LABORATORY MANUAL

MANUFACTURING PROCESS LAB

II B.TECH -II Semester

ACADAMIC YEAR-2017-2018

DEPARTMENT OF MECHANICAL ENGINEERING

CMR ENGINEERING COLEGE
(Approved by AICTE, New Delhi & Affiliated JNTU, Hyderabad)
Kandlakoya (V), Medchal Road, RR.Dist – 501401

VISION OF THE INSTITUTE

- To be recognized as a premier institution in offering value based and futuristic quality technical education to meet the technological needs of the society

MISSION OF THE INSTITUTE

1. To impart value based quality technical education through innovative teaching and learning methods
2. To continuously produce employable technical graduates with advanced technical skills to meet the current and future technological needs of the society
3. To prepare the graduates for higher learning with emphasis on academic and industrial research.

VISION OF THE DEPARTMENT

To be a center of excellence in offering value based and futuristic quality technical education in the field of mechanical engineering.

MISSION OF THE DEPARTMENT

M1. To impart quality technical education imbibed with values by providing state of the art laboratories and effective teaching and learning process.

M2. To produce industry ready mechanical engineering graduates with advanced technical and lifelong learning skills.

M3. To prepare graduates for higher learning and research in mechanical engineering and its allied areas.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS):

PEO 1: The Graduates will exhibit strong knowledge in mathematics, sciences and engineering for successful employment or higher education in mechanical engineering.

PEO 2: The Graduates will design and implement complex modeling systems, conduct research and work with multi disciplinary teams.

PEO 3: The Graduates will be capable of communicating effectively with lifelong learning attitude and function as responsible members of global society.

PROGRAM OUTCOMES (POS):

1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2.Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4.Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12..Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

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PROGRAM SPECIFIC OUTCOMES(PSOS):

PSO.1 Design a Thermal system for efficiency improvement as per industrial needs.

PSO.2 Design and manufacture mechanical components using advanced manufacturing technology as per the industrial needs.

Course Name: Production Technology Lab

Course Code	CO No.	Course Outcome (CO's)
C227	CO1	Make different types of patterns with consideration of design parameters using wood working lathe.
C227	CO2	Making use of Arc, Butt, Spot, Gas and Tig welding joints.
C227	CO3	Develop plastic components making use of plastic injection & blow moulding machine.
C227	CO4	Develop sheet metal components using Hydraulic press.
C227	CO5	Produce a casting of any machine component
C227	CO6	Make welded joints using TIG welding

CO's/PO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	3	-	-	2	-	-	-	-	-
CO2	3	-	3	3	-	-	2	-	-	-	-	-
CO3	3	-	3	3	-	-	2	-	-	-	-	-
CO4	3	-	3	3	-	-	2	-	-	-	-	-
CO5	3	-	3	3	-	-	2	-	-	-	-	-
CO6	3	-	3	3	-	-	2	-	-	-	-	-

CO's/PSO's	PSO1	PSO2
CO1	-	3
CO2	-	3
CO3	-	3
CO4	-	3
CO5	-	3
CO6	-	3

GENERAL INSTRUCTIONS FOR LABORATORY CLASSES

1. All the students must follow the prescribed dress code (apron, formals, shoes) wear their ID cards
2. All the students should sign in login register.
3. All students must carry their observation books and records without fail.
4. Students must take the permission of the laboratory staff before handling the machines in order to avoid any injury.
5. The students must have basic understanding about the theory and procedure of the experiment to be conducted.
6. Power supply to the test table/test rig should be given in the presence of only through the lab technician.
7. Do not LEAN on and do not come CLOSE to the equipment.
8. Instruments like TOOLS, APPARATUS and GUAGE sets should be returned before leaving the lab.
9. Every student is required to handle the equipment with care and follow proper precautions
10. Students should ensure that their work areas are clean.
11. At the end of each experiment, the student must take initials from the staff on the data / observations taken after completing the necessary calculations.
12. The record should be properly written with following section in each experiment:
    a) Aim of the experiment
    b) Apparatus / Tools / Instruments required
    c) Procedure / Theory
    d) Model Calculations
    e) Schematic Diagram
    f) Specifications / Designs Details
    g) Tabulations.
    h) Graph
    i) Result and discussions.
13. Students should attend regularly to all lab classes.
14. Day- to- day evaluation of student performance is carried out and recorded for finalizing internal marks.

SCHEME OF EVALUATION FOR EXTERNAL LABS

Correctness of Write up and Precautions	Conduct Experiment & observations	Model Calculations	Results and Graphs	Viva
Marks: 10	**Marks: 20**	**Marks: 15**	**Marks: 15**	**Marks: 15**
Total Marks: 75 Marks				

SCHEME OF EVALUATION FOR INTERNAL LABS

Day to Day Evaluation ------15 Marks					**Internal Exam------10 Marks**				
Uniform	Observation &Record	Performance of experiment	Results	Viva Voce	Correctness of Write up and Precautions	Conduct Experiment & observations	Model Calculations	Results and Graphs	Viva Voce
Marks:2	**Marks:3**	**Marks:3**	**Marks:4**	**Marks:3**	**Marks:2**	**Marks:2**	**Marks:2**	**Marks:2**	**Marks:2**
Total Marks: 15+10=25 Marks									

LIST OF EQUIPMENT

1	Universal Strength Machine(hydraulic)
2	Sand Rammer
3	Permeability Tester
4	Hydraulic Plastic Injection Moulding Machine Model
5	Pneumatically Operated Blow Molding Machine
6	Injection Machine
7	Spot Welding machine
8	Wood Turning lathe machine
9	Floor with electrical and tools
10	Hydraulic Press with deep drawing die
11	Mechanical fly press with blanking and piercing
12	Brazing setup with cylinder
13	Electrical Melting furnace
14	Tig welding machine
15	Plasma welding & cutting machine

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I. METAL CASTING

II. WELDING

III. PRESS WORKING OPERATIONS

IV.PROCESSING OF PLASTICS

VI. Manufacturing of 24 teeth aluminium gear using modeling/casing methodology

I.METAL CASTING

1. PREPARATION OF A MOULD CAVITY USING SINGLE PIECE PATTERN

Aim:

To prepare a mould for a given single piece pattern

Materials Required:

Moulding sand ,Facing sand ,Banking sand ,Parting sand ,Core ,pattern ,cope box ,Drug box ,bottom board.

Tools Required:

Sprue , Riser , Chaplets , Gate cutter ,Trowel ,Vent rod ,sleek ,Bellow

Terminology of casting:

Flask: A moulding flask is one which holds the sand mould intact .Depending upon the position of the flask in the mould structure it is referred to by various names as drag cope and check .It is made up of wood for temporary application or more generally of metal for long term use.

Drag: lower moulding flask.

Cope: Upper moulding flask used in three moulding.

Pattern: Intermediate is a replica of the object to be made with some modifications. The mould casting is made with the help of the pattern.

Parting Line: This is the dividing line between the two moulding flasks that makes up the sand mould . In split pattern is also the diving line between the two halves of the pattern.

Bottom Board: This is a board normally made of wood which is used at the start if the moulding making. The pattern is first kept on the bottom board sand is poured on it and then the ramming is done in the drag.

Facing Sand: This is specially prepared sand which is placed around the pattern which has superior properties with regards to refractoriness permeability etc. This will ensure better surface ion the castings.

Coal Dust: The small amount of carbonaceous materials sprinkled on the inner surface of the moulding cavity to give better finish to castings.

Moulding Sand: It is a mixture of silica ,clay and moisture in appropriate proportions to get the desired results and it surrounds the pattern facing sand while making the mould .The moulding sand is the mixture

Backing sand: It is chat constitutes most of the refractory material found in the mould. This made up of used and burnt sand.

Core: It is used for making hellow cavities in castings.

Sprue: The passage through which the molten metal from the pouring basin reaches the mould cavity .In many cases it control the flow of metal into the mould.

Runner: the passageways on parting plane through which molten metal flow id regulated before the reach the mould cavity through the In-Gate.

In-Gate : The actual entry point through when molten metal enter mould cavity.

Riser: It is a reservoir of molten metal provided in the casting. So that hot metal can flow into the casting when there is a reduction in volume of metal to solidification

Chill: Chill are metallic objects which are placed in the mould to increase the cooling rate of molten metal.

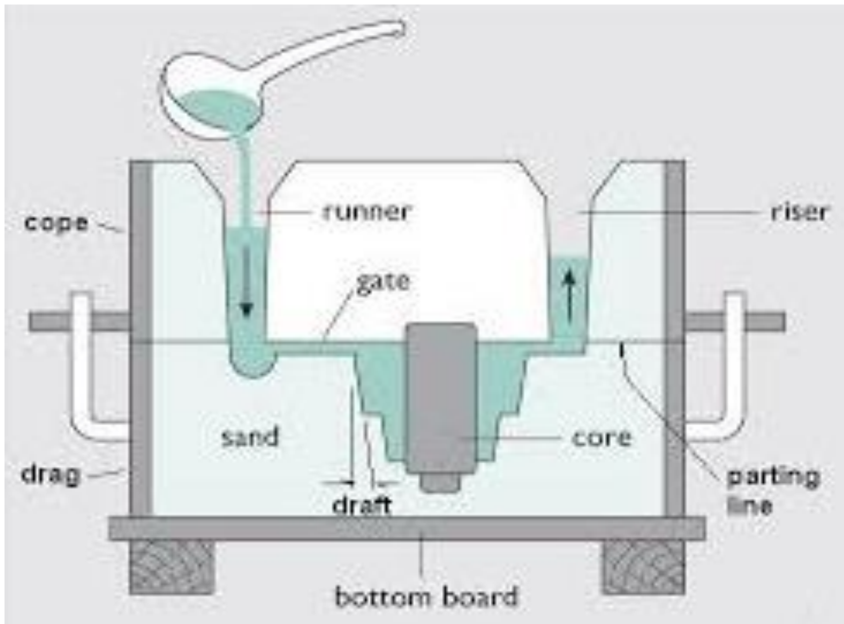
Moulding Procedure:

1. The drag is first placed upside down a moulding.
2. The drag is filled with moulding sand and rammed suitably with the help of a rammer
3. After sand is rammed a strike off bar is used to remove the excess sand and the surface is made half
4. The drag is turned over and cope is placed on it. The two flasks are held together rigidly with the help of sprue pins
5. The above procedure is repeated again after placing the sprue pin and riser at right place.

6. After proper ramming the sprue and riser are removed from cope, vent holes are made using vent rod

7. Now the coper and drag are separated and pattern is removed using draw spike from drag

8. With the help of gate cutter the runner is prepared in the casting



Precautions:

1. There should be enough clearance between the pattern and the walls of the flask.

2. The ramming of the sand should be done properly so as not to compact it too hard, which makes the escape of gases difficult.

Result:

Mould for single pattern is prepare.

2. PREPARTION MOULD CAVITY USING SPLIT PATTERN

Aim:

To prepare a green mould for casting using only two boxes

Tools And Pattern:

Wood pattern made in two halves , dowelled together ,the division passing through the centre of the grooves, cope and drag moulding tools parting sand, brick dust etc.

Stage Sketches:

The mould can be prepared by using tree boxes without any difficulty .However the same can be prepared using two boxes using an ingenious method known as false-core method

Procedure:

1.One half of the pattern is molded in the bottom box, the parting being cut an incline as shown .the other half pattern is then placed in portion and band poured and rammed to form the second parting with a slope down wards from the upper flange of pulley

2. The top box is next placed in the bottom box and properly located .Sand is poured and rammed without damaging the false core.

3. The top box is gently removed the upper half pattern is gently taken out from the top box.

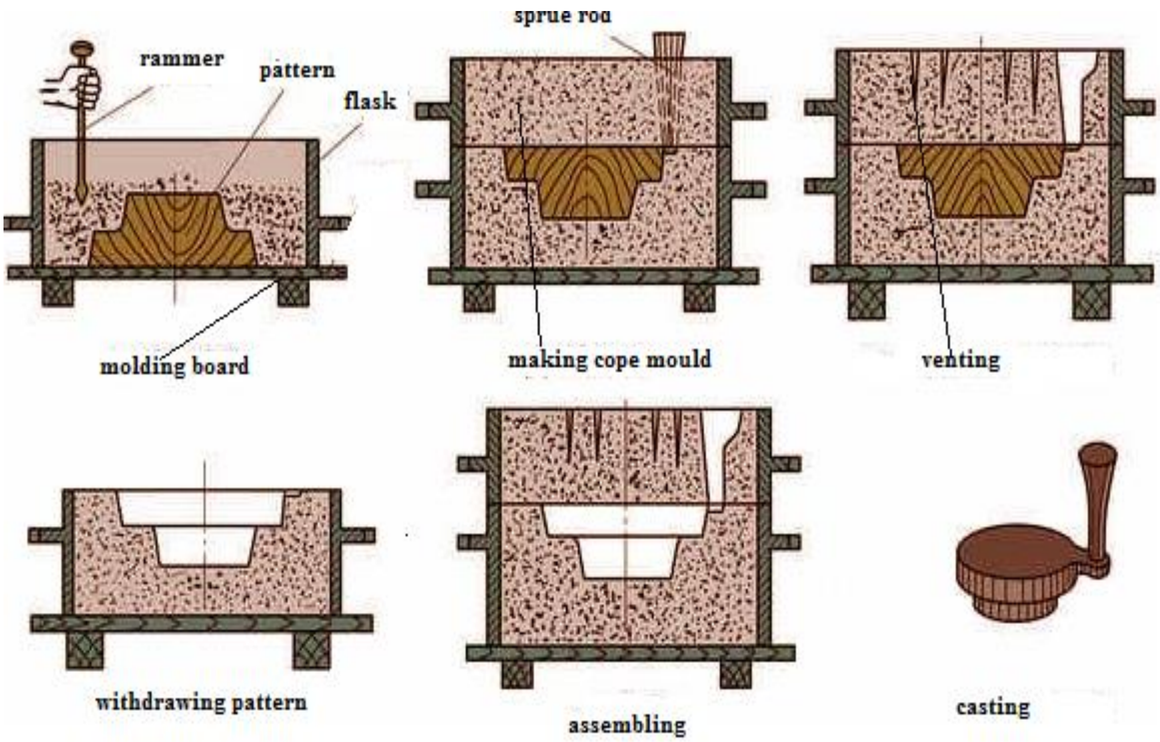
4. The top box is replaced on the drag and the entire mould is turned upside down .The bottom box, which now is at the top , is gently lifted and the remaining half of the pattern is withdrawn.

5. The bottom box is replaced and the mould id inverted .the spruces are removed , pouring basin is cut and the mould is finished after piercing holes (vents)

Observations:

1. After ramming using moulds hardness tester check the moulds hardness on all the four sides of the pattern

2. Locate the rumen and riser 90 degree exactly.



Precautions :

1. Ramming should be uniform strength to the mould.
2. Apply parting sand at the partitions for easy separation of boxes.
3. Locate the two halves of pattern properly to avoid mismatch.

Result:

Sand mould is prepared for the given pattern.

3. PATTERN MAKING

Aim:

To prepare a pattern using design of pattern allowances.

Tools Equipment & Material:

Steel rule, outside caliper, Mortise Chisel, inside chisel , peering Chisel, Firmer Chisel wood rasp half round file outside gauge ,outside Chisel, Try square , handsaw, Mallet, Sand Paper, Teak Wood given size

Procedure:

Match the two rectangular Wood pieces of stock and fix them together by wood screws at either end in the excess portion of wood. This must give a firm clamping of the wood pieces to turn into single piece.

In body portion of the pattern mark a center link using marking gauge and extend it to the dressed end Using the race with counter sunk make indentations at the center of each and to form locations for the head stock and tail stock center

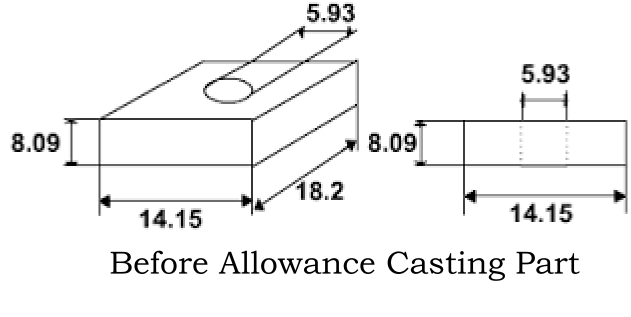
The wood stock is turned on the wood turning lathe using appropriate gauge and finally finished the dimensions.

Sanding paper No.1/2 or No.0 does smooth finishing

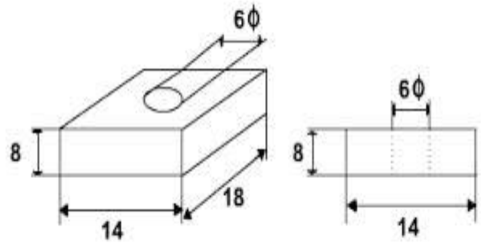
The sand paper should be moved laterally on the rotating work.

1 DESIGN OF A PATTERN FOR SAMPLE CASTING:

The pattern drawing with required dimensions taking shrinkage into account is shown in Fig.1



Before Allowance Casting Part



After Allowance Casting Part
Fig : 1

Shrinkage Allowance:
From Table for steel the shrinkage allowance is 21.0mm/m
For dimension 200, allowance is 200 x 21.0/1000=4.20
For dimension 150,allowance is 150 x 21.0/1000=3.15~3.20
For dimension 100, allowance is 100 x 21.0/1000=2.10
For dimension 80, allowance is 80 x 21.0/1000=1.68~1.70

Draft Allowance:
Assume 1degree taper for external details and 3 degree for internal details.
For 102.1 size the paper required is,
External = 102.1 x tan (1.00) = 1.78675 ~ 1.80
Internal = 102.1 } tan (3.00) = 5.35004 ~ 5.40

Afterproviding for this taper the pattern drawing is as shown in Fig compared to which has been before providing the draft allowance.

Finish or Machining Allowance: Machining allowance of 2 mm is provided
The dimension 81.7 – 2 x 2 = 77.7 Thedimensions 78.1 – 2 x 2 = 74.1
The final dimensions are shown in Fig.1

Precautions:

1.The tools are kept sharp to cut freely without burning and without much pressure to cause chipping.

2.Maintain proper turning angles.

3.Be alert to avoid accidents.

Results:

The Required spilt pattern is prepared.

4. MELTING PRACTICE

AIM :- To observe the melting of metals to prepare the casting.

Material Required And Apparatus :-

Oil furnance, Ladle to sir,Metal.

Specifications :-

Capacity **–** 10 kgs.

Crucible – Graphite of Dia 1 ‘ X height 1.5”

Burner – 0 Number

Blower – 1 HP 2880 rpm.

Oil tank – 100 lts.

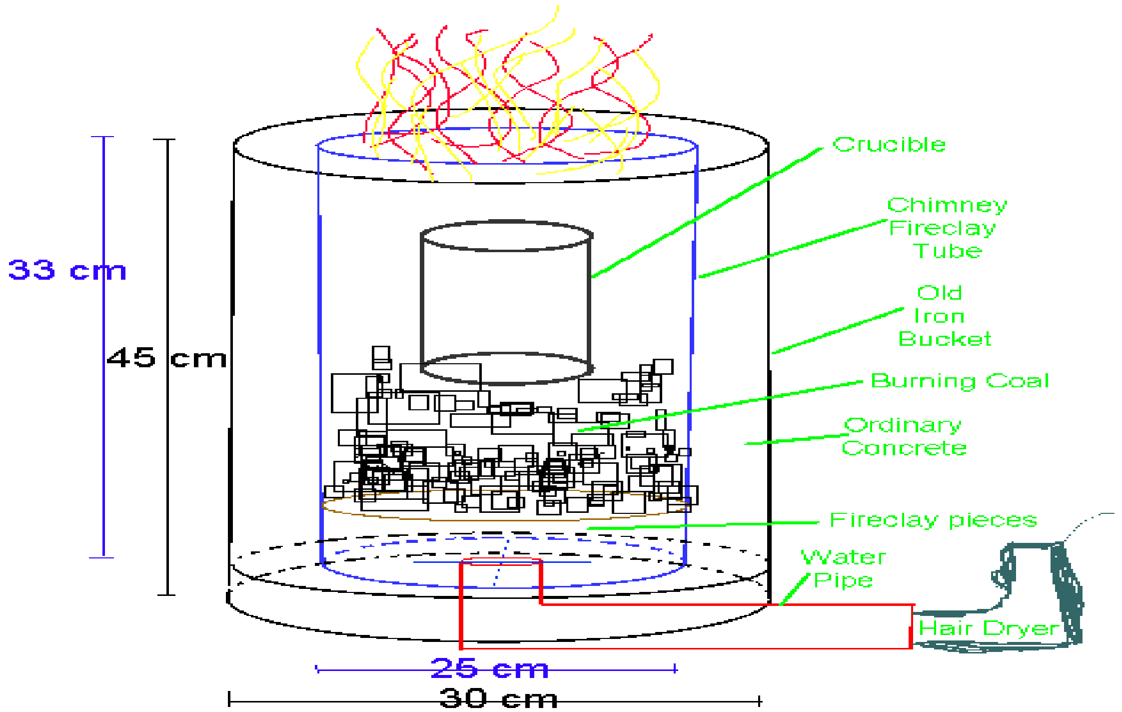
Oil consumption – 2-4 Hrs.

Insulation – Fire bricks

Outer Casting – Mild steel duly painted.

Melting Procedure For Alluminium Alloys :-

The charge materials, chemicals should be free from moisture, oil and corrosion powder and should be preheated before charging .The calculation of charge should be done considering the melting loss of each element in the melting furnace for final desired analysis.



1. The furnace crucible should be clean and red hot for charging.
2. Aluminium alloys get readily oxidized and from dross, using proper covering top with flux and chemicals help to reduce this. Different proprietary chemicals are available for different alloys.
3. Melting should be done under steady conditions without agitation. Stirring is doe to reduce gas pickup.
4. Once melting is complete, degassing using solid chemicals like hexachloro-ethane which evolves chlorine by purging with nitrogen or argon gas is done to remove the dissolved hydrogen. Hydrogen is evolved from moisture.

   $$3H2O+2Al \Rightarrow Al203+6H$$

   Hydrogen absorbed by liquid metal causes serious porosity in casting during solidification.

   Degassing should be done in the temperature range 730 ^{0} C to 750^0 C .
5. Liquid metal after degassing is treated with sodium containing chemicals to improve mechanical properties.
6. Liquid metal once ready should be super heated. Agitated or kept long in the furnace which will cause dressing and gas pickup. Dross should be skimmed properly before pouring.

7. Alloys containing magnesium should be melting carefully as it is highly reacting. Special fluxes and chemical like sulphur are used to inhibit the reactivity and prevent spontaneous ignition , melting loss and dross.

Casting Defects Due To Improper Melting:-

1. **Improper chemical analysis :** Incorrect charge, calculations, including wrong estimates of melting losses, metal recovery, excessive losses due to improper fluxing and slogging operations, improper covering of nonferrous melt causes this defect.
2. **Gassy metal/hydrogen pickup/pinhole porosity :** Unclean melting causes formation and forms cavities inside casting.
3. **Oxygen absorption :** Excessive oxygen furnace operations in atmosphere following oxidation during melting cause this defect. It also causes loss of costly metal added in charge.
4. **Slag inclusions :** Improper fluxing and slag particles to be mixed in the metal being poured. Careless pouring, lip pouring for alloys with fluid slag particles to enter casting.
5. **Cold shut, misrun, unfilled castings :** Low pouring temp, delay in pouring, due to many folds being poured, loss of heat from ladle , due to improper covering failure of ladle opening in the bottom pouring cause premature solidification of metal causing defects.
6. **Sand fusion, metal penetration, rough surface :** excessive pouring temp of liquid causes damage to the casting surface by attacking mould surface.
7. **Sand erosion sand inclusions :** Uncontrolled high pouring rate from ladle into mould leads to erosion of mould/core

PRECAUTIONS:

1. The furnace crucible should be clean and red hot for charging
2. Charge material should be free from oil, moisture etc.,
3. Melting must be done under steady condition to reduce gas pickup.

RESULT:

Melting practice is observed.

II.WELDING

Arc Welding

Introduction to Electric Arc Welding:

Arc welding is joining of two metals together with the aid of a filler rod and heat. In electric arc welding the heat is supplied by electricity from a welding transformer.

A socket supplies electricity with a high voltage to the welding transformer. The transformer changes the electricity to a low voltage which is not harmful and can be used for welding. This electricity however has a high current strength which is essential for obtaining a strong flaming arc.

Electric Arc Welding Equipment:

A-ON/OFF switch, B-Socket, C-PLUG,D-Welding Transformer(A.C),E-Current control, F-Earth clamp, G-Welding table, H-Work piece, I-Electrode, J-Electrode holder, K-Apron, L-Welding shield, M-Gloves, N-Chipping hammer, O-Wire brush

Welding Transformer:

A **welding power supply** is a device that provides an electric current to perform welding. Welding usually requires high current (over 80 amperes) and it can need above 12,000 amperes in spot welding. Low current can also be used; welding two razor blades together at 5 amps with gas tungsten arc welding is a good example. A welding power supply can be as simple as a car battery and as sophisticated as a high-frequency inverter using IGBT technology, with computer control to assist in the welding process. A transformer-style welding power supply converts the moderate voltage and moderate current electricity from the utility mains (typically 230 or 115 VAC) into a high current and low voltage supply, typically between 17 to 45 (open-circuit) volts and 55 to 590 amperes. A rectifier converts the AC into DC on more expensive machines. An Arc Welding machine is shown in Fig 1.

Fig 1: A.C. Arc Welding Equipment

This design typically allows the welder to select the output current by variously moving a primary winding closer or farther from a secondary winding, moving a magnetic shunt in and out of the core of the transformer, using a series saturating reactor with a variable saturating technique in series with the secondary current output, or by simply permitting the welder to select the output voltage from a set of taps on the transformer's secondary winding. These transformer style machines are typically the least expensive.

The trade off for the reduced expense is that pure transformer designs are often bulky and massive because they operate at the utility mains frequency of 50 or 60 Hz. Such low frequency transformers must have a high magnetizing inductance to avoid wasteful shunt currents. The transformer may also have significant leakage inductance for short circuit protection in the event of a welding rod becoming stuck to the workpiece. The leakage inductance may be variable so the operator can set the output current.

Current Controls:

The current is set with a handle or a wheel on the welding transformer. The current and the diameter of the electrode depend on the thickness the material to be welded together, the length of the cables and the size of the whole workplace which may take much of the heat away during welding. Thick electrodes need a higher current than thin electrodes.

Earth Clamp(Ground Clamp):

The ground clamp connects the ground cable to the work. It is an important device because with out proper grounding, one fails to get a stable arc and the required heat for welding. A ground clamp should be designed to provide a strong positive electrical contact, to be capable of easy attachment and detachment and to with stand rough use.

Electrode :

Both welding rods and consumable welding electrodes and filler metal to the weld. In arc welding ,the filler metal is called as electrode. Most electrodes used are mild steel and vary only in the flux covering. Since almost all electrodes are mild steel, welding with them varies only because the flux has different characteristics in our workshop we are using E 6013 electrode

E 6013:

It is widely used on sheet metal when appearance and ease of operation are more important than speed. It is also used for general purpose welding with smaller, limited input, low open-circuit voltage welders. Spatter loss is low, and the beads are bright, smooth and flat with easily removed slag

E---indicates electrode extruded and is used for arc welding

60----indicates the minimum tensile strength

1----indicates the electrode can be used in all positions

3---indicates this electrode has a soft arc,producing only shallow penetration with slightly convex beads.

AC current or either polarity DC current may be used with this electrode to produce medium to high quality deposits

The E 6013 electrode covered with Rutile-potassium flux.Rutile(titanium dioxide)

causes slag formation and potassium (potassium oxalate or potassium silicate) stabilizes the arc.

According to I.S 2879-1975 The mild steel electrode core wires have the following

% of elements in composition

Carbon--------------0.1%

Silicon--------------0.03%

Manganese-----------0.38 to 0.62%

Sulphur---------------0.03%

Phosphorus------------0.03%

Copper----------------0.15%

Iron------------------remaining%

Choosing an electrode:

Basically an electrode should be chosen by looking at these qualities of the welding job:

A) Properties of the base metal

B) position of the joint

C) Type of joint

D) Amount of welding required

E) Tightness of the joint's fit-up

F) Type of welding current available

Electrode Holder:

The electrode holder is used to grip the electrode and provide it with the welding current. A holder can be partly or fully insulated. A properly designed holder is light in weight, grips the electrode securely in position receives and ejects the electrodes easily, and resists over heating in continuous use. Holders are available in various sizes according to their current- carrying capacities, their weight increasing with increasing capacity. Electrode holders should never be immersed in water for cooling.

Apron:

This protects the cloths of operator from dirt and spatter. It is made of soft leather(cow).

Welding shield:

Arc welding demands that a welder use a hand shield or a head shield. The head shield also called a helmet, is used only when the welder needs his other hand to be free while welding. Both the hand shield and head shield are meant to protect the face, head and eyes from the blinding rotation of the arc and hot spatter and are provided with colored filter glasses through which the arc must be observed

Gloves:

These are essential to protect hands. It is made of leather

Chipping hammer:

The welder needs a chipping hammer to remove the slag which covers the deposited weld bead before the next bead is laid. Unless the slag is completely removed,the finished weld joint is likely to have slag inclusions. The chipping hammer is made of hardened steel and is usually double-ended. One end is shaped like a chisel for general chipping, while the other end has a sharp point to deslag the corners.

Wire brush:

After chipping, the weld bead needs to be brushed vigorously with a wire brush to remove the last traces of slag. The wire brush is also used to remove rust and dirt from joint surfaces before starting to weld.

Cables:

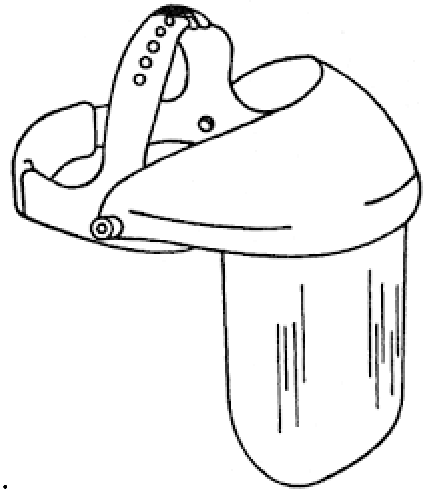
Large, heavy cables carry the current needed for good working heat. These are connected to the positive and negative terminals on the welding machines.

Most cables are made of woven, hairlike strands of copper wire covered with insulated rubber. The rubber allows the woven wire to flex, protects it during use under rough conditions, and insulates it from shorts. Copper connectors fasten the free end of each cable to different kinds of holders

Face Shield:

A face shield is used to protect the eyes and face from the rays of the arc and from spatter or flying particles of hot metal. It is available either in hand or helmet type. The hand type is convenient to use, where ever the work can be done with one hand. The helmet type, though not comfortable to wear, leaves both hands free for the work

Shields are made of light weight non-reflecting fibre and fired with dark glass to filter out the harmful rays of the arc. A cover glass is fitted in front of the dark lens to



protect it from spatter.

Weld Joints

Figure shows some common types of weld joints.Wherever possible,it is better to weld by placing the parts in the flat

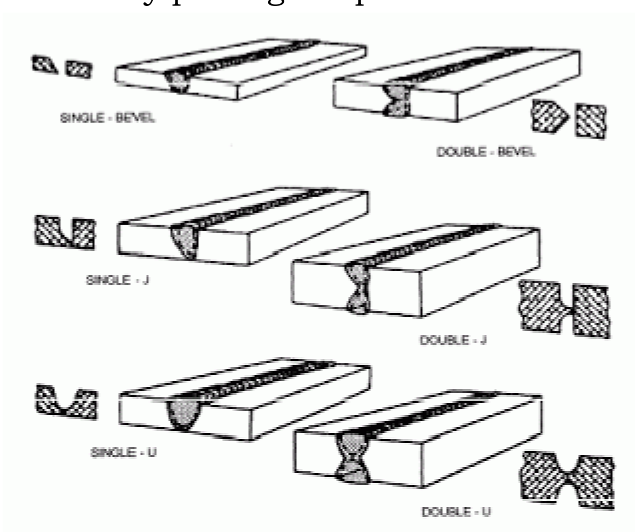
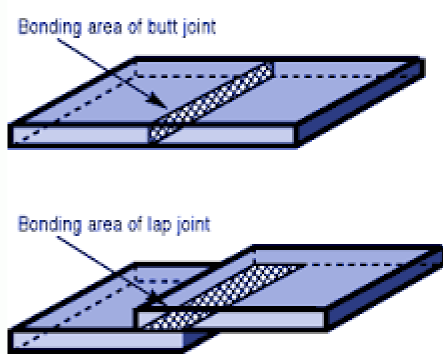
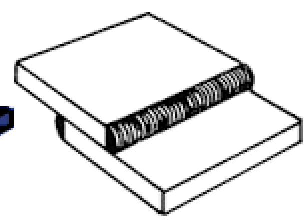
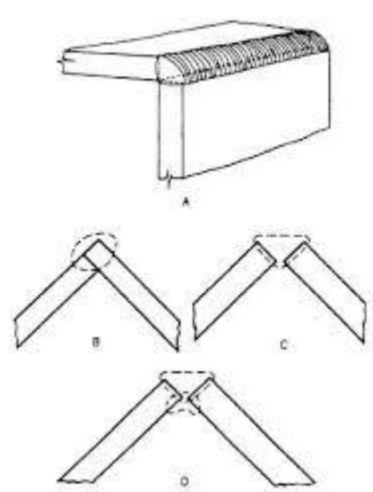


Figure 3-24.—Additional types of groove welds.







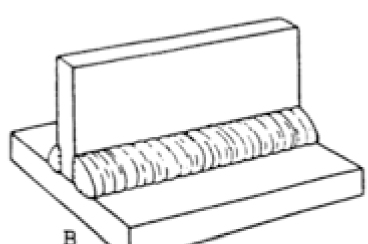


Figure 6-22. Tee joint - single pass fillet weld.

Preparation of work

Before welding, the work pieces must be thoroughly cleaned of rust, scale and other foreign materials. Thin pieces of metal are generally welded without beveling the edges. However, thick work pieces should be beveled to ensure adequate penetration and fusion of all parts of the weld. But, in either case the parts to be welded must be separated slightly to allow better penetration of the weld

Electrodes

Filler rods used in arc welding are called electrodes. They are generally made of a rod of alloying elements suitable for the job, coated with a flux. They are specified y the diameter in SWG and length, apart from the brand and code names, indicating the purpose for which they are most suitable

Electrode holder

The electrode holder is connected to the end of the welding cable and holds the electrode. It should be light, strong and easy to handle and should not become hot while in operation. Figure shows one type of electric holder. The jaws of the holder are insulated, offering protection from electric shock.

Ground clamp

It 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 be strong and durable and give low resistance connection.

<u>Chipping Hammer and Wire Brush</u>

A chipping hammer is used for removing slag formationon welds. One end of the head is sharpened like a cold chisel and the other, to a blunt, round point. A wire brush is used for cleaning and preparing the work for welding.

Safety Rules:

Before starting to weld, you must be aware of the dangers involved

A) The bright light of the arc

B) Hot metal and flying sparks

C) Electric shocks

Precautions:

1) Use a proper welder's eye shield with dark glass when you look into the arc. Never use regular safety goggles instead. They do not give your eyes and your face enough protection

2) If you do not use the eye shield, your eyes will become very painful. Do not your eyes when this happens. If necessary ask for medical help.

3) Always wear safety goggles when you remove slag from a weld with a chipping hammer

4) Keep your skin covered as far as possible. Radiation from the bright light of the arc can cause skin injuries. Protect your skin against flying sparks. Wear leather welding area. Don't carry matches or a lighter in your pocket

5) Keep electric cables in good condition. Repair the insulation if it is damaged.

6) Do not use welding equipment in wet or damp areas, it will increase the danger of electric shocks

7) Shut off the electricity when you stop welding. Do not forget this in case you use your own power unit.

8) Never works on the welding transformer unless you hae pulled the plug out of the socket.

9) Be extremely careful when you weld fuel tanks or containers. Take the necessary precautions.

5 SINGLE V-BUTT JOINT

Aim: To make a single V-butt joint, using the given two M.S. pieces and by arc welding.

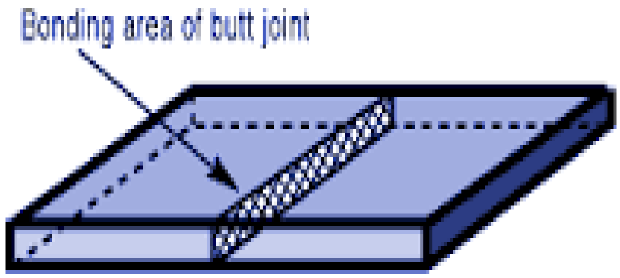
Tools and Equipment required: Rough and smooth files, protractor, arc welding machine (transformer type), mild steel electrode and electrode holder, ground clamp, tongs, face shield, apron and chipping hammer.

Sequence of operations:

1. The given M.S pieces are thoroughly cleaned of rust and scale.
2. One edge of each piece is beveled, to an angle of 30°, leaving nearly $1/4^{th}$ of the flat thickness, at one end.
3. The two pieces are positioned on the welding table such that, they are separated slightly for better penetration of the weld.
4. The electrode is fitted in the electrode holder and the welding current is set to a proper value.
5. The ground clamp is fastened to the welding table.
6. Wearing the apron and using the face shield, the arc is struck and holding the two pieces together, first run of the weld is done to fill the root gap.
7. Second run of the welding is done with proper weaving and with uniform movement. During the process of welding, the electrode is kept at 15° to 25° from vertical and in the direction of welding.
8. The scale formation on the welds is removed by using the chipping hammer.
9. Filling is done to remove any spatter around the weld.

Precautions:

1. Edge preparation should be done carefully.
2. Before welding ensures that the surfaces are extremely clean.
3. While welding always use face shields or goggles.



Result: The single V-butt joint is thus made, using the tools and equipment as mentioned above.

6 LAP JOINT

Aim: To make a Lap joint, using the given two M.S. pieces and by arc welding.

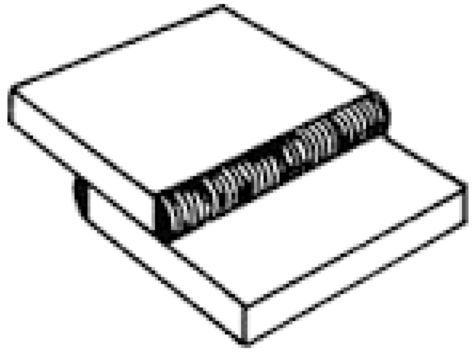
Tools and Equipment required: Rough and smooth files, protractor, arc welding machine (transformer type), mild steel electrode and electrode holder, ground clamp, tongs, face shield, apron and chipping hammer.

Sequence of operations:

1. The given M.S pieces are thoroughly cleaned of rust and scale.
2. Given 2 M.S plates are filled at an angle of 45° at 2 surfaces to be joined.
3. The electrode is fitted in the electrode holder and the welding current is set to a proper value.
4. The ground clamp is fastened to the welding table.
5. Connections to be given such that electrode-negative and work piece positive.
6. Wearing the apron and using the face shield, the arc is struck and holding the two pieces together, first run of the weld is done to fill the root gap.
7. Second run of the welding is done with proper weaving and with uniform movement. During the process of welding, the electrode is kept at 15° to 25° from vertical and in the direction of welding.
8. The scale formation on the welds is removed by using the chipping hammer.
9. Filling is done to remove any spatter around the weld.

Precautions:

1. Edge preparation should be done carefully.
2. Before welding ensures that the surfaces are extremely clean.
3. While welding always use face shields or goggles.



Result: The single V-butt joint is thus made, using the tools and equipment as mentioned above.

7. SPOT WELDING

Aim: To study the effect of the current on weld strength using spot welding process

Equipment: Spot welding machine

Material Required: Two metal pieces of size 4” X 2”

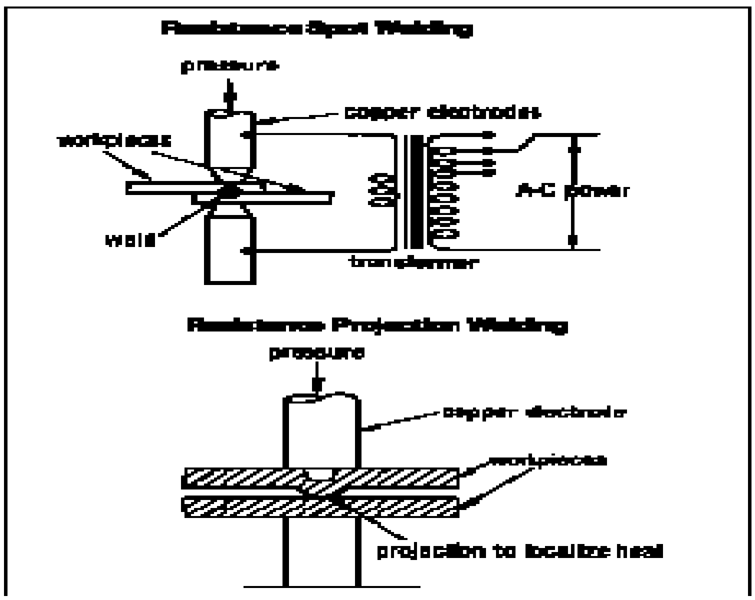
Description of the Equipment:

A typical resistance spot welding machine essentially consists of two electrodes, out of which one is fixed. The other electrode is fixed to a rocker arm (to provide mechanical advantage) for transmitting mechanical force from a pneumatic cylinder. This is the simplest type of arrangement. The other possibility is that of a pneumatic or hydraulic cylinder being directly connected to the electrode without any rocker arm. A portable spot welding machine is shown in figure.

For welding large assemblies such as car bodies, portable spot welding machines are used. Here the electrode holder and the pneumatic pressurizing system is present in the form of a portable assembly, which is taken to the place, where the spot is to be made. The electric current, compressed air and the cooling water needed for the electrodes is supplied through cable and hoses from the main welding machine to the portable unit.

In spot welding, a satisfactory weld is obtained when a proper current density (A/Sqmm) is maintained. The current density depends on the contact area between the electrode and the workpiece. With the continuous use, if the tip becomes upset and the contact area increases, the current density will be lowered and consequently weld is obtained over a large area. This would not but able to melt the metal and hence there would be no proper fusion.

A resistance welding schedule is the sequence of events that normally take place in each of the welds. The events are the squeeze time that is the time required for the electrodes to align and clamp the two workpieces together under them and provides the necessary electrical contact. The weld time is the time of the current flow through the work pieces till they are heated to the melting temperature. The hold time is the time whne the pressure is to be maintained on the molten metal without the electric current. During this time, the pieces are to be forge welded. The off time is time during which, the pressure on the electrode is taken off so that the plates can be positioned for the next spot. The off time is not normally specified for simple spot welding, but only when a series of spots are to be made in a predetermined pitch.



PROCEDURE:

1. Switch on the machine and set the current in the machine to 2 Ampere.
2. Set the timer to two seconds
3. Over lap the two metal pieces to the requires size and place them between the two electrodes.
4. Apply pressure by foot on the lever such that two electrodes come into contact if the over lapped metals.
5. After 2 seconds remove the pressure on the lever slowly.
6. Now the joint is ready for use.

7. Repeat the same procedure at various amperes.
8. Test the strength of the joints using universal testing machine.

PRECAUTIONS:

1. Ensure that the electrodes should not be touched.
2. Don’t touch the welded portion by hand immediately after the welding is done.

Result:

Effect of current on strength of spot weld is studied.

8. TIG WELDING

AIM:

To sturdy the effect of arc current on weld strength and heat effected zone in TIG welding.

EQUIPMENT AND MATERIAL REQUIRED:

TIG welding machine ADORTIG 11/20 (input supply 230 volts, single phase, 50 hertz frequency, maximum welding current @ 60% duty cycle AC/DC is 110/200 amps), bench vice, universal testing machine, metallurgical microscope, m.s plates of 250*50*5mm.

TOOLS REQUIRED:

Hack saw, chipping hammer, wire brush, safety goggles, hand gloves, face shield, files.

DESCRIPTION OF EQUIPMENT:

Tungsten inert gas (TIG) welding or gas tungsten arc welding (GTAW) isan inert gas shielding arc welding process using non consumable electrode. The electrodes may also contain 1% to 2% thoria (thorium oxide) mixed along with the core tungsten or tungsten with 0.15% to 0.40% zirconia (zirconium oxide). The pure tungsten electrode are less expensive but carry less current. The thoriated tungsten electrodes carry high currents and are more desired because they can strike and maintain a stable arc with relative case.

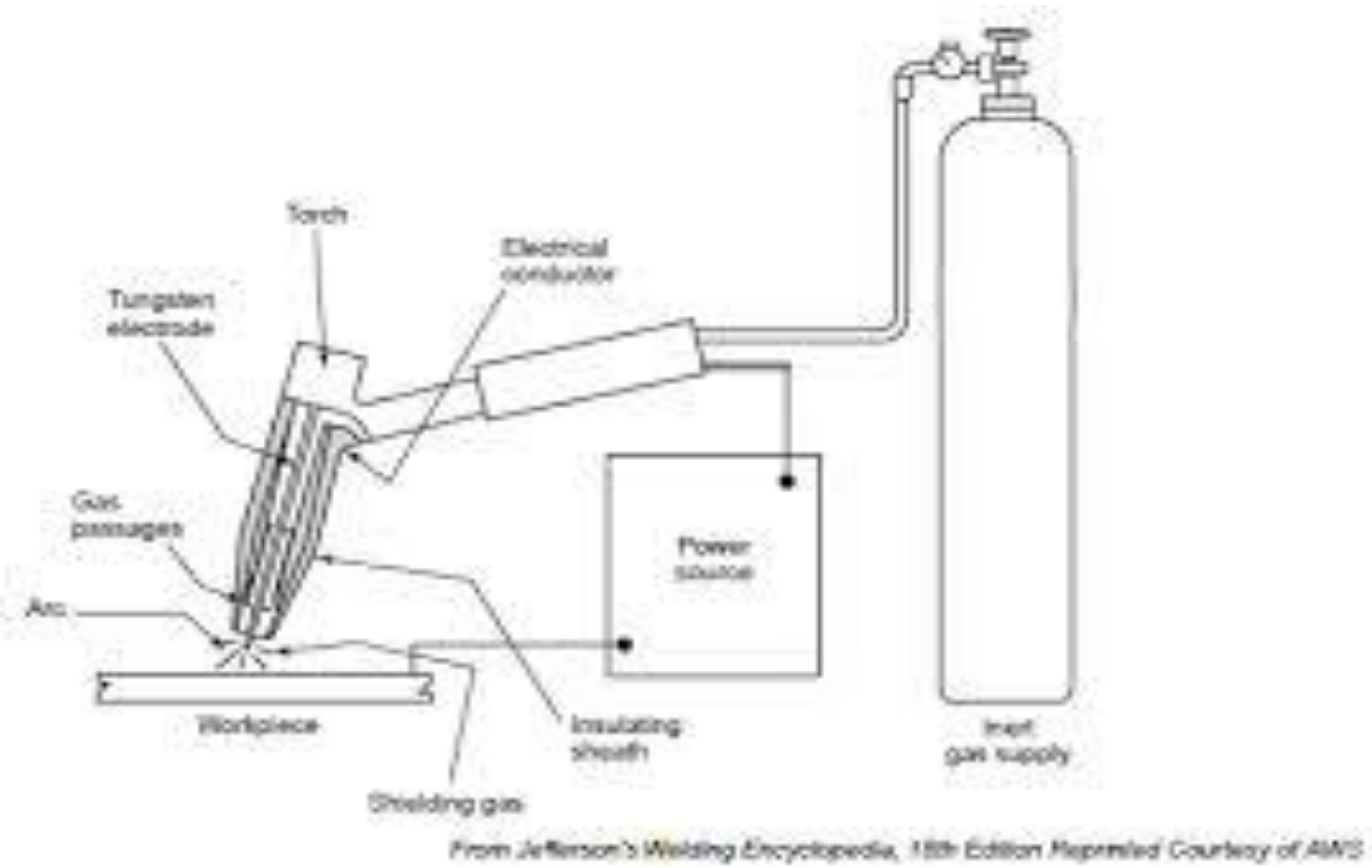


Fig 1: TIG Welding Set Up

They zirconia added tungsten electrodes are better than pure tungsten but inferior to thoriated tungsten electrodes

A typical tungsten inert gas welding setup is shown in fig: 14.1. it consists of a welding torch at the centre of which of which, is the tungsten electrode. The inert gas is supplied to the welding zone through the annular path surrounding the tungsten electrode to effectively displace the atmosphere around the weld puddle. The smaller weld torches may not be provided with any cooling devices for the electrodes, as in fig: 1 but larger ones are provided with circulated cooling water.

The TIG welding process can be used for the joining of a number of materials though the most common ones are aluminium, magnesium and stainless steel. The typical combination of TIG set ups to be used with these and other metals are presented in table 1

MATERIAL	ELECTRODES	POWERSUPPLY USED	PREFERRED SHIELDING GAS
Aluminium	All types	AC	ARGON
Stainless steel	Thoriated tungsten	DECEN	ARGON
Magnesium	Tungsten	AC	ARGON
Deoxidized copper, monel high carbon steel	Thoriated tungsten	DECEN	ARGON
Cast iron	Thoriated tungsten	AC or DCEN	ARGON

TABLE: 1

PROCEDURE:

1. Given two ms plates are filled at an angle of 45 degrees at the surfaces to be joined.
2. Beads on plates are laid on given plates by using various currents by selecting at least 5 current values.
3. After welding the beads are cross sectioned and polished, etched with two percent initial solution.
4. Now the beads are viewed under the microscope of magnification factor x 10 to observe heat effected zone.
5. The strength of weld joints is found using a tensile testing machine.
6. The observation are recorded in tabular column and plotted for analysis.

RESULT: Required TIG welding operation was performed**.**

9.BRAZING

AIM: To make brazed joint on the two given sheets.

Equipment: Oxygen Cylinder, Acetylene Tank, Brazing Torch, Brazing rod and fluxes.

Theory: Brazing is a metal joining process in which two or more metal items are joined together by melting and flowing a filler metal into the joint, the filler metal having a lower melting point than the adjoining metal. Brazing differs from welding in that it does not involve melting the work pieces and from soldering in using higher temperatures for a similar process. The filler metal flows into the gap between close-fitting parts by capillary action. The filler metal is brought slightly above its melting (liquids) temperature while protected by a suitable atmosphere, usually a flux.. It then flows over the base metal (known as wetting) and is then cooled to join the work pieces together. It is similar to soldering, except the temperatures used to melt the filler metal are higher for brazing. A major advantage of brazing is the ability to join the same or different metals with a considerable strength.

Brazing, which utilises a wide variety of heat sources, is often classified by the heating method used. To achieve brazing temperature, some methods heat locally (only the joint area), others heat the entire assembly (diffuse heating). The type of brazing method used here is torch brazing to join two sheets.

Torchbrazing

In this method, the heat required to melt and flow filler metal is supplied by a fuel gas flame. The fuel gas can be acetylene, hydrogen, or propane and is combined with oxygen or air to form a flame. This process is readily automated and requires low capital investment. Torch brazing requires the use of a flux, so a post-braze clean is often required.

Procedure:

1. It must be ensured that the proper clearance and fit is to be maintained between two base metals.
2. The metals to be cleaned properly before brazing
3. Release of gases through cylinders like oxygen and acetylene
4. Adjust the flame in nozzle of Gas torch.
5. Arrangement of flux before brazing process begins.
6. A fixture is to be arranged for correct brazing
7. Brazing process starts
8. Cleaning of the new brazed joint

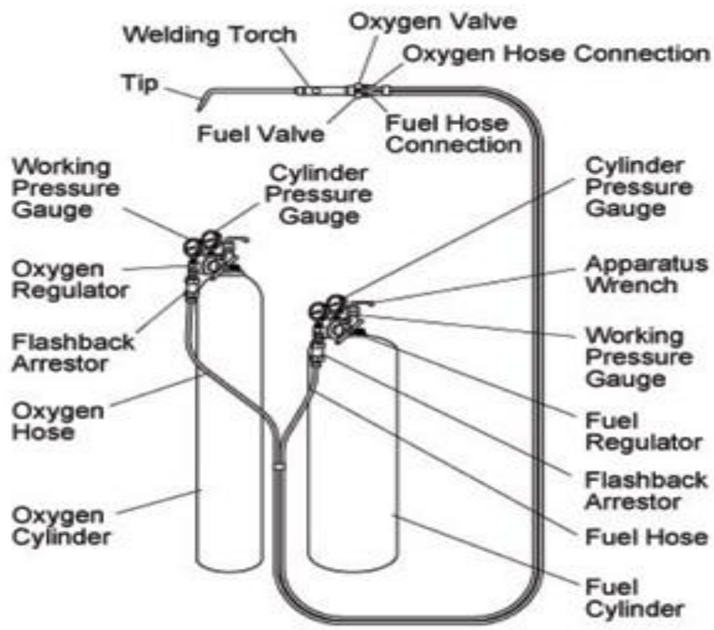


Fig. Brazing set up.

Precautions:

1. Before handling the gases, see that there is no leakage from all the cylinders
2. Safety goggles are to be used for doing brazing
3. After completion of brazing, the entire cylinder valves to be closed.

Result: The brazed joint is done on the suitable and given work sheets.

III.PRESS WORKING OPERATIONS

10. FLY SCREW PRESS

AIM:

To make blanking and piercing operations on a given work piece.

APPARATUS:

Fly screw press, work piece.

DESCRIPTION:

Press work is defined as a method of mass production involving the cold working of metals usually in form of thin sheet (or) strip. This makes use of large forces by press tools for a short time interval which results in cutting (or) shaping the sheet metal.

Figure (1) shows a fly press and its different parts.

1. A RAM (or) SLIDE which has a punch fitted at its bottom moves up and down and is powered from a crank (or) eccentric driver by an electric derive motor.
2. FLY WHEEL stores energy and delivers it at the working stroke.
3. PUNCH will do the necessary operation during the downward stroke of the Ram.
4. DIE will hole the work piece and produce finished work piece. Die is of progressive type which is than in Fig(2).
5. A progressive die is a multistation die which perform number of sheet metal operations at two (or) more stations during each stroke of the press.

THEORY:

Blanking is defined as the operation of producing cutout blanks. Cutout blank is required portion where as the remaining part is scrap. Piercing is defined as production of cutting holes on already cutout blanks in this operation. Hole is the required portion and remaining portion of this operation is shown in fig. 2

Fig : 1 Fly Screw Press

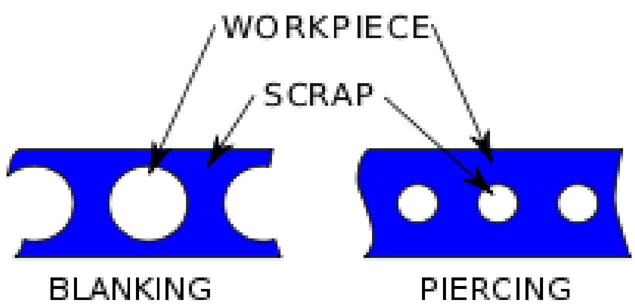


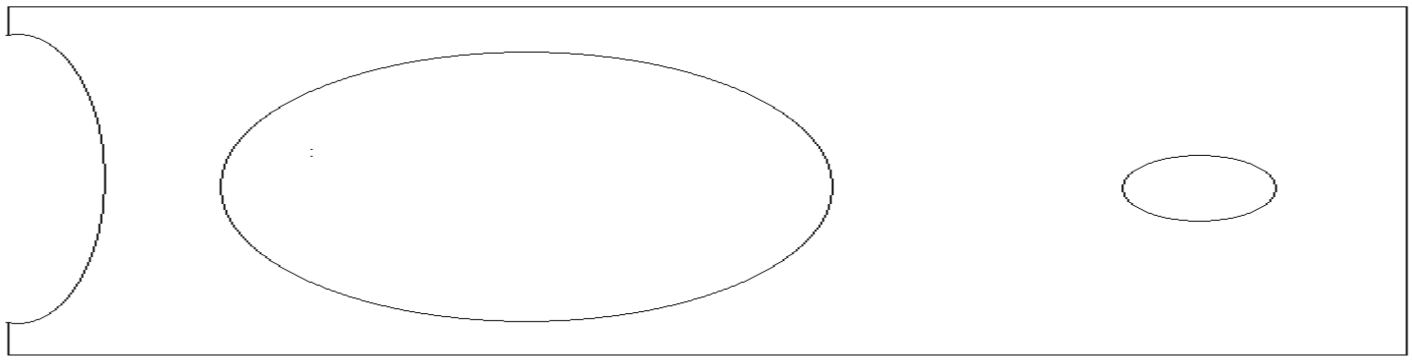
Fig: 2 Blanking versus piercing

PROCEDURE:

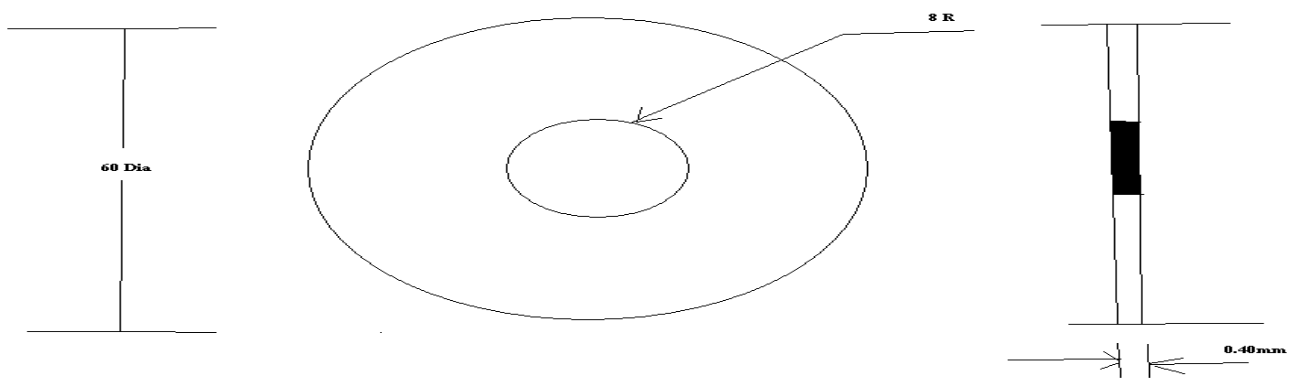
1) Keep the work piece in the first work station and at progressive die.
2) Operate fly wheel so that the ram pushed the punch in forward direction.
3) Operate blanking punch to cut the blanks at first work station.
4) After the blank is cutout more the work piece to next work station.
5) Then operate punching on piercing porch to cut the holes.
6) Remove the finished work piece from the die.

PRECAUTIONS:

Operate fly wheel in such a way that the material should not cling to punch and carried way along with the porch.



STRIP STOCK



Finished Blank

RESULT:

The required washer from work piece is made by fly screw press.

11. HYDRAULIC PRESS

AIM:

To make mosquito coil stand/washer/lid using Hydraulic press.

EQUIPMENT:

Hydraulic press, compound die, progressive die, deep drawing die.

RAW MATERIALS:

Mild steel: CR-SHEET T.K. (0.4) mm.

DESCRIPTION OF THE EQUIPMENT:

Presses are classified in various ways. They may be classified according to

i) Source of power
ii) Method of actuation of the rams (slides)
iii) Number of Slides
iv) Types of frames
v) The type of work for which the press has been designed.

SOURCE OF POWER:

Two kinds of sources of power supply to the ram: Mechanical and Hydraulic.

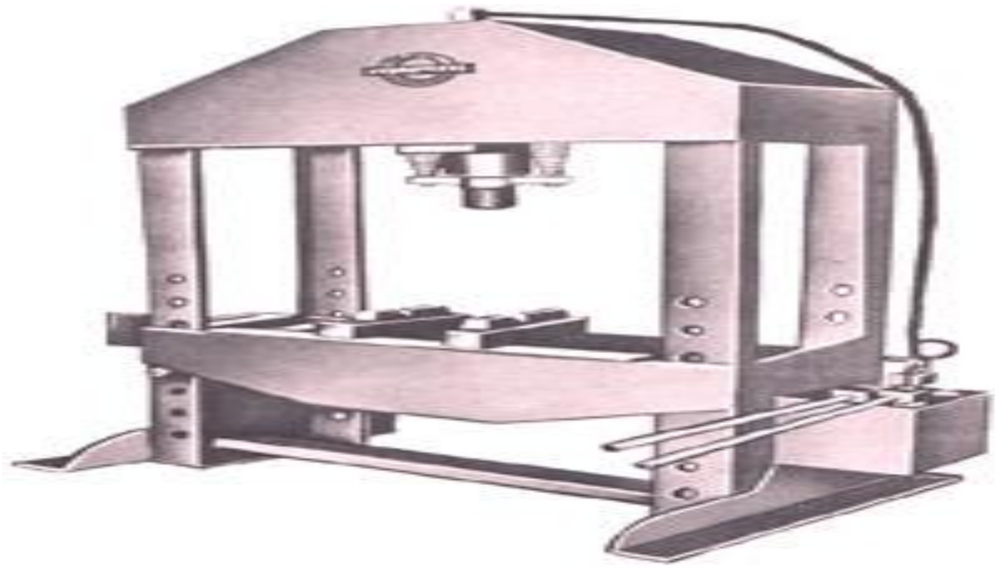
Mechanical presses, the energy of fly wheel is utilized which is transmitted to the work piece by gears, cranks, eccentrics or levers.

The fly wheel rotates freely on the crank shaft and is driven from an electric motor through gears or V-Belts. The motor runs continuously and stores energy in the fly wheel. When the operator presses a foot treadle or actuates a button, the clutch gets engages and the fly wheel is connected to the crank shaft. Drive shaft starts rotating and the stored up energy in the fly wheel is transmitted to the ram on its downward stroke. The clutch to engage and disengaged the fly wheel to the drive shaft can be; a jaw clutch and the air operated clutch or an electromagnetic clutch. In manually operated mechanical presses, the clutch is disengaged to each cycle. But in automatic presses in which the metal strip is fed to the die automatically, there is no need of single stroke clutch, disengaging mechanism and the ram moves up and down continuously. These presses can be classified as plain and geared press, the fly wheel is carried on an auxiliary shaft which is connected to the main shaft. Through one or more gear reduction, depending upon size and energy needed. In this arrangement, the fly wheel stores considerably more energy than the plain as its speed is higher than the main drive shaft.

In Hydraulic press, the ram is actuated by oil pressure on a piston in a cylinder.

Mechanical presses have following advantages over the hydraulic presses.

1. Run faster
2. Lower maintenance cost.
3. Lower capital cost.



ADVANTAGES OF HYDRAULIC PRESSES ARE:

1. More versatile and easier to operate
2. Tonnage adjustable of zero to maximum
3. Constant pressure can be maintained throughout the stroke.
4. Force and speed can be adjusted throughout the stroke.
5. Safe as it will stop at a pressure setting.
6. The main disadvantages of hydraulic press are that it is slower than a mechanical press.

A press is rated in tones of force; it is able to apply without under strain. To keep the deflections small, it is a usual practice to choose a press rated 50 to 100 % higher than the force required for an operation.

PROCEDURE:

1. Set the compound die or progressive die or deep drawing die in the required position.
2. Switch on the motor to start the machine.
3. Press the MS sheet into the progressive die / compound die. In case of deep drawing.
4. Apply injection pressure using direction control valve.

5. The plunger punches the sheet into the mosquito coil stand / washer lid shape.
6. Release injection pressure.
7. Take out the finished product from the die.
8. Switch off the motor.

PRECAUTIONS:

1. Do not apply too high injection pressure
2. Proper lubrication must be done between moving parts of die and press.
3. Operate the hydraulic press carefully.

RESULT:

Mosquito coil stand / washer / lid is prepared using corresponding die un-hydraulic press.

PROCESSING OF PLASTICS

GENERAL:

Plastics belong to the family of organic materials. Organic materials are those materials which are directly from carbon. They consist of carbon chemically combined with hydrogen, oxygen and other non-metallic substances, and their Structure, in most cases, are fairly complex. The large and diverse organic group Includes the natural materials: wood, coal, petroleum, natural rubber, animals fibers and food, which have biological origins. Synthetics include theY are group of solvent, adhesive, synthetic fibers, rubber, plastics, explosive, Lubricants, dyes, soaps and cutting oils etc. which have no biological origins. Of them, plastics and synthetic rubber are termed as “polymer”

POLYMERS

The team “polymer” is the derived from the two Greek words: poly, meaning “many”, and meros meaning “parts” or “units”. Thus polymers are composed of a large number of repeating units (small molecules) Called monomers. The monomers are joining together end-to-end in a polymerization reaction. A polymer is, therefore , made up of thousands of monomers jointed together to form a large molecule of colloidal dimensions are called macromolecule. The unique characteristics of a polymer is that each molecule is either a long chain or a network of repeating unit all covalently bounded together. polymers are molecular materials and are generally non crystalline soilds at originary temperature, but pass through a viscous stage in course of their formation when, shaping is readily carried out.

The most common polymers are those made from compounds of carbon, but Polymers can also be made from inorganic chemicals such as silicates and silicones.

The naturally occuring polymers include: protein, cellulose, resins, starch, Shellac and lignin. They are commonly found in leather, fur, wool, cotton, silk, rubber, Rope, wood and many others. There are also synthetic polymers such as polyethylene, polystyrene, nylon, terylene, dacron etc., termed under plastics fibers and elastomers. Their properties are superior to those of the naturally occuring counterparts.

POLYMERIZATION

The process of linking together of monomers, that is, of obtaining macromolecules is called "polymerization".

PLASTICS

Polymers can be divided into three broad divisions: plastics, fibers and elastomers.

(Polymers of high elasticity , for example, rubber) .synthetic resins are usually referred to as plastics. Plastics derive their name from the fact that in a certain phase of their manufacture, they are present in a plastic stage (that is, acquire plasticity), which makes it possible to imparts any desired shape to the product

Plastics fall into a category known chemically as high polymers.

Thus, "plastics" is a team applied to compositions consisting of a mixture of high molecular compounds (synthetic polymer) and fillers, plasticizers, stains and pigments, lubricating and other substance. Some of the plastics can contain nothing but resin (for instance, polyethylene, polystyrene).

Type of plastics

Plastics are classified on the broad basis of whether heat causes them to set (thermosetting) or causes them to soften and melt (thermoplastic).

1. **Thermosetting plastics**:
   These plastics under go a number of chemical changes on heating and cure to infusible and practically insoluble articles. The chemical change is not reversible thermosetting plastics do not soften on reheating and can be reworked. They rather become harder due to completion of any left-over polymerization reaction. Eventually, at high temperatures, the useful properties of the plastics get destroyed. This is called degradation. The commonest thermosetting plastics are: alkyds, epoxids, melamines, polyesters, phenolics, and ureas.
2. **Thermoplastic plastics**:
   There plastics soften under heat, harden on cooling, and can be resoftened under heat. Thus they retain their fusibility, solubility and capability of being repeatedly shaped. The mechanical properties of these plastics are rather sensitive to temperature and to sunlight and exposure to temperature may cause thermal degradation. Common thermoplastic plastics are : acrylics, poly tetra fluoro ethylene (PTFE), polyvinyl chloride (PVC), nylons, polyethylene, polypropylene, etc.
   Thermosetting plastics are cross-linked polymers and the thermo-plastics are linear

and branched-linear polymers. The method of processing a plastics is determined largely by whether a plastic is thermosetting or thermoplastic.

Properties of plastic:

Their great variety of physico-chemical and mechanism properties, and the ease with which they can be made into various articles have found plastic their wide application in the engineering and other industries.

1. Their comparatively low density (1 to 2 g/cm^3), substantial mechanical strength higher strength –to-weight ratio and high anti friction properties have enabled pastics to efficiently used as substitute for metals, for example, non-ferrous metals and alloys-bronze, babbit etc., for making bearing.
2. With certain special properties (silent operation, corrosion resistance etc.), plastic sometimes replace ferrous metals.
3. From the production point of view, their main advantage is their relatively low melts points and their ability to flow into a mould.
4. Simple processing to obtain machine parts. Generally there is only one product operation required to convert the chemically manufactured plastic intlo a finished article.
5. In mass production, plastics substituted for ferrous metals allow the production cost be reduced by fractor of 1.5 to 3.5 and for non-ferros metals by a fractor of 5 to 20.
6. Good damping capacity and good surface finish of the product.
7. The high heat and electric insulation of plastic prmits them to be applied and electrical engineering industries as dielectrics and as substituts for porcelain, ebonite, mica, natural rubber, etc.
8. Their good chemical stability, when subjected to the action of solvents and ceroxidizing agents, water resistance, gas and steam-proof properties, enable pastics to be used as valuable engineering materials in the automobile and tractor, ship building and other industries.

12. INJECTION MOULDING

Aim:

To prepare a plastic product using injection moulding machine.

Equipment:

Injection Moulding Machine

Material Required:

High grade Poly ethylene

Description of The Equipment:

Hydraulic Plastic Injection Moulding machine, Model JIM-1HD has been designed for moulding variety components upto 45 Gms capacity in polystyrene. The machine is robustly built to ensure consistent high quality and volume production of precision components. Operator fatigue due to injection process is completely eliminated by use of hydraulic power for both the injection and releases operations.

Locking Unit:

This locking is made by hydraulic cylinder.

Injection Unit:

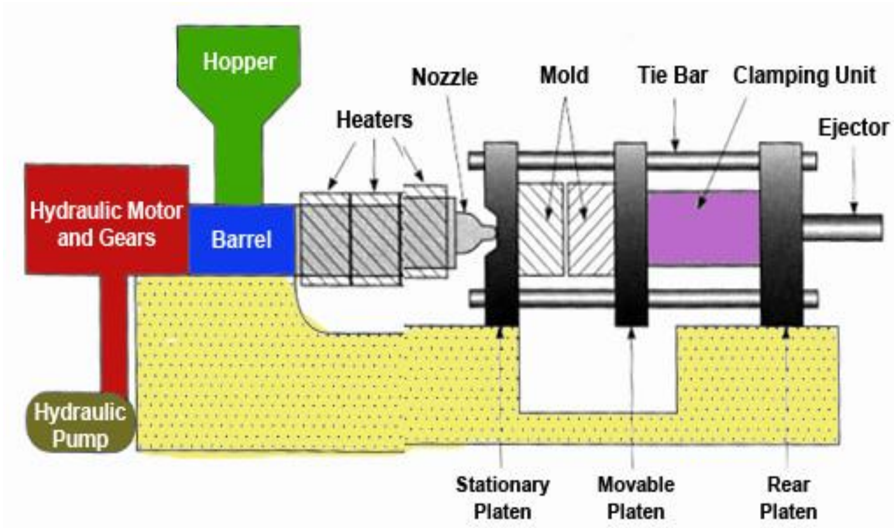
Injection Unit consists of two guide rods, nuts, top and bottom plates with injection cylinder and barrel. Injection cylinder is designed to develop 3 Tons load. Barrel diameter 30 mm is attached with the machine as standard.

Hydraulics:

Hydraulic pump is driven by 3 HP Induction motor for a rated delivery of 14 lp, at 1440 rpm and at 80 kg/cm2. The maximum pressure in the hydraulic system is present in our works and is not to be altered. The oil tank capacity is 60 litres. All hydraulic system manufacturers safety precautions are provided to hydraulic system by using section strainer, which will prevent the contamination entering into the system.

Oil Cooler:

Oil cooler provided to keep the oil temperatures below 50oC which will give more life to hydraulic oil in continuous use.



Electricals: Electrical control panel with automatic blind temperature controller is fixed on the right hand side of the machine for clear viewing of the temperature and for easy to operate the switches. Designed with safety measure, which will protect the motor from over load.

Working Procedures:

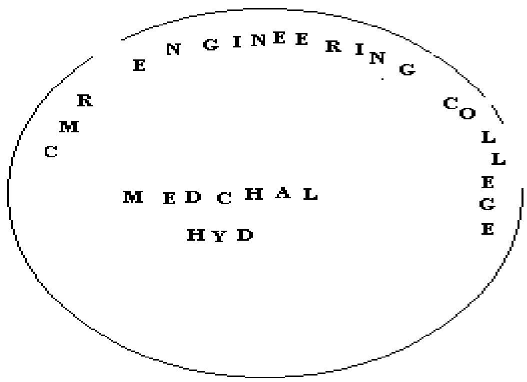
Injection Moulding makes use of heat softening characteristics of thermo plastic materials. These materials soften when heated and re harden when cooled. No chemical change takes place when the material is heated or cool. For this rason the softening and rehardening cycle can be repeated any no. of times.

1. The granular moulding material is loaded hopper where it is metered out in a heating cylinder by a feeding device.
2. The exact amount of material is delivered to a cylinder, which is required to fill the mould completely.
3. Set the die in position Provide spacing plates if necessary. Clamping the Die using hydraulic operate ram.
4. Set the injection pressure by rotating (clockwise) the regulator knob to suit the requirement of moulding the container.
5. Switch on the heater. Set the required timings to the timers, for top and middle.

Heater, Set the temperature by adjusting automatic temperature controller to control the bottom heater. Allow sufficient time to stabilizer. When temperature reached, operate the hand lever valve to inject the material.

1. Apply injection pressure on the heated material using plunger rod.
2. The injection ram pushes the material into the heating cylinder and in doing so pushes a small amount of heated material out of the other end of the cylinder through the nozzle and screw bushing and into the cavity of closed mould.

3. The material is cooled in a rigid state in the mould.
4. Release the injection pressure. In clamp the Die suing hydraulic operated ram.
5. The mould is then opened and piece is ejected out.



Result:

Required product is made using injection moulding process.

13. BLOW MOULDING

Aim:

To prepare a bottle of 200ml using blow mouling machine

Equipment: Blow moulding machine.

Operating instruction:

a) Install the machine on leveled strong flooring near the compressor (within 2 meters)
b) The machine must be placed in a positive where all parts are accessible readily.
c) Check for loose any loose electrical connection with the help of certified electrician and with the electrical circuit enclosed.
d) Fill the lubricator with SAE 20 grade oil to the level indicated. The lubrication has been set to allow one drop of oil for every 5 strokes of air cylinder (oil) drop is factory set, no need to adjust.
e) Connect the air filter to the compressor by rubber/nylon hose (Min inside dia 10mm), pressure with standing capacity 20kg/cm^2
f) Set the pressure switch in the compressor as per the compressor manual to switch on 7 kg/cm^2 pressure & switch off at 10kg/cm^2 (NOTE: The air pressure should not exceed 10cm^2).
g) Set air pressure in machine by adjusting the injection & release regular (18).
h) Set release pressure 2kg/cm^2 by adjusting release regulator.
i) Operate the hand lever valve (13) and check for smooth functioning of plunger.
j) Set the blow pressure in regulator (15) and operate the hand lever valve (14) to check flow of air throw blow nozzle.
k) Eletrical connection should be given as indicated on the main plug phase, neutral and earth.
l) Proper earting should be done.
m) Check the incoming voltage (230VAC, 50Hz) now the machine is ready for operation.

Working principle: The process is applied to only thermo plastics, which are used for producing hollow objects such as bottle, and flow table objects by applying air pressure to the sheet material when it is in heated and in soft pliable condition. Blow moulding can be accomplished in two manners, one is direct blow

moulding and other indirect blow mouling.in the former case, a measured amount of material in form of tube is either injected or extruded in a split cavity die. The split mould is closed around the tube, sealing off the lower end. The air under pressure is blow into the tube, which causes the tube to expand to the walls of cavity. In the latter case, a uniformly softened sheet material by heat is clamped at the edges between the die and cover, which causes the sheet to attain a hemispherical shape or the configuration of mould whatever it may be parts obtained by indirect blow moulding have excellent appearance but they are more costly as only to percent of the sheet stock is utilized and also there is a tendency for excessive thinning of sheet at the deepest point.

Procedure:

1) Set the die in position. Adjust the guide rod nuts to suit die height. Align the tapered face of the die for sealing the parison while blowing also checks for the face opening and closing of the die.
2) Ensure minimum die height is 80mm. provide spacing plates if necessary.
3) Set the injection, release and blow pressure by rotating (clock wise) the regulator knob to suit the requirement of moulding the container.
4) Feed correct quantity & quality of plastic material and switch on the power supply.
5) Switch on the heater.
6) Set the requred timings controller to control the bottom heater.
7) Allow sufficient time to stabilizer.
8) When temperature reached, operate the hand level valve.
9) Extrude the parison (Tubular form) to the required length and close the two die halves release the injection cyclinder.
10) Operate the hand lever valve and blow the air so that the parison to form the shape of the container as designed in the die.
11) Allow the component to cool.
12) Open the die & take the product of the die.
13) Now the machine is ready for nest cycle.

RESULT:

Required product is made using blow moulding process.

LEAD EXPERIMENT

Manufacturing of 24 teeth aluminium gear using modeling/casing methodology

Aim: The aim of the Lead Experiment is to manufacture 24 teeth Aluminium Gear using Moulding /Casting Methodology.

Apparatus: Moulding Sand Testing Equipment, Permeability Tester, Hardness equipment, Melting Furnace, Pattern Making Tools, Casting dies, wood turning lathe, gear driven or belt driven lathe.

Materials Required: Moulding Sand, Bentonite Powder, Clay, Water, Aluminium Ingot material, Wood Pattern material

Description of the Process:

The process is used to make a gear having 24 teeth suitable to petrol engine or Diesel engine. This gear making involves the operation start with sand preparation. It is followed by Sand testing and hardness testing. This sand is mixed with different ingredients like clay, bentonite and other materials in order make mould for gear making. This mould cavity is used for aluminium melt which comes from Melting furnace. This gear will be sent for machining process.

Operation of the Process:

1. First the gear material is selected and pattern is made using wood turning lathe after calculating pattern allowances.
2. After the pattern is prepared, then it must be rammed with the moulding sand which is already prepared and tested.
3. After ramming is over, mould cavity is made using different pattern making tools.
4. Then melting furnace is made ready with pre maintenance is completed.
5. This furnace is pre heated and it is ready for melting aluminium material
6. Once the melting process is over after 4 hours, the liquid is poured into casting dies for making cast objects.
7. This liquid is poured directly into mould cavity suitable for gear making process.
8. This gear casting is allowed for solidification to about 2 hours.
9. Once solidified , gear will be sent for final machining process to remove risers and runners.

Result: The Final Component of Gear is ready for inspection