METHODIST

COLLEGE OF ENGINEERING & TECHNOLOGY

Estd: 2008

Approved by AICTE New Delhi | Affiliated to Osmania University, Hyderabad

Abids, Hyderabad, Telangana, 500001

DEPARTMENT OF MECHANICAL ENGINEERING

LABORATORY MANUAL

MANUFACTURING PROCESSES LABORATORY

BE IV Semester

For the Students admitted in AICTE Scheme

Name: ....

Roll No: ....

Branch:..SEM:........................

Academic Year: ....

Empower youth- Architects of Future World

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COLLEGE OF ENGINEERING & TECHNOLOGY
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VISION

To produce ethical, socially conscious and innovative professionals who would contribute to sustainable technological development of the society.

MISSION

To impart quality engineering education with latest technological developments and interdisciplinary skills to make students succeed in professional practice.

To encourage research culture among faculty and students by establishing state of art laboratories and exposing them to modern industrial and organizational practices.

To inculcate humane qualities like environmental consciousness, leadership, social values, professional ethics and engage in independent and lifelong learning for sustainable contribution to the society.

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DEPARTMENT OF MECHANICAL ENGINEERING

LABORATORY MANUAL

MANUFACTURING PROCESSES LABORATORY (PC262ME)

Prepared by

Dr. P. Shailesh, Professor. Mech. Engg.
Mrs. Sai Gayathri Lahari, Assistant Professor. Mech. Engg.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To be a reputed centre of excellence in the field of mechanical engineering by synergizing innovative technologies and research for the progress of society.

MISSION

- To impart quality education by means of state-of-the-art infrastructure.
- To involve in trainings and activities on leadership qualities and social responsibilities.
- To inculcate the habit of life-long learning, practice professional ethics and service the society.
- To establish industry-institute interaction for stakeholder development.

DEPARTMENT OF MECHANICAL ENGINEERING

After 3-5 years of graduation, the graduates will be able to:

PEO1: Excel as engineers with technical skills, and work with complex engineering systems.

PEO2: Capable to be entrepreneurs, work on global issues, and contribute to industry and society through service activities and/or professional organizations.

PEO3: Lead and engage diverse teams with effective communication and managerial skills.

PEO4: Develop commitment to pursue life-long learning in the chosen profession and/or progress towards an advanced degree

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM OUTCOMES

Engineering Graduates will be able to:

Po1. Engineering knowledge: Apply the basic knowledge of mathematics, science and engineering fund a mentals along with the specialized knowledge of mechanical engineering to understand complex engineering problems.

PO2. Problem analysis: Identify, formulate, design and analyse complex mechanical engineering problems using knowledge of science and engineering.

Po3. Design/development of solutions: Develop solutions for complex engineering problems, design and develop system components or processes that meet the specified needs with appropriate consideration of the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Formulate engineering problems, conduct investigations and solve using research-based knowledge.

PO5. Modern tool usage: Use the modern engineering skills, techniques and tools that include IT tools necessary for mechanical engineering practice.

Po6. The engineer and society: Apply the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. 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.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities during professional practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10.Communication: Communicate effectively on complex engineering activities to various groups, ability to write effective reports and make effective presentations.

PO11. Project management and finance: Demonstrate and apply the knowledge to understand the management principles and financial aspects in multidisciplinary environments.

PO12. 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.

PROGRAM SPECIFIC OUTCOMES

Mechanical Engineering Graduates will be able to:

PSO1: Apply the knowledge of CAD/CAM/CAE tools to analyse, design and develop the products and processes related to Mechanical Engineering.

PSO 2: Solve problems related to mechanical systems by applying the principles of modern manufacturing technologies.

PSO 3: Exhibit the knowledge and skill relevant to HVAC and IC Engines.

CODE OF CONDUCT

1. Students should report to the concerned labs as per the time table schedule.
2. Students who turn up late to the labs will in no case be permitted to perform the experiment scheduled for the day.
3. After completion of the experiment, certification of the concerned staff in-charge in the observation book is necessary.
4. Staff member in-charge shall award marks based on continuous evaluation for each experiment out of maximum 15 marks and should be entered in the evaluation sheet/attendance register.
5. Students should bring a note book of about 100 pages and should enter the readings/observations into the note book while performing the experiment.
6. The record of observations along with the detailed experimental procedure of the experiment performed in the immediate last session should be submitted and certified by the staff member in-charge.
7. Not more than three students in a group are permitted to perform the experiment on a setup for conventional labs and one student in case of computer labs.
8. The components required pertaining to the experiment should be collected from stores in-charge after duly filling in the requisition form.
9. When the experiment is completed, students should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.
10. Any damage of the equipment or burn-out of components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year.
11. Students should be present in the labs for the total scheduled duration.
12. Students are required to prepare thoroughly to perform the experiment before coming to Laboratory.

DO'S

1. All the students are instructed to wear protective uniforms, shoes & identity cards before entering into the laboratory.
2. Please follow instructions precisely as instructed by your supervisor. If any part of the equipment fails while being used, report it immediately to your supervisor.
3. Take proper guidance before performing any experiment on the machine..
4. Students will not be permitted to attend the laboratory unless they bring the practical record fully completed in all respects pertaining to the experiment conducted in the previous class.
5. Practical records should be neatly maintained.
6. Students should obtain the signature of the staff-in-charge in the observation book after completing each experiment.
7. Theory regarding each experiment should be written in the practical record before procedure in your own words.
8. One student from each batch should put his/her signature during receiving the instrument in the instrument issue register.

DON'TS

1. Don't operate any instrument without getting concerned staff member's prior permission. Handle equipment carefully to avoid breakage.
2. Using the mobile phone in the laboratory is strictly prohibited.
3. Do not touch the workpiece after completion of the experiment, because due to friction it gets heated.
4. Do not leave the experiments unattended while in progress.
5. Do not crowd around the equipment & run inside the laboratory.
6. Don't wear loose torn clothing of any kind.
7. Do not wander around the lab and distract other students
8. Do not use any machine that smokes, sparks, or appears defective.

COURSE OBJECTIVES

The objectives of this course are

1.	To gain knowledge and skill in various manufacturing processes such as casting, welding and forming.
2.	To understand and perform operations like pattern making, sand testing and casting.
3.	To join metal pieces by various welding techniques and gain hands on experience.
4.	To understand the working principle and produce some components by various metal forming techniques.

COURSE OUTCOMES

CO No.	Course Outcomes	PO
CO 1	Explain the design of patterns, mould making procedures and testing the sand properties.	1, 2, 8, 9, 10
CO 2	Apply the various joining techniques to fabricate different geometries.	1, 2, 4, 8, 9, 10
CO 3	Demonstrate the blanking and piercing operations for simple components.	1, 2, 4, 8, 9, 10
CO 4	Explain the Applications of plastics and manufacture a simple component by using plastic injection moulding processes.	1, 2, 4, 8, 9, 10
CO 5	Evaluate the mechanical properties of welded joints	1, 2, 4
CO 6	Select suitable manufacturing processes to manufacture the products optimally.	1, 2, 4, 12

COURSE OUTCOMES VS POs MAPPING

S. NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PC262ME.1	2.0	1.0	-	0.0	0	-	-	1	3.0	3.0	-	-	1	-	-
PC262ME.2	3.0	2.0	-	1.0	-	-	-	1	3.0	1.0	-	-	3	-	-
PC262ME.3	3.0	3.0	-	3.0	-	-	-	1	1.0	1.0	-	-	3	-	-
PC262ME.4	3.0	3.0	-	3.0	-	-	-	1	1.0	1.0	-	-	3	-	-
PC262ME.5	3.0	3.0	-	3.0	-	-	-	-	-	-	-	-	3	3.0	-
PC262ME.6	3.0	2.0	-	1.0	-	-	-	-	-	-	-	3.0	2	3.0	-
Avg	2.8	2.3	-	1.8	0	-	-	1	2.0	1.5	-	3.0	2.5	3.0	-

LIST OF EXPERIMENTS

LIST OF ADDITIONAL EXPERIMENTS

Note: Minimum ten experiments should be conducted in the semester

INDEX

Experiment No	Experiment Name	Date	Page No	Marks				Remarks/ Signature
				P	R	V	T	

Experiment No	Experiment Name	Date	Page No	Marks				Remarks/ Signature
				P	R	V	T	

EXPERIMENT - 01

PATTERN DESIGN AND MAKING

AIM:

To Design and Manufacture a single piece wooden Pattern for a given Casting by considering allowances.

APPARATUS:

Material Required: Teak wood of 50 x 50 x 130mm

Equipment And Tools Required: Hack Saw, Jack Plane, Steel Rule, Wood Working Lathe, Drill bit, Boring Tool, Vernier Calipers and Emery Paper.

THEORY:

1. A pattern is a mold forming tool in the hands of foundry men.
2. A pattern is the model or the replica of the object to cast.
3. Except for the various allowances a pattern exactly resembles the casting to be made.
4. A pattern may be defined as a model or form around which sand is packed to give rise to a cavity known as mould cavity in which when molten metal is poured, the result is cast object.

Functions of Pattern:

1. A pattern prepares a mold cavity for the purpose of making a casting.
2. A pattern may contain projections known as core prints if the casting requires a core and need to be hollow.
3. Runner, gates and risers (used for introducing and feeding molten metal to the mold cavity) may form a part of the pattern.
4. Pattern may help in establishing locating points on the mold and therefore on the casting with a purpose to check the casting dimensions.
5. Pattern establishes the parting line and parting surfaces in the mold.
6. Patterns properly made and having finished and smooth surfaces reduce casting defects.
7. Properly constructed patterns minimize overall cost of the castings.

Pattern Making Machines:

1. Besides the hand tools, a modern pattern makers shop needs some power-driven machines also. These machines help the pattern maker in Increasing production.
2. Improving accuracy and maintaining consistency in the patterns.
3. Prepare a split wooden pattern of stepped pulley detailed below with allowance.

Pattern Allowances

***1. Shrinkage allowance*:**

After solidification of the metal from further cooling (room temp.) dimensions of the patterns increases. So pattern size is bigger than that of the finished cast products. This is known as shrinkage allowance.

It depends on:

a) Dimensions of casting

b) Design and intricacy of casting

c) Resistance of mol to shrinkage

d) Molding materials used

e) Method of molding used

f) Pouring temp of the molten metal

***2.Draft or taper allowance*:**

Pattern draft is the taper placed on the pattern surfaces that are parallel to the direction in which the pattern is withdrawn from the mould (that is perpendicular to the parting plane), to allow removal of the pattern without damaging the mould cavity.

It depends on:

a) the method of moulding

b) the sand mixture used

c) the design (shape and length of the vertical side of the pattern)

d) economic restrictions imposed on the casting

e) intricacy of the pattern

3.Distortion allowance:

This allowance is taken into consideration when casting products of irregular shapes.

When these are cooled they are distorted due to metal shrinkage.

***4.Finishing or machining allowance*:**

Machining allowance or finish allowance indicates how much larger the rough casting should be over the finished casting to allow sufficient material to insure that machining will "clean up" the surfaces.

This machining allowance is added to all surfaces that are to be machined. Machining allowance is larger for hand moulding as compared to machine moulding.

It depends on:

a) Machining operation

b) Characteristics of metal

c) Methods of castings

d) Size, shapes and volumes of castings

e) Degree of finish required in castings

f) configuration of the casting

5.Shaking or rapping allowance:

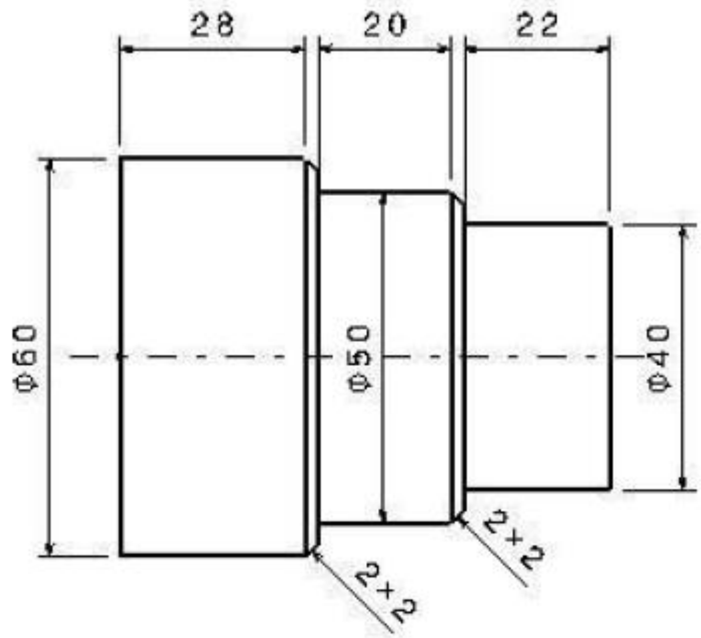
To take the pattern out of the mould cavity it is slightly rapped to detach it from the mould cavity. So the cavity is increased a little.

PROCEDURE:

1. The given work piece is fixed between live centre and dead centre of wood working lathe.
2. Adjust the machine to run the job to a required cutting speed.
3. Fix the cutting tool in the tool post and make sure that the axis of the job coincides with the tip of the cutting tool.
4. Give the depth of cut and feed to the cutting tool
5. Plain turning operation is performed until the diameter of the work piece reduces to 43 mm
6. Step turning operation is performed according to the given dimensions.
7. Perform shoulder turning operation according to the dimensions shown in fig.
8. Frequently check the dimensions by using vernier calipers.
9. Finish the work piece using emery paper.

Precautions:

1. The work piece should be held rigidly between the two centres before operating the machine.
2. Tool should be properly ground, fixed at the correct height and properly secured, a. work also be firmly secured.
3. Optimum machining conditions should be maintained.



Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What are the pattern materials?
- Wax pattern is used in which to be of special casting Process?
- Which is the negative allowance given to the pattern?
- Which type of pattern is used for manufacturing Axi-symmetrical parts?
- List the types of allowances?

EXPERIMENT - 02

SAND PROPERTIES TESTING

AIM:

To determine permeability number of green sand, core sand and raw sand.

APPARATUS:

Equipment Requirements: Hand reamer, Specimen Cylinder 100mm Height of a Dia 50mm, Specimen Remover, Permeability Tester, Flat and Stepped Discs
Machine Contains: Water tank , Air tank ,Manometer, Standard chart ,Rubber boss , O-P-D valve Orifices Composition of Sand Preparation:
Material Required: Molding Sand.

THEORY:

Properties Of Molding Sand:

Molding sand must possess some properties like permeability, flow ability collapsibility, adhesiveness, cohesiveness or strength and refractoriness. The properties are determined not only by the chemical composition, but by the amount of clayey matter in the sand, by its moisture content, and lastly by the shape and size of the silica sand grains.

Porosity: Molten metal always contains a certain amount of dissolved gases, which are evolved when the metal freezes. Also, the molten metal ,coming in contact with the moist sand, generates steam or water vapor .If these gases and water vapor evolved by the molding sand do not find opportunity to escape completely through the mould they will form gas holes and pores in the casting. The sand must, therefore, be sufficiently porous to allow the gases or moisture present or generated within the moulds to be removed freely. When the moulds are poured. This property of sand is called porosity or permeability.

Flow ability: Flow ability of molding sand refers to its ability to behave like a fluid so that, when rammed it will flow to all portions of a mould and pack all-round the pattern and take up the required shape. The sand should respond to different molding processes. Flow ability increases as clay and water content increases.

Collapsibility: After the molten metal in the mould gets solidified the sand mould must be collapsible so that free contraction of the metal occurs, and this would naturally avoid the tearing or cracking of the contracting metal.

Adhesiveness: The sand particles must be capable of adhering to another body, i.e.. they should cling to the sides of the molding boxes. It is due to this property that the sand mass can be successfully held in a molding box and it does not fall out of the box when it is removed.

Cohesiveness or Strength: This is the ability of sand particles to stick together. Insufficient strength may lead to a collapse in the mould or its partial destruction during conveying, turning over or closing. The closing may also be damaged during pouring the molten metal. The strength of molding sand must, therefore, be sufficient to permit the mould to be formed to the desired shape and to retain this shape even after the hot metal is poured in the mould. This property of sand in its green or moist state is known as green strength. A mould having adequate green strength will retain its shape and will not distort or collapse even after the pattern is removed from the molding box. The strength of sand that has been dried or baked is called dry strength .It must have the strength to withstand erosive forces due to molten metal, and retain its shape.

Refractoriness: The sand must be capable of withstanding the high temperature of the molten metal without fusing. Molding sands with poor refractoriness may burn on to the casting. Refractoriness is measure by the sinter point of the sand rather than its melting point.

Permeability Meter**:** The body of the Permeability Meter is an aluminum casting of a water tank and base. Inside water tank floats a balanced air drum carefully weighed and designed to maintain constant pressure of 10cm during its fall. The outlet from the air drum is connected to a centre post in the base via three way air valve. The centre post incorporates a pipe for measuring pressure, which is connected to the water manometer and an expandable ―O‖ ring for sealing the specimen tube. It also accommodates the orifices

PROCEDURE:

Permeability Test**:**

1. Place the instrument on leveled platform.
2. Take 'O-P-D' valve knob at 'D' position.
3. Close the opening of the air tube inside water tank by thumb and pour water up to the W' mark.
4. Insert air tank into water tank carefully.
5. A screw is provided at the left side of the manometer to fill the water in manometer. Unscrewing the knob operates this screw and water is filled in the manometer.
6. The water level should coincide with the zero of the manometer scale the screw is closed by tightening.
7. Final zero level is adjusted by opening 'zero adjusts screw' provided in front of manometer

8. Selection of orifice it is recommended to use small orifice for permeability below 50Nos. and large orifice for permeability above 50Nos.
9. Tighten the orifice by fingers only. Take the specimen tube with rammed specimen and place it inverted over the rubber boss.
10. Put the valve on 'P position. Read the height of the water column in the manometer tube. Find out corresponding permeability number from the chart provided with the instrument.
11. Put the valve on '0' position. Whenever the air tank is flush with water tank, keep the valve on 'D' position and slowly lift the air tank to the top position.
12. Lift the air tank drum slowly up keeping the valve in 'D' position
13. Permeability number can be determined by the following relation;

$$\text{Permeability Number} = \frac{V.H}{A.P.T}$$

Where V = volume of air passed through the specimen
H = height of the specimen
A = area of the specimen
T = time taken by the air to pass through the sand specimen
P = pressure recorded by manometer

***Compression Strength Test*:**

1. The A.F.S specimen 50X50 mm is held between the grips.
2. Hand wheel when rotated actuates a mechanism which builds up hydraulic pressure on the specimen.
3. Dial indicator fitted on the tester measures the deformation occurring in the specimen.
4. As the applied load is continues, the specimen breaks at a particular load.
5. At this point, note down the reading of dial indicator which directly gives the compression strength of the sand.

S.NO	GREEN STRENGTH		DRY STRENGTH	
	COMPRESSION	SHEAR	COMPRESSION	SHEAR

Precautions:

1. Keep the instrument dust proof.
2. Keep the instrument clean.
3. Lift the air drum only in 'D' Position to avoid any water entering the air passage
4. For removal of the water tank completely from manometer
5. Use zero adjustment knob valves..

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What is permeability?
- What are the properties of good molding sand?
- What is the composition of molding sand?
- What is fluidity?
- What is collapsibility?
- What is the effect of sand grit size with respect to permeability?

EXPERIMENT - 03

ARC WELDING SINGLE V-BUTT JOINT

AIM:

To prepare a single V butt joint using area welding.

APPARATUS:

***Materials Required*:** Mild steel flat 50 mm X 50 mm X 7mm. -2 No's

Equipment Required: Flat rough file, try square, step down transformer, electric lugs, shield, goggles, gloves, electrode holder, electrode, chipping hammer, wire brush.

THEORY:

The welding in which the electric arc is produced to give heat for the purpose of joining two surfaces is called electric arc welding. Principle Power supply is given to electrode and the work. A suitable gap is kept between the work and electrode. A high current is passed through the circuit. An arc is produced around the area to be welded. The electric energy is converted into heat energy, producing a temperature of 3000°C to 4000°C. This heat melts the edges to be welded and molten pool is formed. On solidification the welding joint is obtained.

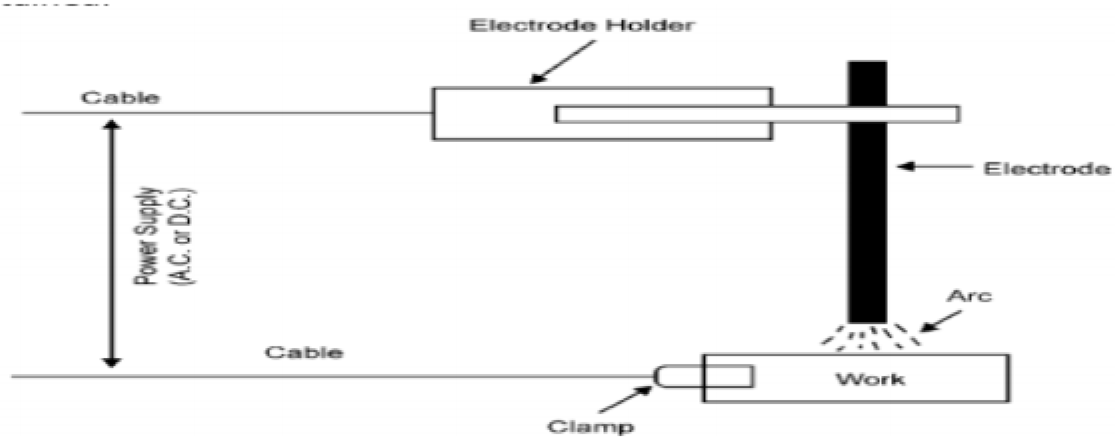


Figure 3.1: Arc Welding

Butt Joint In this type of joint, the edges are welded in the same plane with each other. V or U shape is given to the edges to make the joints strong. Some examples of butt joints are shown in the figure.

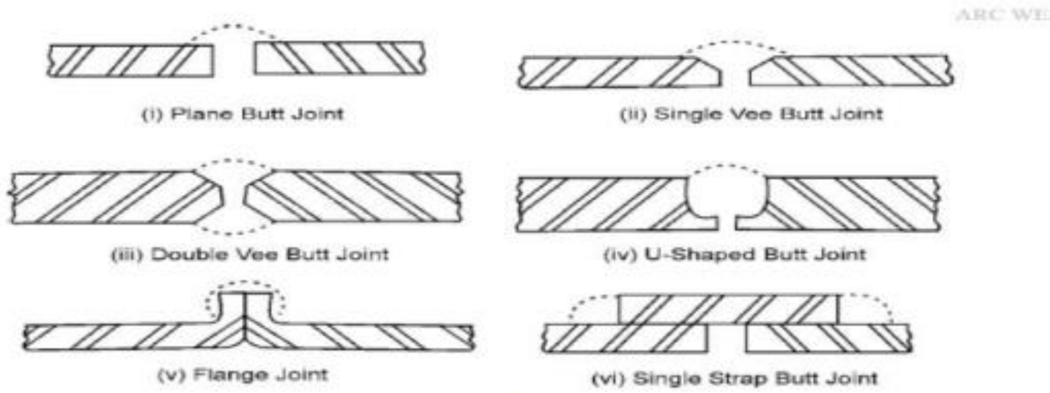


Figure: Different Types of Butt Joints

PROCEDURE:

1. Filing is done on four sides of the mild steel flat and right angles are checked by using try square.
2. With a root face of 2 mm, 30° taper is made along the longer length of the work piece.
3. Repeat the above two steps for the other work piece.
4. Two pieces are kept such that the width will form for a ring V-groove.
5. Tags are made at both the ends of the work piece.
6. Welding is carried out along the length of the V-groove by slowly moving the electrode in a wavy fashion, so that a sufficient amount of metal is filled in the groove.
7. After welding is over, the slag is removed using chipping hammer, cleaning is done by using a wire brush.
8. The joint thus obtained is a V-butt joint

Precautions:

1. Check the right angles of the work pieces properly using try square.
2. Tags should be made so that work pieces are not disturbed from their positions.
3. Arc is struck by touching the work piece, with the electrode away from the work piece. The electrode should be kept -at a distance equal to electrode diameter for maintaining the arc.
4. Electrode should be moved slowly so that required amount metal is filled in the weld puddle.
5. Never see the arc directly with naked eye, It is advisable to wash the eyes three to four times after welding.

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What are the types of welded joints?
- Amount of voltage required to generate the arc under no load condition is called?
- How the deflection of arc in arc blow is done?
- Arc welding is also known as?
- Among gas and electric arc welding, which has the higher rate of heating?
- Which welding joint is strongest?
- What are the three types of fillet joints?

EXPERIMENT - 04

SPOT WELDING (LAP JOINT)

AIM:

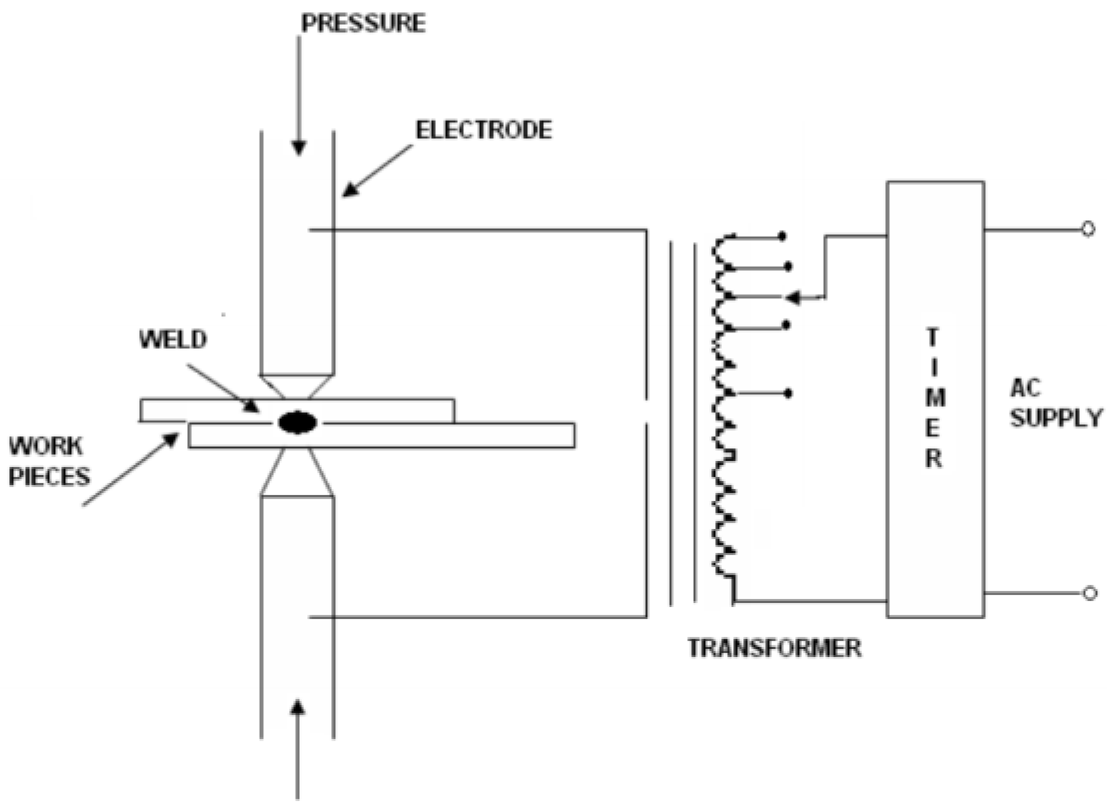
To prepare a Single Strap Butt Joint on the given work pieces using spot welding

APPARATUS:

***Material Required*:** GI Sheet of 50 x 40mm--- 2 No's
***Apparatus Required*:** Spot Welding Equipment, Snips and Gloves

THEORY:

Spot welding is a resistance welding process in which overlapping sheets are joined by local fusion at one or more spots by the heat generated by resistance to the flow of electric current through work pieces that are held together under force of two electrodes, one above and the other below the two overlapping sheets as shown in fig



PRINCIPLE OF RESISTANCE SPOT WELDING

In resistance welding (RW) a low voltage (typically IV) and very high current (typically 15,000 A) is passed through the joint for a very short time (typically 0.25 s). This high amperage heats the joint, due to the contact resistance of the joint and melts it. The pressure on the joint is continuously maintained and the metal fuses together under this pressure. The heat generated in resistance welding can be expressed as

$$H = k I^2 R t$$

Where H = the total heat generated in the work, J

I = electric current, A

t = time for which the electric current is passing through the joint, s

r = the resistance of the joint, ohms and

k = a constant to account for the heat losses from the welded joint.

The resistance of the joint, R is a complex factor to know because it is composed of

1. The resistance of the electrodes.
2. The contact resistance between the electrode and the work piece,
3. The contact resistance between the two work piece plates,
4. The resistance of the work piece plates.

The amount of heat released is directly proportional to the resistance. It is likely to be released at all of the above-mentioned points, but the only place where a large amount of heat is to be generated to have an effective fusion is at the interface between the two work piece plates. Therefore, the rest of the component resistances should be made as small as possible, since the heat released at those places would not aid in the welding. Because of the squaring in the above, equation, the current, i needs to be precisely controlled for any proper joint. The main requirement of the process is the low voltage and high current power supply. This is obtained by means of a step down transformer with a provision to have different tappings on the primary side, as required for different materials. The secondary windings are connected to the electrodes which are made of copper to reduce their electrical resistance. The time of the electric supply needs to be closely controlled so that the heat released is just enough to melt the joint and the subsequent fusion takes place due to the force (forge welding) on the joint. The force required can be provided either mechanically, hydraulically or pneumatically. To precisely control the time, sophisticated electronic timers are available. The critical variable in a resistance welding process is the contact resistance between the two work piece plates and their resistances themselves. The contact resistance is affected by the surface finish on the plates, since the rougher surfaces have higher contact resistance. The contact resistance also will be affected by the cleanliness of the surface. Oxides or other contaminants if present should be removed before attempting resistance welding

PROCEDURE:

1. The two pieces to be joined by spot welding are placed between the two electrodes in the required position.
2. Set the timer for which the current flows through the electrodes with reference to the thickness of the plates
3. Press the foot lever, so that the movable electrode moves towards the fixed electrode.

4. This causes to develop a pressure of about 200-1000 Kg / cm2 on the sheets.
5. A low voltage and very high current is passed through the joint for a very short time. The duration of the current flow is for about 2 sec (This high amperage heats the joint, due to the contact resistance at the joint and melts it).
6. Then the metal under electrodes pressure is squeezed and welded
7. The pressure is then released and the process is repeated until the job is completed.

Precautions:

1. Proper pressure should be applied on the electrodes.
2. Correct electrode diameter needs to be chosen depending on the material thickness to be joined.
3. Proper weld time should be selected for welding.
4. Use Gloves while doing operation.

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- Which kind of resistance is experienced in upset butt welding?
- Electrodes used in spot welding are made up of which material?
- How are the metals to be welded connected to each other in spot welding?
- What is the maximum power supply needed for the working of spot welding process?
- Projection welding is
- In which type of resistance welding process roller type electrodes are used:

EXPERIMENT - 05

TUNGSTEN INERT GAS (TIG) WELDING

AIM:

To prepare a butt Joint Using TIG Welding.

APPARATUS:

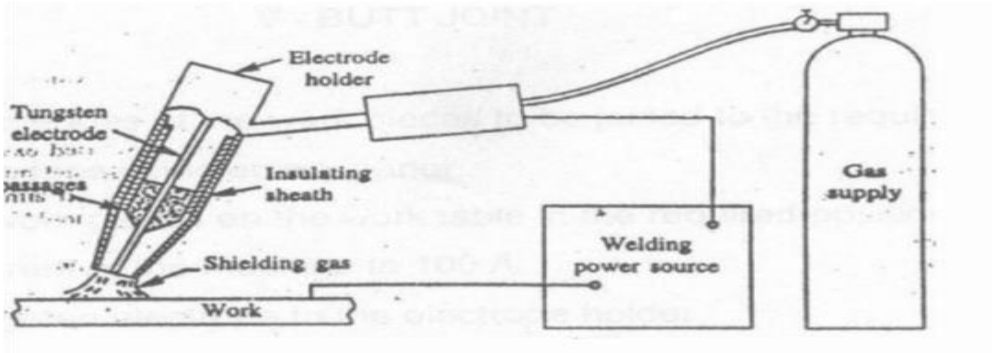
***Material And Apparatus Required*:** MS flat 100 x 50 X 5 mm3 ---2 No's Tong, Chipping Hammer, goggles Tungsten Electrode, Ceramic Nozzle and Filler rod.

***Equipment Required*:** Transformer, Rectifier and Argon gas cylinder.

THEORY:

The Endeavour of welder is always to obtain a joint which is as strong as the base metal and at the same time, the joint is as homogeneous as possible. To this end, the complete exclusion of oxygen and other gases which interfere with the weld pool to the detriment of weld quality is very essential. In manual metal arc welding, the use of stick electrodes does this job to some extent but not fully. In inert gas shielded arc welding processes, a high pressure inert gas flowing around the electrode while welding would physically displace all the atmospheric gases around the weld metal to fully protect it. The shielding gases most commonly used are argon, helium, carbon dioxide and mixtures of them. Argon and helium are completely inert and therefore they provide completely inert atmosphere around the puddle, when used at sufficient pressure. Any contaminations in these gases would decrease the weld quality. Argon is normally preferred over helium because of a number of specific advantages. It requires a lower arc voltage, allows for easier arc starting and provides a smooth arc action. A longer arc can be maintained with argon, since arc voltage does not vary appreciably with arc length. It is more economical in operation. Argon is particularly useful for welding thin sheets and for out of position welding. The main advantage of Helium is that it can with stands the higher arc voltages. As a result it is used in the welding where higher heat input is required, such as for thick sheets or for higher thermal conductivity materials such as copper or aluminum. Carbon dioxide is the most economical of all the shielding gases. Both argon and helium can be used with AC as well as DC welding power sources. However, carbon dioxide is normally used with only DC with electrode positive.

Tungsten Inert Gas (TIG) Welding: Tungsten inert gas (TIG) welding is as inert gas shielded arc welding process using non consumable electrode. The electrode may also contain 1 to 2% thorium mixed along with core tungsten or tungsten with 0.15 to 0.4% zirconium. The pure tungsten electrodes are less expensive but will carry less current. Throated tungsten electrodes carry high currents and are more desirable because they can strike and maintain stable arc with relative ease. The zirconium added tungsten electrodes are better than pure tungsten but inferior to throated tungsten electrodes. A typical TIG welding setup is shown in fig.



It consists of a welding torch at the centre 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 TIG welding process can be used for the joining of a number of materials, though the most common ones are aluminum, magnesium and stainless steel. The power sources used are always the constant current type. Both DC and AC power supplies can be used for TIG welding. When DC is used, the electrode can be negative (DCEN) or positive (DCEP). With DCEP is normally used for welding thin metals where as fro deeper penetration welds DCEN is used. An Ac arc welding is likely to give rise to a higher penetration than that of DCEP.

PROCEDURE:

1. Prepare the edges of the work pieces to be joined to the required position.
2. Finish the edges using emery paper.
3. Place the work pieces on the work table in the required position.
4. Set the current of the machine to 100 A. Fix the tungsten electrode to the electrode holder. Required size of the nozzle is selected and it is fixed to the torch.
5. Adjust the inert gas flow rate to the required rate.
6. Select the filler rod (same as base metals) of required diameter.
7. Touch the electrode to the work, so that current flow will be established and then separated by a small distance and the arc will be generated.
8. First weld is done on the work pieces. Move the electrode slowly along the length of the joint with the filler rod, so that the filler metal will be deposited in the joint.
9. Repeat the operation for the second pass, so that required amount of filler metal will be deposited on the work pieces.

Precautions:

1. Never look at the arc with the naked eye. Always use a shield while welding.
2. Always wear the safety hand gloves, apron and leather shoes.
3. Ensure proper insulation of the cables and check for openings.
4. Select the parameters of the machine properly based on the metals to be welded.
5. Set these parameters properly before performing the operation.
6. Inflammable and combustible materials are removed from the vicinity of welding operations.

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- Which current is used in Tungsten Inert-Gas (TIG) welding?
- Which type of electrode is used in TIG Welding?
- Gas mixtures used in TIG welding are?
- Which welding process is used to join two thick plates in one single pass?
- Polarity used in GTAW?

EXPERIMENT - 06

GAS WELDING

AIM:

To make the butt joint by using gas welding equipment

APPARATUS:

***Equipment Required*:** Oxy-acetylene gas welding outfit

***Tools Required*:** Wire brush, Hand gloves, chipping hammer, Spark lighter

***Material Required*:** MS Sheets100*50*5mm (2no.)

THEORY:

Gas Welding or Oxy-fuel gas welding is a general term used to describe any welding process that uses a fuel gas combined with oxygen to produce a flame. The most commonly used fuel is acetylene (C2H2) gas. The heat source is the flame obtained by combustion of oxygen and acetylene. When mixed together in correct proportions within a hand-held torch or blowpipe, a relatively hot flame is produced with a temperature of about 3300ºC (6000ºF). The chemical action of the oxyacetylene flame can be adjusted by changing the ratio of the volume of oxygen to acetylene. The combustion of oxygen and acetylene (C2 H2) is a two-stage reaction. Chemical reactions are as follows: -

Stage 1: In the first stage, the supplied oxygen and acetylene react to produce Carbon Monoxide and Hydrogen. Approximately one-third of the total welding heat is generated in this stage. $C_2H_2 + O_2 = 2CO + H_2 + \text{heat}$

Stage 2: The second stage of the reaction involves the combustion of the CO and H2. The remaining two-third of the heat is generated in Stage 2. The specific reactions of the second stage are: $2CO + O_2 = 2CO_2 + \text{heat}$ $H_2 + \frac{1}{2} O_2 = H_2O + \text{heat}$

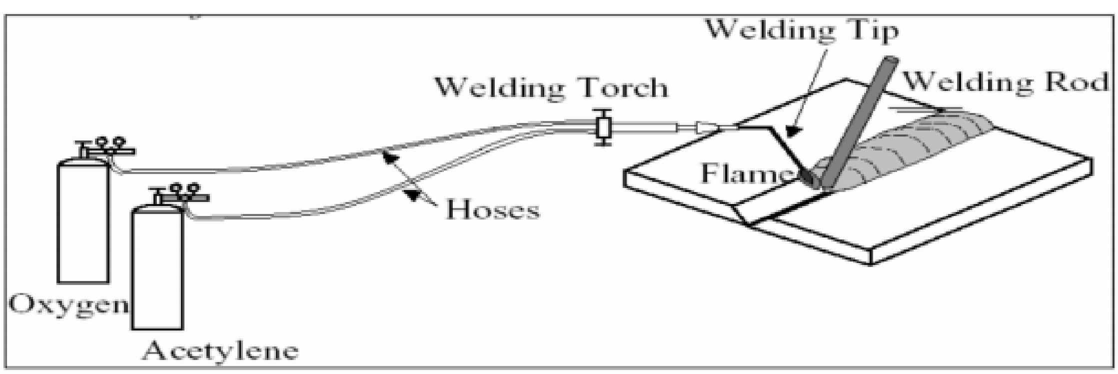
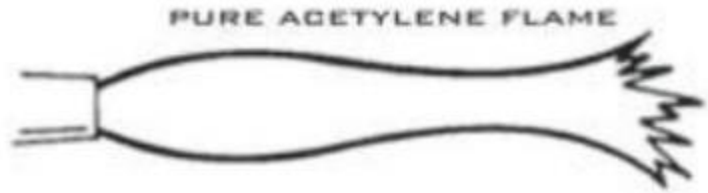
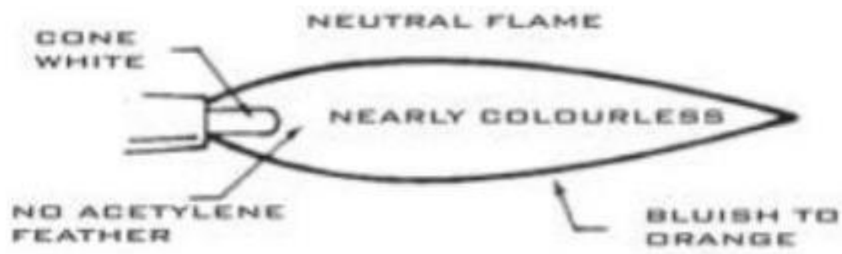


Figure: Gas Welding (Oxygen–fuel gas) process

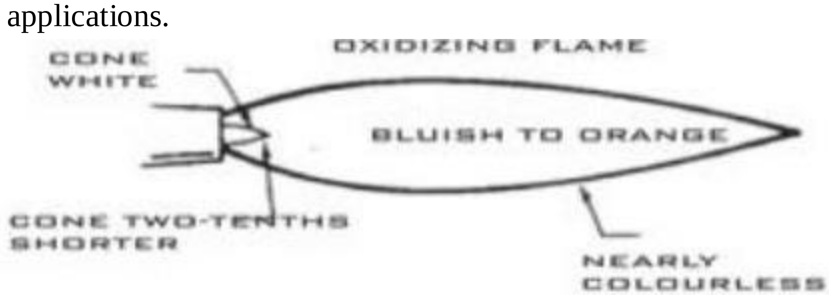
***Types of flames*:** Three different types of flames can be obtained by varying the oxygen–acetylene (or oxygen– fuel gas) ratio.

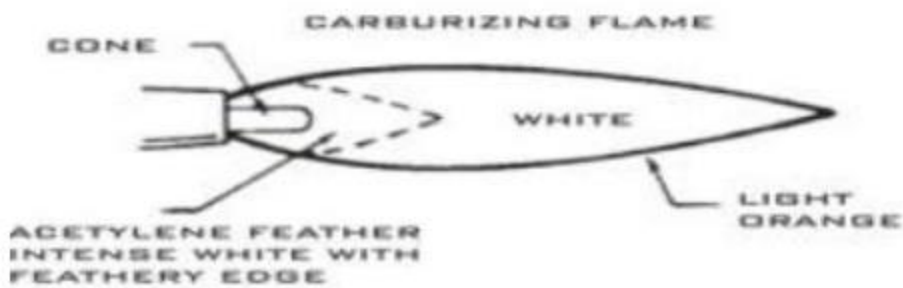


***Neutral Flame*:** When the ratio of oxygen-acetylene (or oxygen–fuel gas) is between 1:1 and 1.15:1, all reactions are carried to completion and a neutral flame is produced. As the supply of oxygen to the blowpipe is increased, the flame contracts and the white cone becomes clearly defined, assuming a definite rounded shape. This type of flame is the one most extensively used by the welder, who should make himself thoroughly familiar with its appearance and characteristics.



Oxidizing flame: A higher ratio of oxygen-acetylene (or oxygen–fuel gas), such as 1.5:1, produces an oxidizing flame, which is hotter than the neutral flame (about 3600°C or 6000°F). With the increase in oxygen supply, the inner cone will become shorter and sharper, the flame will turn a deeper purple color and emit a characteristic slight "hiss". An oxidizing flame is only used for special applications.





***Carburizing flame*:** Excess fuel compared to oxygen produces a carburizing flame. The excess fuel decomposes to carbon and hydrogen, and the flame temperature is not as great (about 3050°C or 5500°F). This type of flame is mainly used for hard surfacing and should not be employed for welding steel as unconsumed carbon may be introduced into the weld and produce a hard, brittle, deposit.

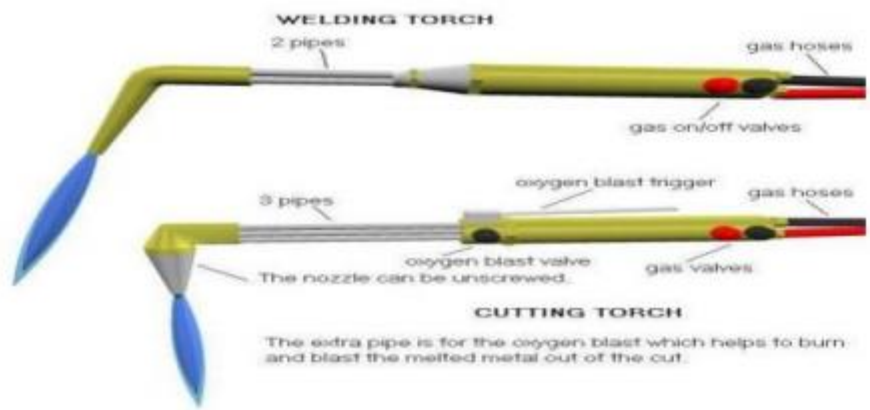


Figure: welding torch

Filler Metals & Flux Filler metals are used to supply additional material to the weld zone during welding. These consumable filler metals maybe bare or flux coated. The purpose of flux is to retard oxidation of the surfaces of the parts being welded, by generating a gaseous shield around the weld zone.

Torches: The torch is the part that the welder holds and manipulates to make the weld. It has a connection and valve for Oxygen and also a connection and valve for Fuel, a handle for grasp, a mixing chamber for mixing of the fuel and oxygen, a tip where the flame forms. A welding torch head is used to weld metals and can be identified by having only two pipes running to the nozzle and no oxygen blast trigger. A cutting torch head is used to cut metals and can be identified by having three pipes that go to an around 900 nozzle and also by oxygen-blast trigger that provides oxygen to blast away material while cutting

PROCEDURE:

1. Acetylene valve on the torch is opened slightly and lightened with the help of spark lighter.
2. Now acetylene valve is opened to get the required flow of acetylene.
3. Oxygen valve is opened till the intermediate flame feather reduces into inner cone to get a neutral flame
4. The torch tip to be positioned above the plates so that the white cone is at the distance of 1.5mm to 3mm.
5. Torch to be held at an angle of 30degrees to 45degrees to the horizontal plane.
6. Now filler rod is to be held at a distance of 10mm from the flame and 1.5 to 3mm from the surface of the weld pool.

7. As backward welding allows better penetration, backward welding is to be used for welding.
8. After completion of welding slag is to be removed by means of chipping hammer and wire brush.

Precautions:

1. The use of safety equipment such as goggles with shaded with lenses, Face shields, glows and protective clothing, is essential.
2. Proper connection of hoses to the cylinders Is also an important factor in safety.
3. Oxygen and acetylene has different threads, so that the hoses cannot be connected to the wrong cylinders.
4. Gas cylinders should be anchored securely and should not be dropped or mishandled.

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- Which flame is suitable for welding of ferrous metals, Cu and Al alloys
- Which flame is suitable for cutting operations?
- Explain the types of flames in gas welding
- In which of the following type of flame, oxygen is of same proportion with acetylene
- For brazing, soldering and flame hardening which type of flame is used
- The inner cone of the flame in welding has which type nature?

EXPERIMENT - 07

INJECTION MOULDING

AIM:

To Prepare a Plastic product using Injection Molding machine

APPARATUS:

Equipment: Injection molding machine Setup.
Material Required**:** High grade polyethylene

THEORY:

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 impart any desired shape to the product. Plastics fall into a category known chemically as high polymers. Thus Plastics is a term applied to compositions consisting of a mixture of high molecular compounds (synthetic polymers) and fillers, plasticizers, stains and pigments, lubricating and other substances. Some of the plastics contain nothing but resin (for instance, polyethylene, polystyrene).

Types 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).

Thermosetting Plastics: These plastics undergo 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 cannot be reworked. They rather become harder due to completion of any leftover polymerization reaction. Eventually at high temperatures, the useful properties of the plastics get destroyed. This is called degradation. The commonest thermosetting plastics are: alkyds, epoxides, melamines, polyesters, phenolics and ureas.

Thermoplastic Plastics: These plastics soften under heat, harden on cooling, and can be softened 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 thermoplastics are: acrylics, polytetrafluoroethylene (PTFE), polyvinyl chlorides (PVC), nylon, polyethylene, polypropylene etc.

Processing of Thermoplastic Plastics**:**

The common forms of raw materials for processing plastics into products are: Pellets, Powders, Sheet, Plate, and Tubing. Liquid plastics are used especially in the fabrication of reinforced plastic parts. Thermoplastics can be processed to their final shape by molding and extrusion processes. However, extruding is often used as an intermediate process to be followed by other processes for example vacuum forming or machining. An important industrial method of producing articles of thermoplastics is Injection Molding.

PROCEDURE:

1. Pour the raw material in the hopper.
2. Place the die in such a way that its hole coin sides with the central axis of the cylinder. Heat the cylinder by pouring plastic pallets in it.
3. When the plastic pellets is heated at 800 C to 1000 C it is converted into molten steel.
4. The die is placed exactly below the nozzle of the container. Press the lever so that the softened plastic will enter into the die and gets the desired shape of the mould and it is allowed to solidify say for about one minute.
5. Allow it to cool for some time. Then retract the lever arm slightly and open the mould. Then eject the mould piece of the required shape from the die

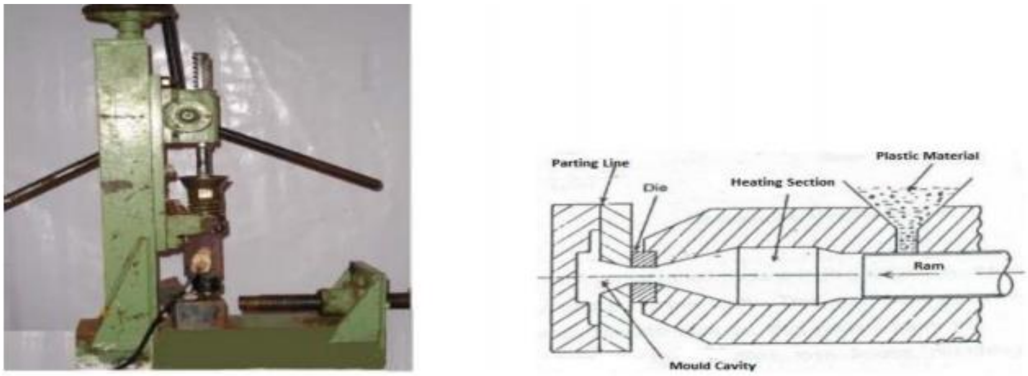
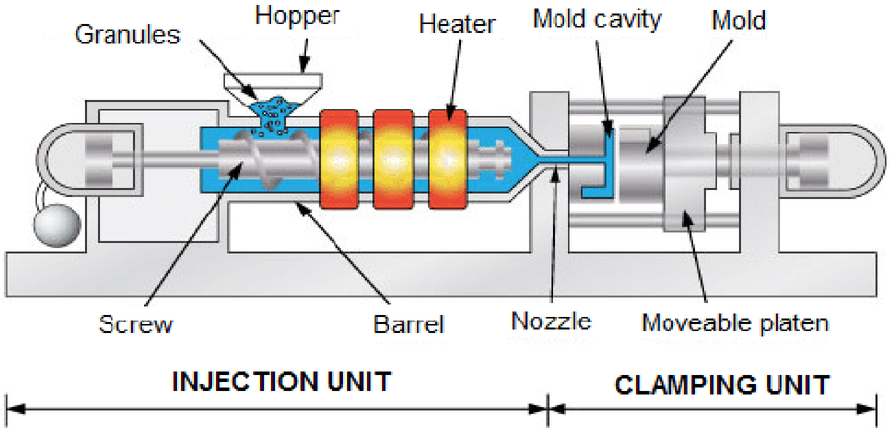


Fig.. Injection Moulding Setup

***Precautions*:**

1. Align the opening of the die and an orifice of the cylinder carefully.
2. Use gloves while holding die.



Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What are the products manufactured through Injection moulding machine
- Which type of plastics are used in Injection moulding machine
- What is thermo forming?
- What are the types of die plates used in injection moulding?
- Explain the design considerations of Die in injection moulding machine

EXPERIMENT - 08

GREEN SAND MOULDING MAKING PROCESS WITH SPRUES,GATING DESIGN AND RISER DESIGN

AIM:

To Prepare a Casting for the given Solid Pattern using Green Sand Molding Processes.

APPARATUS:

Material Required: Molding sand

Tools Required: Pattern, Shovel, Riddle, Rammer, Trowel, Slick, Lifter, Strike – Off bar, Draw – spike, Mallet, Molding Boxes, Vent rod, Runner, Riser, and Swab

THEORY:

Gating system:

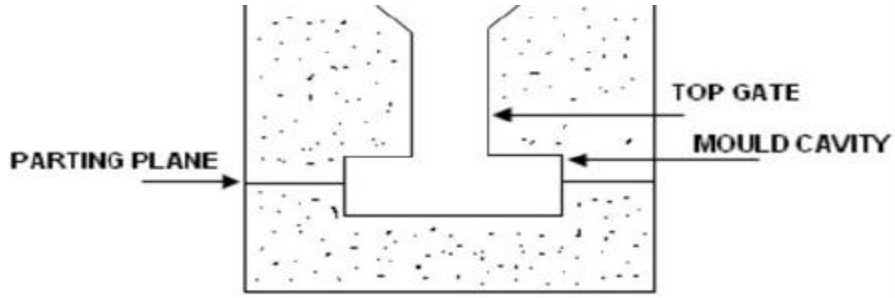
Gating system refers to all those elements which are connected with the flow of molten metal from the ladle to the mould cavity. The various elements that are connected with a gating system are:

1. Pouring basin
2. Sprue
3. Sprue base well
4. Runner
5. Runner extension
6. Ingate
7. Riser

Gates:

Also called the ingates, these are the openings through which the molten metal enters the mould cavity. Depending on the application, various types of gates are used in the casting design. They are:

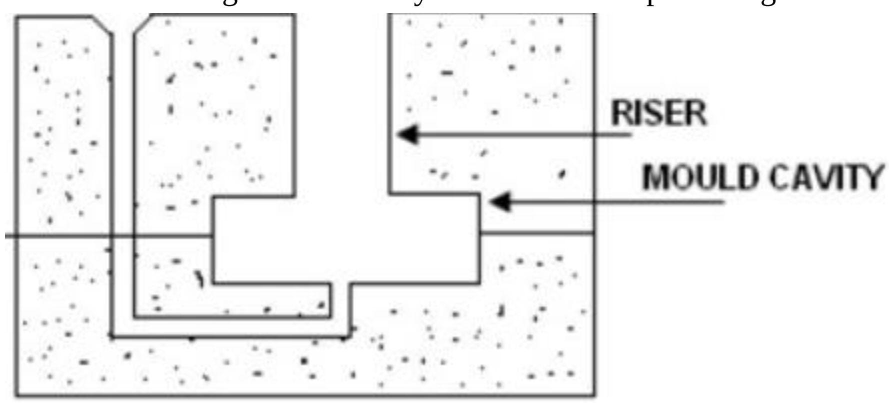
1. Top Gate
2. Bottom Gate
3. Parting Gate



TOP GATE

Top gate**:** This is the type of gating through which the molten metal enters the mould cavity from the top as shown in fig. since the first metal entering the gate reaches the bottom and hotter metal is at the top, a favorable temperature gradient towards the gate is achieved. Also the mould is filled very quickly. But as the metal falls directly into the mould cavity through a height, it is likely to cause mould erosion. Also because it causes turbulence in the mould cavity it is porne to form dross and as such top gate is not advisable for those materials which are likely to form excessive dross. It is not suggested for non – ferrous alloys and is suggested only for ferrous alloys. It is suitable only for simple casting shapes which are essentially shallow in nature.

Bottom gate: When molten metal enters the mould cavity slowly as shown in fig., it would not cause any mould erosion. Bottom gate is generally used for very deep moulds. It takes higher time for filling the mould and also generates a very unfavorable temperature gradient.

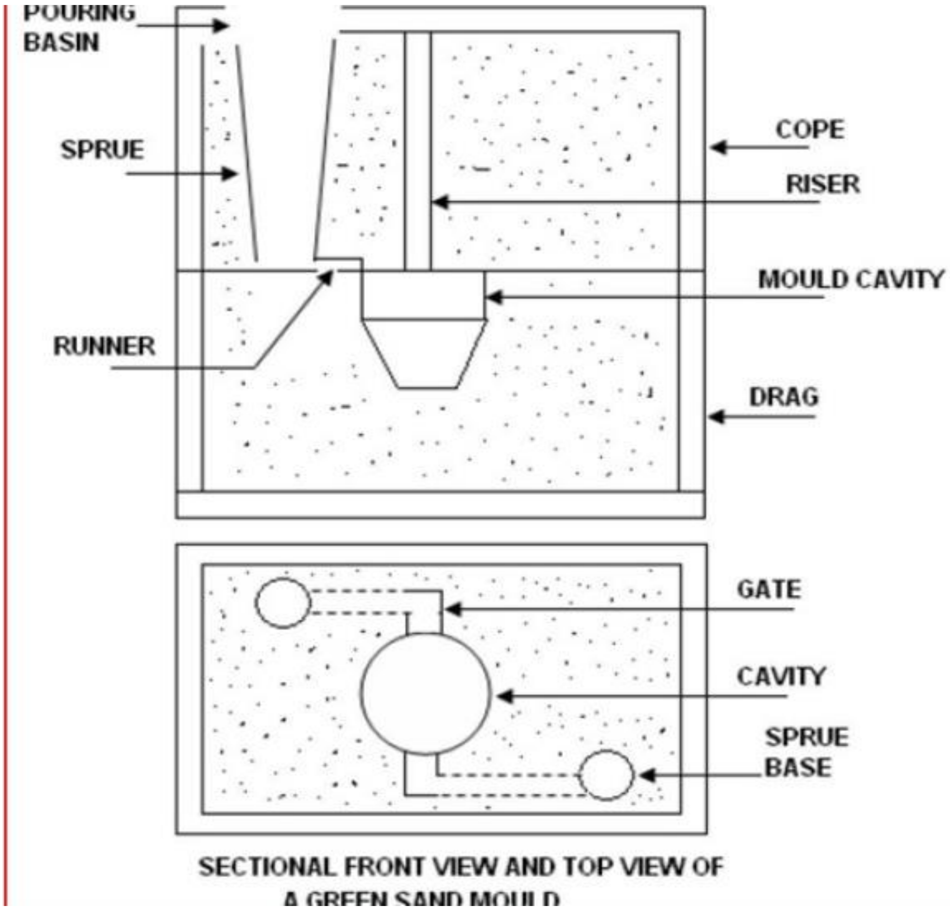


BOTTOM GATE

PROCEDURE:

1. First the pattern is placed with its larger diameter side is on a mould board.
2. The drag section of the flask is set over the pattern on the same board.
3. After powdering the pattern with lycopodium, talc or graphite, a 15 to 20 mm layer of facing sand is riddled over the pattern.
4. The drag is then filled with layers of green sand mixture from 70 to 100 mm thick, compacting each layer with rammer.

5. The top of the mould is rammed with the butt end of a rammer. The object of ramming the sand is to consolidate it, thereby preventing the cavity of the mould from being enlarged by the metal.
6. After the sand is rammed a strickle is used to scrape off the excess sand level with the top of the flask.
7. The mould is then vented by sticking it with a fine stiff wire at numerous places (The vent holes should not reach the pattern by 15 to 20 mm as otherwise they may spoil the mould. Moreover, the metal may run into the vent holes during pouring. These vent holes permit the escape of gases generated in the mould when the molten metal comes in contact with moist sand).
8. A small amount of loose sand is sprinkled over the mould and bottom board is placed on the top. The drag is rolled over, the molding board is removed, and the upper surface is sprinkled with parting sand (The parting sand is used to prevent the joints between the halves of a mould from adhering to one another when the two parts of the molding box are separated).
9. The cope section of the flask is then assembled.
10. Tapered wooden pegs to serve as sprue and riser are placed in proper position as shown in figure on the pattern which is riddled with facing sand and then cope is filled with green sand.
11. The operation of filling, ramming and venting of the cope proceed in the same manner as in the drag.
12. A funnel shaped opening is scooped out at the top of the sprue to from the pouring basin.
13. Next the cope is lifted off and placed on a board with the parting line upward.
14. An iron bar is now pushed down to the pattern and rapped sideways .So as to loosen the pattern and prevents any sand from sticking to the pattern.
15. Next pattern is drawn out using draw spike. Runners are cut in the cope according to the dimensions shown in fig.
16. Cut the gates in the drag according to the dimensions shown (Use Top Gating System).
17. If needed all the cavity edges are repaired. Finally the mould is assembled, the cope being carefully placed on the drag so that the flask pins fit into the bushes.
18. The mould is then ready for pouring.



Precautions:

1. Care must be taken to have proper alignment of the pattern as well as molding boxes.
2. Sand should be rammed properly and evenly.
3. The pattern should be rapped gently and withdrawn carefully without damaging the mould cavity.

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- Explain the gating system design.
- What is directional solidification
- What is the purpose of chaplets?
- What is the chill?
- Why Vent holes are given to the moulding box?
- What is sprue base well?

EXPERIMENT - 09

EVALUATION OF FORMABILITY USING ERICHSEN CUPPING TEST

AIM:

To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test.

APPARATUS:

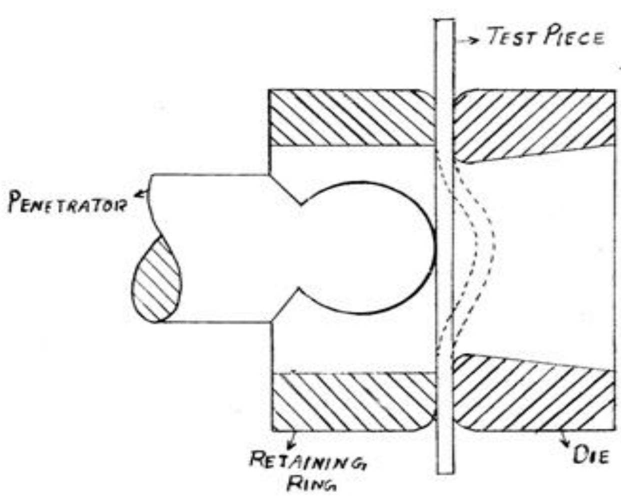
Cupping test machine, test specimen, vernier caliper, steel rule.

THEORY:

This is a mechanical test used to determine the ductility and drawing properties of sheet metal. It consists in measuring the maximum depth of bulge or cup which can be formed before fracture. Cupping number is the depth of impression at fracture, in the cupping test, usually expressed in millimeters.

PROCEDURE:

1. Measure the dimension of the test piece.
2. Place the test piece in the machine dies and touch the penetrator.
3. Rotate the handle of the machine to penetrate the penetrator in the test piece by pressing the retaining ring.
4. As soon as crack appears in the test piece stop rotating the handle.
5. Determine the depth of cup from med, which is the cupping number.



***Observation*:**

1. Thickness of test piece:--------------- mm.
2. Rotation speed: ----------------- mm per minute.
3. Diameter of ball: -------------- mm

SNO	TEST PIECE THICKNESS IN mm	READING		CUPPING NUMBER
		INITIAL	FINAL	
1				
2				

***Precaution*:**

1. Test piece should be perfectly flat.
2. Test piece should be free from foreign matter.
3. The cup formed should be continuously watehed.
4. The handle should be rotated uniformly and continuously.

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What is formability?
- What is cupping number?
- What is measured in cupping test?
- What is the size of indent diameter?
- What are the types of sheet metal tastings?

EXPERIMENT - 10

BLANKING AND PIERCING OPERATION USING FLY PRESS

AIM:

To do blanking and piercing operations on flywheel press by using dies.

APPARATUS:

Material: GI Sheet.

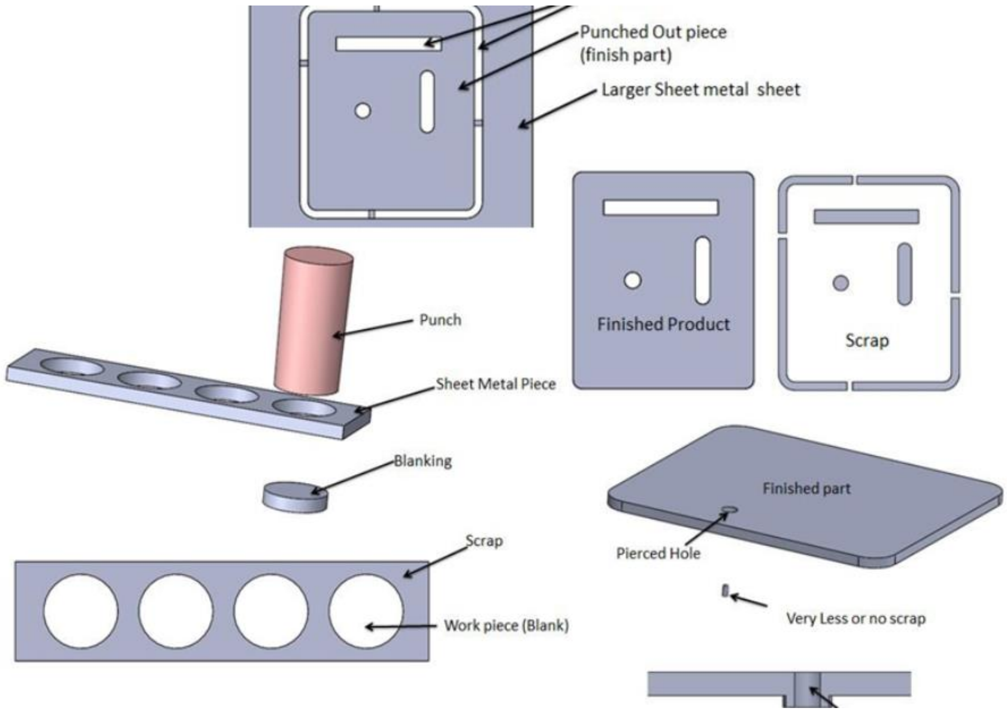
Equipment**:** Flywheel press, dies and required spanners.

THEORY:

Blanking: It is a process in which the punch removes a portion of material from the stock which is a strip of sheet metal of the necessary thickness and width. The removed portion is called a blank and is usually further processed to be of some use. In this operation the cut out piece is of importance and in it we can measure only the maximum diameter. Therefore incase of blanking operation the die should be given exact size and the clearance should be made on the punch.

Piercing**:** Piercing also called sometimes as punching, is used for making hole in a sheet. It is identical to blanking, except of the fact that the punched out portion coming out through the die is discharged as scrap. In this case the left out piece is importance and in it the minimum diameter is measured. Thus the punch should be given exact size and the clearance should be provided on the die.

Fly wheel is used to supply energy for that period of operation which requires more energy and during other periods, it stores the energy. If machine lacks sufficient flywheel energy, it will come to stop and will not be able to complete the operation. Actually by employing flywheel, we can work with motor of less capacity and at the same time supply maximum tonnage at the desired used of operation. For faster working operational (in case of blanking and piercing operations) more energy and power must be provided. In case of blanking and piercing operations, the work is completed in a very brief portion of stroke. So in this entire energy is to be tapped from flywheel, and flywheel supplies instantaneously whole energy required for operation and for remaining period of cycle, it will restore.



PROCEDURE:

1. Fix the top part of the die (punch) in the fly press shaft and tighten it with nuts.
2. Place the die on base of the fly press and fix with clamps.
3.Place the material in the die
4. Rotate the flywheel, the shaft will come down and punch the material.
5. Lift the fly press shaft and remove the material from the die.
6.Repeat the cycle for the second operation.

Precautions:

1. Die and punch should be aligned.

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What is the difference between blanking and punching?
- What is the blank size?
- Which part is used for holding the metal sheet during blanking operation?
- Which die is not the type of cutting dies in the metal cutting operations?
- What is embossing ?
- What is lancing?

EXPERIMENT - 11

MOULDING MELTING AND CASTING

AIM:

To produce a carting from sand mould.

APPARATUS:

***Equipment**:*

A. Sand Moulds with different shapes of cavities
B. Crucible

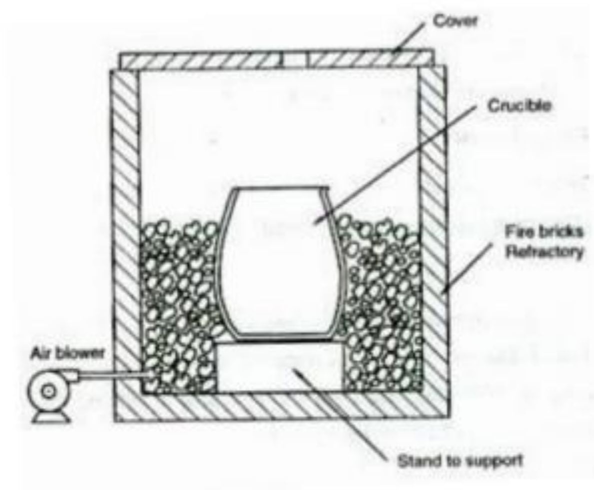
Materials: Molding Sand, Aluminum metal

THEORY:

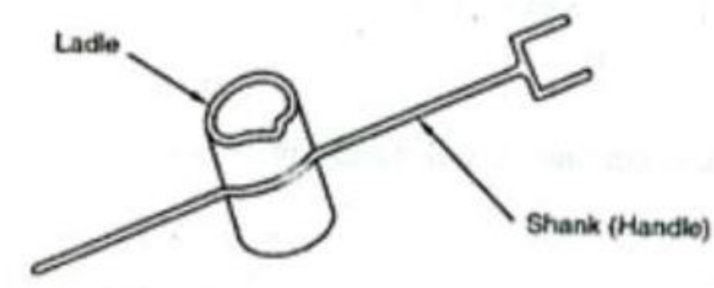
The casting process is the oldest, most versatile, and most flexible process for forming metals. Basically, it consists of introducing molten metal into a cavity or mould of desired form and allowing the metal to solidify. There is practically no limit to the size, shape, and alloy of the casting that may be made. Castings regularly produced range from tiny dental inlay of rare metals to complicated steel castings exceeding 2000 ton in weight. Almost any article may be cast with proper technique. In sand casting, a mould is produced by shaping a suitable refractory material to form a cavity of desired shape, such that a liquid metal can be introduced into this cavity. The mould cavity has to retain its shape until the molten metal has solidified and the casting is separated from the mould. There are also some other types of casting processes: e.g. permanent mould casting, die casting, plaster casting, investment casting, squeeze / semi solid casting, slush casting, shot casting etc.

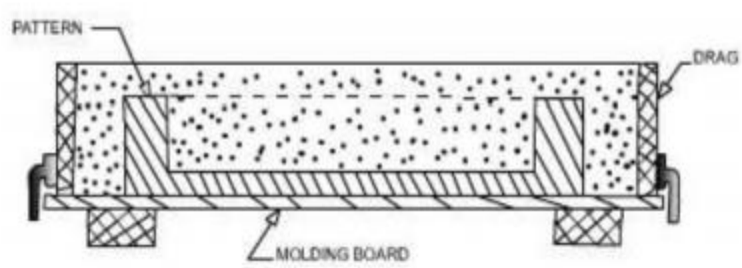
PROCEDURE:

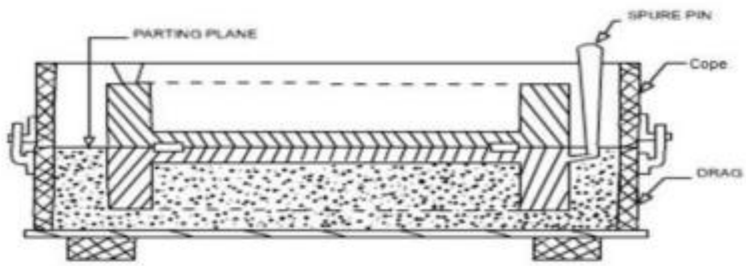
1. First of all, prepare sand for sand molding
2. Then, prepare a sand mould
3. After the preparation of sand mould, melt aluminum metal or any available aluminum in furnace.
4. When the metal is liquid enough to pour into the mould, put off the fire and hold the crucible with the help of a holder.
5. Place some weight on the mould and pour the molten metal into the mould through the spruce or pouring basin.
6. Continue pouring until the molten metal comes out of risers of the mould.
7. Allow the metal to solidify in the sand mould for some time.
8. When the metal in the mould is solidified, break the sand mould with the help of breakers to remove the required metal casting.
9. Finally, the casting is machined to get the finished shape.

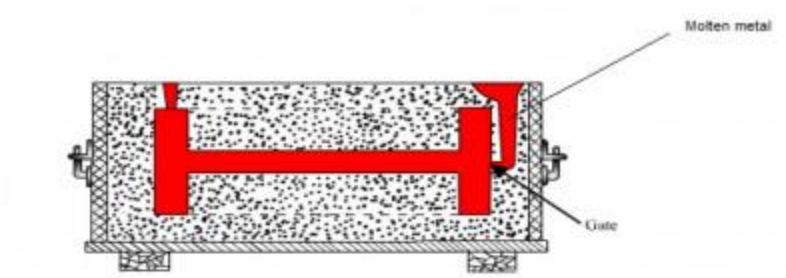


Melting furnaces






PARTING PLANE
SPURE PIN
Cope
DRAG


Molten metal
Gate

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What is the purpose of ladle?
- What is core venting
- How dendrites are formed?
- What are the applications of casting
- Classify moulding Machines
- what are the different types of furnaces used for casting.
- State the main functions of tuyeres in cupola furnace.

EXPERIMENT - 12

BLOW MOULDING PROCESS

AIM:

To prepare a plastic bottle using blow molding machine.

APPARATUS:

***Equipment**:* Blow molding machine

Material Required: Low grade polyethylene

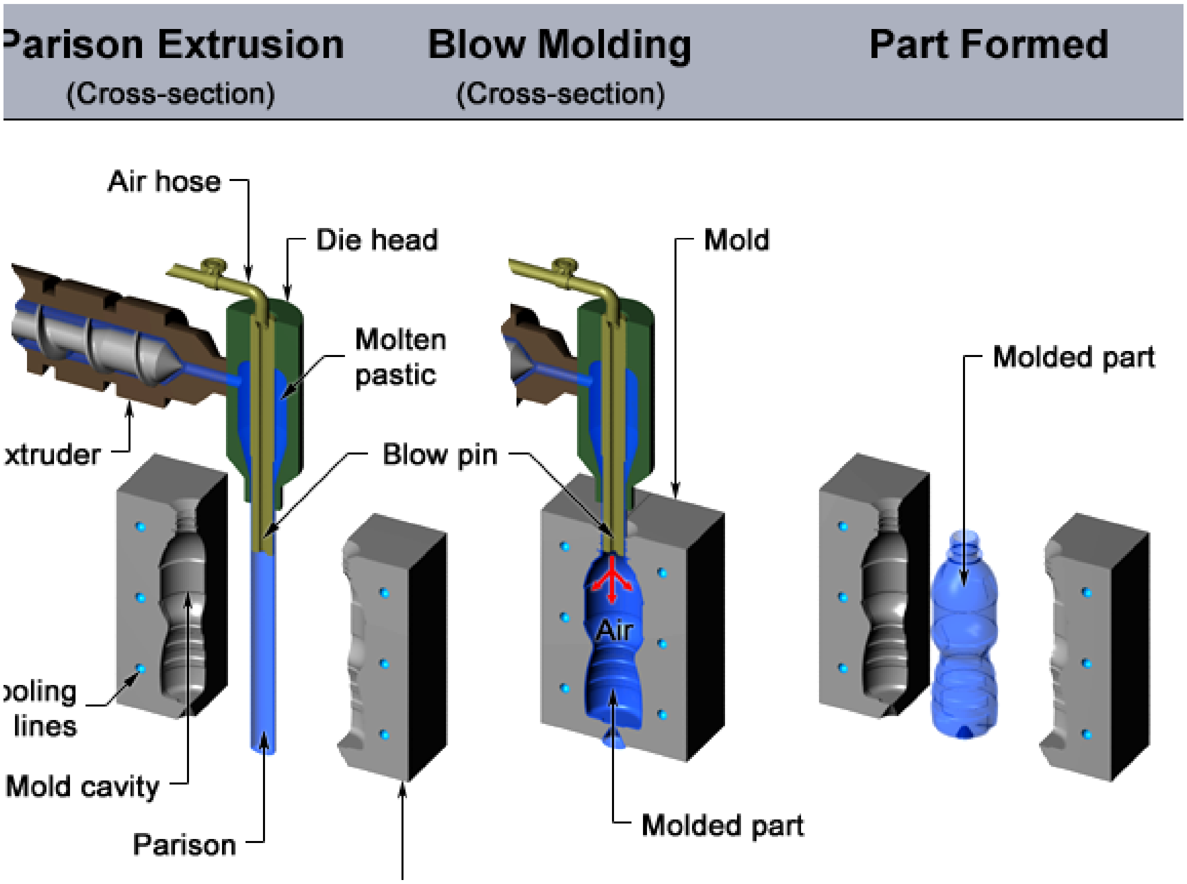
THEORY:

Working Principle: The process is applied to only thermoplastics, 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 heated and in soft pliable condition. Blow molding can be accomplished in two manners; one is direct blow molding and other indirect blow molding. In the former case, a measured amount of material in the 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 blown 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 molding 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 (clockwise) the regulator knob to suit the requirement of molding the container.
4. Feed correct quantity & quality of plastic material and switch on the power supply.
5. Switch on the heater.
6. Set the required timings controller to control the bottom heater.
7. Allow sufficient time to stabilizer.
8. When temperature reached, operate the hand lever valve.
9. Extrude the parison (Tubular form) to the required length and close the two die halves. Release the injection cylinder.

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 out of the die.
13. Now the machine is ready for next cycle.



Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What is extrusion blow moulding process?
- What is blow moulding process?
- What is parison tube?
- What are the products manufactured in blow moulding machine?
- Blow moulding machine is suitable for which type of plastics?
- What is injection blow moulding process?
- What is drape forming?

EXPERIMENT - 13

HYDRAULIC PRESS (DEEP DRAWING)

AIM:

To Determine the Blank Size, Drawing Force and Blank Holding Force for Producing a symmetrical cup of circular cross section using a Draw Tool and Perform Drawing Operation.

APPARATUS:

Equipment and Tools Required:

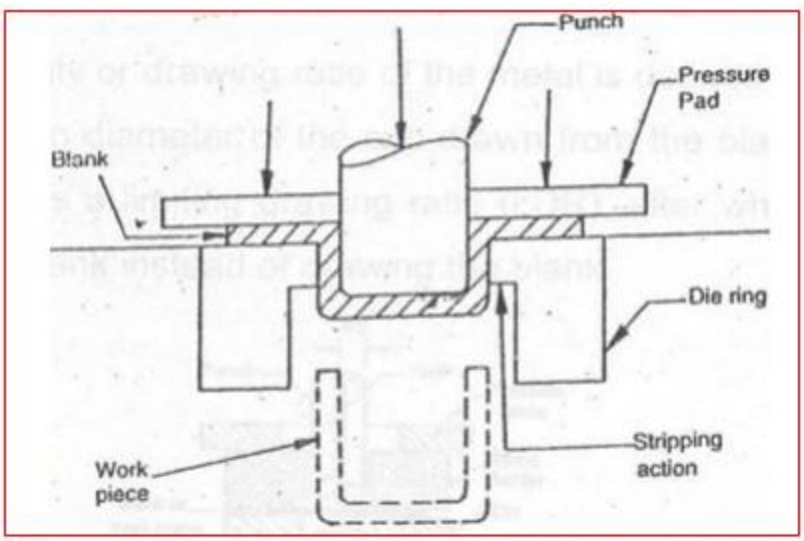
- Hydraulic Press
- Draw tool and Inclinometer.

Material Required:

Aluminium sheet of required size and MS round bar of 25mm diameter.

THEORY:

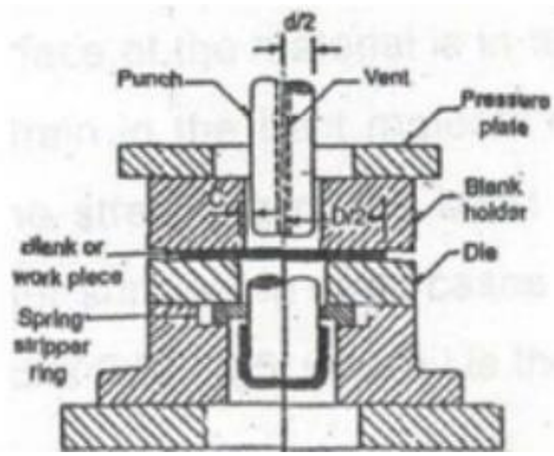
Drawing: Drawing operation is the process of forming a flat piece of material into a hollow shape by means of a punch which causes the blank to flow into the die cavity. The depth of draw may be shallow, moderate or deep. If the depth of the formed cup is up to half of its diameter, the process is called "Shallow drawing". If the depth of the formed cup exceeds the diameter it is termed as "Deep drawing". Parts of various geometries and sizes are made by drawing operation, two extreme examples being bottle caps and automobile panels.



Deep drawing operation

As the drawing progress i.e. as the punch forces the blank into die cavity, the blank diameter decreases and causes the blank to become thicker at its outer portions. This is due to the circumferential compressive stress to which the material element in the outer portions is subjected. If this stress becomes excessive the outer portions of the blank will have the tendency to buckle or wrinkle. To avoid this, a pressure pad or blank holder is provided. The holding down of pressure is obtained by means of springs, rubber pad, compressed air cylinder or the auxiliary ram on a double action press. The portion of the blank between the die wall and punch is subjected to nearly purely tension and tends to stretch and becomes thinner. The portion of the formed cup which wraps around the punch radius is under tension in the presence of bending. This part becomes the thinnest portion of the cup. This action is termed as 'necking' and in the presence of unsatisfactory drawing operation, is usually the first place to fracture. The outer portions of the blank hole are become thicker duration. then these portions are draw into the e cavity owning' of this section will occur if the clearance between punch is no nought to accurate increases of the work piece. This ironing is useful if uniform thickness of the product is desired after the drawing operation.

Deep Drawbility: Deep drawability or drawing ratio of the metal is defined as the ratio of the max blank diameter to diameter of the cup drawn from the blank, i.e. D/d. For a given material there is a limiting drawing ratio (LDR), after which the punch will pierce a hole in the blank instead of drawing the blank.



This ratio depends upon many factors, such as material, amount of friction present etc. The usual range of the max drawing ratio is 1.6 to 2.3.

A simple push through drawing die is shown. The drawing punch should be properly vented with drilled passengers. Venting serves double purpose it eliminates suction which would hot the cup on the punch and damage the cup when it is stripped from the punch. Secondly, venting provides passages for lubricants. Many presses are used for the deep drawing operations are hydraulically operated and these presses have an additional hydraulic cylinder and piston for the additional slide.

Product applications of deep drawing process are: cups, shells, automotive bodies, gas tanks, house hold hard ware etc.

Redrawing: In deep drawing the percentage reduction in one draw is defined as:

% reduction = [D-d)/D] X 100

Now D/d = 6 to 2.3, d/D=0.435 to0.625 =0.5 (average)

The average reduction in deep drawing= [1-d/D] X 100 = 50%

To make tall cups of smaller diameter it is necessary to use successive drawing operations. Reducing the drawn cup to the smaller diameter and increased height is known as "redrawing".

Blank Size: One of the first jobs of the draw die designer is to find the size of the blank to be used for making a given cup. It is often difficult to find a blank of exact size required for making a given shell, because of thinning and thickening of sheet during drawing. The calculation should be based on volume, surface area or by layout. The following gives the useful relations in calculating the blank diameter for cylindrical shells for relatively thin materials.

$$D = \sqrt{d^2 + 4dh} \qquad \text{When } d \geq 20r$$

$$D = \sqrt{d^2 \quad dh \quad r} \qquad \text{When } 15r \leq d \leq 20r$$

$$D = \sqrt{d^2 + 4dh \quad r} \qquad \text{When } 10r \leq d \leq 15r$$

$$D = \sqrt{(d \quad 2r)^2 \quad 4d(h \quad r) \quad 2 \quad (d \quad 0.7r)} \qquad \text{When } d < 10r$$

Where r = corner radius on the punch, mm h = height of the shell, mm

d = outer diameter of the shell, mm D = blank diameter, mm

Drawing Force

The drawing force depends on the cup material, its dimensions and the configuration. The drawing force can empirically be calculated using the following equation for cylindrical shells.

$$P = \pi d t s \left(\frac{D}{d} - C\right)$$

Where P = drawing force, N

t = thickness of the blank material, mm

s = yield strength of the metal, Mpa

C = constant to cover friction and bending. Its value is between 0.6 and 0.7

<u>PROCEDURE:</u>

1. Fix the punch to the ram of the press.
2. Fix the die on the bed of the machine using clamps, bolts and nuts.
3. Calculate the required blank size and place the same between the punch and die block.

4. Apply the hydraulic pressure on the punch through ram so that the punch slowly descends on the blank and forces it take the cup shape formed by the end of the punch, by the it reaches the bottom of the die.
5. When the cup reaches the counter bored portion of the die, the top edge of the cup formed around the punch expands slightly due to spring back.
6. Observe the reading of the pressure gauge which directly gives the force required to perform the operation.
7. Calculate the drawing force required, to perform the operation using above relations.
8. Compare the two readings
9. Then move the punch in the return direction so that the cup will be stripped by counter bored portion.

Precautions:

1. The die should be properly clamped to the bed of the machine and it is not disturbed during the process.
2. The punch is properly fixed to the ram of the machine.
3. The load should be applied uniformly on the bar.
4. The bar should be held properly on the die block.

Space For Calculations

RESULT & CONCLUSIONS:

VIVA QUESTIONS:

- What do you mean by clearance ?
- What is Inclinometer ?
- How much Force required for the deep drawing ?
- What do you mean by Yield Strength ?
- What is LDR ?

Estd: 2008

METHODIST

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