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To Prepare two metal pieces as male and female socket as per required specifications.

1. OBJECTIVES

To prepare two metal pieces as male and female socket as per required specifications.

2 APPARATUS

(i) Small try square (ii) Scriber (iii) Surface Plate (iv) Surface gauge (v) Bench Vice (vi) Hacksaw (vii) file

The tools used in fitting shop are discussed briefly here:

(i) Try Square → It's used for checking squareness of two surfaces. It consists of a blade made up of steel which is attached to a base at 90°. The base is made up of cast iron or steel, figure 1. Try square is also used for making right angles and measuring straightness of surfaces

(ii) Scriber: It is a hand tool used in metalworking to mark lines on workpieces,

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prior to machining. The process of using a scriber is called scribing and is just part of the process of marking out. A commonly used scriber is shown in fig 2 below.

(iii) Surface Plate: A surface plate is a solid, flat plate used as the main horizontal reference plane for precision inspection, marking out (layout) and tooling setup. A commonly used surface plate is shown in fig3 below.

(iv) Surface gauge → It's normally used to scribe parallel lines. Its base is heavy and this means it is stable when in used. Surface gauges sometimes have magnetic bases and this means they can be locked onto metal surfaces making it easier to use. A commonly used surface gauge is shown here in fig 4 below.

(v) Bench vice → It's a common tool used for holding jobs. It consists of a cast iron jaws. Jaw plates are made up of high carbon steel and are wear resistant. One jaw is fixed to the body and the second slide on a square threaded screw with the help of a handle as per fig 5.

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It's fixed at the four corners of the fitters work bench.

(vi) Hacksaw: It's used for cutting of rods, flats etc. The blade of the hacksaw is made up of high carbon steel or high speed steel figure 6. The teeth of saw blades are generally forward cut. The length of blade ~~is~~ varies from 8" to 14", but generally 12" blade is used in fixed frame hacksaw.

(vii) files → This is also a multi tooth tool. It's used to remove material by rubbing it on the metal. The main parts of a file are shown in the fig 7 below. The tang is shaped into a handle. And is usually knurled on swiss pattern files. files with no tang are referred to as 'plain'. As the worker pushes the file along the material, applying light pressure, these teeth slice into it one after another. In this way, files work through 'abrasion', a repetitive process that involves rubbing something rough against a piece of material to smooth it down. The files are classified according to their shape, cutting teeth and pitch or grade of the teeth figure 8, Round

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files are used for filing circular openings or concave surfaces. Half round files are well suited to descaling pipes or working to shape or smooth concave surface. Square files taper slightly toward the point on all four sides and are double-cut. They are used for filing saws having 60 degree angle teeth.

3. THEORY

Machine tools are capable of producing work at a faster rate, but there are occasions when components are processed at the bench. The assembly of machine tools, jigs, gauges etc, involves certain amount of bench work. The term 'bench work' refers to the production of components by hand on the bench, where as fitting deals which the assembly of mating parts, through removal of metal, to obtain the required fit. The work material normally used for making the model is Mild steel (MS) a low carbon steel with less than 0.25% C.

4 PROCEDURE

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- A steel of mild steel is taken and mounted on a bench vice.
- Two pieces of dimensions given were cut with the help of a hacksaw keeping in consideration the allowances.
- A paste of crushed chalk and water was applied and allowed to dry up to give a plain white surface easy for marking
- The marking was then carried out on two work pieces with the help of surface plate, scale and vernier height gauge.
- The required cutting is done with the hacksaw
- Surface are made smooth by filing first the hand file is used to smoothen the rough surface and then the half round file is used to give a fine surface finish.

5 Results & Discussions

Thus a male female socket of required

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specification is obtained. The dimensions of the parts obtained may be checked by using a vernier.

6. Conclusion

A male female socket of required specifications is obtained.

7 Precautions

(i) The teeth of the hacksaw should be facing forward.

(ii) Marking should be done with great care

(iii) While sawing allowances should be made for filing

(iv) All the edges should be smooth.

(v) The piece should be fixed straight in the jaws of the bench vice otherwise errors in shape might occur

(vi) Work pieces and tools should be regularly oiled to avoid rusting.

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To make a Butt joint, lap and T-joint with the help of arc welding.

1. OBJECTIVE

To make a butt joint, lap and T-joint with the help of arc welding

2. APPARATUS

The following apparatus are mainly used in the electric arc welding

(i) Welding Electrodes
(ii) Power supply (AC or DC)
(iii) Safety Equipments.

(i) Welding Electrodes → Filler rods are used in arc welding are called electrodes. These are made of metallic wire called core wire, having approximately the same composition as the metal to be welded. It help in transmitting full current from electrode holder to the front end of the electrode coating.

(ii) Power supply (AC or DC) → Transformers, motor generators and rectifiers' sets are used as

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arc welding machines. Sizes of welding machines are rated according to their approximate amperage capacity of 60% duty cycle, such as 150, 200, 250, 300, 400, 500 and 600 amperes. It takes power directly from power supply line and transforms it to the voltage required for welding. They are designed to produce D.C current in either straight or reversed polarity. The basic electric arc equipments are shown in fig 2 below.

(iii) Safety Equipments → Like other jobs or carrers, welders must wear suitable protective equipment. In general, these safety equipments must protect against hazards such as burns, sparks, spatter, electric shock and radiation. The hand type is convenient to use wherever the work can be done with one hand. Shields are made of light weight non-reflecting fiber or fitted with dark glasses to filter out the harmful rays of the arc. The ground clamp is connected to the end of the ground cable and is clamped to the work or welding table to complete the electric circuit. It should

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be light, strong and easy to handle and should not become hot while in operation.

3 THEORY

Welding is a material joining process which produces coalescence of materials by heating them to suitable temperatures with or without the application of pressure or by the application of pressure alone, and with or without the use of filler material. All the various welding processes can be classified into two types namely : (i) Plastic welding or Pressure welding (ii) fusion welding or Non-Pressure welding.

(i) Plastic Welding or Pressure Welding, The piece of metal to be joined are heated to a plastic state are forced together by external pressure. for example Resistance welding

(ii) fusion welding or Non-Pressure welding → The material at the joint is heated to a molten state and allowed to solidify for ex- Gas welding Arc welding

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It's a process of joining two metal pieces by melting the edges by an electric arc. The electrode and the work piece are brought nearer with small air gap (3 mm approximately). Temperature of arc is about 4000°c. Electrodes used in arc welding are coated with a flux. The slag gets deposited over the weld metal. This protects the weld seam from rapid cooling. Fig 4 shows arc welding process

Fig 5: Types of joint T Joints → To weld tee joints in the vertical position, start the joint at the bottom and weld upward. When more than one pass is necessary to make a tee weld, you may use either of the weaving motion.

LAP JOINTS → To make welds on lap joints in the vertical position, you should move the electrode in the triangular weaving motion. Hold the arc short and pause slightly at the surface of the plate Cr. The precautions to ensure good fusion and uniform. weld a deposit that was previously outlined for tee joints also apply to lap joi

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Butt joints → Prepare the plates used in vertical welding identically to those prepared for welding in the flat position. To obtained good fusion and penetration with no undercutting.

4. PROCEDURE

(i) Obtain all necessary equipment. This should be a welding machine, electrode and work piece clamps (and their leads), a welding helmet darker than shade 10, welding gloves and appropriate safety clothing.

(ii) Prepare the metal to be welded. This includes grinding down rough edges and cleaning the areas to be welded.

(iii) Align your metal to make sure the edge line up well. They should be smooth and align cleanly.

(iv) Turn your pieces over. This should be the flat side if on or more pieces are beveled or the side you don't want to start welding.

(v) flip your metal over to be welded.

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5. Results and Discussion

Butt joint, lap joint and T joints are successfully obtained by the electric arc welding. The workpieces need to be held properly while making to obtain the T joint.

6. PRECAUTIONS

(i) Make sure your welding helmet's lens is the proper shade for the amperage and process you are using

(ii) Plasma cutters use an electric arc, so safety precautions from arc welding apply to this also

(iii) Always wear pant without cuffs, shirts without pockets, and safety glasses when chipping slag off welds.

(iv) If using a torch to bevel the metal, use caution and avoid setting a brass torch tip on a hard surface.

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To make a butt joint, Lap joint, T joint and brazing of broken pieces with the help of Gas welding.

1. OBJECTIVES

To make a butt joint, lap joint, T joint and brazing of broken pieces with the help of gas welding

2. APPARATUS

The gas welding apparatus consists mainly of the following

(i) Gas Cylinders (ii) Regulators (iii) Pressure Gauges (iv) Hoses (v) Blow pipe (vi) Check valve

(i) Gas Cylinders: Two large steel cylinders, capable to withstand high pressure are needed to keep oxygen and acetylene separately. Oxygen is filled at pressure 125 kg / cm^2, Acetylene is filled at pressure 16 kg / cm^2. Acetylene cylinder should not be exposed to higher temperature for safety reasons.

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(ii) Regulatorss - Each of the cylinders should be equipped with pressure regulatorss at the top. Pressure regulatorss maintains supply pressure at a constant value which has to be much less than the pressure at which gas has been filled in the cylinder. Value of supply pressure depends upon inside diameter of outlet nozzle

(iii) Pressure Gauges: Pressure gauges measures the pressure with respect to the atmospheric pressure. Second gauge is used to know the supply pressure of the gas to below pipe.

(iv) Hoses: Hoses pipe are used to carry gases from their respective cylinders to blow pipe. Hose pipes are made of rubber with long life. ~~These valves~~ One Valves is mounted on the each hosepipe where these are connected to blow pipe. These valves can stop the flow and the control of blow ~~of~~ Oxygen and acetylene independently to get carburizing, oxidizing or neutral flame.

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(V) Blow Pipe - Blow pipes are used in welding or cutting. These are made in different design and size to suit the work. Blow pipes are classified as high pressure torch used in gas welding. In case of high pressure blow pipe acetylene is supplied at high pressure as compared to low pressure blow pipe.

(VI) Check valve → Check valve and Flashback Arrestors are safety devices for protecting workers using OXy-acetylene cutting and welding equipment. A Check Valve is a device that is designed to prevent the unintentional backflow of gases.

3 THEORY

Welding is a fabrication or sculptural process the joins materials, usually metals or thermoplastics, by causing coalescence This is often done by melting the work pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat or by itself to produce the weld.

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Oxygen and Acetylene are the gases used to produce the welding flame. A flux is used during welding to prevent oxidations and to remove impurities. Metals 2mm to 50mm thick are welded by gas welding. The temperature of oxyacetylene flam is about 3200°C. Fig2 shows Gas welding equipments.

Oxy-Acetylene welding can use for welding of wide range of metals and alloys. This burning also produces carbon dioxide which helps in preventing oxidation of metals being welded

Highest temperature that can be produced by this welding is 3200 C. The chemical reaction involved in burning of acetylene is

$$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O + Heat$$

On the basis of supply pressure of gases oxy-acetylene welding is categorized as high pressure welding in this system both gases oxygen and acetylene supplied to welding zone are high pressure from their respective high pressure cylinders.

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In this case high pressure supply of oxygen pulls acetylene at the welding zone. High pressure welding equipment is handy, supplies pure acetylene at constant pressure, with better control

On the basis of supply proportion of acetylene and oxygen, flames can be divided into three categories

(i) Carburizing flame
(ii) Neutral flame
(iii) Oxidizing flame

(i) Carburizing flame or Reducing flame → This flame is obtained when excess of acetylene is supplied than which is theoretically required. It's white in color due to excess acetylene. Larger the excess of acetylene larger will be its length. The resulting flame will have its temperature generation range is 3100°C to 3300°C.

(ii) Neutral flame → A neutral frame is obtained when amount of O_2 equal and C_2H_2 are mixed and burnt at the outlet of welding torch. In this flame

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none of two gases is supplied in excess This flame is of white cone and has the maximum use for successful welding of many metals.

(iii) Oxidizing flames → This flame as an excess of oxygen over that required for a neutral flame. The ratio $O_2 : C_2H_2$ 1.15 : 1.50. Its inner cone is relatively shorter and excess oxygen turns the flame to flame to light blue color. It burns with a harsh sound.

4. PROCEDURE

(A) Procedure for lighting the flame:

(i) Open the main valve on the acetylene tank ½ turn. This changes the pressure regulator at the top of the tank

(ii) Open the pressure regulator valve on the acetylene tank (turn clockwise to open) and adjust the pressure in the acetylene line to psi

(iii) Open the main valve on the oxygen tank. Turn the valve until it's fully

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open.

(iv) Open the pressure regulator's valve on the oxygen tank (turn clockwise to open) and adjust the pressure

(v) Slightly open the acetylene valve (~1/8) until you can adjust barely hear acetylene escaping

(B) Pressure of Gas Welding

(i) Assemble all of the materials needed to make the weld. This includes parts, OA equipment, fixture, tools, safety mask, gloves and filler rod

(ii) Clean the parts to be welded to remove any oil, rust or other contamin
Use a wire brush if needed to remove any rust

(iii) Assemble and fixture the parts in place- the parts need to be stable for a good weld line. Ceramic bricks, vise grips, pliers and clamps are available in a file cabinet in the weld room for fixture

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(iv) Attach the nozzle to the gas feed line by hand. Don't over torque - the nozzle and house fitting are both made of soft brass with doesn't stand up well to abuse. A snug, finger tight fit is sufficient.

(C) Procedure for shutting down and Cleaning up:

When you're completely finished welding and are ready to quit for the day, you need to clean up.

(i) With the flame extinguished and the pin valves closed, close the main valve on the oxygen tank. It should be firmly seated at the bottom

(ii) Open the oxygen pin valve to bleed off all of the oxygen in the regulator and feed line. Close the pin valve once the feed line pressure has gone to zero

(iii) Repeat steps 1 through 3 for the acetylene line

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5 Results and Discussion

Gas welding is used in this experiment to obtain a butt joint, lap joint, T joint for mild steel workpieces. The gas welding process has got a number of advantages. Gas welding can be used to weld disimilar metals. Very thin metals can be joined. Metals with different thickness can be joined easily. In brazing thermal stresses are not produced in the work piece. Hence there is no distortion.

6 Precautions

(i) Oxygen and acetylene cylinders must be securely stored in an upright positions.

(ii) Always have a suitable fire extinguisher near your work area.

(iii) Don't use an oxyacetylene torch near ~~your work area~~ any flammable work

(iv) Make sure that you understand and observe all legislative and personal safety producers when carrying out the following tasks.

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To make Tray, Cylinder, hopper and funnel of zinc coated iron sheet

1. Objective - To make Tray, Cylinder, hopper and funnel of zinc coated iron sheet

2 Apparatus

a) Steel rule
b) flat file
c) Scriber
d) Try square
e) Snips
f) Dot punch
g) stakes
h) Mallet

Materials required: Galvanized Iron sheet (150 × 110 × 26 gauge)

3 Theory

31 Introduction

Sheet metal working covers the use of thin metallic sheets with hand tools and sheet metal machines. Many important engineering articles made

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up of sheet metal find their application in airconditioning ducts, aircraft industry, agriculture implements, decorative articles and household goods.

3.2 Types of sheet metal

1. Ferrous sheet

i) Mild steel sheets → These are black iron sheets, suspected to rust and corrosion, mostly used in water tanks and fabrication works.

ii) Stainless steel sheets - It's an alloy of high-grade steel with chromium, nickel, phosphorous and manganese. It's used in household goods, food-processing plants etc.

iii) Tin plate - Steel coated with tin is called tin steel. It's used for making food containers.

2 Non-ferrous sheet

i) Aluminium sheets - It's two and half times lighter than iron but lacks in tensile strength. Small percentage of

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of other elements like copper, manganese and silicon is added to make it suitable for production in aircraft industry and other industrial goods

(ii) Copper and Brass sheets → These are non-ferrous sheets used in electrical industry and various other industrial and household articles.

3.3 Measurement of thickness of sheets

Thickness of sheet is generally measured by gauge number which is obtained by actually measuring the sheet thickness with a sheet gauge or wire gauge. The more the SWG number, lesser is the thickness of sheet.

3.4 Tools used in sheet metal

3.4.1. Marking Tools

1. Steel Rule: Available in different sizes, it could be steel foot rule, folding rule or tape rule

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2. Scriber: It's a steel wire with one end sharp and hardened to mark lines on metallic sheet.

3. Divider: It's used to scribe arcs and circles on metallic sheets

4. Trammel points: It's used for drawing large circles and arcs.

5. Punches:

a) Prick Punch: Used for making indentats. marks for locating center position for dividers, it has a taper angle of 30°.

b) Centre punch: Used for marking the location of points and centering hole to be drilled, it has a taper angle of 90°

3.7.2 Cutting Tools

1. Straight Snips: It's blades are straight, it is used to cut 22 SWG or lighter sheets along straight line

2. Hollow punch: Hollow punch is used to cut circular holes on thin sheets.

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3 Striking Tools

1. Hammers : Hammers are used for bending of sheets, smothering of sheets, locking of joints and riveting work.

a) Ball pean Hammer → General purpose, face is slightly curved and head is round.

b) Raising Hammer : It's used to form flat surface of sheet into curved surface.

c) Mallet : Made of good quality of wood or plastic used whenever light force is required.

3.4.1 Supporting Tools

1. Stakes - Stakes are used to support sheets in bending, seaming, forming riveting, punching etc. Some commonly used stakes are

(a) Hand stake : It's handy with flat face, two st. edges one concave edge, other convex edge, used for pressing the inner sides of st. @ joint.

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b) Taper stake: It's used for rounding of tapering jobs such as conical jobs.

c) Grooving stake: It's made up of forged steel, used for grooves of different sizes

3.5 Sheet metal working Machines

1. Sheet Bending Machine: This is used for bending and folding the edges of sheet metal

2. Swaging Machine: It's used to provide different types of swages to give strength to thin sheets

3. Lever shearing Machine: It's used for sheet cutting, round bar shearing mostly used in sheet metal shop.

4. Grooving machine: It's used to make grooves; depth of groove can be adjusted

3.6 Sheet metal joints

1. Lap joint - It can be prepared by

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means of soldering or riveting

2. Wired Edge - It's one of the methods of strengthening the thin metal by turning over the edge on a wire in it.

3. Hinged joint - It's used for easy movement of opening or closing doors, window etc

4. Cap joint - It's provides another useful form of locked seam joint.

3] Sheet Metal Operations

1. Measuring and Marking - Sizes are marked on large sheet to cut the latter into small pieces

2. Cutting and Shearing - The term shearing stands for cutting of sheet metal by two parallel cutting edges moving in opposite direction

3. Hand forming - It stands for shaping, bending of sheet metal in three dimensions in order to give the desired shape and size of final product.

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4. Nibbling - It's a process of continuous cutting along a contour which may be of straight or irregular profile.

5 Bending - Bend in sheet material is to be bent at different angles to shape it to required form.

6 Circle Cutting - It's an operation of cutting circular blanks or curved contours with the help of circular cutting machines

7. Turned over Edge - It's the method of strengthening the thin metalat edge. The edges are turned with some radius.

8. Swaging - This is also a method of strengthening thin sheet metal by making impressions in the bodies. It's done by machine or by hand.

4. Procedure

4.2 Operations to be carried out:

1. Planning

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2 Marking
3 Cutting
4 Bending
5 Seaming
6 Soldering

Procedure for Rectangular Tray:

1. The size of the given sheet is checked with steel rule.
2. The layout of the tray is marked on given sheet.
3. The layout of the tray is cut by using the straight snips
4. The sheet is bent to the required shape using stakes and Mallet
5. The joint is soldered

4.3 Cylinder:

Procedure for cylinder

1. The size of the given sheet is checked with steel rule.

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2. Mark the measurement and make the development surface sketch diagram
3. The sheet is bent to the required shape using stakes and Mallet.
4. Join both the ends with in a cylindrical shape

4.4 funnel

Procedure for funnel :-

4.4.1 Body of funnel

1. Draw the pattern of body of funnel on a drawing sheet as per dimension by Radial line method as shown in diagram
2. Mark the allowance for flange and lock seam joint.
3. Cut the pattern from drawin sheet with sharp blade.
4. Cut the sheet on the marked line with a suitable snip

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5. Remove the burrs with a smooth file

6. Make closed flods on both ends for lock seam joint

7. Flange out top edge of body of funnel as per diagram

4.4.2 Development Of Round Funnel (Frustrum of a cone)

Procedure - A round equally tapering body having top and base parallel is frustrum of a right cone. Draw the elevation and plan of frustrum of the cone as shown in figure. Produe the edge line AC & BD to an apex marked O. Divide the outer circle of the plan in equal number of parts (i.e 12). Draw another arc of O as centre taking radius equal to OD. Join OB and OA.

1. Draw the pattern for bottom of funnel by triangulation method on drawing sheet as shown in diagram

2. Mark the allowance for soft soldering lap joint.

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3 Cut the pattern from 'drawing sheet

4. Cut the sheet on the marked line with suitable snip

5. ~~Cut the sheet along the~~ Remove burrs with a smooth file

6. Bend from the sheet to required shape

7. Soft solder the over lap joint.

5. Observation

It has been observed that tray, cylinder, funnel of zinc coated iron sheet using sheet metal working tools. We have to learn about every procedure to make the required geometry.

6. Result and discussion

Tray, cylinder, funnel of zinc coated iron sheet is made as per required dimensions using sheet metal working tools.

7. Conclusion

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a. All the sheet metal working tools has identified before tray, cylinder, funnel preparation.

b. All the object has been prepared w/in 2-5% dimensional accuracy

c. Joints are being identified.

8. Precautions

1. Be careful while working on sharp edges of sheets to avoid injury.

2. Don't use blunt cutting edge tools

3. Appropriate cutting tools and machines must be used for cutting tin sheets.

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