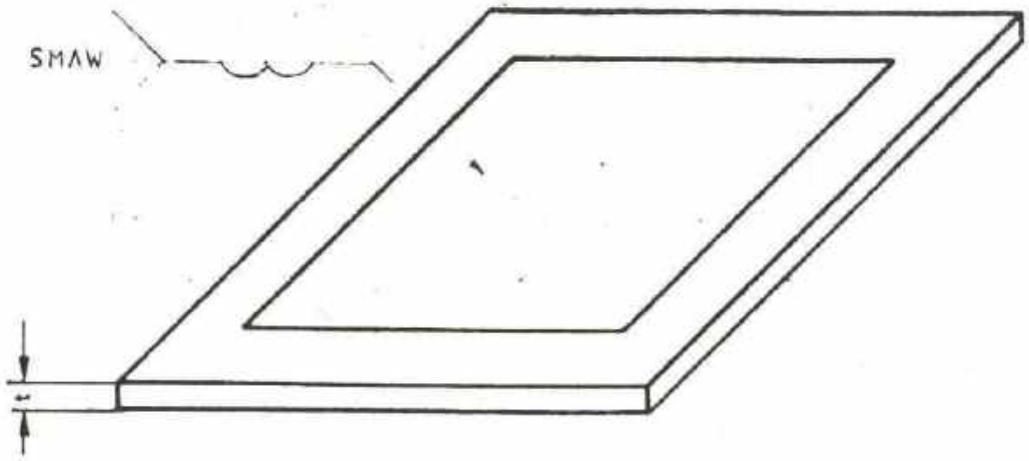



| SCALE | PIPE ON PLATE (horizontal) | MP/2.3/3.6.2/12 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

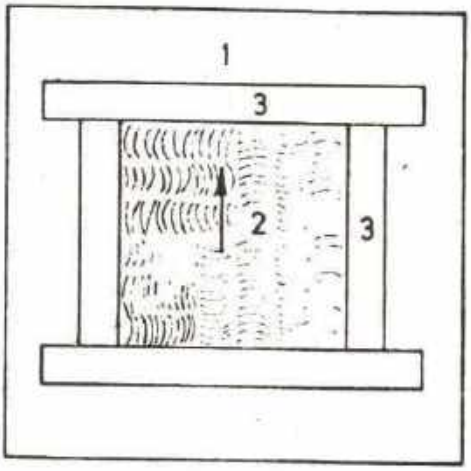
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode ⌀ mm | SWG | Name of Electrode | Amps. recommended | Amps used |
|---|---|---|---|---|---|---|---|---|---|
| 13 | | | 3/16" | | | 10 | | | |




1 = Base plate

2 = Deposit

3 = Copper or aluminium plate

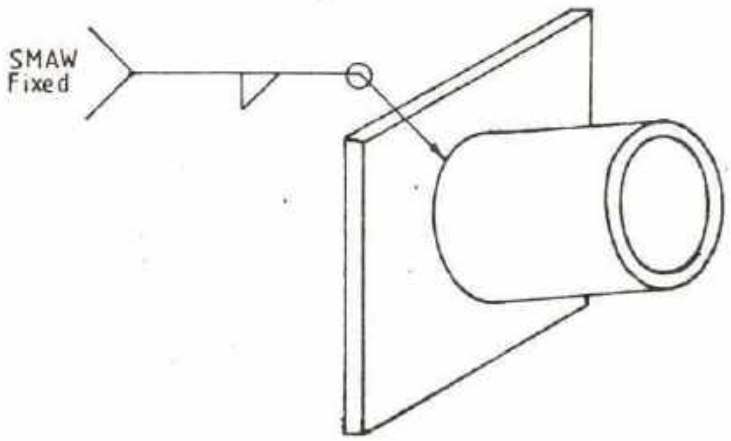
1. When built-up-welding use a copper or aluminium plate on the edges of the deposit to get a sharp corner.
2. Weld the layers criss-cross!

| SCALE: | BUILD-UP WELD FLAT | MP/23/36/2/13 |
|---|---|---|
| MAT MILDSTEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK GERMAN TECHNICAL TRAINING PROGRAMME

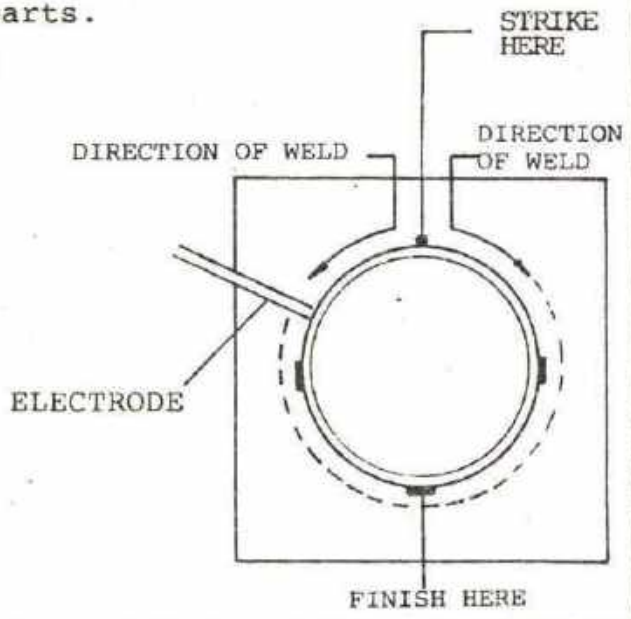
WELDER




| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode ø mm | SWG | Name of Electrode | Amps recommended | Amps. used |
|---|---|---|---|---|---|---|---|---|---|
| 14 | 4.76 | | | | | | | | |

SEQUENCE OF OPERATIONS

- Set the workpieces and tack the parts.
- Clamp the job in proper position.
- Deposit the bead with short arc without weaving.




POSITION OF ELECTRODE

Travel Angle $60^{\circ}$ - $70^{\circ}$

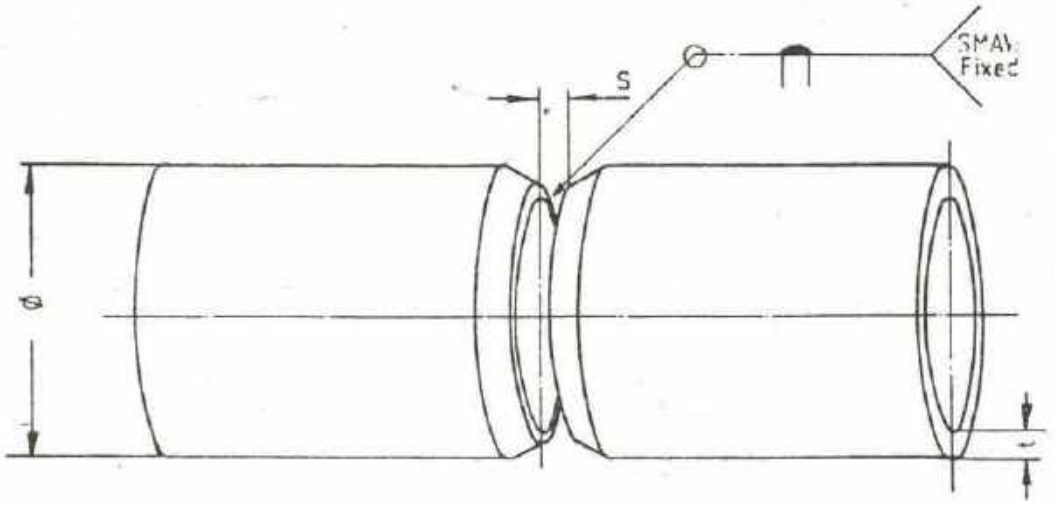
Work Angle $45^{\circ}$

| SCALE | PIPE ON PLATE (T-joint fixed downward) | MP/2.3/3.6.2/14 |
|---|---|---|
| MAT. MILD STEEL | | ARC WELDING |

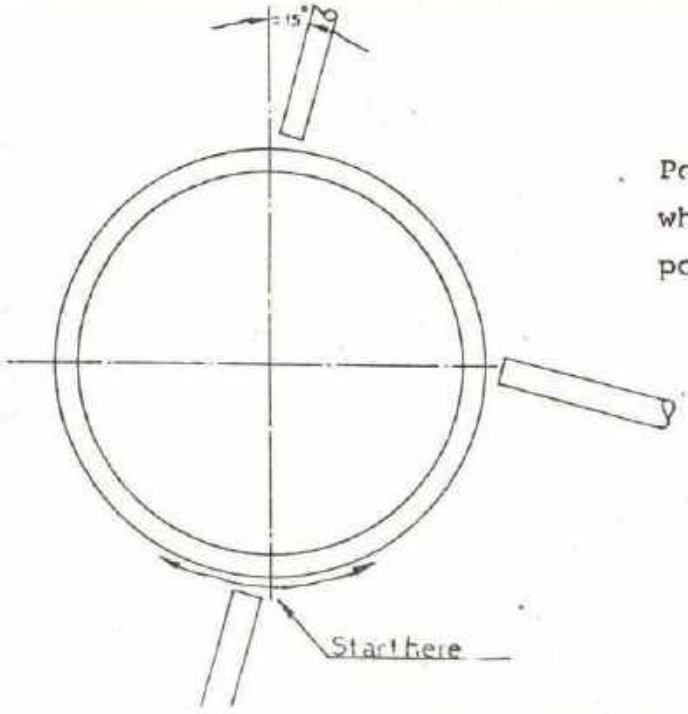
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex. No. | Thickness t | | | Space | Electrode Ø | | Name of Electrode | Amps. recommended | Amps used |
|---|---|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | mm | SWG | | | |
| 1) | | | | | | 10 | | | |



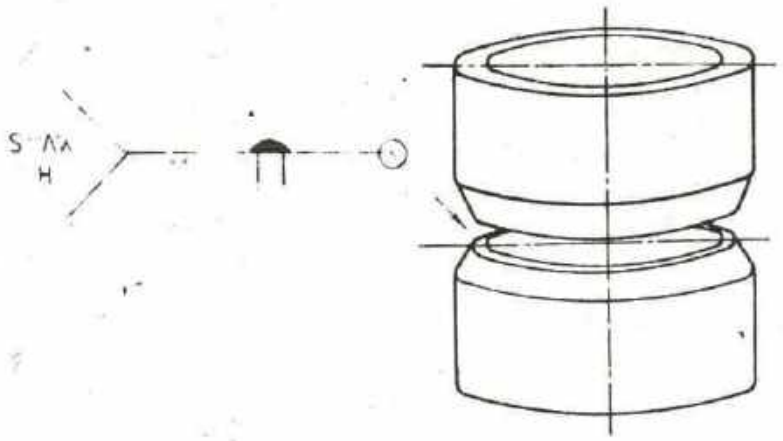

Position of the electrode when pipe welding in fixed position.

| | | |
|---|---|---|
| SCALE: | SINGLE V BUTT JOINT ON TUBE FL/V/0 | MF/23/3 6 2/1 |
| MAT: MILDSTEEL | | ARC – WELDING |

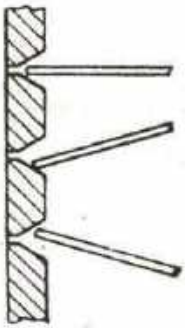
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

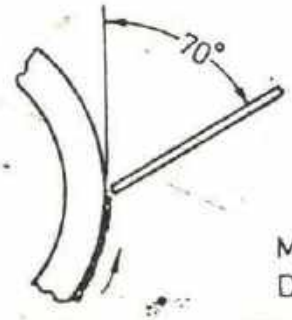


| Ex No | Thickness t mm | SWG | inch | Space mm | Electrode Ø mm | SWG | Name of Electrode | Amps recommended | Amps used |
|---|---|---|---|---|---|---|---|---|---|
| 16 | | | | | | 10 | | | |




## SEQUENCE OF OPERATION

1. Clean, set up and tack weld the pieces.
2. Clamp the job in the position required.
3. Deposite the root run, clean it thoroughly and examine.
4. Weld the 2nd layer and clean it.
5. Weld the 3rd layer and clean the seam thoroughly.



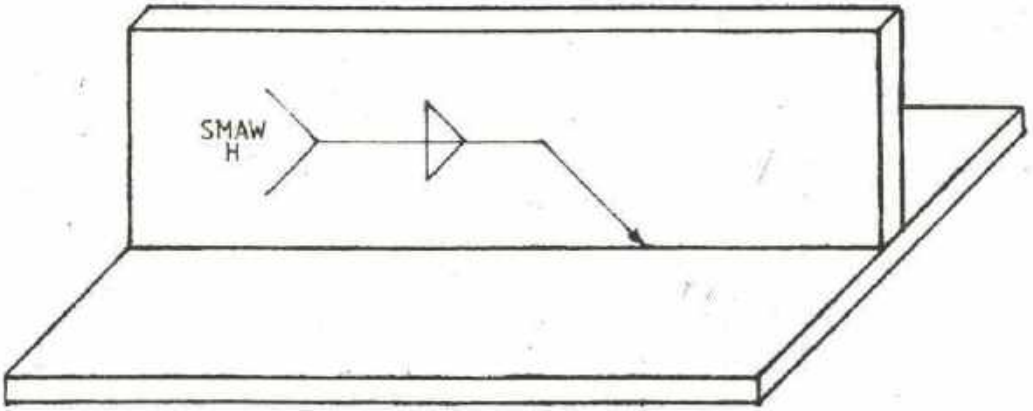

Move around the joint while welding.
Do not turn the pipe.

| SCALE: | SINGLE V BUTT JOINT (HORIZONTAL FIXED) | MP/2.3/3.6.2/15 |
|---|---|---|
| MAT MILDSTEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



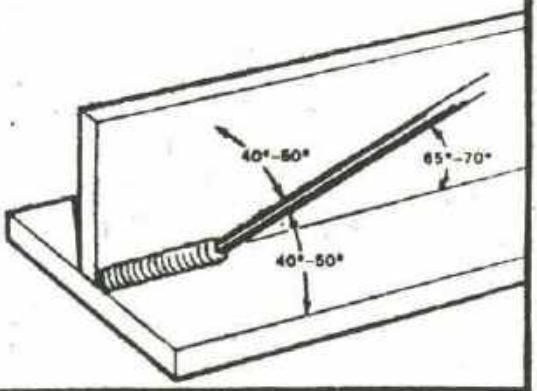

| Ex. No. | Thickness t mm | SWG | inch | Space mm | Electrode ø mm | SWG | Name of Electrode | Amps recommended | Amps used |
|---|---|---|---|---|---|---|---|---|---|
| 17 | 6.35 | | | | 4 | | | | |

SEQUENCE OF OPERATIONS

- Counteract any tendency of deposited metal to fall towards the horizontal plate by increasing slightly the electrode angle to the vertical plate.
- Adjust the rate of travel so that a fillet weld of equal leg length of 5 mm is deposited.

Note Be sure the right kind of electrode for the type of stainless to be welded.

POSITION OF ELECTRODE

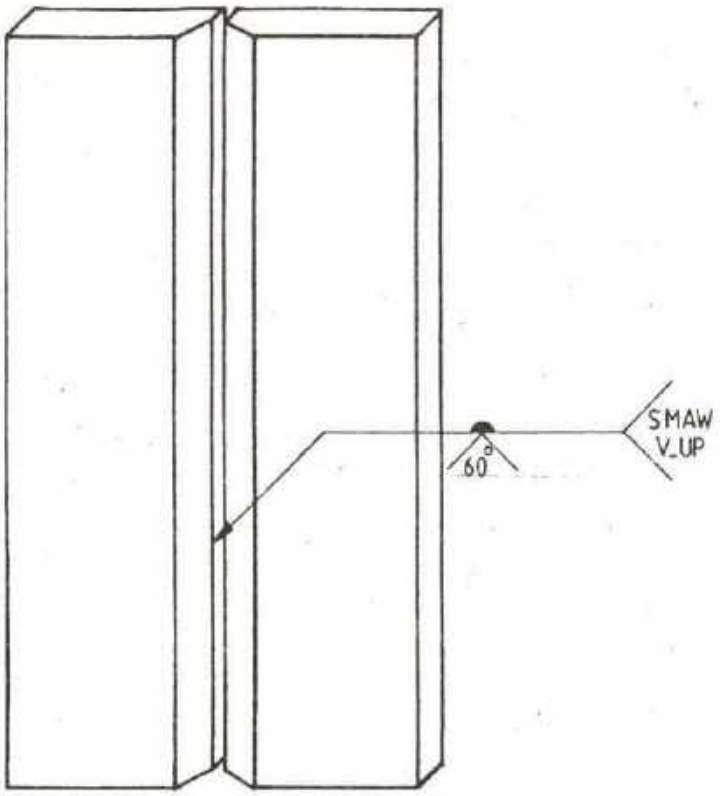



| SCALE | T JOINT (horizontal) | MP/2.3/3.6.2/17 |
|---|---|---|
| MAT. STAINLESS STEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



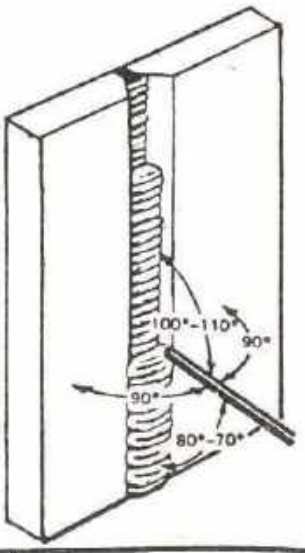

| Ex. No. | Thickness t | | | Space | Electrode ø | | Name of Electrode | Amps recommended | Amps used |
|---|---|---|---|---|---|---|---|---|---|
| | mm | SWG | inch | mm | mm | SWG | | | |
| 18 | 9.52 | | | | | | | | |

SEQUENCE OF OPERATIONS

- Deposit the root run, using a very small crescent weaving motion.
- Deposit the second run, using a more Whip-stitch weave and bringing the weld to within 3 mm of the outer edges of the fusion faces.
- Deposit the third run, using a Hem-stitch weave in which the electrode is moved slightly upwards as the arc plays on the outer edge of each fusion face. Make sure that the deposit fills the V.

1st run weave Crescent Motion.
2nd run weave Whip-stitch,
3rd run weave Hem-stitch.

POSITION OF ELECTRODE



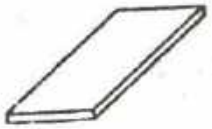

| SCALE | SINGLE V BUTT JOINT ( vertical upward ) | MP/2.3/3.6.2/18 |
|---|---|---|
| MAT. STAINLESS STEEL | | ARC WELDING |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

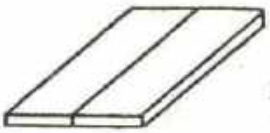
WELDER

GTAW



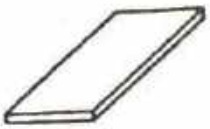
Straight Bead

1



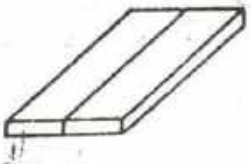
Square Butt Joint

2



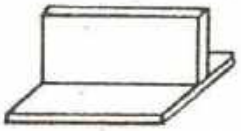
Straight Bead

3



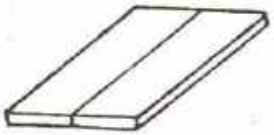
Square Butt Joint

4



T Joint

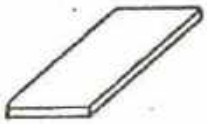
5



Square Butt Joint

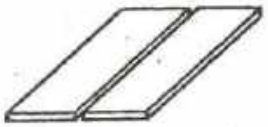
6

GMAW



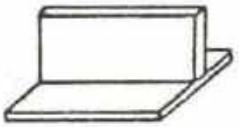
Straight Bead

7



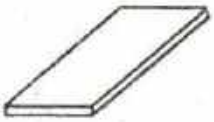
Square Butt Joint

8



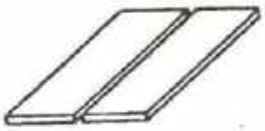
T Joint

9



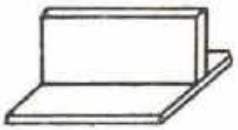
Straight Bead

10



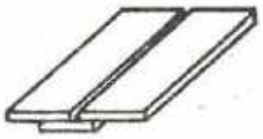
Square Butt Joint

11



T Joint

12



Square Butt Joint

13

103

| | | |
|---|---|---|
| TRADE TRAINING II | LAYOUT | MP/2-3/3-63<br>GTAW/GMAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

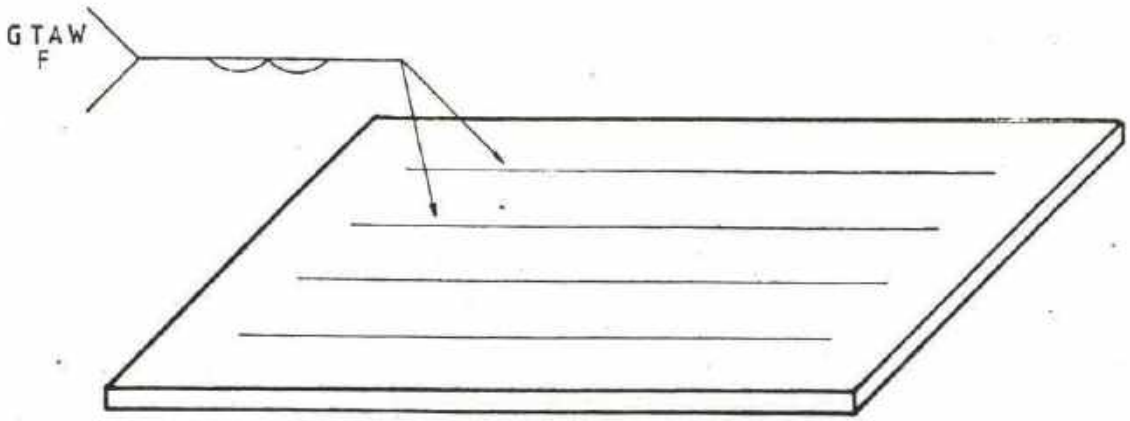
WELDER

TRADE TRAINING II
GTAW/GMAW
NO:2.3/3.6.3/1 to 13

# MATERIAL REQUIRED

( Length given in millimeters

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Length per trainee | Length for 16 trainees |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M.S.Flat 100x1.6 4"x1/16" | 150 | | | | | | | | | | | | | 150 | 2.5m |
| M.S.Flat 50x1.6 2"x1/16" | | 900 | | | | | | | | | | | | 900 | 14.5m |
| S.S.Sheet 100x1.2 4"x1/16" | | | 150 | | | | | | | | | | | 150 | 2.5m |
| S.S.Sheet 50x1.2 2"x1/16" | | | | 900 | | | | | | | | | | 900 | 14.5m |
| Al-Sheet 50x3 | | | | | 900 | 900 | | | | | | 900 | 900 | 3600 | 58m |
| M.S.Flat 100x3 | | | | | | | 150 | | | | | | | 150 | 2.5m |
| M.S.Flat 50x3 | | | | | | | | 900 | 900 | | | | | 1800 | 29 m |
| S.S.Sheet 100x3 | | | | | | | | | | 150 | | | | 150 | 2.5m |
| S.S.Sheet 50x3 | | | | | | | | | | | 900 | | | 900 | 14.5m |
| Al-Sheet x3 | | | | | | | | | | | | | 450 | 450 | 7.25m |




| Ex.No | Thickness mm | Thickness swg | Filler Rod | Tungsten Electrode | Nozzel Size | Shielding Gas | Electrode Stick out | Current |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.6 | | 1.6 | 2.4 Thoriated | 9.5mm | Argon 4L/min. | 5 mm | 40-50 A DC |

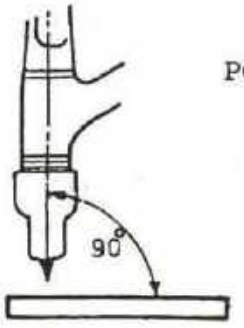
SEQUENCE OF OPERATIONS

- Clean the job with aceton.
- Establish the pool of molten metal, add filler rod.
- Hold a close arc, maintain a puddle of approximately 1/8" wide while forming a consistent bead across the plate.

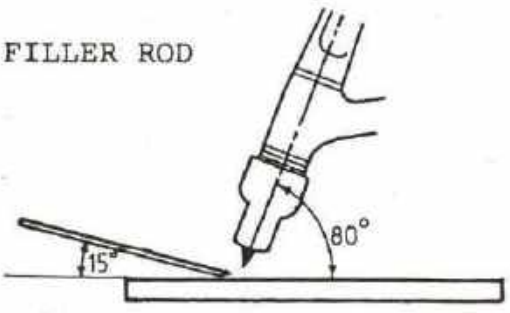
CAUTION

- Use direct current straight polarity.
- Use tungsten electrode pointed tip.
- Do not touch the base metal and filler rod with tungsten electrode.

POSITION OF TORCH AND FILLER ROD




WORK ANGLE




TRAVEL ANGLE

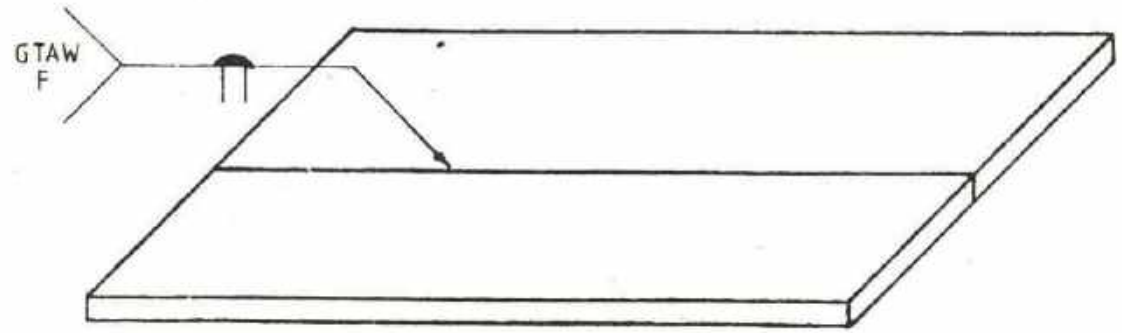
105

| | | |
|---|---|---|
| SCALE | STRAIGHT BEAD ( FLAT ) | MP/2.3/3.6.3/1 |
| MAT. MILD STEEL | | GTAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex.No | Thickness mm | Thickness swg | Filler Rod | Tungsten Electrode | Nozzel Size | Shielding Gas | Electrode Stick out | Current |
|---|---|---|---|---|---|---|---|---|
| 6 | 3 | | 2.5 | 3.2 mm Zirconia-ted. | 12.7 mm | Argon 9-10L P/min. | 5 mm | 75-85A AC |

SEQUENCE OF OPERATIONS

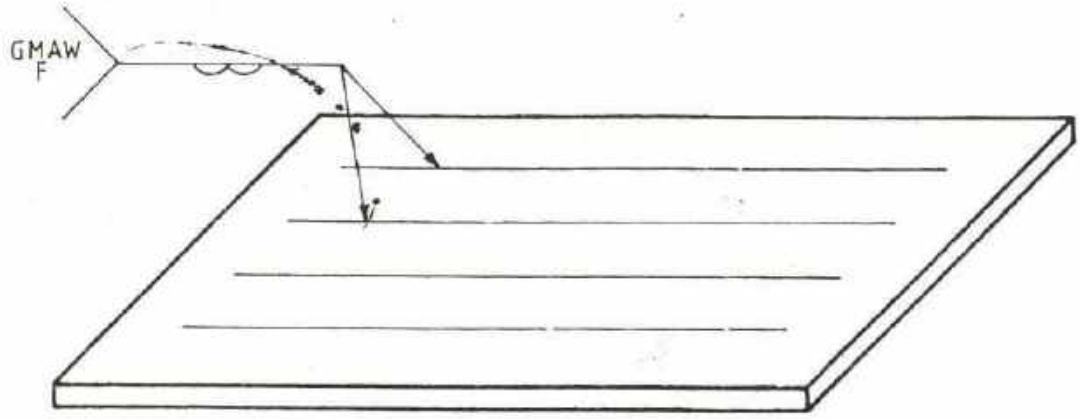
- Set up and tack the pieces at distance 70mm.
- Support in flat position with grooved fire brick.
- Establish the arc at the right hand end of the joint.
- Immediately on fusion of the root, add filler metal to prevent excessive fusion of parent metal.
- Move to the left without weaving of torch.
- Coordinate addition of filler metal and rate of travel so as to maintain fusion to the root and build up the weld to a slightly convex profile.

| | | |
|---|---|---|
| SCALE | SQUARE BUTT JOINT (FLAT) | MP/2.3/3.6.3/6 |
| MAT. ALUMINIUM | | GTAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

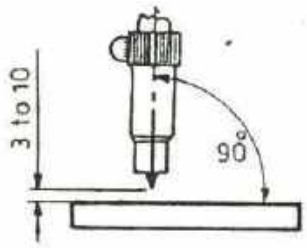
WELDER




| Ex.No | Thickness mm | swg | Space | Electrode Wire | Nozzel Type | Shielding Gas | Arc volts | Current |
|---|---|---|---|---|---|---|---|---|
| 7 | 3 | | | 0.8 mm | short reach | $CO_2$ 14L/min. | 19-20 | 110-130 A |

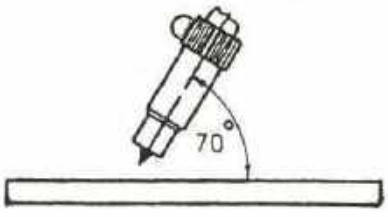
SEQUENCE OF OPERATIONS

- Check the return lead is firmly connected to work piece and power source.
- Check all connections to wire feed and control unit are in good order.
- Check the gas hoses.
- Draw the straight line in the job.
- Set the gas flow and wire feed.
- Establish the arc at the right end.
- Adjust the travel speed to ensure the bead width and height is uniform.




WORK ANGLE

POSITION OF GUN



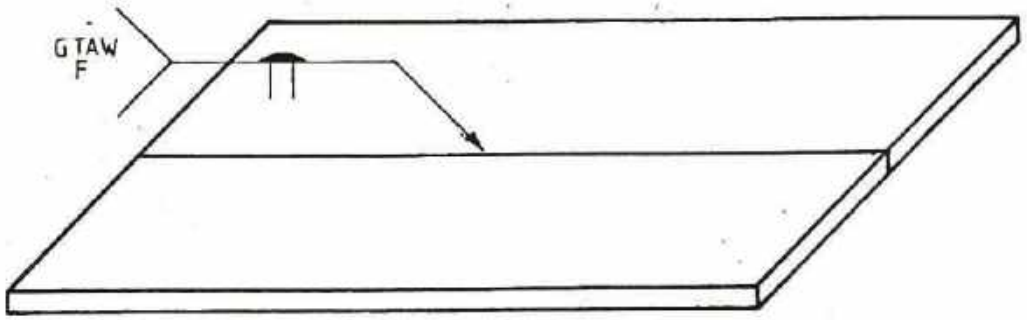

TRAVEL ANGLE

| SCALE | STRAIGHT BEAD ( FLAT ) | MP/2.3/3.6.3/7 |
|---|---|---|
| MAT. MILD STEEL | | GMAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex.No | Thickness mm | Thickness swg | Filler Rod | Tungsten Electrode | Nozzel Size | Shielding Gas | Electrode Stick out | Current |
|---|---|---|---|---|---|---|---|---|
| 4 | 1.2 | | 1.6 mm | 1.6 Thoriated | 9.5 mm | Argon 4L/min. | 5 mm | 35-45 A DC |

SEQUENCE OF OPERATIONS

- Set up and tack the pieces at distance 70 mm without gap.
- Establish the arc on the first tack and move quickly to the right hand end of joint to start welding.
- As soon as a small pool of molten metal is formed, add filler metal.
- Maintain the small depression in the base by moving the torch forward and feeding the filler rod into the main pool. Continue this action along the way to allow the weld to be reinforced sufficiently.

CAUTION

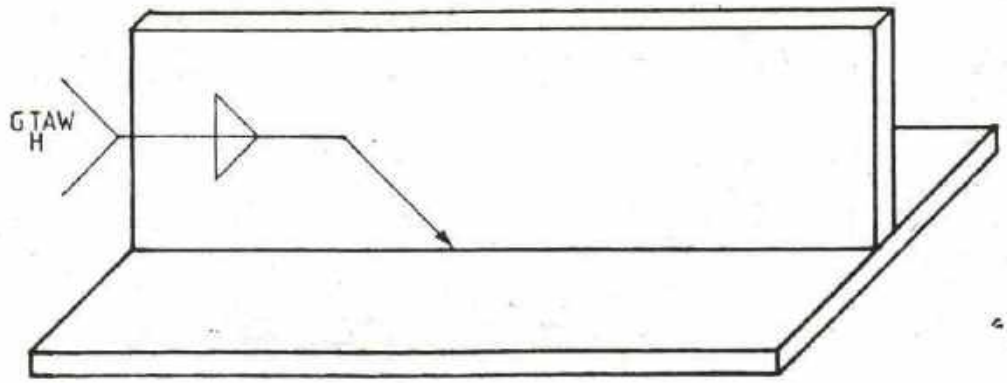
- Use argon backing bar.

| | | |
|---|---|---|
| SCALE | SQUARE BUTT JOINT (FLAT) | MP/2.3/3.6.3/4 |
| MAT S STEEL | | GTAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex.No | Thickness mm. | swg | Filler Rod | Tungsten Electrode | Nozzel Size | Shielding Gas | Electrode Stick out | Current |
|---|---|---|---|---|---|---|---|---|
| 5 | 3 | | 3.2 | 3.2 Zirconi-ated. | 12.7mm | Argon 6L/min. | 5 mm | 75-85 A AC |

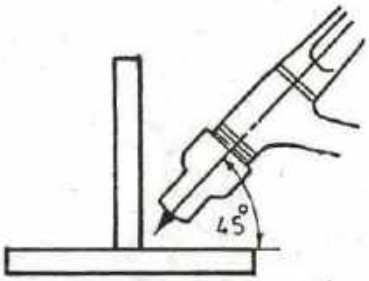
SEQUENCE OF OPERATIONS

- Set up and tack the pieces at both ends.
- Establish the pool on the rignt end.
- Add filler metal as soon as a pool of molten metal is formed.
- Adjust rate of travel.

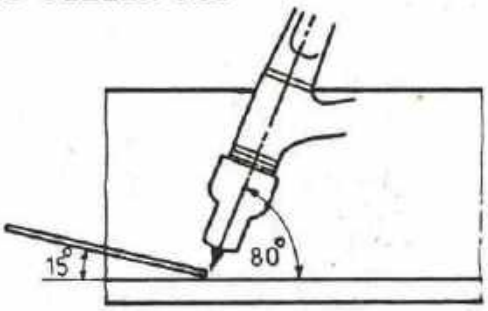
CAUTION

- Use rounded tip tungsten electrode.

POSITION OF TORCH AND FILLER ROD




WORK ANGLE



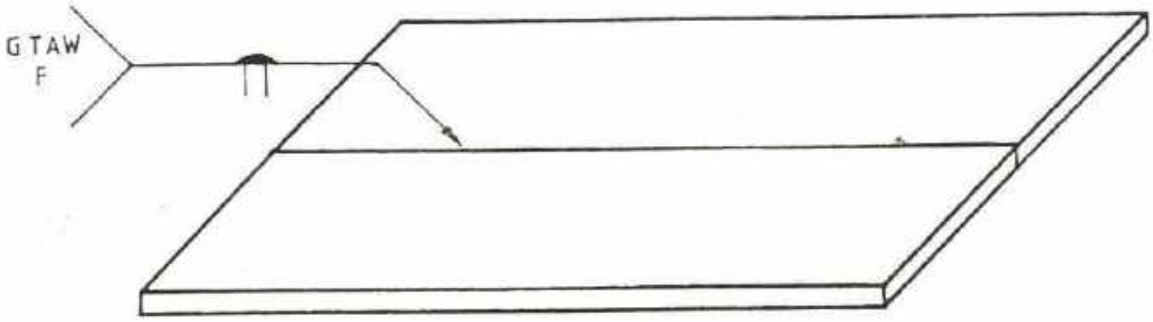

TRAVEL ANGLE

| SCALE | T JOINT ( HORIZANTAL ) | MP/2.3/3.6.3/5 |
|---|---|---|
| MAT. ALUMINIUM | | GTAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex.No | Thickness mm | Thickness swg | Filler Rod | Tungsten Electrode | Nozzel Size | Shielding Gas | Electrode Stick out | Current |
|---|---|---|---|---|---|---|---|---|
| 2 | 1.6 | | 1.6 mm | 2.4 Thoriated | 9.5 mm | Argon 4L/min. | 5 mm | 40-50 A DC |

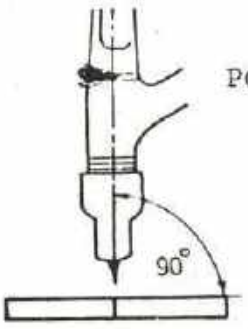
SEQUENCE OF OPERATIONS

- Set up and tack the pieces.
- Deposit a bead using the joint in the center of the weld across the piece.
- Obtain complete penetration.

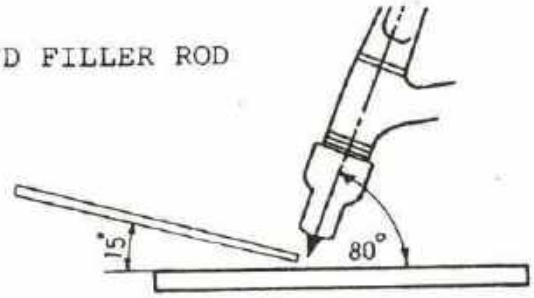
CAUTION

- Use direct current straight polarity.

POSITION OF TORCH AND FILLER ROD




WORK ANGLE



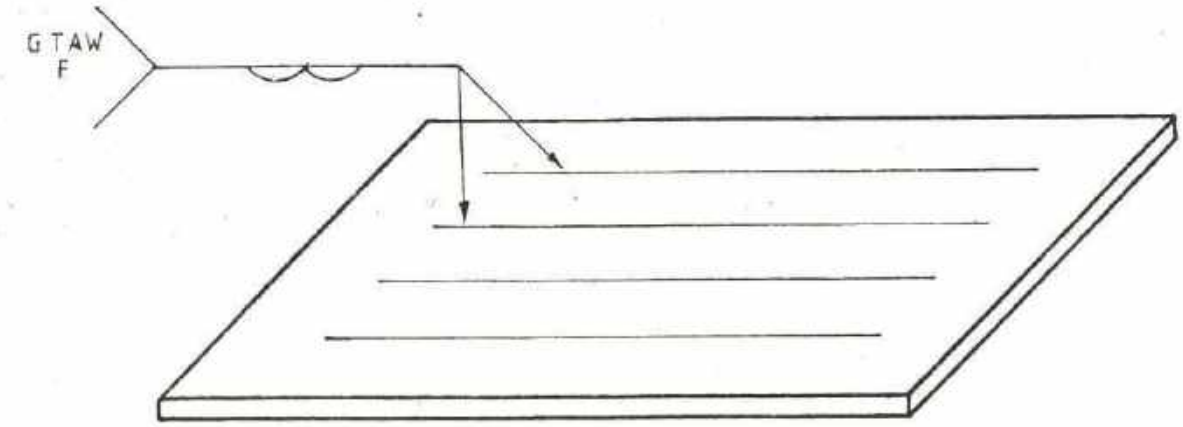

TRAVEL ANGLE

| SCALE | SQUARE BUTT JOINT (FLAT) | MP/2.3/3.6.3/2 |
|---|---|---|
| MAT MILD STEEL | | GTAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex.No | Thickness mm | Thickness swg | Filler Rod | Tungsten Electrode | Nozzel Size | Shielding Gas | Electrode Stick out | Current |
|---|---|---|---|---|---|---|---|---|
| 3 | 1.2 | | 1.6 mm | 1.6 mm Thoriated | 9.5 mm | Argon 4L/min. | 5 mm | 35-45 A DC |

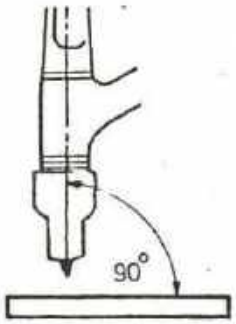
SEQUENCE OF OPERATIONS

- Clean the job.
- Establish small pool of the molten metal, add filler rod.
- Adjust rate of travel to avoid excessive melting.

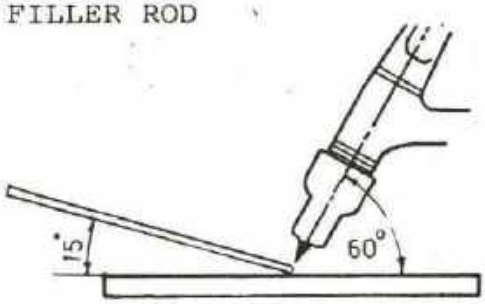
CAUTION

- Use DC current.

POSITION OF TORCH AND FILLER ROD




WORK ANGLE



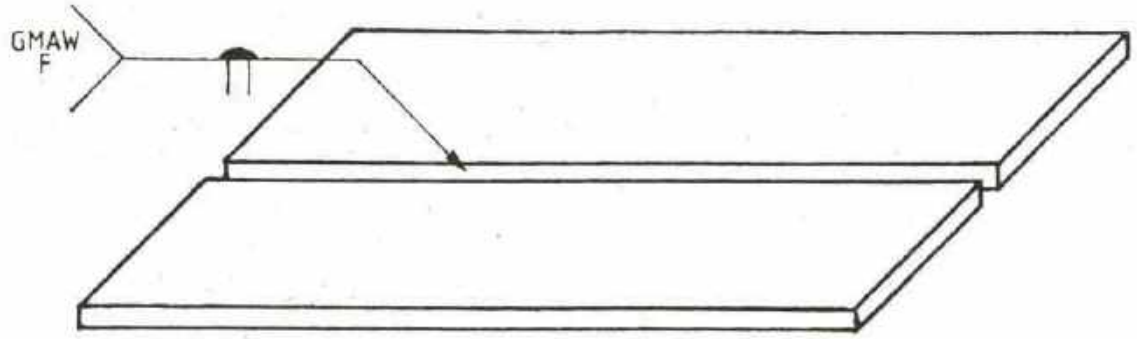

TRAVEL ANGLE

| SCALE | STRAIGHT BEAD (FLAT) | MP/2.3/3.6.3/3 |
|---|---|---|
| MAT. S.STEEL | | GTAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

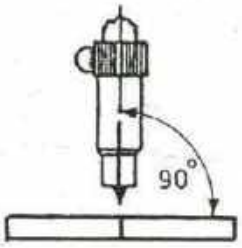



| Ex.No | Thickness mm | Thickness swg | Space | Electrode Wire | Nozzel Type | Shielding Gas | Arc volts | Current |
|---|---|---|---|---|---|---|---|---|
| 8 | 3 | | 1.5 to 2.5 | 0.8 mm | short reach | $CO_2$ 14L/min. | 18-19 | 85-95 A |

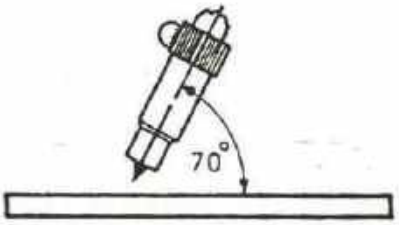
SEQUENCE OF OPERATIONS

- Clean and tack the pieces.
- Establish the arc at the right hand end of the joint.
- Adjust the travel speed to ensure fusion of the spaced edges of the parent metal.
- Use small weaving motion side to side.
- Obtain complete penetration.

POSITION OF GUN




WORK ANGLE



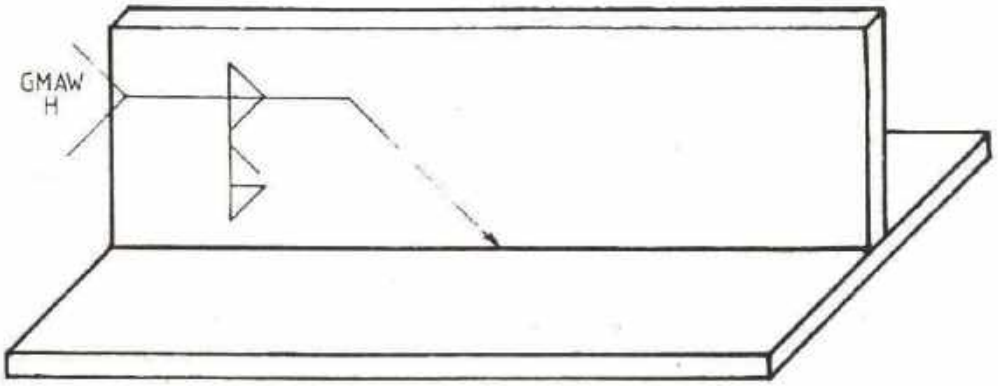

TRAVEL ANGLE

| SCALE | SQUARE BUTT JOINT (FLAT) | MP/2.3/3.6.3/8 |
|---|---|---|
| MAT. MILD STEEL | | GMAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

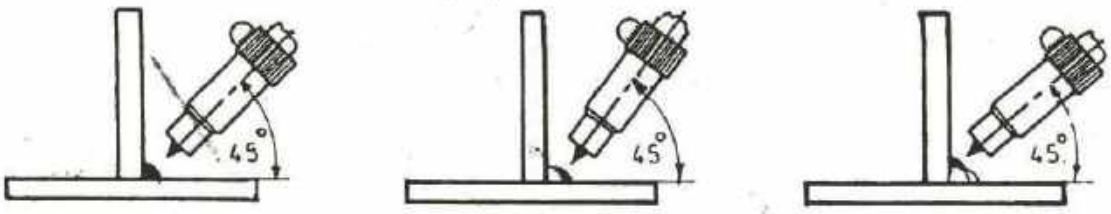



| Ex.No | Thickness mm | Thickness swg | Space | Electrode Wire | Nozzel Type | Shielding Gas | Arc volts | Current |
|---|---|---|---|---|---|---|---|---|
| 9 | 3 | | - | 0.8 mm | short reach | $CO_2$ 14L/min. | 19-20 | 110-130 A |

SEQUENCE OF OPERATIONS

- Set up and tack the pieces.
- Point the electrode wire at the root of the joint.
- Establish the arc at the right-hand end of the joint.
- Deposit the second pass overlapping half width of the first pass on both sides of the joint.
- Deposit the third pass overlapping the first and second passes on both sides of the joint.

POSITION OF GUN

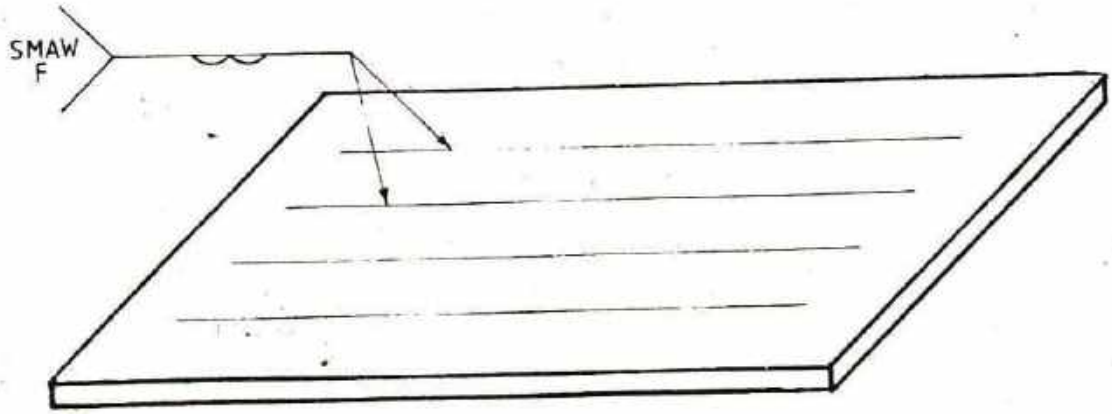



| | | |
|---|---|---|
| SCALE | T JOINT ( HORIZANTAL ) | MP/2.3/3.6.3/9 |
| MAT. MILD STEEL | | GMAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER




| Ex.No | Thickness mm | Thickness swg | Space | Electrode Wire | Nozzel Type | Shielding Gas | Arc volts | Current |
|---|---|---|---|---|---|---|---|---|
| 10 | 3 | | - | 0.8 mm | short reach | Ar + $O_2$ 99% + 1% 14L/min. | 19-20 | 110-130 A |

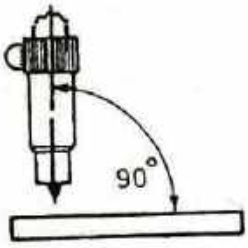
SEQUENCE OF OPERATIONS

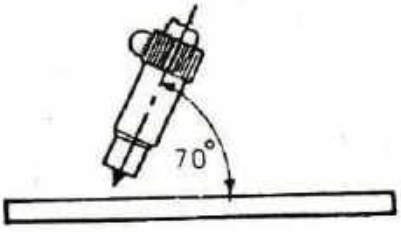
- After cleaning, mark the straight lines on the job.
- Set wire feed and gas flow.
- Adjust the rate of travel.

CAUTION

- Use direct current reserve polarity.

POSITION OF GUN



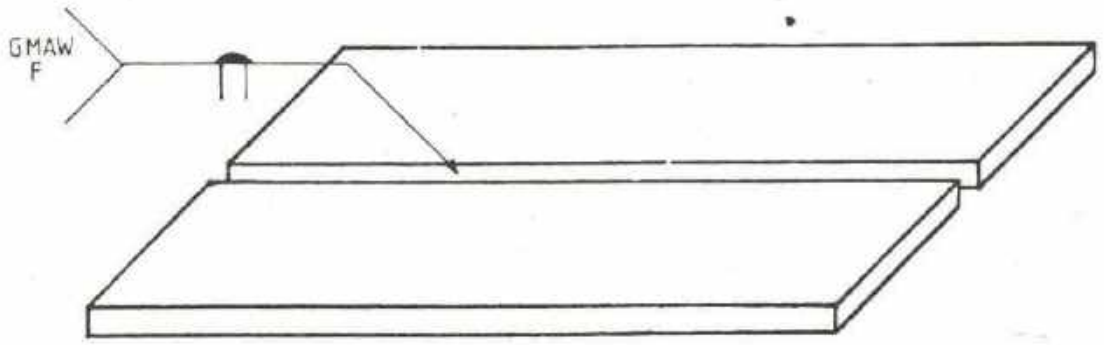




| | | |
|---|---|---|
| SCALE | STRAIGHT BEAD (FLAT) | MP/2.3/3.6-3/10 |
| MAT. STAINLESS S. | | GMAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER



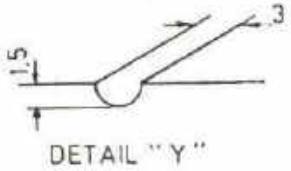

| Ex.No | Thickness mm | Thickness swg | Space | Electrode Wire | Nozzel Type | Shielding Gas | Arc volts | Current |
|---|---|---|---|---|---|---|---|---|
| 11 | 3 | | 1.5 to 2.5 | 0.8 mm | short reach | Ar + $O_2$ 99% + 1% 14L/min. | 19-20 | 110-130 A |

SEQUENCE OF OPERATIONS

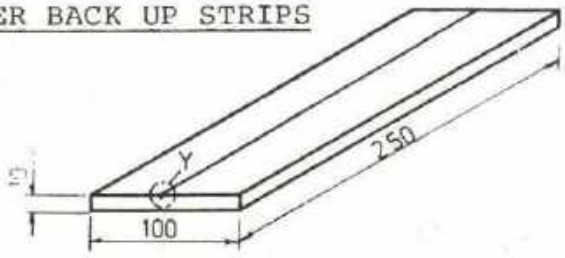
- Set up and tack the pieces with gap.
- Set the job on copper back up strips.
- Establish the arc at the right hand of the joint.
- Adjust the travel speed to secure fusion of the spaced edges of the parent metal.
- Obtain complete penetration.

CAUTION

- Use copper back up strips.




COPPER BACK UP STRIPS

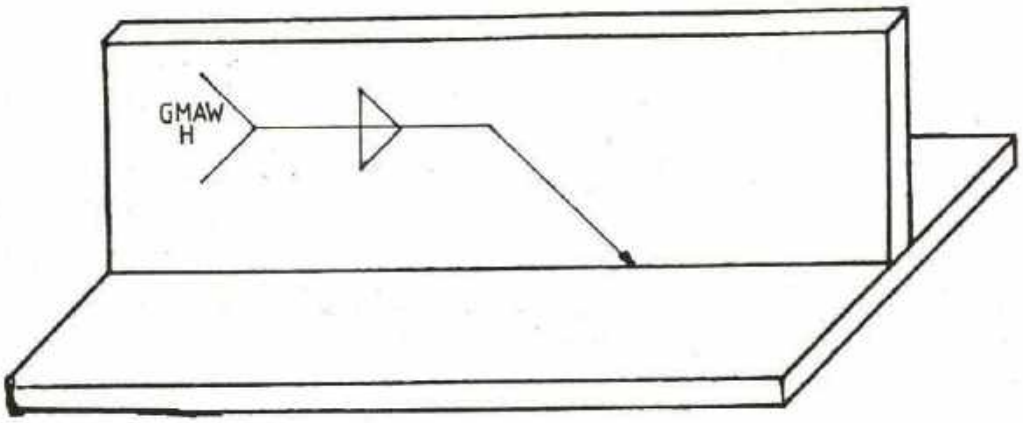



| SCALE | SQUARE BUTT JOINT (FLAT) | MP/2.3/3.6.3/11 |
|---|---|---|
| MAT STAINLESS S. | | GMAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

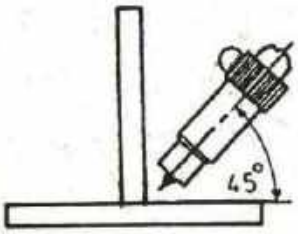



| Ex.No | Thickness mm | Thickness swg | Space | Electrode Wire | Nozzel Type | Shielding Gas | Arc volts | Current |
|---|---|---|---|---|---|---|---|---|
| 12 | 3 | | - | 1.2 mm | long reach | Argon 17L/min. | 24 | 180 A |

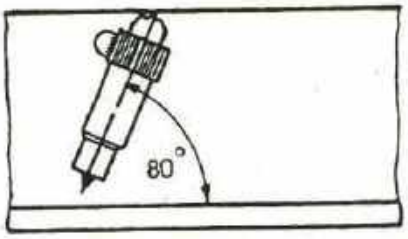
SEQUENCE OF OPERATIONS

- Set up and tack the pieces.
- Establish the arc at the right hand end of the joint.
- Deposit the bead with equal leg length.

POSITION OF GUN




WORK ANGLE



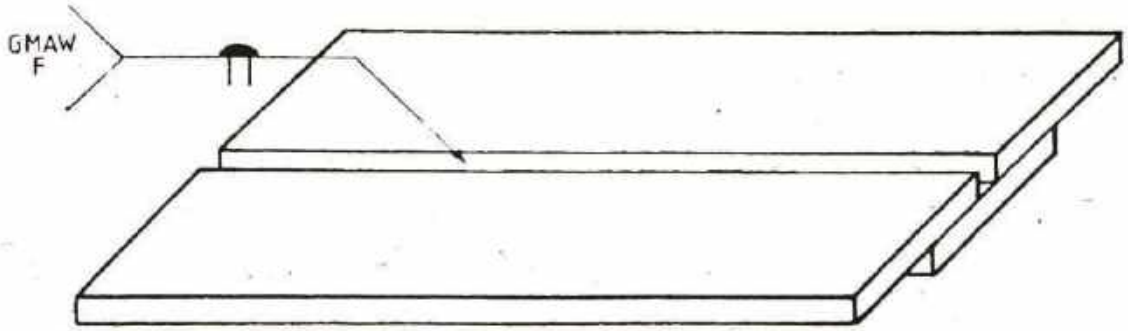

TRAVEL ANGLE

| SCALE | T JOINT (HORIZANTAL) | MP/2.3/3.6.3/12 |
|---|---|---|
| MAT. ALUMINIUM | | GMAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER

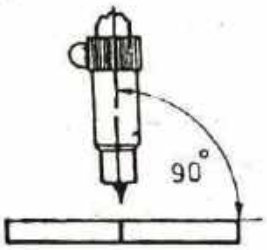



| Ex.No | Thickness mm | swg | Space | Electrode Wire | Nozzel Type | Shielding Gas | Arc volts | Current |
|---|---|---|---|---|---|---|---|---|
| 13 | 3 | | - | 1.2 mm | long reach | Argon 17L/min | 24 | 160 A |

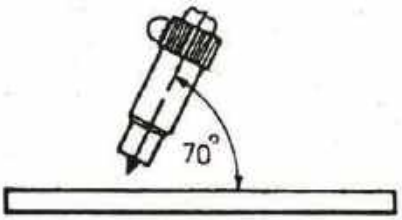
SEQUENCE OF OPERATIONS

- Set up and tack the pieces with gap.
- Establish the arc on the tack weld at the right hand of the joint.
- As soon as pool of molten metal is formed to full depth of joint prepared, move the gun progressively leftwards.
- Adjust the rate of travel so that the deposit fills the joint.
- Complete the weld by fusing into the tack weld at the left hand end of the joint.

POSITION OF GUN




WORK ANGLE




TRAVEL ANGLE

| SCALE | SQUARE BUTT JOINT (FLAT) (with backing strip) | MP/2.3/3.6.3/13 |
|---|---|---|
| MAT ALUMINIUM | | GMAW |

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

WELDER