COURSE MATERIAL

II Year B. Tech I- Semester

MECHANICAL ENGINEERING

AY: 2022-23

Computer Aided Machine Design

R20A0307

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MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

VISION

- To establish a pedestal for the integral innovation, team spirit, originality and competence in the students, expose them to face the global challenges and become technology leaders of Indian vision of modern society.

MISSION

- To become a model institution in the fields of Engineering, Technology and Management.
- To impart holistic education to the students to render them as industry ready engineers.
- To ensure synchronization of MRCET ideologies with challenging demands of International Pioneering Organizations.

QUALITY POLICY

- To implement best practices in Teaching and Learning process for both UG and PG courses meticulously.
- To provide state of art infrastructure and expertise to impart quality education.
- To groom the students to become intellectually creative and professionally competitive.
- To channelize the activities and tune them in heights of commitment and sincerity, the requisites to claim the never - ending ladder of **SUCCESS** year after year.

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Department of Mechanical Engineering

VISION

To become an innovative knowledge center in mechanical engineering through state-of-the-art teaching-learning and research practices, promoting creative thinking professionals.

MISSION

The Department of Mechanical Engineering is dedicated for transforming the students into highly competent Mechanical engineers to meet the needs of the industry, in a changing and challenging technical environment, by strongly focusing in the fundamentals of engineering sciences for achieving excellent results in their professional pursuits.

Quality Policy

- ✓ To pursuit global Standards of excellence in all our endeavors namely teaching, research and continuing education and to remain accountable in our core and support functions, through processes of self-evaluation and continuous improvement.
- ✓ To create a midst of excellence for imparting state of art education, industry-oriented training research in the field of technical education.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 Ability to analyze, design and develop Mechanical systems to solve the Engineering problems by integrating thermal, design and manufacturing Domains.

PSO2 Ability to succeed in competitive examinations or to pursue higher studies or research.

PSO3 Ability to apply the learned Mechanical Engineering knowledge for the Development of society and self.

Program Educational Objectives (PEOs)

The Program Educational Objectives of the program offered by the department are broadly listed below:

PEO1: PREPARATION

To provide sound foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems.

PEO2: CORE COMPETANCE

To provide thorough knowledge in Mechanical Engineering subjects including theoretical knowledge and practical training for preparing physical models pertaining to Thermodynamics, Hydraulics, Heat and Mass Transfer, Dynamics of Machinery, Jet Propulsion, Automobile Engineering, Element Analysis, Production Technology, Mechatronics etc.

PEO3: INVENTION, INNOVATION AND CREATIVITY

To make the students to design, experiment, analyze, interpret in the core field with the help of other inter disciplinary concepts wherever applicable.

PEO4: CAREER DEVELOPMENT

To inculcate the habit of lifelong learning for career development through successful completion of advanced degrees, professional development courses, industrial training etc.

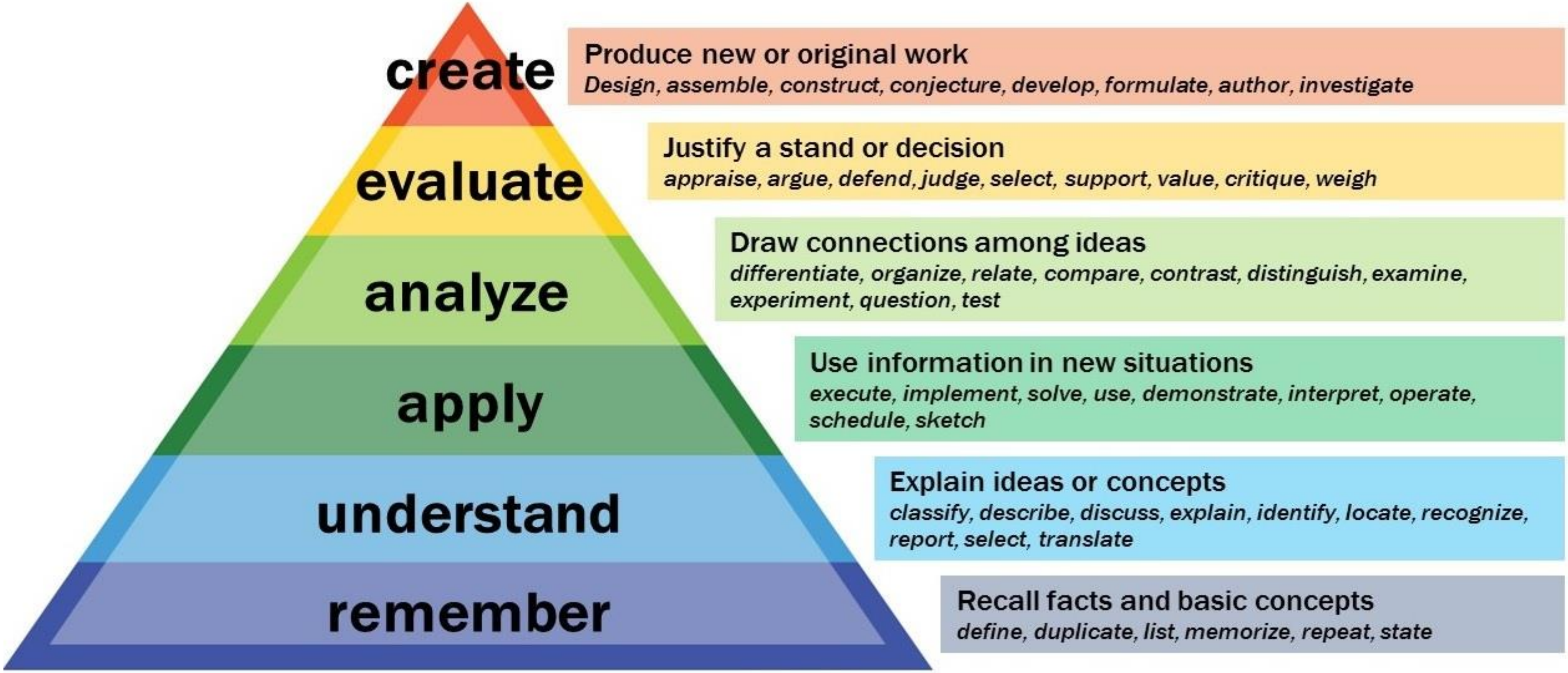
PEO5: PROFESSIONALISM

To impart technical knowledge, ethical values for professional development of the student to solve complex problems and to work in multi-disciplinary ambience, whose solutions lead to significant societal benefits.

Blooms Taxonomy

Bloom's Taxonomy is a classification of the different objectives and skills that educators set for their students (learning objectives). The terminology has been updated to include the following six levels of learning. These 6 levels can be used to structure the learning objectives, lessons, and assessments of a course.

1. **Remembering**: Retrieving, recognizing, and recalling relevant knowledge from long- term memory.
2. **Understanding**: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
3. **Applying**: Carrying out or using a procedure for executing or implementing.
4. **Analyzing**: Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
5. **Evaluating**: Making judgments based on criteria and standard through checking and critiquing.
6. **Creating**: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.



create
Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate
evaluate
Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh
analyze
Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test
apply
Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch
understand
Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate
remember
Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

II Year B.Tech. ME- I Sem **L/T/P/C**
2/-/2/3

(R20A0307) COMPUTER AIDED MACHINE DESIGN

COURSE OBJECTIVES:

1. To familiarize with the standard conventions for different materials and machine parts in working drawings.
2. To gain knowledge of conventional representation of various machining and mechanical details as per IS.
3. To gain knowledge of threads, bolts, nuts, stud bolts, tap bolts, set screws, Keys, cottered joints and knuckle joint.
4. To make part drawings including sectional views for various machine elements.
5. To prepare assembly drawings given the details of part drawings.

Part A: Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cottered joints and knuckle joint.
3. Rivetted joints for plates
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

Part B: Assembly Drawings

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

1. Steam engine parts – stuffing boxes, cross heads, Eccentrics.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts - Screws jacks, Petrol engine connecting rod, Plummer block, Fuel Injector
4. Valves - Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE:

1. First angle projection to be adopted. The student should be able to provide working drawings of actual parts.
2. Part A need to be done by using AUTOCAD and Part B need to be done by using Creo.

TEXT BOOKS:

1. Machine Drawing –K.L.Narayana, P.Kannaiah&K.VenkataReddy / New Age/ Publishers
2. Machine Drawing with Auto CAD / Goutham Pohit, Goutam Ghosh / Pearson
3. Machine Drawing / N.D. Bhatt / Charotar

REFERENCE BOOKS:

1. Machine Drawing by / Bhattacharyya / Oxford
2. Machine Drawing / Ajeet Singh / Mc Graw Hill
3. Machine Drawing –P.S.Gill.

COURSE OUTCOMES:

1. Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
2. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
3. Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
4. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
5. Title boxes, their size, location and details - common abbreviations and their liberal usage. Types of drawings – working drawings for machine parts.

INTRODUCTION

Course Objectives:

CO1: To familiarize with the standard conventions for different materials and machine parts in working drawings.
CO2. To gain knowledge of conventional representation of various machining and mechanical details as per IS.

Course Outcomes:

Conventional representation of materials, common machine elements

COURSE OUTLINE

LECTURE	LECTURE TOPIC	KEY ELEMENTS	LEARNING OBJECTIVES (2 to 3 objectives)
1.	Introduction to IS conventions	Materials, machine component	Understanding the representation of materials machine components (B2)

TYPES OF DRAWINGS

GRAPHIC LANGUAGE

General

A technical person can use the graphic language as powerful means of communication with others for conveying ideas on technical matters. However, for effective exchange of ideas with others, the engineer must have proficiency in (*i*) language, both written and oral, (*ii*) symbols associated with basic sciences and (*iii*) the graphic language. Engineering drawing is a suitable graphic language from which any trained person can visualise the required object. As an engineering drawing displays the exact picture of an object, it obviously conveys the sameideas to every trained eye.

Irrespective of language barriers, the drawings can be effectively used in other countries, in addition to the country where they are prepared. Thus, the engineering drawing is the universal language of all engineers.

Engineering drawing has its origin sometime in 500 BC in the regime of King Pharos ofEgypt when symbols were used to convey the ideas among people.

Importance of Graphic Language

The graphic language had its existence when it became necessary to build new structures and create new machines or the like, in addition to representing the existing ones. In the absence of graphic language, the ideas on technical matters have to be conveyed by speech or writing, both are unreliable and difficult to understand by the shop floor people for manufacturing. This method involves not only lot of time and labour, but also manufacturing errors. Without engineering drawing, it would have been impossible to produce objects such as aircrafts, automobiles, locomotives, etc., each requiring thousands of different components.

Need for Correct Drawings

The drawings prepared by any technical person must be clear, unmistakable in meaning and there should not be any scope for more than one interpretation, or else litigation may arise. In a number of dealings with contracts, the drawing is an official document and the success or failure of a structure depends on the clarity of details provided on the drawing. Thus, thedrawings should not give any scope for mis-interpretation even by accident.

It would not have been possible to produce the machines/automobiles on a mass scale where a number of assemblies and sub-assemblies are involved, without clear, correct and accurate drawings. To achieve this, the technical person must gain a thorough knowledge of both the principles and conventional practice of draughting. If these are not achieved and or practiced, the drawings prepared by one may convey different meaning to others, causing unnecessary delays and expenses in production shops.

Hence, an engineer should posses good knowledge, not only in preparing a correct drawingbut also to read the drawing correctly. The course content of this book is expected to meet these requirements.

The study of machine drawing mainly involves learning to sketch machine parts and to make working and assembly drawings. This involves a study of those conventions in drawingsthat are widely adopted in engineering practice.

CLASSIFICATION OF DRAWINGS

MACHINE DRAWING

It is pertaining to machine parts or components. It is presented through a number of orthographic views, so that the size and shape of the component is fully understood. Part drawings and assembly drawings belong to this classification. An example of a machine drawing is given in Fig. 1.1.

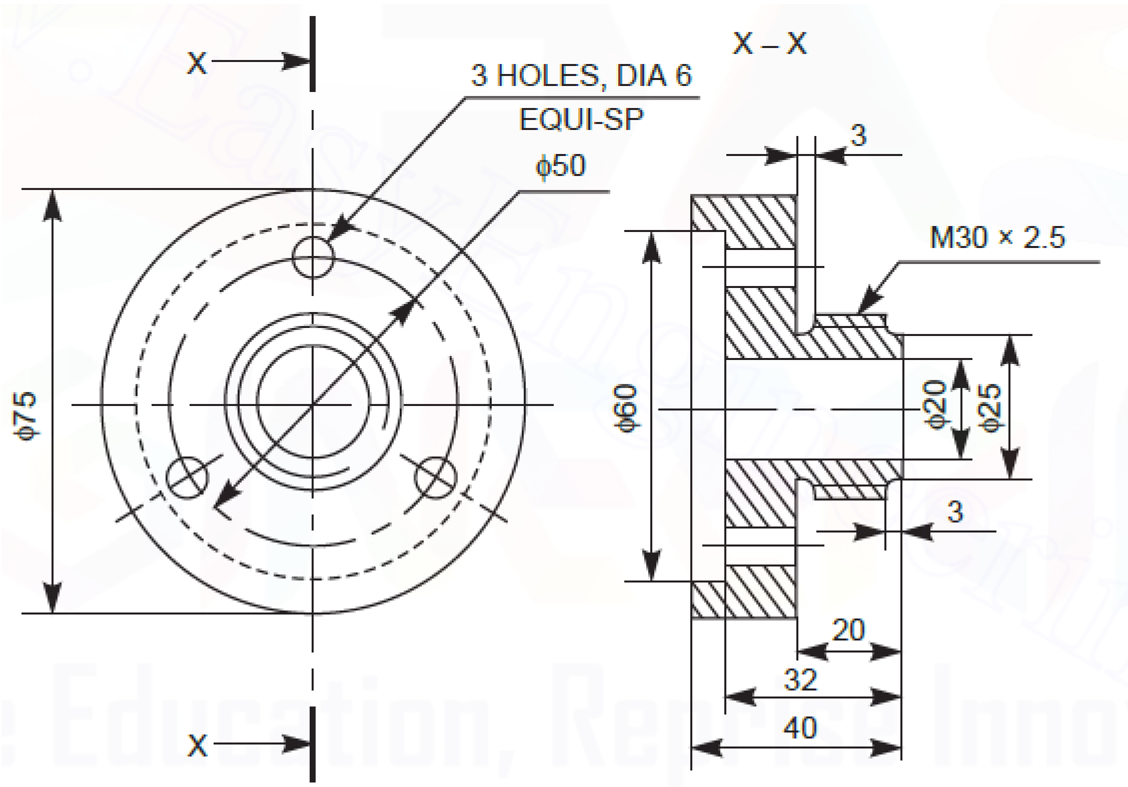


Fig 1.1: Machine Drawing

Production Drawing

A production drawing, also referred to as working drawing, should furnish all the dimensions, limits and special finishing processes such as heat treatment, honing, lapping, surface finish, etc., to guide the craftsman on the shop floor in producing the component. The title should also mention the material used for the product, number of parts required for the assembled unit, etc.

Since a craftsman will ordinarily make one component at a time, it is advisable to prepare the production drawing of each component on a separate sheet. However, in some cases the drawings of related components may be given on the same sheet. Figure 1.2 represents an example of a production drawing.

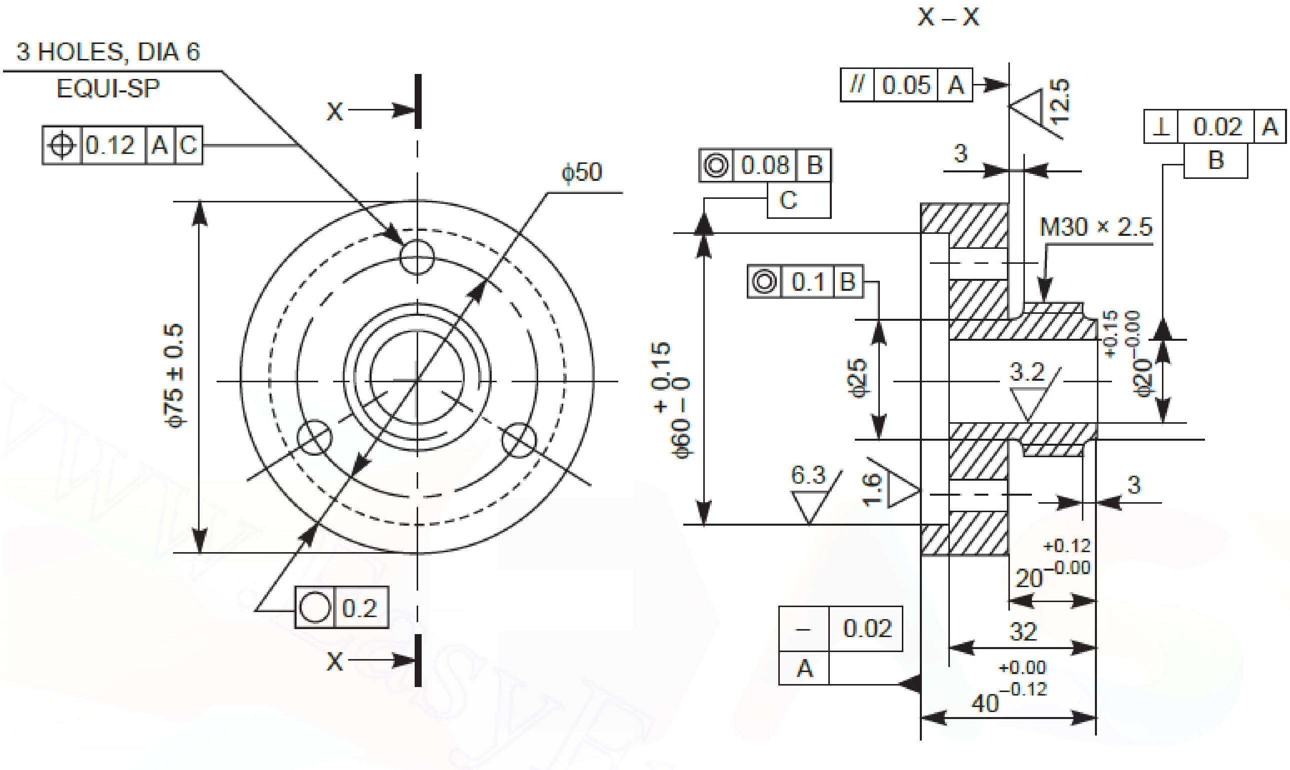


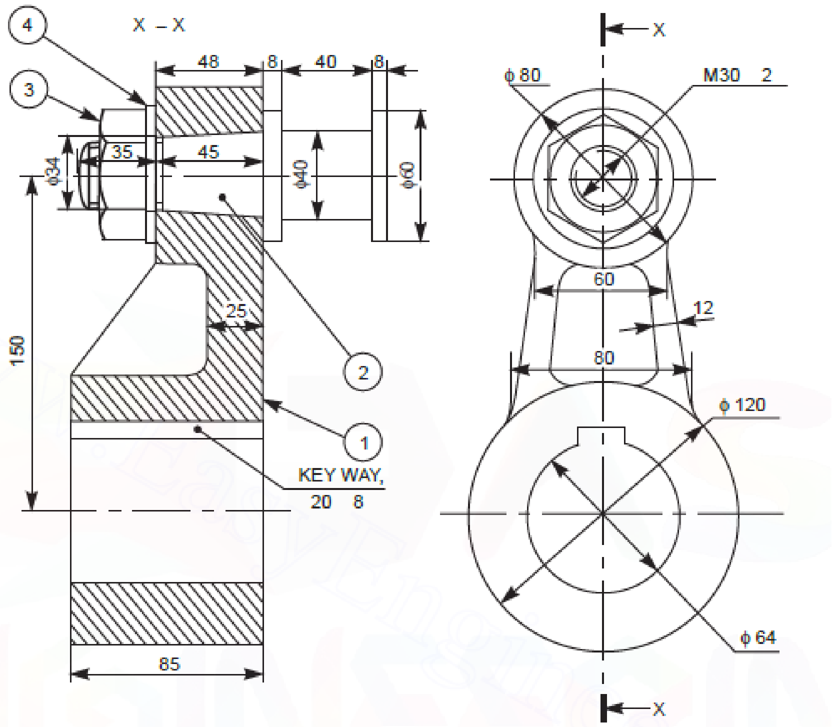
Fig. 1.2 Production drawing

Part Drawing

Component or part drawing is a detailed drawing of a component to facilitate its manufacture. All the principles of orthographic projection and the technique of graphic representation must be followed to communicate the details in a part drawing. A part drawing with production details is rightly called as a production drawing or working drawing.

Assembly Drawing

A drawing that shows the various parts of a machine in their correct working locations is an assembly drawing (Fig. 1.3).



Parts List

Part No.	Name	Material	Qty
1	Crank	Forged Steel	1
2	Crank Pin	45C	1
3	Nut	MS	1
4	Washer	MS	1

Fig 1.3 Assembly Drawing

There are several types of such drawings.

Design Assembly Drawing

When a machine is designed, an assembly drawing or a design layout is first drawn to clearly visualise the performance, shape and clearances of various parts comprising the machine.

Detailed Assembly Drawing

It is usually made for simple machines, comprising of a relatively smaller number of simple parts. All the dimensions and information necessary for the construction of such parts and for the assembly of the parts are given directly on the assembly drawing. Separate views of specific parts in enlargements, showing the fitting of parts together, may also be drawn in addition to the regular assembly drawing.

Sub-assembly Drawing

Many assemblies such as an automobile, lathe, etc., are assembled with many pre-assembled components as well as individual parts. These pre-assembled units are known as sub-assemblies.

A sub-assembly drawing is an assembly drawing of a group of related parts, that form a part in a more complicated machine. Examples of such drawings are: lathe tail-stock, diesel engine fuel pump, carburettor, etc.

Installation Assembly Drawing

On this drawing, the location and dimensions of few important parts and overall dimensions of the assembled unit are indicated. This drawing provides useful information for assembling the machine, as this drawing reveals all parts of a machine in their correct working position.

Assembly Drawings for catalogues

Special assembly drawings are prepared for company catalogues. These drawings show only the pertinent details and dimensions that would interest the potential buyer. Figure 1.4 shows a typical catalogue drawing, showing the overall and principal dimensions.

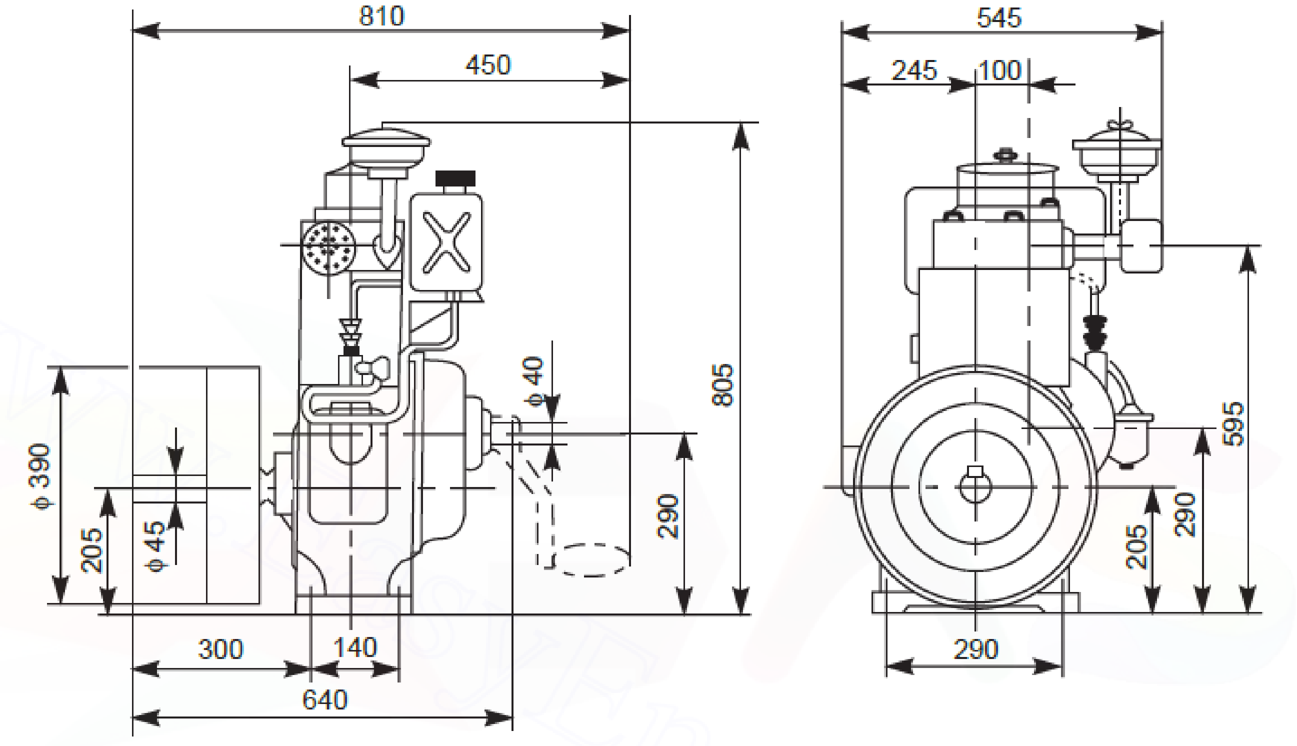
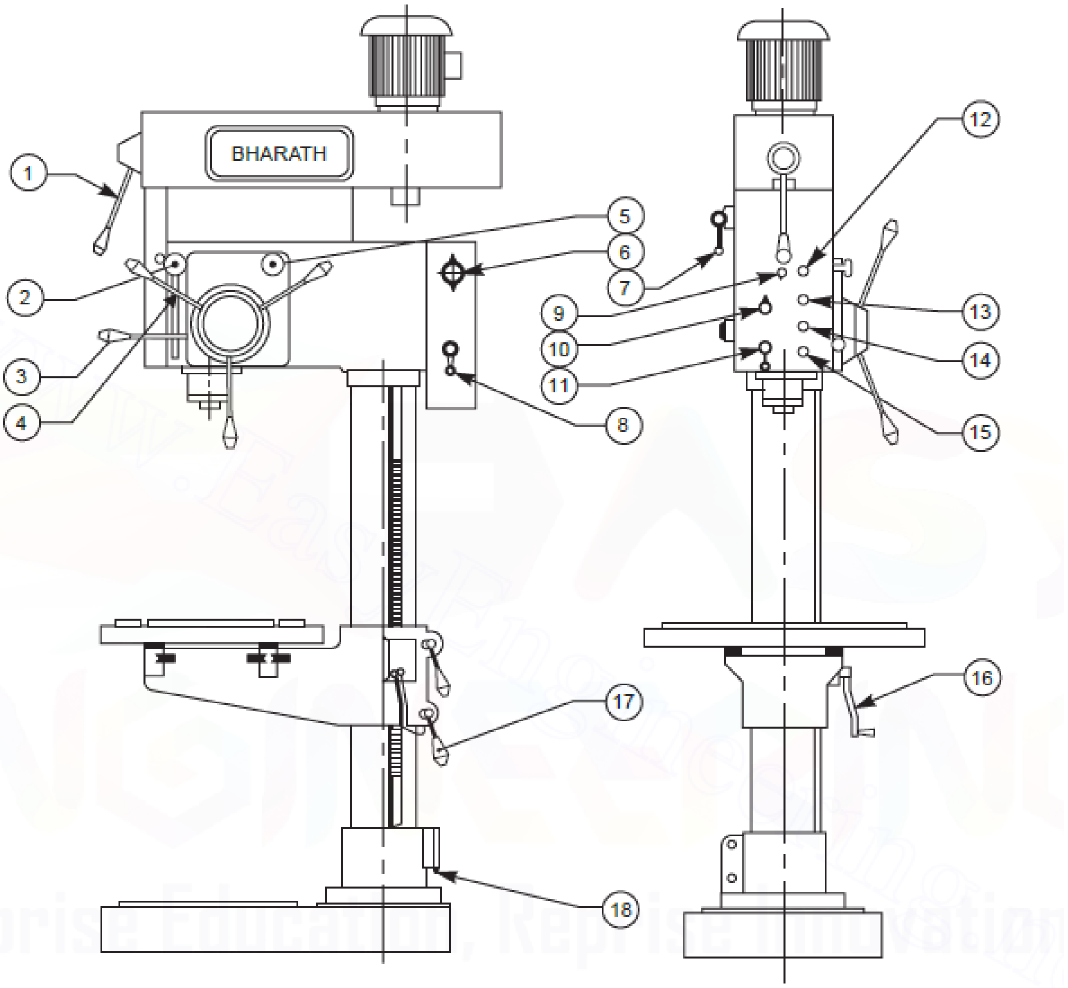


Fig 1.4 Catalogue Drawings

Assembly Drawings for Instruction Manuals

These drawings in the form of assembly drawings, are to be used when a machine, shipped away in assembled condition, is knocked down in order to check all the parts before reassembly and installation elsewhere. These drawings have each component numbered on the job. Figure 1.5 shows a typical example of such a drawing.



Speed change lever (1)
Depth adjusting knob (2)
Mech. feed engagement lever (3)
Hand feed lever (4)
Feed change knob (5)
Switch for tapping (6)
Gear shifting lever (7)
Main switch (8)
Lamp switch (9)
Selector switch (10)
Forward/reverse switch (11)
Pilot lamp (12)
Feed disengagement push button (13)
Start push button (14)
Emergency stop (15)
Elevating handle (16)
Clamping handle (17)
Supply inlet (18)

Fig 1.5 Assembly Drawing for Instruction Manuals

Exploded Assembly Drawing

In some cases, exploded pictorial views are supplied to meet instruction manual requirements. These drawings generally find a place in the parts list section of a company instruction manual. Figure 1.6 shows drawings of this type which may be easily understood even by those with less experience in the reading of drawings; because in these exploded views, the parts are positioned in the sequence of assembly, but separated from each other.

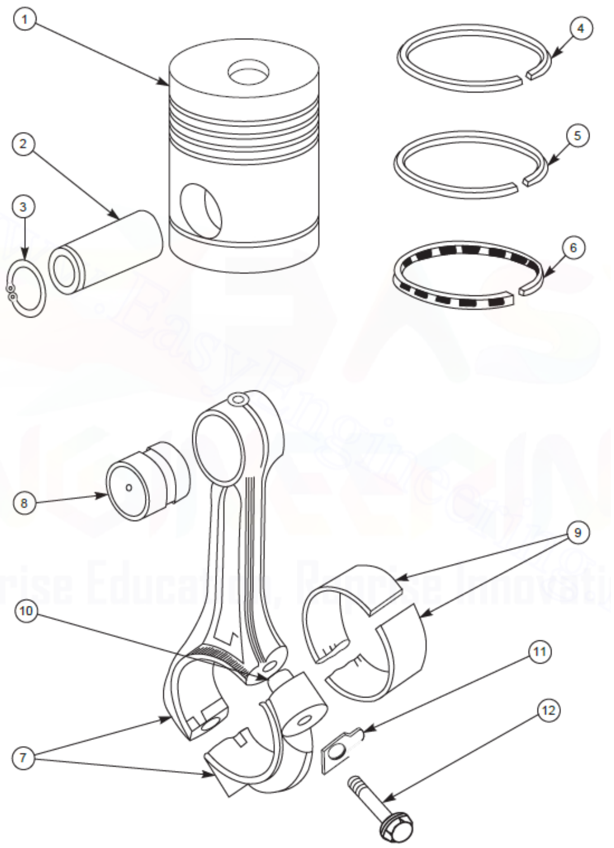


Fig 1.6 Exploded assembly drawing

Schematic Assembly Drawing

It is very difficult to understand the operating principles of complicated machinery, merely from the assembly drawings. Schematic representation of the unit facilitates easy understanding of its operating principle. It is a simplified illustration of the machine or of a system, replacing all the elements, by their respective conventional representations. Figure 1.7 shows the schematic representation of a gearing diagram.

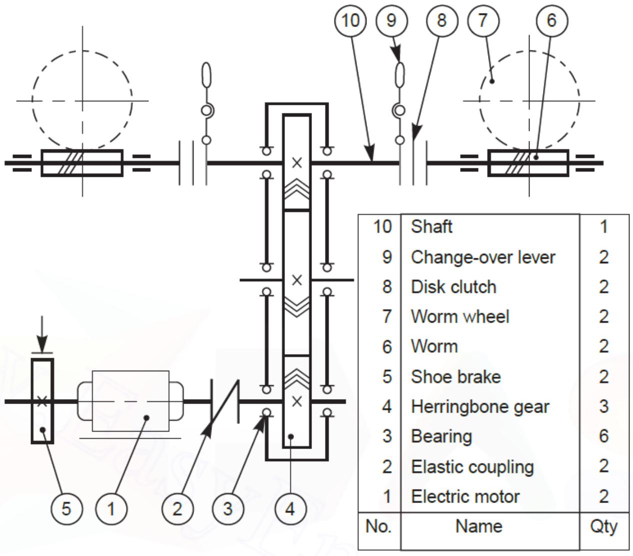


Fig 1.7 Schematic Assembly Drawing

Machine Shop Drawing

Rough castings and forgings are sent to the machine shop for finishing operation (Fig. 1.8). Since the machinist is not interested in the dimensions and information of the previous stages, a machine shop drawing frequently gives only the information necessary for machining. Based on the same principle, one may have forge shop drawing, pattern shop drawing, sheet metal drawing, etc.

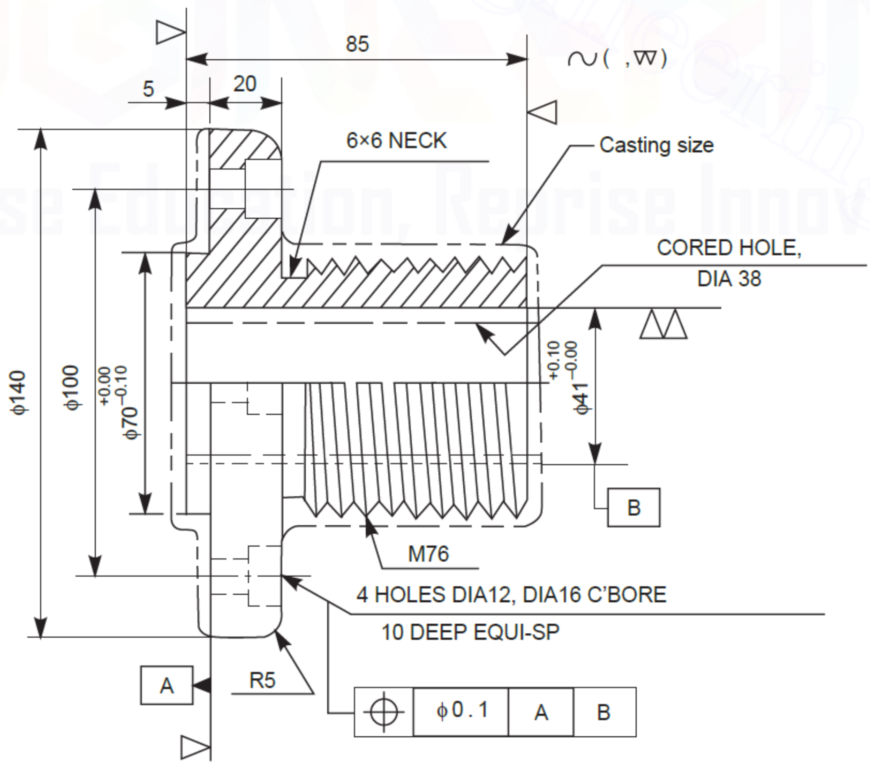


Fig 1.8 Machine Shop Drawing

Patent Drawing

When new machines or devices are invented, patent drawings come into existence, to illustrate and explain the invention. These are pictorial drawings and must be self-explanatory. It is essential that the patent drawings are mechanically correct and include complete illustrations of every detail of the invention. However, they are not useful for production purposes. The salient features on the drawing are numbered for identification and complete description.

CONVENTIONAL REPRESENTATION

Certain draughting conventions are used to represent materials in section and machine elements in engineering drawings.

Materials

As a variety of materials are used for machine components in engineering applications, it is preferable to have different conventions of section lining to differentiate between various materials. The recommended conventions in use are shown in Fig.1.9.

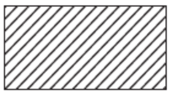
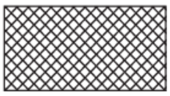
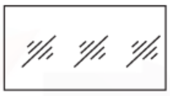
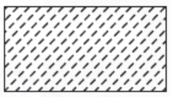
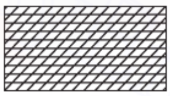
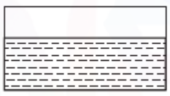
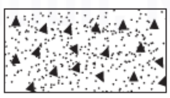
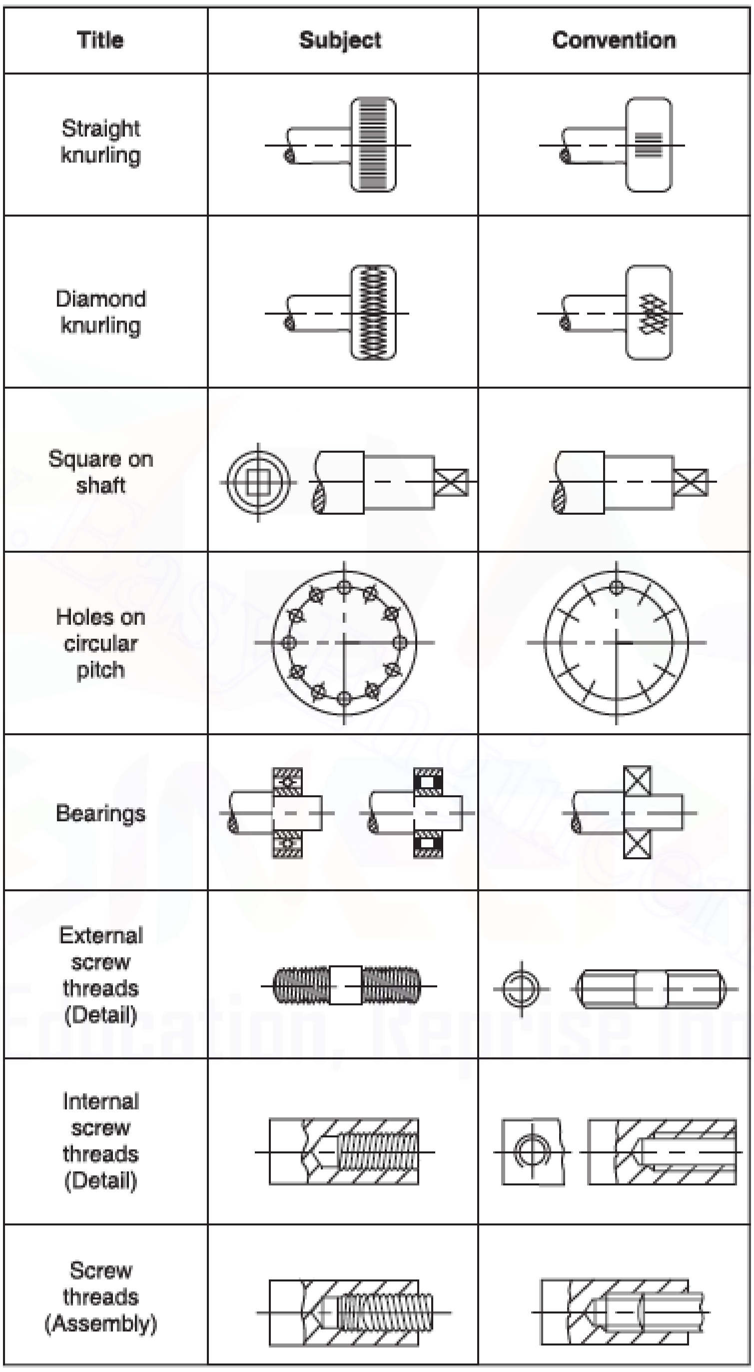
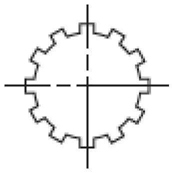
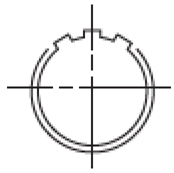
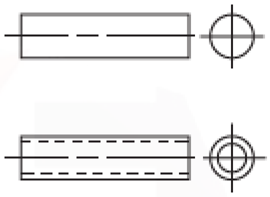
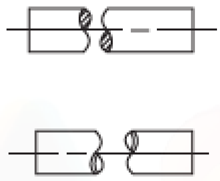
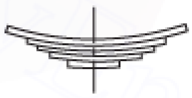
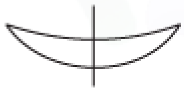
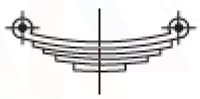
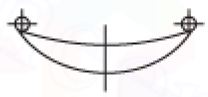
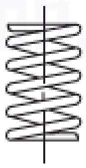
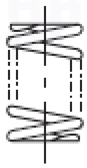
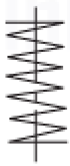
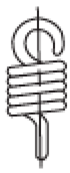
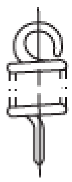
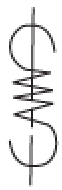
Type	Convention	Material
Metals		Steel, Cast Iron, Copper and its Alloys, Aluminium and its Alloys, etc.
		Lead, Zinc, Tin, White-metal, etc.
Glass		Glass
Packing and Insulating material		Porcelain, Stoneware, Marble, Slate, etc.
		Asbestos, Fibre, Felt, Synthetic resin products, Paper, Cork, Linoleum, Rubber, Leather, Wax, Insulating and Filling materials, etc.
Liquids		Water, Oil, Petrol, Kerosene, etc.
Wood		Wood, Plywood, etc.
Concrete		A mixture of Cement, Sand and Gravel

Fig 1.9 Conventional representation of materials

Machine Components

When the drawing of a component in its true projection involves a lot of time, its convention may be used to represent the actual component. Figure 1.10 shows typical examples of conventional representation of various machine components used in engineering drawing.



Title	Subject	Convention	
Splined shafts			
Interrupted views			
Semi-elliptic leaf spring			
Semi-elliptic leaf spring with eyes			
	Subject	Convention	Diagrammatic Representation
Cylindrical compression spring			
Cylindrical tension spring			

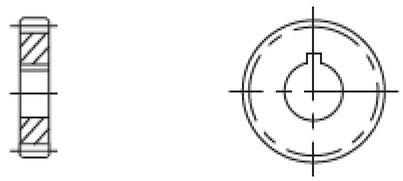
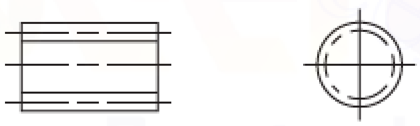
Title	Convention
Spur gear	
Bevel gear	
Worm wheel	
Worm	

Fig 1.10 Conventional representation of machine components

DIMENSIONING

A drawing of a component, in addition to providing complete shape description, must also furnish information regarding the size description. These are provided through the distances between the surfaces, location of holes, nature of surface finsih, type of material, etc. The expression of these features on a drawing, using lines, symbols, figures and notes is called dimensioning.

General Principles

Dimension is a numerical value expressed in appropriate units of measurement and indicated on drawings, using lines, symbols, notes, etc., so that all features are completely defined.

1. As far as possible, dimensions should be placed outside the view.
2. Dimensions should be taken from visible outlines rather than from hidden lines.

3. Dimensioning to a centre line should be avoided except when the centre line passes through the centre of a hole.

4. Each feature should be dimensioned once only on a drawing.

5. Dimensions should be placed on the view or section that relates most clearly to the corresponding features.

6. Each drawing should use the same unit for all dimensions, but without showing the unit symbol.

7. No more dimensions than are necessary to define a part should be shown on a drawing.

8. No features of a part should be defined by more than one dimension in any one direction.

Method of Execution

The elements of dimensioning include the projection line, dimension line, leader line, dimension line termination, the origin indication and the dimension itself. The various elements of dimensioning are shown in Figs. 1.11. The following are some of the principles to be adopted during execution of dimensioning:

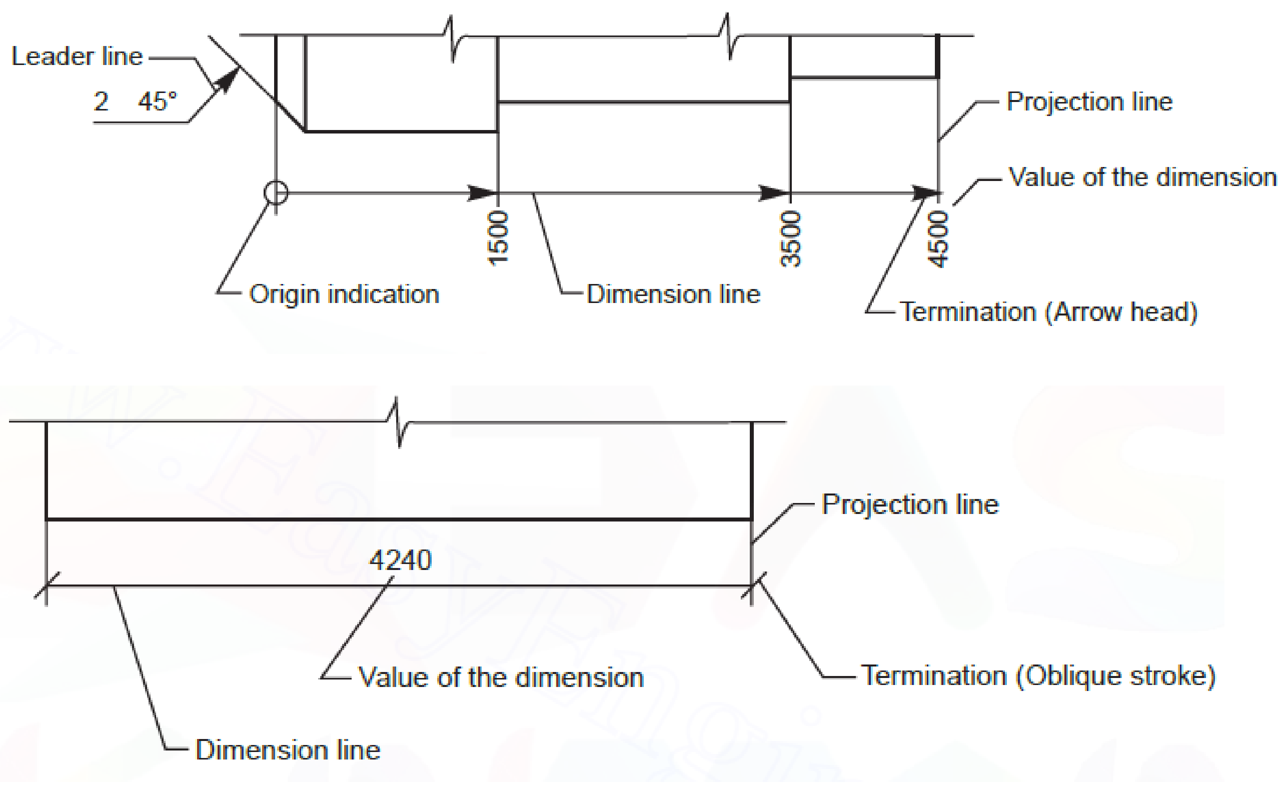


Fig 1.11 Elements of dimensioning

1. Projection and dimension lines should be drawn as thin continuous lines.

2. Projection lines should extend slightly beyond the respective dimension lines.

3. Projection lines should be drawn perpendicular to the feature being dimensioned. Where necessary, they may be drawn obliquely, but parallel to each other (Fig. 1.12). However, they must be in contact with the feature.

4. Projection lines and dimension lines should not cross each other, unless it is unavoidable (Fig. 1.13).

5. A dimension line should be shown unbroken, even where the feature to which it refers, is shown broken (Fig. 1.14).

6. A centre line or the outline of a part should not be used as a dimension line, but may be used in place of projection line (Fig. 1.13).

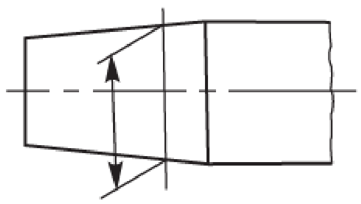


Fig 1.12

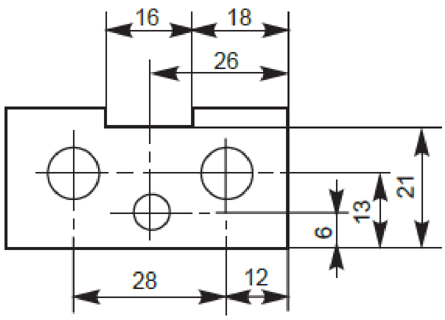


Fig 1.13

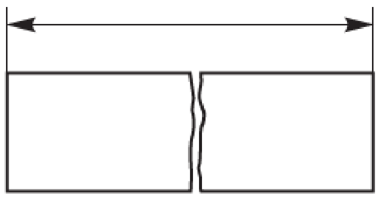


Fig 1.14

PART A

DRAWING OF MACHINE ELEMENTS AND PARTS

SYLLABUS

Part A: Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cotter joints and knuckle joint.
3. Rivetted joints for plates
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

NOTE:

1. First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

2. Part A need to be done by using AUTOCAD.

Course Objectives:

CO2: To gain knowledge of conventional representation of various machining and mechanical details as per IS.
CO3: To gain knowledge of threads, bolts, nuts, stud bolts, tap bolts, set screws, Keys, cottered joints and knuckle joint.
CO4: To make part drawings including sectional views for various machine elements.

Course Outcomes:

1. Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
2. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
3. Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
4. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
5. Title boxes, their size, location and details - common abbreviations and their liberal usage. Types of drawings – working drawings for machine parts.

COURSE OUTLINE

LECTURE	LECTURE TOPIC	KEY ELEMENTS	LEARNING OBJECTIVES (2 to 3 objectives)
1.	Screwed fasteners	Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.	1. Remember the standard formulas of component (B1). 2. Understand the how to draw a components (B2). 3.Apply the design formulas for components(B3)
2.	Keys, cottered joints and knuckle joint	i) Saddle keys, sunk keys ii) Cotter joint with sleeve, cotter joint with socket &spigot ends, cotter joint with a gib. iii)knuckle joint	1. Remember the standard formulas of component (B1). 2. Understand the how to draw a components (B2). 3.Apply the design formulas for components(B3)
3.	Rivetted joints	Plates	1. Remember the standard formulas of component (B1). 2. Understand the how to draw a components (B2). 3.Apply the design formulas for components(B3)
4.	Shaft coupling, spigot and socket pipe joint	Draw the different types of shaft couplings, Spigot and Socket pipe joints	1. Remember the standard formulas of component (B1). 2. Understand the how to draw a components (B2). 3.Apply the design formulas for components(B3)
5.	Bearings	Journal, pivot and collar and foot step bearings	1. Remember the standard formulas of component (B1). 2. Understand the how to draw a components (B2). 3.Apply the design

INTRODUCTION TO AUTOCAD

Computer-Aided Design(CAD) or Computer-Aided Design and Drafting (CADD) can be defined as using computer systems to assist in the creation, modification, analysis, or optimization of a design.

CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and create a database for manufacturing.

CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. (Pottmann, and et al., 2007)

About AutoCAD

AutoCAD is an industry-leading commercial CAD software.

AutoCAD is used by AEC(Architecture, Engineer, and Construction) to generate and optimize 2D and 3D designs. AutoCAD is a widely used software program that can help you draft construction documentation, explore design ideas, visualize concepts through photorealistic renderings, and simulate how a design performs in the real world.

AutoCAD was first released in December 1982 as a desktop app. In 2010, AutoCAD was released as a mobile- and web app, marketed as AutoCAD 360.

- The Word AutoCAD is made up of two words “Auto(logo of company)”and CAD “(computer aided design)”.
- AutoCAD is 2D and 3D modeling software.
- It is developed by Autodesk company.
- Autodesk is an U.S.A based company.
- It is widely used in industry for 2D drawing and 3D modeling.
- In another way we can say that AutoCAD is a designing course , which is performed by the help of computer.

VERSION OF AUTOCAD

- AutoCAD software was firstly launched by Autodesk company in Dec. 1982.
- It comes in India in 1988. T
- The first version of AutoCAD was R1 after that R2,R3,R4…………… and so on.
- In 2000,Autodesk launched a version of AutoCAD 2000 after that 2001,2002…… so on.

USER INTERFACE

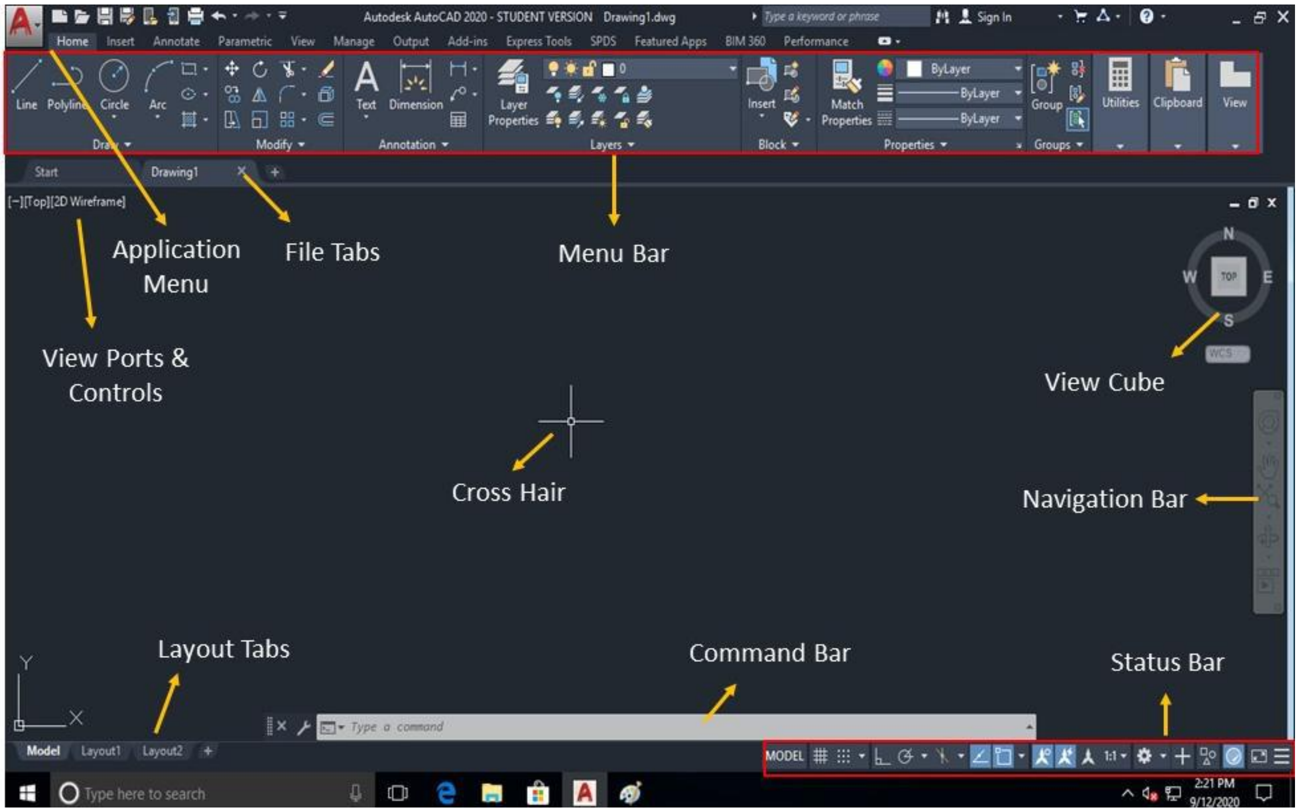


Fig 1.15 User Interface

FUNCTION KEYS

Key	Feature	Description
F1	Help	Displays Help for the active tooltip, command, Palette or dialog box.
F2	Expanded History	Displays an expanded command history in the Command window
F3	Object Snap	Turns object snap ON and OFF
F4	3D Object Snap	Turns additional object snaps for 3D ON and OFF
F5	Isoplane	Cycles through 2D isoplane settings (Top, Right and Left)
F6	Dynamic UCS	Turns automatic UCS alignment with planar surfaces ON and OFF
F7	Grid display	Turns the grid display ON and OFF
F8	Ortho	Locks cursor movement to horizontal or vertical
F9	Grid Snap	Restricts cursor movement to specified grid intervals
F10	Polar Tracking	Guides cursor movement to specified angles
F11	Object Snap Tracking	Tracks the cursor horizontally and vertically from object snap locations
F12	Dynamic input	Displays distances and angles near the cursor and accepts input as we use Tab between fields

STATUS BAR

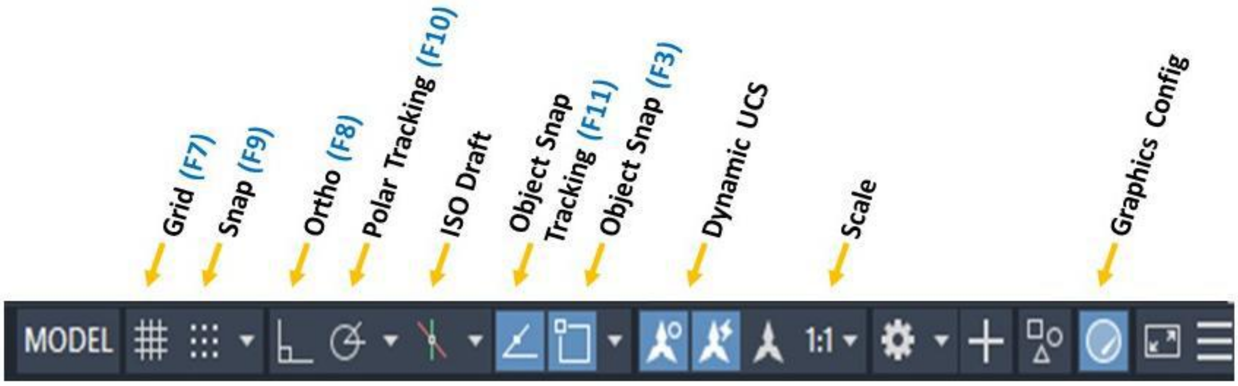


Fig 1.16 Status Bar

Axes

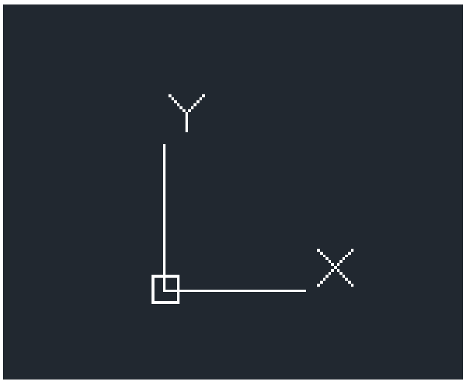


Fig 1.17 Axes

COORDINATE SYSTEM

There are 2 types of Coordinate System

1. **Absolute or Cartesian Coordinate System**

Absolute coordinates refers to a Cartesian System that uses x-axis, y-axis, and sometimes a z-axis to establish a point some distance from a common origin. (x,y)

2. Polar Coordinate System

The polar coordinate system is a two-dimensional coordinate system in which each point on a plane is determined by a distance from a reference point and an angle from a reference direction (r,θ)

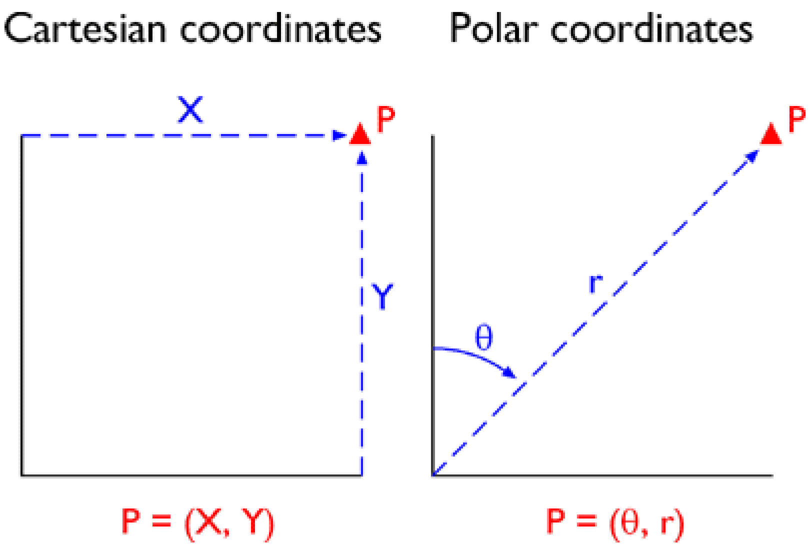


Fig 1.18 Cartesian and Polar Coordinates

1. Absolute Coordinate System

- In the absolute coordinate system the points are located with respect to the origin (0,0).
- The format for Absolute Coordinate System is (x,y)

2. Relative Coordinate System

- There are two types of relative coordinates

a. Relative Rectangular Coordinates

- In the relative coordinate system the points are located with respect to the last point drawn.
- The format for Relative Rectangular Coordinates is @(x,y)

b. Relative Polar Coordinates

- In the relative polar coordinate system, a point can be located by defining both the distance of the point from the current point and the angle that the line between the two points makes with the positive X axis.
- The format for Relative Rectangular Coordinates is @Distance < Angle

Pan – P

- The **Pan command** moves the observer and focus point relative to a fixed model position. Imagine that you are looking straight ahead and moving laterally left/right or up/down. The image will move opposite to the panning direction. ... Drag (left click and hold) up or down, or arrow up or down, to **pan** up and down.

Fig 1.19 Pan icon

Zoom – Z

- Increases or decreases the magnification of the view in the current viewport

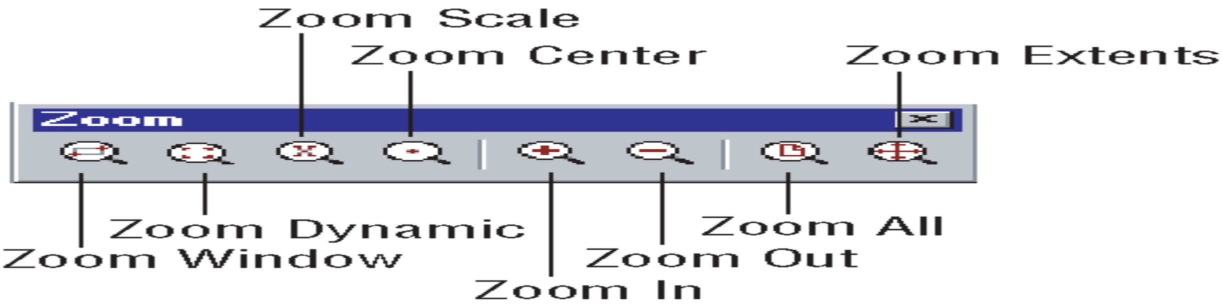


Fig 1.20 Zoom Tool bar

DRAW TOOLBAR

Fig 1.21 Draw Tool bar

Commands

1. Line – L
2. Polyline – PL
3. Circle – C
4. Arc – A
5. Rectangle – REC
6. Ellipse – EL
7. Polygon – POL
8. Spline – SPL

9. Point – PO

10. Hatch – H

11. Multiline Text – MTEXT

12. Block – B

13. Write Block - WB

MODIFY TOOLBAR

Fig 1.22 Modify Toolbar

Commands

1. Erase – E
2. Copy – CO
3. Mirror – MI
4. Offset – O
5. Array – AR
6. Move – M
7. Rotate – RO
8. Scale – SC
9. Fillet – F
10. Chamfer – CHA
11. Trim – TR
12. Extend – EX

DIMENSIONING TOOLBAR

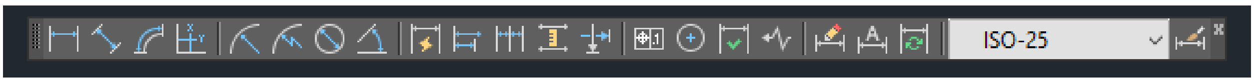


Fig 1.23 Dimensioning Toolbar

Commands

- Dimension – DIM
- The commands for linear, aligned, angular, etc will be given as first DIM and then the respective command.
- For example,
- Linear – DIMLIN
- Aligned – DIMALI
- Angular – DIMANG

LAYER TOOLBAR

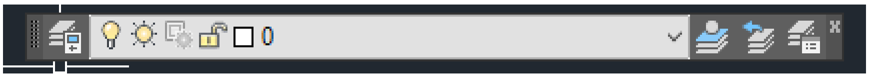


Fig 1.24 Layer Toolbar

Layer - LA

Other used Toolbars in AutoCAD are:

- **Format Menu**

Commands used are Dimension Style, Point Style, Text Style

- **Properties Tool Bar**
- **Parametric Menu**

Commands used are Geometrical Constraints, Dimensional Constraints

SCREWED FASTENERS

INTRODUCTION

A machine element used for holding or joining two or more parts of a machine or structure is known as a fastener. The process of joining the parts is called fastening. The fasteners are of two types : permanent and removable (temporary). Riveting and welding processes are used for fastening permanently. Screwed fasteners such as bolts, studs and nuts in combination, machine screws, set screws, etc., and keys, cotters, couplings, etc., are used for fastening components that require frequent assembly and disassembly.

Screwed fasteners occupy the most prominent place among the removable fasteners. In general, screwed fasteners are used : (*i*) to hold parts together, (*ii*) to adjust parts with reference to each other and (*iii*) to transmit power.

SCREW THREAD NOMENCLATURE

A screw thread is obtained by cutting a continuous helical groove on a cylindrical surface (external thread). The threaded portion engages with a corresponding threaded hole (internal thread); forming a screwed fastener. Following are the terms that are associated with screw threads (Fig. 2.1).

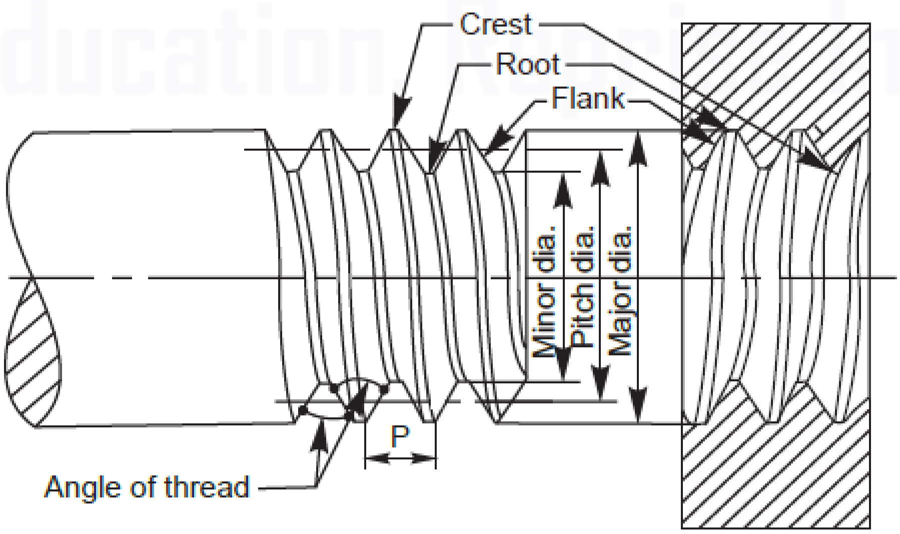


Fig. 2.1 Screw thread nomenclature

1. Major (nominal) diameter

This is the largest diameter of a screw thread, touching the crests on an external thread or the roots of an internal thread.

2. Minor (core) diameter

This is the smallest diameter of a screw thread, touching the roots or core of an external thread (root or core diameter) or the crests of an internal thread.

3. Pitch diameter

This is the diameter of an imaginary cylinder, passing through the threads at the points where the thread width is equal to the space between the threads.

4. Pitch

It is the distance measured parallel to the axis, between corresponding points on adjacent screw threads.

5. Lead

It is the distance a screw advances axially in one turn.

6. Flank

Flank is the straight portion of the surface, on either side of the screw thread.

7. Crest

It is the peak edge of a screw thread, that connects the adjacent flanks at the top.

8. Root

It is the bottom edge of the thread that connects the adjacent flanks at the bottom.

9. Thread angle

This is the angle included between the flanks of the thread, measured in an axial plane.

FORMS OF THREADS

Bureau of Indian Standards (BIS) adapts ISO (International Organisation for Standards) metric threads which are adapted by a number of countries apart from India.

The design profiles of external and internal threads are shown in Fig. 2.2. The following are the relations between the various parameters marked in the figure :

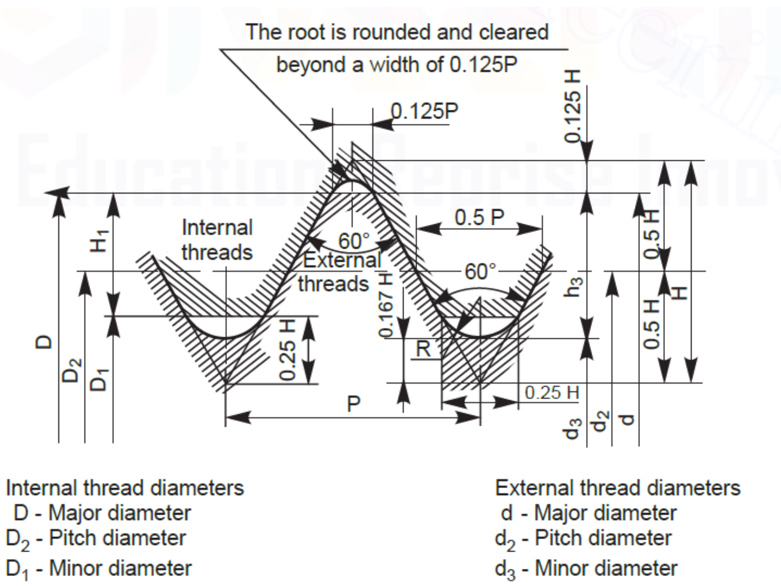


Fig. 2.2 Metric screw thread

P = Pitch

H = 0.86 P

$d3 = d2 – 2 (H/2 – H/6)$

$= d – 1.22P$

D = d = Major diameter

$H1 = (D – D1)/2 = 5H/8 = 0.54P$

$D2 = d2 = d – 0.75H$

$h3 = (d – d3)/2 = 17/24H = 0.61P$

$D1 = d2 – 2(H/2 – H/4) = d – 2H1 = d – 1.08P$

$R = H/6 = 0.14P$

It may be noted from the figure that in order to avoid sharp corners, the basic profile is rounded at the root (minor diameter) of the design profile of an external thread. Similarly, in the case of internal thread, rounding is done at the root (major diameter) of the design profile.

Other Thread Profiles

Apart from ISO metric screw thread profile, there are other profiles in use to meet various applications. These profiles are shown in Fig. 2.3, the characteristics and applications of whichare discussed below :

V-Thread (sharp)

This thread profile has a larger contact area, providing more frictional resistance to motion. Hence, it is used where effective positioning is required. It is also used in brass pipe work.

British Standard Whitworth (B.S.W) Thread

This thread form is adopted in Britain in inch units. The profile has rounded ends, making it less liable to damage than sharp V-thread.

Buttress Thread

This thread is a combination of V-and square threads. It exhibits the advantages of square thread, like the ability to transmit power and low frictional resistance, with the strength of the V-thread. It is used where power transmission takes place in one direction only such as screw press, quick acting carpenter's vice, etc.

Square Thread

Square thread is an ideal thread form for power transmission. In this, as the thread flank is at right angle to the axis, the normal force between the threads, acts parallel to the axis, with zero radial component. This enables the nut to transmit very high pressures, as in the case of a screw jack and other similar applications.

ACME Thread

It is a modified form of square thread. It is much stronger than square thread because of the wider base and it is easy to cut. The inclined sides of the thread facilitate quick and easy engagement and disengagement as for example, the split nut with the lead screw of a lathe.

Worm Thread

Worm thread is similar to the ACME thread, but is deeper. It is used on shafts to carry power to worm wheels

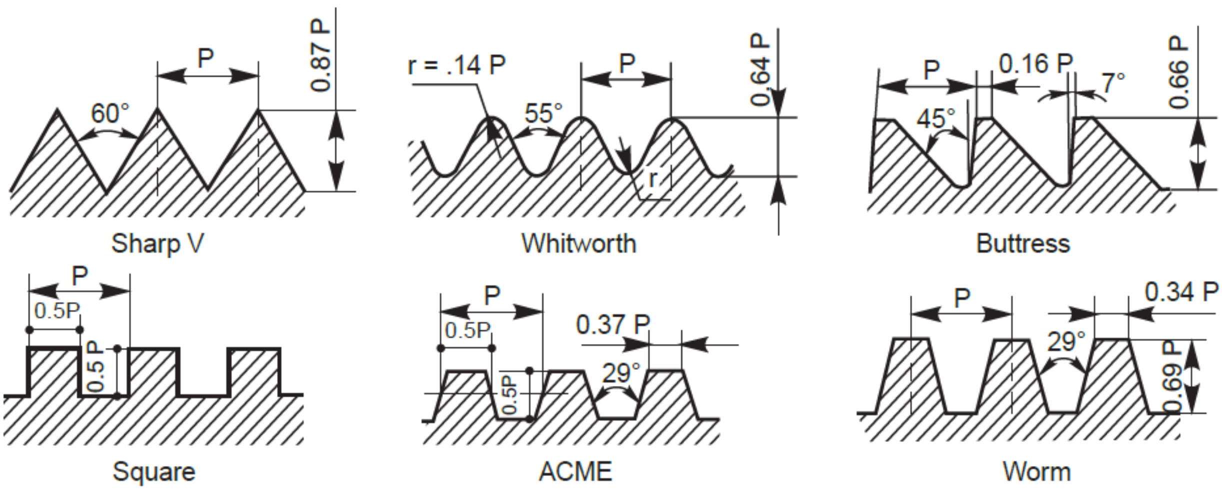


Fig. 2.3 Types of thread profiles

THREAD SERIES

BIS recommends two thread series: coarse series and fine series, based on the relative values of the pitches. However, it must be noted that the concept of quality is not associated with these terms. For any particular diameter, there is only one largest pitch, called the coarse pitch and the rest are designated as fine pitches.

Table 2.1 gives the nominal diameter and pitch combinations for coarse and fine series of ISO metric screw threads.

Table 2.1 Diameter-pitch combination for ISO metric threads

Nominal diameter		*Pitch*			
First choice	*Second choice*	*Coarse*	*Fine*		
			1	*2*	*3*
2	—	0.4	0.25	—	
—	2.2	0.45	0.25	—	—
2.5	—	0.45	0.35	—	—
3	—	0.5	0.35	—	—
—	3.5	0.6	0.35	—	—
4	—	0.7	0.5	—	—
—	4.5	0.75	0.5	—	—
5	—	0.8	0.5	—	—
6	—	1	0.75	0.5	—
8	—	1.25	1	0.75	—
10	—	1.5	1.25	1	0.75
12	—	1.75	1.5	1.25	—
16	14	2	1.5	1	—
20	18,22	2.5	2	1.5	1
24	27	3	2	1.5	1
30	33	3.5	2	1.5	1
36	39	4	3	2	1.5
42	45	4.5	4	3	2
48	52	5	4	3	2
56	60	5.5	4	3	2
64	68	6	4	3	2
72	76	6	4	3	2
80	85	6	4	3	2
90	95	6	4	3	2
100	—	6	4	3	2
105 to 300	—	—	6	4	3

THREAD DESIGNATION

The diameter-pitch combination of an ISO metric screw thread is designated by the letter 'M' followed by the value of the nominal diameter and pitch, the two values being separated by the sign '×'. For example, a diameter pitch combination of nominal diameter 10 mm and pitch 1.25 mm is designated as M10 × 1.25.

If there is no indication of pitch in the designation, it shall mean the coarse pitch. For example, M 10 means that the nominal diameter of the thread is 10 mm and pitch is 1.5 mm.

Following are the other designations, depending on the shape of the thread profile :

SQ 40 × 10 – SQUARE thread of nominal diameter 40 mm and pitch 10 mm

ACME 40 × 8 – ACME thread of nominal diameter 40 mm and pitch 8 mm

WORM 40 × 10 – WORM thread of nominal diameter 40 mm and pitch 10 mm

MULTI - START THREADS

A single-start thread consists of a single, continuous helical groove for which the lead is equal to the pitch. As the depth of the thread depends on the pitch, greater the lead desired, greater will be the pitch and hence smaller will be the core diameter, reducing the strength of the fastener. To overcome this drawback, multi-start threads are recommended.

Figure 2.4 shows single and double-start threads of V-and square profiles

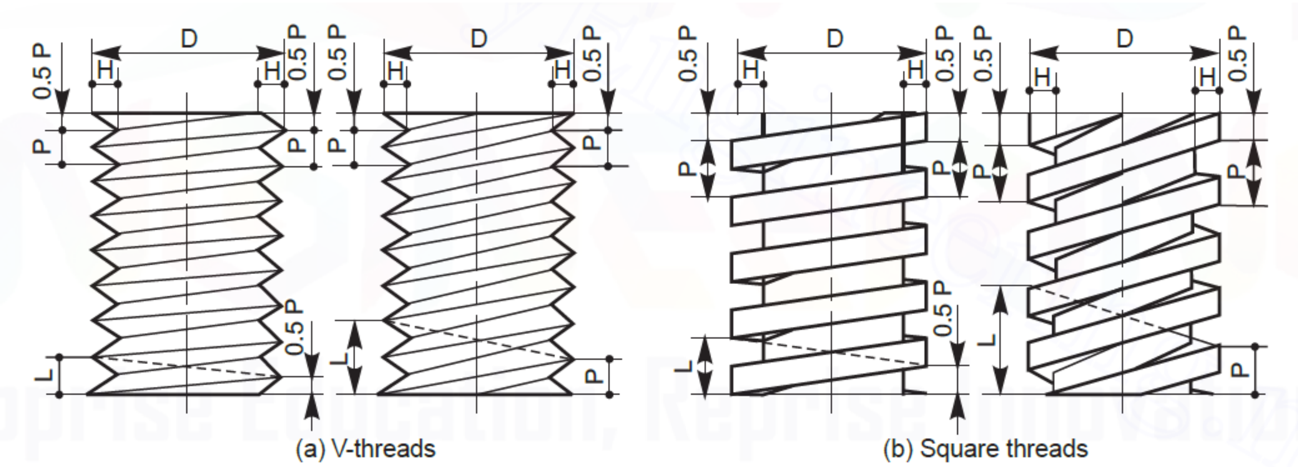


Fig. 2.4 Single and Multi-start threads

In multi-start threads, lead may be increased by increasing the number of starts, without increasing the pitch. For a double start thread, lead is equal to twice the pitch and for a triple start thread, lead is equal to thrice the pitch.

In double start threads, two threads are cut separately, starting at points, diametrically opposite to each other. In triple start threads, the starting points are 120° apart on the circumference of the screws.

Multi-start threads are also used wherever quick action is desired, as in fountain pens, automobile starters, arbor press spindles, hydraulic valve spindles, etc.

RIGHT HAND AND LEFT HAND THREADS

Screw threads may be right hand or left hand, depending on the direction of the helix. A right hand thread is one which advances into the nut, when turned in a clockwise direction and a left hand thread is one which advances into the nut when turned in a counter clockwise direction. An abbreviation LH is used to indicate a left hand thread. Unless otherwise stated, a thread should be considered as a right hand one. Figure 2.5 illustrates both right and left hand thread forms.

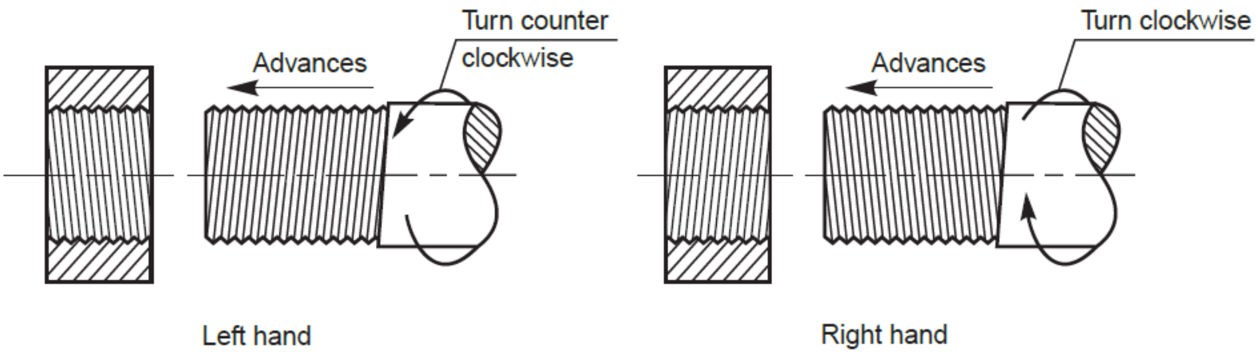


Fig. 2.5 Right hand and left hand threads

REPRESENTATION OF THREADS

The true projection of a threaded portion of a part consists of a series of helices and it takes considerable time to draw them. Hence it is the usual practice to follow some conventional methods to represent screw threads. Figure 2.1 shows the true projection of a screw thread, whereas the conventional representation of external and internal threads as recommended by BIS is shown in Fig. 2.6.

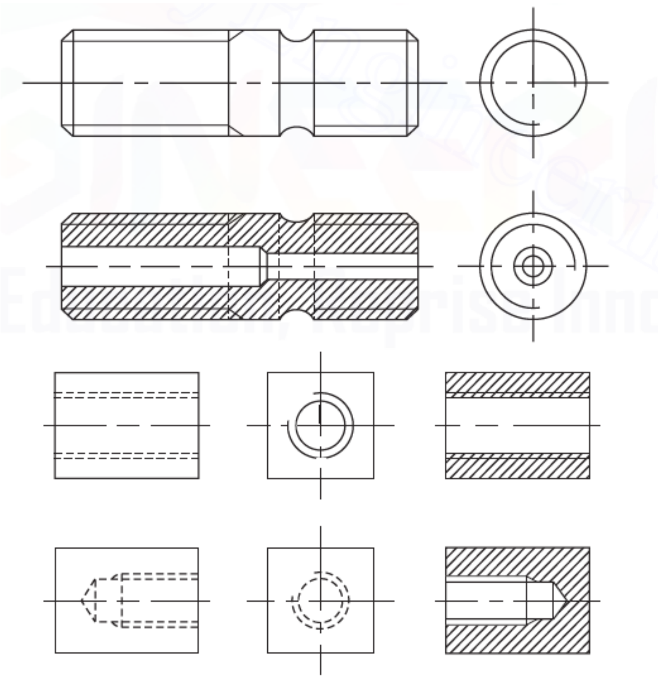


Fig. 2.6 Conventional representation of threads

The limit of useful length of screw threads is represented by a continuous thick line or a dotted line, depending on its visibility. The length upto which the incomplete threads are formed beyond the useful limit, is known as a run-out. It is represented by two inclined lines.

The simplified representation, though it saves time, is not an effective method to convey thread forms. The schematic representation, used for the purpose is shown in Fig. 2.7. In practice, the schematic representation is followed for only visible threads, i.e., for external threads and internal threads in section. From the Fig. 2.7, it may be observed that the crest diameters, both in external and internal threads, are drawn by thick lines. Further, the crests are represented by thin lines, extending upto the major diameter and the roots by thick lines, extending upto the minor diameter, these lines being drawn inclined with a slope equal to half the pitch.

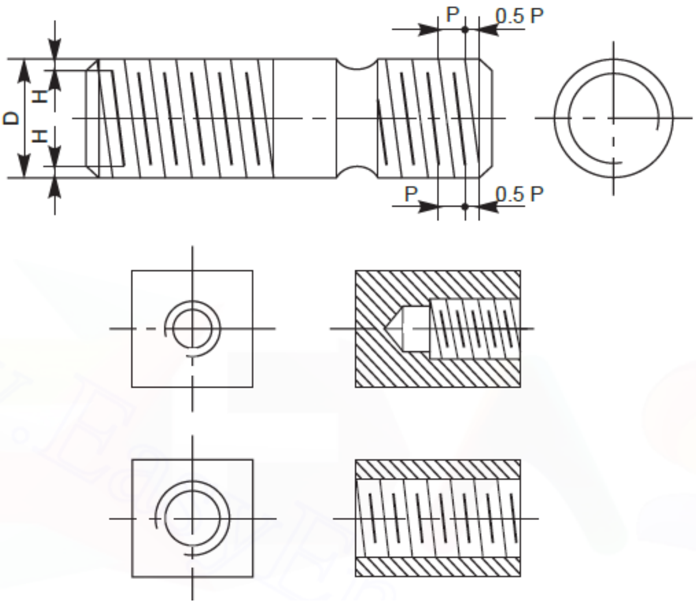


Fig. 2.7 Schematic representation of threaded parts–V-threads

Fig. 2.8 illustrates the schematic representation of square threads.

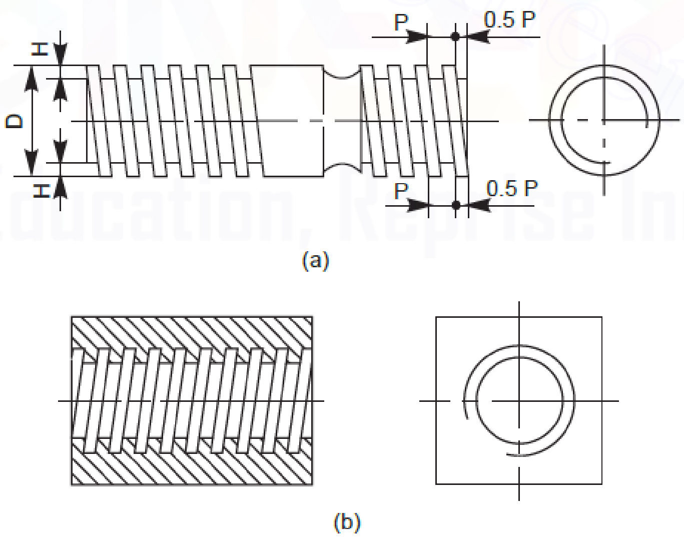
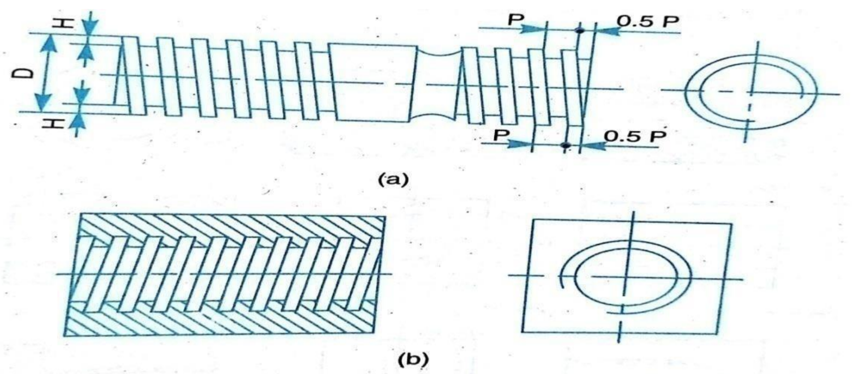


Fig. 2.8 Schematic representation of threaded parts–Square threads

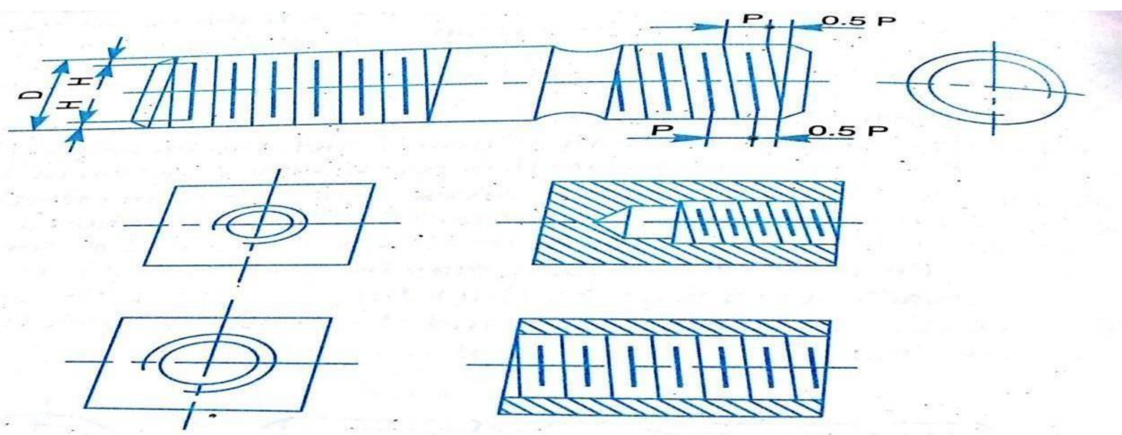
V-THREAD & SQUARE THREAD

The simplified representation, though it saves time, is not an effective method to convey thread forms. The schematic representation, used for the purpose is shown in Fig. In practice, the schematic representation is followed for only visible threads, *i.e.,* for external threads and internal threads in section. From the Fig. it may be observed that the crest diameters, both in external and internal threads, are drawn by thick lines. Further, the crests are represented by thin lines, extending up to the major diameter and the roots by thick lines, extending up to the minor diameter, these lines being



9 Schematic representation of threaded parts--Square threads

drawn inclined with a slope equal to half the pitch



Schematic representation of threaded parts—V-threads

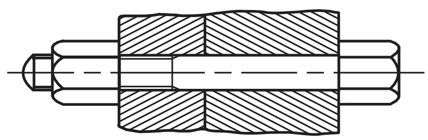
BOLTED JOINT

A bolt and nut in combination Fig. is a fastening device used to hold two Parts together. The body of the bolt, called shank is cylindrical in form, the head; square or hexagonal in shape, is formed by forging. Screw threads are cut on the other end of the shank. Nuts in general are square or hexagonal in shape. The nuts with internal threads engage with the corresponding size of the external threads of the bolt. However, there are other forms of nuts used to suit specific requirements. For nuts, hexagonal shape is preferred to the square one, as it is easy to tighten even in a limited Fig. Bolted joint space. This is because, with only one-sixth of a turn, the spanner can be re-introduced in the same position. However, square nuts are used when frequent loosening and tightening is required, for example on job holding devices like vices, tool posts in machines, etc. The sharp corners on the head of bolts and nuts are removed by chamfering

Methods of Drawing Hexagonal (Bolt Head) Nut:

Drawing hexagonal bolt head or nut, to the exact dimensions is laborious and time consuming. Moreover, as standard bolts and nuts are used, it is not necessary to draw them accurately. The following approximate methods are used to save the draughting time.

(Fig.)



Empirical relations:

Major or nominal diameter of bolt = D Thickness of nut, T = D

Width of nut across flat surfaces, W = 1.5D + 3 mm

Radius of chamfer, R = 1.5D

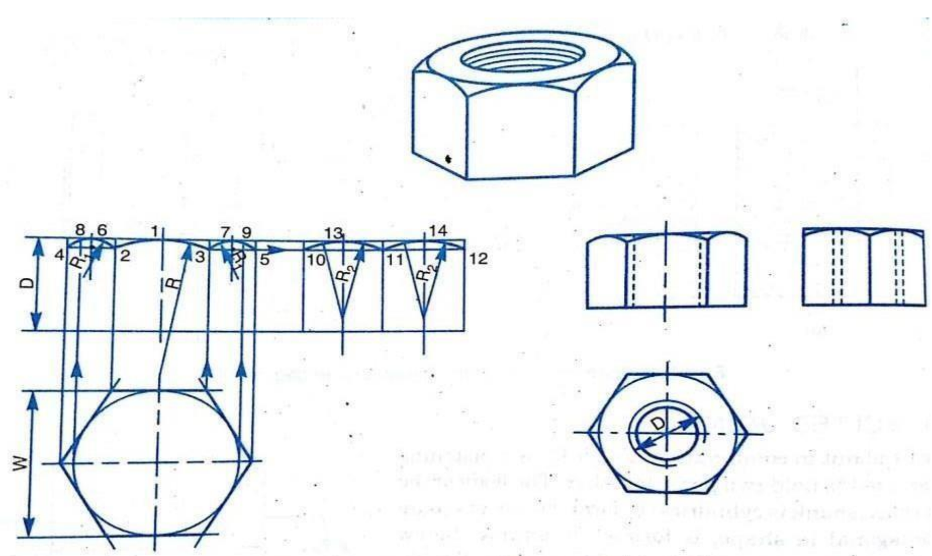


Fig. 5.12 Method of drawing views of a hexagonal nut (Method I)

PROCEDURE:

1. Draw the view from above by drawing a circle of diameter, W and describe a regular hexagon on it, by keeping any two parallel sides of the hexagon, horizontal.

2. Project the view from the front, and the view from side, and mark the height equal to D.

3. With radius R, draw the chamfer arc 2-1-3 passing through the point 1 in the front face.

4. Mark points 4 and 5, lying in-line with 2 and 3.Locate points 8,9 on the top surface, by projecting from the view from above.

5. Draw the chamfers 4–8 and 5–9.

6. Locate points 6 and 7, lying at the middle of the outer two faces.

7. Draw circular arcs passing through the points 4, 6, 2 and 3, 7, 5, after determining the radius R_1 geometrically.

8. Project the view from the side and locate points 10, 11 and 12.

9. Mark points 13 and 14, lying at the middle of the two faces (view from the side).

10. Draw circular arcs passing through the points 10, 13, 11 and 11, 14, 12, after determining the radius R_2 geometrically.

It may be noted that in the view from the front, the upper outer corners appear chamfered.

In the view from the side, where only two faces are seen, the corners appear square.

Method 2 (Fig.)

Empirical relations:

Major or nominal diameter of bolt = D Thickness of nut, T= D

Width of the nut across corners= 2 D Radius of chamfer arc, R= 1.5 D

Figure illustrates the stages of drawing different views of a hexagonal nut, following the above relations, which are self-explanatory.

The above method may be followed in routine drawing work, as it helps in drawing the views quickly.

Method of Drawing Square (Bolt Head) Nut

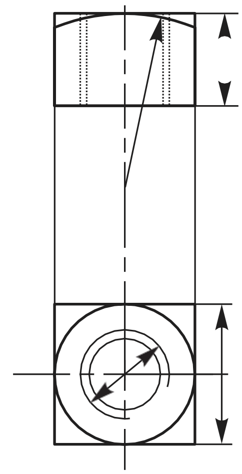
A square bolt head and nut may be drawn, showing either across flats or corners. Following relations may be adopted for the purpose:

Major or nominal diameter of bolt =D

Thickness of nut, T

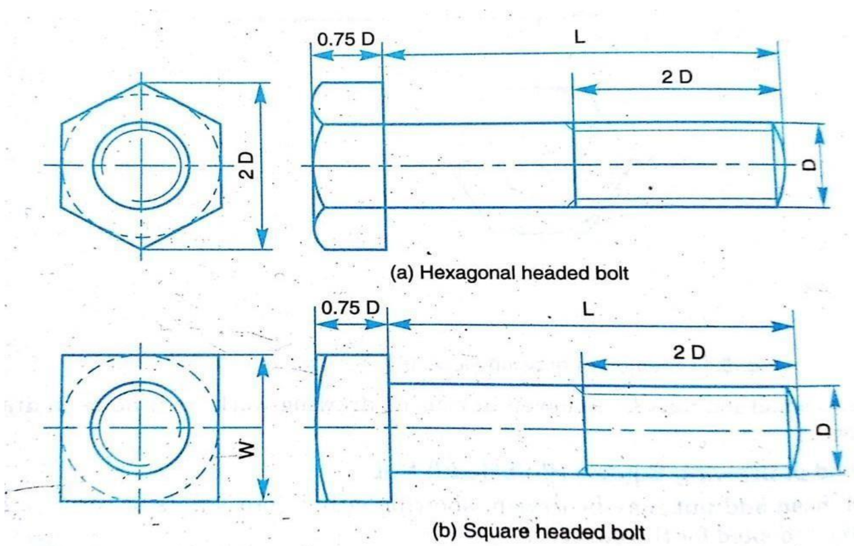
Width of the nut across flats, W = 1.5 D + 3 mm

Radius of chamfer arc, R = 2 D



Method of drawing the views of a square

Figure shows the two views of a hexagonal headed bolt and square headed bolt, with the proportions marked.



Washers:

A washer is a cylindrical piece of metal with a hole to receive the bolt. It is used to give a perfect seating for the nut and to distribute the tightening force uniformly to the parts under the joint. It also prevents the nut from damaging the metal surface under the joint. Figure shows a washer, with the proportions marked. Figure illustrates the views of a hexagonal headed bolt with a nut and a washer in position.

Other Forms of Bolts:

Square Headed Bolt with Square Neck: It is provided with a square neck, which fits into a corresponding square hole in the adjacent part, preventing the rotation of the bolt.

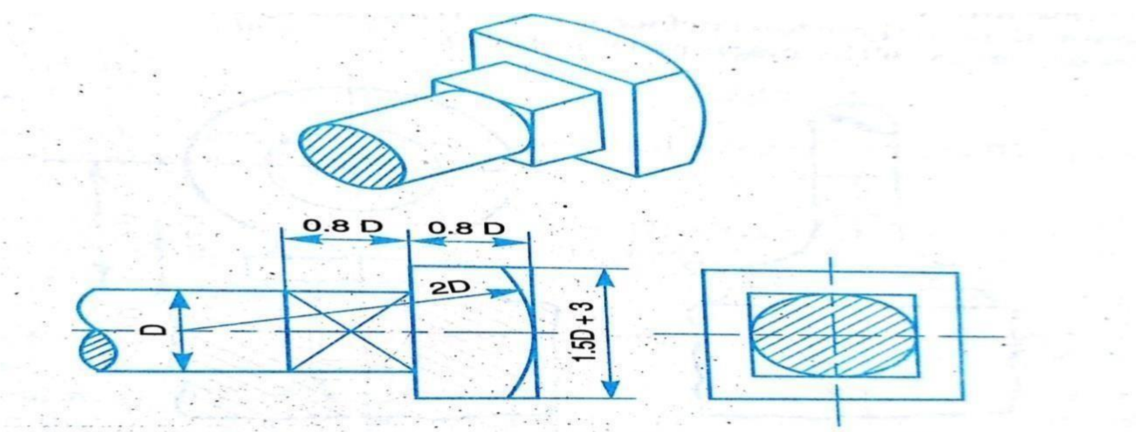


Fig. 5.18 Square headed bolt with square neck

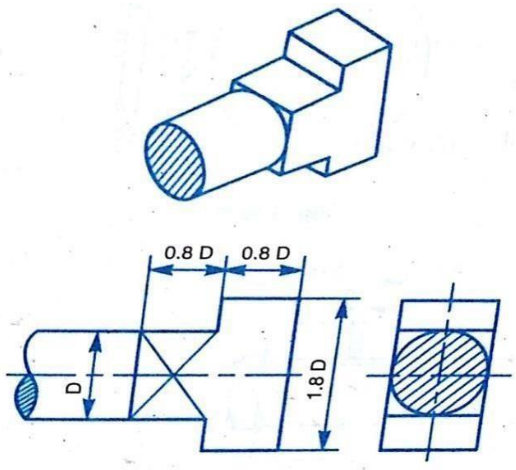
T-Headed Bolt with Square Neck:

In this, a square neck provided below the head, prevents the rotation of the bolt. This type of bolt is used for fixing vices, work pieces, etc., to the machine table having T-slots Fig.

Hook Bolt:

This bolt passes through a hole in one part only, while the other part is gripped by the hook shaped bolt head. It is used where there is no space for making a bolt hole in one of the parts.

The square neck prevents the rotation of the bolt Fig



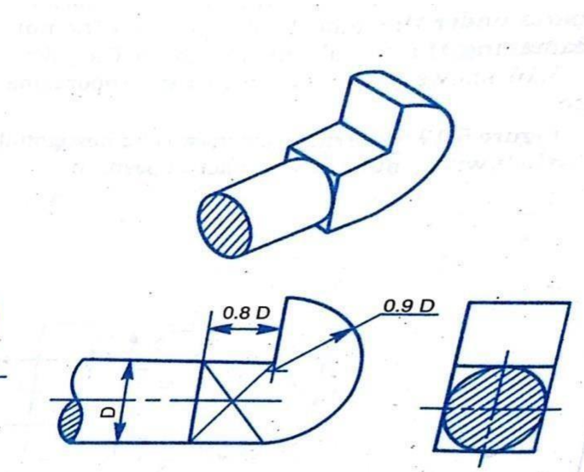
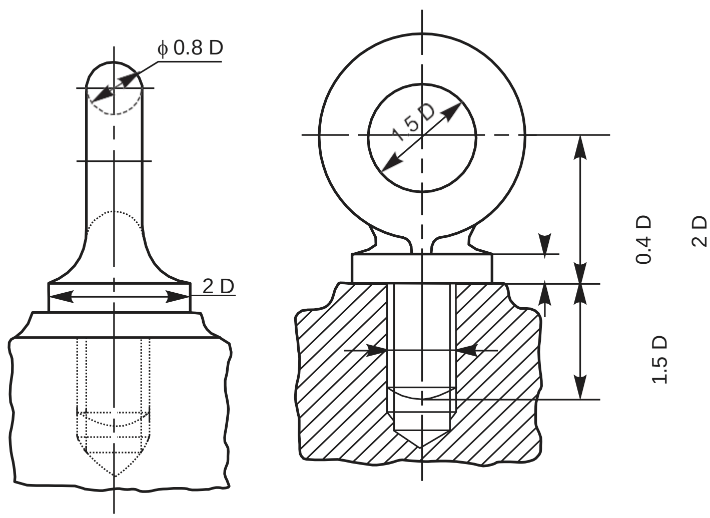


Fig. 5.19 T-headed bolt **Fig. 5.20** Hook bolt

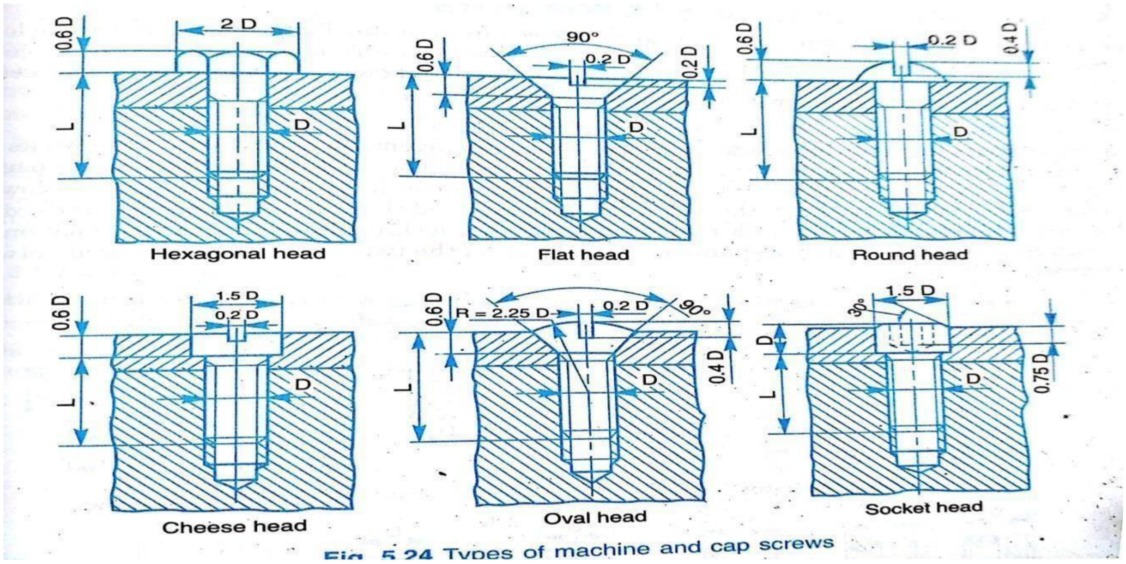
Eye Bolt:

In order to facilitate lifting of heavy machinery, like electric generators, motors, turbines, etc., eye bolts are screwed on to their top surfaces. For fitting an eye bolt, a tapped hole is provided, above the centre of gravity of the machine Fig.



Cap Screws and Machine Screws :

Cap screws and machine screws are similar in shape, differing only in their relative sizes. Machine screws are usually smaller in size, compared to cap screws. These are used for fastening two parts, one with clearance hole and the other with tapped hole. The clearance of the unthreaded hole need not be shown on the drawing as its presence is obvious. Figure



5.24 shows different types of cap and machine screws, with proportions marked

The bolted joints, though removable in nature, are required to stay firm without becoming loose, of their own accord. However, the joints used in the moving parts of machinery, may be subjected to vibrations. This may slacken the joint, leading to serious breakdown. To eliminate the slackening tendency, different arrangements, as discussed further, are used to lock the nuts:

LOCK NUT:

This is the most commonly used locking device. In this arrangement, a second nut, known as lock nut is used in combination with a standard nut Fig. The thickness of a lock nut is usually two-thirds D, where D is the major diameter of the bolt. The lock nut is usually placed below the standard nut. To make the joint, the lock nut is first screwed tightly and then the standard nut is tightened till it touches the lock nut. Afterwards, the locknut is then screwed back on the standard nut, which is held by a spanner. The threads of the two nuts become wedged between the threads of the bolt.

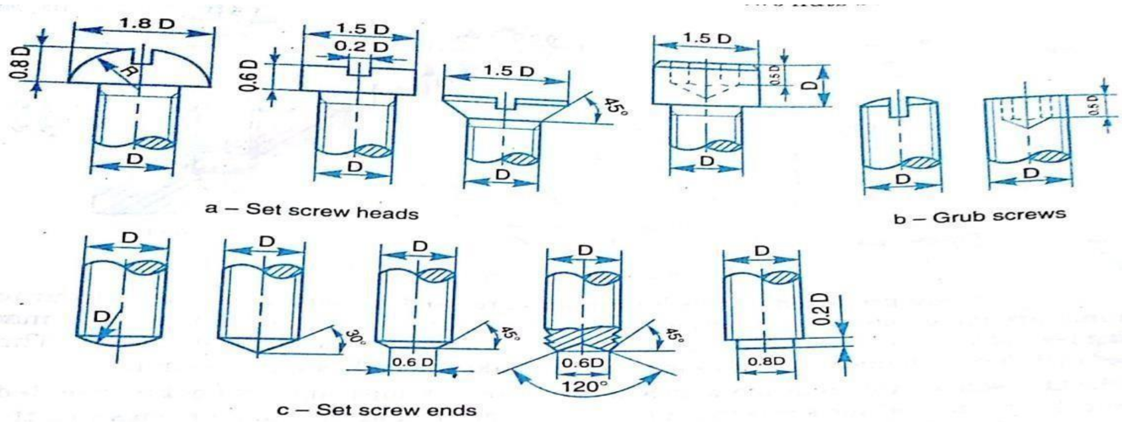


Fig. 5.26

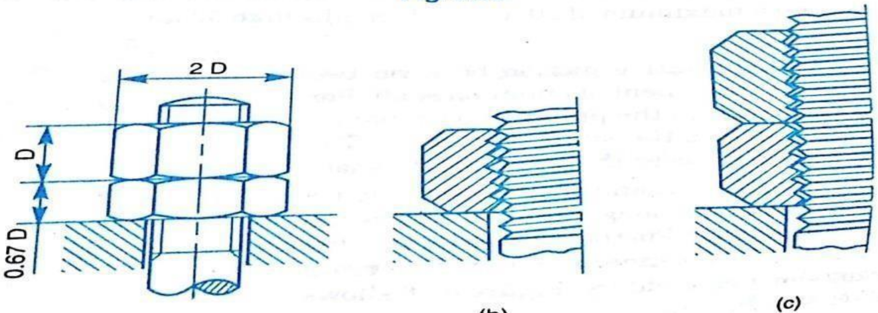


Fig. 5.27 Lock nut

LOCKING BY SPLIT PIN

A split pin is inserted through a hole in the bolt body and touching just the top surface of the nut. Then, the ends of the pin are split open to prevent it from coming out while in use Fig.

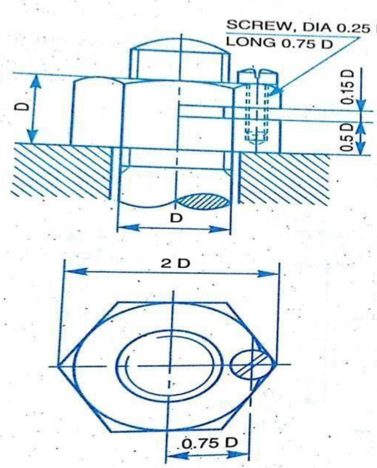


Fig. 5.30 Wile's lock nut

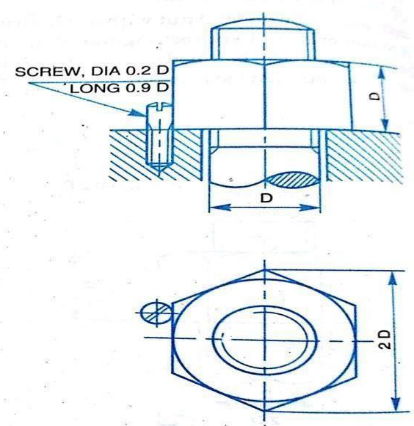


Fig. 5.31 Locking by set screw

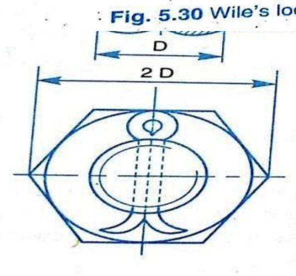


Fig. 5.28 Locking by split pin

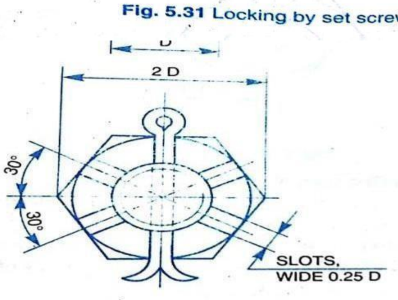


Fig. 5.29 Castle nut

WILE'S LOCK NUT

It is a hexagonal nut with a slot, cut half-way across it. After tightening the nut in the usual manner, a set screw is used from the top of the nut, compressing the two parts. For this purpose, the upper portion of the nut should have a clearance hole and the lower portion tapped Fig.

LOCKING BY SET SCREW

In this arrangement, after the nut is tightened, a set screw in fitted in the part, adjoining the nut, so that it touches one of the flat faces of the nut. The arrangement prevents the loosening tendency of the nut Fig

GROOVED NUT

It has a cylindrical grooved collar, integrally provided at the lower end of the nut. This collar fits into a corresponding recess in the adjoining part. In this arrangement, after tightening the nut, a set screw is inserted from one end of the upper part, so that the end of the set screw enters the groove, preventing the loosening tendency of the nut Fig.

LOCKING BY SCREW

In this, a cap nut with an integral washer and with a threaded hole in the cylindrical cap, is used. A corresponding tapped hole at the top end of the bolt is also required for the purpose. In this arrangement, a set screw fitted through the cap and through the bolt end, prevents the loosening tendency of the nut, when the pitches of the main nut and the set screw are different Fig. This type of arrangement is used for fitting the propeller blades on turbine

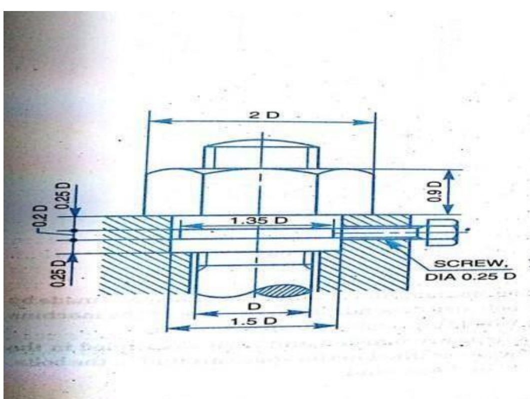


Fig. 5.32 Grooved nut

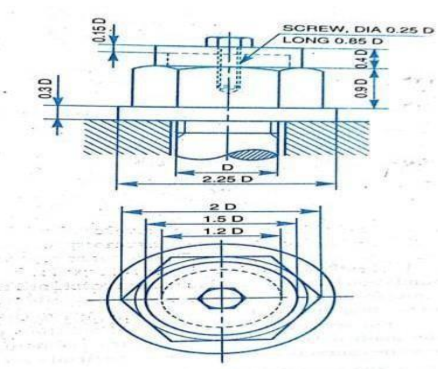


Fig. 5.33 Locking by screw

LOCKING BY PLATE

A locking plate is grooved such that it fits a hexagonal nut in any position, at intervals of 30° of rotation. It is fixed around the nut, by means of a machine screw, as shown inFig.

LOCKING BY SPRING WASHER

In this arrangement, a spring washer of either single or double coil is placed under the nut and tightened. The spring force of the washer will be acting upwards on the nut.

FOUNDATION BOLTS:

Foundation bolts are used for fixing machines to their foundations. Foundation bolts are made by forging from mild steel or wrought iron rods. The bolt size depends upon the size of the machine and the magnitude of the forces that act on them when the machine is in operation.

For setting the bolts in position, their positions are marked and then suspended in the holes made in the ground. Afterwards, cement concrete is filled in the space around in the bolt.

EYE FOUNDATION BOLT

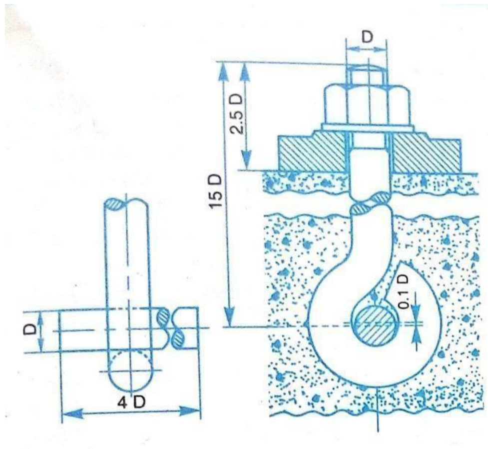
This is the simplest form of all foundation bolts. In this, one end of the bolt is forged into an eye and a cross piece is fixed in it. Figure shows an eye foundation bolt that is set in concrete.

BENT FOUNDATION BOLT

As the name implies, this bolt is forged in bent form and set in cement concrete. When machines are to be placed on stone beds, the bolts are set in lead. Figure shows a bent foundation bolt that is set first in lead and then in cement concrete, resulting in a firm and stable bolt.

RAG FOUNDATION BOLT

This bolt consists of a tapered body, square or rectangular in cross-section, the tapered edges being grooved. Figure shows a rag foundation bolt that is set first in lead and then in cement concrete.



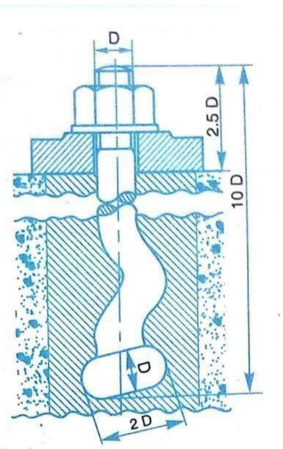
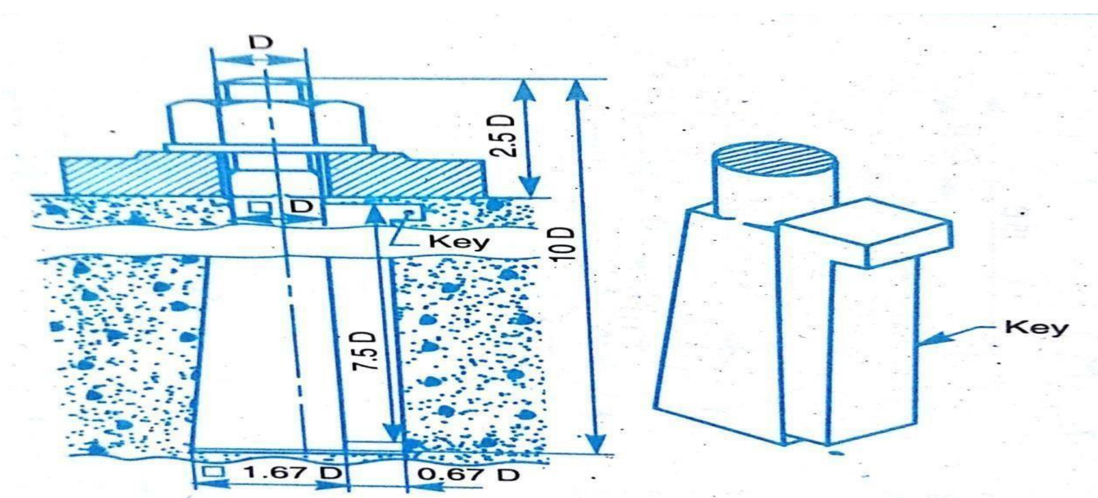


Fig: Eye foundation bolt

Fig: Bent foundation bolt

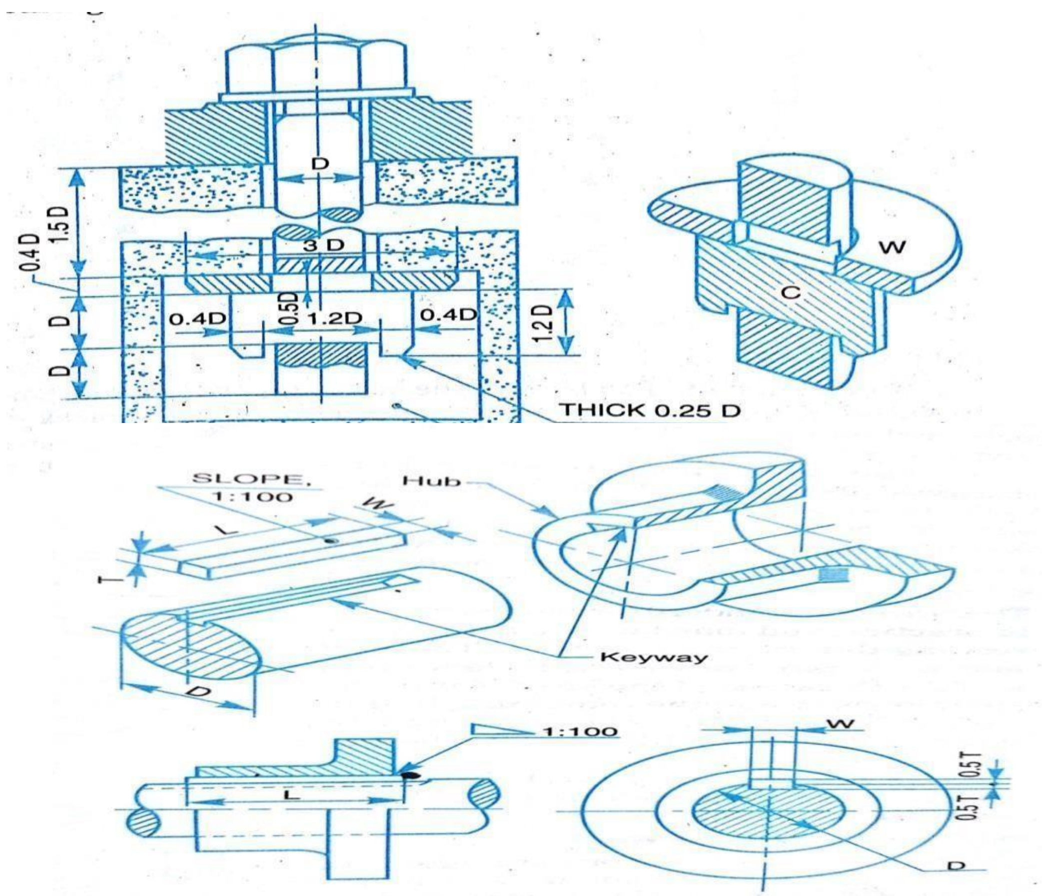
LEWIS FOUNDATION BOLT

This is a removable foundation bolt. The body of the bolt is tapered in width on one side. To use this bolt, a pit is produced in cement concrete, by using a (foundation) block. Once the concrete sets-in, the bolt is placed in it so that the tapered bolt surface, bears against the tapered face of the pit. A key is then inserted, bearing against the straight surfaces of the pit and the bolt. This arrangement makes the bolt firm in the bed. However, the bolt may be removed by withdrawing the key. This type of foundation bolt is not commonly used for fixing machines.



COTTER FOUNDATION BOLT

It is used for fixing heavy machines. It has a rectangular slot at its bottom end, to receive a cotter. For putting the bolts in position, the foundation bed is first made, providing holes for inserting cotters. Figure shows a cotter foundation bolt in position. A cast iron washer (W) placed as shown, provides bearing surface for the cotter (C).



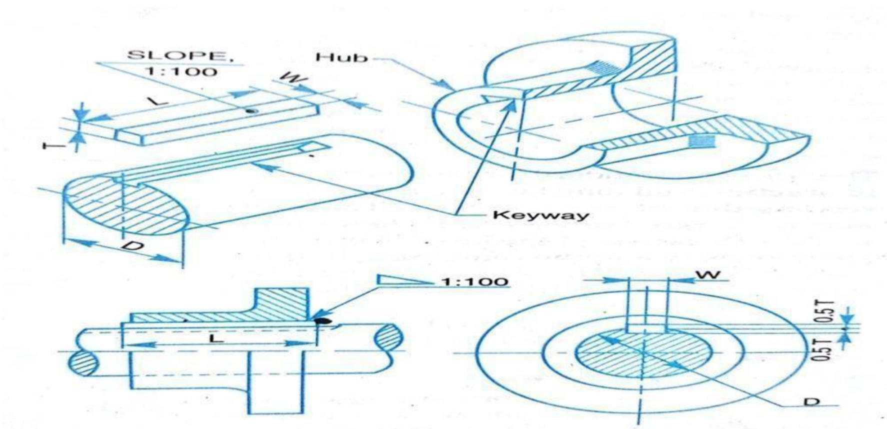
KEYS, COTTERS AND PIN JOINTS

INTRODUCTION

Keys, cotters and pin joints discussed in this chapter are some examples of removable (temporary) fasteners. Assembly and removal of these joints are easy as they are simple in shape. The standard proportions of these joints are given in the figures.

KEYS

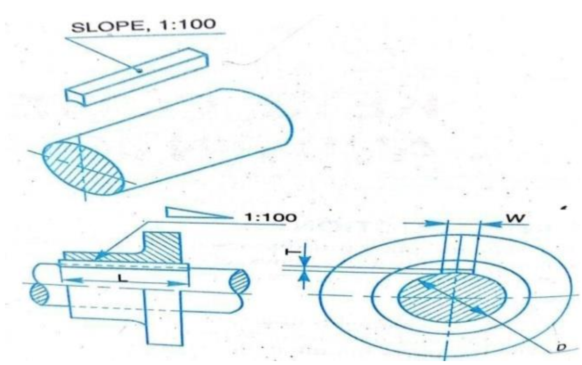
Keys are machine elements used to prevent relative rotational movement between a shaft and the parts mounted on it, such as pulleys, gears, wheels, couplings, etc. Figure shows the parts of a keyed



joint and its assembly.

Hollow Saddle Key

A hollow saddle key has a concave shaped bottom to suit the curved surface of the shaft, on which it is used. A keyway is made in the hub of the mounting, with a tapered bottom surface. When a hollow saddle key is fitted in position, the relative rotation between the shaft and the mounting is prevented

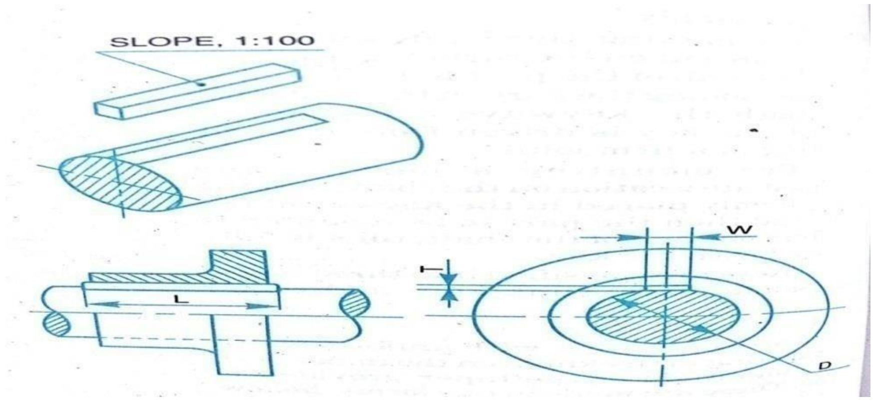


due to the friction between the shaft and key

Flat Saddle Key

It is similar to the hollow saddle key, except that the bottom surface of it is flat. Apart from the tapered keyway in the hub of the mounting, a flat surface provided on the shaft is used to fit this key in position.

Sunk keys may be classified as:



(i) Taper keys, (ii) parallel or feather keys and (iii) woodruff keys.

Fig: Flat Saddle Key

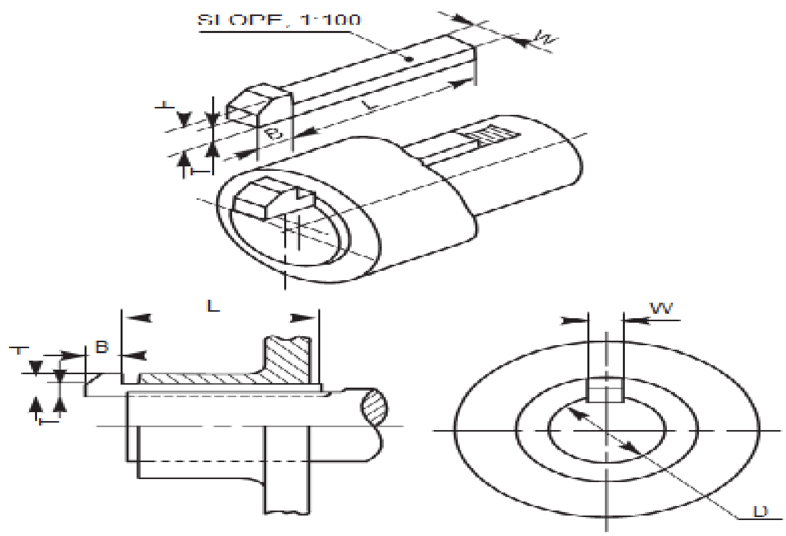


Fig. Key with gib

Head Following are the proportions for a gib head

Width of head, B= 1.5 T If D is the diameter of theshaft, then,

Width of key, W= 0.25 D + 2 mm

Thickness of key, T= 0.67 W (at the thicker end)

Standard taper = 1:100

Height of head, H= 1.75 T

Parallel or Feather Keys

A parallel or feather key is a sunk key, uniform in width and thickness as well. These keys are used when the parts (gears, clutches, etc.)

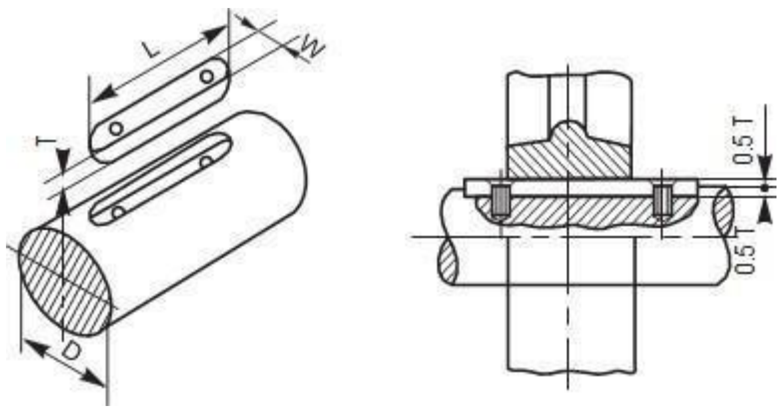
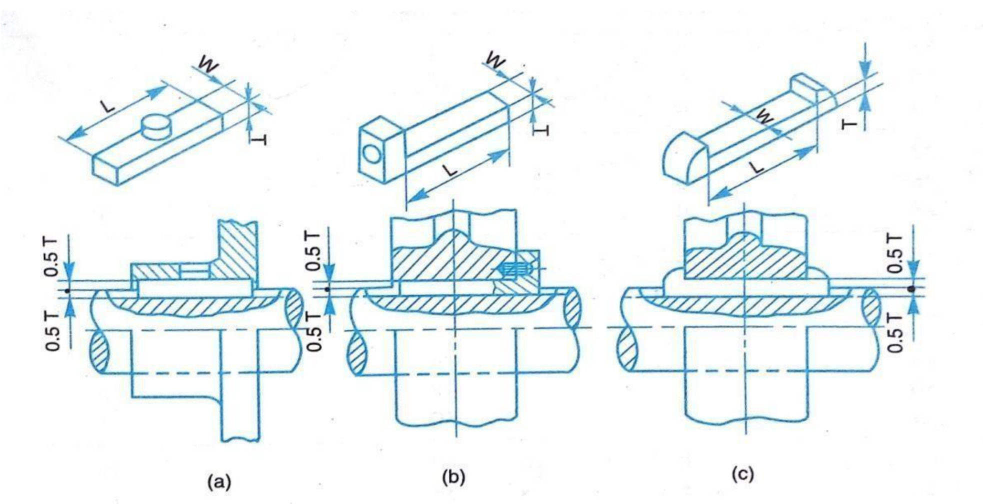


fig: Parallel sunk key

The feather key may be fitted into the keyway provided on the shaft by two or more screws Fig. or into the hub of the mounting Fig. As seen from Fig., these keys are of three types: (i) peg feather key, (ii) single headed feather key and (iii) double headed feather key



Peg Feather Key:

In this key, a projection known as peg is provided at the middle of the key. The peg fits into a hole in the hub of the sliding member (Fig. *a*). Once placed in a position, the key and the mounting move axially as one unit.

Single Headed Feather Key:

In this, the key is provided with a head at one end. The head is screwed to the hub of the part mounted on the shaft (Fig. *b*).

Double Headed Feather Key:

In this, the key is provided with heads on both ends. These heads prevent the axial movement of the key in the hub. Here too, once placed in position, the key and the mounting move as one unit (Fig. c).

Woodruff Key:

It is a sunk key, in the form of a segment of a circular disc of uniform thickness. As the bottom surface of the key is circular, the keyway in the shaft is in the form of a circular recess to the same curvature as the key.

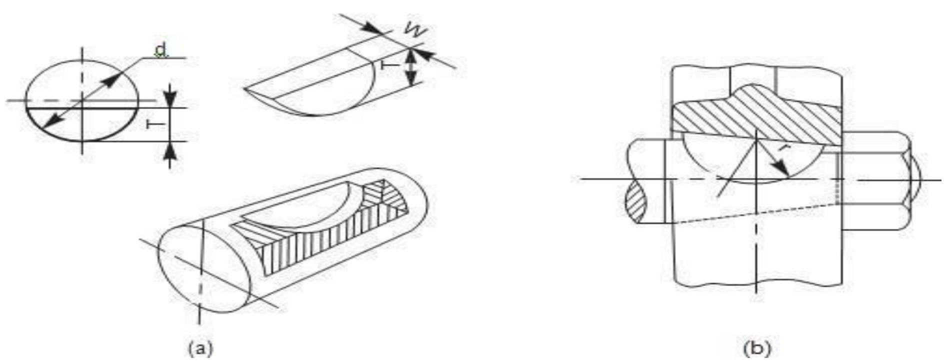


Fig: Woodruff

Key If D is the diameter of the shaft,

Thickness of key, W	= 0.25 D
Diameter of key, d	= 3 W
Height of key, T	= 1.35 W
Depth of the keyway in the hub, T1	=
0.5 W + 0.1 mm	
Depth of keyway in shaft, T2	=
0.85 W	

Round Keys: Round keys are of circular cross-section, usually tapered (1:50) along the length. A round key fits in the hole drilled partly in the shaft and partly in the hub Fig.The mean diameter of the pin may be taken as 0.25 D, where D is shaft diameter. Round keys are generally used for light duty, where the loads are not considerable.

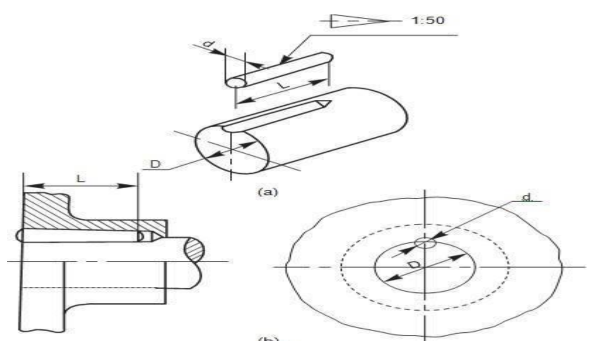


Fig: Round key

COTTER JOINTS:

Cotter joints are used to connect two rods, subjected to tensile or compressive forces along their axes. These joints are not suitable where the members are under rotation. The following are some of the commonly used cotter joints:

Cotter Joint with Sleeve:

This is the simplest of all cotter joints, used for fastening two circular rods. To make the joint, the rods are enlarged at their ends and slots are cut. After keeping the rods butt against each other, a sleeve with slots is placed over them. After aligning the slots properly, two cotters are driven-in through the slots, resulting in the joint Fig

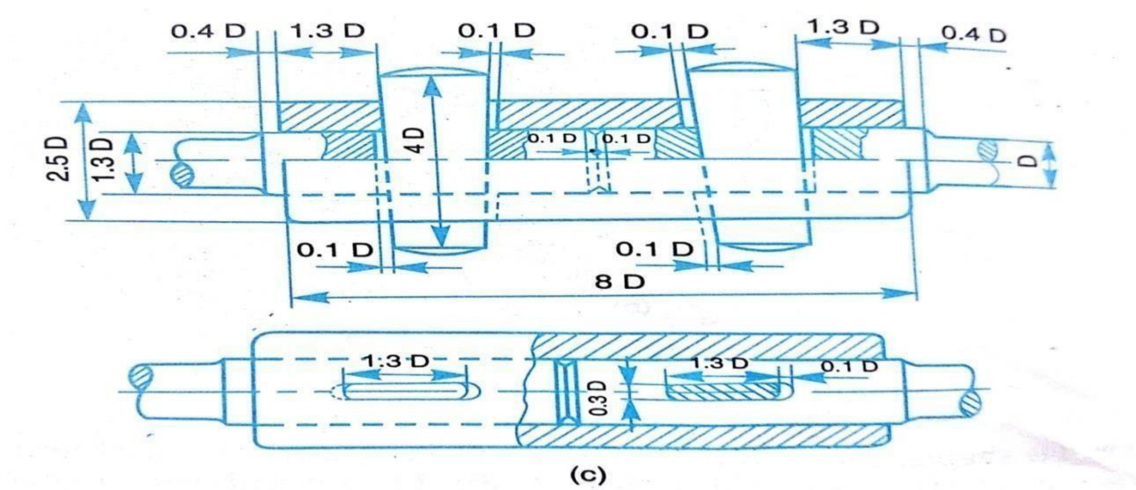
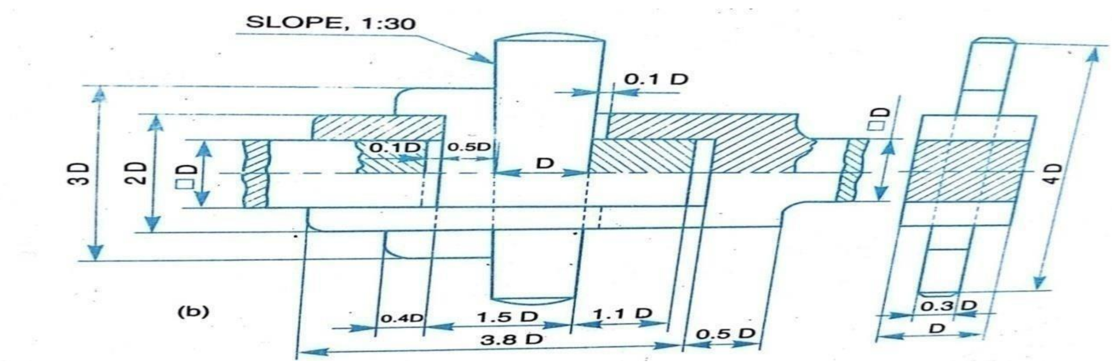


Fig. Cotter joint with sleeve

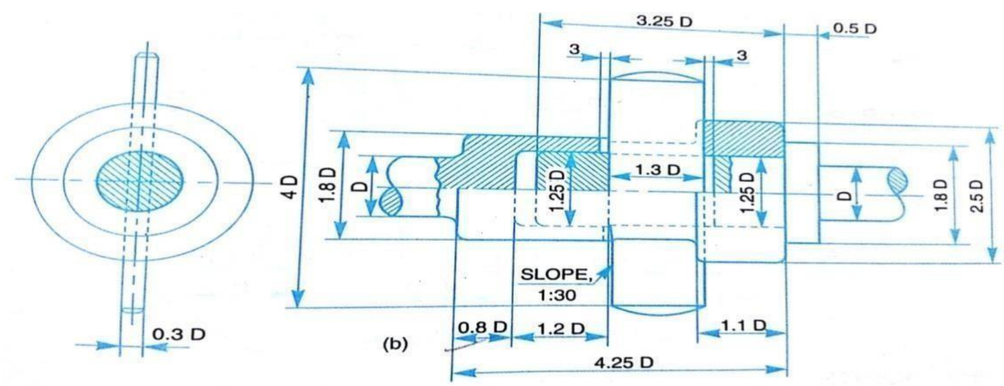
Cotter Joint with Socket and Spigot Ends

This joint is also used to fasten two circular rods. In this, the rod ends are modified instead of using a sleeve. One end of the rod is formed into a socket and the other into a spigot Fig. and slots are cut. After aligning the socket and spigot ends, a cotter is driven-in through the slots, forming the joint.



Cotter Joint with a Gib

This joint is generally used to connect two rods of square or rectangular cross-section. To make the joint, one end of the rod is formed into a U-fork, into which, the end of the other rod fits in. When a cotter is driven-in, the friction between the cotter and straps of the U-fork, causes the straps to open. This is prevented by the use of a gib.



PIN JOINTS: In a pin joint, a pin is used to fasten two rods that are under the action of a tensile force; although the rods may support a compressive force if the joint is guided. Some pin joints such as universal joints use two pins and are used to transmit power from one rotating shaft to another.

Knuckle Joint: A knuckle joint is a pin joint used to fasten two circular rods. In this joint, one end of the rod is formed into an eye and the other into a fork (double eye). For making the joint, the eye end of the rod is aligned into the fork end of the other and then the pin is inserted through the holes and held in position by means of a collar and a taper pin (Fig). Once the joint is made, the rods are free to swivel about the cylindrical pin.

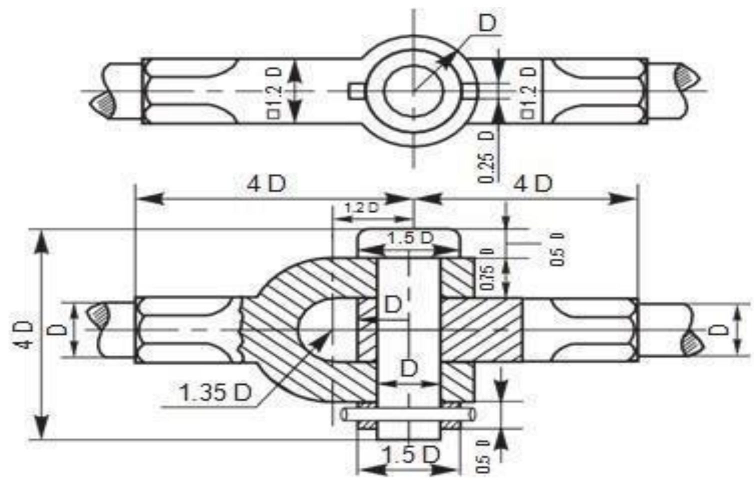


Fig. Knuckle joint

SHAFT COUPLINGS

INTRODUCTION

Shaft couplings are used to join or connect two shafts in such a way that when both the shafts rotate, they act as one unit and transmit power from one shaft to the other. Shafts to be connected or coupled may have collinear axes, intersecting axes or parallel axes at a small distance. Based on the requirements, the shaft couplings are classified as: (i) rigid couplings, (ii)flexible couplings, (iii) loose or dis-engaging couplings and (iv) non-aligned couplings.

Rigid Couplings

Rigid shaft couplings are used for connecting shafts having collinear axes. These are further sub-classified into muff or sleeve couplings and flanged couplings.

Sleeve or Muff Couplings

This is the simplest of all couplings. It consists of a sleeve called muff, generally made of cast iron, which is fitted over the ends of the shafts to be connected. After properly aligning the keyways in the shafts and sleeve, a sunk key is driven-in; thus making the coupling. Instead of a single key running the entire length of the sleeve, it is desirable to use two keys, which may be inserted from the outer ends of the sleeve; thus overcoming the possible miss-alignment between the keyways. The following are the types of muff couplings:

Butt-muff Coupling

In this, the ends of the two shafts to be coupled butt against each other, with the sleeve keyed to them, as discussed above.

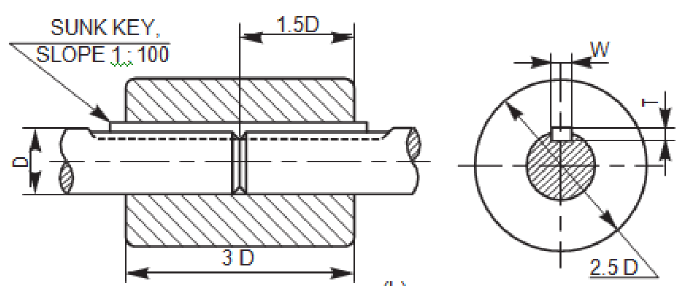
Half-lap Muff Coupling

In this, the ends of the shafts overlap each other for a short length. The taper provided in the overlap prevents the axial movement of the shafts. Here too, after placing the muff over the overlapping ends of the shafts, a saddle key(s) is(are) used to make the coupling.

Split-muff Coupling

In this, the muff is split into two halves and are recessed. A number of bolts and nuts are used to connect the muff halves and the recesses provided accommodate the bolt

Fig. Butt-muff coupling



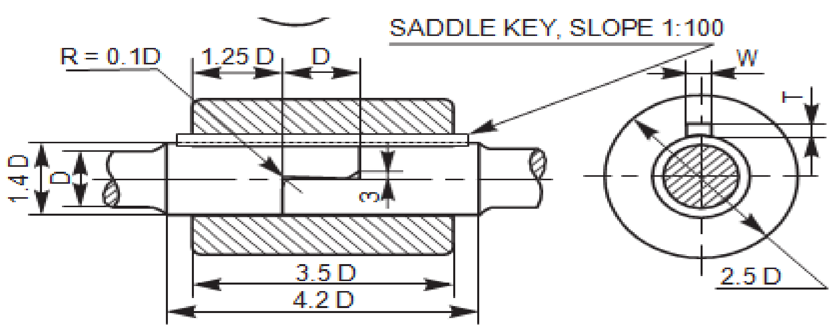


Fig. Half-lap muff coupling

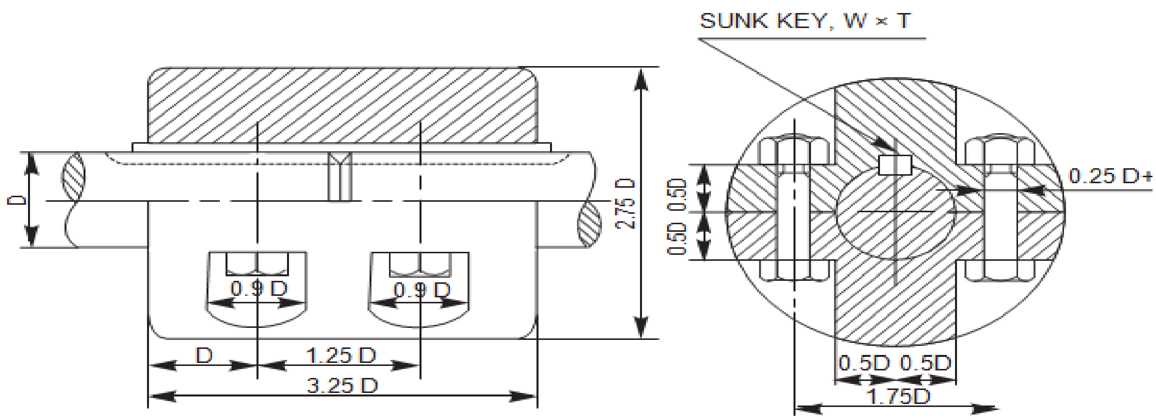


Fig. Split-muff coupling

Flanged Couplings:

These are the standard forms of couplings, most extensively used. In a flanged coupling, flanges are either fitted or provided at the ends of shafts. The flanges are fastened together by means of a number of bolts and nuts. The number and size of the bolts depend upon the power to be transmitted and hence, the shaft diameter.

Flanged Coupling with Detachable Flanges

In this, two flanges are keyed, one at the end of each shaft, by means of sunk keys. For ensuring correct alignment, a cylindrical projection may be provided on one flange which fits into the corresponding recess in the other.

Solid Flanged Coupling

Couplings for marine or automotive propeller shafts demand greater strength and reliability. For these applications, flanges are forged integral with the shafts. The flanges are joined together by means of a number of headless taper bolts.

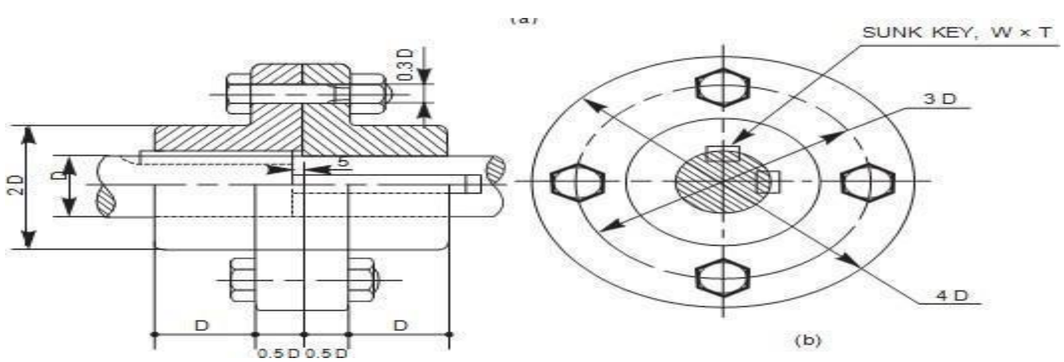


Fig. Flanged coupling

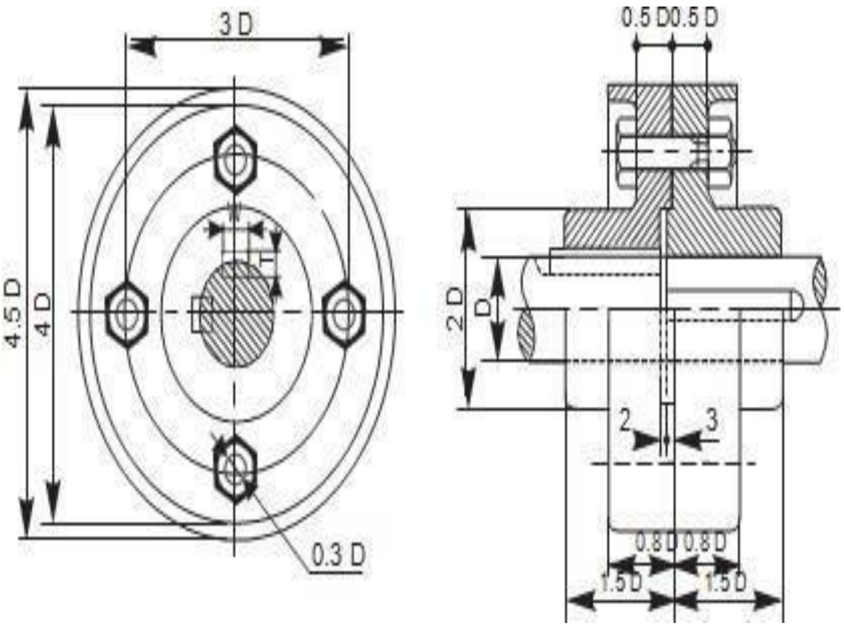


Fig. Protected flanged coupling

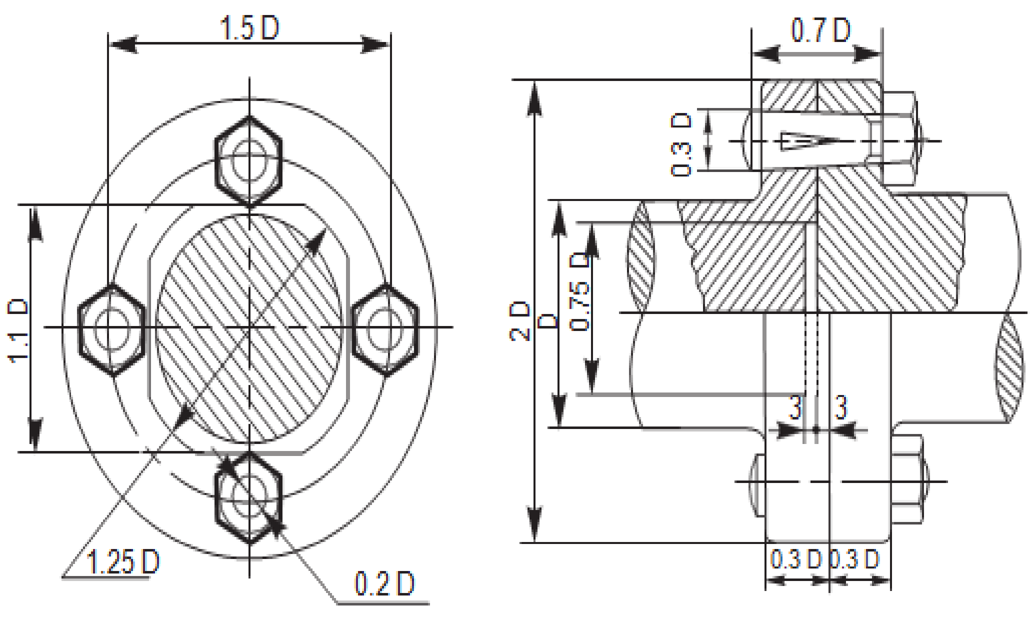
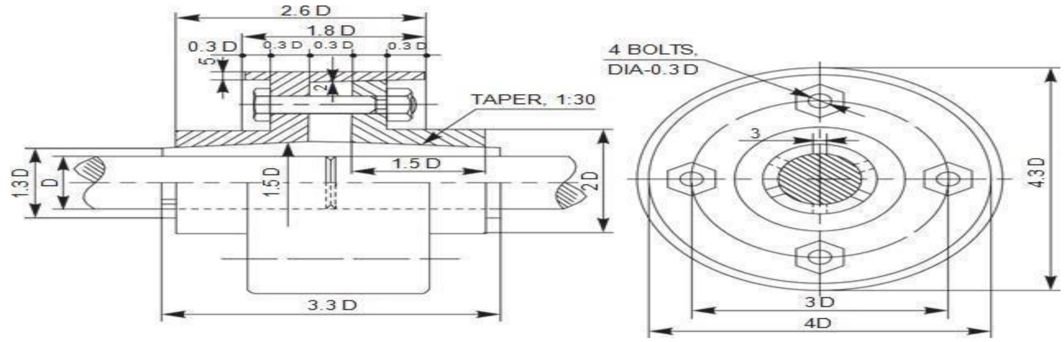


Fig. Solid flanged coupling

Compression Coupling: This consists of a compressible steel sleeve which fits on to the ends of the shafts to be coupled. The sleeve corresponds to the shaft diameter and its outer surface is of double



conical form. The sleeve has one through cut longitudinally and five other cuts, equip-spaced, but running alternately from opposite ends to about 85% of its length; making it radially flexible.

Claw Coupling

In this, each flange has a number of identical claws which engage into the corresponding recesses in the flange. One flange is firmly fitted to the driving shaft by means of a taper sunk key. The other one is placed over the driven shaft by two feather keys, so that it can slide freely on it. The sliding flange has a groove on the boss, into which the forked end of a lever fits.

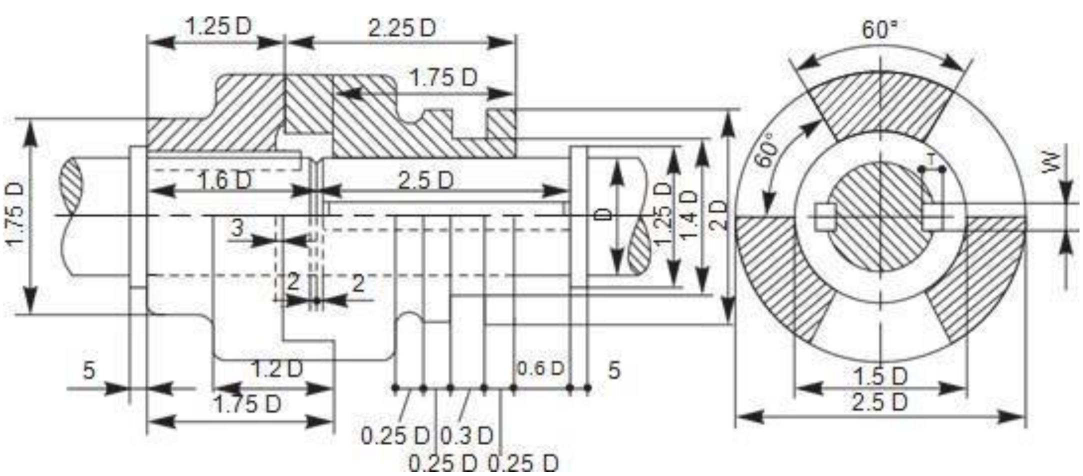


Fig. Claw coupling

Cone Coupling

In this, two shafts may be coupled together by means of two flanges with conical surfaces (on the inside of one and on the outside of the other) by virtue of friction. Here too, one flange is firmly fitted to the driving shaft by means of a taper sunk key, whereas the other slides freely over a feather key fitted to the driven shaft.

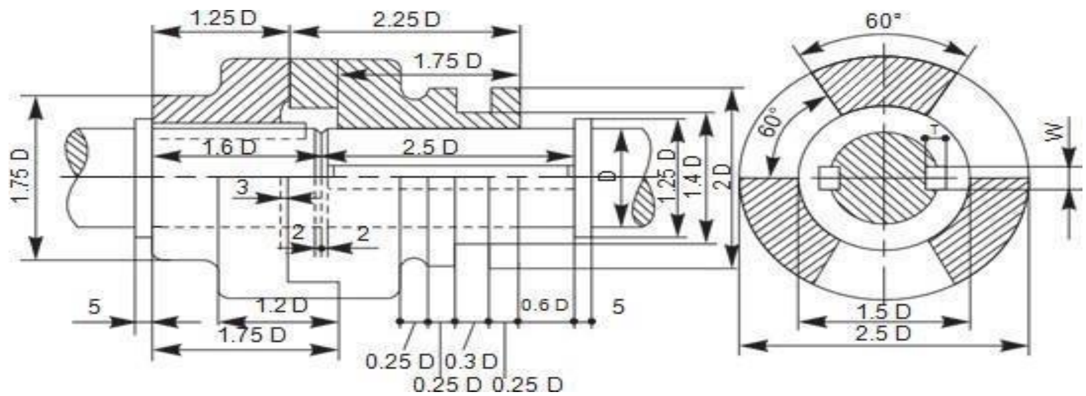
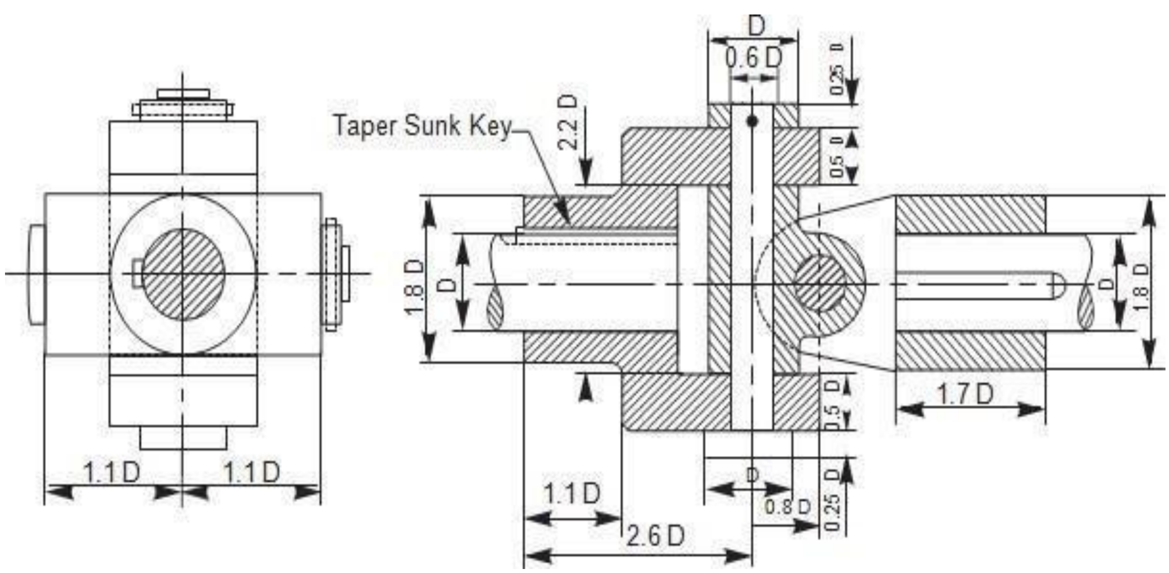


Fig. Cone coupling

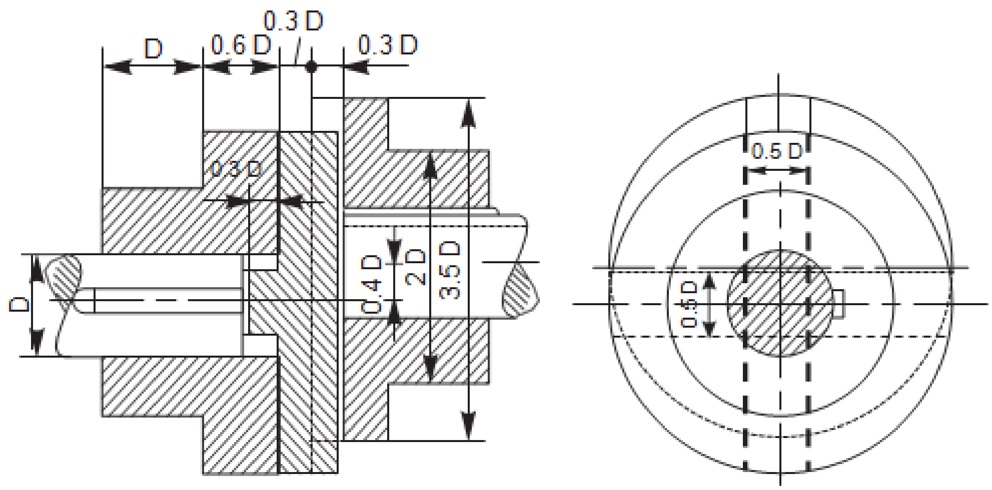
Universal Coupling (Hooke's Joint):

It is a rigid coupling that connects two shafts, whose axes intersect if extended. It consists of two forks which are keyed to the shafts. The two forks are pin joined to a central block, which has two arms at right angle to each other in the form of a cross. The angle between the shafts may be varied even while the shafts are rotating.



Oldham Coupling

It is used to connect two parallel shafts whose axes are at a small distance apart. Two flanges, each having a rectangular slot, are keyed, one on each shaft. The two flanges are positioned such that, the slot in one is at right angle to the slot in the other.



Socket and Spigot Joint:

This type of joint is used for underground pipelines of large diameters. In this, one end of a pipe is made into a socket and the other end into a spigot. After placing the spigot end into the socket, the space between them is filled-in, partly by rope (jute or coir) and the remaining by molten lead.

Because of the flexible nature of the joint, it adapts itself to small changes in level due to settlement of earth

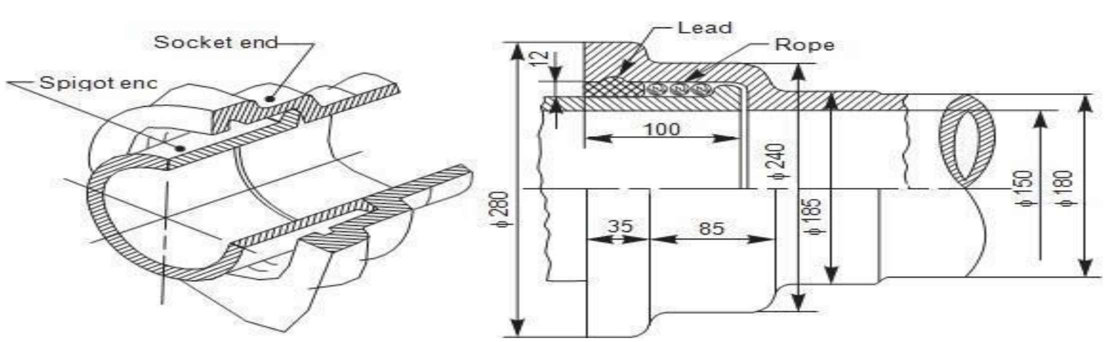


Fig. Socket and spigot joint

RIVETTED JOINTS FOR PLATES

INTRODCTION

Riveted joints are permanent fastenings and riveting is one of the commonly used method of producing rigid and permanent joints. Manufacture of boilers, storage tanks, etc., involve joining of steel sheets, by means of riveted joints. These joints are also used to fasten rolled steel sections in structural works, such as bridge and roof trusses.

Rivet

A rivet is a round rod of circular cross-section. It consists of two parts, viz., head and shank (Fig.(*a*)). Mild steel, wrought iron, copper and aluminum alloys are some of the metals commonly used for rivets. The choice of a particular metal will depend upon the place of application.

Riveting

Riveting is the process of forming a riveted joint. For this, a rivet is first placed in the hole drilled through the two parts to be joined. Then the shank end is made into a rivet head by applying pressure, when it is either in cold or hot condition.

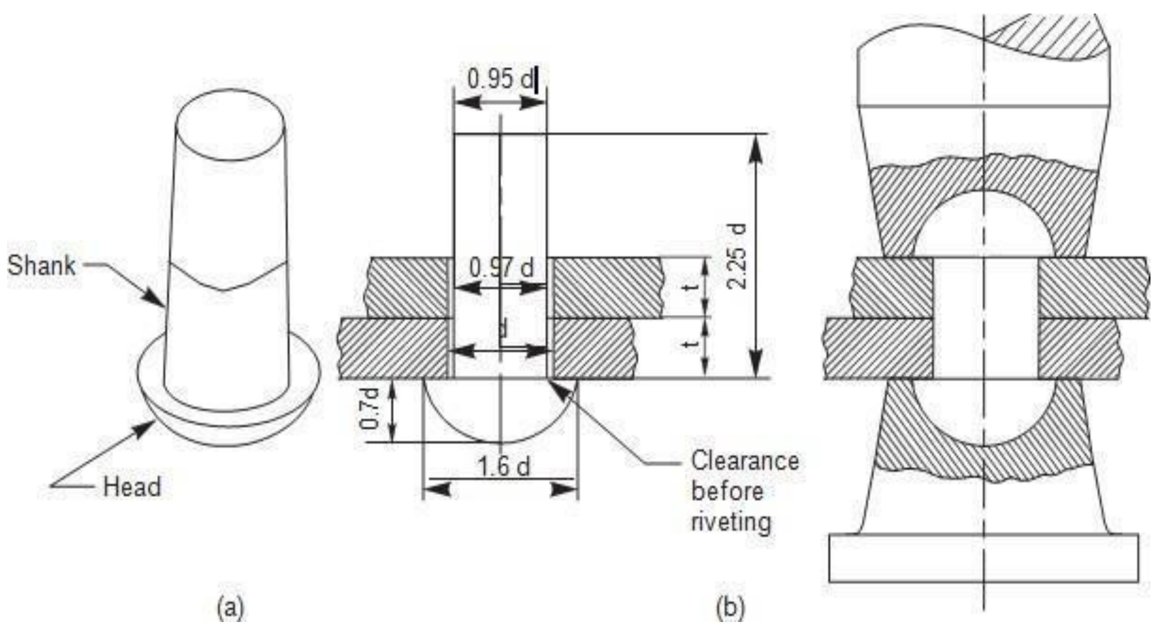
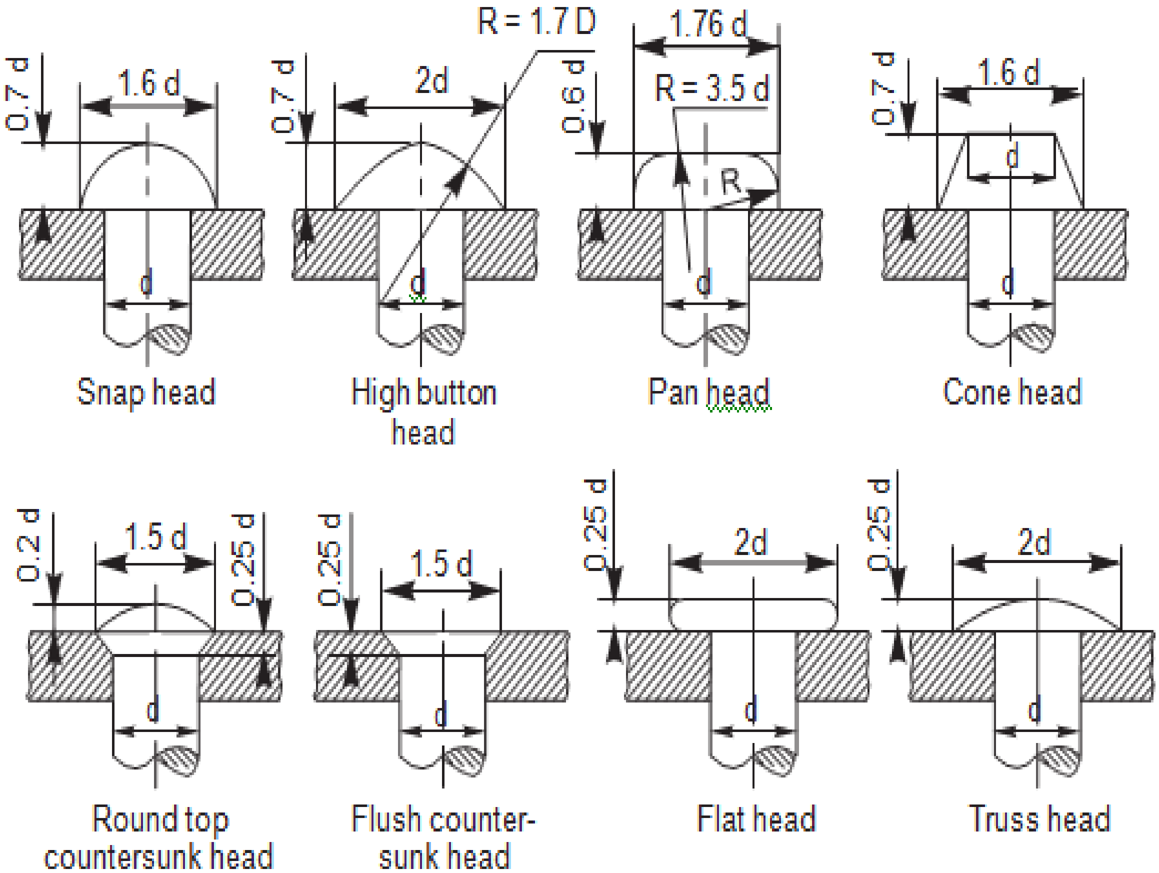


Fig.(*a*) Rivet (*b*) Riveting

RIVET HEADS: Various forms of rivet heads used in general engineering works and boiler construction and as recommended by Bureau of Indian Standards,are shown in Fig. The standard proportions are also indicated in the figure.

Fig.Types of rivet heads



Diamond Butt Joint:

This is one kind of butt joint made either with a single or double strap. As the name implies, the rivets in this joint are arranged in a diamond shape. Figure shows a double strap diamond butt joint. The joint is generally used to connect tie bars in bridge structures and roof trusses

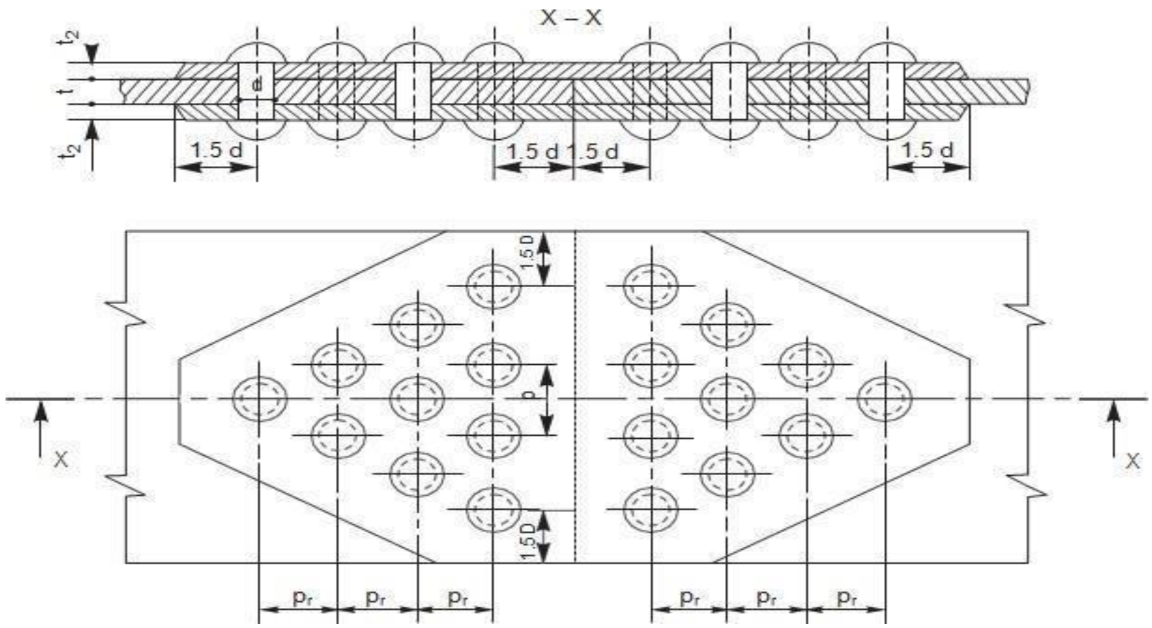


Fig: Double strap diamond butt joint

Lap Joints:

In a lap joint, the plates to be riveted overlap each other. The plates to be joined are first bevelled at the edges, to an angle of about 80°. Depending upon the number of rows of rivets used in the joint, lap joints are further classified as single riveted lap joint, double riveted lap joint and so on.

In multi-row riveted $\sqrt{t}$ joints, rows may be arranged either in chain or zig-zag fashion, as shown in Figs.

Figure shows a single riveted lap joint. The size of the rivet, *d* is taken as, *d* = 6mm

Where's' is the thickness of the plates to be joined in millimeters.

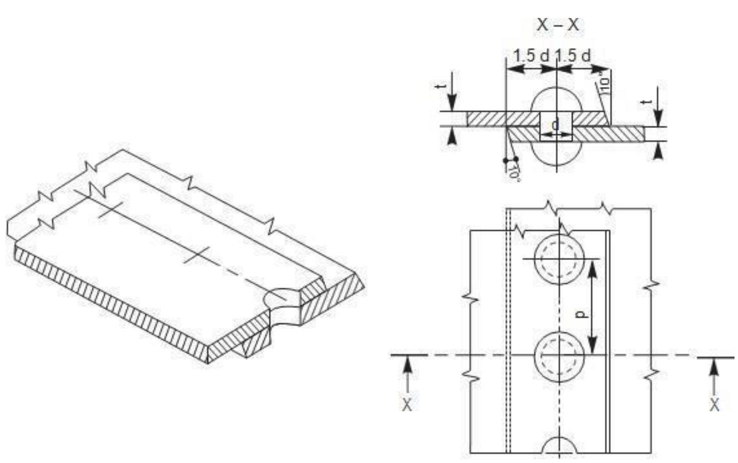


Fig. Single riveted lap joint

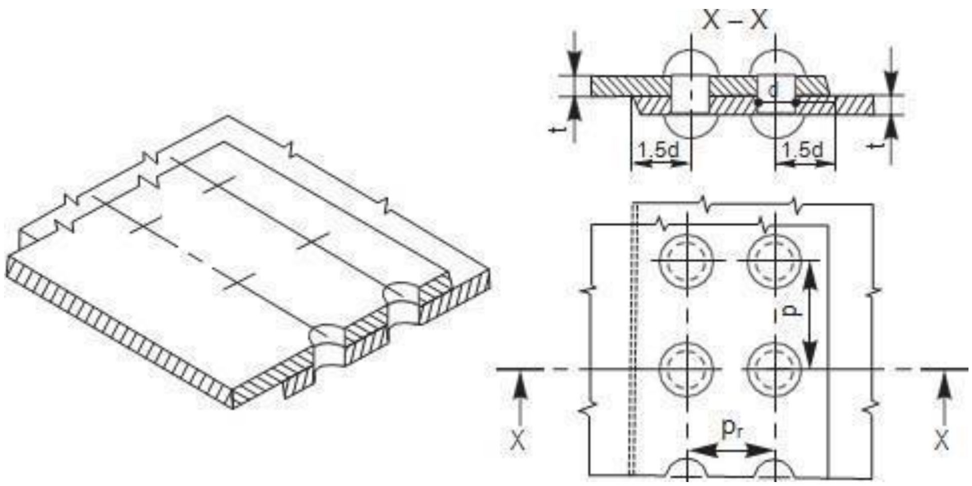


Fig. Double riveted chain lap joint

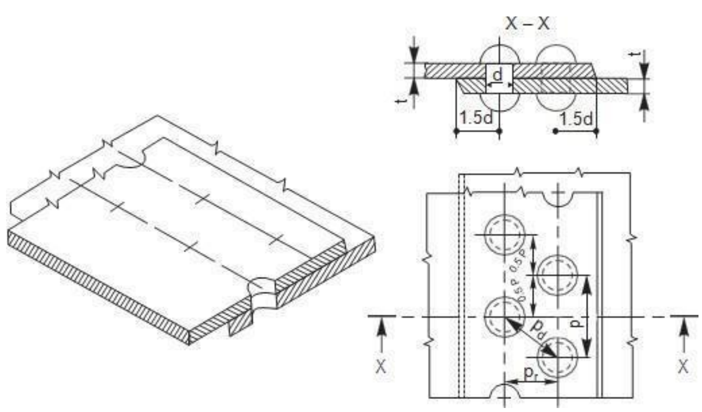


Fig. Double riveted zig-zag lap joint

Butt Joints:

In a butt joint, the plates to be joined butt against each other, with a cover plate or strap, either on one or both sides of the plates; the latter one being preferred. In this joint, the butting edges of the plates to be joined are square and the outer edges of the cover plate(s) is (are) beveled.

In a single strap butt joint, the thickness of the strap (cover plate) is given by, t1 = 1.125t If two straps are used, the thickness of each cover plate is given by, t2 = 0.75t

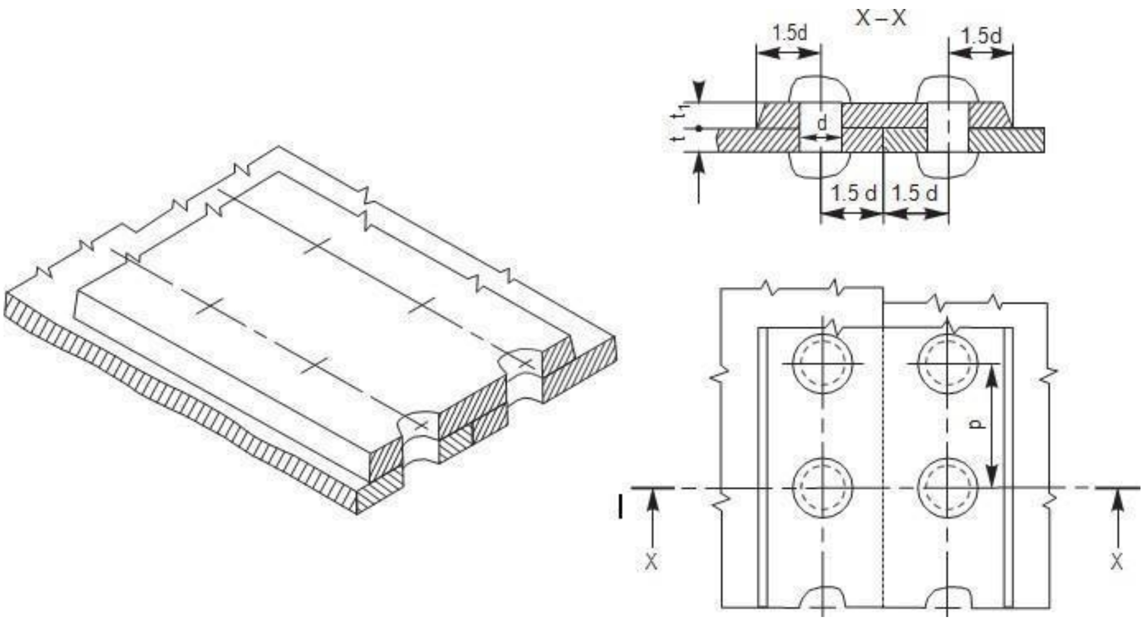


Fig. Single riveted, single strap butt joint

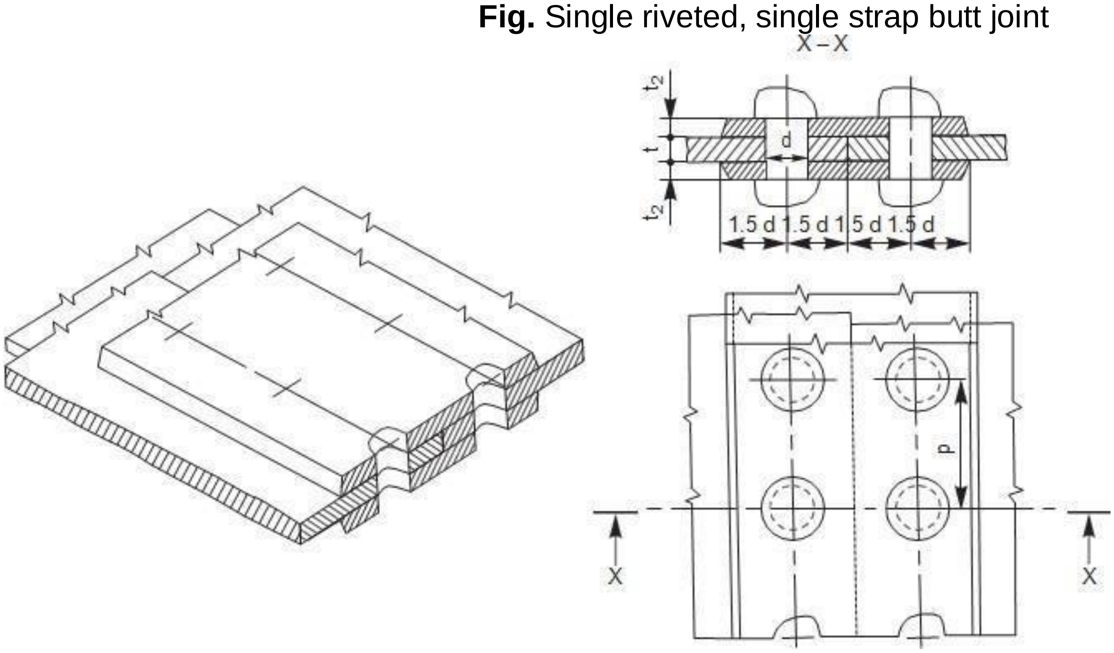


Fig. Single riveted, double strap butt joint

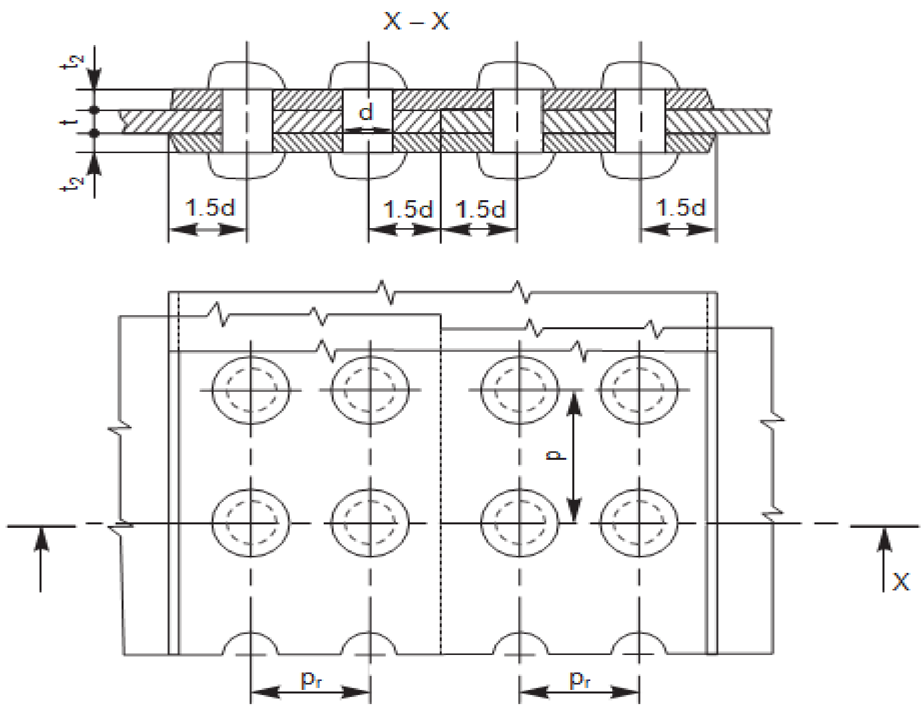


Fig. Double riveted, double strap chain butt joint

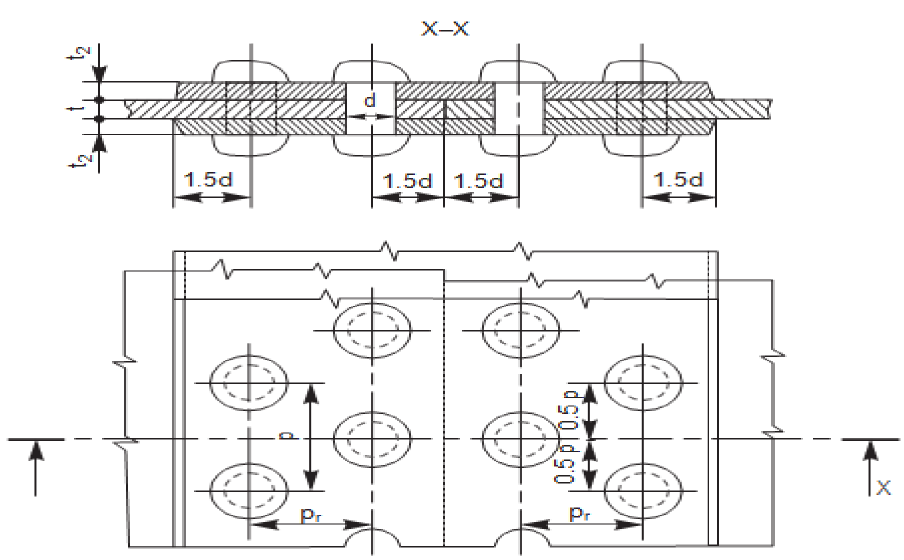


Fig. Double riveted, double strap zig-zag butt joint

Pivot or Foot-step bearing:

This bearing is used to support a vertical shaft under axial load. Further, in this, the shaft is terminated at the bearing. The bottom surface of the shaft rests on the surface of the bearing which is in the form of a disc. The bush fitted in the main body supports the shaft in position and takes care of possible radial loads coming on the shaft.

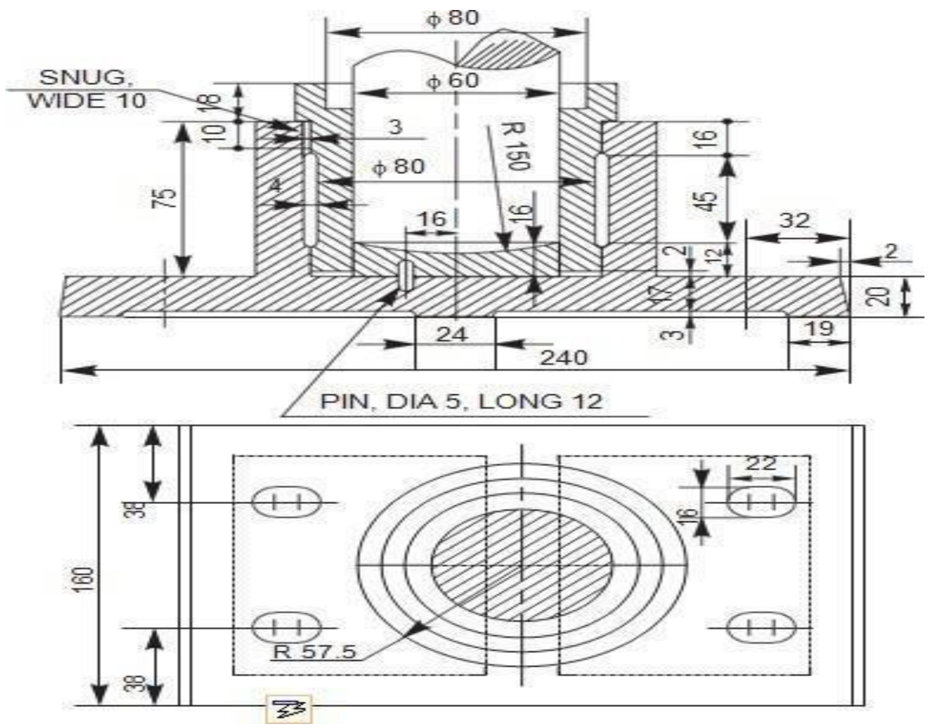
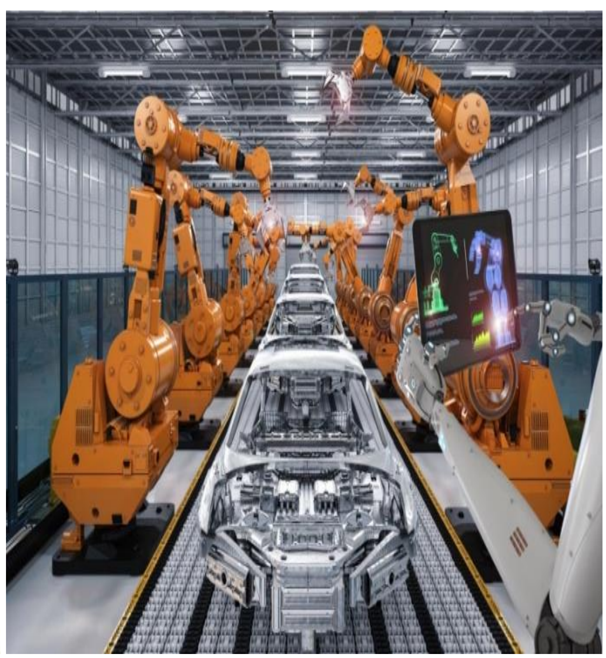


Fig. Foot-step bearing

Industrial Application of screw fasteners

- **Military** – Fasteners specially designed to withstand the stress of high temperature, high wear and corrosive environments such as engines, motors, heat exchangers and process equipment. We offer a wide range of diameters, lengths and thread configurations using stainless steel, copper alloys, alloy steels, nickel alloys and exotic alloys.
- **Oilfield** – Fasteners manufactured using stainless steel, tool alloys, nickel alloys and exotic metals that will perform well in the high stress, corrosive environment found in oilfield and mining applications. Our fasteners are used in drilling rigs, tanks and pumping equipment.
- **Turbine & Power Generation** – Fasteners used in electrical equipment, turbines, motors, exhaust systems, pumping systems and storage vessels. Nickel alloys, aluminum, steel alloys and stainless steel are used for their strength, high wear and anti-corrosive properties. Copper alloys are used for their conductive properties.



Riveted joints in Boilers:

Coupling

BEARINGS

Tutorial Questions:

1. Draw the conventional representation of following materials
   (a) Porcelain (b) Fiber (c) Lead (d) Petrol (e) Copper
2. Draw the single riveted single strap Butt joint of plate thickness as 12 mm .
   Draw the half-sectional front view and side view of journal bearing which can accommodate 40 mm diameter shaft.

4. Draw the three views of a hexagonal headed bold of nominal diameter 20 mm and length 80 mm with a hexagonal nut and washer.

5. Draw the conventional representation of the following materials.

   (a) Cast iron (b) Lead (c) marble (d) glass (e) water (f) concrete (g) wood

   Draw the sectional front view and top view of a double riveted double strap chain Butt Joint to joint two plates of thickness 10 mm

6. Draw the sectional front, top and side view of a knuckle joint to join two rods of diameter 30 mm each.
7. Draw the three views of a hexagonal headed bold of nominal diameter 20 mm and length 80 mm with a hexagonal nut and washer.
8. Draw the sectional front view of a universal coupling joining two shafts of diameter 50 mm. Show the dimensions.
9. Draw the sectional view from the front and top view of a single riveted single strap butt joint with plates of thickness 15 mm.
10. Sketch the sectional front view of rag foundation bolt of diameter 25 mm. Show the proportionate dimensions in the drawing

Question bank for Assignments

1 .Answer the following:

Sketch a (i) Hexagonal nut convention, (ii) Convention of a stud bolt.

2. Sketch the conventional representation of Square headed bolt ii. Keys.

3. Sketch the conventional representation of

i) Hexagonal bolt ii) Shaft. Iii). Mention the importance of list of materials.

4. Sketch the conventional representation of i) Eye bolt ii.) Foundation bolt.

5. Answer the following:

Sketch conventional representation of the materials steel and Lead

6. Sketch the following: Whit worth thread and Buttress thread.

7. Show the conventional representation of the following materials:

i) Wood ii. Lead iii. Straight Knurling iv. Internal screw threads v Bearing on shafts.

8. Sketch the conventional representation of the various materials.

Sketch the conventional representation of the different engineering materials.

9. Draw the triple start square threads with D as 30 mm.

10. Draw sectional front view and side view of Cotter joint with socket and spigot ends taking d=30 mm.

11. Draw sectional front view and top view of double riveted, zig zag joint with dia of rivet as 10 mm.

12. Draw two views of locking the nut with set screw if D= 30mm.

13. Draw sectional front view and side view of the Cotter Joint with a gib of 40 square.

14. Draw sectional front view and top view of double riveted, zig zag joint with dia of rivet as 10 mm.

15. Draw two views of hexagonal headed bolt and nut and square headed bolt along with nut. (D=30mm).

16. Draw two views of hexagonal headed bolt and nut and square headed bolt along with nut. (D=30mm).

17. Draw the sectional front view and top view of the double riveted double strap zig zag butt joint with dia of the rivet as 14 mm.

18. Draw at least four types of thread profiles taking pitch as 20 mm.

19. Draw sectional front view and side view of Cotter joint with socket and spigot ends taking d=30 mm.

20. Answer any Two of the following by drawing proportionate diagrams:

Single riveted, double strap butt joint for plates of 12 mm thickness with cover plate thickness of 10 mm

ii.. Mu coupling to connect two shafts of 50mm diameter.

iii. Foot step bearing for a shaft of 75 mm diameter.

21. Answer any Two of the following by drawing proportionate diagrams

Triple riveted single strap zig-zag butt joint to connect two plates of 12mm thick.

Flange coupling to connect to shafts of 20 mm diameter.

22. Answer any Two of the following by drawing proportionate diagrams

Triple riveted single strap zig-zag butt joint to connect two plates of 12mm thick.

Flange coupling to connect to shafts of 20 mm diameter.

23. Answer any Two of the following:

Draw plan and sectional elevation of a chain type double - riveted lap joint. Take the diameter of rivet as 18 mm.

Sketch a Knuckle joint showing sectional front view and top view to connect two rods of 40 mm diameter.

Draw half sectional view from the front and side view of a mu coupling to connect two shafts of 30 mm diameter.

24. Answer any Two of the following:

Draw front view with top half in section and side view of a socket and spigot type of cotter joint to connect two rods of 25 mm diameter each.

Draw sectional front view and top view of double riveted, double cover butt joint, zig-zag riveting to join plates of thickness 16 mm.

Draw proportionately a hexagonal bolt with nut. Take the diameter of the bolt as 25 mm.

25. Answer any Two of the following:

26. Draw half sectional view from the front and side view of a flange coupling to connect two shafts of 25 mm diameter.

27. Draw plan and sectional elevation of double riveted lap joint, chain riveting, taking 12mm diameter rivet.

28. Draw half sectional front view and side view of a foot step bearing for 40 mm diameter.

29. Answer any Two of the following:

i. Draw plan and sectional elevation of a double – riveted lap joint (chain riveting) taking diameter of rivet as 20 mm.

ii.Sketch two views of cotter joint with a gib to connect two square rods of side 30 mm with proper dimensions.

iii.Draw half sectional front view and side view of a rigid flange coupling to connect two shafts of 30 mm diameter.

30. Draw two views of knuckle joint with properties to connect two shafts of 25 mm diameter.

31. Draw single strap butt joint of two rows zigzag to connect two plates of 5 mm thick.

32. Draw protected flange coupling to connect two shafts of 50 mm diameter.

33. Draw spigot and socket type of pipe joint to connect 30 mm diameter pipes.

34. Draw double riveted lap joint zigzag type to join 15mm plates.

35. Draw flexible flanged coupling to join two shafts of 100 mm diameter.

36. Draw a footstep bearing for a shaft of 150 mm diameter.

37. Draw a collar bearing to a shaft of 50 mm diameter.

38. Draw a sleeve and cotter joint to connect two shafts of 30 mm diameter.

39. Draw a triple riveted single strap butt joint to connect two plates of 15 mm thickness.

40. Draw a Plummer block for a shaft of 25 mm diameter.

41. Draw a double riveted double strap chain type butt joint to connect plates of 20 mm size.

42. Sketch square headed bolt with a nut and washer

43. Draw two views of knuckle joint with properties to connect two shafts of 25mm diameter.

44. Draw single strap butt joint of two rows zigzag to connect two plates of 5mm thick

45. Draw spigot and socket type of pipe joint to connect 30 m diameter pipes

SECTION B

ASSEMBLY DRAWINGS

SYLLABUS

Part B: Assembly Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

1. Steam engine parts – stuffing boxes, cross heads, Eccentrics.

2. Machine tool parts: Tail stock, Tool Post, Machine Vices.

3. Other machine parts - Screws jacks, Petrol engine connecting rod, Plummer block, Fuel Injector

4. Valves - Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE:

1. First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

2. Part B need to be done by using Creo.

Course Objectives:

CO5: To prepare assembly drawings given the details of part drawings.

Course Outcomes:

1. Developing assembly drawings using part drawings of machine components.

COURSE OUTLINE

LECTURE	LECTURE TOPIC	KEY ELEMENTS	LEARNING OBJECTIVES (2 to 3 objectives)
1.	Steam engine parts	Stuffing boxes, cross heads, Eccentrics	1. Understand the PART drawing of assembly components (B2). 2.Apply the assembly procedure (B3)
2.	Machine tool parts	Tail stock, Tool Post, Machine Vices	1. Understand the PART drawing of assembly components (B2). 2.Apply the assembly procedure (B3)
3.	Other machine parts	Screws jacks, Petrol engine connecting rod, Plummer block, Fuel Injector	1. Understand the PART drawing of assembly components (B2). 2.Apply the assembly procedure (B3)
4.	Valves	Steam stop valve, spring loaded safety valve, feed check valve and air cock	1. Understand the PART drawing of assembly components (B2). 2.Apply the assembly procedure (B3)

INTRODUCTION TO ASSEMBLY DRAWINGS

A machine is an assembly of various links or parts. It is necessary to understand the relation between the various parts of the unit for the purpose of design and production.

An assembly drawing is one which represents various parts of a machine in their working position. These drawings are classified as design assembly drawings, working assembly drawings, sub-assembly drawings, installation assembly drawings, etc. An assembly drawing made at the design stage while developing a machine is known as design assembly drawing. It is made to a larger scale so that the required changes or modifications may be thought of by the designer, keeping in view both the functional requirement and aesthetic appearance. Working assembly drawings are normally made for simple machines, comprising small number of parts. Each part is completely dimensioned to facilitate easy fabrication. A sub-assembly drawing is an assembly drawing of a group of related parts which form a part of a complicated machine. Thus, a number of such sub-assembly drawings are needed to make a complete unit. An installation assembly drawing reveals the relation between different units of a machine, giving location and dimensions of few important parts.

The final assembly drawings are prepared from design assembly drawings or from the working drawings (component drawings). The class-room exercises are designed to train the students to master fundamentals of machine drawing, such as principles of drawing, orthographic projections, etc. In addition, the student will understand the relation between the different parts of the components and working principles of the assembled unit. The following steps may be made use of to make an assembly drawing from component drawings:

1. Understand the purpose, principle of operation and field of application of the given machine. This will help in understanding the functional requirements of individual parts and their location.

2. Examine thoroughly, the external and internal features of the individual parts.

3. Choose a proper scale for the assembly drawing.

4. Estimate the overall dimensions of the views of the assembly drawing and make the outline blocks for each of the required view, leaving enough space between them, for indicating dimensions and adding required notes.

5. Draw the axes of symmetry for all the views of the assembly drawing.

6. Begin with the view from the front, by drawing first, the main parts of the machine and then adding the rest of the parts, in the sequence of assembly.

7. Project the other required views from the view from the front and complete the views.

8. Mark the location and overall dimensions and add the part numbers on the drawing.

9. Prepare the parts list.

10. Add the title block.

NOTE It is not advisable to complete one view before commencing the other. The better method is to develop all the required views simultaneously.

INTRODUCTION TO CREO

Creo Parametric is one of the most powerful Computer-Aided Design (CAD), Computer-Aided Analysis and Computer-Aided Manufacture (CAM) software packages available in the world today. It is the flagship of a family of other software products, developed by PTC Corporation, for engineering design and product development, also including Creo Direct, Creo Simulate, Creo Layout and others. The main applications are in mechanical, product design, aerospace, construction, shipbuilding and other industries.

Creo Parametric (or Creo) was previously known as Pro/Engineer and Wildfire. The core of the software contains a variety of tools for the creation, validation and communication of complex three-dimensional (3D) objects as parts and assemblies. In addition, there are integrated applications that associate directly with the 3D model geometry and support the development of engineering drawings, mould design, NC machine simulation, sheet metal design, piping and wiring, harness design, structural strength, thermal and CFD analyses, kinematic and dynamic analyses, feasibility and optimisation studies, and others. This long list of applications is not meant to scare the user but only to illustrate the vast scope and complexity of a modern CAD/CAM package.

For designers who are involved in several parts of product development, Creo offers them scalable access to the right capabilities. At the same time, for people involved in a specific aspect of the process, there are Creo apps tailored to their precise requirements. It doesn’t matter what part you play in the product development process, Creo means you get to use the right tool for the job.

#2 INTEROPERABILITY

All of the Creo apps are able to communicate seamlessly with each other. This means your data can flow easily between the different apps that you are using.

So, no need to recreate work as you move through the design process and no more siloes between different stages of product development.

#3 COMBINED BENEFITS OF PARAMETRIC AND DIRECT MODELLING

PTC Creo IntroductionUsing Creo means you can access both 3D CAD modelling approaches when you are doing your work, all in one tool. This means you have the control provided by parametric modelling, alongside the speed and flexibility of direct modelling.

#4 ABILITY TO WORK WITH MULTI-CAD DATA

This benefit of Creo allows you to work with data from any CAD source. This means no recreating designs because of incompatible data, saving you time and money in the product development process.

Creo is a solution, enabling companies to overcome the typical product design challenges of designing, analysing and sharing information between your teams, your partners and your customers.

Getting Started with Creo

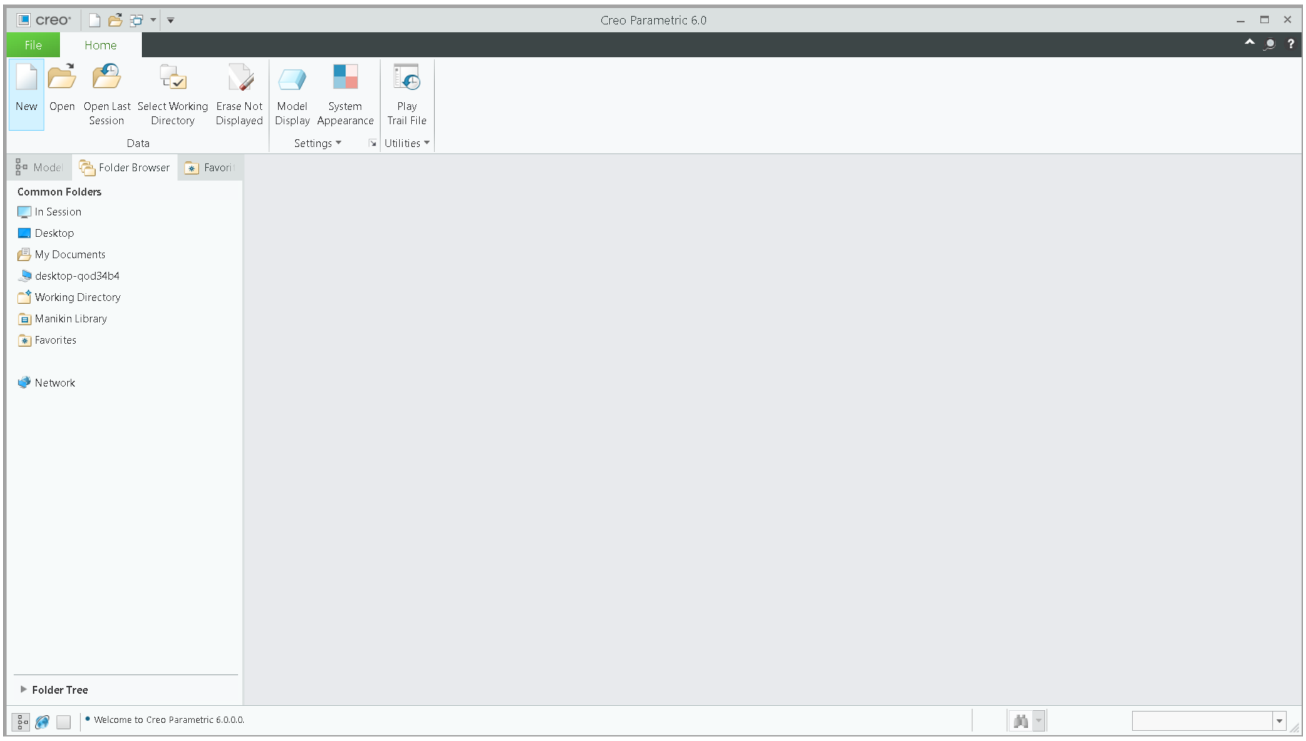


Fig 2.1 – Creo upon starting up

The main interface at Start Up looks as shown in Figure 2.1. The main areas and functions of this interface are as follows:

The Folder Browser tab (Figure 2.1), located on the left of the screen next to the Model Tree tab, lists the folders on the computer or network. Browse the folders and view their contents in the Folder Browser. The Favourites tab is a multi-functional Web browser embedded in Creo. It displays models and tutorials from PTC.com and other websites. A preview window appears in the centre of the screen after the launch.

The Graphics area is a large grey area where the 3D model geometry is visible when a model is opened (Figure 2.2). This is the main area where the model geometry is developed and displayed. The user can rotate, move and zoom the model.

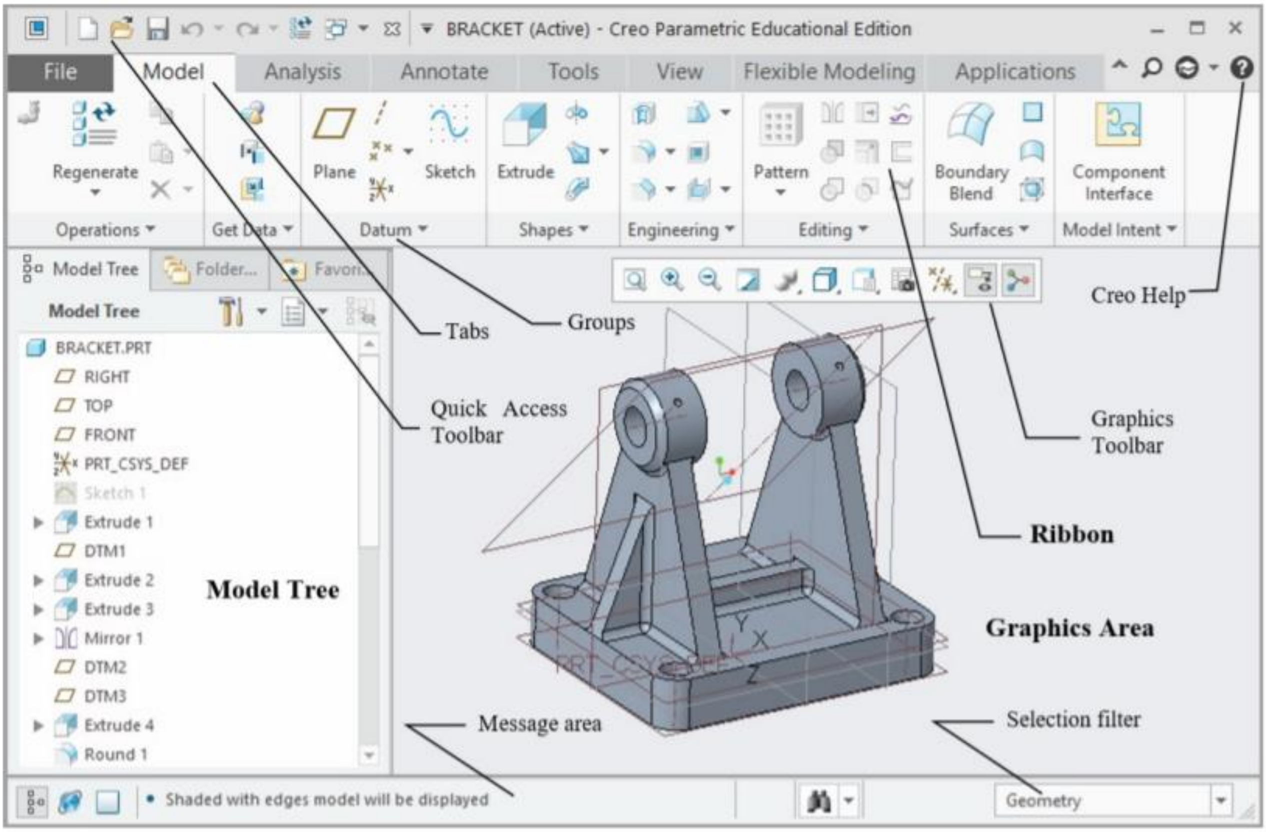


Fig 2.2: Creo Part Modeling Interface

Select working directory

The Working Directory is a directory or a folder in the PC disc memory (hard drive, solid state disc memory, USB memory stick, network, etc.) where all models (objects) belonging to a project are stored. The user can set any existing folder with Read/Write permissions as a Working Directory. It is very important to do this immediately after starting Creo or switching to a new project. If a Working Directory is not selected, the software will save or open an object from the default directory (usually in C: drive). For example, an assembly model containing several parts will not open those models that are located outside the Working Directory. The missing part name will appear in red in the assembly Model Tree.

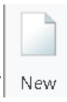
Rule number one is to set up a Working Directory immediately after starting the software! This ensures that all existing and new models (files) are opened or saved in one place.

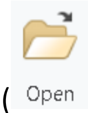
Click on Select Working Directory icon ( ) from the Home menu at Start Up (Figure 2.1) and set up a Working Directory. Alternatively, select File > Manage Session > Select Working Directory.

File menu options

File menu options appear when selecting the File tab from the menu bar as shown in Figure 1.6. Some commands might be dimmed at Start Up.

The main commands are:

- New: Click on New (

), (or File > New) to create a new model.
- Open: Click on Open (

), (or File > Open) to open a model.
  New and Open commands create a new model or open an existing model from the Working Directory. They can be activated directly from the Home menu after Start Up (Figure 2.1).
- Save: Click on Save icon (), (or File > Save) to save the model in the current Working Directory, thus creating another version of the object.

Creo does not overwrite the existing file after Save. It creates a new file version containing the latest modifications.

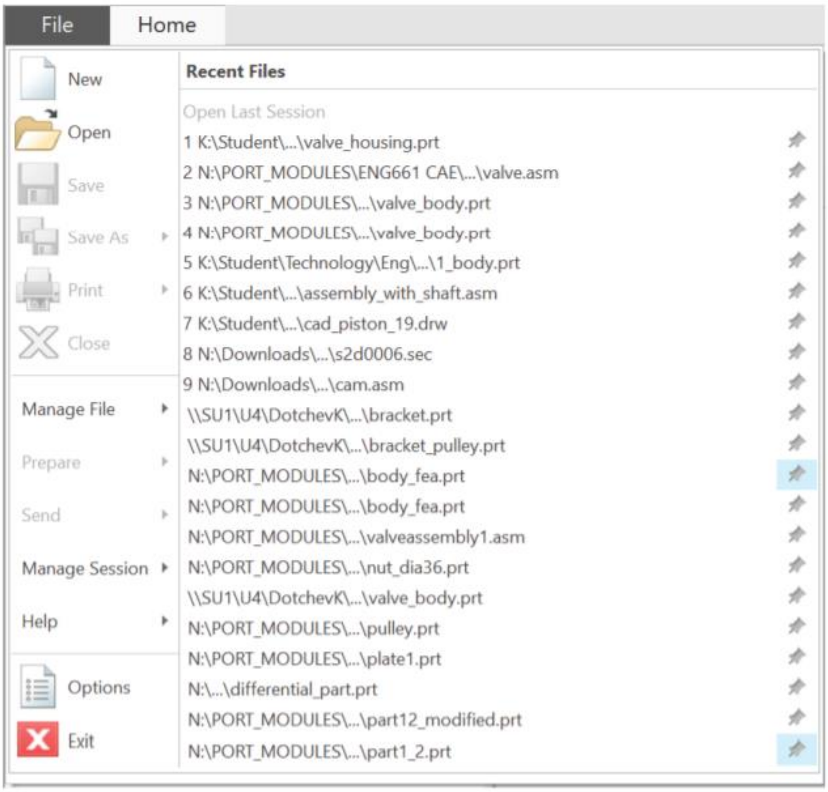


Fig 2.3: File Menu

- Save As: Save As () icon a sub-menu with three commands:

- Save a Copy: This command saves the current model with a new name. Also, it can save the model in a different file format that can be used to transfer a Creo model data to another CAD software. The most used file formats are: Stereolithography (*.STL) for 3D printing, STEP and IGES for transferring the 3D geometry into another CAD/CAM system.
- Save a Backup: This command backs up an object to the current directory.
- Mirror Part: This command creates a part as a mirrored copy of the current model.

- Print: Print () icon has a sub-menu with several commands to print the object from the active window to a printer as either a rendered image from the screen, a 2D drawing, a drawing in PDF format or a tessellated model in STL Stereolithography format.
- Close: Click on Close icon () to close the active window. Note that the object is still in the computer RAM, which is called Session. If the current model is closed accidentally, it can be opened back from the Session and then saved.

Manage file

Manage File (Figure 2.3) has a sub-menu with the following commands:

- Rename (File > Manage File > Rename): This command renames the current object and its versions in the Session (computer RAM) and/or in the Working Directory.
- Delete Old Versions (File > Manage File > Delete Old Versions): This command deletes all versions except the latest (with the highest variant number) of the current object from the Working Directory.
- Delete All Versions (File > Manage File > Delete All Versions): THIS COMMAND DELETES ALL VERSIONS of the current object from the Working Directory (from the computer disc) and the Session. The software asks the user to confirm this action. One should be very careful when using this command!!!

Manage session

Session is the computer RAM allocated for all Creo-opened models (objects). Several objects (parts, assemblies, drawings, etc.) can be opened simultaneously and displayed in different windows within a single Session. Typically, the user works simultaneously on different models, belonging to a project, and switches from one window to another.

Sometimes, a new Working Directory needs to be set up without stopping Creo. In this case, all opened objects in the Session need to be closed and removed from it to avoid memory conflicts. This is done with the following tools from the Manage Session menu (Figure 2.3):

- Erase Current (File > Manage Session > Erase Current):
  This command removes an object (model) from the active window.
- Erase Not Displayed(File > Manage Session > Erase Not Displayed):

It removes all objects from the current Session that are not displayed.

- ·Select Working Directory: (the same command as in Figure 2.2).
- ·Object List: Display the names of all objects in session.

The best way to start a different project located in another directory is to remove all models residing in the memory (In Session) and then to set up a new Working Directory as follows:
Close all windows with objects.
Click on Erase Not Displayed to remove them from the memory.
A dialogue window asks for confirmation. Before clicking on Yes, make sure that all listed objects have been saved.
Click on Select Working Directory to set up the new project directory.

File names and conventions

An object name can consist of letters and or numbers but cannot contain spaces or special symbols. The use of underscore symbol is permitted and it can also be used to separate some sections within the name. For example, MY_FIRST_MODEL is a correct name. Also, the software does not distinguish between upper and lower case letters. These rules apply to all Creo names, including the names of files, folders, features, parameters, etc.

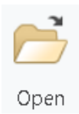
How to Open a Creo Object (file)?

Always open a Creo object (file) from the software interface. NEVER double-click on a Creo file from the Windows File Explorer to open and launch the software. To avoid mistakes, follow this procedure:

(1) Start Creo Parametric.

(2) Click on File > Manage Session > Select Working Directory.

This command sets up a directory to Save a new model(s) or Open existing model(s).

(3) Click on File > Open (

).

This command opens a window with all Creo objects from the Working Directory. Select the model name and click on Open.

Functions of the Mouse Buttons

The PC mouse is an essential input device in Creo 3D modelling. Every click of a mouse button generates an input for the software. It is important to understand and learn the functions of each mouse button when clicking on an icon (command) from the user interface or clicking on a model geometry item. In the beginning, it is difficult to remember all mouse button functions, but after some practice it will become second nature to use the correct button and key combinations. Usually, the software does not react if an incorrect button is clicked or if a wrong item selected.

However, sometimes it may stop working or crash if the user repeatedly clicks a (wrong) button. Therefore, one should be careful and use the mouse buttons correctly. The main mouse button functions and combinations are explained in the following.

- **Left Mouse Button (LMB):**
  The LMB is used to: click and initiate an action, such as click on interface icon, tab, tool, pull down menu, open a menu and other functions. For example to click on Open, Save, Extrude, Rotate and other icons (commands).
  In addition, the LMB is used to click and select (pick) a geometry item as input for a command sequence. For example to click on datum plane, axis, point, edge, feature, etc.
  Typically, the user performs a click and release action with the LMB to click and select (pick) an item.
  In order to make multiple selections and add (or remove) more than one geometrical item(s), the user must press and hold the CTRL key down (CTRL + Hold) and then continue selecting the items with the LMB.
- **Middle Mouse Button or the Wheel (MMB):**
  This is used to accept the current selection or input. In 2D (Sketch) mode, the MMB is used to place dimensions and also to abort (stop) the current command.
  MMB is also used to rotate the model in the Graphics area and to view it at various angles. To rotate, place the cursor on a point inside the Graphics area, press and hold the MMB (MMB + Hold) and drag the mouse slowly to rotate the model. Some computer mice have a wheel instead of a middle button. The wheel rotation zooms-In or zooms Out the model. Rotating and zooming the model are constantly used during the modelling process.
  Another purpose of the MMB (or the wheel) is to translate the model on the screen. Press SHIFT and hold (SHIFT + Hold) with one finger, click the MMB, and then drag to translate the model.
- **Right Mouse Button (RMB):**
  It is used to initiate shortcut and mini menus by clicking once or by pressing and holding for a few seconds (RMB + Hold).

Creo Modelling Interface

The default, Part mode (part modelling) interface is shown in Figure 2.3.

The main components of the interface are as follows:

Main Menu — It is located on the top of the screen. Commands are grouped into tabs depending on their functions, such as File, Model, Analysis, Annotate, Tools, View, Flexible Modelling and Applications. Each of these tabs except File activates a specific ribbon interface. Each ribbon contains a number of icons, organized into groups, which activate commands or tools with specific actions.

The commands are context dependent, and some of them might be disabled (dimmed) if correct prerequisites are not available or if geometrical entities not selected.

The ribbon interface is active when a new or an existing Creo object is opened in the Graphics area. Figure 2.3 shows Part mode ribbon interface with a part opened and shown in the Graphics area. Every Creo application, i.e. part, assembly, mould design, NC assembly, and others, has a specific interface and commands.

Graphics Area — This is the screen area in which the model geometry is displayed. By using the mouse, the user interacts with the model, selecting geometrical entities such as plane, point, surface, edge, etc., in order to create a new model feature or modify existing model features.

Ribbon — The Model ribbon (Figure 2.4) is a context-sensitive menu that contains the main commands (icons and drop-down menus). These are arranged in groups from left to right following the modelling workflow.

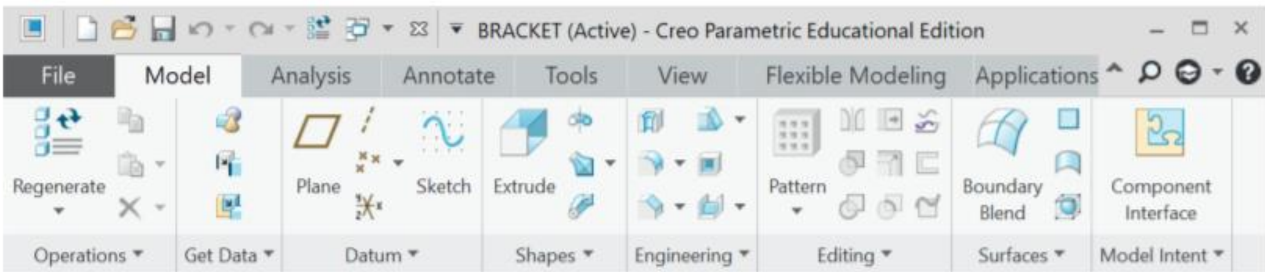


Fig 2.4: Model Ribbon

Message Area — A bar at the bottom of the screen under the Model Tree and Graphics area (Figure 2.3) providing prompts and help.

Graphics Toolbar (Figure 2.5) — It is a small bar under the ribbon used to control the view of the model or sketch.

Fig 2.5: Graphics Toolbar

Quick Access Toolbar — It is located on the top left of the screen. It contains the following commands: New, Open, Save, Undo, Redo, Regenerate and Windows (shown in Figure 2.6).

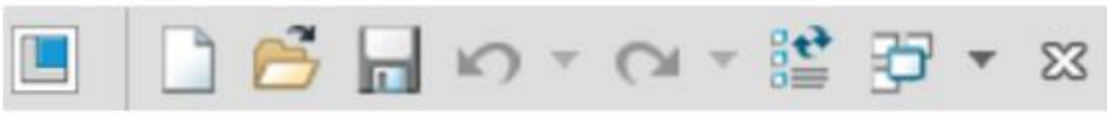
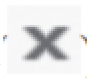


Fig 2.6: Quick Access Toolbar

The **Regenerate** command icon () is frequently used in Part or Assembly mode to initiate the model recalculation after a change of a dimension or another parameter.

Dashboard (Figure 2.7) — This is a submenu that will open after activation of a top-level command. For example, commands for creating Extrude, Rotate, Blend, Sweep, or other features have their dashboards. Each dashboard has command-specific tools and options for creating variations of the activated feature.
For instance, the Extrude command) opens a dashboard that has options to create a protrusion (adding material) or cut (removing material). Also, the dashboard can switch to create a solid or surface feature.
Click (LMB) on Extrude (i.e. Model > Shapes > Extrude) to activate the Extrude dashboard (Figure 2.7). If all necessary inputs are provided into the dashboard, for example, a 2D sketch (two concentric circles) and extrude depth (Figure 2.7), then a green tick () is available to save the changes and close the Extrude command.

Creo cannot continue if the command dashboard is still open. Click (LMB) on the OK green tick () or Cancel () icon on the right-hand side of the dashboard to close and continue.

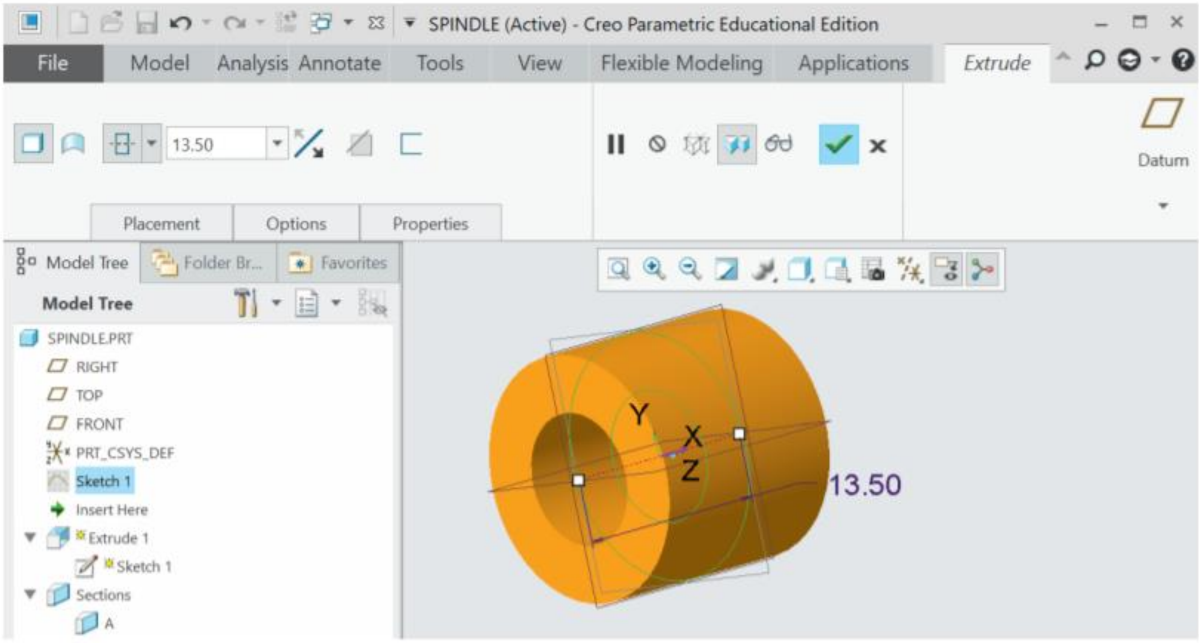


Fig 2.7: Extrude command dashboard

Model Tree (Figure 2.3) — It is a record of all features and parameters following the order of their creation. In fact, the model is a software programme containing commands and input values that Creo executes to create the model geometry. The Model Tree shows the model history. It updates every time new features are added or deleted.

Creo Help — To access Creo Help Centre, click (LMB) on Help ( ) icon at the top right corner of the main screen (Figure 2.3).

Use the **Search** tool ( ) and type into the search bar to quickly find anything related to Creo, e.g. 'extrude'. The result activates the command or highlights it on the screen in real time.

PTC Learning Connector ( ) — It is located next to Creo Help. It allows the user to log into the PTC University e-Learning database and access tutorials and videos. The user needs a Login name and Password. Most help however can be quickly sourced from the Creo Help Centre tab.

Changing Model Properties

The model properties such as Material, Units, Accuracy, Tolerance etc. can be changed using Model Properties tab shown in Fig 2.8.
File – Prepare – Model Properties

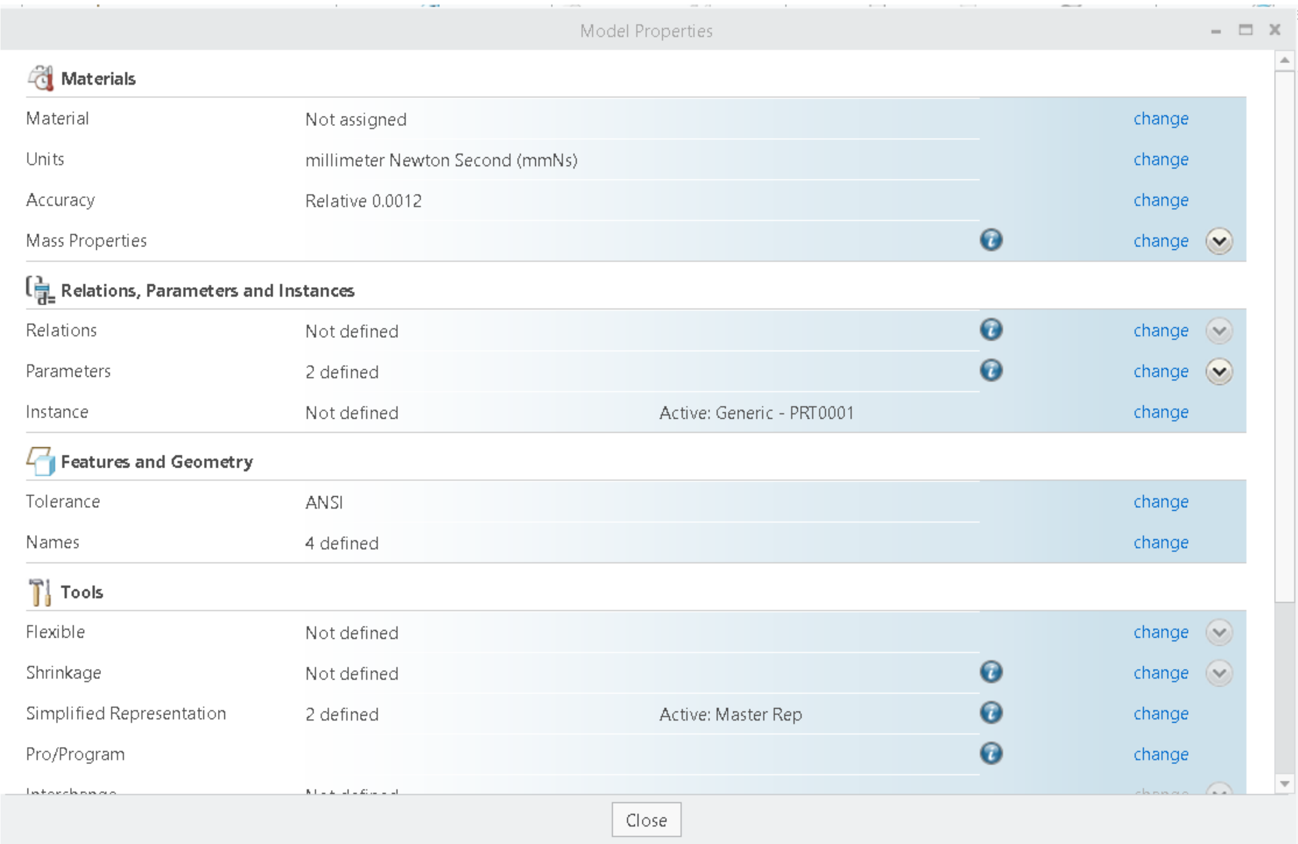


Fig 2.8 Model Properties

ENGINE PARTS

1) STUFFING BOX:

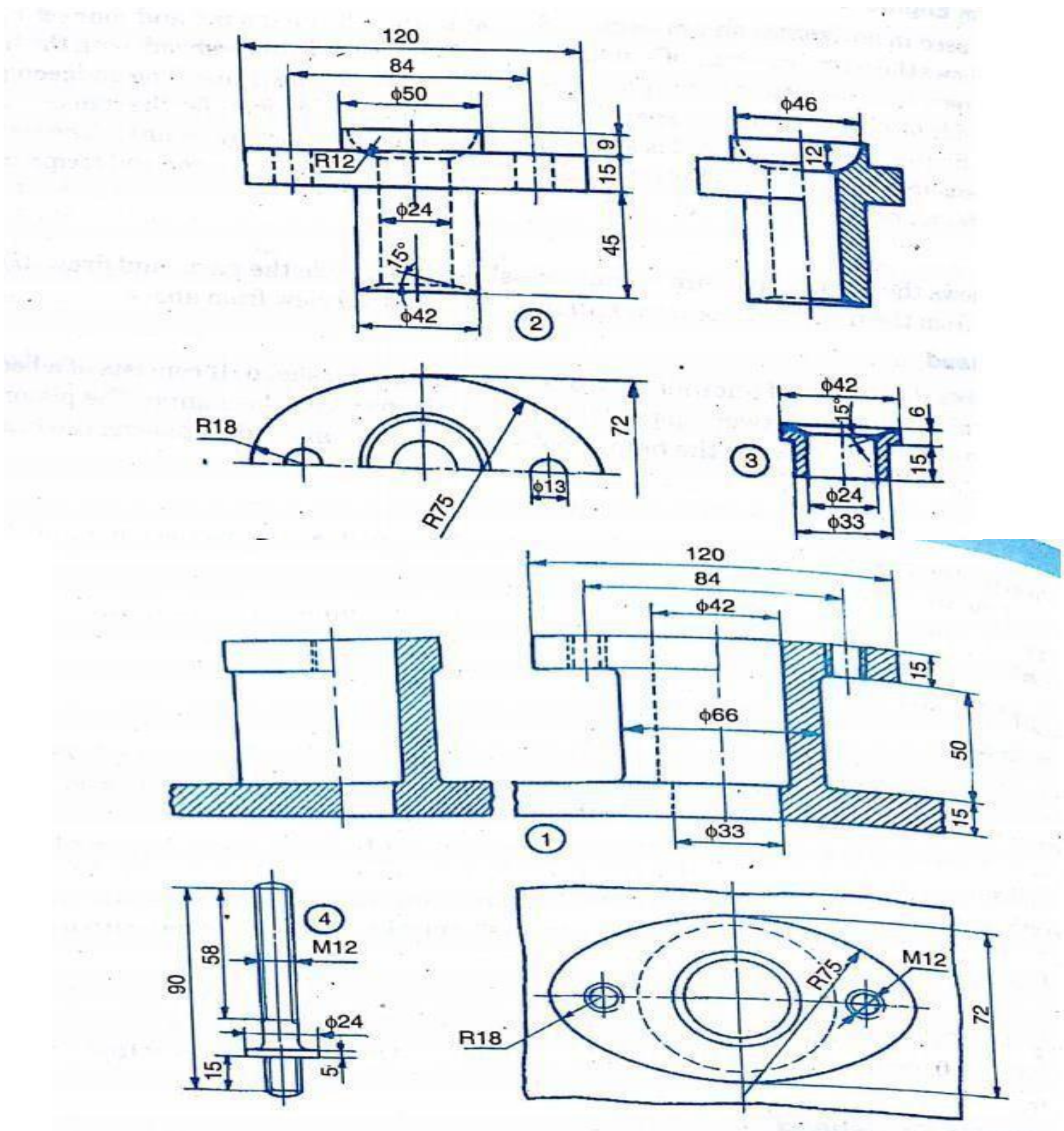


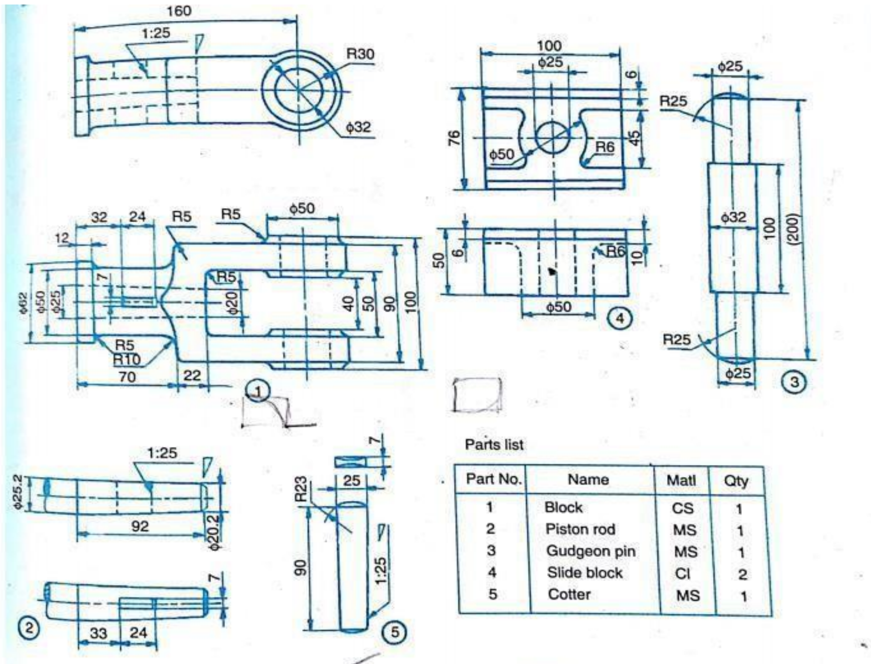
Fig. Stuffing box

Parts list:

Part No.	Nam e	Matl	Qt y
1	Body	CI	1
2	Gland	Brass	1
3	Bush	Brass	1
4	Stud	MS	2
5	Nu t, M12	MS	2

STEAM ENGINE CROSSHEAD:

Crosshead is used in horizontal steam engines for connecting the piston rod and connecting rod.



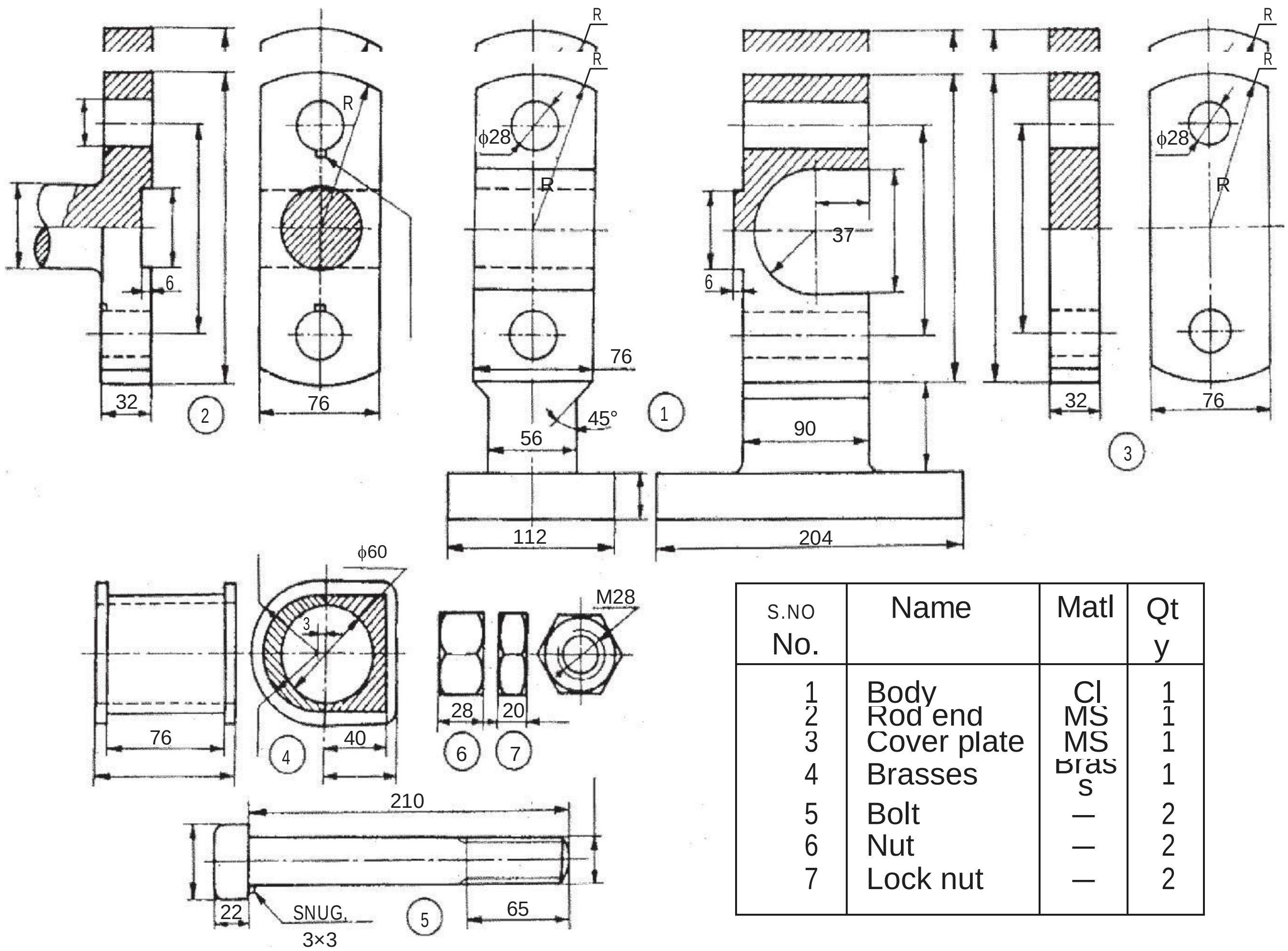
Part No.	Name	Matl	Qty
1	Block	CS	1
2	Piston rod	MS	1
3	Gudgeon pin	MS	1
4	Slide block	CI	2
5	Cotter	MS	1

Fig. 18.2 Steam engine crosshead

Figure 18.2 shows the part drawings of a steam engine crosshead. The crosshead, with the help of slide block 4, reciprocates between two guides provided in the engine frame. The gudgeon pin 3, connects the slide blocks with the crosshead block 1. This acts as a pin joint for the connecting rod (not shown in figure). The piston rod 2 is secured to the crosshead block by means of the cotter 5. The assembly ensures reciprocating motion along a straight line for the piston rod and reciprocating cum oscillatory motion for the connecting rod.

CROSSHEAD:

Figure shows the details of another type of steam engine crosshead. It consists of a body or slide block 1, which slides in-between parallel guides in the frame of the engine. The piston rod end 2 is fitted to the crosshead with the help of bolts 5 and nuts 6 and 7 after placing the brasses 4, and cover plate 3 in position.

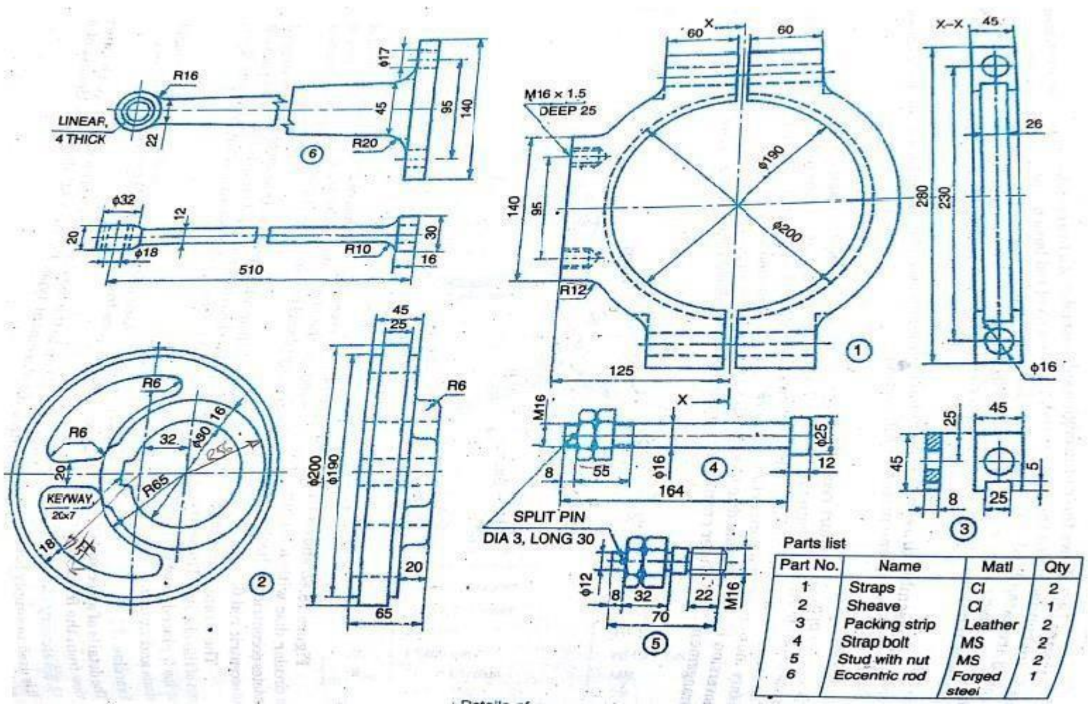


S.NO No.	Name	Matl	Qty
1	Body	CI	1
2	Rod end	MS	1
3	Cover plate	MS	1
4	Brasses	Brass	1
5	Bolt	—	2
6	Nut	—	2
7	Lock nut	—	2

Fig. Crosshead

ECCENTRIC:

It is used to provide a short reciprocating motion, actuated by the rotation of a shaft. Eccentrics are used for operating steam valves, small pump plungers, shaking screens, etc. The components of an eccentric are shown in isometric views Fig. for easy understanding of their shapes. Rotary motion can be converted into a reciprocating motion with an eccentric, but the reverse conversion is not possible due to excessive friction between the sheave and the strap. The crank arrangement, in a slider crank mechanism however, allows conversion in either direction.

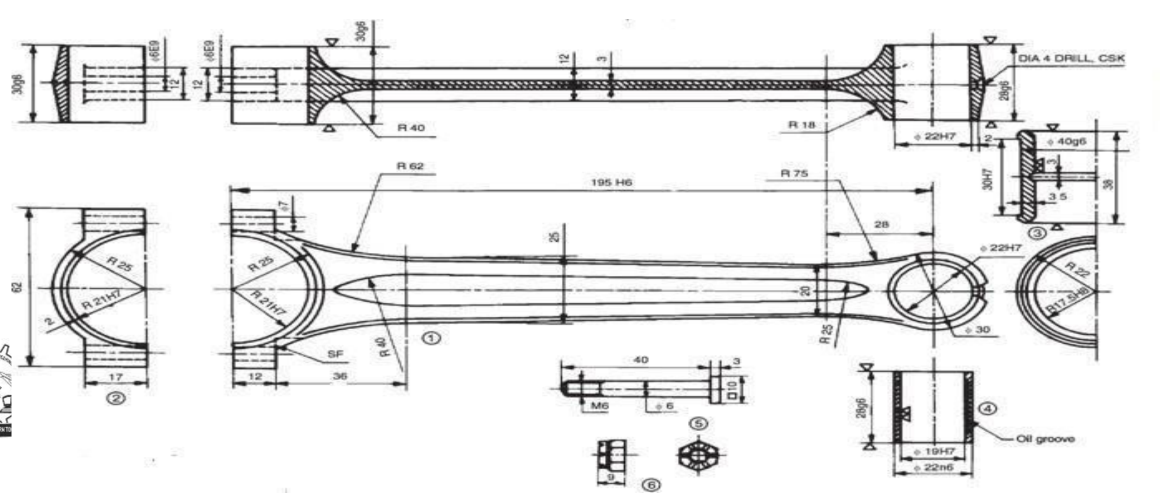


Part No.	Name	Matl	Qty
1	Straps	CI	2
2	Sheave	CI	1
3	Packing strip	Leather	2
4	Strap bolt	MS	2
5	Stud with nut	MS	2
6	Eccentric rod	Forged steel	1

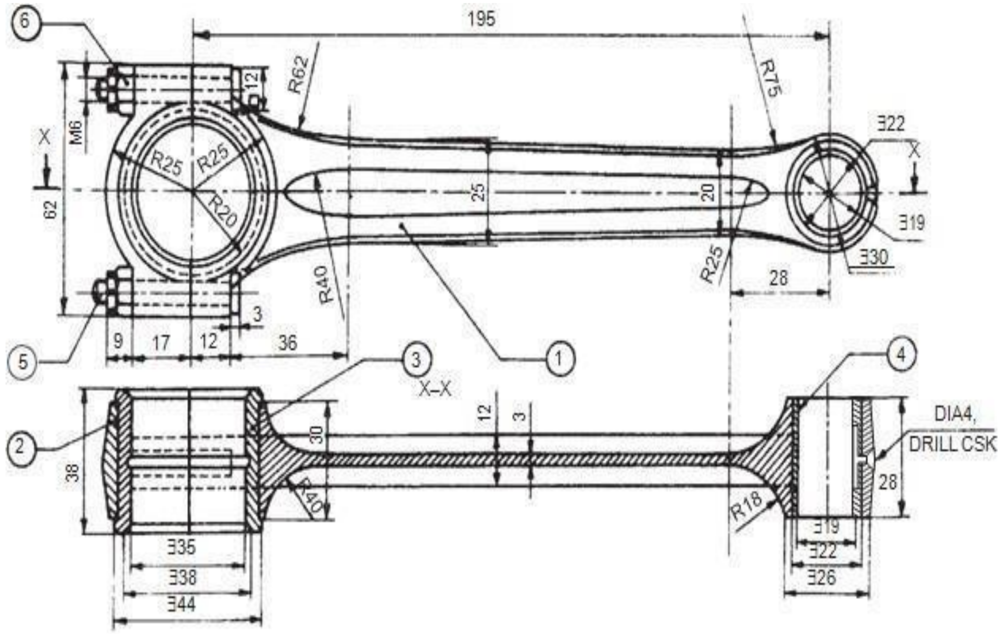
Details of an Eccentric

CONNECTING ROD

PETROL ENGINE CONNECTING ROD



Assembly of connecting rod:



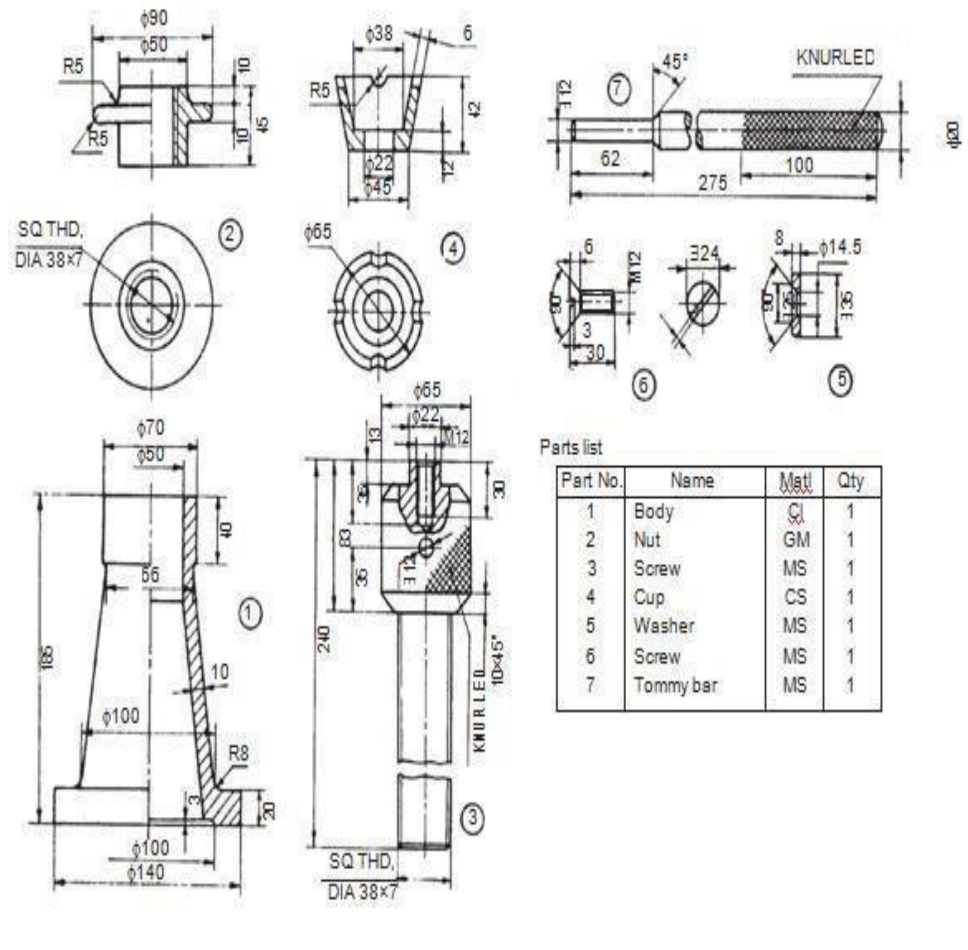
Parts list

Part No.	Name	Matl.	Qty.
1	Rod	FS	1
2	Cap	FS	1
3	Bearing brass	GM	2
4	Bearing bush	P Bronze	1
5	Bolt	MCS	2
6	Nut	MCS	2

Fig. Petrol engine connecting rod

OTHER MACHINE PARTS:

SCREW JACK: Screw jacks are used for raising heavy loads through very small heights. Figure shows the details of one type of screw jack. In this, the screw 3 works in the nut 2 which is press fitted into the main body 1. The Tommy bar 7 is inserted into a hole through the enlarged head of the screw and when this is turned, the screw will move up or down, thereby raising or lowering the load

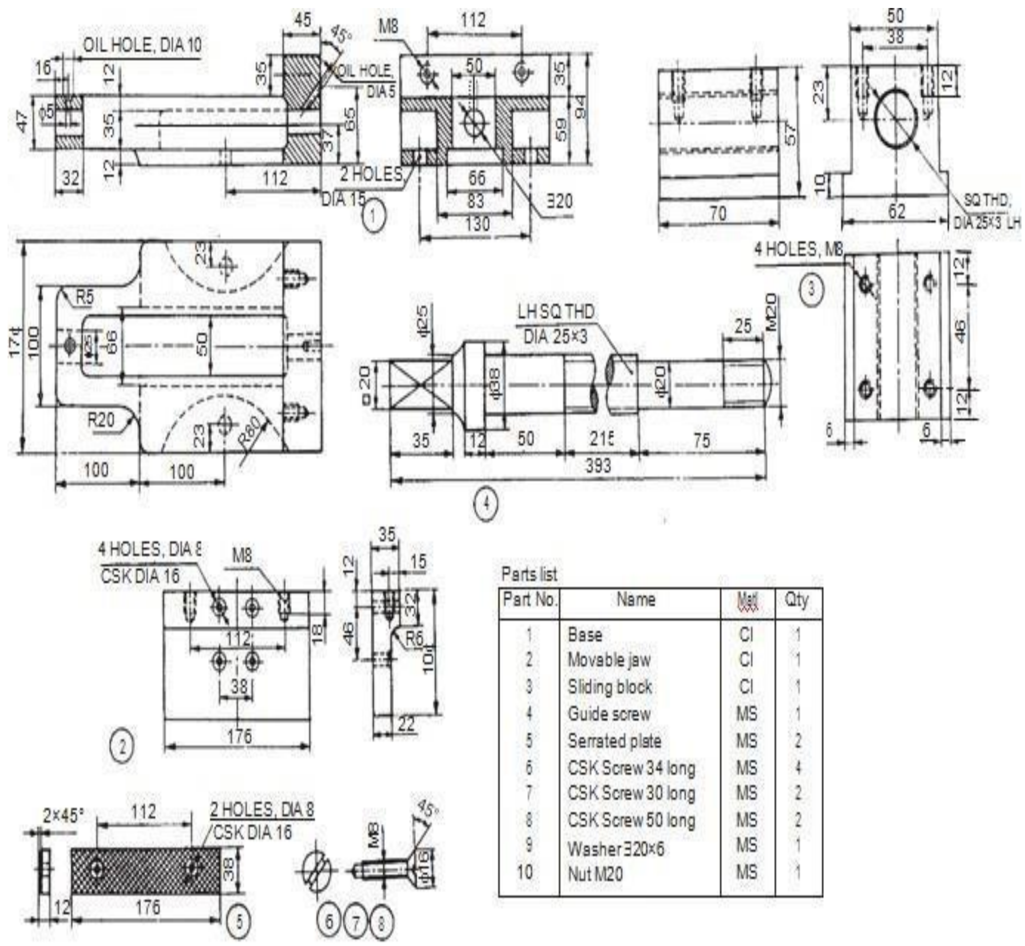


Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

* Screw jack

MACHINE VICE:

The details of a plain machine vice are shown in Fig. It consists of the base 1 which is clamped to the machine table using two T-bolts. The sliding block 3 is fixed in the centre slot of the base by means of the guide screw 4. The movable jaw 2 is fixed to the sliding block with four screws 8 and 7. One of the serrated plates 5 is fixed to the jaw of the base by means of screws 6 and the other to the movable jaw by the screws 7. One end of the guide screw is fixed to the base by means of the washer 9 and nut 10 (not shown in figure). The movable jaw is operated by means of a handle (not shown) which fits onto the square end of the guide screw

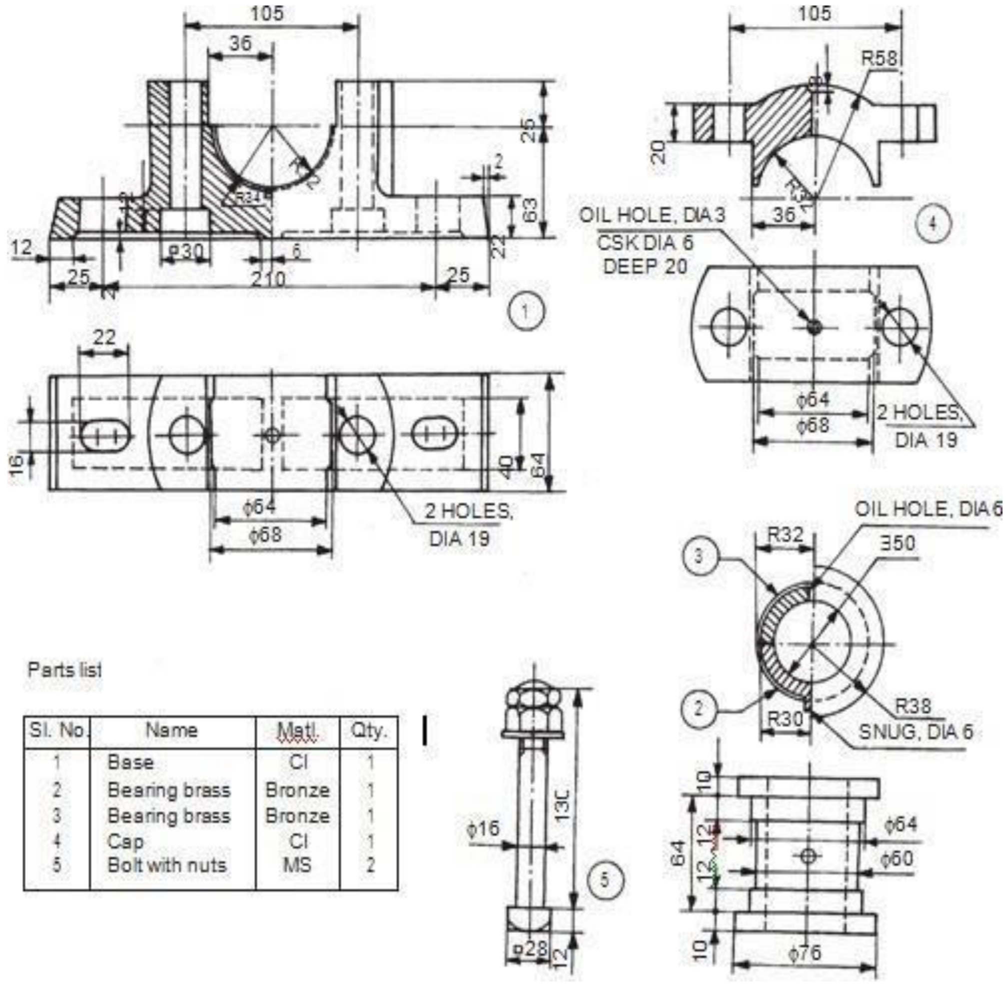


Parts list

Part No.	Name	Mat'l	Qty
1	Base	CI	1
2	Movable jaw	CI	1
3	Sliding block	CI	1
4	Guide screw	MS	1
5	Serrated plate	MS	2
6	CSK Screw 34 long	MS	4
7	CSK Screw 30 long	MS	2
8	CSK Screw 50 long	MS	2
9	Washer ∃20×6	MS	1
10	Nut M20	MS	1

Fig. Machine vice

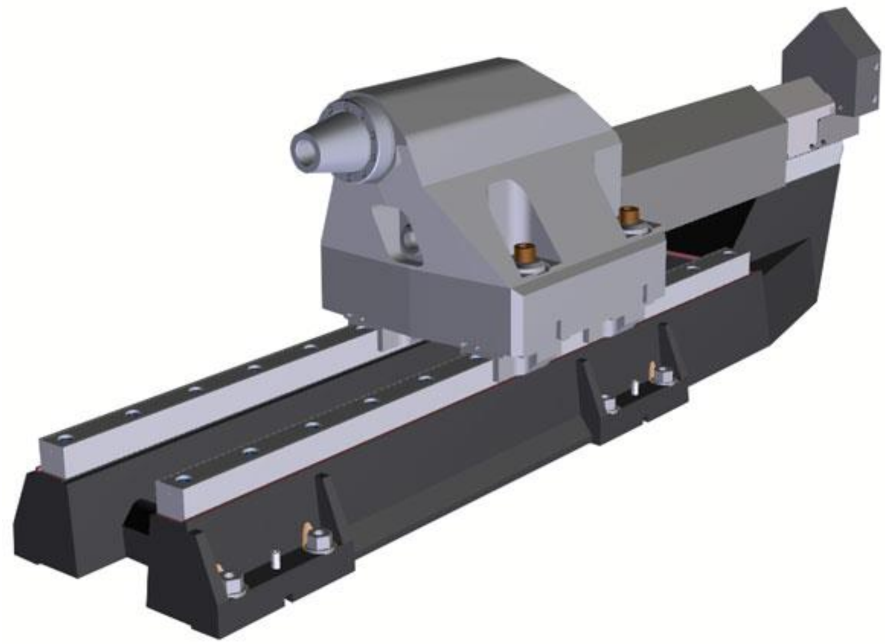
PLUMMER BLOCK:

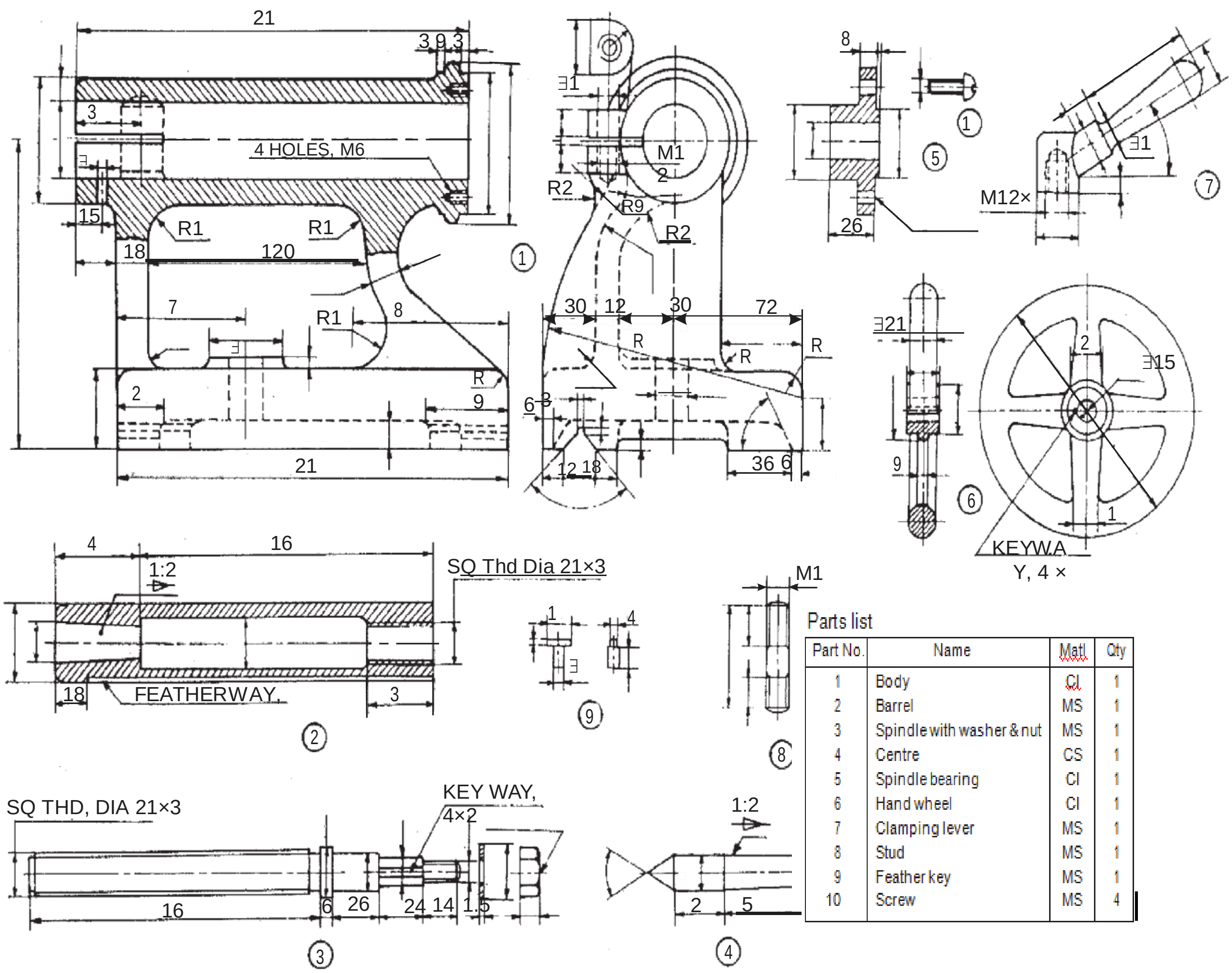


Parts list

Sl. No.	Name	Matl.	Qty.
1	Base	CI	1
2	Bearing brass	Bronze	1
3	Bearing brass	Bronze	1
4	Cap	CI	1
5	Bolt with nuts	MS	2

LATHE TAIL-STOCK:



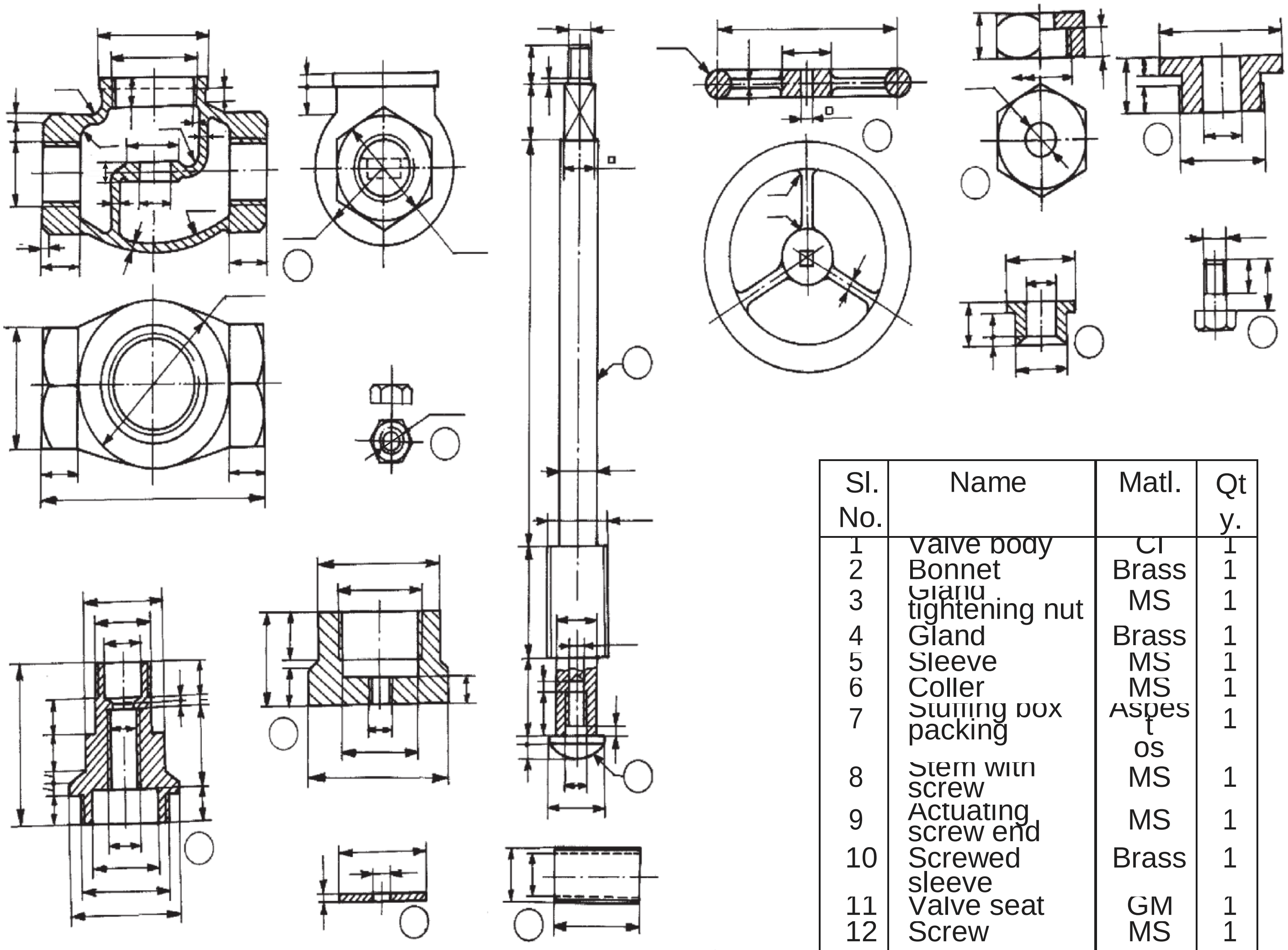


Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Barrel	MS	1
3	Spindle with washer & nut	MS	1
4	Centre	CS	1
5	Spindle bearing	CI	1
6	Hand wheel	CI	1
7	Clamping lever	MS	1
8	Stud	MS	1
9	Feather key	MS	1
10	Screw	MS	4

VALVES:

STEAM STOP VALVE:



Sl. No.	Name	Matl.	Qty.
1	Valve body	CI	1
2	Bonnet	Brass	1
3	Gland tightening nut	MS	1
4	Gland	Brass	1
5	Sleeve	MS	1
6	Coller	MS	1
7	Stuffing box packing	Aspestos	1
8	Stem with screw	MS	1
9	Actuating screw end	MS	1
10	Screwed sleeve	Brass	1
11	Valve seat	GM	1
12	Screw	MS	1
13	Hand wheel	CI	1
14	Nut	MS	1

Steam stop valve

SPRING LOADED SAFETY VALVE

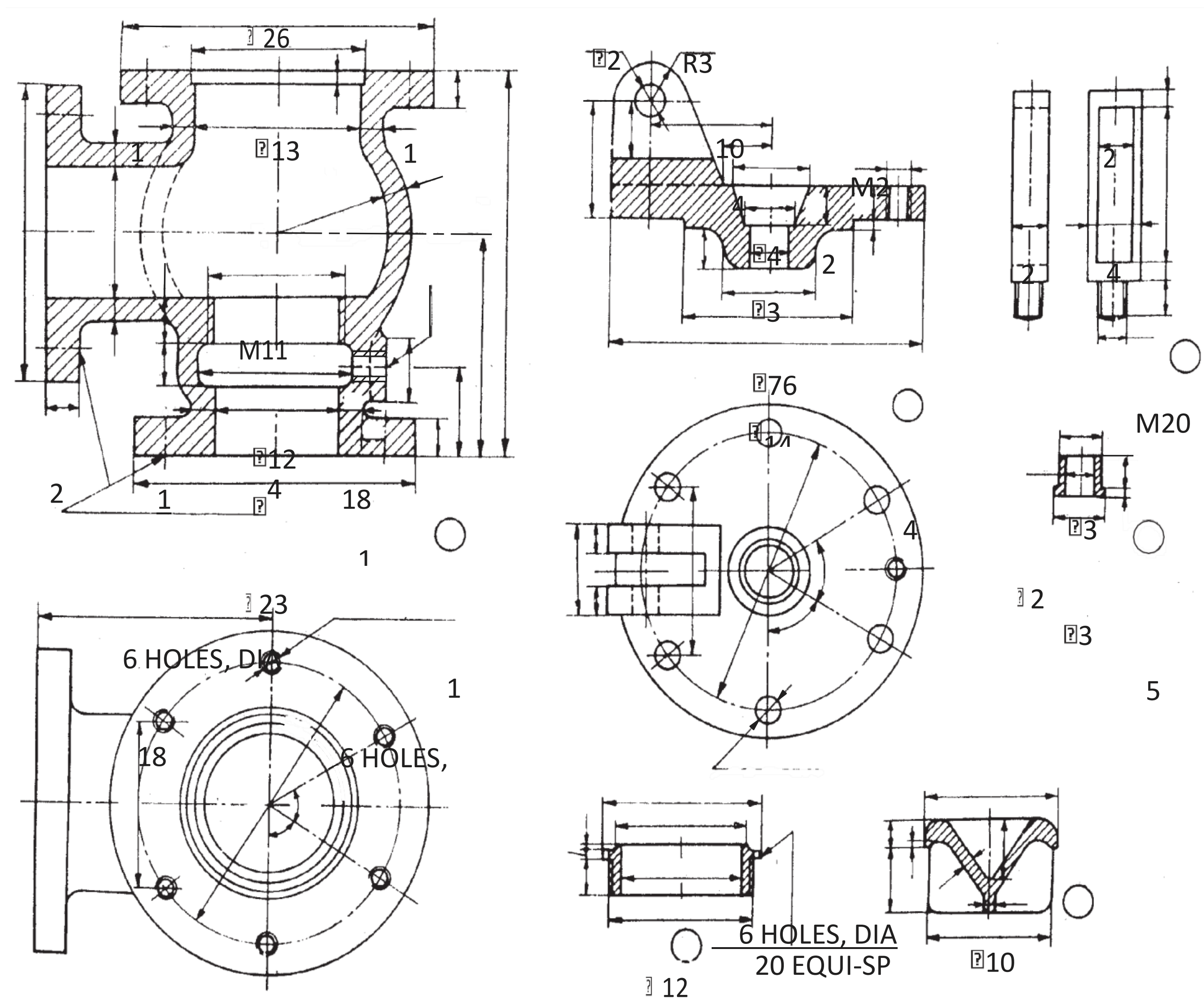
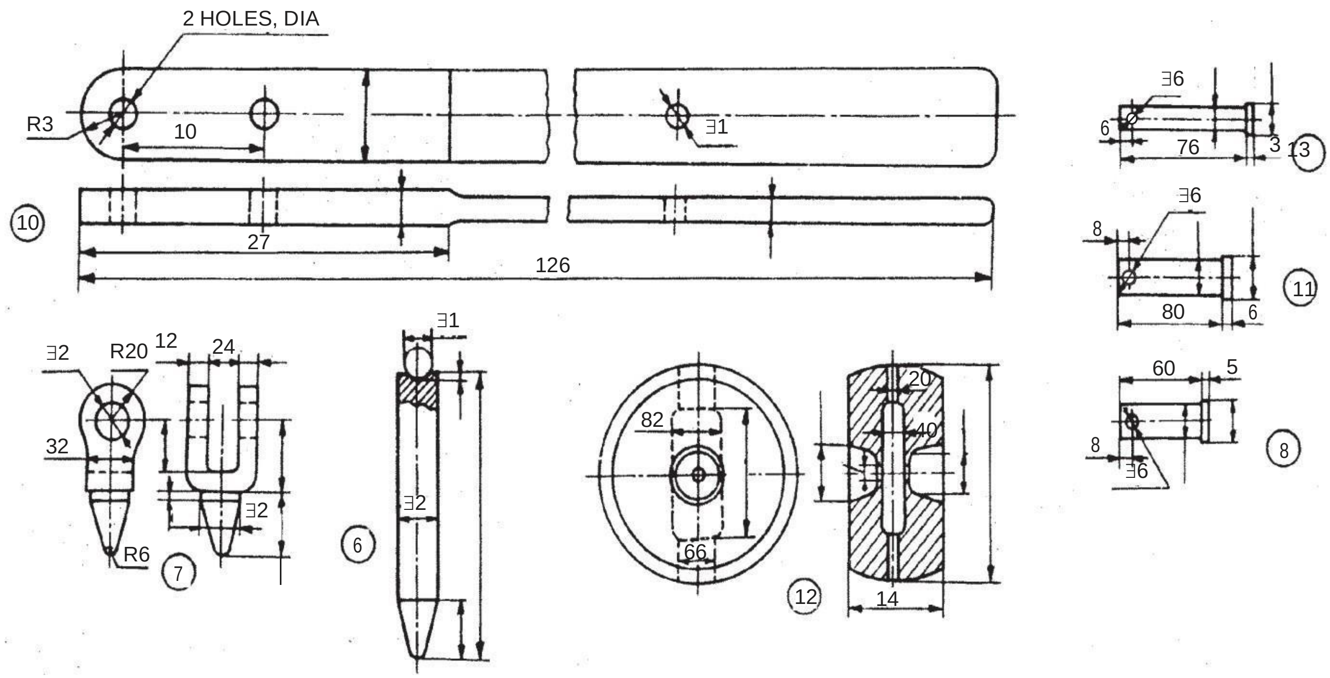


Fig. spring loaded safety valve

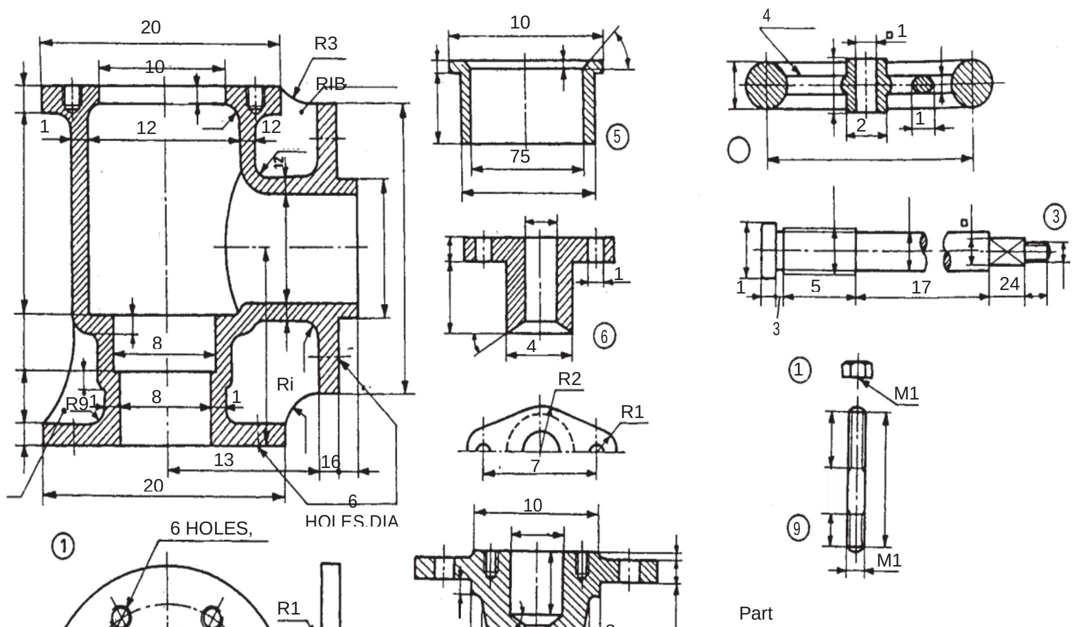


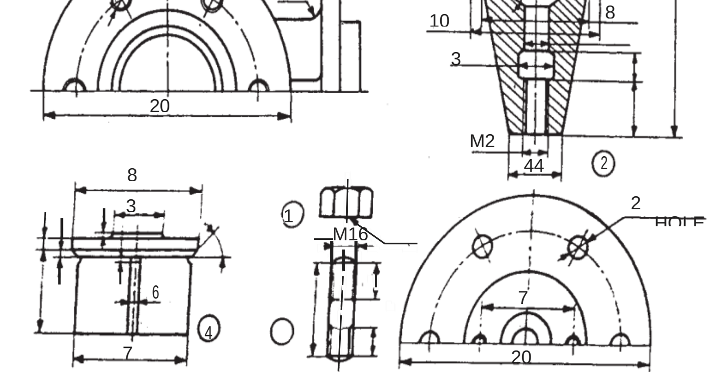
Part No.	Name	Matl	Qty	Part No.	Name	Matl	Qty
1	Body	CI	1	8	Toggle-pin	MS	1
2	Valve seat	GM	1	9	Lever guide	MS	1
3	Valve	GM	1	10	Lever	FS	1
4	Cover	CI	1	11	Fulcrum pin	MS	1
5	Cover bush	Brass	1	12	Weight	CI	1
6	Spindle	MS	1	13	Lever pin	MS	1
7	Toggle	MS	1	14	Stud with nut M20	—	6

Fig. spring loaded safety valve

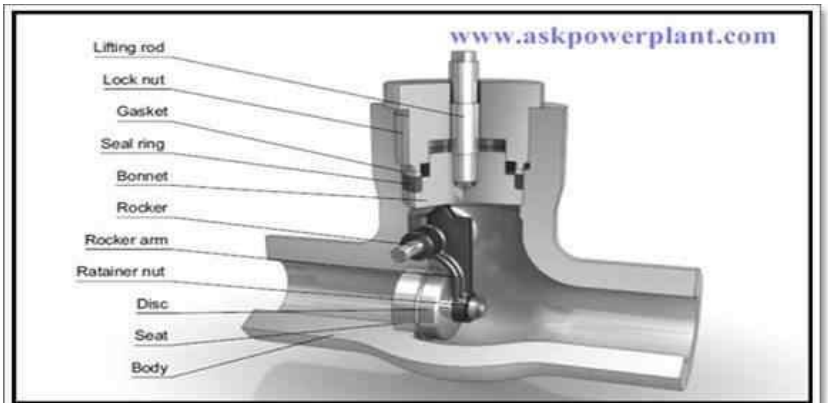
FEED CHECK VALVE:

It is used in boilers to regulate the supply of feed water and to maintain the water level. It is fitted close to the boiler shell and in the feed pipe line. Figure shows the details of a feed check valve. The valve prevents water from being returned to the supply line, due to steam pressure in the boiler. Hence, it functions like a non-return valve.





S No.	Name	Matl.	Qty
1	Body	CI	1
2	Cover	CI	1
3	Spindle	MS	1
4	Valve	GM	1
5	Valve seat	GM	1
6	Gland	GM	1
7	Hand wheel	CI	1
8	Stud	MS	6
9	Stud	MS	2
10	Nut	MS	6
11	Nut	MS	3

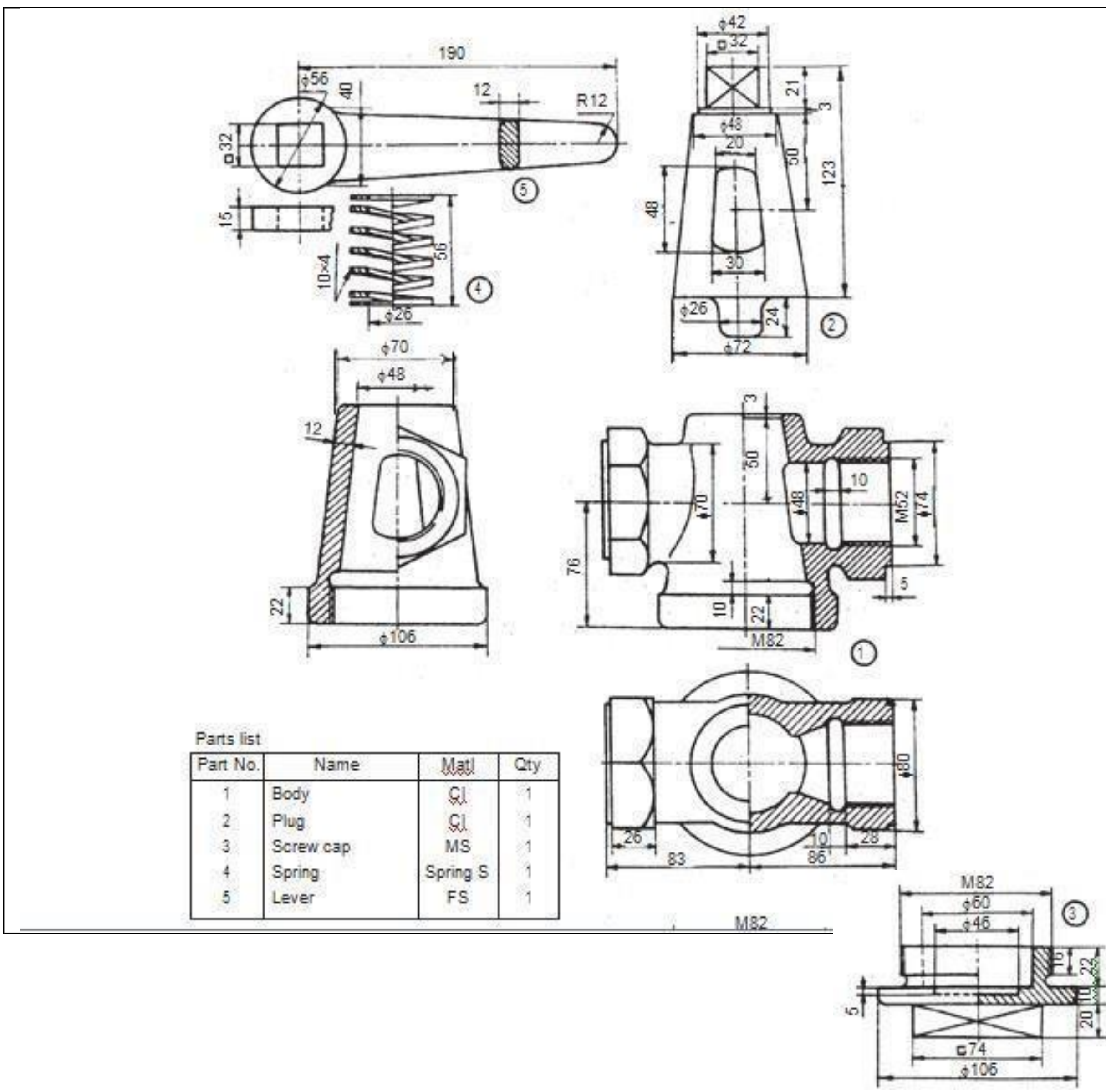


Feedcheck Valve

AIR COCK:

This valve is used to control air or gas supply. The details of an air cock are shown in Fig. It consists of a plug 2 which is inserted into the body 1, from the bottom. The rectangular sectioned spring 4 is placed in position at the bottom of the plug and seated over the screw cap

3. The screw cap is operated to adjust the spring tension. Lever 5 with square hole is used to operate the cock. By a mere 90° turn, the cock is either opened or closed fully.



Parts list

Part No.	Name	Matl	Qty
1	Body	C.I.	1
2	Plug	C.I.	1
3	Screw cap	MS	1
4	Spring	Spring S	1
5	Lever	FS	1

INDUSTRIAL APPLICATIONS:

1 Marine Gas-Tight Bulkhead Stuffing Box between Pump and Engine Room.

2**. Steam Engine Cross Head used in Marine/Locomotive engines.**

Eccentric

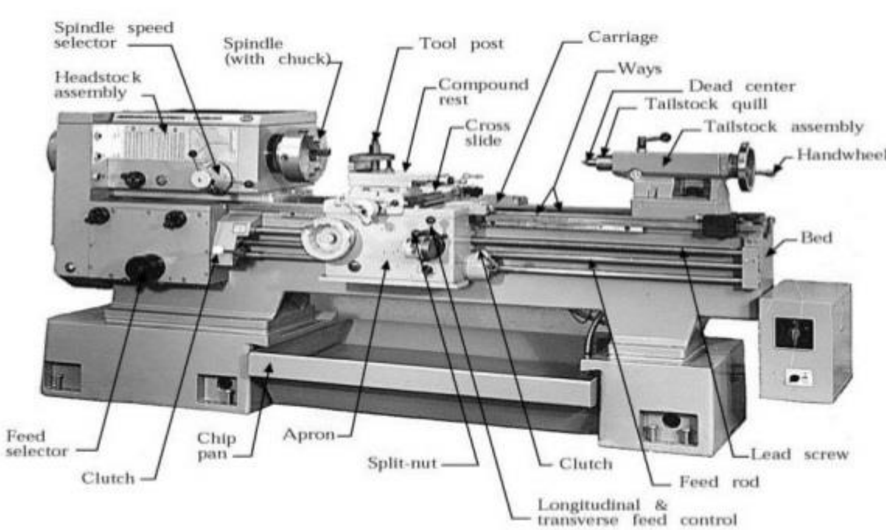
Pistons used in Automobile

SCREW JACK is used for lifting the load.

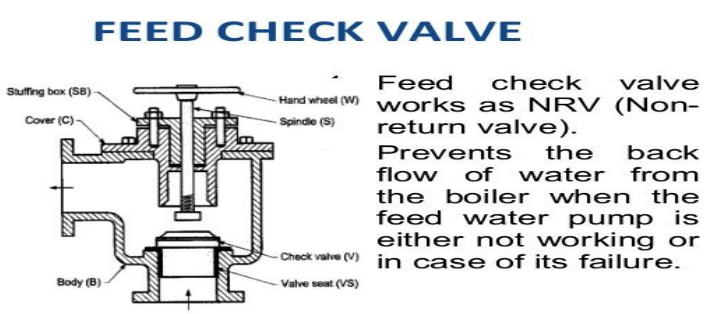
Machine Vice:

Plumber block

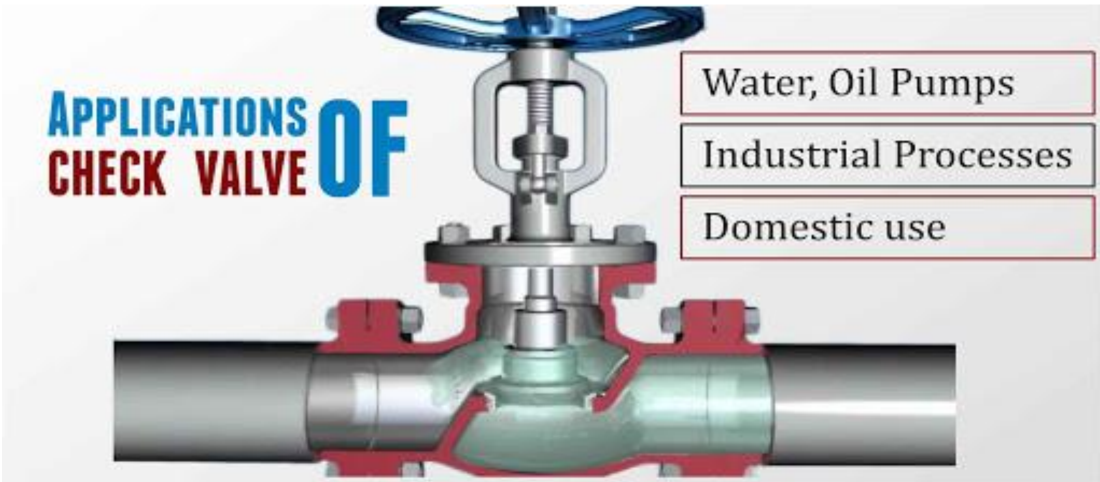
Lathe tail stock used in industries for different operations



Feed Check valve



Steam stop valve



Code No: R15A0310 **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester supplementary Examinations, April/May 2019

Machine Drawing

(ME)

Roll No										

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B
Part A consists of three Questions, answer any two questions. Each question carries 15 marks.
Part B consists of one question which is compulsory. Which carriers 45 marks.

****

Part-A (30Marks)

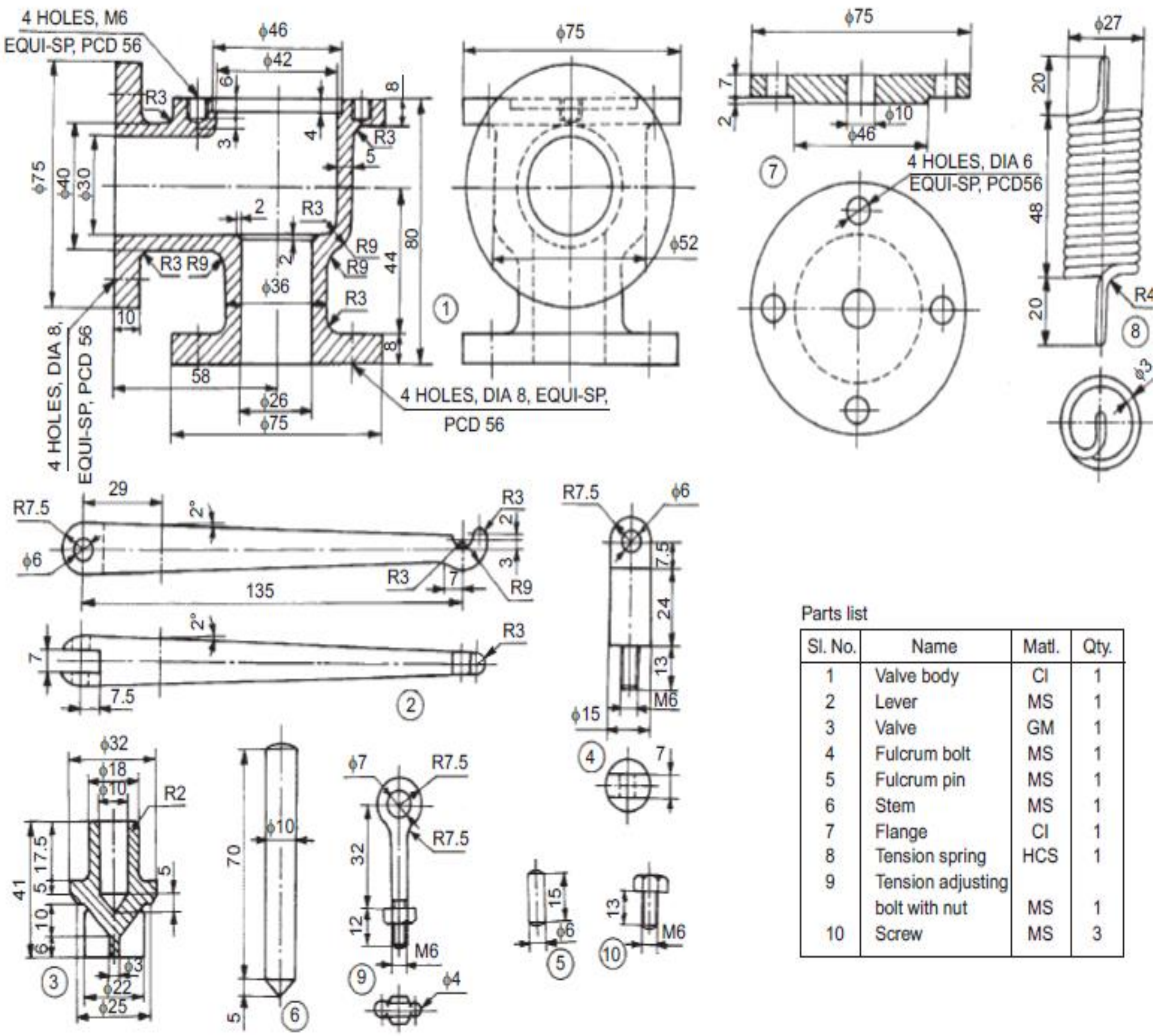
Answer any two of the following (2x15=30M)

3. Draw the conventional representation of following materials
(a) Porcelain (b) Fiber (c) Lead (d) Petrol (e) Copper
4. Draw the single riveted single strap Butt joint of plate thickness as 12 mm .
5. Draw the half-sectional front view and side view of journal bearing which can accommodate 40 mm diameter shaft.

Part-B (45Marks) (1x45=45M)

6. Assemble the parts of spring loaded safety valve as shown in the figure and draw
   a) Sectional front view
   b) Top view

P.T.O



Parts list

Sl. No.	Name	Matl.	Qty.
1	Valve body	CI	1
2	Lever	MS	1
3	Valve	GM	1
4	Fulcrum bolt	MS	1
5	Fulcrum pin	MS	1
6	Stem	MS	1
7	Flange	CI	1
8	Tension spring	HCS	1
9	Tension adjusting bolt with nut	MS	1
10	Screw	MS	3

Fig. Spring loaded safety valve

Code No: **R17A0310** **R17**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Supplementary Examinations, May 2019

Machine Drawing

(ME)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper consists of 2 parts. Answer any **TWO** Questions from part-A, Which carries of 28 marks and Part-B consist of one question which is compulsory which carries 42 marks.

******

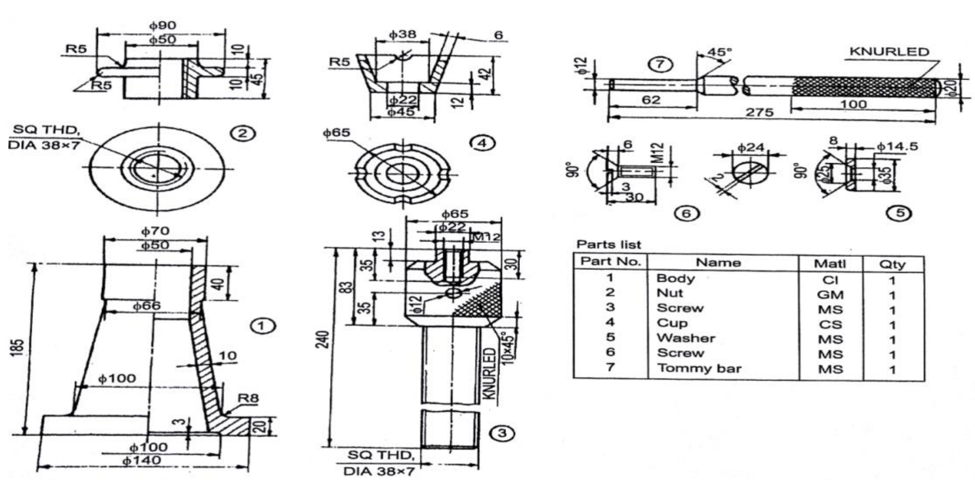
Part- A (28 Marks)
Answer any two of the following (14*2=28)

1. Draw the sectional front view of a universal coupling joining two shafts of diameter 50 mm. Show the dimensions.
2. Draw the sectional view from the front and top view of a single riveted single strap butt joint with plates of thickness 15 mm.
3. Sketch the sectional front view of rag foundation bolt of diameter 25 mm. Show the proportionate dimensions in the drawing.

Part-B (42 Marks) (1*42=42M)

4. Develop the assembly drawing views as mentioned below of Screw Jack using the part drawings shown in Figure.1.
   (i) Half-Sectional Front View
   (ii) Top View

Figure 1. Details of Screw Jack
****



Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

R17

Code No: R17A0310

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B. Tech I Semester Regular Examinations, November 2018

Machine Drawing

(ME)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 2 parts. Answer any two questions from Part-A, which carries of 28 Marks and Part-B consists of one question which is compulsory which carries 42 marks.

******

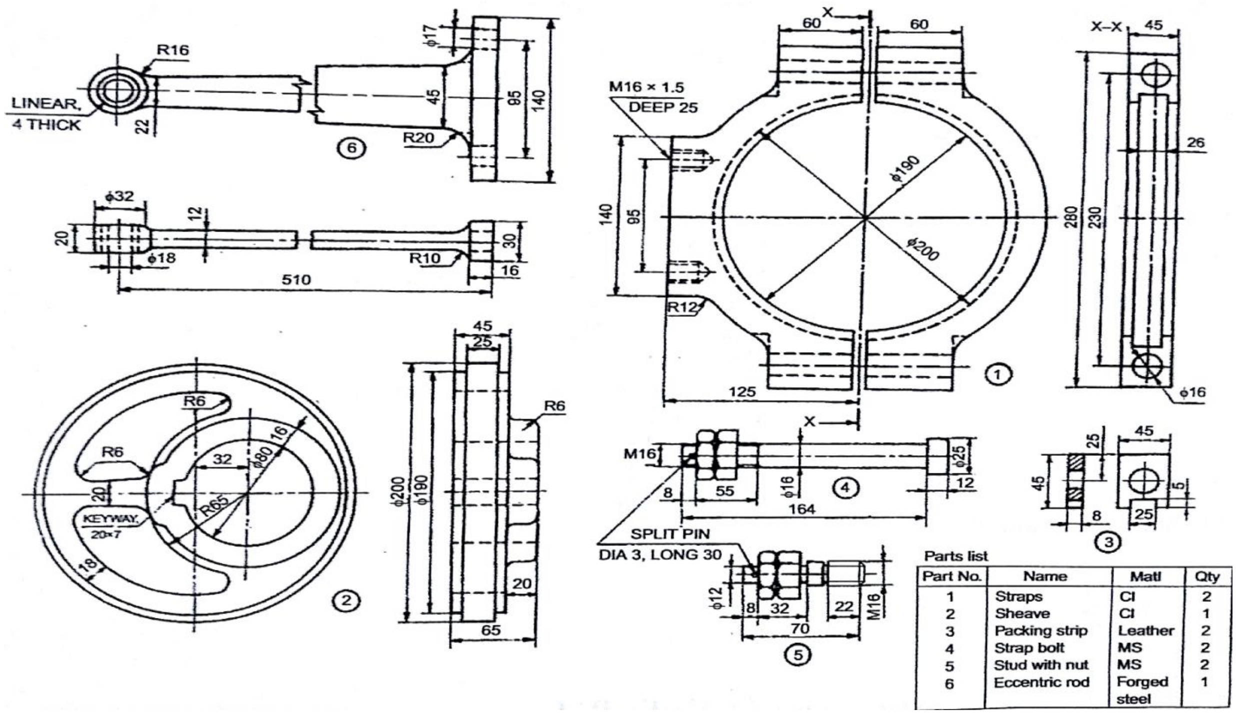
Part- A (28 Marks)
Answer any two of the following (14*2=28)

5. Draw the three views of a hexagonal headed bold of nominal diameter 20 mm and length 80 mm with a hexagonal nut and washer.
6. Draw the conventional representation of the following materials.
   (b) Cast iron (b) Lead (c) marble (d) glass (e) water (f) concrete (g) wood
7. Draw the sectional front view and top view of a double riveted double strap chain Butt Joint to joint two plates of thickness 10 mm.

Part-B (42 Marks)
(1*42=42M)

8. Develop the assembly drawing views as mentioned below of an Eccentric using the part drawings shown in Figure.1.
   (iii) Half-Sectional Front View with top half in section

(iv) Side view from right



Parts list

Part No.	Name	Matl	Qty
1	Straps	CI	2
2	Sheave	CI	1
3	Packing strip	Leather	2
4	Strap bolt	MS	2
5	Stud with nut	MS	2
6	Eccentric rod	Forged steel	1

Figure.1 Details of Eccentric

***

R15

Code No: R15A0310

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech II Semester supplementary Examinations, Nov/Dec 2018

Machine Drawing

(ME)

Roll No										

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B
Part A is consists of Three questions among them Two questions should be answered Which carriers 30 marks.
Part B Consists of one question, which is compulsory, which carries 45 Marks.

****

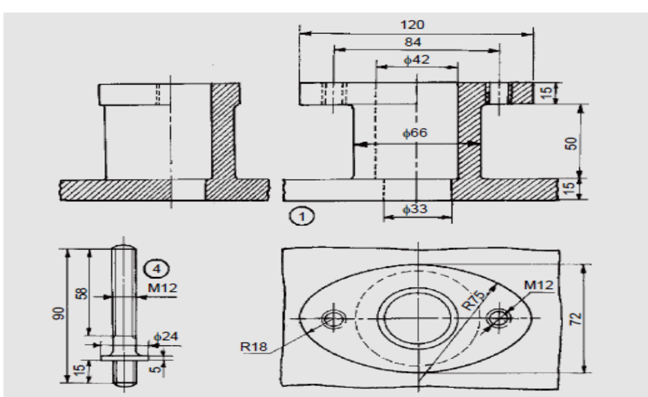
Part-A (30Marks)

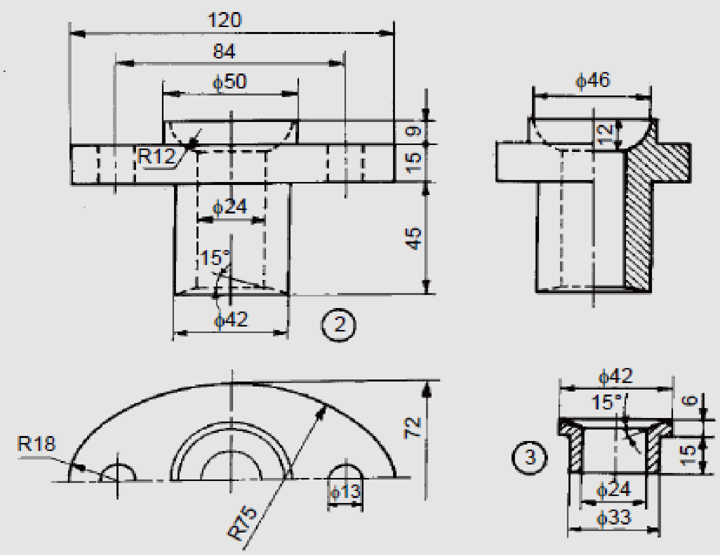
Answer any two of the following (2x15=30M)

7. Draw the following material conventions
(i) CI (ii) Water (iii) Wood (iv) concrete (v) Leather
8. Draw front view and top view of double riveted zig-zag lap joint of 10mm plate thickness.
9. Draw the sectional front, top and side view of a knuckle joint to join two rods of diameter 30 mm each.

Part-B(45Marks) (1X45=45M)

10. Assemble all the parts of the stuffing box for a vertical steam engine, show the fallowing figure and draw
    a) Half sectional view from the front, with left half in section
    b) View from above. All dimensions are in mm





Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Gland	Brass	1
3	Bush	Brass	1
4	Stud	MS	2
5	Nut, M12	MS	2