SAGAR INSTITUTE OF TECHNOLOGY

SVVR EDUCATIONAL SOCIETY GROUP OF INSTITUTIONS

Flame of forest, Chevella-Urella (PO), Chevella, Hyderabad-501503.

WORKSHOK MANUAL

FOR B-Tech 1st YEAR STUDENTS.

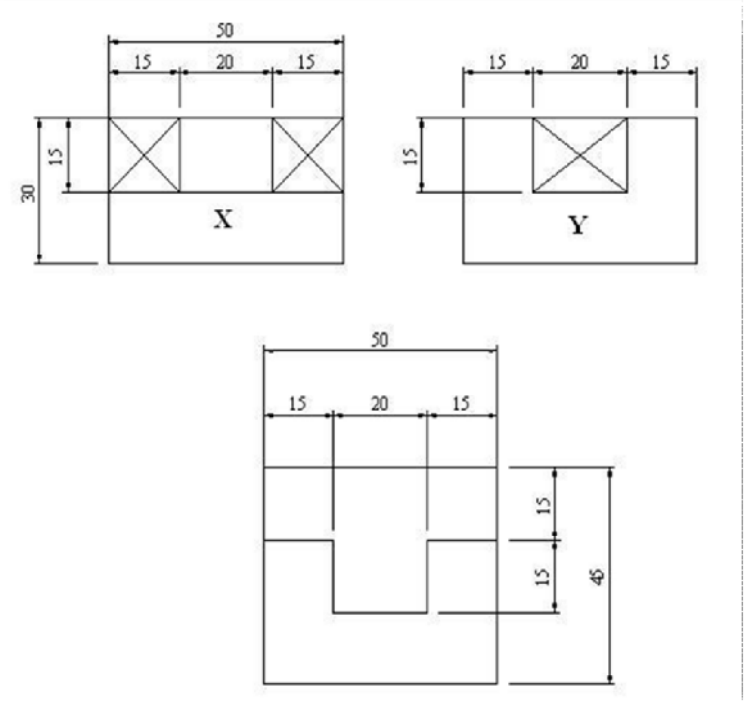
INDEX

1. FITTING

1.1 SQUARE FITTING

AIM: - To make a Square fitting from the given two M.S pieces.

TOOLS REQUIRED: - Bench vice, steel rule, tr y-square, ball-peen hammer, dot punch, scriber, files, surface plate, hacksaw wit h blade and flat chisel.



SQUARE FITTING

NOTE:-

1. All dimensions are in mm .
2. Remove the crossed symbol portion.

SEQUENCE OF OPERATIONS:-

1. The dimensions of the given pieces are checked with the steel rule.
2. The pieces are clamped one after the other in a bench vice and the outer mating edges are filed using files.
3. The pieces are checked for their flatness with the help of the try -square.
4. The side edges of the two pieces are filed such that, they are at right angle to each other, and the required dimensions are obtained.
5. Chalk is then applied on the surface of the two pieces.
6. The given dimensions of the square fitting are marked, by using steel rule, scriber and surface plate.
7. Using dot punch, dots are punched along the above scribed lines.
8. Using the hacksaw, the unwanted portions are removed.
9. Using the flat chisel, the unwanted material is removed.
10. The corners of the stepped surfaces are filed by using a square or triangular file to get the sharp corners.
11. The pieces(X and Y) are fitted together and the matting is checked for the correctness of the fit. Any defects noticed are rectified by filing with a smooth file.

PRECAUTIONS:-

1. Care should be taken while marking.
2. Care should be taken while hack sawing.
3. Use cleaning brush while removing chips.

RESULT:-The required square fitting is thus obtained.

1.2 V- FITTING

AIM: - To make a V-fitting from the given two M.S pieces.

TOOLS REQUIRED: - Bench vice, steel rule, try -square, ball-peen hammer, dot punch, scriber, files, surface plate, hacksaw with blade and flat chisel.

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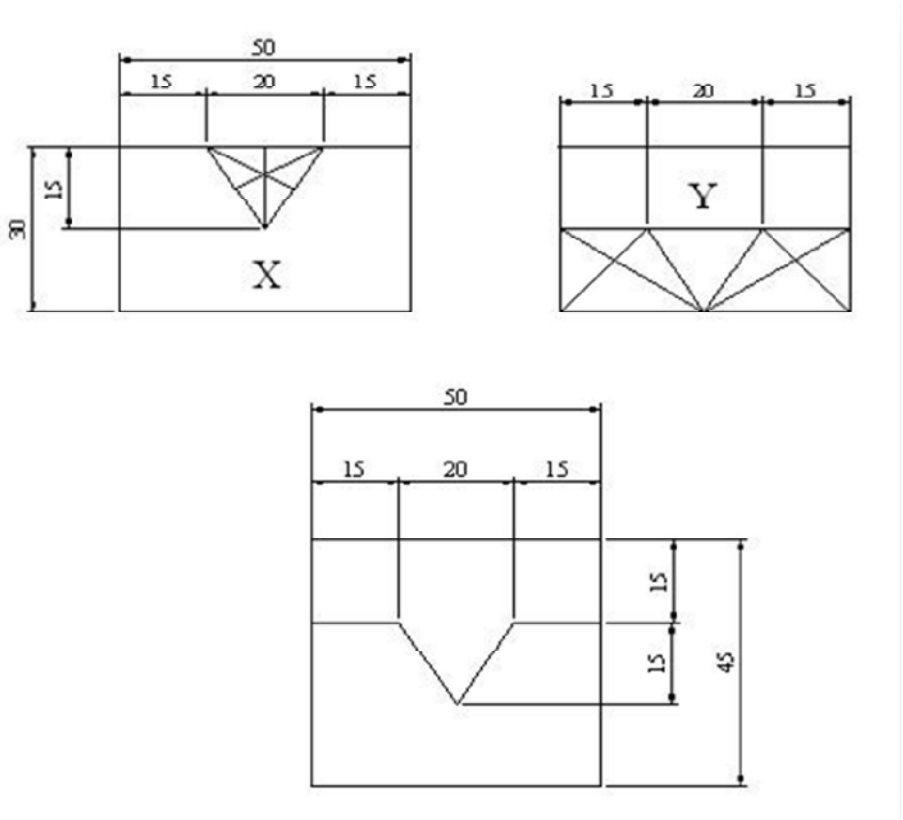


V-FITTING

NOTE:-

1. All dimensions are in mm .
2. Remove the crossed symbol portion.

SEQUENCE OF OPERATIONS:-

1. The dimensions of the given pi eces are checked with the steel rule.
2. The pieces are clamped one after the other in a bench vice and the outer mating edges are filed using files.
3. The pieces are checked for their flatness with the help of the try -square.
4. The side edges of t he two pieces are filed such that, they are at right angle to each other, and the required dimensions are obtained.
5. Chalk is then applied on the surface of the two pieces.
6. The given dimensions of the square fitting are marked, by using steel rul e, scriber and surface plate.
7. Using dot punch, dots are punched along the above scribed lines.
8. Using the hacksaw, the unwanted portions are removed.
9. Using the flat chisel, the unwanted material is removed.
10. The corners of the stepped surf aces are filed by using a square or triangular file to get the sharp corners.
11. The pieces(X and Y) are fitted together and the matting is checked for the correctness of the fit. Any defects noticed are rectified by filing with a smooth fil e.

PRECAUTIONS:-

1. Care should be taken while marking.
2. Care should be taken while hack sawing.
3. Use cleaning brush while removing chips.

RESULT:-The required V - fitting is thus obtained.

2. CARPENTRY

2.1 T-LAP JOINT

AIM:-To make a T-lap joint from the given two reapers.

TOOLS REQUIRED:-Carpenter's vice, steel rule, jack plane, try -square, marking gauge, cross-cut saw, tenson saw, scriber and mallet.

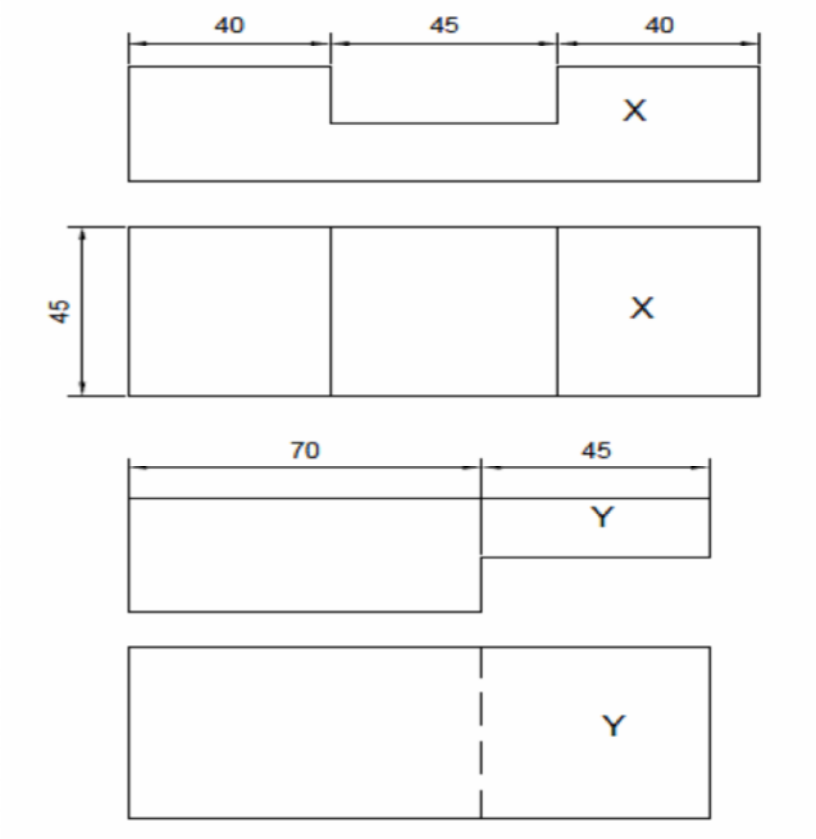
SEQUENCE OF OPERATIONS:-

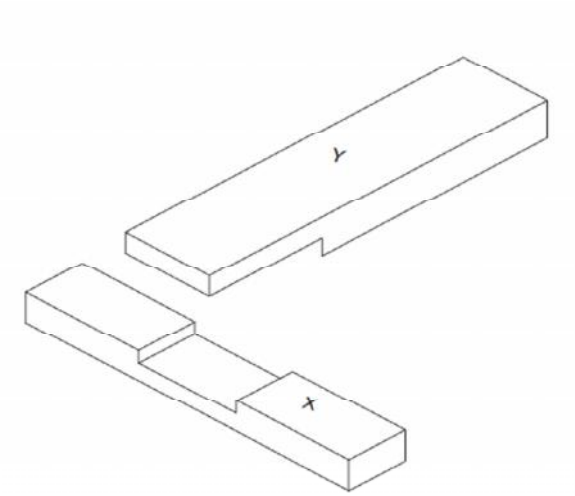
1. The given reaper is checked to ensure its correct size.
2. The reaper is firmly clamped in the carpenter's vice and any two adjacent faces are planed by the jack plane and the two faces are checked for squareness with the try - square.
3. Marking gauge is set and lines are drawn at 30 and 40 mm, to mark the thickne ss and width of the model respectively.
4. The excess material is first chiseled out with firmer chisel and then planed to correct size.
5. The mating dimensions of the parts X and Y are then marked using scale and marking gauge.
6. Using the cross-cut saw, the portions to be removed are cut in both the pieces, followed by chiseling and also the parts X and Y.
7. The ends of both the parts are chiseled to the exact lengths.
8. A fine finishing is given to the parts, if required so that, proper fit ting is obtained.
9. The parts are fitted t o obtain a slightly tight joint.

PRECAUTIONS:-

1. Care should be taken while marking.
2. Care should be taken while cutting the wooden piece with chisel.

RESULT:-The T-lap joint is thus made by following the abo ve sequence of operations.





T-LAP JOINT

NOTE:-

1. All dimensions are in mm .

2.2 DOVETAIL LAP JOINT

AIM: - To make a dovetail lap joint from the given two reapers.

TOOLS REQUIRED: - Carpenter's vice, steel rule, jack plane, try -square, marking gauge, Cross-cut saw, tension saw and mallet.

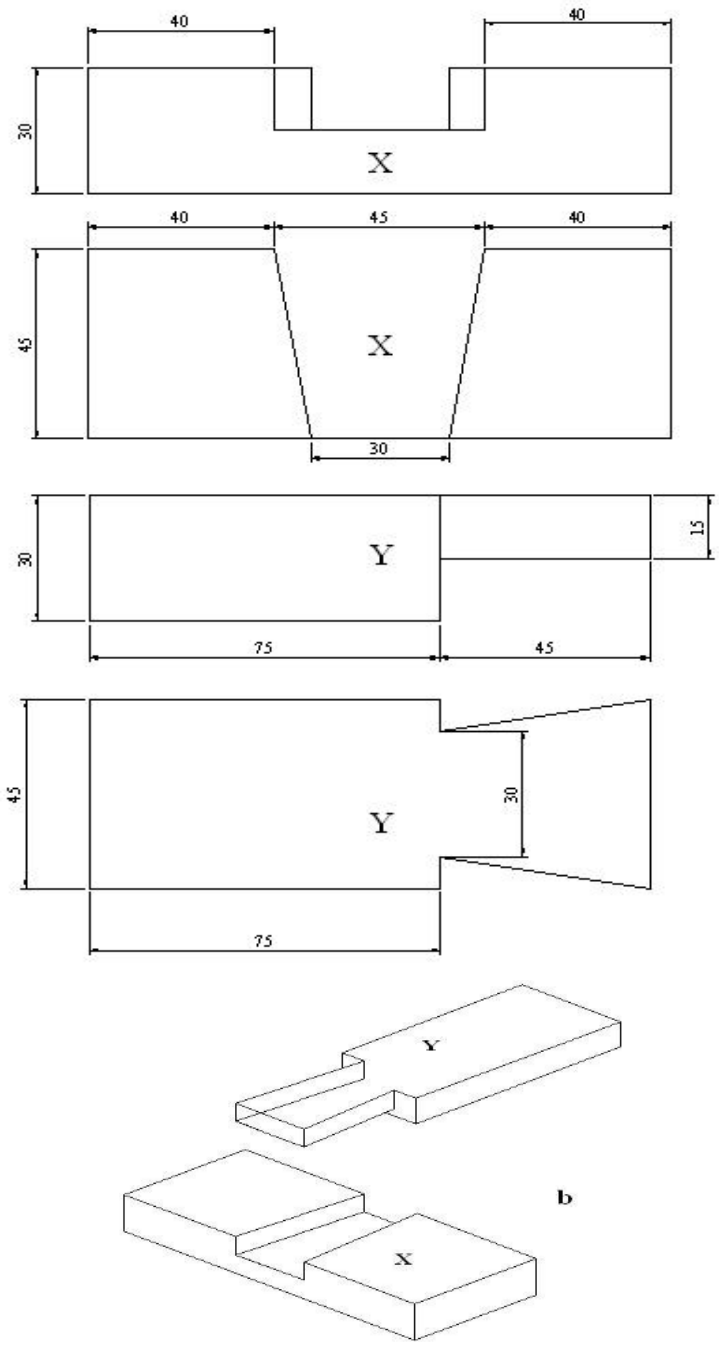
SEQUENCE OF OPERATIONS: -

1. The given reaper is checked to ensure its correct size.
2. The reaper is firmly clamped in the carpenter's vice and any two adjacent faces are planed by the jack plane and the two fac es are checked for squareness with the try - square.
3. Marking gauge is set and lines are drawn at 30 and 40 mm, to mark the thickness and width of the model respectively.
4. The excess material is first chiseled out with firmer chisel and then plane d to correct size.
5. The mating dimensions of the parts X and Y are then marked using scale and marking gauge.
6. Using the cross -cut saw, the portions to be removed are cut, followed by chiseling the parts X and Y.
7. The ends of both the parts are chiseled to the exact lengths.
8. A fine finishing is given to the parts, if required so that, proper fitting is obtained.
9. The parts are fitted to obtain a slightly tight joint.

PRECAUTIONS: -

1. Care should be taken while marking.
2. Care should be tak en while cutting the wooden piece with chisel.

RESULT: - The dovetail lap joint is thus made by following the above sequence of operations.



DOVETAIL LAP JOINT

NOTE:-

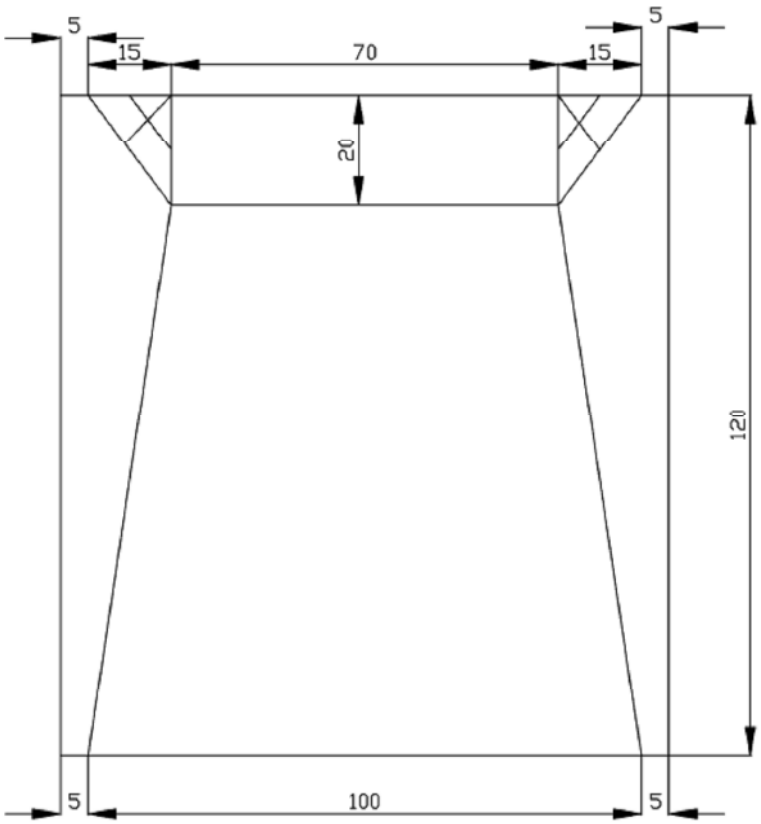
1. All dimensions are in mm .

3. TIN SMITHY

3.1 OPEN SCOOP

AIM: -To make a open scoop, using the given sheet metal.

TOOLS REQUIRED: - steel rule, try-square, divider, scriber, straight snip, mallet, cross peen hammer and hatchet stake.



OPEN SCOOP

NOTE:-

1. All dimensions are in mm .
2. Remove the crossed symbol portion.

SEQUENCE OF OPERATIOS: -

1. The size of the given sheet is checked with the steel rule.
2. The layout of the scoop are marked on the given sheet.
3. The layout of the scoop is cut by using the straight snip.
4. The corners of the scoop are hemmed.
5. The edges of the scoop can b e riveted or soldered to ensure stability of the joints.

PRECAUTIONS: -

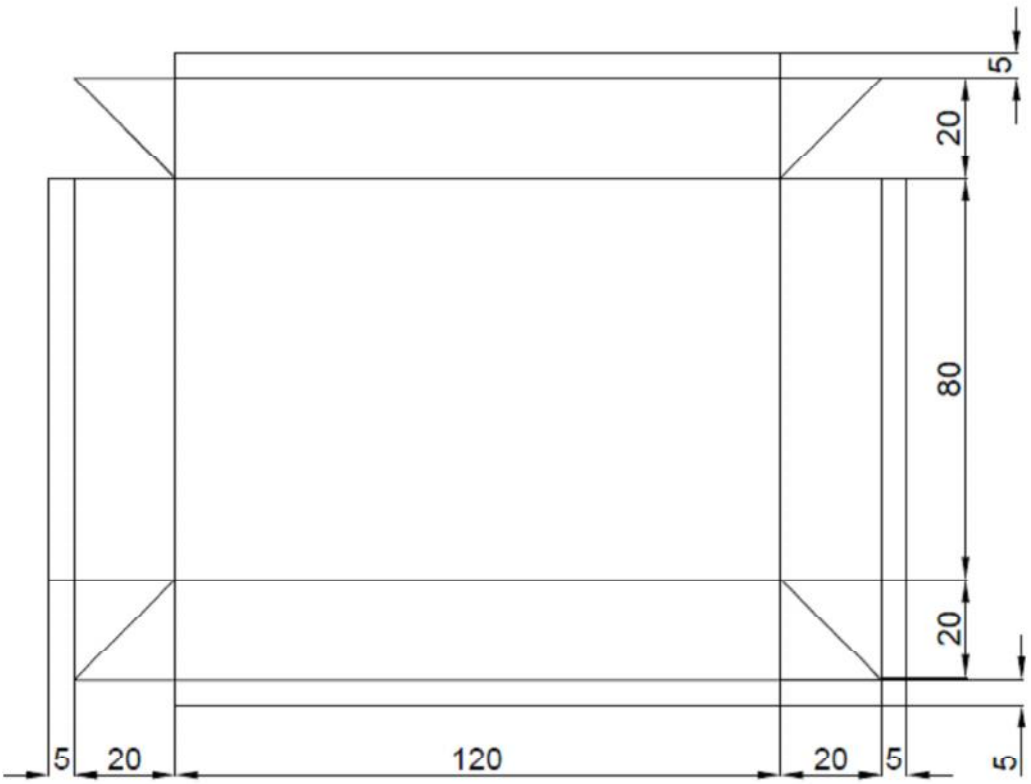
1. Mark the dimensions correctly.
2. Cut the sheet carefully.
3. Remove the chips with brush.

RESULT:-The open scoop is thus made from the given sheet metal.

3.2 RECTANGLE TRAY

AIM:-To make a rectangular tray, using the given sheet metal.

TOOLS:-Steel rule, try-square, divider, scriber, straight snip, mallet, ball - peen hammer and hatchet stake.



RECTANGULAR TRAY

NOTE:-

1. All dimensions are in mm .

SEQUENCE OF OPERATIOS:-

1. The size of the given sheet is checked with the steel rule.
2. The layout of the tray is marked on the given sheet.

3. The layout of the tray is cut by using the straight snip.
4. Single hemming is made on the four sides of the tray.
5. The edges of the scoop can be riveted or soldered to ensure stability of the joints.

PRECAUTIONS: -

1. Mark the dimensions correctly.
2. Cut the sheet carefully.
3. Remove the chips with brush.

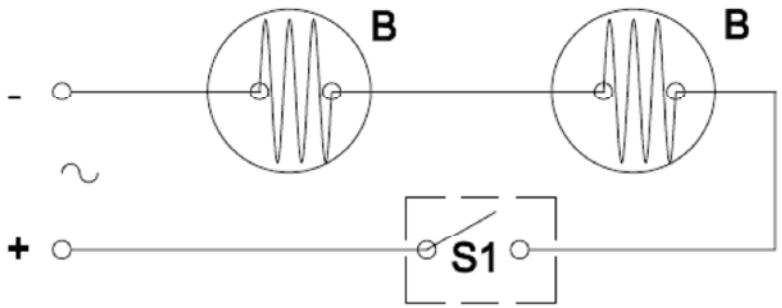
RESULT:-The rectangular is thus made, from the given sheet metal.

4. HOUSE WIRING

4.1 TWO LIGHTS CONTROLLED BY ONE SWITCH IN SERIES

AIM:-To give connection to two lights, controlled by one switch in series.

TOOLS REQUIRED:-Wooden wiring board, one way switch, wooden round block, batten lamp holders, connector sc rew driver, wires, wire clips, nails, wood screws, poker and bulbs.



TWO LIGHTS CONTROLLED BY ONE SWITCH IN SERIES

SEQUENCE OF OPERATIONS:-

1. The outline of the wiring diagram is marked on the wooden wiring board.
2. Clips are nailed to the board, fol lowing the wiring diagram.
3. Wires are stretched and clamped with the clips.
4. Round blocks (3No's) are screwed onto the board, as per the diagram.
5. Wires are connected to the holders and switch, which are then screwed onto the round blocks.
6. Bulbs are fitted to the holders .
7. The wiring connections are then tested, by giving power supply.

PRECAUTIONS:-

1. Connect the wires correctly as per the given circuit.
2. Do not run too many electrical items from point.

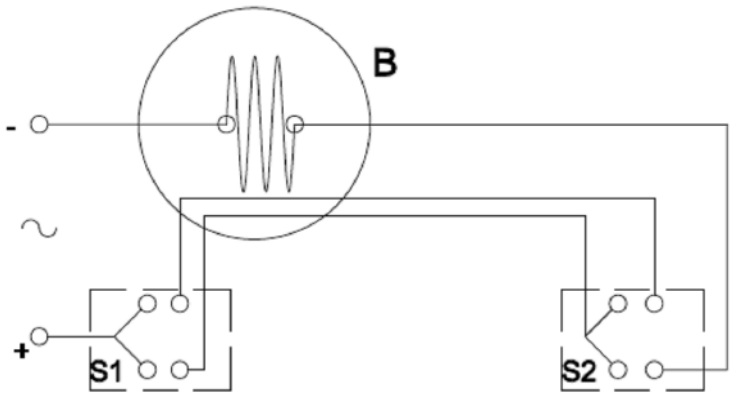
3. Never work on electric wires when th e power is on.
4. Check the earth connections before switching on portable equipment.
5. Never work with bare feet. It is better to wear rubber shoes while working.
6. Whenever there is power failure, put –off the power supply to all equipment, in order to prevent spontaneous recovery.

RESULT:-The electrical circuit, for two lights controlled by one switch in series is thus made.

4.2 ONE LIGHT CONTROLLED BY 2 TWO -WAY SWITCHES

AIM:-To give connection to one light, controlled by two -way switches.

TOOLS REQUIRED:-Wooden wiring board,2 two -way switches, wooden round blocks, batten lamp holders, connector screw driver, wires, wire clips, nails, wood screws, poker and bulb.



ONE LIGHT CONTROLLED BY 2 TWO -WAY SWITCHES

SEQUENCE OF OPERATIONS:-

1. The outline of the wiring diagram is marked on the wooden wiring board.
2. Clips are nailed to the board, following the wiring diagram.
3. Wires are stretched and clamped with the clips.
4. Round blocks (3No's) are screwed onto the board, as p er the diagram.
5. Wires are connected to the holders and switch es, which are then screwed onto the round blocks.
6. Bulb is fitted to the holder .
7. The wiring connections are then tested, by giving power supply.

PRECAUTIONS:-

1. Connect the wires correctly as per the given circuit.
2. Do not run too many electrical items from point.
3. Never work on electric wires when the power is on.
4. Check the earth connections before switching on portable equipment.
5. Never work with bare feet. It is better to wear rubber shoes while working.
6. Whenever there is power failure, put -off the power supply to all equipment, in order to prevent spontaneous recovery.

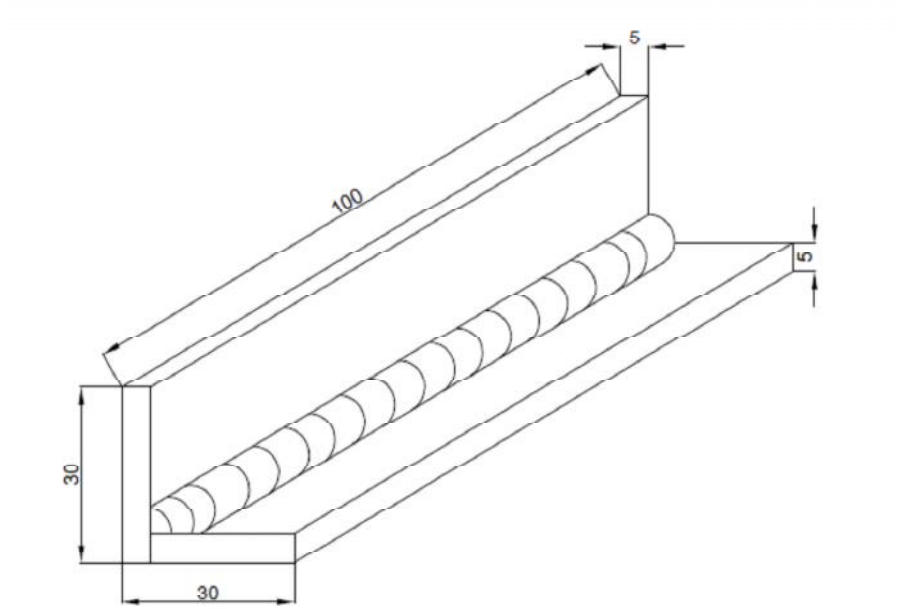
RESULT:-The electrical circuit, for one light controlled by 2 two-way switches is thus made.

5. WELDING

5.1 CORNER JOINT

AIM:-To make a corner joint, using the given two M.S pieces and by arc welding.

TOOLS AND EQUIPMENT REQUIRED: -Arc welding machine (transformer), mild steel electrode and electrode holder, ground clamp, tongs, face shield, apron and chipping hammer.



CORNER JOINT

SEQUENCE OF OPERATIONS: -

1. The given M.S pieces are thoroughly cleaned of rust and scale.
2. The work pieces are positioned on the welding table such that, the L shape is formed.
3. The electrode is fitted in an electrode holder and the welding current is set to a proper valve.
4. The ground clamp is fastened to the welding table.

5. Wearing the apron and using the face shield, the arc is struck and the work pieces are tack-welded at both the ends at the center of the joint.
6. The alignment of the corner joint is checked and the tack -welded pieces are reset, if required.
7. Welding is then carried out throughout the length of the corner joint.
8. The scale formation on the welds is removed by using the chipping hammer.
9. Filing is done to remove any spatter around the weld.

PRECAUTIONS: -

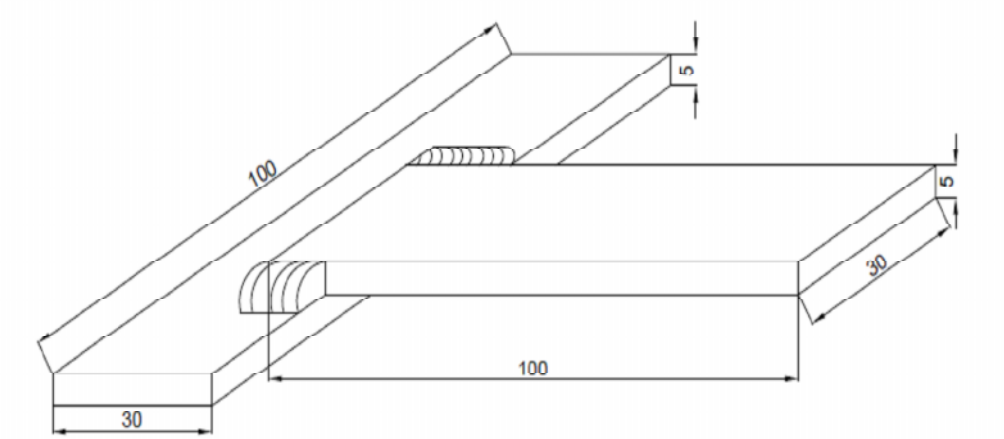
1. Check the welding machine to make sure that it is properly grounded and that all leads are properly insulated.
2. Never look at the arc with the n aked eye. The arc can burn your eyes severely. Always use a face shield while welding.
3. Prevent welding cables from coming in contact with hot metal, water, oil, or grease. Avoid dragging the cables around sharp corners.
4. Ensure proper insula tion of the cable and check for openings.
5. Always wear the safety hand gloves, apron and leather shoes.
6. Always turn-off the machine when leaving the work.
7. Apply eye drop after welding is over for the day, to relieve the strain on the eyes.
8. While welding, stand on dry footing and keep the body insulated from the electrode.

RESULT:-The corner joint is thus made, using the tools and equipment as mentioned above.

5.2 DOUBLE PARALLEL FILLET WELD

AIM:-To make a double parallel fillet weld, usi ng the given two M.S pieces by arc welding.

TOOLS AND EQUIPMENT REQUIRED: -Arc welding machine (transformer), mild steel electrode and electrode holder, ground clamp, tongs, face shield, apron and chipping hammer.



DOUBLE PARALLEL FILL ET WELD

SEQUENCE OF OPERATIONS:-

1. The given M.S pieces are thoroughly cleaned of rust and scale.
2. The work pieces are positioned on the welding table, to form a lap joint with the required overlapping.
3. The electrode is fitted in an electrode holder and the weldin g current is set to a proper valve.
4. The ground clamp is fastened to the welding table.
5. Wearing the apron, using the face shield and holding the overlapped pi eces, the arc is struck and the work pieces are tack -welded at the end of both the sid es.
6. The alignment of the lap joint is checked and the tack -welded pieces are reset, if required.
7. Welding is then carried out throughout the length of the lap joint, on both the sides.
8. The scale formatting on the welds is removed by using the chipp ing hammer.

PRECAUTIONS: -

1. Check the welding machine to make sure that it is properly grounded and that all leads are properly insulated.
2. Never look at the arc with the naked eye. The arc can burn your eyes severely. Always use a face shield while welding.
3. Prevent welding cables from coming in contact with hot metal, water, oil, or grease. Avoid dragging the cables around sharp corners.
4. Ensure proper insulation of the cable and check for openings.
5. Always wear the safety hand gloves, apron and leather shoes.
6. Always turn-off the machine when leaving the work.
7. Apply eye drop after welding is over for the day, to relieve the strain on the eyes.
8. While welding, stand on dry footing and keep the body insulated from the elect rode.

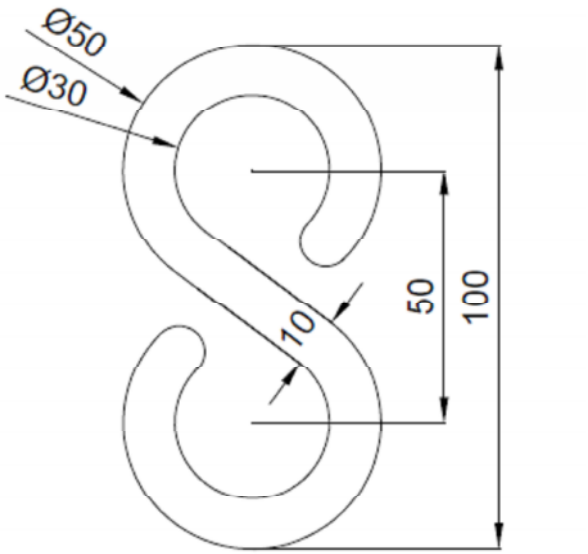
RESULT:-The double parallel fillet weld is thus made, using the tools and equipment as mentioned above.

6. BLACK SMITHY

6.1 S-HOOK

AIM:-To make a S-hook from a given round rod, by following hand forging operation.

TOOLS REQUIRED:-Smith's forge, anvil, ball-peen hammer, flatters, swage block, half-round tongs and pick-up tongs.



S-HOOK

SEQUENCE OF OPERATIONS:-

1. One end of the bar is heated to red hot condition in the smith's forge for the required length.
2. Using the pickup tongs, the rod is taken from the forge, and holding it with the half round tongs, the heated end is forged into a tapered pointed end.
3. The length of the rod required for S-hook is estimated and the excess portion is cut-off, using a cold chisel.
4. One half of the rod towards the pointed end is heated in the forge to red hot condition and then bent into circular shape as shown.

5. The other end of the rod is then heated and forged into a tapered pointed end.
6. The straight portion of the rod is fi nally heated and bent into circular shape as required.
7. Using the flatter, the S -hook made as above, is kept on the anvil and flattened so that, the shape of the hook is proper.

PRECAUTIONS:-

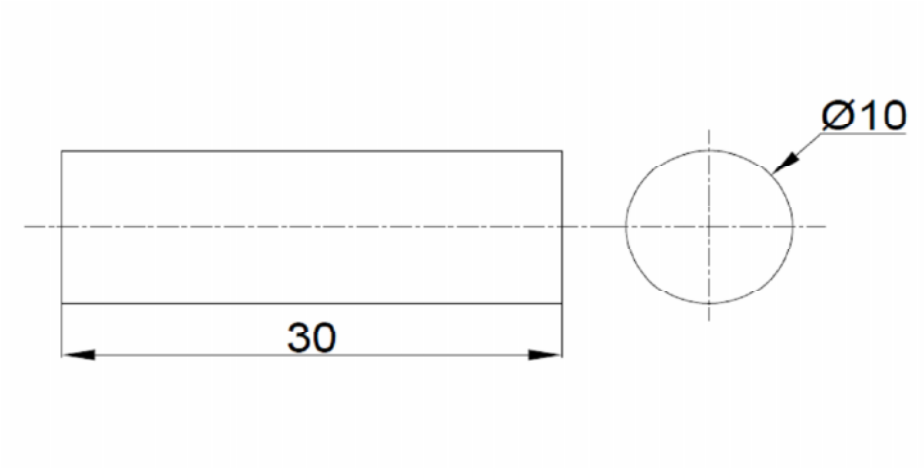
1 Hold the hot work downward close to the ground, while transferring from the hearth to anvil.
2. Use correct size and type of tongs to fit the work.
3. Care should be exercised in the use of the hammer.
4. Wear face shield when hammering hot metal.
5. Wear gloves when handling hot metal.
6. Wear steel-toed shoes.
7. Ensure that hammers are fitted with tight and wedged handles.

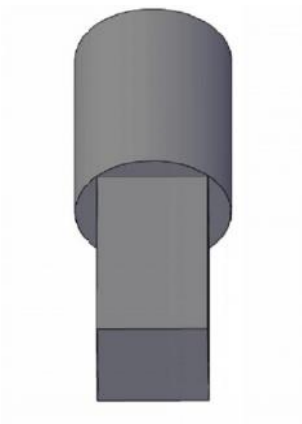
RESULT:-The S-hook is thus made from the given round rod, by following the stages mentioned above.

6.2 SQUARE ROD

AIM:-To make an square rod from a given round rod, by using hand forging operation.

TOOLS REQUIRED:-smith's forge, anvil, ball -peen hammers, flatter, round bit tongs and pick-up tongs.





SQUARE ROD

SEQUENCE OF OPERATIONS:-

1. One half of the rod is heated to red hot condition in the smith's forge.
2. Holding the rod with round bit tongs, the rod is placed on the anvil face, the rod is then hammered.
3. The rod is hammered such that the round rod is converted to square rod.

4. Following the above steps, the round rod is converted to square rod up to the g iven specified length.

PRECAUTIONS:-

1 Hold the hot work downward close to the ground, while transfe rring from the hearth to anvil.

2. Use correct size and type of tongs to fit the work.

3. Care should be exercised in the use of the hammer.

4. Wear face shield when hammering hot metal.

5. Wear gloves when handling hot metal.

6. Wear steel-toed shoes.

7. Ensure that hammers are fitted with tight and wedged handles.

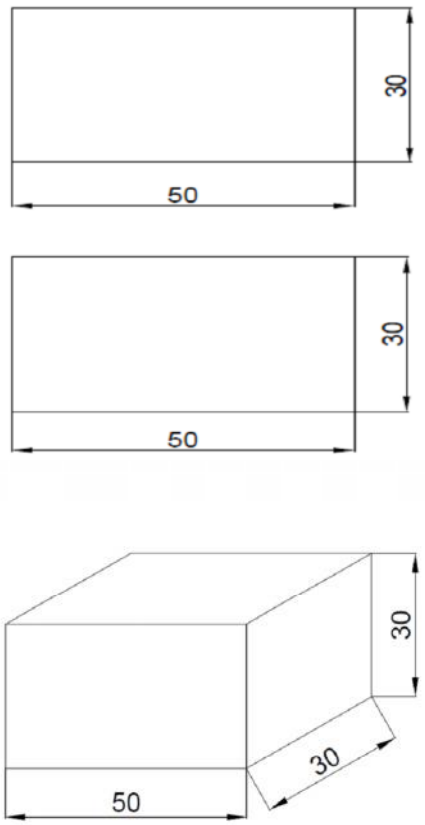
RESULT:-The square rod is thus made from the given round rod, by following the hand forging operations, as mentioned above.

7. FOUNDRY

7.1 MOLD FOR A RECTANGLE BLOCK

AIM:-To prepare a sand mold, using the given signal piece pattern for a solid flange.

TOOLS REQUIRED:-Molding board, drag and cope boxes, molding sand, parting sand, rammer, strike-off bar, bellows, riser and sprue pins, gate cutter, vent rod and draw spike.



RECTANGLE BLOCK

SEQUENCE OF OPERATIONS:-

1. The pattern is placed on the molding board, with its flat side on the board.
2. The drag box is placed ov er the board, after giving it a clay wash inside.
3. Parting sand is sprinkled over the pattern and the molding board.

4. Foundry sand is placed over the pattern, until it is covered to a depth of 20 to 30mm.
5. Using fingers, sand is packed around the pat tern and into the corners of the box.
6. Some more sand is then placed in the box and packed with the rammer. using first, peen end and then with the butt end.
7. The excess sand from the top surface of the drag is removed by striking -off with the strike-off bar.
8. The drag is turned upside down.
9. The loose sand particles are blown -off with the bellows and the surface is smoothened.
10. The cope box is placed in position in position on top of the drag box, after giving it clay wash inside. The riser pin is then located on the surface of the pattern.
11. The sprue pin is placed at about 50 to 60mm from the pattern, but on the opposite side of the riser pin.
12. Parting sand is sprinkled on the upper surface.
13. Step 4 to 7 are repe ated.
14. Using a vent rod, holes are made to about 10mm from the pattern.
15. The sprue and riser pins are removed, by carefully drawing them out. A funnel shaped hole is made at the top of the sprue h ole, called pouring basin/cup.
16. The cope is lifted and placed aside on its edge.
17. A draw spike is inserted into the pattern and the edges around the pattern are wetted. Then the pattern is located by tapping, and then drawn straight up.
18. The mold is repaired by adding bits of sand, whe rever the mold is found defective.
19. Using a gate cutter, a gate is cut in the drag, from the sprue to the mold.
20. The loose sand particles that are present in the mold are blown -off.
21. The mold is finally closed by replacing the cope on the drag and placing weights on it.

PRECAUTIONS:-

1. Do not let sand too wet. Water is an enemy of molten metals.
2. Never stand or look over the mold during the pouring or immediately after pouring because the metal might spurt out of the hole.
3. While work ing with molten metal, wear protective clothing such as face shield or safety

goggles, asbestos or leather gloves, which are tight at the wrist, protective aprons that will protect from heat as well as molten particles of metal.

4. Provide adequate ventilation to remove smoke and fumes.
5. Do not shake-out a casting too hastily, which may result in second and third degree burns.

RESULT:-The sand mold for a solid flange is thus made, which is ready for pouring the molten metal.