

2 Marks Q & A

Unit I

1. What are the types of tooling?

- (i) Cutting tools
 - a. Single point cutting tools
 - b. Multi-point cutting tools
- (ii) Press tools
- (iii) Dies
- (iv) Jigs and Fixtures
- (v) Gauges

2. Define the term Tool design.

Tool design is the process of designing and developing the tools, methods, and techniques necessary to improve manufacturing efficiency and productivity.

3. Mention the factors influencing tool design.

- (i) Overall size and shape of the component to be manufactured.
- (ii) Type and condition of work piece material.
- (iii) Method of machining operation and sequence of operations.
- (iv) Degree of accuracy required.
- (v) Number of components to be manufactured.
- (vi) Locating and clamping surfaces on the component.
- (vii) Type and size of machine tool: Whether the machine tool is single spindle or multi-spindle.
- (viii) Should the tool be capable of performing more than one operation?
- (ix) Cutting tool materials.
- (x) Life of cutting tool required.
- (xi) Cutting fluids to be used.

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4. State the objectives of tool design.

- (i) To provide simple, easy-to-operate tools for maximum efficiency.
- (ii) To reduce manufacturing expenses by producing parts at the lowest possible cost.
- (iii) To design tools which consistently produce parts of high quality.
- (iv) To increase the rate of production with existing machine tools.
- (v) To design tool to make it foolproof and to prevent Improper use.
- (vi) To select materials that will give adequate tool life.
- (vii) To provide in the design of the tools for maximum safety of the operator.

5. What are production devices?

Production devices are generally work holding devices such as work holders with/without tool guiding/setting arrangement. These are generally called as jigs and fixtures.

6. Define jig.

A jig may be defined as a work holding device which locates and holds the component for a specific operation. It is also provided with tool guiding elements.

7. What are the elements of jigs and fixtures?

- (i) Locating elements
- (ii) Clamping elements
- (iii) Tool guiding and setting elements

8. What are inspection devices?

Inspection devices are used to check the accuracy of the machined components. It facilitates the interchangeability and uniformity of the produced components.

9. State the purpose of Jigs and Fixtures.

Jigs and fixtures are the devices which are designed for holding, supporting and locating the workpiece and to guide the tools.

10. State the use of jigs and fixtures.

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These devices are used to produce a repetitive type of workpiece with "zero defects". But these are economical in mass production only. Jigs and fixtures are designed to save production time, to maintain dimensional accuracy, to facilitate quick and interchangeable assembly.

11. What are the essential features of jigs?

1. Reduction of idle time
2. Cleanliness
3. Replaceable parts or standardization
4. Provision for coolant
5. Hardened surfaces
6. Inserts or pads
7. Fool-proofing
8. Economic soundness
9. Easy implementation
10. Initial location
11. Position of clamps
12. Clearance
13. Ejecting devices
14. Rigidity and stability
15. Safety

12. Name the various operations that can be performed using jigs and fixtures.

Jig is usually lighter in construction. Jigs are used on drilling, reaming, tapping and counter boring operations.

13. Differentiate between jigs and fixtures. [Anna Univ. Apr'04, Apr'06, Apr'08 & May'09]

<i>Jigs</i>	<i>Fixtures</i>
1. It holds, locates the workpiece and also guides the tool.	1. It holds and positions the workpiece but does not guide the tool.
2. Jigs are smaller in size and lighter in construction.	2. Fixtures are usually massive and heavier in construction.
3. Semi-skilled workers can operate.	3. Skilled operator is necessary as compared to jig.
4. Fabrication time and cost are less.	4. Production time and cost are more.
5. Clamping with the table is often not necessary.	5. It is bolted rigidly on the machine table.

14.

advantages of using jigs and fixtures.

Mention any four

- (i) It reduces the production time by eliminating the marking out, measuring and setting the job.

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- (ii) It reduces the cost of production by eliminating the laying out of work and setting up of tools.
- (iii) It increases the machining accuracy as the work is rigidly fixed and located and tool is guided.
- (iv) It minimises the machining time by increasing depth of cut, feed and speed, due to better clamping rigidity of the job and guiding the tool.

15. What are the main four considerations of jigs and fixtures in design?

- (i) Location
- (ii) Clamping
- (iii) Loading
- (iv) Stability and rigidity.

16. Define locating devices. [Anna Univ. Apr'04]

Locators are those parts of a jigs or fixture which help a workpiece to seat in proper position in it. Depending on the type of work, locators are designed. There is a large variety of locating devices or locators and methods of locating available to a jig and fixture designed. The majority of workpiece can be located with these methods.

17. State any two important conditions while locating the workpiece.

- (i) Locating surfaces should be as small as possible and the location must be done from the machined surface.
- (ii) Sharp corners in the locating surfaces must be avoided.

18. Define clamping devices. [Anna Univ. Apr'04]

Clamping devices are used to hold the workpiece in the correct relative position in the jig or fixture. It should ensure that the workpiece is not displaced under the action of cutting forces. For efficient operation, firm clamping of the workpiece is must.

19. What are the important points to be considered for clamping the workpiece?

- (i) Clamping should always be arranged directly above the points supporting the work.
- (ii) Quick acting clamps should be used wherever possible.

20. State the significance of clamping force in relation to cutting force. [Anna Univ. Apr'04]

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Clamping force of any jigs and fixtures must be equal to the cutting force or greater than cutting force, in order to avoid movement during machining.

21. Explain the importance of clamping force. [Anna Univ. Dec'05]

- (i) The applied clamping pressures against the workpiece must counteract the tool forces.
- (ii) The clamping force should be kept minimum. It must only hold the workpiece and should never be great enough so as to damage the workpiece.
- (iii) The clamping pressure should be exerted on the solid supporting part of the workpiece to prevent distortion.
- (iv) Clamping should be simple, quick operating and foolproof.

22. How are the supporting loading surfaces made?

Loading and supporting surface usually made of hardened material and also it should be renewable wherever possible.

23. Why should jigs and fixtures be rigid?

Jigs and fixtures should possess a high rigidity to withstand the cutting forces.

24. State the purpose of providing index plate in jigs and fixtures.

Index plate enables the workpiece to divide into any number of equispaced faces.

25. Sketch a latch clamp. [Anna Univ. Apr'04]

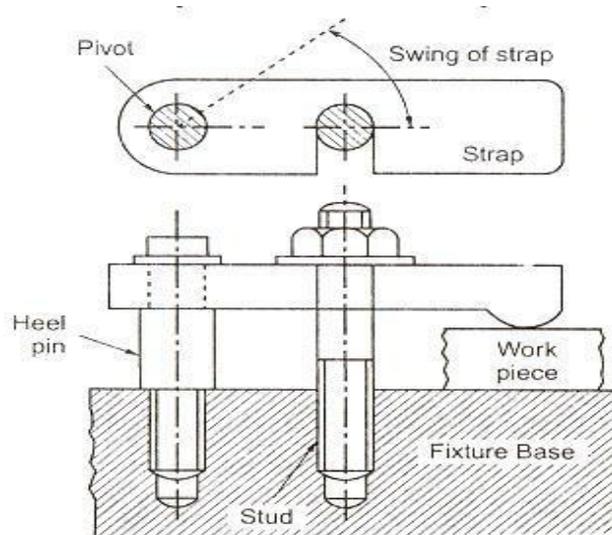


Figure 1.72 Latch clamp

26. When All sharp
27. What do locating

will the jig and fixture be safety?
edges should be removed or avoided.
you infer about the degree of freedom in principles?

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Any workpiece has six degrees of freedom. Three of these freedoms are translation and remaining is rotation with respect to three mutually perpendicular axes.

28. What is meant by 3-2-1 principle of location? [Anna Univ. Dec'05]

According to this principle, a workpiece can be completely restrained by providing three location points in one plane, two location points in the second plane and one location point in the third plane. Therefore, it is called 3-2-1 principle of location.

29. Define principle of least points.

According to this principle, only the minimum locating points should be used to secure location of the workpiece in anyone plane.

30. Define principle of extreme positions.

According to this principle, the locating points should be placed as far away from one another as possible, to achieve the greatest accuracy in location. This is essential to keep the workpiece under stable equilibrium.

31. Define "Principle of mutually perpendicular planes".

An ideal location of a component is achieved when it is located on six locating pins in three mutually perpendicular planes.

32. If principle of mutually perpendicular planes is not properly implemented, what will happen?

- (i) Lifting of workpiece due to the wedging action of locators.
- (ii) Displacement of locating point by a particle adhering to it magnifies the error.

33. Write down the formula of resulting error due to mislocation.

The resulting error due to mislocation of workpiece is

$$P=R-I$$

Where R = Resulting error, I = Introducing error.

34. Define fool proofing. [Anna Univ. Nov'04 & May '06]

The location system should positively prevent the wrong loading of workpiece in a fixture by fool-proofing.

35. State the various locating elements used in jigs and fixtures.

- 1. Pin and button locators
- 2. V-locators
- 3. Bush locators
- 4. Nest or cavity locators

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36. Mention the locating methods. [Anna Univ. Apr'05]

1. Pin and Button Locators 2. V-Locators 3. Bush locators 4. Nest or cavity locators

37. Define jack pin locator. [Anna Univ. Apr'06]

The locator which positions itself automatically by means of spring force according to the need is known as jack pin locator.

38. State the use of adjustable pin locator.

Adjustable pin locators are used when the surface is rough or uneven such in castings, forgings or non-machined faces.

39. What is the main advantage of using jack pin locator?

It positions itself automatically according to the need.

40. When is a diamond-pin used for locations? [Anna Univ. Model questions]

A workpiece with two finished holes at the two ends such as connecting rods or lever can be easily located with the help of two cylindrical pins.

41. What are the two main types of V-locators?

1. Fixed V-locator, 2. Adjustable type V-locator.

42. How are bush locators used to locate the workpiece?

These are used to locate cylindrical workpiece, such as shafts, spindles, etc.

43. How does nest or cavity location differ from bush locator?

Properly designed nests should locate the workpiece without supplementary locating devices, although locating pins are occasionally used.

44. What is the use of dowel pins? Give one example. [Anna Univ. Apr'05]

It is used for easy and correct location of mating parts. Eg. Foundry.

45. What is the use of clamping device?

Clamping devices are used to hold the workpiece in the correct relative position in the jig or fixture.

46. Write any two requirements of clamping devices. [Anna Univ. Nov'08].

(i) The applied clamping pressures against workpiece must counteract the tool forces.

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(ii) The clamping force should be kept minimum. It must only hold the workpiece and should not be so high as to damage the workpiece.

47. Classify clamping devices.

(i) Mechanical actuating clamps (ii) Power clamps.

48. Mention any four types of mechanical actuating clamps.

(i) Screw clamps (ii) Strap clamps (iii) Latch clamps (iv) Wedge or key clamps

49. Write the equation for calculating force developed on the screw clamp.

$$F = \frac{PL}{R \tan(\alpha + \theta)}$$

Where F = Force developed by screw,
P = Pull or push applied to spanner,
R = Pitch radius of screw thread,
L = Length of spanner or lever,
 α = Helix angle of thread,
 θ = Friction angle of thread.

50. What are the two main limitations of screw clamps?

- (i) Clamping force is not constant
- (ii) Time taken by clamping is more.

51. What are the various types of strap clamps or lever clamps?

(i) Bridge (ii) Heel (iii) Edge clamp.

52. Write down the formula for calculating the total pressure all work using bridge clamp.

$$\text{Total pressure} = \frac{y}{x+y} \times R$$

Where x => The distance between the point of contact of workpiece with clamp and centre line of bolt,

y => The distance between the point of contact of clamp with support pin and centre line of

bolt, P => Total clamping pressure.

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53. What is side clamp?

The type of clamps which are mostly used for machining horizontal surfaces are called side clamp.

54. What is latch clamp?

Latch clamp is a special type of clamp which provides an entry for loading and unloading of workpiece without removing the strap fully.

55. What is the advantage of swing plate clamp? [Anna Univ. Apr'06J

This is a special type of clamp which provides a means of entry for loading and unloading the workpiece without removing the strap fully. For this purpose, the strap can be swung out or in. It is also called as latch clamp.

56. How work is clamped using hinged clamps?

The work is clamped in a strap which is used to enable loading and unloading of workpiece.

57. How are loading and unloading of work done in a hinged clamp?

The hexagonal nut is loosened partially and eye bolt is swung out of the open slot to free the hinge plate to load and unload the workpiece.

58. How does cam operated hinged clamp lock the work?

Locking is done with the help of a hook type cam after closing.

59. How is unloading of workpiece performed using C-clamps?

By slightly unscrewing the locking nut, the C-clamp is removed for unloading of work.

60. What are the two types of cam operated clamps?

- (i) Cam actuated plate clamp
- (ii) Eccentric clamp.

61. Sketch a Bayonet clamp. [Anna Univ. Apr'05]

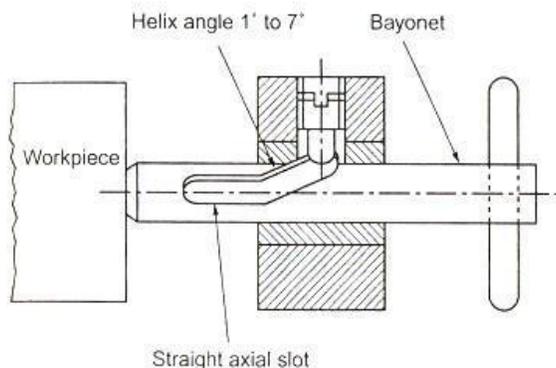


Figure 1.73 Bayonet clamp

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62. State the provision made on the quick acting nut.

Internal parallel threads are cut on either end of the hole to a limited length from both the ends.

63. How do toggle clamps work?

Toggle clamps are withdrawn by a considerable distance for loading and unloading of workpiece.

64. How is Bayonet clamp operated during loading and unloading of works?

These clamps can be pulled back straight axially through the straight slot to provide ample clearance during loading and unloading.

65. Sketch and write the use of an equalising clamp. [Anna Univ. Dec'07]

These clamps are used to clamp two or more unequal workpiece at a time.

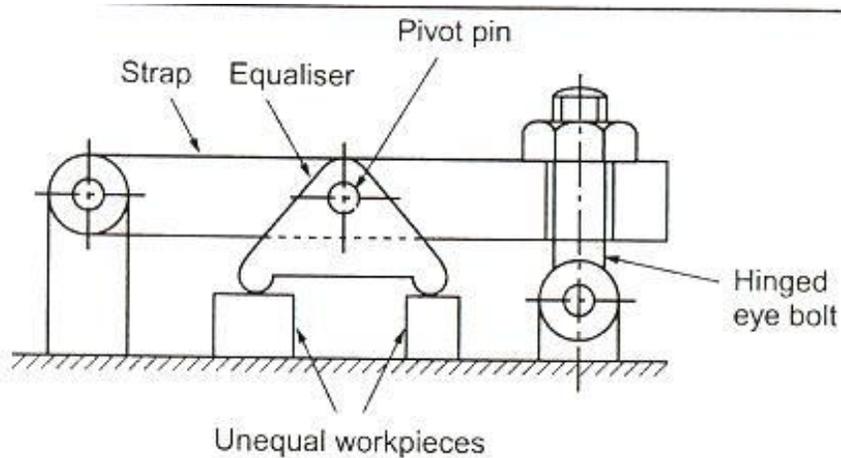


Figure 1.74 Equalising clamp

66. Where used?

This is type of

67. Where pneumatic

These

hydraulic or pneumatic methods where large production quantities are required,

68. Define stack clamping. [Anna Univ. Nov'04]

It is also called as a heel clamping. It consists of a robust plate or strap, centre stud and a heel pin. When the clamping nut is unscrewed, the clamp will be automatically pushed upwards by the spring to make the workpiece free. Then the clamp is rotated in anticlockwise direction and the workpiece is removed.

69. List out some the power clamping. [Anna Univ. Nov'04 & Apr'08]

is the hook bolt clamp

used where the convenient clamp is not convenient.

are hydraulic and clamps mainly used?

clamps are actuated by

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1. Hydraulic clamps

2. Pneumatic clamps

70. How can loading and unloading of work performed using fluid power clamps?

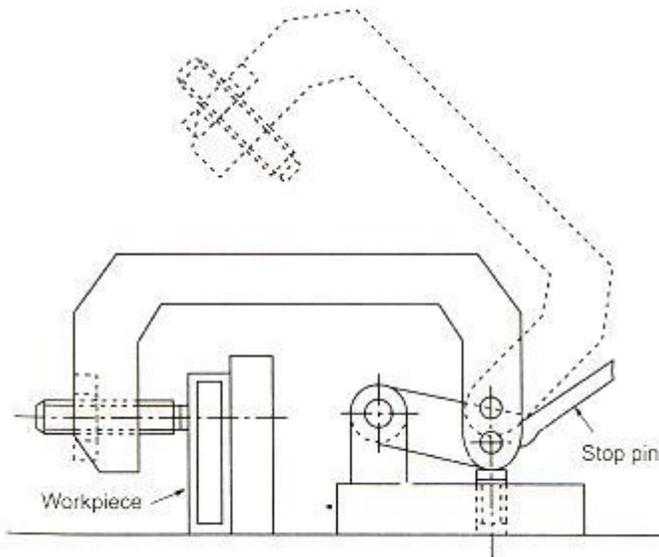
For loading, the piston inside the cylinder is actuated by oil or air pressure.

For unloading, the piston moves back thereby actuating the levers. Then, the clamping pressure on the workpiece is released.

71. Mention the air pressure inside the cylinder in pneumatic clamps.

5 - 6 kg/cm²

72. Sketch a quick acting clamp. [Anna Univ. Model questions]



73. Define

Univ.May'06]

It is another

workpiece which have variations in dimensions. There are two types of jack pins available. This type of jack pin is raised upward due to the spring pressure.

jack pin locator. [Anna

type of pin locator for locating

74. Explain the term redundant location. [Anna Univ.May'07]

The use of extra or duplicate locators that does not position the workpiece accurately is called redundant location.

75. How can the fabrication tolerance for jigs and fixture be calculated? [Anna Univ. Apr'08]

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Tolerance grades may be obtained either

(i) Directly from tables in PSGDB page, or by using formulae.

76. List the standard parts used in jigs and fixtures fabrication. [Anna Univ.May'09]

- | | | | |
|-----------------------|---------------------|-----------------------------|---------------------------|
| 1. Bases | 2. Rest buttons | 3. Pins | 4. Handles and hand knobs |
| 5. Feet | 6. Lift rings | 7. Clamps and pressure feet | 8. Drill bushes |
| 9. Threaded fasteners | 10. Stock sections. | | |

77. Name any two materials commonly used in jigs and fixtures and their Hardness range. [Anna Univ. Nov'08]

Jigs and fixtures can be made from various materials which are hardened to resist wear and tear. Sometimes, non-ferrous metals, such as phosphor, bronze, nylons or fibers are also used to resist wear of mating parts. Some of the metals are given below.

- | | | |
|---------------------------|--|---------------------------|
| 1. High speed steel (HSS) | 2. Die steel | 3. Carbon steel |
| 4. Collect steel | 5. Oil Hardening Non-shrinking Tool Steel (OHNS) | |
| 6. Nickel chrome steel | 7. High tensile steel | 8. Cast iron |
| 9. Phosphor Bronze | 10. Nylon or Fibre | 11. Case Hardening steels |

78. What is advantage of conical locators? [Anna Univ.Dec'05]

Conical locators are preferred over the cylindrical locators where it is necessary to accommodate variation in the hole diameters of the workpiece without affecting the accuracy III location.

79. What is best method to locate a rough surface? [Anna Univ. Dec'05]

Adjustable pin locators are used when the surface is rough or uneven such as in castings, forgings or non-machined faces.

80. What is the primary function of a linear bushing? [Anna Univ. Dec'07, Apr'08& May'09]

These bushes are used to guide both renewable and slip bushes and sometimes they are also used as a guide to tools.

81. Where should locators contact the part? Why? [Anna Univ. Dec'07]

The part should contact as far as possible in extreme positions.

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Unit II

1. Which is the main element of a jig?

Jig body.

2. Where are jig feet provided?

The jig feet are provided at the bottom of the jig .

3. What is the function of jig bushes? [Anna Univ.Apr'04]

Drill bushes are used to guide drills, reamers and other cutting tools into the proper position on the workpiece.

4. State the purpose of a jig plate.

A jig plate carries the drill bush for guiding the tools.

5. Why locators are necessary in jigs?

Locators are used to rest the workpiece in proper position of the jig.

6. State the use of clamps.

Clamps are used to hold the workpiece firmly against all disturbing forces occurred by machining operations.

7. What are the materials generally used for making drill bushes?

1. Tool steel
2. Water hardening carbon steel

8. When will press fit bushes or fixed bushes be used?

These types of bushings are used when little importance is put on the accuracy or finish.

9. What are the two types of press fit bushes?

1. Plain or headless bushes
2. Flanged or headed bushes

10. Specify the condition of using plain and flanged bushes in jigs .

Plain bushes:

These are mainly used when the free surface is required on the. Top face of the jig plate.

Flanged bushes:

It is employed when the jig plate into which it is installed in thin.

11. State the purpose of providing liner in renewable bushes.

Liner is used to provide hardened wear resistance on mating Surfaces.

12. How the rotation and movement of bush can be prevented?

By providing set screws, the bushes are retained with the jig plate.

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13. When slip bushes are used?

Slip bushes are mainly used when a hole in the workpiece requires two operations. Example: Performing both drilling and reaming in a same jig plate.

14. Why threaded bushes are used in jig plates?

Threaded or screwed bushes are used to hold the bush in place as well as to make the bush adjustable.

15. Liner bushes are known as _____?

Master bushes

16. How liner bushes are used?

Liner bushes are always used in conjunction with a renewable or slip bushes.

17. Tell the other name of special bushes.

Non-standard bushes

18. What are the different types of jigs?

- | | | | |
|--------------------|-----------------------|-----------------|-------------|
| 1. Plate jigs | 2. Latch or leaf jigs | 3. Channel jigs | 4. Box jigs |
| 5. Angle plate jig | 6. Turnover jig | 7. Pot jig | |

19. Define sandwich jig. [Anna Univ. Apr'05]

These jigs are a form of plate jig with a back plate. This type of jig is ideal for thin or soft parts that could bend or warp in another style of jig. Here again, the use of bushing is determined by the number of parts to be made.

20. State the provision made on latch or leaf jig?

Leaf plate is capable of swinging about a fulcrum point so that it can open or close the load or unload the workpiece.

21. What is the disadvantage of leaf jigs?

1. Clips may accumulate inside and cause trouble unless provisions are made for them.
2. Drill bushings are fitted in the leaf, play in pivoted and may affect drilling accuracy.

22. State the materials used for fabricating channel jigs.

1. Cast Iron
2. Mild steel plates.

23. When will box jigs be used?

When holes are to be drilled in more than one faces of the workpiece, box jigs are used.

24. Distinguish between a plot jig and a box jig. [Anna Univ. Nov'08]

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In channel jigs, holes are drilled only in face but holes can be drilled on more than face using box jigs.

25. Distinguish between a pot jig and a box jig. [Anna Univ.May'07]

In a pot jig, holes are drilled in hollow cylindrical components having flanges with relatively smaller outside and inside diameters but holes can be drilled on more than face using box jigs.

26. What are the operations that can be performed using post jigs?

1. Drilling
2. Reaming

27. Sketch the channel jig. [Anna Univ. Nov'04 & Apr'06]

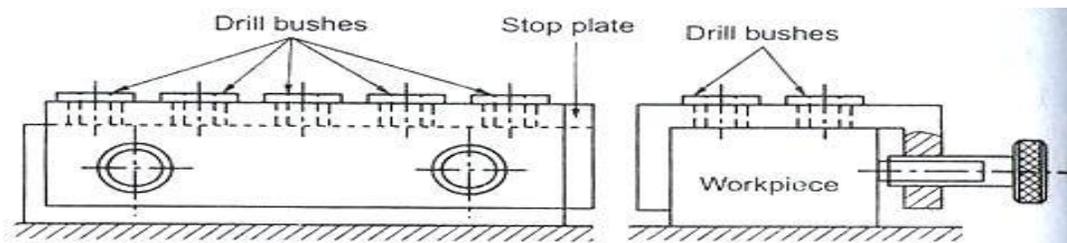


Figure 2.148 Open type channel jigs

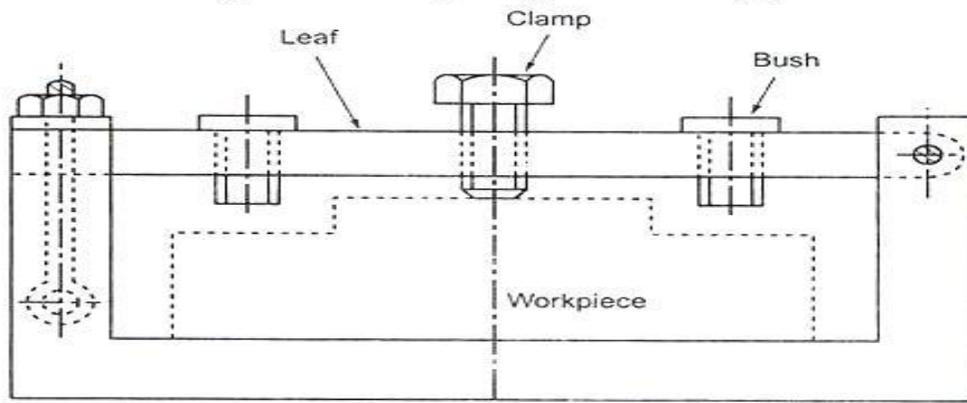


Figure 2.149 Channel and leaf jigs

28.State the provision made on angular post jig to drill run and removal of the workpiece.

The drill bushes are extended and shaped.

29. What is the main advantage of turnover jig?

Workpiece having no suitable resting surface can be drilled conveniently with turnover jigs.

30. What are the two important parts of pot jigs?

1. Pot or bottom part
2. Bush or jig plate

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31. When will solid jigs be more suitable?

It is a very simple form of jig used for drilling holes in articles of simpler shapes and relatively smaller sizes.

32. At what condition, the trunnion jigs are used?

When a large, heavy workpiece are to be drilled from a number of sides so that the faces requiring drilling operations can be easily turned and positioned.

33. What are the advantages of trunnion jig? [Anna Univ. Nov'04]

- (i) The workpiece is located and clamped to the carrier which also carries the drill plates.
- (ii) The carrier is mounted on trunnion so that it can be rotated from face to face.
- (iii) It can be positioned and locked using an indexing device.

34. Define indexing device. . [Anna Univ. Apr'05]

Device used for dividing the rotation of the circular workpiece into equal number of portions is known as indexing device.

35. What is the use of indexing jig?

Indexing jigs are used to drill series of holes in a circle on the face of a workpiece.

36. How can we identify universal jigs?

Universal jigs are those having either adjustable or adaptable with more than one drilling jobs.

37. How do automatic drill jigs differ from other jigs?

All the functions of jigs are performed automatically without any manual adjustment.

38. Illustrate the working of an automatic drill Jig. [Anna Univ. Nov'08]

Automation may be full or partial. In fully automated jigs, all the functions of jigs are performed automatically. The function of operator is limited only to the loading of workpiece and control the performance of jigs and machine tools. In partially automatic jigs or semi-automatic jigs, some of the steps or processes are automated. These processes or steps include loading and unloading of workpiece by various methods; clamping and unclamping of workpiece; removal or push-out of workpiece from the work zone.

39. What are the various possibilities to operate automatic drill jigs?

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- | | |
|-----------------------|------------------------------|
| 1. Mechanical | 2. Pneumatic or air operated |
| 3. Hydraulic operated | 4. Pneumo-hydraulic |

40. What is the use of fixtures?

Fixtures are used to hold the workpiece during machining operations.

41. When are the fixtures used?

When the components to be produced are in larger number, fixtures are used.

42. What are fixtures?

Some type of tooling used in positioning parts relative to each other for fabricating purposes are commonly referred to as fixtures.

43. What are the standard work holding devices in lathes?

- | | | | |
|-----------|------------|---------------|-------------|
| 1. Chucks | 2. Collets | 3. Face plate | 4. Mandrels |
|-----------|------------|---------------|-------------|

44. How can a lathe fixture be clamped to the lathe? [Anna Univ.May'08 & Nov'08]

These fixtures are normally mounted on the nose of the machine spindle or on a faceplate and the workpiece is held on them.

45. Write the specific requirements of a turning fixture. [Anna Univ.May'07]

1. The fixture should be accurately balanced in order to avoid vibrations while revolving.
2. Clamps and other holding devices should be designed in such a way that they will not be loosened by centrifugal force.
3. There should be no projections of the fixture which may cause injury to the operator.
4. The fixture should be light in weight as far as possible, since . It IS rotating,

46. How are face plate turning fixtures located?

Face plate turning fixtures are located on the face plate by means of two dowel pins and secured by T-bolts inserted into T-slots in the face plate.

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47. What is the function of mandrels in turning fixture? [Anna Univ. Apr'05]

It is used to hold the hollow workpiece, mandrels.

48. State the use of built-up turning fixture.

These fixtures are used for boring and facing operations on a bearing housing.

49. Mention the application of turning fixture. [Anna Univ. Nov'04 & Apr'06]

The fixture body is designed to drill a hole in the face of a cubical shaped workpiece.

50. The table is _____ relative to the cutters with the aid of the _____ in a milling machine mounted with milling fixtures.

[Ans: Positioned, Setting block]

51. Why is clearance provided in the milling fixture?

It is provided for the easy disposal of large quantity of swarf.

52. Mention any four essential features made on milling fixtures.

1. Base 2. Tenon strips 3. Setting block 4. Locating elements

53. Note down the purpose of using base on a milling fixture.

The base of a milling fixture should absorb the cutting forces during machining.

54. How can be maximum accuracy produced on work while using tenon strips?

The two tenon should be placed as far apart as possible.

55. What for setting block is used in conjunction with fixture?

It is used to reduce the setting time of the milling cutter with respect to workpiece.

56. List out the various locators used in fixtures.

1. Cylindrical locating pin, 2. Diamond pin locator, 3. Screws and dowels, etc.

57. State the purpose of using in-built clamping element.

The fixture with in-built clamping element has provided for rigidly clamping the workpiece.

58. What are the various types of milling fixtures?

1. Special vice jaws 2. Simple or plain milling fixture 3. Straddle milling fixture

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4. String or line milling fixture 5. Gang milling fixture 6. Indexing milling fixture
7. Key-way milling fixture 8. Boring fixture.

59. Name any four essential features of a milling fixture. [Anna Univ. Nov'08]

- (i) Base (ii) Setting block
(iii) Locating elements (iv) Tenon strips (v) Clamping element

60. Mention the special provision made on a setting block plain milling fixture.

Setting block has two setting faces-one for 'depth' setting and the other for 'transverse' setting.

61. How does straddle milling fixture differ from plain milling fixture?

The milling fixture in which two sides of a boss is to be milled.

62. How is cutter setting done?

The 'cutting setting' is done by using machined side faces of the casting below the rest pad.

63. What are the factors to be considered while string milling fixture selection?

1. The length depends on size of workpiece.
2. Length of milling machine table.
3. Length of stroke of table.
4. The workpiece should be clamped properly to ensure accurate machining.

64. How machining operations are performed using gang milling fixture ?

More than two cutters are mounted on the arbor and several faces of the workpiece are milled simultaneously in one feed.

65. What are the factors to be considered while selecting gang milling fixture?

1. The large profiled portion behind the workpiece takes the load of cut.
2. The selection of number of cutter for gang milling is made by considering the positive deflection of the arbor due to its loading.
3. The arbor must run truly for high quality work. This could be achieved by proper support to the arbor.
4. The cutting forces should not act against the clamp but against a solid mass of metal supporting the workpiece.

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5. Sufficient clearance should be provided for swarf disposal due to large amount of chip collected.

Tools

66. When are indexing fixtures used?

When a number of surfaces to be milled on a periphery of a workpiece are gear teeth, slots, splines in shafts, etc.

67. What are boring fixtures? How do you classify them? [Anna Univ. Nov'04 & Apr'05May'09]

This fixture which is used for cutting internal key-ways in pulleys, gears, sprockets, etc is known as key way broaching fixture.

Boring fixtures can be divided into two general classes:

- (i) The fixture guides the boring bar as in drill jigs and it is more appropriately called as a boring jig, and
- (ii) The fixture holds the work in the proper relation to the bar as in mill fixture.

Boring bars may be classified according to its length as

- (i) stub bar, (ii) single-piloted bar, (iii) Double-piloted bar.

68. How is boring operation carried out?

- (i) Boring bar is stationary and the workpiece moves into the bar.
- (ii) The workpiece is stationary and the bar moves into the workpiece.

69. What are the various machine tools used for boring?

- (i) Lathes (ii) Drill presses (iii) Milling machines
- (iv) Jig boring machine and (v) Vertical or horizontal boring mills.

70. State the classification of boring bars.

- (i) Stub bar (ii) Single-piloted bar (iii) Double-piloted bar

71. What are the different types of broaching operations?

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- (i) Keyway broaching (ii) Hole broaching (iii) Gear broaching

72. How are broaching operations classified?

- (i) Internal broaching (ii) External broaching

73. Where key-way broaching fixtures are used?

These fixtures are used for cutting internal key-way in pulleys, gears, sprockets, etc.

74. How are external surface broaching fixtures used in machining?

External broaches are used for producing external surfaces, splines, gears and required profiles.

75. State the use of grinding fixtures.

Several different forms of fixtures are used on grinding machines to locate, hold and support the workpiece during the operations.

76. What are the various type of mandrels used in cylindrical grinding fixture?

- (i) Taper mandrel (ii) Straight mandrel (iii) Combined taper and straight mandrel.

77. Where is surface grinding used?

Surface grinding is used widely in manufacturing industries to finish lengths and thicknesses of the workpiece within precise tolerances.

78. What are the ways the workpiece can be held for machining on a surface grinder?

- (i) Workpiece may be clamped directly on the machine table (ii) It may be held in a vice
(iii) It may be held by means of a magnetic chuck or a vacuum chuck
(iv) It may be held in a special fixture

79. What are the various shapes of magnetic chuck available?

- (i) Rectangular (ii) Circular (iii) V-block

80. What is the use of vacuum chucking?

The non-magnetic materials made workpiece are very conveniently held by means of vacuum chucking.

95. What are tile important elements of inspection fixtures?

- (i) Locating element (ii) Clamping element
(iii) Gauging element (iv) Auxiliary element

**96. A mechanical dial gauge acts as an
fixture. [Ans: Inspection]**

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97. What are welding fixtures? State the general purpose of a welding fixture: [Anna Univ. May'09]

A welding fixture is used to hold the workpiece in the proper position for fabrication of the workpiece by welding. The welding fixtures comprise the usual locating and clamping elements used in other fixtures.

98. Mention any two design principles applicable to welding fixture.

- (i) Welding spatter should not be allowed to fall on the threaded parts of the clamping elements.
- (ii) Welding fixture should not be so designed that it does not get overheated due to continuous work.

99. List out the type of locators and clamping devices used in welding fixture.

Time	Locators	Clamping devices
1	Pads	Screw clamp
2	Bosses	Strap clamp
3	Studs	Swinging clamp
4	V-blocks	C-clamp
5	Lugs	Eccentric clamp
6	Screws, pins	Toggle clamp

100. What is the use of tack welding fixture?

Tack welding fixtures are used to locate the components of a weldment in their correct relationship with proper clamps while a welder tacks them together prior to their final welding.

101. State the purpose of providing central boss in a wing nut welding fixtures.

The central boss is located by a loose female spigot to facilitate expansion due to heat during welding.

102. How can be falling of welding spatter prevented in using angle frame welding fixture?

The base plate of the fixture is milled with grooves below the welding area to provide positive clearance between workpiece and the base.

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103. List down the modular fixturing systems.

- (i) Sub-plate systems (ii) 'T' -slot systems (iii) Dowel-pin systems.

104. What devices are mainly used to assemble modular elements? [Anna Univ.May'08]

Modular fixturing is a work-holding system which uses a series of reusable standard, continents to build a wide variety of special-purpose work-holding devices. These types of fixtures are assembled with a variety of standard tooling plates, supports, locating elements, clamping devices and similar units.

105. Write down the advantages of modular fixture.

- (i) Modular fixturing offers a wide range of features components that greatly reduce the costs of building special tooling. Even though its initial cost is high, it can save money and time.
- (ii) Load time is reduced considerably with modular fixturing. Savings of 80% or more over conventional tooling are common.
- (iii) Reusability is another advantage of modular fixturing. Once a tool has been built and used, it can be disassembled and its elements used for other fixtures.
- (iv) Versality is also an advantage of modular fixturing. Almost any tool can be built with these sets. Even multi-part work-holders are quite easy to assemble.
- (v) Modular fixturing also serves as excellent alternatives to conventional tooling for very short runs to work out problems before hard tooling is built.

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UNIT - III

1. What is a press?

A press is a metal forming machine tool used to shape or cut metal by applying force.

2. State the advantages of press working operations.

- ❖ Material economy
- ❖ Reduction of weight and considerable cost reduction of fabricated parts
- ❖ High productivity
- ❖ Use of unskilled labour
- ❖ High degree of precision
- ❖ Uniformity of parts
- ❖ Predictable strength characteristics
- ❖ Use of less labour
- ❖ Possibility of automation.

3. What are the applications of press working operations?

1. Electronic appliances
2. Steel furniture
3. Coach building
3. press Working Terminologies and Cutting Dies
4. Automobile industry
5. Utensils
6. Two wheeler industry
7. Aircraft industry and
8. Ship building industry.

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4. Mention the three different ways of working sheet metal in presses.

1. Shearing
2. Bending
3. Drawing

5. Classify sheet metal operations.

1. Cutting operations
2. Forming operations.

6. How is the cutting operation carried out?

The workpiece is stressed beyond its ultimate strength and cutoff into two pieces.

7. How is forming operation carried out?

In a forming process, the stresses are below the ultimate strength of the metal .

8. List out the various cutting operations.

1. Blanking
2. Punching or piercing
3. Shearing
4. Parting off
5. Notching
6. Trimming
7. Shaving
8. Perforating
9. Slitting
10. Lancing.

9. Name some types of forming operations.

1. Bending
2. Drawing
3. Sequeezing
4. Embossing.

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10. Distinguish between blanking and piercing. [Anna Univ. Model Questions]

<i>S.No.</i>	<i>Blanking</i>	<i>Piercing</i>
1.	The cutout portion is the required part.	The cut out portion is considered as waste.
2.	The left out portion is considered as waste.	The left out portion is the required part
3.	Die is made to exact size.	Punch is made to exact size
4.	Clearance is provided on the punch and made smaller in size.	Clearance is provided on the die and made bigger in size.

11. Distinguish between a blanking die and a bending die. [Anna Univ. May'07]

<i>S.No.</i>	<i>Blanking die</i>	<i>Bending die</i>
1.	It is cutting operation	It is a forming operation.
2.	A permanent deformation is produced beyond it plastic range to cut out the required part.	It is a localised permanent deformation within the plastic range.
3.	Shear is provided either on die or on punch.	No shear is provided either on die or on punch.
4.	The left out portion is considered as waste.	No scrap is produced.
4.	Tonnage requirement is more.	Tonnage requirement is less.

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12. Differentiate between punching and piercing operation. [Anna Univ. May'06]

S.No	Punching	Piercing
1	Punching is the operation of making holes regardless of shape and size	It is the operation of producing the hole on the workpiece by a pointed and well designed punch.
2	The design of punch, shear on the punch and clearance on die do not play as a main role.	The design of punch, shear on the punch and clearance on die are considered as main elements to ensure the perfect piercing

13. State any four advantages of press working.

1. Material economy
2. High productivity
3. Use of unskilled labour
4. High degree of precision.

14. List out the press working terminology.

1. Base
2. Bolster plate
3. Die holder
4. Die
5. Stripper
6. Punch
7. Back up plate
8. Guide post or guide pin
9. Pitman
10. Shut height
11. Stroke etc.

15. What are the types of presses according to position of frame?

1. Inclinable press
2. Vertical press
3. Horizontal press
4. Inclined press.

16. Classify presses according to the mechanism used for applying power to ram.

1. Crank
2. Toggle
3. Eccentric
4. Cam
5. Screw
6. Rack and pinion
7. Hydraulic
8. Pneumatic.

17. Mention any four important factors to be considered while selecting a press.

1. Force required to be cut the metal
2. Die space
3. Stroke length
4. Shut height.

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18. What is the main difference between inclined presses and inclinable presses?

Inclined Press:

The frame of the press itself is inclined at an angle for easy discharge of workpiece and scrap from the press.

Inclinable Press:

The whole press can be used both in vertical as well as inclined positions.

19. How can we identify arch presses?

The shape of the frame is in the form of an arch.

20. How is the ram actuated in eccentric driven presses?

The ram slides or moves up and down in its guides, when the eccentric rotates.

21. How do rack and gear driven presses differ from other presses?

As the pinion gear rotates, the ram connected with the rack slides up and down.

22. When will be hydraulically driven presses used?

Whenever large forces and slow speed are required in forming, pressing and drawing operations, hydraulically driven presses are used.

23. List out the main parts of a power press. [Anna Univ. Nov'08]

1. Piston-cylinder arrangement
2. Connecting rod
3. Storage device
4. Pipe lines.

24. What is the use of clutch in a power press? [Anna Univ. May'08]

A clutch is used in a power press to control and vary the speed of cutting and forming operations.

25. How do triple action presses work?

The three slides are mounted properly to ensure three motions for triple action of drawing, redrawing and forming operations.

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30. Write down the formula for calculating the percentage of utilization of stock.

$$\% \text{ utilization of stock} = \frac{B}{A} \times 100$$

Where B = Area of the blank (perimeter)

A = Area of the stock (perimeter)

31. What factors should be considered for selecting an appropriate press for a given job? [Anna Univ. May'09]

- ❖ Force required to be cut the metal
- ❖ Die space
- ❖ Size and type of die
- ❖ Stroke length
- ❖ Method of feeding and size of sheet blank
- ❖ Shut height
- ❖ Type of operation
- ❖ Speed of operation.

32. List down the materials used for press working operations.

- | | | |
|---------------|--------------------|--------------|
| 1. Mild steel | 2. Stainless steel | 3. Brass |
| 4. Copper | 5. Aluminum | 6. Mica |
| 7. Fiber | 8. Hard rubber | 9. Celluloid |

33. Define shearing.

Shearing is the process of cutting a portion from the sheet metal strip.

34. What is the purpose of the set back angle found on a punch or die? [Anna Univ. Nov'07]

The shear angle helps to reduce the shocks to the press and smoothen the cutting operation.

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35. What is meant by clearance? Why is it important in shearing operation? [Anna Univ. Nov'07]

Clearance is the intentional space between the punch cutting edge and die cutting edge. It is important in shearing to cut a sheet metal to deform by a shear failure in order to make various contours from the metallic sheet.

36. In which part the clearance is provided for blanking operations?

The clearance is provided on the punch and die is made to exact size.

37. Mention the required portion in a stock while punching.

The left out portion after punching is the required part.

38. Clearance is provided on for blanking operations. Ans: Punch

39. What are the effects of inadequate clearance and excessive clearance upon die -cut metals? [Anna Univ. May'08 & Nov'08]

Inadequate clearance:

It does not allow a clean break but partial break occurs. It is also called as secondary shear.

Excessive clearance:

It allows a large edge radius and excessive plastic deformation. Large burrs are present at the break edge and the break is not smooth.

40. Find die clearance range for shearing a 2 mm thick aluminum sheet. [Anna Univ. May'09]

$$\begin{aligned} \text{Die clearance} &= 3\% \text{ of metal thickness} \\ &= 0.03 \times 2 = \mathbf{0.06 \text{ mm}} \end{aligned}$$

41. Mention the methods of reducing cutting forces in piercing operation. [Anna Univ. May'07]

1. Double shear can be provided in the punch
2. Stepped punches can be used.

42. Mention the significance of center of pressure as applied to Press tool design. [Anna Univ. Model Questions]

It is the centre of gravity of the line. The press tool is designed that the centre of pressure will lie on the axis of the press ram when the tool is mounted on the press.

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43. How is the coordinates of centre of pressure determined?

$$\text{Coordinates of X} = \frac{\Sigma Lx}{\Sigma L} = \frac{L_1 x_1 + L_2 x_2 + \dots}{L_1 + L_2 + \dots}$$

and

$$Y = \frac{\Sigma Ly}{\Sigma L} = \frac{L_1 y_1 + L_2 y_2 + \dots}{L_1 + L_2 + \dots}$$

44. Mention the various types of dies.

1. Simple die
2. Progressive die
3. Compound die and
4. Combined die

45. How is the task performed on simple dies?

These dies are designed to perform any single specific operation in one stroke of the punch.

46. Distinguish between a compound die and a combination die. [Anna Univ. Nov'04 & May'09]

[Anna Univ. Nov'04 & May'09]

S.No.	Combination Die	Compound Die
1.	It performs more than one operation at a time in the same station.	It also performs more than one operation at a time but in each station.
2.	Tonnage requirement is less.	Tonnage requirement is more.
3.	Maintenance will lead to idle of the die due to break down.	During maintenance, one station atleast can work.
4.	N number of components can be made with N strokes of die.	N number of components can be made with N+1 strokes of die.

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47. What is a progressive die? When should a progressive die be used? [Anna Univ. Nov'07 & May'08]

A die which is used to perform two or more operations at different stages every time when the ram descends is called progressive die. It is mainly used where accuracy of the products is maintained.

48. In what way the operations are carried out in progressive die?

The die is designed to perform two or more operations in one stroke of the punch but in different stages.

49. State any two advantages and disadvantages of progressive dies?

Advantages:

1. One workpiece is finished in every stroke of the ram.
2. Suitable for mass production.

Disadvantages:

1. Complicated design of die set as compared with simple dies.
2. Cost of die set is high when compared to simple die set.

50. Differentiate progressive dies with compound dies.

<i>S.No.</i>	<i>Progressive Die</i>	<i>Compound Die</i>
1.	It performs one operation at a time in each station.	It performs more than one operation at a time in each station.
2.	Tonnage requirement is less.	Tonnage requirement is more.
3.	Simple in design and construction of die set.	Complicated in design and construction of die set.
4.	It ensures less accuracy position.	It ensures more accuracy.
5.	Less expensive to construct and repair.	More expensive to construct and repair.

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51. What is called die block?

The die block with cutting edge is the female half of the two mating tools.

52. Write the advantages of sectional dies over solid dies.

1. Dies with large and complicated can be easily made into sections of convenient shape.
2. Sectional type of dies eliminates heat treatment, distortion and cracking.
3. Grinding of sections is easily done.
4. Maintenance is easy and simple, and less costly.

53. Mention the disadvantages of sectional dies over solid dies.

1. Sectional type is not suitable for quite large stock thickness.
2. A proper alignment of punch and die is difficult

54. What are the types of die set?

1. Precision die set
2. Commercial die set

55. What are the factors to be considered for selecting die set?

1. Diameter of shank or no shank
2. Overall length and type of guide pins based on
 - (a) Shut height
 - (b) Length of stroke
3. Type and length of bushing
4. Die area
5. Load or forces acting during the cutting or forming operation
6. Thickness of the stock strip.

56. Explain the function of bolster plate in press tool. [Anna Univ. Apr'06]

The bolster plate is the thick plate mounted on the base. It is used for locating and supporting the die assembly. It is usually 5 to 12.5mm thick plate.

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57. State the various functions of a bolster plate.

- (i) It provides attachment holes for the dies rather than drilling these holes in the press bed.
- (ii) It supports the die shoe, when it is located over a large hole in the press bed.
- (iii) It provides chutes for ejecting parts or scrap out the sides of the press.
- (iv) It takes up space in the press, when the press shut height is too great for the die shut height.

58. When do we use backup plate in press working operations?

The backup plate is used when the punch diameter is less than four times the stock thickness.

59. Write down the formula to calculate the maximum punch length.

$$L = \frac{\pi}{d} \sqrt{\left(\frac{E}{\tau} \cdot \frac{d}{t}\right)}$$

where d = Diameter of punch
 E = Modulus of elasticity
 τ = Shear strength of the blank
 t = thickness of the blank

60. Write down the formula for calculating the smallest hole that can be punched in a sheet metal.

$$d = \frac{4 t \tau}{\sigma_c}$$

where t \Rightarrow Thickness of material
 τ \Rightarrow Shear strength
 σ_c \Rightarrow Compressive strength

61. List down the various methods of arranging guide pins in the die set.

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1. back-post design
2. Centre-post design
3. Diagonal-post design
4. Four-guide post design

62. What is the function of a stripper? When should a spring-load stripper be used? {Anna Univ. Nov'05, May'05 & May'09]

The prime function of the 'stripper' or 'stripper plate' is to remove the stock from the punch after blanking or piercing operation. Spring -load stripper are used where very accurate blanks are needed and when very thin material is to be punched.

63. Compare fixed stripper and spring loaded stripper.

63. Compare fixed stripper and spring loaded stripper.

S.No.	Fixed stripper	Spring-loaded stripper
1.	It is simple in construction.	It is complicated in construction.
2.	It does not apply any hold-down pressure.	It applies hold-down pressure due to springs.
3.	It is mainly used for strip sheet metal where feeding the sheet fixed.	It is mainly used for coiled sheet metal where feeding of spring loaded. The sheet is done by feed roll.
4.	For very large stripping force, fixed stripper is preferred because it may not be possible to provide sufficient stripping forces with springs in the space available.	It is used for moderate spring force.

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64. What do we consider for the selection of stripper?

- (i) Stripping force (ii) Space available

65. What factors decide to select the right spring for strippers?

- (i) Pressure required (ii) Stage limitations (iii) Shape of die and nature of work.

66. State the function of a knockout.

The function of knockout is to eject or remove the workpiece from within the die cavity as the workpiece may adhere in the die cavity due to friction.

67. Mention the use of stockstops.

The stockstops help the strip to move for a correct distance after each blanking.

68. What are the types of stockstop?

- (a) Lever or latch type (b) Automatic stop
(c) Solid stop or shoulder stop (d) Starting stop.

69. What is the purpose of pilot? [Anna Univ. Nov'04 & May'06]

Pilot is a locating pin chamfered on the front end to facilitate catching and entering the work piece.

70. What are the methods of holding pilots?

- (i) Direct pilots (ii) Indirect pilots

71. Mention the common standard parts used in a die set.

- (a) Screws and Dowels (b) Pilots (c) Stripper springs and Stripper bolts.

72. List the factors considered to avoid redesigning of die elements.

- (i) Optimum strip layout (ii) Availability of strip material
(iii) Availability of strip width and thickness (iv) Tolerance availability of stock material
(v) Press selection and tonnage calculation (vi) Stock length
(vii) Shunt height (viii) Mounting arrangements.

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73. What are the elements considered for the good design of die set?

- | | | |
|-----------------------------------|-----------------------------|---------------------|
| (i) Types of die set | (ii) Die block | (iii) Bolster plate |
| (iv) Punch plate and backup plate | | (v) Punch |
| (vi) Punch holder | (vii) Guide pins and bushes | (viii) Strippers |
| (ix) Knockouts | (x) Stock stop | (xi) Pilots |

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UNIT IV

1. Differentiate between a cutting die and forming die. [Anna Univ. Nov'08]

S.No.	Cutting die	Forming die
1.	It is cutting operation.	It is a forming operation.
2.	A permanent deformation is produced beyond its plastic range to cut out the required part.	It is a localised permanent deformation within the plastic range.
3.	Shear is provided either on die or on punch.	No shear is provided either on die or on punch.
4.	The left out portion is considered as waste.	No scrap is produced.
4.	Tonnage requirement is more.	Tonnage requirement is less.

2. Differentiate bending and drawing

2. Differentiate bending, forming and drawing processes.

S. No	Bending	Forming	Drawing
1	Axis of bend is a straight line.	Axis of bend may be a curved line or a circle.	Not mere bending, severe plastic deformation occurs.
2	Forms plane surface with defined angle between original surfaces.	Forms the shape of the punch or die.	Forms the shape of a shell or cup.
3	Metal flow is uniform along the bent axis.	Metal flow is not uniform due to some localized deformation.	Metal flow is not uniform. Thinning may occur in the wall, whereas metal under punch will not flow much.

bending, forming processes.

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3. Define neutral axis.

The axis which separates the portions of tension and compression is known as "Neutral axis" or "Neutral layer".

4. What is bend angle?

Bend angle is the angle between the two extreme positions of bend radius.

5. What are the elements to be considered for bending process?

- (i) Material to be bent should be ductile and strong. It should not be hard.
- (ii) Bending is smooth, if the axis of the bend is perpendicular to the direction of grains.
- (iii) Spring back phenomenon should be taken care of.
- (iv) Holes pierced before bending will be distorted, if they are close to the bend area.
- (v) In most of bending operations, lubrication required is very less.

6. List down the types of bending dies.

- (i) Edge bending
- (ii) V-bending
- (iii) U-bending

7. Write down the formula to calculate bending force.

Bending force required to bend a material is calculated by

$$\text{Bending force, } F_b = \frac{k L f t^2}{W}$$

Where k => Die opening factor

L => Contact length of work

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σ_u	=>	Ultimate tensile strength
t	=>	Thickness of work material
W	=>	Width of die = R ₁ + R ₂ + C

where	R ₁	=>	Die radius
	R ₂	=>	Punch radius
	C	=>	Clearance
For			V-bends, K= 1.33 for W= 8t, K= 1.2 for W= 16t
For			U-bending, K = 2.66 for W = 8t K= 2.4 for W= 16t
	For edge bending,		K = 0.67 for W = 8t, K= 0.6 for W= 16t

8. State the various factors limiting bending.

- (i) Properties of material
- (ii) Length of bend
- (iii) Condition of the cut edge at the ends of bend line
- (iv) Direction of orientation of the axis of the bend to the direction in which material was rolled.

9. What is spring back in bending? [Anna Univ. May'07]

The tendency of the metal tries to resume its original position causing a decrease in bend angle known as spring back.

10. What does spring back cause in bending? [Anna Univ. Model Questions]

Spring back is caused by a larger bend radius.

11. Spring back depends on the following factors:

- (i) Material type
- (ii) Thickness
- (iii) Hardness
- (iv) Bend radius.

12. What does meant by bending allowance? [Anna Univ. Apr'04]

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19. Define deep drawing. [Anna Univ. Nov'05]

Deep drawing is the manufacturing process of forming sheet metal stock, called blanks, into geometrical or irregular shapes which are more than half their diameter in depth.

20. Write down the formula for calculating drawing force required in drawing operations.

$$\text{Drawing force, } F = \pi d t \sigma_y \left[\frac{D}{d} - k \right]$$

where

d = Outside diameter of the shell,

t = Thickness of material,

σ_y = Yield strength of metal,

D = Diameter of the blank to be cut,

k = 0.6 - 0.7 for ductile materials.

21. How is blank holding force calculated?

$$\text{Blank holding force, } B = \frac{\pi}{4} \times (D - d)^2 \times \sigma$$

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where

σ	=	Stress
D	=	Blank diameter
d	=	Shell diameter.

22. Define redrawing process.

The process of deepening the cup after the first draw is known as redrawing.

23. What is meant ironing?

The process of reducing wall thickness and lengthening of the cup is known as ironing.

24. Write down the formula to calculate ironing force.

Ironing force, I =

Where

I	=	Ironing force
D	=	Diameter (outside) of the cup
t	=	Blank thickness
t_1	=	Reduced thickness or die clearance
σ_c	=	Compressive stress of metal
h	=	Height of the cup
h_1	=	Increased height.

25. Mention the advantages and disadvantages of ironing process.

Advantages of ironing:

- (i) It produces a smooth surface.
- (ii) Spring back of material due to elastic properties can be eliminated.

Disadvantages of ironing:

- (i) It increases the drawing force.
- (ii) Severe plastic deformation produces a strain hardening.
- (iii) Sometimes, it leads to tearing of cup base
- (iv) It reduces the percentage reduction which in turn increases the number of draw.

26. List down the types of drawing dies.

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1. Single action dies
2. Double action dies.

27. What are the factors affecting drawing?

- | | | | |
|---------------------------|-------------------|-----------------------|------------------------|
| (i) Type of material | (ii) Ductility | (iii) Yield strength | (iv) Force of friction |
| (v) Blank holder pressure | (vi) Lubrication | (vii) Radius on punch | (viii) Radius on die |
| (ix) Drawing speed | (x) Die clearance | | |

28. Why is extra metal added during blank development?

1. Thickening and thinning of metal during drawing.
2. Non uniformity of materials.
3. Friction at work-die surface.
4. Non-uniformity of pressure applied.
5. Condition of deforming tool.

29. How is the press capacity determined for exerting force in drawing?

Total force to be exerted by the press, $P = F + B + I$

Where $F =$ Cutting force $= \pi d t \sigma_y \left[\frac{D}{d} - k \right]$

$B =$ Blank holding force $= \frac{\pi}{4} (D^2 - d^2) \times \sigma$

$I =$ Ironing force $= \pi d (t - t_1) \sigma_c$

Where $d =$ Outside diameter of the shell I 34.

$I =$ Thickness of material

$\sigma_y =$ Yield strength

$D =$ Diameter of the blank

$\sigma =$ Stress

$t_1 =$ Thickness of material after ironing

$\sigma_c =$ Compressive strength

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30. What are the methods of holding pilots?

- (i) Direct pilots (ii) Indirect pilots

31. List down the types of direct pilots.

- (i) Press fit pilots (ii) Threaded shank pilots
(iii) Socket set screw pilots (iv) Ball lock mechanism

32. Classify indirect pilots.

- (i) Acron type or spherical type (ii) Flatted end type

33. What is called pressure pad?

Pressure pad is a small localized stripper used in forming or bending operation. Strippers remove the stock from the punch after a blanking or piercing operation whereas pressure pads eject the pieces by pushing them out of the tooling after forming or bending operation.

34. What do ejectors do?

Ejector removes the drawn component from the die cavity. The following are the ways to eject the components. Spring loaded stock lifters, pressure' pins or pressure pads can be used as ejectors of finished parts.

35. List down the types of ejector pins.

- (i) HDS ejector pins (ii) Step ejector (iii) Square ejector
(iv) Steel ejector pins (v) Blade ejector

36. What are the variables affecting metal flow in drawing operation?

- (i) Radius on punch (ii) Radius on die (iii) Friction
(iv) Material to be drawn (v) Drawing speed (vi) Die clearance

37. Define ductility.

Ductility is the ability of the material to undergo a change in shape without fracture.

38. How can we define drawing speed?

Drawing speed is defined as the velocity at which the punch travels into the drawing die during the drawing process.

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39. What is meant by clearance?

Clearance is the gap between a punch and die. If the clearance is too large, the material will not be in contact with both punch and die simultaneously.

40. What is the purpose of stock-stop? [Anna Univ. Apr'04]

It is used to stop the die at a required distance. It avoids over penetration of die in a materials.

41. What are draw die inserts?

Draw die inserts are small tooling segments attached to form a shape during drawing operations.

42. Classify draw beads.

- (i) Internal beads
- (ii) External beads

43. List down the advantages of applications.

Application of draw beads:

- (i) Deep drawing of shells
- (ii) Forming processes need proper material control and surface finish.

Advantages of using draw beads:

- (i) It avoids wrinkling
- (ii) It regulates material flow
- (iii) It facilitates drawing and ironing to produce smooth surfaces

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UNIT – V

1. What is plastic processing?

Plastic processing is one of the fastest growing segments of manufacturing. Plastic processing is a form conversion process.

2. List down the plastic processing methods.

1. Compression molding
2. Transfer molding
3. Extrusion
4. Blow molding
5. Injection molding
6. Thermoforming
7. Composite processing
8. Pultrusion

3. Mention the various plastic processes which use dies.

1. Extrusion
2. Pultrusion
3. Thermoforming
4. Lay up
5. Stamping.

4. Define injection moulding.

Injection molding is a process of producing parts from thermoplastics and thermoset plastics.

5. What is the temperature range in injection moulding process?

150°C - 370°C.

6. State the two units of a ram type of injection moulding process.

- 1) Injection unit.
- 2) Clamping unit.

7. What is injection nozzle?

The rotating screw transport sand injects the molten plastic mixture into a split mold cavity through a small opening called injection nozzle

8. Mention the advantages of injection moulding.

- 1) It has high production capacity and less material losses.
- 2) Low cost and less finishing operation can be obtained.
- 3) It is used for making complex threads and thin walled parts.
- 4) Accuracy becomes $\pm 0.025\text{mm}$
- 5) Wide range of shapes can be moulded.

9. Write down the applications of injection moulding.

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- 1) It is used in making parts of complex threads.
- 2) It is used to produce intricate shapes, such as thin walled parts.
- 3) It is used to produce typical parts, such as cups, containers, tool handles, toys, knobs, plumbing fittings.
- 4) It is used to produce electrical and communication components, such as telephone receivers.

10. What are the limitations of injection moulding?

- 1) Equipment of cylinder and die should be non-corrosive.
- 2) Reliable temperature controls are essential.
- 3) The injection capacity of injection moulding machines ranges from 12,000 mm³ to 2.2. x 10⁶ mm³.

11. List down the types of moulds for injection mould.

1. Slide mould
2. Three plate moulds
3. Split cavity mould
4. Mould With screw device
5. Stripper ejector mould.

12. Classify blow moulding.

1. Injection Blow Moulding
2. Extrusion Blow Moulding
3. Stretch Blow

Moulding.

13. Write the applications of blow moulding.

1. It is used to produce plastic bottles and toys
2. It is used to produce plastic buckets
3. It is used to produce plastic cans
4. It is used to produce plastic barrels
5. The hollow containers are produced by this process.
6. The multiplayer blow moulding used in cosmetics and pharmaceutical Industries.

14. What is the use of rotational moulding?

The rotational moulding process is used to make thin walled hollow parts.

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15. Draw the sketch of rotational moulding.

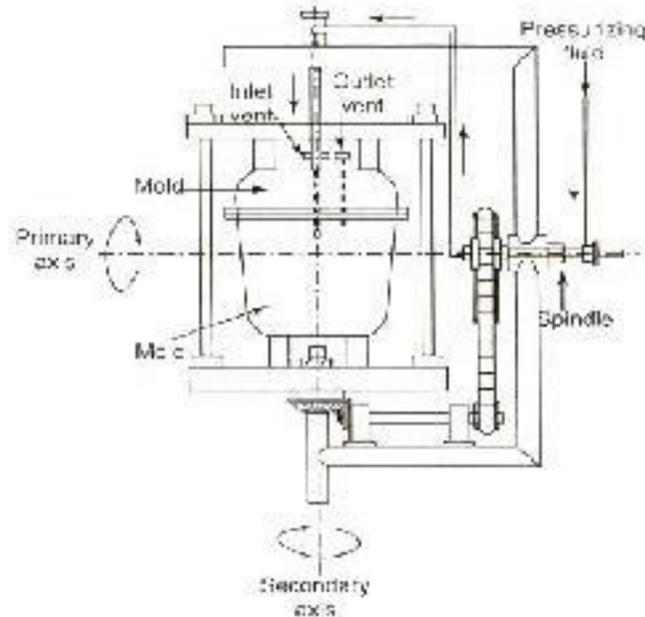


Figure 6.10 Rotational moulding

16. Mention the applications of rotational moulding.

1. It is used to produce toys in P.V.C.
2. It is used to make large containers of polyethylene.
3. It is used to make petrol tanks for motorcars from polyethylene and nylon.
4. Metallic or plastic inserts are moulded by this process.

17. Define cycle time.

The time interval covering the mould cycle is known as cycle time.

18. What is the press tonnage of compression moulding?

The press tonnage requirement may range from 100 – 500 tonnes.

19. List down the steps involved in compression moulding.

1. Flash type
2. Landed positive type
3. Positive type
4. Semi positive type.

20. What is called positive mould?

When the plastic is completely trapped between the male and female dies, it is called as positive mould.

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21. State the applications of compression moulding.

1. It is used to make dishes, handles, container taps, and fittings.
2. Electrical and electronic components, washing machine agitators and housings are made by this process.
3. It is used to produce plastic fittings and housings.

22. What is called transfer pot?

Transfer moulding is a modification of compression moulding in which the material is first placed in a separate chamber called transfer pot.

23. What are the points to be considered while designing transfer moulding?

1. Flow of materials should be easy.
2. Ejecting of mould should be easier.
3. Heating of all the parts should be uniform.

24. Write down the advantages of transfer moulding.

1. Before completely filling the metal in the mould cavity, little pressure is maintained inside the mould and it will create a full liquid pressure inside the cavity.
2. When the plastic flows through the orifice into the cavity, the temperature will increase.
3. Cold presses can be used.
4. Viscosity of flow material is reduced.

25. Mention the applications of transfer moulding.

1. It is used for less mass production.
2. A short run of mould metal is obtained during the moulding.
3. Shape of mould can be readjusted.
4. It is used to produce electrical and electronic components
5. It is used to produce rubber and silicone parts.

26. How is thermoforming carried out?

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It is a process in which a heated plastic sheet is changed to a desired shape by causing it to flow against the mould surface by reducing the air pressure between one side of the sheet and the mould surface.

27. What is the main advantage of thermoforming?

The main advantage of this process is low cost and quick process of making the sheet.

28. State the applications of thermoforming.

1. It is very much useful for making trays, drink cups, Aircraft window reveals, bathtubs and refrigeration door lines.
2. It is used for making switch panels for shower stalls and advertising signs, car bumpers and motor bike fairings.

29. What are the sections in extrusion?

1. Feed section connects the material from hopper into central region of the barrel.
2. Melt section in which plastic causes melting to begin.
3. Pumping section in which additional shearing and melting occurs.

30. Classify extrusion die.

1. Die for solid section
2. Die for hollow section.

31. Write down the applications of extrusion process.

1. It is used to make tubes, sheets, films, pipes, ropes and other profiles.
2. Complete shapes with constant cross sections can be extruded with relatively inexpensive tooling.

32. What is called pultrusion?

Pultrusion is a continuous production process similar to the extrusion. It is a continuous process for fabricating reinforced plastics that usually have a constant cross sectional shape (I, U, H and other shapes).

33. State common impregnation liquids.

1. Epoxy
2. Polyurethane

34. State the primary functions of mould.

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1. To contain the polymer melt within the mould cavity so that the mould cavity can be completely filled to form the replicate shape of mould cavity.
2. To effectively transfer heats from the hot polymer melt to the cooling system.
3. To eject the part from the mould in a rapid and repeatable manner.

35. What are the secondary functions of mould?

1. To resist displacement caused by the injection process and heat.
2. To guide the polymer melt to one or more cavities through runner and gate to completely fill the mould cavity.
3. To lead the heat from part to the mould casing.
4. To lead the heat from mould to cooling system.
5. To open the mould through an appropriate parting plane.
6. To remove the parts using appropriate lifters and ejecting pin.

36. List down the mould and die materials.

1. Carbon steel (ANSI No. 1020, 1030, 1040 and 1095)
2. Alloy steels (ANSI No. 4130, 4140, 6150 and 8620)
3. Tool steels
4. Beryllium copper alloy
5. Aluminum alloys
6. Bismuth Tin alloys

37. Mention the various components involved in mould design.

1. Bolster plate mounted on the injection moulding machine
2. Pathways composed of sprue, runners and gates
3. Parts composed of cavities and cores to form moulding products
4. Mould cooling system
5. Mould opening and part ejection system.

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38. What are the elements considered for the construction of an injection mould?

- | | | |
|--------------------------------|-----------------------------|-----------|
| 1. Fixed half and moving, half | 2. Cavity | 3. Core |
| 4. Impression | 5. Sprue bush | 6. Runner |
| 7. Gate systems | 8. Guide pillars and bushes | |

39. What are called fixed half and moving half?

Injection mould in most cases is made of two halves. The first half is attached to the stationary platen of the machine is called fixed half. The other half attached with the moving platen of the machine is called moving half.

40. What do we understand the word cavity?

Cavity is the female portion of an injection mould which forms the external shape of the component to be produced. Cavity is normally formed on cavity plate and fixed in the fixed half of the mould.

41. What is called core?

Core is the male portion of an injection mould which form the internal shape of the component to be produced. Core is normally formed on cavity plate and fixed in the moving half of the mould.

42. What does impression refer in injection moulding?

Impression is the shape of the empty space formed by the assembly of cavity and core into which the plastic melt is injected. Impression resembles the final product to be produced.

43. Mention the function of runner.

Runner is the primary channel carrying the plastic melt from sprue to the gate systems in multiple cavities in a mould.

44. What do gate systems do?

Gate is the secondary channel carrying plastic melt from runner to the mould cavity.

45. Classify cavity and core.

1. Integer cavity and core plates
2. Cavity and core inserts

46. What do you mean integer cavity and core plates?

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The large plates or block of steels used to form the cavity of the mould and core of the mould are called integer cavity plate and integer core plates.

47. Mention the advantages of integer type moulds.

1. Number of machine operations is less.
2. Overall size of the mould is relatively less and easy to handle.
3. Cooling of mould is easy.

48. Stale the disadvantage of integer type moulds.

1. Since whole mould plate is produced from expensive mould steel, the cost of material is high.
2. Since machining and aligning multiple impressions are difficult, it is suitable for single impression mould.
3. Cost of heat treatment is high.
4. Replacement of damaged parts is difficult.

49. Define the following terms: (a) insert (b) cavity insert and (c) bolster plate.

Small blocks of steel in which impressions are machined are called inserts. The insert which forms the female portion is known as cavity insert and the one form the male portion is known as core insert.

The inserts are fixed on a backup plate called bolster plate.

50. Mention the functions of inserts.

1. To enclose the cavity where the part is formed.
2. Withstand the resulting forces from melt pressure exerted.
3. To contain cooling line to remove the heat from polymer melts.
4. To contain other components, such as retaining screw, ejector pin and others.

51. What are the types of cavity and core inserts?

1. Rectangular inserts blocks
2. Circular inserts blocks

52. List down the types of layouts followed in multiple impression moulds.

1. Multiple impression mould with circular layout
2. Multiple impression mould with rectangular layout.

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53. Write down the advantages and disadvantages of insert-bolster moulds?

Advantages:

1. Since mould steel used only in inserts cost of material is less.
2. It is easy to provide multiple cavities.

Disadvantage of insert-bolster moulds:

1. Cost and time of machining will be high.
2. Since multiple impressions are provided, the overall size of the mould is increased which in turn increases the difficulties in handling the mould during machining and it also increases the cost of machinery to handle large size steel blocks.

54. What is a bolster?

Bolster is the steel plate on which the cavity or core inserts are mounted. It is normally made up of mild steel.

55. What are the functions of bolsters?

1. It must provide a suitable pocket into which the inserts are fitted.
2. It must retain the inserts in position securely during operations.
3. It must withstand the moulding pressure developed due to polymer melt.

56. Mention the types of bolsters.

- | | |
|-----------------------|-----------------------|
| 1. Solid bolster | 2. Strip type bolster |
| 3. Frame type bolster | 4. Chase type bolster |

57. List down the modifications are adopted in the inserts to fix the insert in the pocket.

1. By accurately machining of pocket corner to the insert's corner radius or machining of insert corner to the pocket radius. But this practice is an expensive process.
2. By providing a sufficient chamfer in the insert block.
3. By machining a recessed in the corner of the pocket.
4. By using a slotted bolster

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58. What is called feed system?

The flow way which conveys the plastic melt from the injection moulding machine to each impression in the mould is called as flow system or feed system.

59. Mention the various steps followed in the process of designing feed system.

1. Selection of the type of feed system
2. Routing the feed system through the mould
3. Determine the size of each segment of feed system.

60. List down the Factors affecting runner size.

1. Volume of the moulding.
2. Distance of the impression from the main runner or sprue.
3. Runner cooling considerations.
4. Plastic material to be used.

61. What is gate in injection moulding?

Gate is the channel or orifice connecting the runner with the impression.

62. Write down the functions of gate system.

1. To control the volume and direction of flow of plastic melt.
2. To enclose the plastic melt in the cavity until it solidifies and to block backflow to the runner.
3. To generate heat by viscous dissipation due to shear at the narrow gate portion and thus raise the temperature of the polymer melt to reduce flow marks and weld lines.
4. To assure the

multi cavity mould.

filling of all cavities uniformly in

63. Sketch a gate used in

injection moulding.

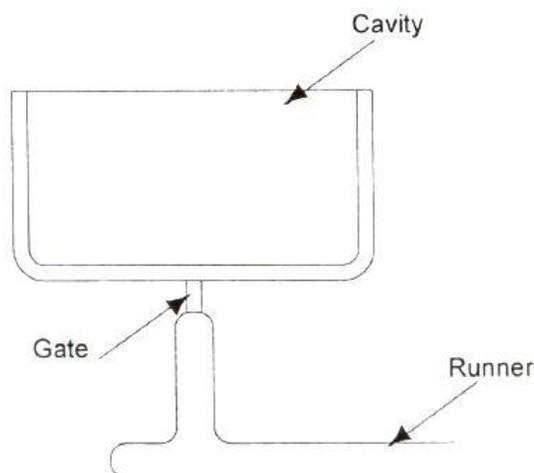


Figure 6.41 Gate

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64. Mention the factors affecting gating size.

1. The flow characteristics of the material to be moulded.
2. The wall section of the moulding.
3. The volume of material to be injected into the impression.
4. Temperature of the melt.
5. Temperature of the mould.

65. Classify gating system.

- | | | | |
|-----------------|--------------|-------------------|----------------------------|
| 1. Sprue gate | 2. Edge gate | 3. Pin point gate | 4. Tab gate |
| 5. Tunnel gate | 6. Film gate | 7. Overlap gate | 8. Fan gate diaphragm gate |
| 9. Winkle gate. | | | |

66. Define sprue gate.

When the plastic melt is directly fed into the cavity from a sprue, the feed section is called as sprue gate.

67. How can we define a sprue?

Sprue is the path way through which the plastic melt enters into the mould from injection moulding machine.

68. What are the types of ejection system?

- | | | |
|-----------------|--------------------------------|-----------------|
| 1. Ejector pins | 2. Sleeve and a stripper plate | 3. Air ejector. |
|-----------------|--------------------------------|-----------------|

69. List down the advantages of ejector pin.

- | | |
|--------------------------|--------------------------|
| 1. Service life is more. | 2. It is easy to repair. |
|--------------------------|--------------------------|

70. State the disadvantages of ejector pin.

1. Due to intrusion of pin into the mould parts, defects, such as cracks, whitening and distortion may occur.
2. The possibility of stress concentration is more.

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71. What are the applications of Sleeve and stripper plate mechanism?

1. Optical parts.
2. Deep shells.
3. Cylindrical parts.

72. Mention the advantages of Sleeve and stripper plate mechanism.

1. Uniform ejection reduces less crack and distortion.
2. There is no ejector mark.

73. Write down the applications air ejection system.

1. Buckets
2. Basins
3. Tray
4. Bowls

74. What are the advantages air ejection systems?

1. Mould construction is simple because an ejector plate is unnecessary
2. It can be employed with core type mould or cavity type mould.
3. Products are free from deformation and crack because air pressure is uniform.
4. Blowing air also acts as a cooling agent.

75. What is meant by vent?

The space machined in the mould cavity to allow the air or gas to escape is called vent.

76. List down the locations of vents in injection moulding.

1. End of the runner.
2. Directly opposite to gate in a cavity.
3. Last place to fill.
4. Point at which the flow path meets.
5. Bottom of the projections (dead pockets).

77. What are the factors affecting the operating temperature in injection moulding?

1. Type of polymer used.
2. Length of flow within the impression.
3. Wall section of moulding length of the feed system.
4. Number of impressions in the mould.

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78. Mention the various problems incurred with low molten temperature of molten metal.

1. It affects the viscosity.
2. There is a possibility of incomplete filling of cavity
3. There is a possibility of weld line in the surface.
4. It increases the cycle time.

79. What are the sections to be cooled when the injection mould is used for plastic objects?

- | | | |
|------------------------------|----------------------------|-----------------------|
| 1. Integer type mould plates | 2. Integer type core plate | 3. Bolster plate |
| 4. Cavity insert | 5. Core insert | 6. Other mould parts. |

80. Define guide bushes.

The bushes incorporated in the mould to provide a suitable wear resisting surface for the guide pillar is known as guide bushes.

81. What is called de-moulding ill injection process?

De-moulding is the process of removing the solidified final parts from the mould cavity.

82. How is form locking happened?

Some of the polymers after solidification will stick on the mould surface. This phenomenon is called as form locking.

83. Define draft angle.

De-moulding can be facilitated by providing a slightly inclined mould wall called draft angle.

84. What is meant by a hoop in a slide core?

The sliding core is machined in a thin band like metallic sheet called hoop.

85. Write down the disadvantages split cavity mould.

1. It is difficult to construct split cavity mould for tiny articles.
2. It is difficult to align the split moulds and form pins.

