MACHINING

Level-II

Based on March 2022, Curriculum Version 1



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Addis Ababa Ethiopia

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Acronyms

- BED : Basic Engineering Drawing
- ISO : International Standard Organization
- PP : Picture plane
- SP : Station point
- VP : Vanishing point

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Introduction to the Module

In **Machining** occupation, Basic Engineering Drawing (BED) helps the trainees to identifythe drawing requirements for machining operation. So BED helping the trainees To Prepare drawings or make changes to existing drawings, to prepare engineering parts list ,to issue approved drawing for **Machining**.

This module is designed to meet the industry requirement under **Machining**occupational standard, particularly for the unit of competency: **PreparingBasic Engineering Drawing.**

This module covers the units :

- Drawing Requirements
- Drawings Preparation
- Drawing Parts List
- Drawing Approval

Learning Objective of the Module which lets the trainees to:-

- Applyengineering drawing requirements
- Prepare engineering drawings or make changes to existing drawings
- Prepare engineering drawings parts list
- approve drawingissue

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the self-checks at the end of each unit
3. Perform operation sheets which were provided at the end of units
4. Do the “LAP test” given at the end of each unit and
5. Read the identified reference book to get more knowledge as well as to do examples and exercise

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Unit One: Basic EngineeringDrawing

This unit to provide you the necessary information regarding the following content coverage and topics:

- Specifications and data.
- Necessary data or norm/ standards drawing.
- Drawing requirements.
  - ✓ Drawing symbols and standards
  - ✓Types and uses of drafting equipment and drawing instruments
  - ✓measuring instruments
  - ✓ relevant personnel

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Determine specifications and other data.
- Identify and analyzing necessary data of norm/ standards drawing.
- Verify drawing requirements.

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Introduction to engineering Drawing

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 visualize the required object. As an engineering drawing displays the exact picture of an object, it obviously conveys the same ideas to every trained eye.

1.1Specifications and other data

Language has a set of rules and regulations for it to operate correctly. The same is true of engineering drawing. In the English language, there are two basic rules. The first is the word order that gives information on subject and object. The second is spelling, which gives information on the words themselves in terms of the spelling, i.e. the nouns, verbs, etc. Considering the word order, the phrase 'the cat sat on the mat' is very different from the phrase 'the mat sat on the cat'. All that has happened is that the words 'cat' and 'mat' have been swapped. Previously, the phrase described a perfectly feasible situation whereas it now describes an impossible situation. Thus, the word order gives information on which is the subject and which is the object. The second set of rules concern spelling and thus the phrase 'the cat sat on the mat' is very different from 'the bat sat on the mat' and yet this difference is the result of only one letter being changed!

In engineering drawing, there are similarly two sets of rules. The first also concerns order but in this case the order of the different orthographic views of an engineering artifact. The second is concerning how the individual views are drawn using different line thicknesses and line types, which is the equivalent of a spelling within each individual word. These are shown in Figure 1.8. The first set is the 'drawing layout rules', which define information concerning the projection method used and therefore the arrangement of the individual views and also the methodology concerning sections. The second set of rules is the 'manufacturing rules', which show how to produce and assemble an artifact. This will be in terms of the size, shape, dimensions, tolerances and surface finish. The drawing layout rules and the manufacturing rules will together make a legal specification that is binding. Both sets of rules are defined by ISO standards. When a

contractor uses these two sets of rules to give information to a subcontractor on how to make something, each part is able to operate because of theunderpinning provided by ISO standards.

1.2Necessary Data of Norm/ or Standards Drawing

Data Requirements Analysis

Though traditional requirements analysis centers on functional needs, data requirements analysis complements the functional requirements process and focuses on the information needs, providing a standard set of procedures for identifying, analyzing, and validating data requirements and quality for data-consuming applications. Data requirements analysis is a significant part of an enterprise data management program that is intended to help in:

- Articulating a clear understanding of data needs of all consuming business processes,
- Identifying relevant data quality dimensions associated with those data needs,
- Assessing the quality and suitability of candidate data sources,
- Aligning and standardizing the exchange of data across systems,
- Implementing production procedures for monitoring the conformance to expectations and correcting data as early as possible in the production flow, and
- Continually reviewing to identify improvement opportunities in relation to downstream data needs.

During this process, the data quality analyst needs to focus on identifying and capturing more than just a list of business questions that need to be answered. Analysis of system goals and objectives, along with the results of stakeholder interviews, should enable the analyst to also capture important business information characteristics that will help drive subsequent analysis and design activities: data and information requirements must be relevant, must add value, and must be subject to availability.

Data analysis with a good statistical program isn't really difficult. It does not require much knowledge of mathematics, and it doesn't require knowledge of the formulas that the program uses to do the analyses. It really only requires a few things:

.

- A “clean” spreadsheet that’s analysis-ready
- A clear idea of what evaluation questions you want the data to answer
- Attention to detail
- A relaxed frame of mind.

This section is quite dense for people who have little or no background with data analysis, but we will take you through it step by step. There's no need to try to grasp it quickly. We suggest taking your time, and experimenting. We have provided you a sample spreadsheet, described below, and we have provided some examples of evaluation questions and analyses that can be done to answer those questions.

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 sectional views conventions in use are shown in Fig. below.

Table 1.1 conventional representation of material

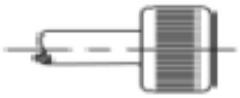
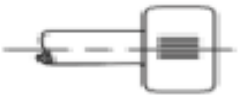
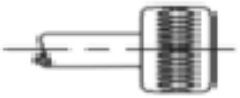
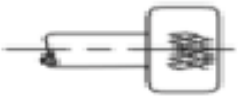
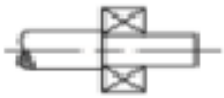
Type	Convation	Materials
Metals		Steel, Cast Iron, Copper and its Alloys, Aluminium and its Alloys, etc.
		Lead, Zinc, Tin, White-metal, etc.
Glass		Glass
Packing and Insulating materials		Porcelain, Stoneware, Marble, Slate, etc.
		Asbestos, Fibre, Felt, Synthetic resin products, Paper, Cork, Linoleum,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

.

Machine components:

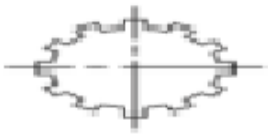
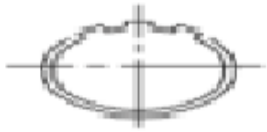
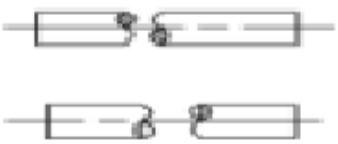
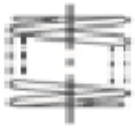
When the drawing of a component in its true projection involves a lot of time, its convention may be used to represent the actual component. Figure below.shows typical examples of conventional representation of various machine components used in engineering drawing.

Table 1.2 Conventional representation of machine components

Title	Subject	Convantion
Straight knurling		
Diamandknurling		
Square on shaft		
Holes on circular pitch		
Bearing		
External screw thread (detal)		
Internal screw thread (detal)		
Screw threads (Assembly)		

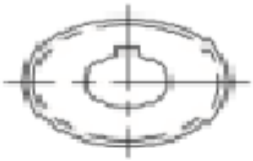
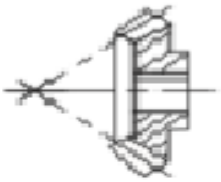
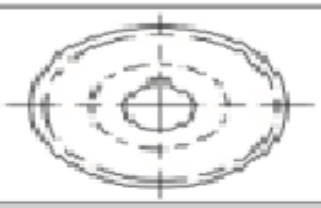
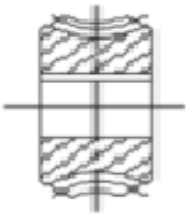
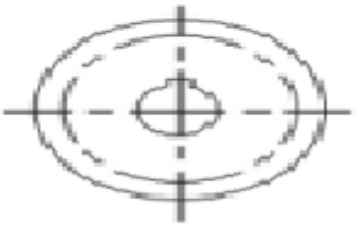
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Conventional representation of machine components (Contd .)

Title	Subject	Convantion
Splined shaft		
Interrupted views		
Semi-eliptic Leaf spring		
Semi-eliptic Leaf spring with eyes		
	Subject / Convention / Diagrammatic Representation	
Cylinderical compression spring	  	
Sylinderical tension spring	  	

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Conventional representation of machine components (Contd .)

Title	Subject	Convantion
Spur gear		
Bevel gear		
Worm gear		
Worm		

1.3 Requirements of drawings

1.3.1.Drawing Symbols and Standards

Drawing **Symbols**

The basic symbol is shown in Figure 3.1. The dimensions of surface texture symbols are shown in Figure 3.2. Sloping lines in the symbol are at 60 degree to the horizontal.

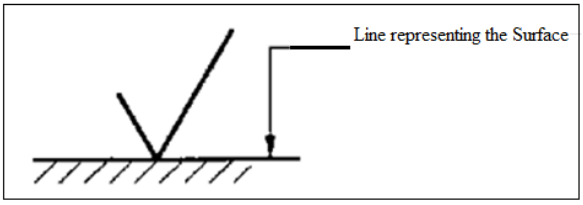


Fig :-1.3.1 Basic symbols

The following modifications may be made to the basic symbol:

a. The symbol to be used where machining is mandatory shall be the basic symbol with a bar added, as shown in Figure 3.3.

This symbol may be used alone to indicate that a surface is to be machined without defining either the surface texture or the process to be used.

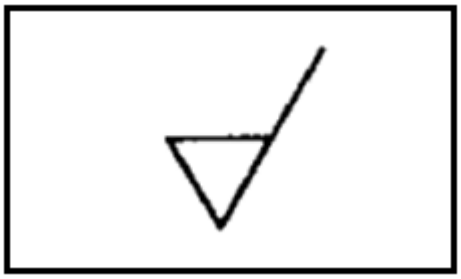


Fig:-1.3.2symbols when machining mandatory

(b) The symbol to be used when the removal of material is not permitted shall be the basic symbol with a circle added, as shown in Figure 3.4. This symbol may be used alone to indicate that a surface is to be left in the state resulting from a preceding manufacturing process.

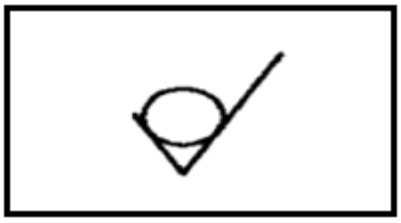


Fig:-1.3.3 Symbol when material Remove is not permitted

Extension of symbols When special surface characteristics are to be indicated may be extended by adding a line of appropriate length to the long leg, as shown below

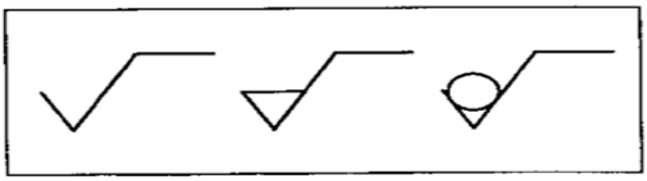
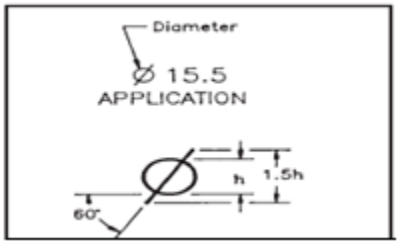


Fig:-1.3.4. Extension for symbols for special surface characteristics

1.3.2 General symbols

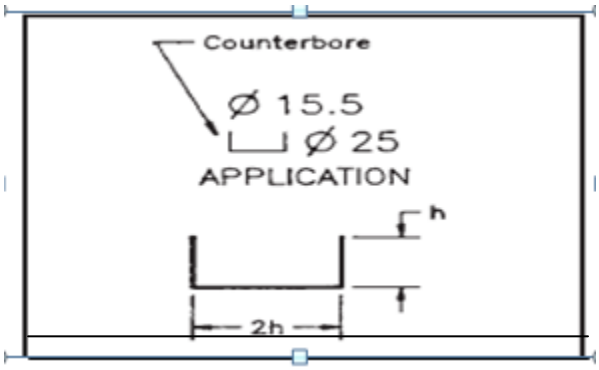
General symbols are used with dimensions to clarify the requirement defined by a dimension value and to minimize the number of words or abbreviations placed on a drawing.

1. **Diameter**:- A diameter symbol is placed in front of any dimension value that is a diameter.



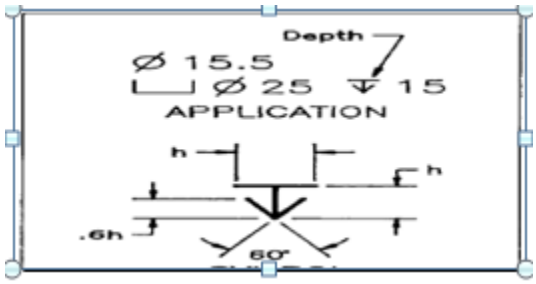
Fig;- 1.3.5 symbols of Diameter

2. **Counter bore Symbol**:- A **counter bore** symbol combined with a diameter symbol is placed in front of a specified counter bore or spot face diameter.



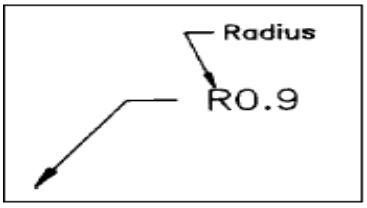
Fig;-1.3.6 symbols of Counter bore

3. **Depth**:-A downward-pointing arrow is used for the depth symbol, and it is placed in front of the depth value in such applications as for counter bore and hole depths.



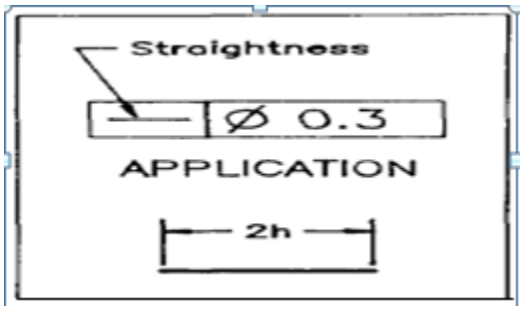
Fig;-1.3.7 symbols of Depth

4. **Radius**:- *The letter **R** is placed in front of any value that indicates a radius dimension.*



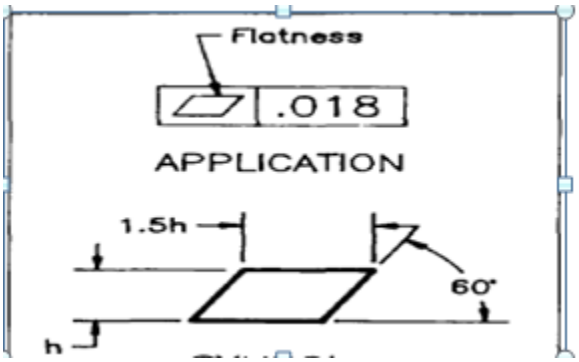
Fig;-1.3.8 symbols of Radius

5. **Straightness**:-A **straight line** is used to indicate a Straightness requirement. It is only applied in a feature control frame, and maybe used to control straightness of surface elements. It may also be used to control the straightness of an axis or center plane.



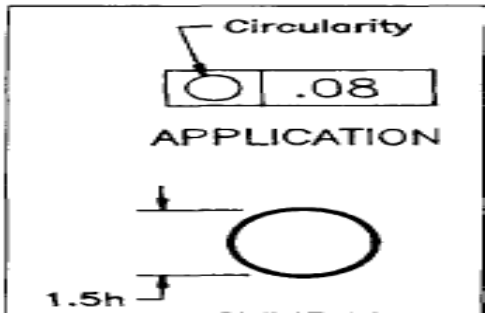
Fig;-1.3.9 symbols ofStraightness

6. **Flatness**:- The **flatness** symbol appears as an oblique view of a square surface. See Figure 13. This symbol is used in feature control frames and is only used to control the form variations on flat features.



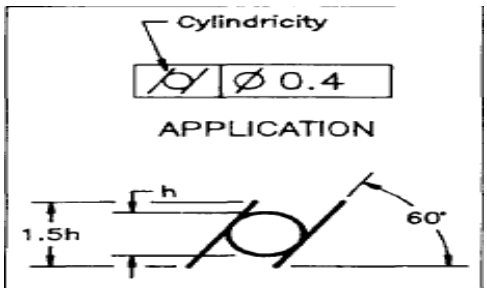
Fig;-1.3.10 symbols ofFlatness

7. **Circularity:-Circularity** is indicated by a circle. It controls the amount of form error permitted on the surface of a circular feature at individual cross sections.



Fig;-1.3.11 symbols ofCircularity

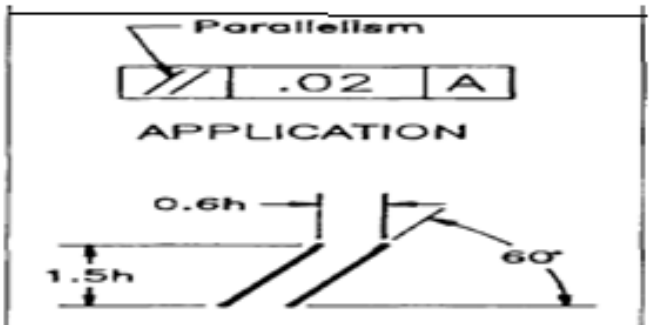
8. **Cylindricity**:- This symbol is a circle with two parallel lines drawn tangent to the circle. It is used to control the surface errors on a cylindrical feature. It simultaneously



Fig;-1.3.12 symbols ofCylindricity

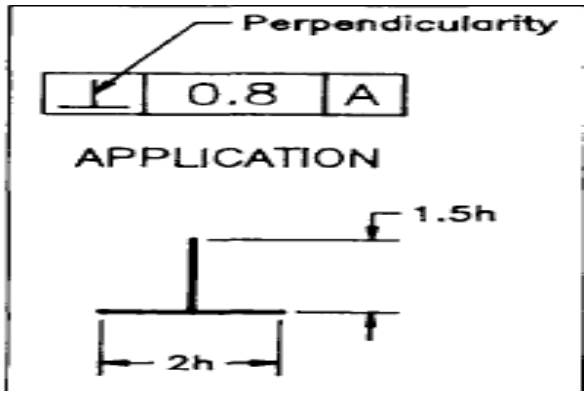
9. **Orientation -** Orientation **tolerance** symbols include **parallelism, perpendicularity,** and **angularity:**

- **Parallelism**–;Parallelism is indicated by two parallel straight line



Fig;-1.3.13 symbols of Parallelism

- **Perpendicularity** – Perpendicularity is indicated by two perpendicular lines



Fig;-1.3.14 symbols of Perpendicularity

1.3.3Drafting Equipment and Drawing Instruments

*1.3.3.*1 Types and uses of drafting equipment

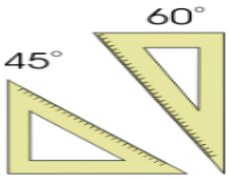
T-Square is use to draw horizontal lines. They are especially useful when constructing accurate orthographic drawings or architectural drawings. A T-Square is normally used with a drawing board, set squares and clips. It must be pushed firmly against the edge of the drawing board when it is being used. If successive usage of T-square, a recommendation for cleaning is a must. To wipe out pencil residues and dirt molecules attached on the instrument cause of continuous

friction. The proper usage of a T-square is to position the blade along the horizontal age of the board and not the vertical position.



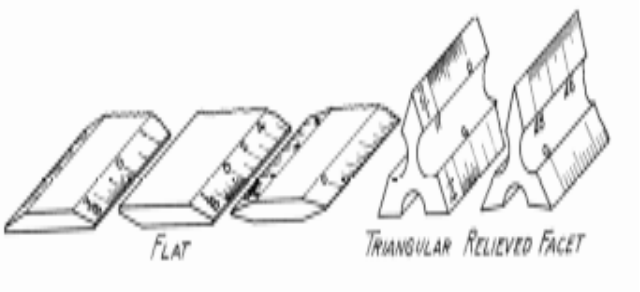
Fig;- 1.4.1 T-Squares

Set Squares are used to draw accurate angles. When using set squares they should always used along with a T-Square. The Set-square rest on the straight edge of the T-Square and this ensures when the angle is drawn that it is accurate. Apply pressure from your hand when using the set square. You can also draw lines vertically from the edge of the t-square.



Fig;- 1.4.2 Set Squares

Scale is use in converting of lines, objects or building from original size to the size that will fit on the drawing paper or tracing paper. Which it is convenient and readable for a draftsman or end user. The scale at which the drawing is to be made may depend upon three things: first the size of the paper on which the draftsman wishes to work; second the size of the building or detail to be drawn; third, the amount of detail that is desirable to show in the drawing. The usage of these instrument is very important in making floor plans.



Fig;- 1.4.3*Scale*

Paper sizes are very important material to be distinguished and it is use for the drawing of details. For drawing exercises, recommended paper size is essential for a student to use to consider economical aspects.

Table 1.1 Preferred drawing sheet or*Paper sizes*

.

Designation	Dimension (mm)
A0	841 × 1189
A1	594 × 841
A2	420 × 594
A3	297 × 420
A4	210 × 297

Tracing paperis a thin white transparent paper for general use where one drawing is to be made over another. But if ink was applied then you cannot use again. These material is expensive and a beginner drafter or students are not advise to use this paper for practice purposes. Use only tracing paper for final presentation of your outcome drawing. Tracing paper is an important material for blue printing.



Fig- ***1.4.4*** *Tracing paper*

Board clipsare used to hold the drawing paper in position. They simply clip on to the board holding the paper firmly against the drawing board. The disadvantage of using board clips is it obstruct the movement of the T-square or the set squares in use during working drawing. Occasionally tear off the edge of the drawing paper if not properly detached after using the said material.

Pencil sharpeneris use for sharpening pencils. You can use electrical and manual heavy duty pencil sharpener. Be cautious in using these tool so that your pencil will not be consumed rapidly.

Drawing Pencilsis use to produce quick drawings and shading. On the other hand, when drawing precisely a 2H or even a harder pencil such as a 4H is ideal. This type of pencil keeps its sharp edge for longer and produces very fine lines. The proper way of using these instrument is to

gradually roll the tip of the pencil as you go along drawing a line. The purpose of rolling the tip of your pencil is to maintain the thickness of your drawn line and also not to flatten the tip of the pencil and so that you can avoid successive sharpening of your pencil to avoid deterioration of your instrument.

Refillable pencilis very useful especially if you are constructing a drawing that needs a constant thickness of line. The refills are available in a range of thicknesses and either hard or soft leads.

Ink fountain pencan be used for producing 'fancy' styles of writing. Often the pens can be bought with a variety of 'nibs' as a set. These can be used to draw / write in a vast range of styles. This type of writing is called 'Calligraphy'. Ink pens are rarely used now as word processing software can be used to produce accurate styles of writing in a range of fonts.

Fine penis use in final stage of your working drawing. A common concept in preparing drawing is using a fine pencil for you can easily edit when mistakes occurs, but when fine pen is applied then it is very difficult to erase though there is an eraser to use for it. Some marks is visible even erasure was being done. Fine pen ink is used to draw permanent, accurate and final drawing works. Fine pens are available with various thicknesses of 'tips'. They are especially useful for printing and placing notes alongside designs and sketches. They are also used for producing the final outline of a design.

Erasersare being used for cleaning off light lines or soiled places. Pencil outlines are very easy to wipe out and eventually not leaving any mark. For permanent markings, eraser for this purpose is recommended but sometimes leave markings and it will contribute bad image of your final result of your drawing work. Special eraser particles are available to help reduce smudging and to keep the drawing and your equipment clean. Use this material sparingly since too much can cause your lines to become fussy. Cleaning powders are not recommended for use on ink drawings.

Circle templateis use for drawing small circles and are difficult to draw it using a traditional compass because the compass can easily slip on the paper. With a template, the circle diameter is selected and a sharp pencil is used to draw round the cutout circle. These instrument is also recommended to use for final drawing or inking procedure.

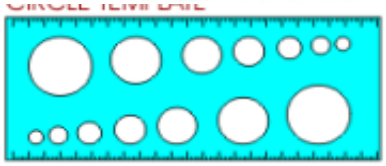


Fig-1.4.5 *Circle template*

Ellipse templateissimilar to circle templates and these material is useful for drawing ellipse / oval shapes accurately. Just make sure to observe distance of the tip of your pen from the edge of ellipse guide to avoid ink blots. This is also effective only on a small curvature.

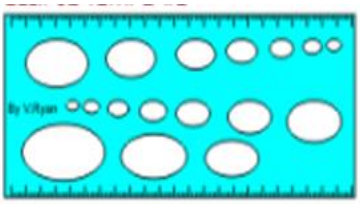


Fig-1.4.*5Ellipse template*

French Curvesare being used to draw curves by finding the section of curve that matches the desired shape on the profile of the curve. Some French Curves also have either circles or ellipses of various sizes cut out. These can be used in the same way as circle or ellipse templates especially in irregular curve outlines.

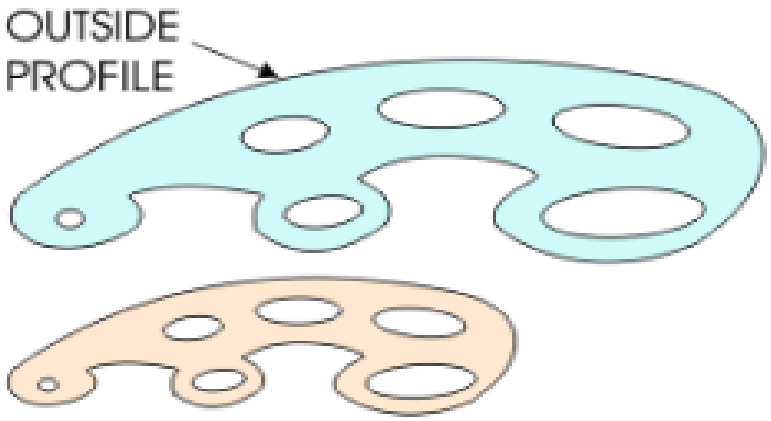


Fig -1.4.6*French Curves*

Compass is use for drawing big diameter circles very accurately. Sometimes compass can be used in drawing small circle but very often to commit error. It recommends more practice to obtain accuracy of these tool. Cheap compasses tend to slip on the paper and break quite easily.

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A good, quality compass set will last a life time. Compasses are used to draw circles and arcs. However, using a compass can be time consuming if small diameter of a circle is to be considered. A compass is especially useful for large circle or arcs. Keep both the compass needle point and lead sharp. The points are removable for easy replacement.

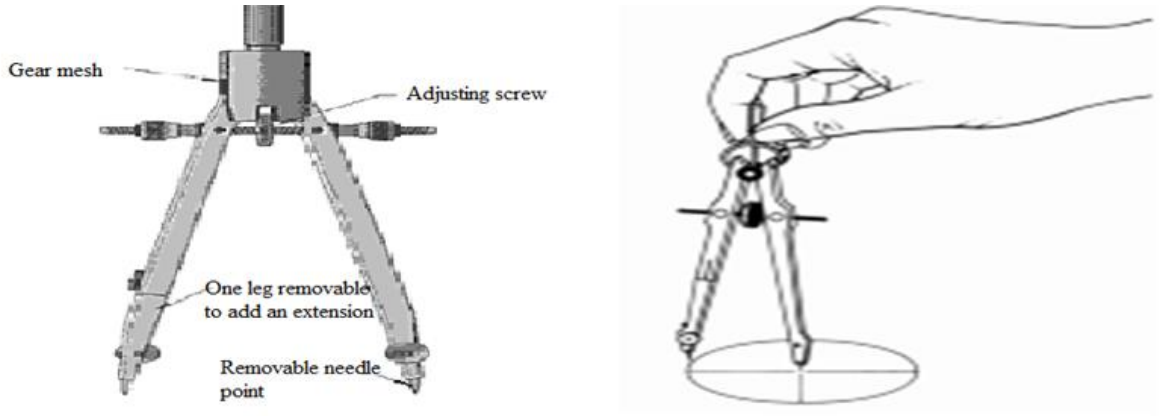


Fig-1.4.7 *Compass*

Compass Adaptor is use in your final drawing of circles or curves. These instrument is being attached in one leg of a compass and also a pen simultaneously.



Fig-1.4.8 *Compass Adaptor*

Dividers are used to transfer dimensions or to divide a distance into a number of equal parts. It also step off equal distances or to divide a line or space into equal parts. Observed strictly that do

not try to use dividers as a compass. A good divider should not be too loose or too tight. It should be easily adjustable with one hand. In fact, you should control a divider with one hand as you lay out equal increments or transfer dimensions from one feature to another.

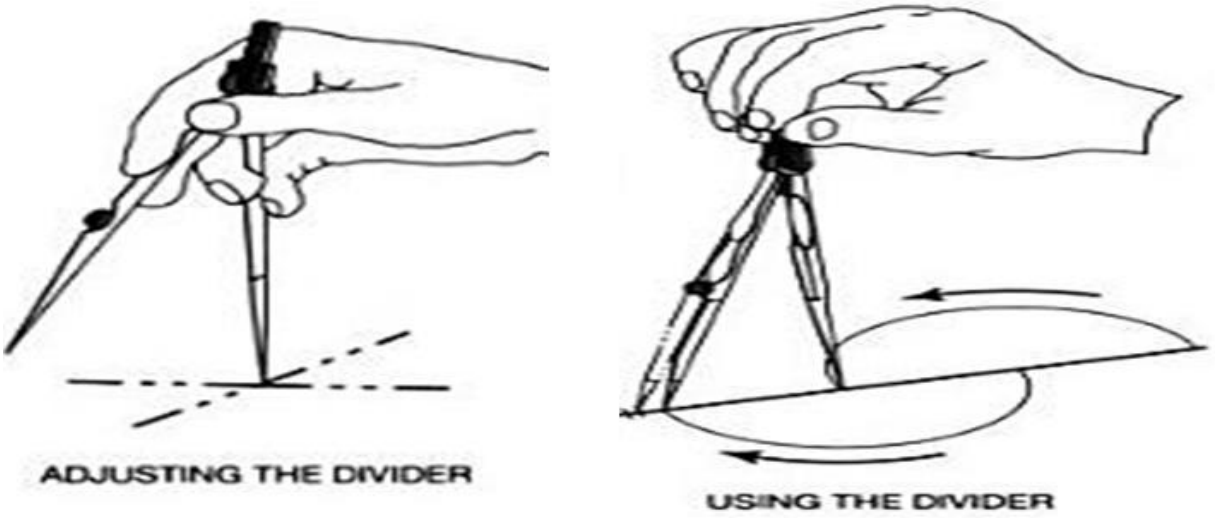


Fig-1.4.9 *Divider*

Protractoris use to measure angles. This piece of instrument is not only used in graphics for constructing accurate drawings but is also used in subjects like Mathematics.

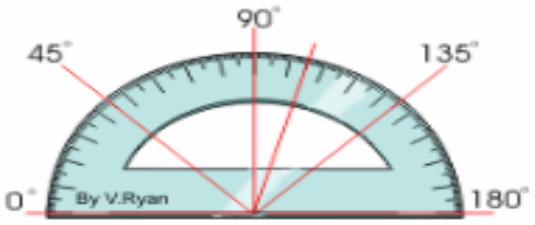


Fig-1.4.10 *Protractor*

Type anduses of drawing instruments

Drawing Table/Board-This has different dimensions that depends on the needs of a drafter. This should be a perfectly smooth flat board of soft wood or metal are made in such a way that it cannot warp or split. All angles should be perfectly true and smooth. The drawing board should be smooth and free from any hard particle.

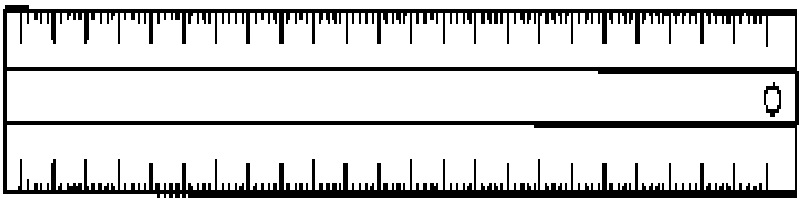
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Fig;-1.4.2.1*Drawing Table/Board*

A ***ruler***is possibly one of the most important pieces of drawing equipment. Be remembered that the edge of a ruler is not guaranteed to have a perfectly straight edge unlike a good T-Square or set square. The recommended material for a ruler is a plastic but for cutting purpose, it is advisable to use a metal ruler. Recommended maximum dimension of a ruler is 12 inches and it is commonly known as one foot ruler.

A ***ruler***is possibly one of the most important pieces of drawing equipment. Rulers should only to used to measure distances with lines being drawn with T-Squares and Set Squares. However, most people use rulers to draw straight lines. But it must be remembered that the edge of a ruler is not guaranteed to have a perfectly straight edge unlike a good T-Square or set square.



Fig;- 1.4.2.2*ruler*

Drawing Pencils are a basic requirement of any graphics course. You need a number ranging from 2B to 2H. These letters refer to the hardness of the pencil lead. When sketching a soft lead such as 2B is can be used to produce quick drawings and shading. On the other hand , when

drawing precisely a 2H or even a harder pencil such as a 4H is ideal. This type of pencil keeps its sharp edge for longer and produces very fine lines.

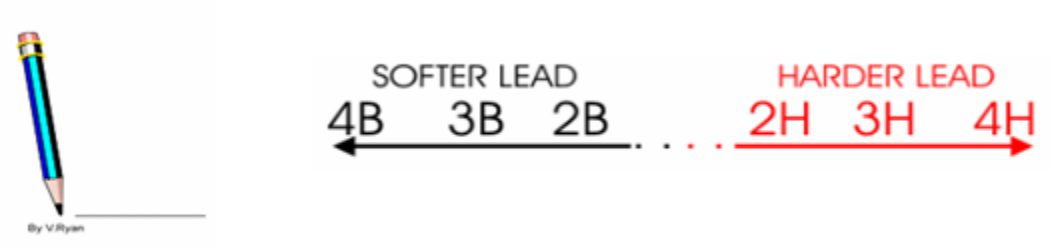


Fig-1.4.2.3 *Drawing Pencils*

Using measuring instruments

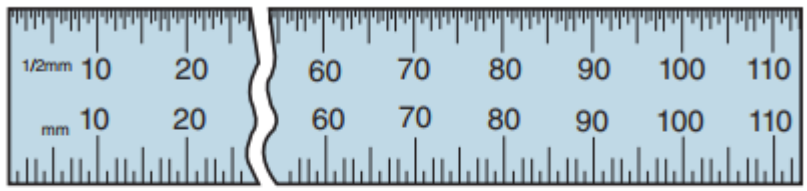
Measuring tools are instruments used to determine lengths and angles. They follow two systems. They are the US customary system and the International System (SI), commonly referred to as metric. US customary rulers and scales measure feet and inches. Smaller units are measured in fractions of an inch.

Rulers

A ruler that is in good condition is a practical instrument for measuring shorter, straight lines (linear lines). We can measure millimetres and centimetres with a ruler. A ruler is not suitable to measure long lengths and round shapes. **Figure 2.1** below present the typical type of ruler used for measurement.

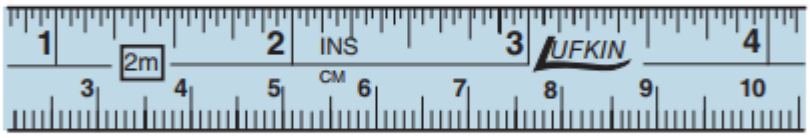


Figure 2.1.Rurle



A—US Customary Rule

B—Metric Rule



C—Combination Rule

Lufkin Division—The Cooper Group, The L.S. Starrett Co.

Figure Rule measuring units. Use the system designated on the working drawings. A—US customary. B—Metric. C—Combination of both units.

1.4 Establishing relevant personnel.

The trainee will be tested for his skill, knowledge and attitude during the period of the unit of competence and at the end of the training program as notified by the collage registrar. Then, relevant personnel is instructor himself. By apply professional knowledge, core skills & performing the work. Assessment will be conducted using assessment criteria.

- Relevant personnel may include, but is not limited to:
  - ✓ Supervisor
  - ✓ Technical personnel
  - ✓ Manufacturers
  - ✓ Suppliers
  - ✓ Contractors
  - ✓ Customers

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Definition of Supervision:

"Supervision is getting the job done through others."

This classic definition of supervision states the relationship between supervisors, subordinates, and work. However, it doesn't explain how to be a delegator, a decision maker, a coach, an instructor, a motivator, or most importantly, a leader. The skills of good supervision are new to most people when they are asked to lead for the first time. To be successful as a leader, the new supervisor needs to consider three broad areas:

Administrative:

The new supervisor is accountable for many organizational procedures that subordinates don't have to consider. These include daily reports, monitoring time and attendance, budgeting, work orders, transmitting management directives and bulletins, and a host of other types of information.

Technical:

New supervisors have demonstrated their proficiency in technical skills in order to be promoted to supervision. However, as a leader becomes more involved in supervision, the amount of time available for doing technical tasks decreases and the amount of time spent helping others increases. Supervisors eventually find themselves helping people with tasks that they themselves have never done.

Interpersonal:

Becoming an effective supervisor involves learning a whole set of leadership skills. Prior training both on the job and in school probably hasn't covered the interpersonal skills of leadership. New supervisors need to look to role models and mentors for tips on leadership behaviors. They also need to examine their own personal styles and consider the changes they need to make for their own growth and development. As an exercise in defining supervision, think about all the different tasks that are part of the supervisor's job. Make a list of these tasks on the next page and discuss them with your manager. Ask if you will actually be evaluated on how well or poorly you perform each task.

Supervisory Duties:

Planning and Organizing: Lay out the work and decide how to handle it.

Processing the Work: Assign the work and supply what your employees need to get the job done.

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Controlling the Operation: Keep the work up to standards and check on costs and materials.

Administering Rules:

See that conduct and procedures are done according to the rules.

Keeping People Informed:

Talk with and listen to staff - up and down the line.

Making Improvements:

Find better ways for doing the work and solve job problems.

Handling Personnel Matters:

Administer leave time, benefits, pay, change of jobs, overtime, and other personnel functions.

Training and Development:

Break in new people, build morale, plan replacements.

Monitoring Safety and Security:

Prevent trouble. Deal with accidents and illnesses. Safeguard equipment and supplies. **Serving as Representative:**

Act for the group or the organization as required."

Manufacturers /Manufacturing Drawings/

Manufacturing drawings communicate engineers' ideas in a clear way and inform machine operators and production workers how a certain product is manufactured and assembled. They're greatly important in the production process, but, due to their highly detailed nature, they require a lot of time and attention. Because of this, many engineers and entrepreneurs take advantage of the manufacturing drawing services we offer here at Cad Crowd. Our freelancers are experts in this type of illustrative material and can assist you in creating informative manufacturing drawings that comply with international standards.

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Self-Check–1

Part I - Choose the best answer.

Directions: Answer all the questions listed below.use the answer sheet provided in the next page:

1, which of not included about required for drawing.

A, Scales B, Protractor C, Drawing pencils D, non of the above

2. _____ is a specialized ruler designed to facilitate the drafting and measuring of architectural drawings, such as floor plans and orthographic projections

A, protractor B, architect's scale C,Drafting Pencils

3. Relevant personnel may include, _____

A. Supervisor Technical B. personnel C. Manufacturers D. Suppliers E. all

4._____is use to measure angles

A, Rule B, Protractor C, Drawing pencils

5. The recommended A4 paper size is _____

A,841*1189 B, 210*297 C, 297*420 D.594*841

Part II - True or False

Directions: II- Say true if the statement is true and false if the statement is false.

1- T-Square is a technical drawing instrument used by draftsperson
2- Engineering drawing hasn't a set of rules and regulations for it to operate correctly
3- Technical is New supervisors have demonstrated their proficiency in technical skills in order to be promoted to supervision
4- Making Improvements is Find better ways for doing the work and solve job problems.
5- *Dividers* are used to transfer dimensions or to divide a distance into a number of equal parts.

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<u>Part III</u>–write Short answer

Directions - Give short answer to the following questions

1- What are the definitions of engineering drawing?
2- List down the basic requirements of engineering drawings?
3- Explain purpose of 3 or more drawing instrument must be needed engineering drawing?

Direction- IV- Matching the column A to column B

A	B
1,  1._____	a. Square on shaft
 2._____	b.Holes on circular pitch
 3._____	c.Glass
 4.____	d. Splinted shaft

Unit Two: Prepare drawings

This unit to provide you the necessary information regarding the following content coverage and topics:

- drafting principles.
  - ✓ Local standards
  - ✓ International standards
- dimensions, notes and specifications
- complete drawings.

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Apply ***Drafting principles***
- Indicate dimensions, notes and specifications
- Present Completed drawing

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2.1. Applying drafting principles

Introduction

Engineering drawings are to be prepared on standard size drawing sheets. The correct shape and size of the object can be visualized from the understanding of not only the views of it but also from the various types of lines used, dimensions, notes, scale, etc. To provide the correct information about the drawings to all the trainee, the drawings must be prepared, as the following certain standard practices.

2.1.1 Drafting principles to be applied in the preparation of drawing

- **Drawing sheet /paper**

Engineering drawings are prepared on drawing sheets of standard sizes.

Sheet size

Table 2.1.1 Preferred drawing sheet sizes (First choice) ISO-A Series

Designation	*Dimensions* (mm)
A0	841 × 1189
A1	594 × 841
A2	420 × 594
A3	297 × 420
A4	210 × 297

For this Module, we use 210mm X 297mm sized paper or A4 for the assignments or class works.

2.1.2Local Standards

A standard established in a specific area or country national level Standards can be industrial product specification and work proceduresdepending on product type .same country's can havetheir own standards example India country

2.1.3International Standards

There are many different standards for drawings, some of the more common ones are as follows: British standards BS 8888:2006 Specification for defining, specifying

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and graphically representing products.

The ISO Drawing standard of which Part 1 covers technical drawings in general including:

- ISO 128-20:1996 Technical drawings — General principles of presentation Basic conventions for lines
- ISO 128-21:1997 Technical drawings — General principles of presentation Preparation of lines by CAD systems
- ISO 128-22:1999 Technical drawings — General principles of presentation Basic conventions and applications for leader lines and reference lines
- ISO 128-23:1999 Technical drawings — General principles of presentation Lines on construction drawings Key Learning Points Identify why international drawing standards are used
- Identify the key international drawing standards Industrial Insulation Standard Drawing Conventions Revision 2.0 September 2014
- ISO 128-24:1999 Technical drawings — General principles of presentation Lines on mechanical engineering drawings
- ISO 128-25:1999 Technical drawings — General principles of presentation Lines on shipbuilding drawings
- ISO 128-30:2001 Technical drawings — General principles of presentation Basic conventions for views
- ISO 128-34:2001 Technical drawings — General principles of presentation Views on mechanical engineering drawings
- ISO 128-40:2001 Technical drawings — General principles of presentation Basic conventions for cuts and sections
- ISO 128-44:2001 Technical drawings — General principles of presentation Sections on mechanical engineering drawings
- ISO 128-50:2001 Technical drawings — General principles of presentation: Basic conventions for representing areas on cuts and sections

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- ISO 129:1985 Technical drawings — Dimensioning — General principles, definitions, methods of execution and special indications
- ISO 406:1987 Technical drawings — Tolerancing of linear and angular dimensions
- ISO 2553:1992 Welded, brazed and soldered joints — Symbolic representation on drawings ASME drawing standards including
- ASME Y14.1- Imperial drawing sheet size and format
- ASME Y14.1M- Metric drawing sheet size and format
- ASME Y14.100- Engineering drawing and practices
- ASME Y14.2- Line conventions and lettering
- ASME Y14.3- Multi-view and sectional view drawings
- ASME Y14.4- Pictorial drawings o ASME Y14.5- Dimensioning and Tolerance
- ASME Y14.24- Types and applications of Engineering drawings
- ASME Y14.34- Associated lists o ASME Y14.35- Drawing revisions
- ASME Y14.38- Abbreviations o ASME Y14.41- Digital product definition drawing practices
- ASME Y14.42- Electronic approval systems

2.2. Dimensions, notes and specifications

2.2.1. Dimension

Definitions

- Dimension line is a thin line, broken in the middle to allow the placement of the dimension value, with arrowheads at each end Dimensioning Drawing
- An arrowhead is approximately 3 mm long and 1 mm wide. That is, the length is roughly three times the width.

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 finish, type of material, etc. The

expression of these features on a drawing, using lines, symbols, figures and notes is called dimensioning.

General principle: 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 center line should be avoided except when the centre line passes through the center 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

An extension line extends a line on the object to the dimension line. The first dimension line should be 151 approximately 12 mm (0.6 in) from the object. Extension lines begin 1.5 mm from the object and extend 3 mm from the last dimension line.

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. 2.1 and 2.2The following are some of the principles to be adopted during execution of dimensioning:

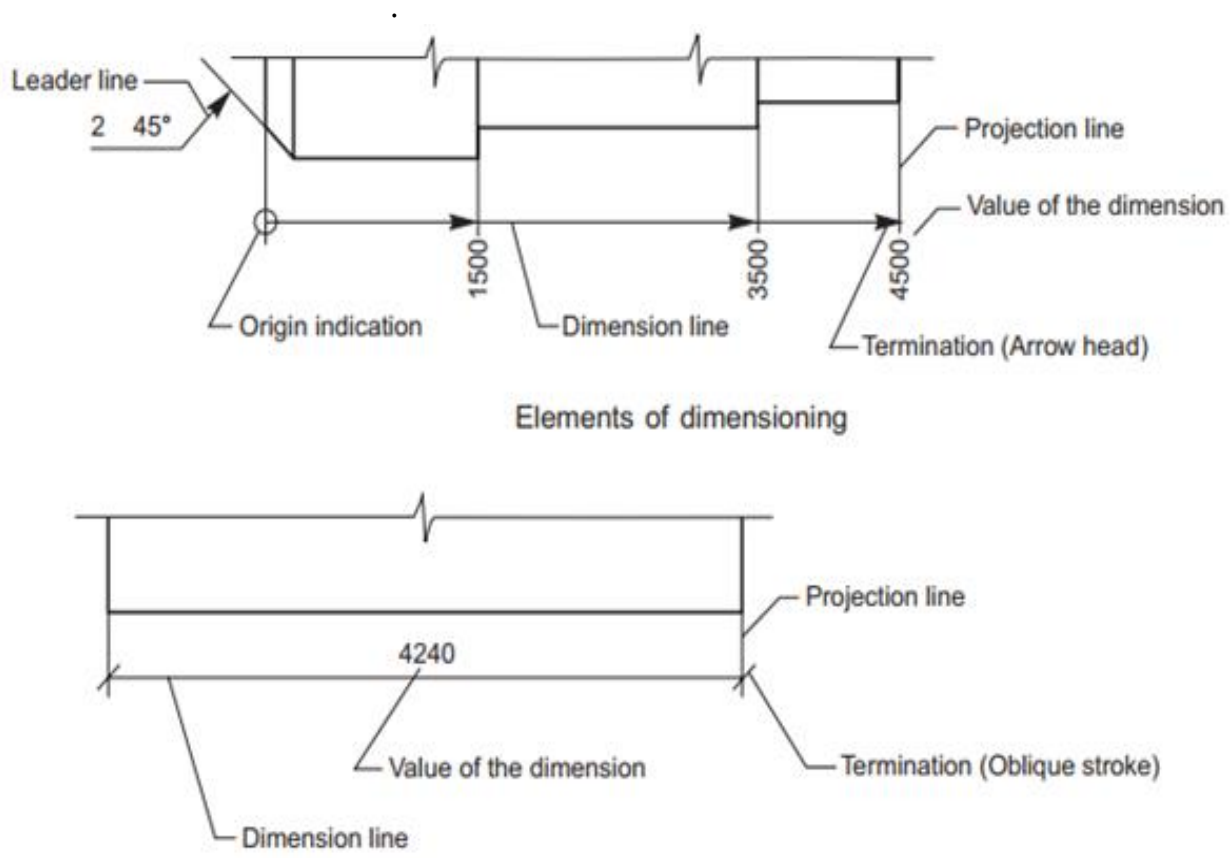


Fig. 2.1 Elements of dimensioning

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 However, they must be in contact with the feature.

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

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

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. 2.31A).

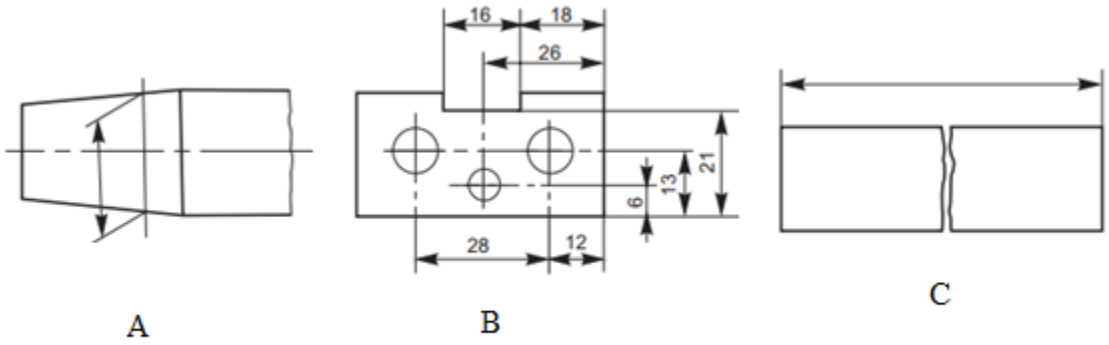


Fig: 2.2 System of Indicting dimension

Methods of indicting dimension

Dimensions should be shown on drawings in characters of sufficient size, to ensure complete legibility. They should be placed in such a way that they are not crossed or separated by any other line on the drawing. Dimensions should be indicated on a drawing, according to one of the following two methods. However, only one method should be used on any one drawing.

Method–1 (Aligned System)

Dimensions should be placed parallel to their dimension lines and preferably near the middle, above and clear-off the dimension line

An exception may be made where superimposed running dimensions are used (

Dimensions may be written so that they can be read from the bottom or from the right side of the drawing. Dimensions on oblique dimension lines should be oriented as shown in Fig. 2.3 Angular dimensions may be oriented as shown in Fig. 2.3

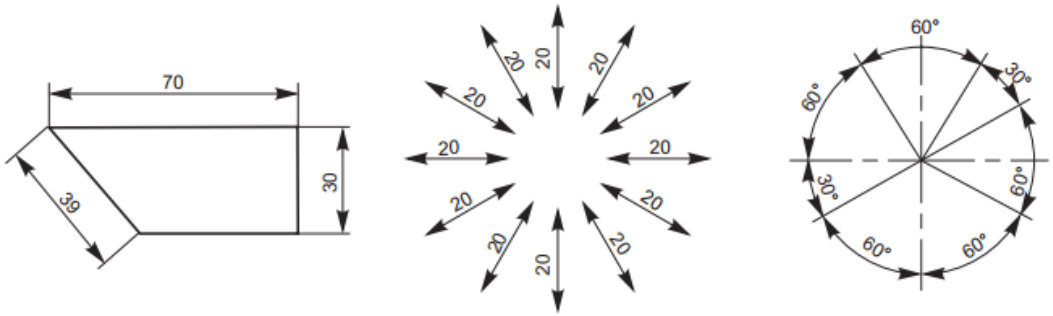


Fig: 2.3 Aligned System

Method–2 (Unidirectional System)

Dimensions should be indicated so that they can be read from the bottom of the drawing only. Non-horizontal dimension lines are interrupted, preferably near the middle, for insertion of the dimension (Fig. 2.4).

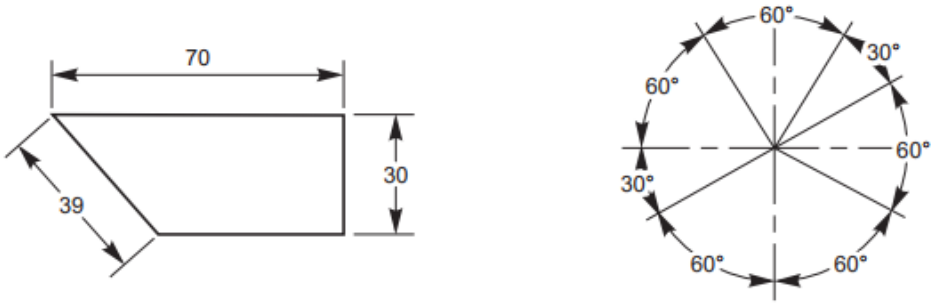


Fig: 2.4 Unidirectional System

Dimensions can be, (*i*) above the extension of the dimension line, beyond one of the terminations, where space is limited or (*ii*) at the end of a leader line, which terminates on a dimension line, that is too short to permit normal dimension placement or (*iii*) above a horizontal extension of a dimension line, where space does not allow placement at the interruption of a non-horizontal dimension line). Values of dimensions, out of scale (except where break lines are used) should be underlined as shown in Fig. 2.5

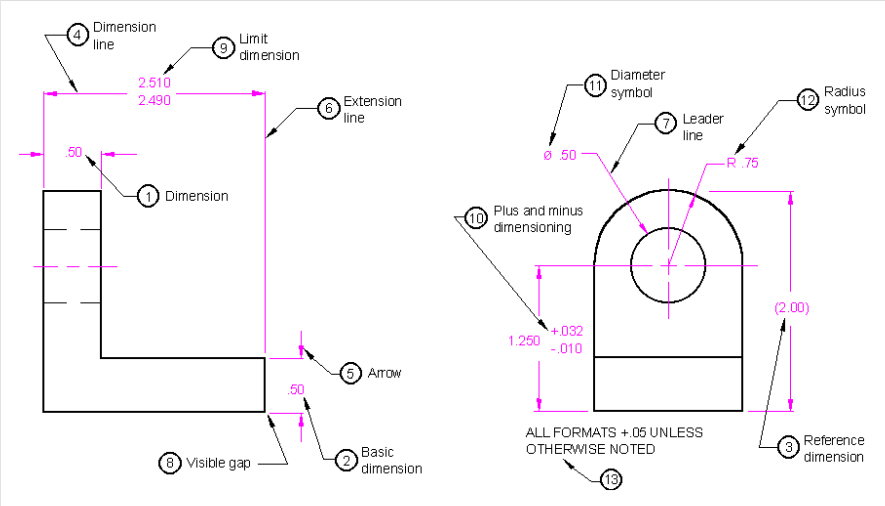


Fig: 2.5 non-horizontal dimension line

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Arrangement of dimensions

The arrangement of dimensions on a drawing must indicate clearly the design purpose. The following are the ways of arranging the dimensions.

Chain dimensions

Chains of single dimensions should be used only where the possible accumulation of tolerances does not endanger the functional requirement of the part (Fig. 2.6).

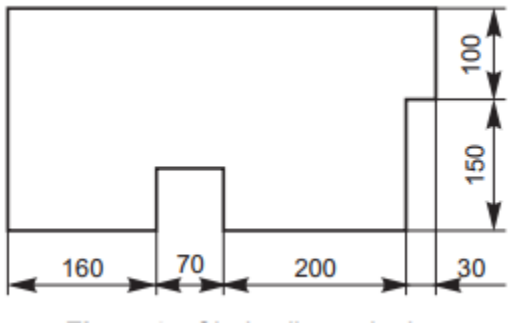


Fig: 2.6 Chain dimensioning

Parallel dimensions

In parallel dimensioning, a number of dimension lines, parallel to one another and spaced-out are used. This method is used where a number of dimensions have a common datum feature

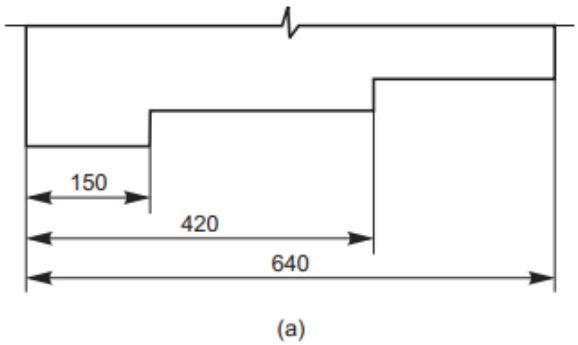


Fig. 2.7 parallel dimensioning

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Super imposed Running dimensions

These are simplified parallel dimensions and may be used where there are space limitations .

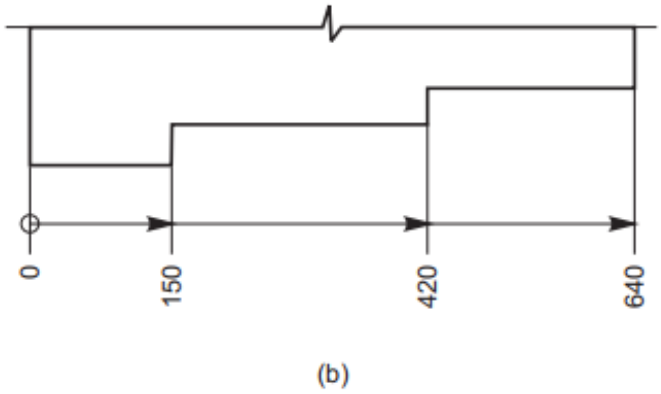


Fig. 2.8 parallel dimensioning

Combined dimension

These are the result of simultaneous use of chain and parallel dimensions

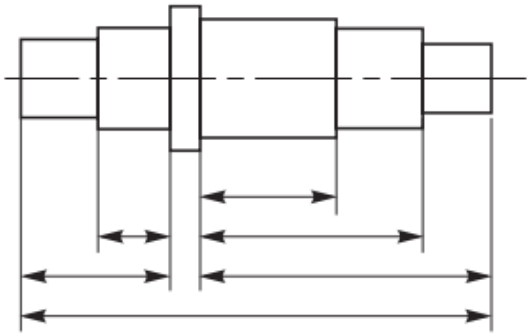
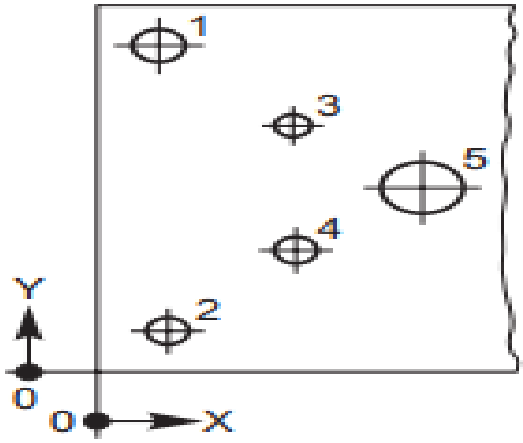


Fig. 2.9 Combined dimensioning

Co-ordinate dimension

The sizes of the holes and their co-ordinates may be indicated directly on the drawing; or they may be conveniently presented in a tabular form, as shown in



	X	Y	ϕ
1	20	160	15.5
2	20	20	13.5
3	60	120	11
4	60	60	13.5
5	100	90	26
6			
7			
8			
9			
10			

Fig. 2.10 Co-ordinatedimensioning

Special Indications

Diameters

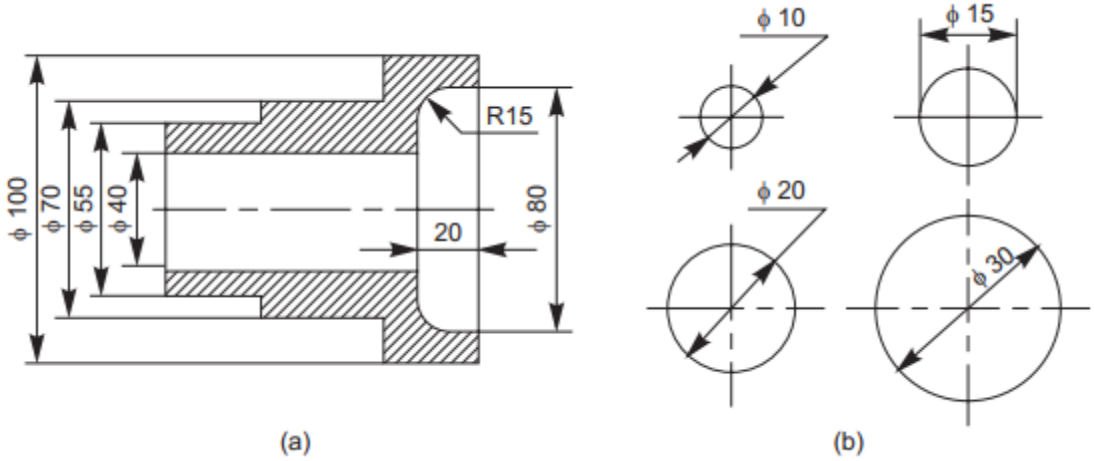
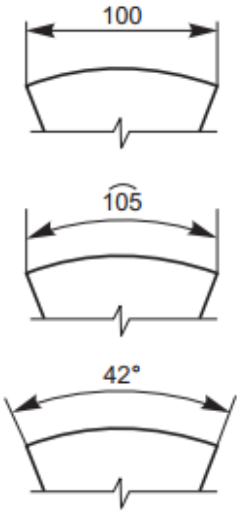


Fig. 2.11 Special Indications

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Dimensioning of chords, arcs radii and angles

Equi-distant features



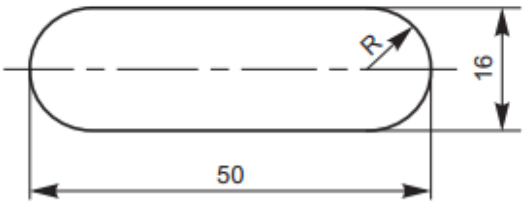


Fig. 2.49 Dimensioning of radius

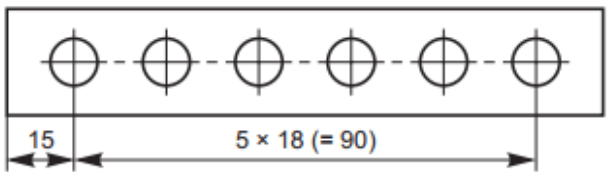


Fig. 2.12Equi-distant features

Chamfer and countersunk

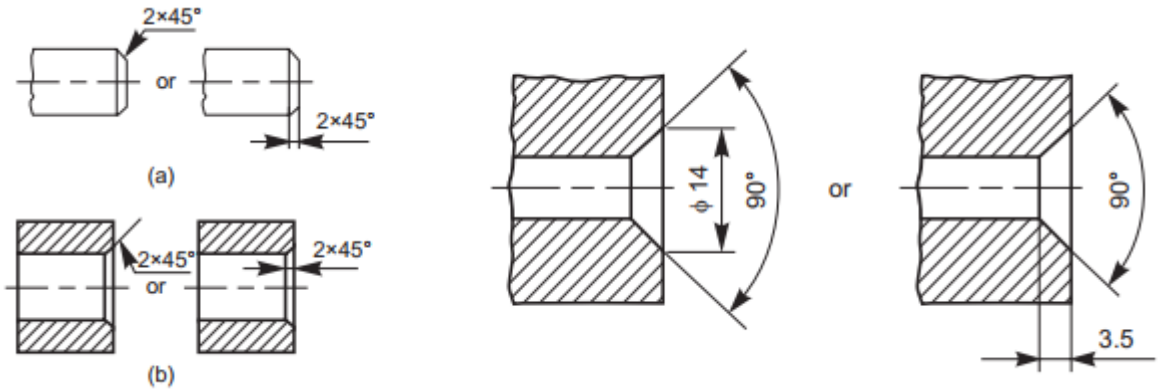


Fig. 2.13 Chamfer and countersunk

2.2.2.Notes on Drawings

Notes on Drawings Information other than pictorial views and dimensions necessary for completing a drawing is classified as “notes.” The two types of note forms are General Notes and

.

Local Character Notes. Notes on a drawing take precedence over specification requirements; hence, notes conflicting with referenced specifications shall not be placed on a drawing unless they are necessary for deviations from certain provisions of the specification.

Notes should always be written horizontally in capital letters and begin above the leader line and may end below also. Further, notes should be brief and clear and the wording should be standard in form. the standard forms of notes and the method of indication, for typical cases is shown below and the meaning of the notes is given in Table

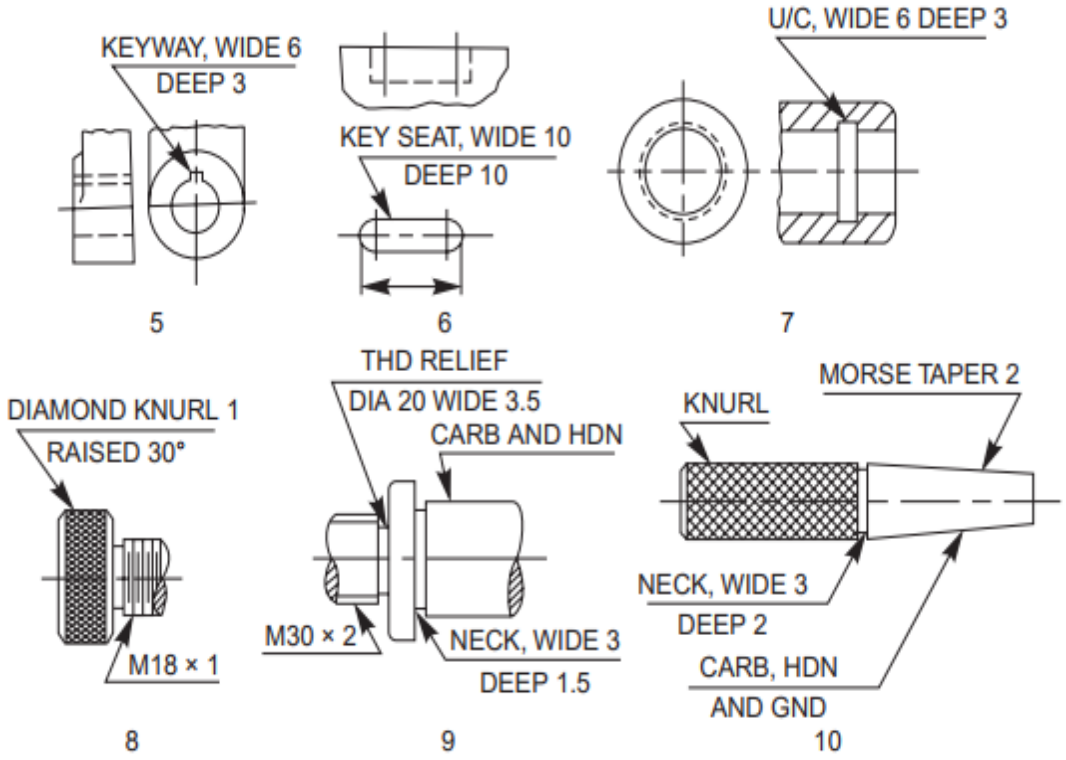


Fig 2.14a- Notes on drawing

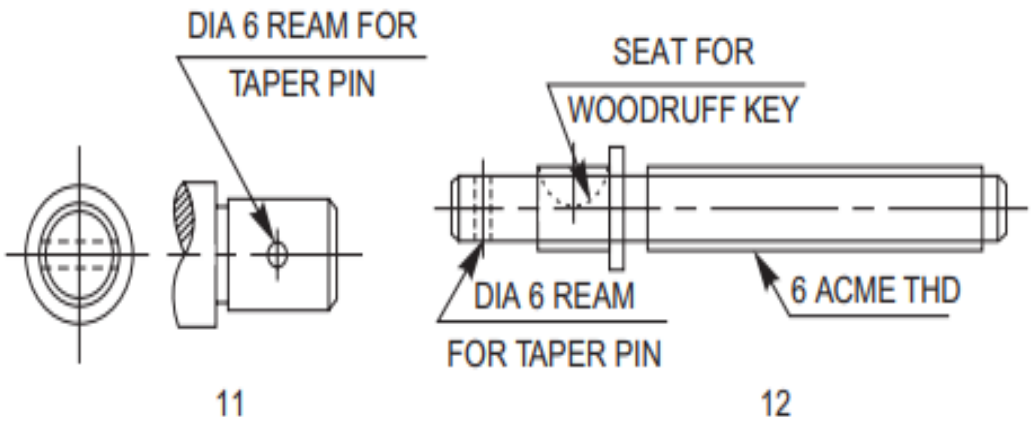


Fig 2.14b- Notes on drawing

Table 2.2.1 Meaning of notes

S.No.	*Note*	*Meaning / Instruction*
1.	DIA 25 DEEP 25	Drill a hole of diameter 25 mm, to a depth of 25 mm.
2.	DIA 10 CSK DIA 15	Drill a through hole of diameter 10 mm and countersink to get 15 mm on top.
3.	4 HOLES, DIA 12 C BORE DIA 15 DEEP 8	Dirll through hole of ϕ 12 mm, counterbore to a depth of 8 mm, with a ϕ 15 mm, the number of such holes being four.
4.	6 HOLES, EQUI–SP DIA 17 C BORE FOR M 16 SOCKET HD CAP SCR	Drill a through hole of ϕ 17 and counterbore to insert a socket headed cap screw of M 16. Six holes are to be made equi-spaced on the circle.
5.	KEYWAY, WIDE 6 DEEP 3	Cut a key way of 6 mm wide and 3 mm depth.
6.	KEY SEAT, WIDE 10 DEEP 10	Cut a key seat of 10 mm wide and 10 mm deep to the length shown.

7. U/C, WIDE 6 DEEP 3	Machine an undercut of width 6 mm and dpeth 3 mm.
8. (*a*) DIAMOND KNURL 1 RAISED 30°	Make a diamond knurl with 1 mm pitch and end chamfer of 30°.
(*b*) M 18 × 1	Cut a metric thread of nominal diameter 18 mm and pitch 1 mm.
9. (*a*) THD RELIEF, DIA 20 WIDE 3.5	Cut a relief for thread with a diameter of 20.8 mm and width 3.5 mm.
(*b*) NECK, WIDE 3 DEEP 1.5	Turn an undercut of 3 mm width and 1.5 mm depth
(*c*) CARB AND HDN	Carburise and harden.
10. (*a*) CARB, HDN AND GND	Carburise, harden and grind.
(*b*) MORSE TAPER 2	Morse taper No. 1 to be obtained.
11. DIA 6 REAM FOR TAPER PIN	Drill and ream with taper reamer for a diameter of 6 mm to suit the pin specified.
12. 6 ACME THD	Cut an ACME thread of pitch 6 mm.

2.2.3Complete drawings.

2.2.3.1 Blue printing

Introduction

In many ways, learning to read a drawing is the same as learning to read a language. Blueprint is the common name of the copies taken from an original drawing, usually drawn on a tracing paper. The copies may be obtained by way of reprographic processes, *viz*., blueprinting, ammonia printing, xerox copying, copy of a photo film, etc., but the colour of the print has nothing to do with the name “blueprint”.

For blueprint reading and understanding the drawing, one must have a thorough knowledge of the principles of drawing and orthographic projections. The knowledge of various manufacturing processes and the sequence of operations required to obtain the finished shape, intended by the designer, also helps in interpreting the drawings.

In this module, the examples chosen help providing guidelines to enable students to understand the shape and size of a component, in the case of component drawings, and also its location, in the case of assembly drawings. While reading the drawings, the details such as shape, size, through dimensions, notes and material to be used, and additional notes to the workman on machining, surface finish, tolerances, etc., are to be noted carefully.

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Examples

Rear tool post

Rear tool post is generally used on capstan lathes, mainly for parting-off operations. It is fixed on the cross-slide in the slots, provided at the rear side of the lathe. Study the drawing shown in Fig. 17.1 and answer the following:

1. What is the overall size of the tool post?— 102mm × 70mm × 62mm
2. How many bolts are provided for fixing the tool, and what is the size of each bolt?—3, M10
3. What type of tool can be used with it?— Parting tool
4. What is the maximum height of the tool holder?— 25mm
5. How many screws are provided to locate the tool?— 2
6. How is the tool holder fixed to the cross slide?— By 2 Nos. of M6 Hex. socket headed set screws
7. What is the purpose of the threaded hole marked ‘X’?— For adjusting the tool height, by means of a screw
8. Explain the note—4 HOLES, M10.—There are three tapped holes in the body to clamp the tool in position by screwsand the fourth tapped hole is at the bottom of the base. The size of the tap is 10mm.

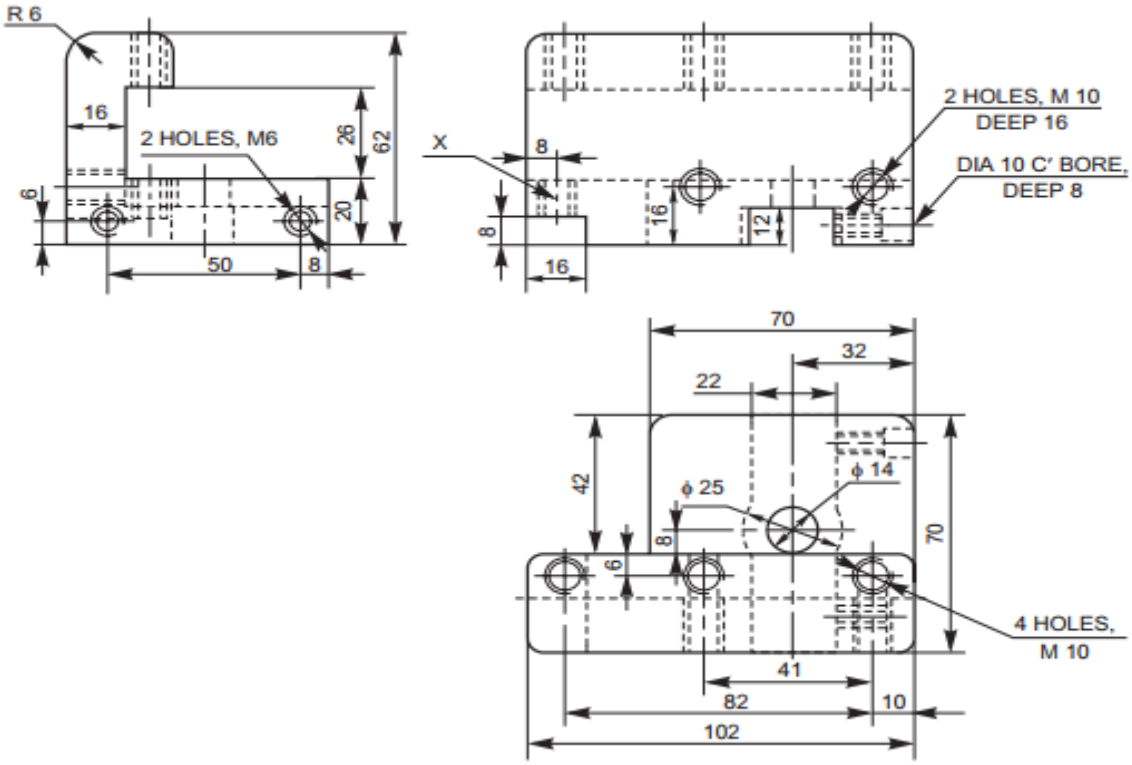


Fig. 2.15. notes on drawing

Tabulated drawing

A tabulated drawing depicts similar items with differences in characteristics such as dimensions, material, finish, and other requirements. These differences are tabulated on the drawing, the fixed characteristics depicted once. Pictorial differences that are not clear should be shown in views or details and should be properly labeled. A tabulated drawing precludes the preparation of an individual drawing for each item. See Figure below.

.

Self check-2

Part-I Matching

Instruction: select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

A	B
---------1. Notes	A. Common name taken for copies
---------2. Parallel Dimension	B. Indian Standard
---------3. ISO	C. Information other thenpictorial views
---------4. Local standard	D. International StandardOrganization
---------5. Blue print	E. Parallel to one another
	F. Used when ruler is too long

Part II: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points.

1. What is the purpose of measurement?
2. Write down the difference between Aligned dimension system and unidirectional systems?
3. Explain Local standards ?
4. Explain ISO standards ?
5. Write down the purpose **of** Notes on Drawings ?

Part III: True or False

Instruction: say true if the statement is true and False if the statement False

1.Parallel dimension lines and perpendicular to each other.

2.British slandered (BS) are grouped under ISO slandered.

3.projection lines and dimension lines should not cross each other.

.

Operation sheet 2.

- **Operation title:** Procedures of Dimensions, notes and specifications
- **Purpose:** To practice and demonstrate the knowledge and skill required system in indicting Dimensions, notes and specifications
- **Instruction:** Use the given figure below (Figure 2.13), the tools and required measuring system in indicting Dimensions, notes and specifications
- For this operation you have given 3Hour and you are expected to provide the answer on the given table.
- **Tools and requirement:**
    1. This operation sheet
    2. Ruler,
    3. Scale
    4. Pencil
    5. Protractor
    6. French curve
- **Precautions:** Measure at least three times before recording the result on the given format
- **Procedures in doing the task**

    Step-1: Use the given figure

    Step-2: Indicate each Dimensions, notes and specifications on drawing with mm

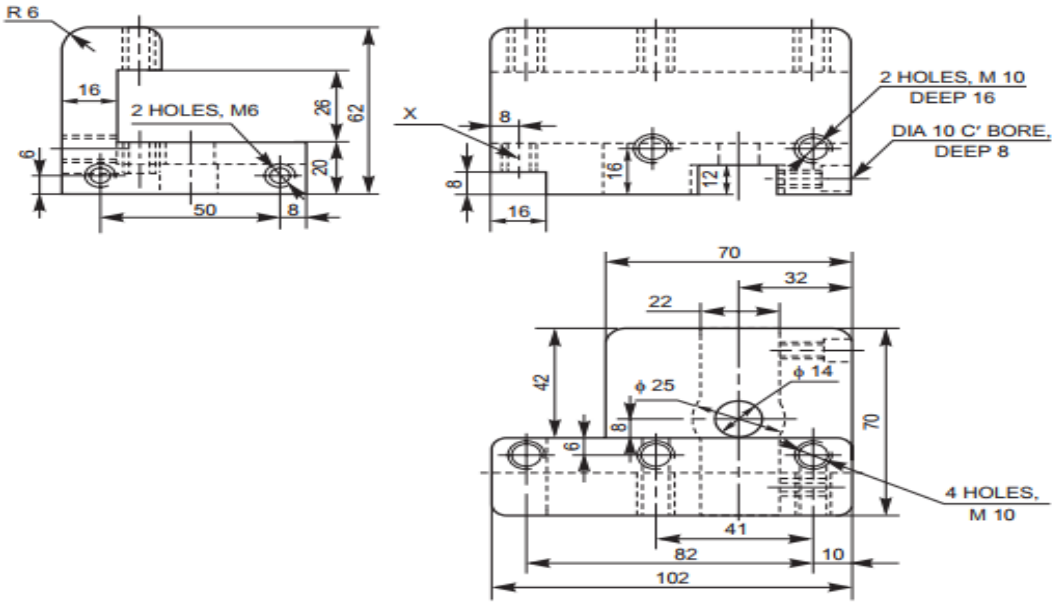


Figure 2.2: Figure given for operation sheet 2.2

Quality Criteria: the given dimensions, and notes are must be visible

Lap Test-2

- Task-1: Perform liner measurement using ruler
- Task-2: Measure dimension
- Task-3: check notes
- Task-4: Record dimensions, and notes standard procedure

Unit three:- Engineering drawing parts list

This unit to provide you the necessary information regarding the following content coverage and topics:

- Component parts and material
- part lists records

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- identify and organize Component parts and material
- complete Parts lists ***records***

.

3.1 Component parts and material

Isometric, orthographic and exploded view drafting

A. Isometric drawing

- Isometric means equal measure.
- Makes equal angle with the principal plane (120^o).
- Is the most commonly used axonometric drawing type.

Isometric drawing is similar to an Isometric projection except that it is not a true axonometric projection, but an approximate method of drawing a pictorial.

Isometric projection is foreshortened by 82% of full size. The Isometric drawing is drawn full size for convenience.

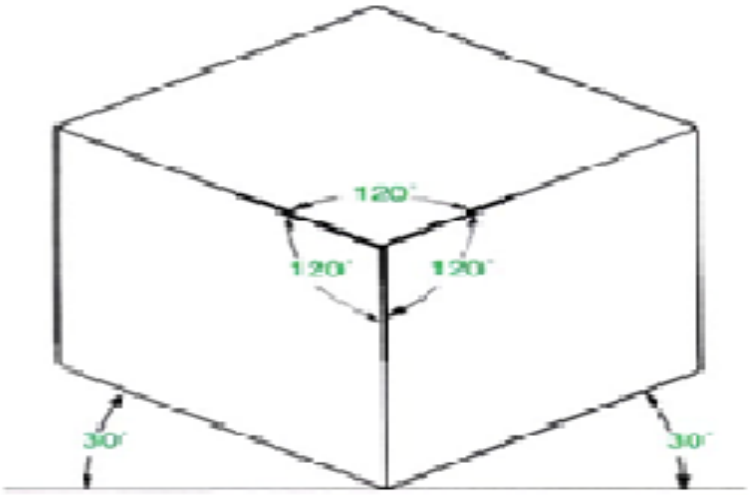


Fig 3.1 Issometric drawing

Terminology:

- The station of the observer's eye is called *Station point* (SP).
- The imaginary plane of projection is called *Picture plane* (PP).
- The point where all projection lines converge is called *vanishing point* (VP).
- A horizontal line in the front view representing an infinite horizontal is called *Horizon*.

The three basic types of perspectives are:

I. One point – single vanishing point

II. Two point – two vanishing point

III. Three point – three vanishing point

One Point Perspective Drawing

Has one surface of the object parallel to the picture plane. However, other sides vanish to a single point. To draw one point perspective projection, we can develop from top and front views of an object.

When drawing any perspective, the station point should be placed far enough away from the object to permit the cone of vision to be less than 30^o to reduce distortion.

We can work one point perspective either by simply selecting a stationary point or by measuring points. The use of measuring point eliminates the need of placing top view above the front view.

MULTIVIEW DRAWING

Multi view projection is a method by which the exact shape of an object can be represented by two or more separate views produced on projection planes that are at right angles to each other.

The system of constructing multi view drawing is orthographic projection. Orthographic views are two dimensional views of three dimensional objects.

SYSTEM OF PROJECTIONS

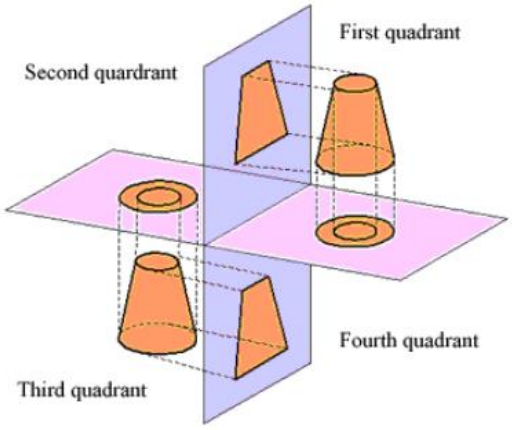
There are two types of projection systems in use today. These are:

- *Third-angle projection* is used in the United States, Canada, and in many other countries.

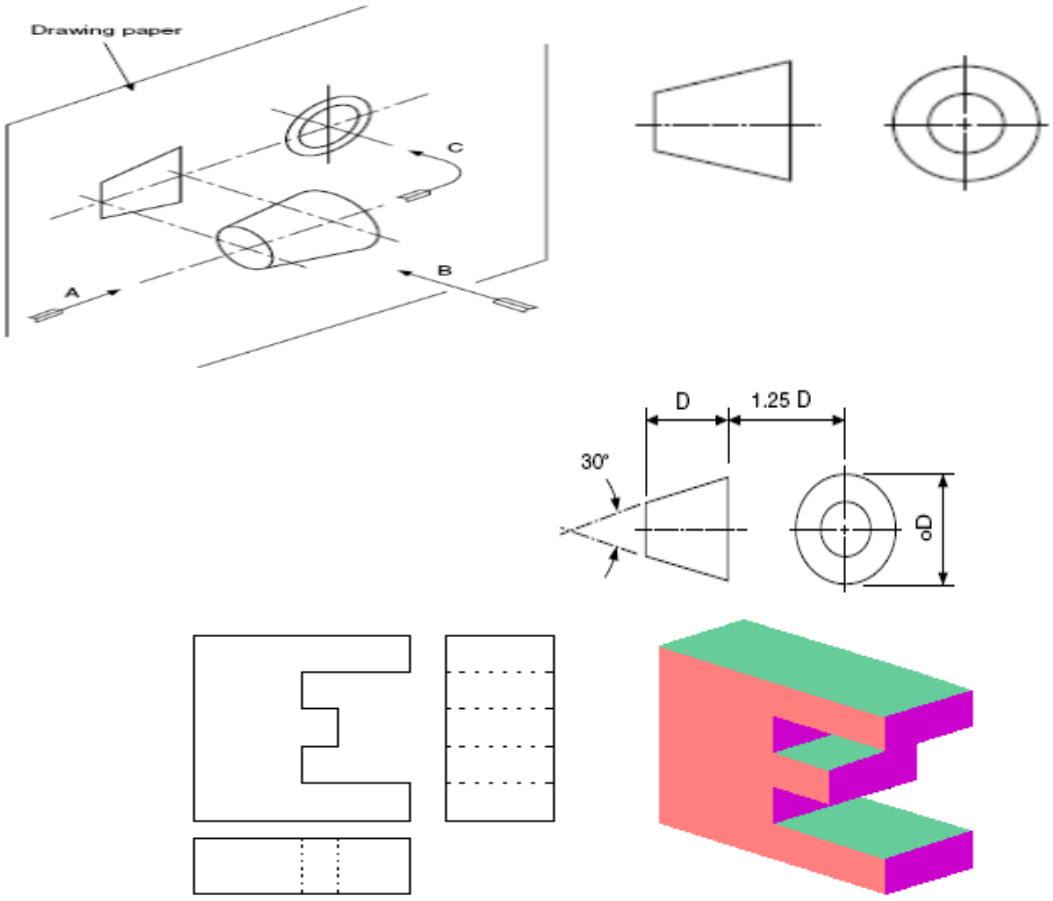
First-angle projection is used mainly in Europe.

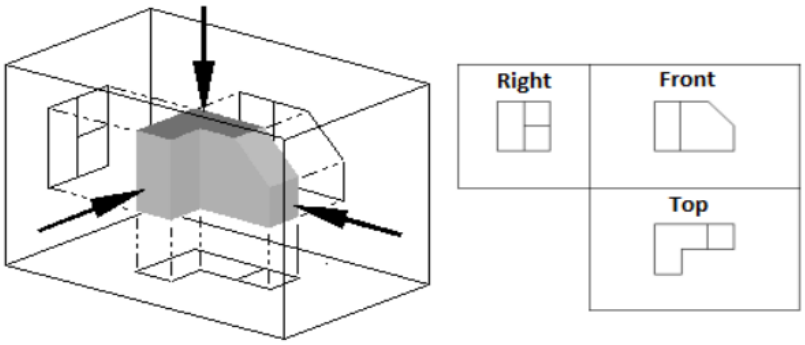
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Same Examples are listed below

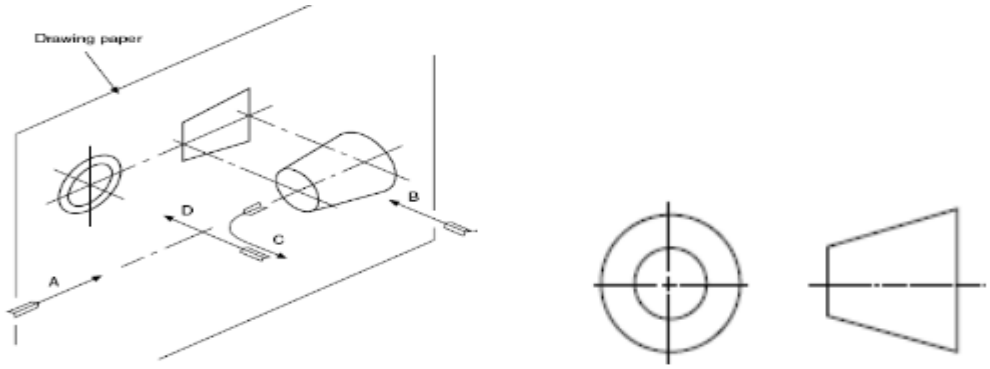


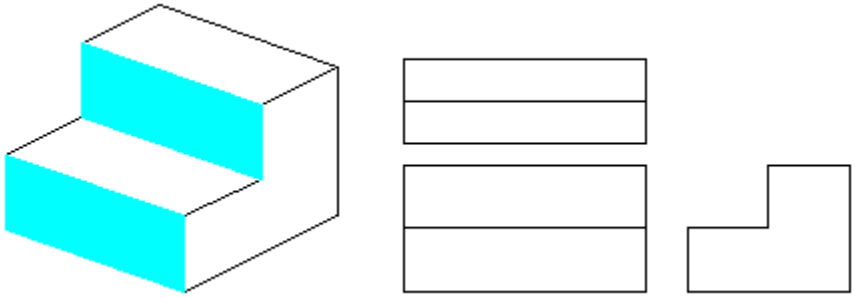
Symbolic representation of first angle orthographic projection is:

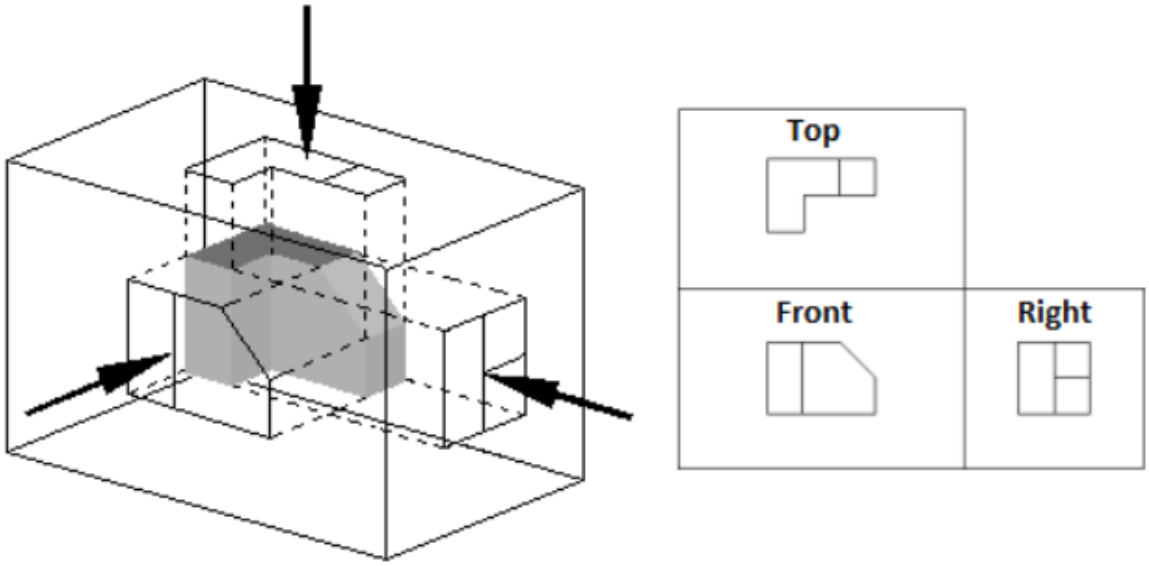




The standard symbolic representation for the third angle projection is:

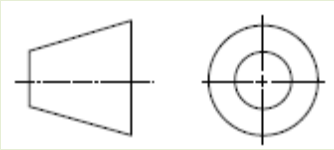
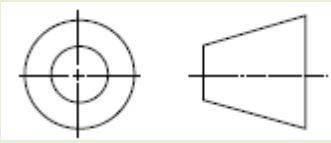






Comparisons

Table 3.1 Comparison of first angle projection and third angle projection

first angle projection	third angle projection
R.S.V F.V L.S.V T.V 	T.V L.S.V F.V R.S.V 

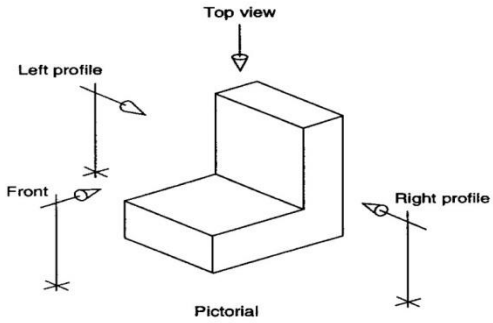
B. Orthographic projection:

Is a system of views of an object formed by projectors from the object perpendicular to the desired planes of projection.

Here we have three principal projection planes. That is to say:

- Horizontal projection plane (H)
- Frontal projection plane (F)
- Profile projection plane (P)

For example:



For the above object we can have orthographic projection as follow:

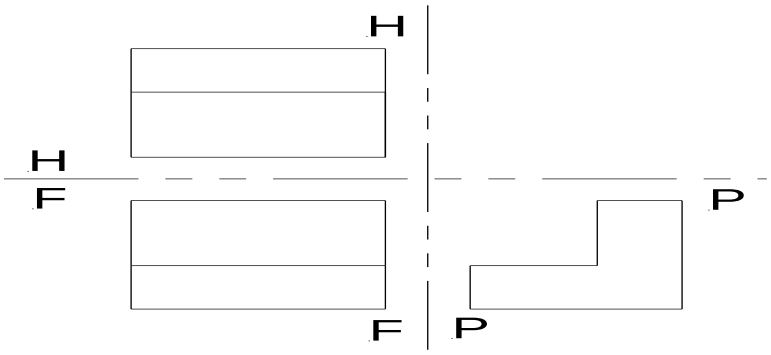


Fig.3.1 Orthographic projection (Multi-view drawing)

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Choice & layout of views

Six principal views can be obtained for any object by using the principles of multi view drawing or orthographic projection which are the maximum views. Width dimension remains the same for top, front and bottom views. Whereas height is common for right side, front, left-side, and rear views.

Only views that are necessary for a clear and complete description should be selected. Because the repetition of information may tends to confuse the reader. So that, it is important to have a set of views that describe an object clearly.

Technical drawings usually include only the front, top and right side orthographic views because together they are considered sufficient to completely define an object's shape.

GROUND RULES FOR SELECTION OF VIEWS

- Right hand side view should be used in preference to a left side view and a top view in preference to a bottom view.
- Place the object to obtain the smallest number of hidden lines. When both views of an equal numbers of hidden lines exist, the right side view will be traditionally selected.

Precedence of Lines

The following listed lines are the various types conventionally used over the world now a day;

- Visible Lines – solid thick lines that represent visible edges or contours
- Hidden Lines – short evenly spaced dashes that depict hidden features
- Section Lines – solid thin lines that indicate cut surfaces
- Center Lines – alternating long and short dashes
- Dimensioning
    - Dimension Lines - solid thin lines showing dimension extent/direction
    - Extension Lines - solid thin lines showing point or line to which dimension applies
    - Leaders – direct notes, dimensions, symbols, part numbers, etc. to features on drawing
- Cutting-Plane and Viewing-Plane Lines – indicate location of cutting planes for sectional views and the viewing position for removed partial views

.

- Break Lines – indicate only portion of object is drawn. May be random “squiggled” line or thin dashes joined by zigzags.
- Phantom Lines – long thin dashes separated by pairs of short dashes indicate alternate positions of moving parts, adjacent position of related parts and repeated detail
- Chain Line – Lines or surfaces with special requirements

C. Explode view

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 below 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.

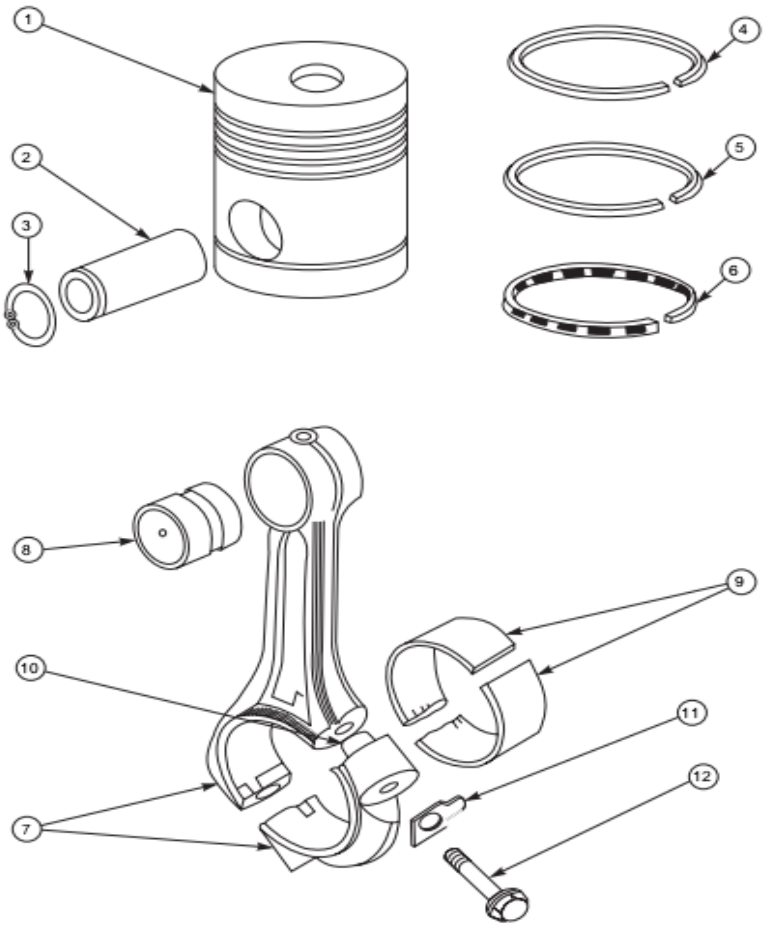


Fig.3.2 Exploded assembly drawing

D .ISO Tolerances and fits

When parts are assembled together, engineers have to decide andthe associated with it. The manufacture of interchangeable parts requires precision. Precision is the degree of accuracy to ensure the functioning of a part as intended.

- **Tolerance**

Tolerance is the difference between the maximum limit of size and the minimum limit of size. The permissible variation of a size is called tolerance. It is the difference between the maximum and minimum permissible limits of the given size. If the variation is provided on one side of the basic size, it is termed as unilateral tolerance. Similarly, if the variation is provided on both sides of the basic size, it is known as bilateral tolerance.

- Limit

The two extreme permissible sizes between which the actual size is contained are called limits. The maximum size is called the upper limit and the minimum size is called the lower limit.

- ✓ **Deviation**It is the algebraic difference between a size (actual, maximum, etc.) and the corresponding basic size.
- ✓ **Actual deviation**It is the algebraic difference between the actual size and the corresponding basic size.
- ✓ **Upper deviation**It is the algebraic difference between the maximum limit of the size and the corresponding basic size.
- ✓ **Lower deviation**It is the algebraic difference between the minimum limit of the size and the corresponding basic size.

- **Allowance**

  It is the dimensional difference between the maximum material limits of the mating parts, intentionally provided to obtain the desired class of fit. If the allowance is positive, it will result in minimum clearance between the mating parts and if the allowance is negative, it will result in maximum interference.

- **Basic Size**

It is determined solely from design calculations. If the strength and stiffness requirements need a 50mm diameter shaft, then 50mm is the basic shaft size. If it has to fit into a hole, then 50 mm is

the basic size of the hole. Figure 15.1 illustrates the basic size, deviations and tolerances. Here, the two limit dimensions of the shaft are deviating in the negative direction with respect to the basic size and those of the hole in the positive direction. The line corresponding to the basic size is called the zero line or line of zero deviation.

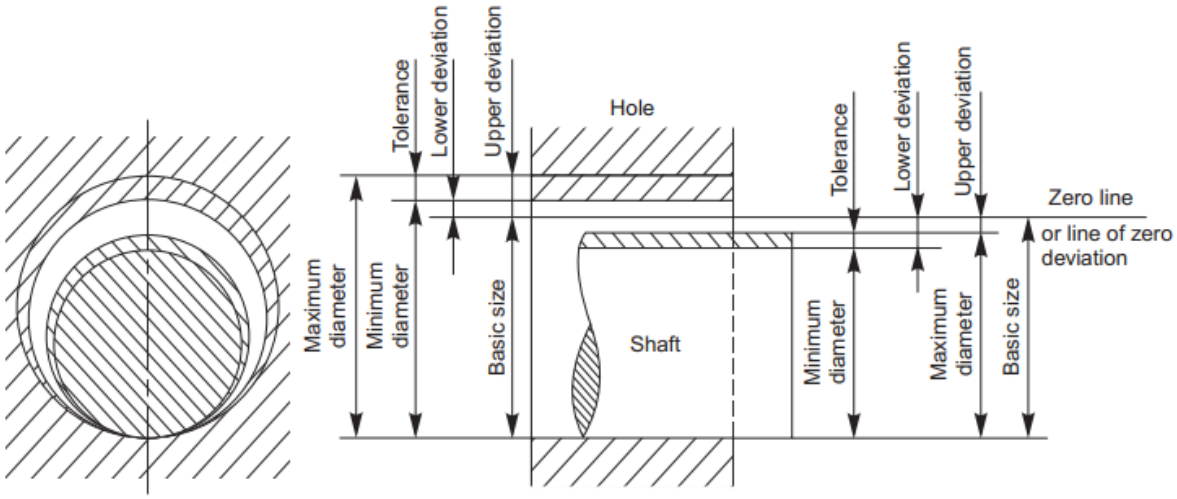


Fig. 3.3 Diagram illustrating basic size deviations and tolerance

Design Size : It is that size, from which the limits of size are derived by the application of tolerances. If there is no allowance, the design size is the same as the basic size. If an allowance of 0.05 mm for clearance is applied, say to a shaft of 50 mm diameter, then its design size is (50 – 0.05) = 49.95 mm. A tolerance is then applied to this dimension.

Actual Size : It is the size obtained after manufacture.

Tolerance :Great care and judgment must be exercised in deciding the tolerances which may be applied on various dimensions of a component. If tolerances are to be minimum, that is, if the accuracy requirements are severe, the cost of production increases. In fact, the actual specified tolerances dictate the method of manufacture. Hence, maximum possible tolerances must be recommended wherever possible

Bilateral tolerance : The variation in both directions from the basic dimension. That is, the basic size is between the two limits, for example, 1.005 ± 0.002 in. The two parts of the tolerance need not be equal.

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Unilateral tolerance: The basic dimension is taken as one of the limits, and variation is permitted in only one direction, for example, +0.004

1.005 -0.000 in

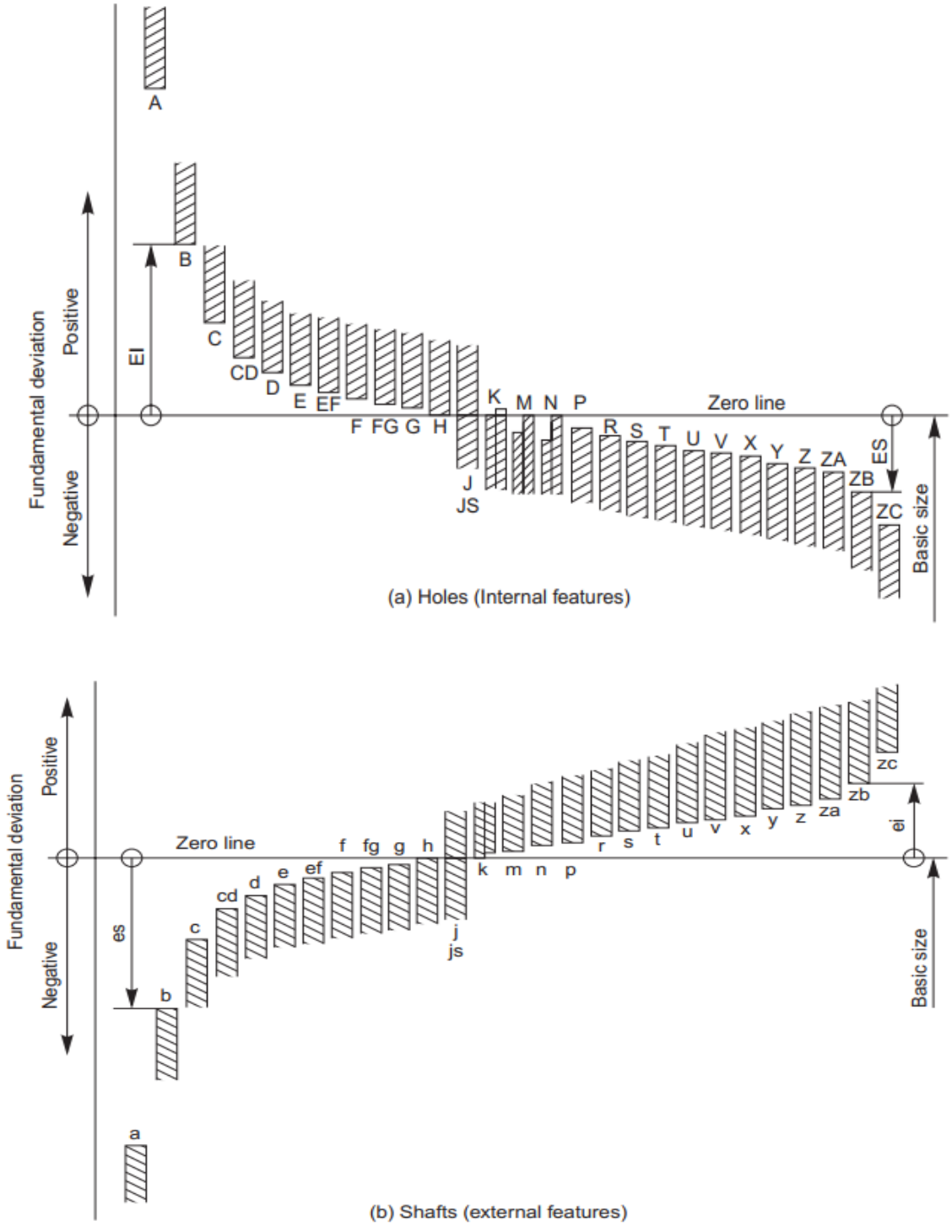


Fig. 3.4 Graphical illustration of tolerance zones

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Unilateral tolerance

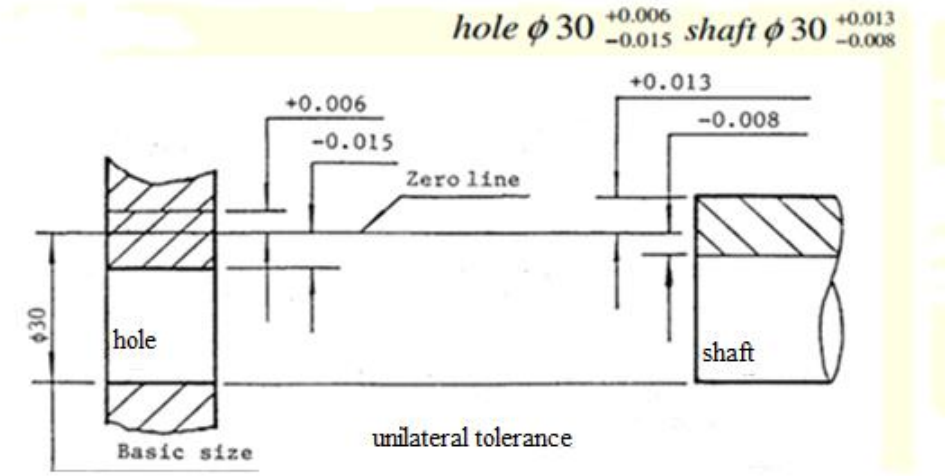


Fig. 3.5unilateral tolerance

Bilateral Tolerance

Fit.

Clearance fit - It is a fit that gives a clearance between the two matin

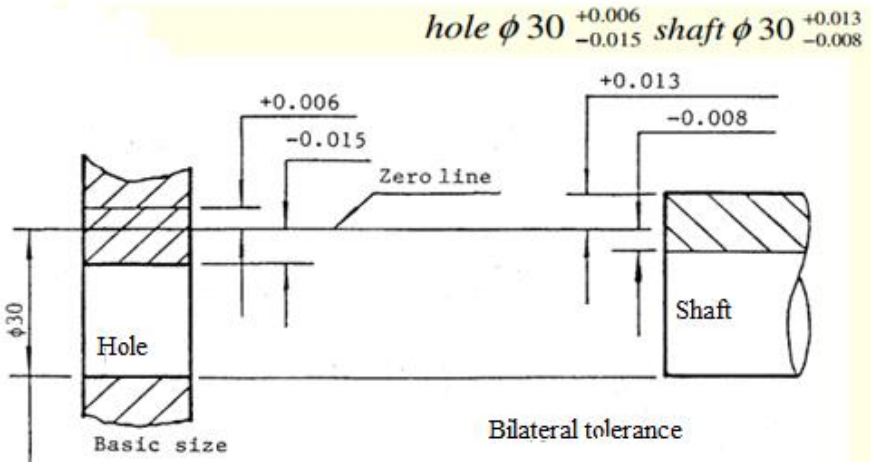


Fig. 3.6 Bilateral Tolerance

Fit- The relation between two mating parts is known as a fit. Depending upon the actual limits of the hole or shaft sizes, fits may be classified as clearance fit, transition fit and interference g parts.

Minimum Clearance -It is the difference between the minimum size of the hole and the maximum size of the shaft in a clearance fit.-

Maximum Clearance -It is the difference between the maximum size of the hole and the minimum size of the shaft in a clearance or transition fit. The fit between the shaft and hole in Fig. 15.10 is a clearance fit that permits a minimum clearance (allowance) value of 29.95 – 29.90 = + 0.05 mm and a maximum clearance of + 0.15 mm.

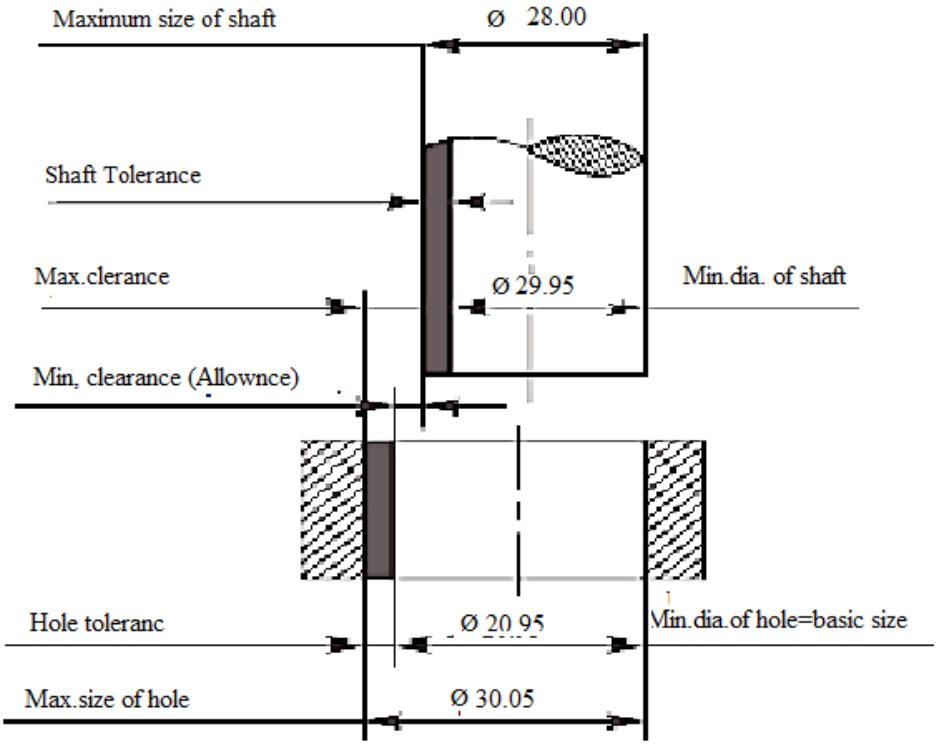


Fig. 2.1.3 .7 Clearance fit

Transition fit

This fit may result in either interference or a clearance, depending upon the actual values of the tolerance of individual parts. The shaft in Fig. 15.11 may be either smaller or larger than the hole and still be within the prescribed tolerances. It results in a clearance fit, when shaft diameter is 29.95 and hole diameter is 30.05 (+ 0.10 mm) and interference fit, when shaft diameter is 30.00 and hole diameter 29.95 (– 0.05 mm).

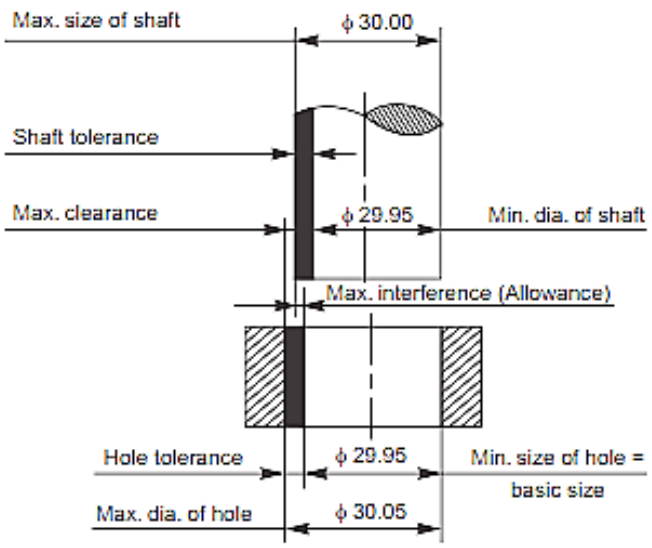


Fig. Transition fit

Fig. 3.8 Transition fit

Interference fit : If the difference between the hole and shaft sizes is negative before assembly; an interference fit is obtained.

Minimum Interference: It is the magnitude of the difference (negative) between the maximum size of the hole and the minimum size of the shaft in an interference fit before assembly.

Maximum Interference :It is the magnitude of the difference between the minimum size of the hole and the maximum size of the shaft in interference or a transition fit before assembly. The shaft in Fig. 15.12 is larger than the hole, so it requires a press fit, which has an effect similar to welding of two parts.

The value of minimum interference is 30.25 – 30.30 = – 0.05 mm and maximum interference is 30.15 – 30.40 = – 0.25 mm.

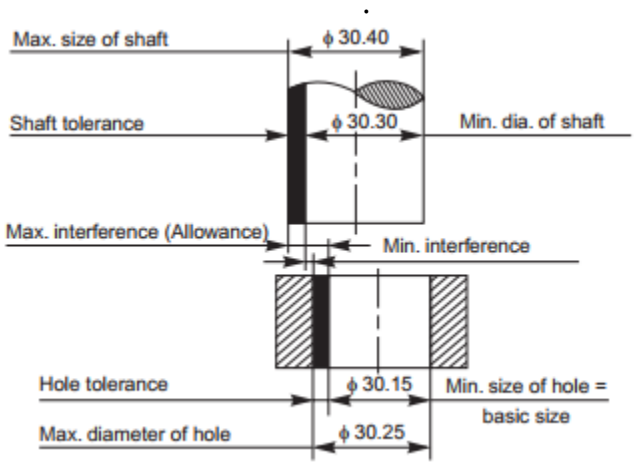


Fig. 3.9 Interference fit

Figure 1 shows the conventional representation of these three classes of fits.

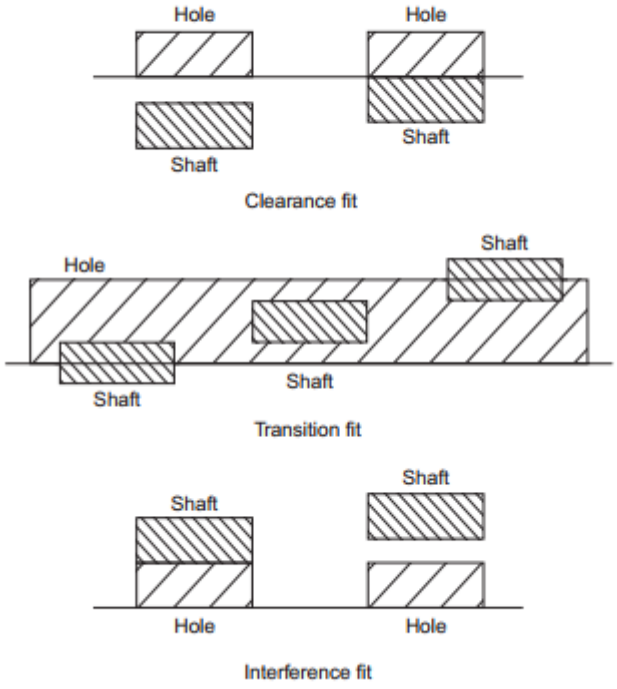


Fig. 3.10 Schematic representation of fits

.

Self-Check - 3

Part I - Choose the best answer.

Directions: Answer all the questions listed below. Use Answer sheet provided in the next page

1. _____ is built on 3 main axis namely the vertical axis and two 30 degrees axis from a horizontal line to the left and right of the vertical axis.

A, Isometric drawing B, Orthographic drawing C, exploded view drafting D, none

1. _____is different types and thicknesses are used for graphical representation of objects.

A, graph B, line C, point D, none

3. _____is straight elements that have no width

A. Lines B. Symbol C. Straight D. None

4. _____The *three* basic types of perspectives are: A.one point – single vanishing point B.two point – two vanishing point C.three point – three vanishing point D. all

5._____ *Third-angle projection* is used in the countries of A, United States, B, Canada, C ,Europe D, A&B

Part II - True / False

Directions: Say True / False answer for the given question

_____1.Precision is the degree of accuracy to ensure the functioning of not a part as intended

_____2. Deviation is the algebraic difference between a size (actual, maximum, etc.) and the corresponding basic size.

____.3 Allowance is the dimensional difference between the maximum material limits of the mating parts, intentionally provided to obtain the desired class of fit

_____4. The relation between two mating parts is known as a fit

_____5.Bilateral tolerance is the variation in both directions from the basic dimension

<u>Part III</u> - Short answer writing

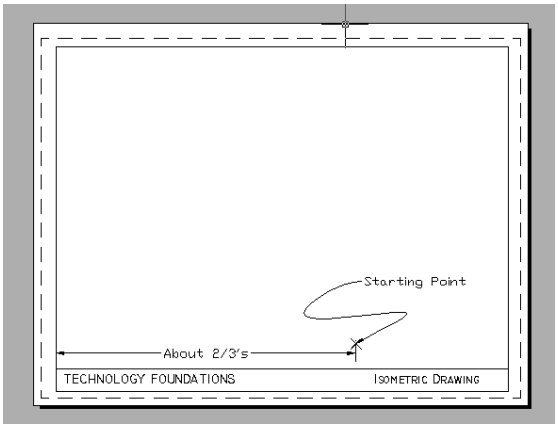
Directions - Give short answer to the following questions

1. List and explain two basic types of drawings?
2. What is the definition of orthogonal drawing?
3. Write the difference between first angle projection and t*hird-angle projection*

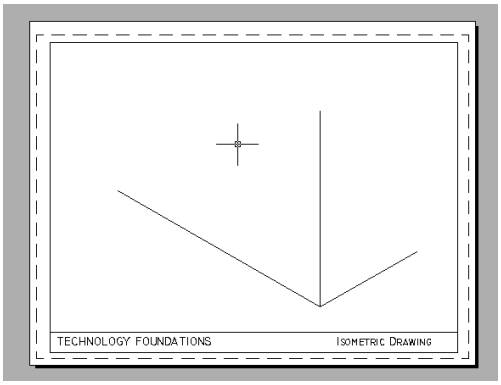
Operation Sheet 3	Isometric view drawing

How to Make an Isometric Drawing

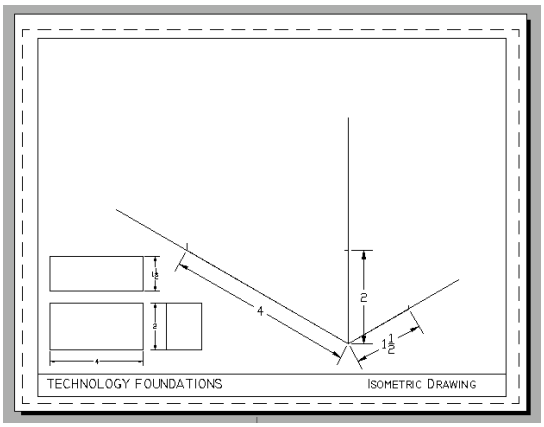
Step 1. If the starting point is not given, begin your drawing about 1" up from the title block and 2/3's across the page from the left margin



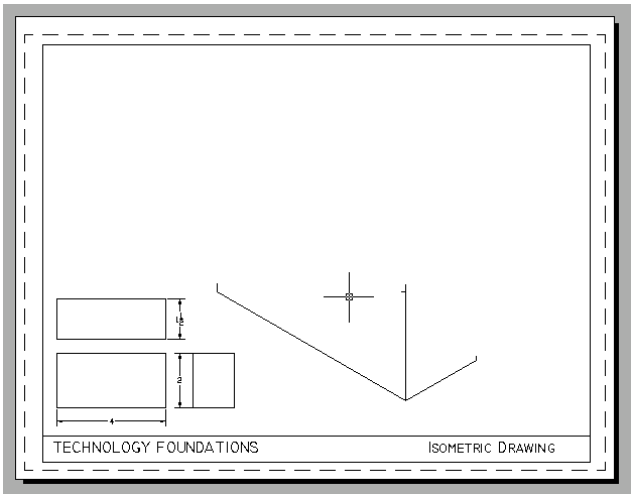
Step 2. From the starting point, draw lines 30 deg. to the left, 30 deg. to the right, and 90 deg. up with *light* construction lines.



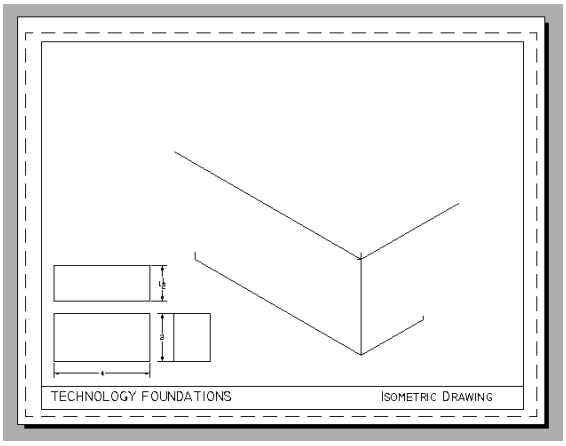
Step 3. Place the length measurement on the "30 deg. to the left" line, the thickness measurement on the "30 deg. to the right" line, and the height measurement on the "90 deg. up" line



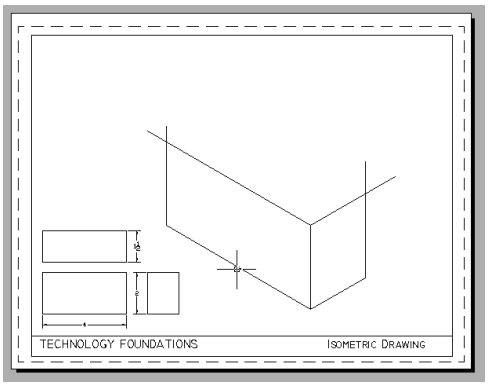
Step 4. Erase excess lines back to each mark.



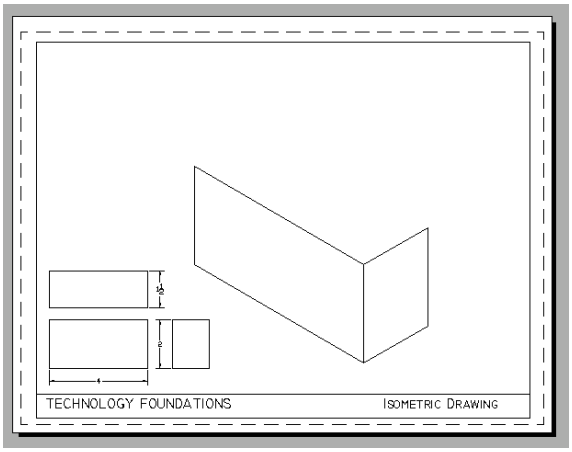
Step 5. Draw construction lines 30 deg. to the left and 30 deg. to the right from the height mark



Step 6. Draw lines 90 deg. up from both ends

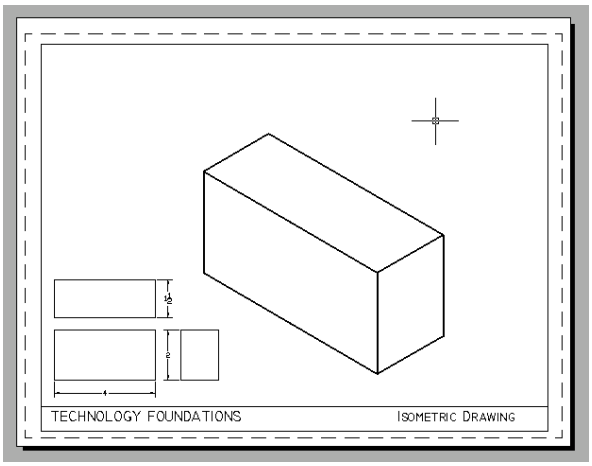


Step 7. Erase excess lines back to each intersection.



Step 8. Draw construction lines 30 deg. to the left and 30 deg. to the right from each end until they intersect.

- Convert all construction lines to object lines


TECHNOLOGY FOUNDATIONS
ISOMETRIC DRAWING

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LAP Test 3	Practical isometric drawing

Instructions: Given necessary measuring tools, materials and drawing instrument you are required to perform the following tasks within 8-12 hours.

Task 1: Identify key information about different between isometric and orthographic drawing

Task 2: List use drawing instrument

Task 3: draw orthographic view using third angle

.

Unit Four:- Issue approved drawing

This unit to provide you the necessary information regarding the following content coverage and topics:

- *Copy and issue drawing and norm parts lists.*
- *Store and catalogue*

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- *Copy and issue* drawing and/or norm parts lists.
- Store and catalogue drawings and/or norm parts lists

.

4.1.Copying and issuing drawing and norm parts lists.

4.1.1Copy Approved drawing.

Completed drawings are usually presented on company standard sheets. Sizes, areas and designation are given at the standard level. The layout of a typical sheet contains information required for identification, administration and interpretation and a company could design several types of standard sheets, particularly appropriate to their products.

If drawings are produced manually, then the drawing sheets may be supplied with printed borders and blocks containing relevant notes and headings.

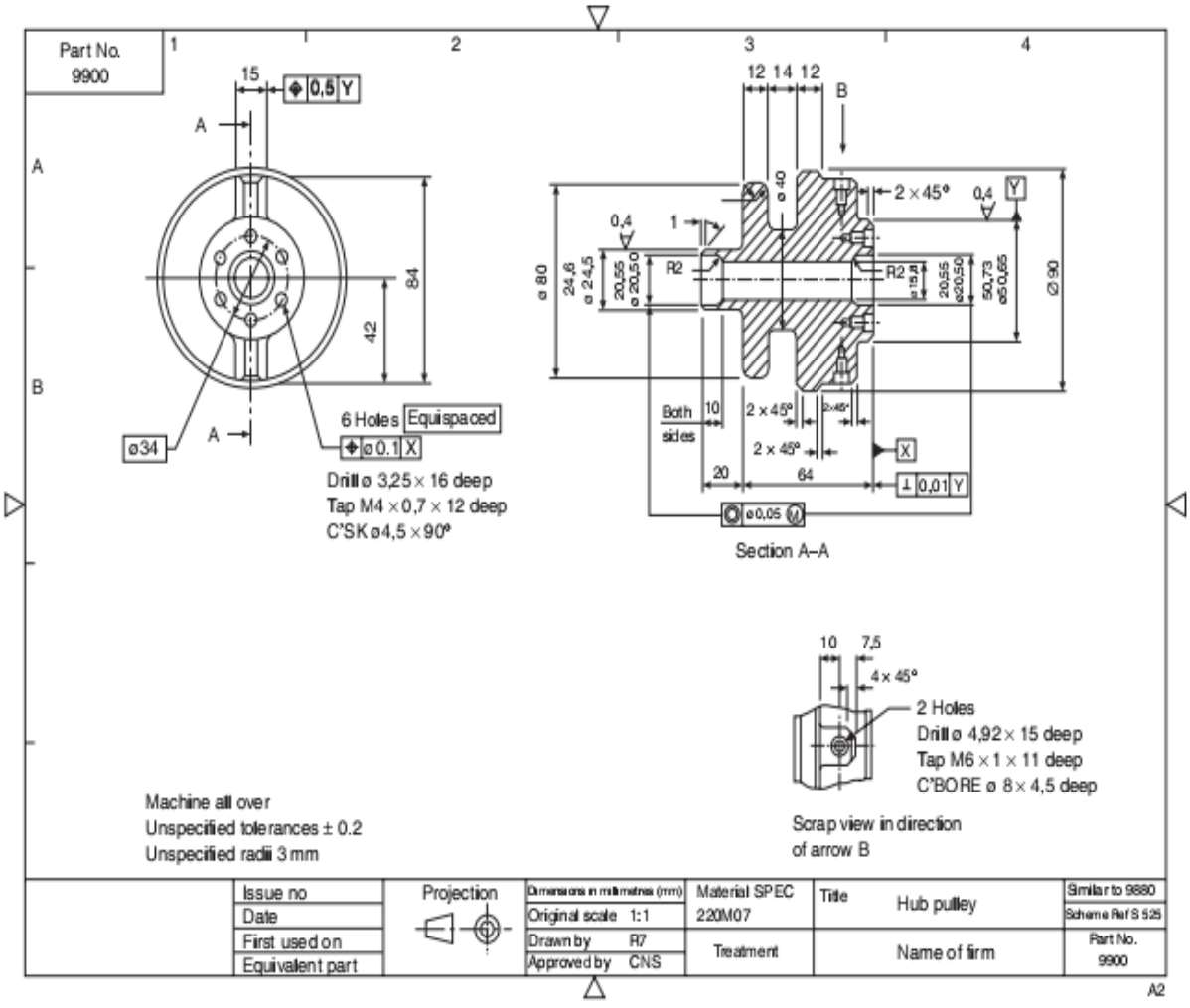


Fig 4.1 sample of Copy Approved drawing.

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4.1.2 Issue approved drawing

Approved drawing and/or parts lists need to be copied and **issued** to relevant personnel in accordance with standard operating procedures.

Drawings issued are in the form of hard copy photo graphic slide or transparency form

Table 4.1.Issue approved drawing

MALONE O'REGAN	St.Catherine's House, Catherine Street, Waterford. Tel : +353 51 876 855 Fax : +353 51 876 828 Email : info@Waterford.MORce.ie												2B Richview Office Park, Clonskeagh, Dublin 14. Tel : +353 1 2602655 Fax : +353 1 2602660 Email : info@MORce.ie		Sheet No. 01
DRAWING ISSUE FORM															
Job No :	Job :		Date Issued												
W10100	New Slipway & Associated Works at Ferrybank, Wexford Harbour	Day	05												
		Month	09												
		Year	12												
Drawing No.	Drawing Title		Revision No.												
100	Proposed Site Plan		P												
101	Proposed Sections 1-1 to 5-5		P												
102	Proposed Sections 6-6 to 11-11		P												
103	Proposed Lease Map		P												
104	Outfall Details		P												
105	Admiralty Chart showing Location of Proposed		P												
	Slipway														
106	Site Location Map (1:10560)		P												

Issued to :		No. of Copies										
Client	Wexford County Council	1										
Contractor												
Architect												
Quantity Sur.												
M&E Cont.												
Others	Department of the Environment	3										
Others												
Others												
Purpose of Issue :		PL										
Issue Method :		H/CD										
Issued by :		SD										
Purpose of Issue												
PR = Progress/Preliminary	PL = Planning	F = Fire Cert	T = Tender	C = Construction								
G = General												
Issue Method												
H = Hardcopy	E = Email	CD = Compact Disc	D = Floppy Disc									

4.2.store and catalogue Approved drawings and norm of parts list

Figures below clearly show that documentation can occupy much of the sheet area. The space provided for basic and supplementary information will be decided by the company; its actual position on the sheet may vary with the sheet size.

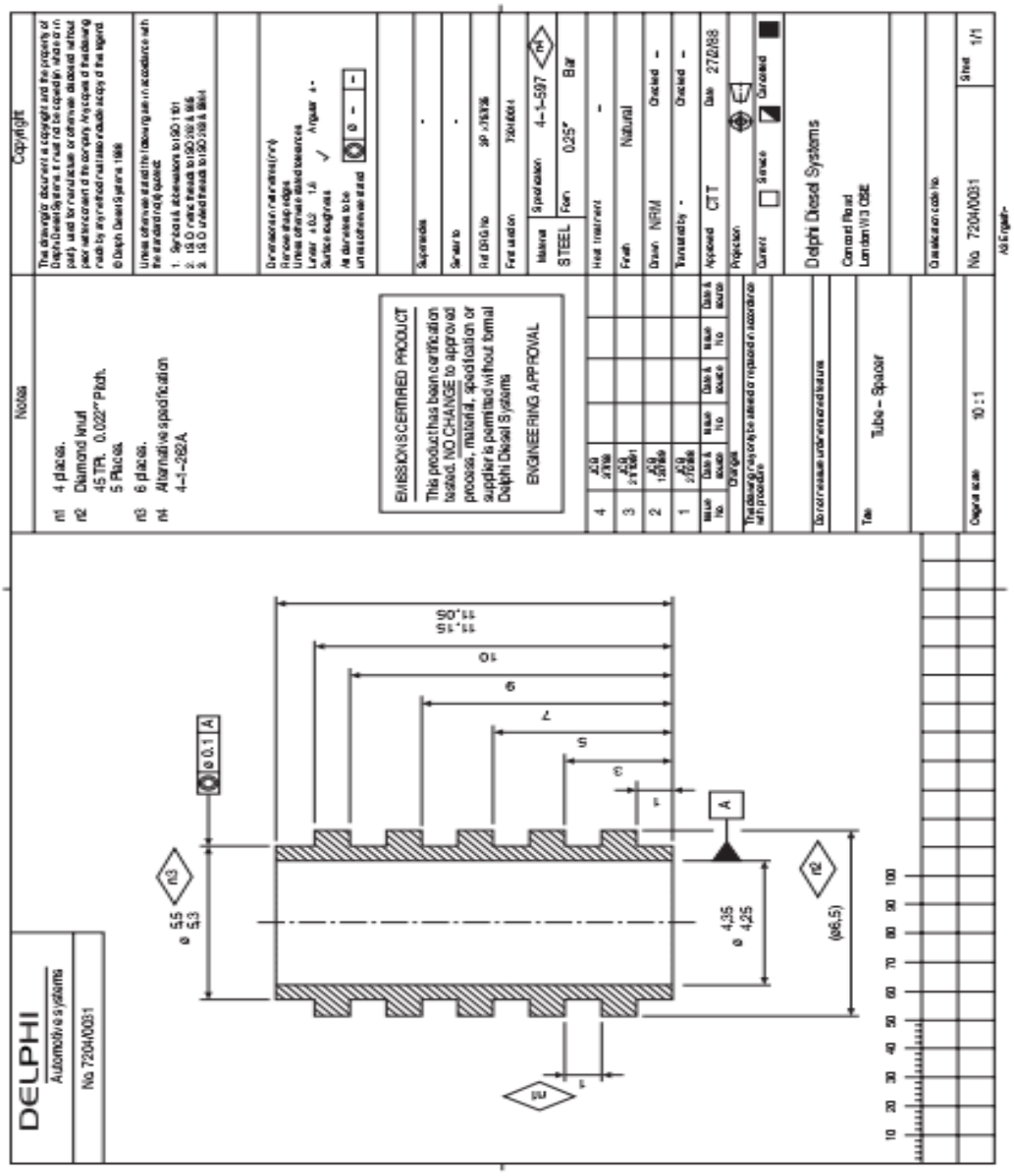


Fig 4.2 store and catalogue Approved drawings and norm of parts list

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Part I

Self-Check – 4

Directions: Answer all the questions listed below. Use your the provided Answer sheet

1.Write the steps of coping drawing?

2. How to catalogue drawing?

3. Write the forms of drawing issues?

Part II:- True or False

Directions: Say True or False for the given question

_____1. Approved drawings can be stored and catalogue

_____2. Drawings issued are reported to relevant personnel in the form of hard copy photo graphic slide or transparency form

_____3. company will be decided supplementary information

Part III

Directions: Fill in the blank space.

_____drawings are usually presented on company standard sheets.

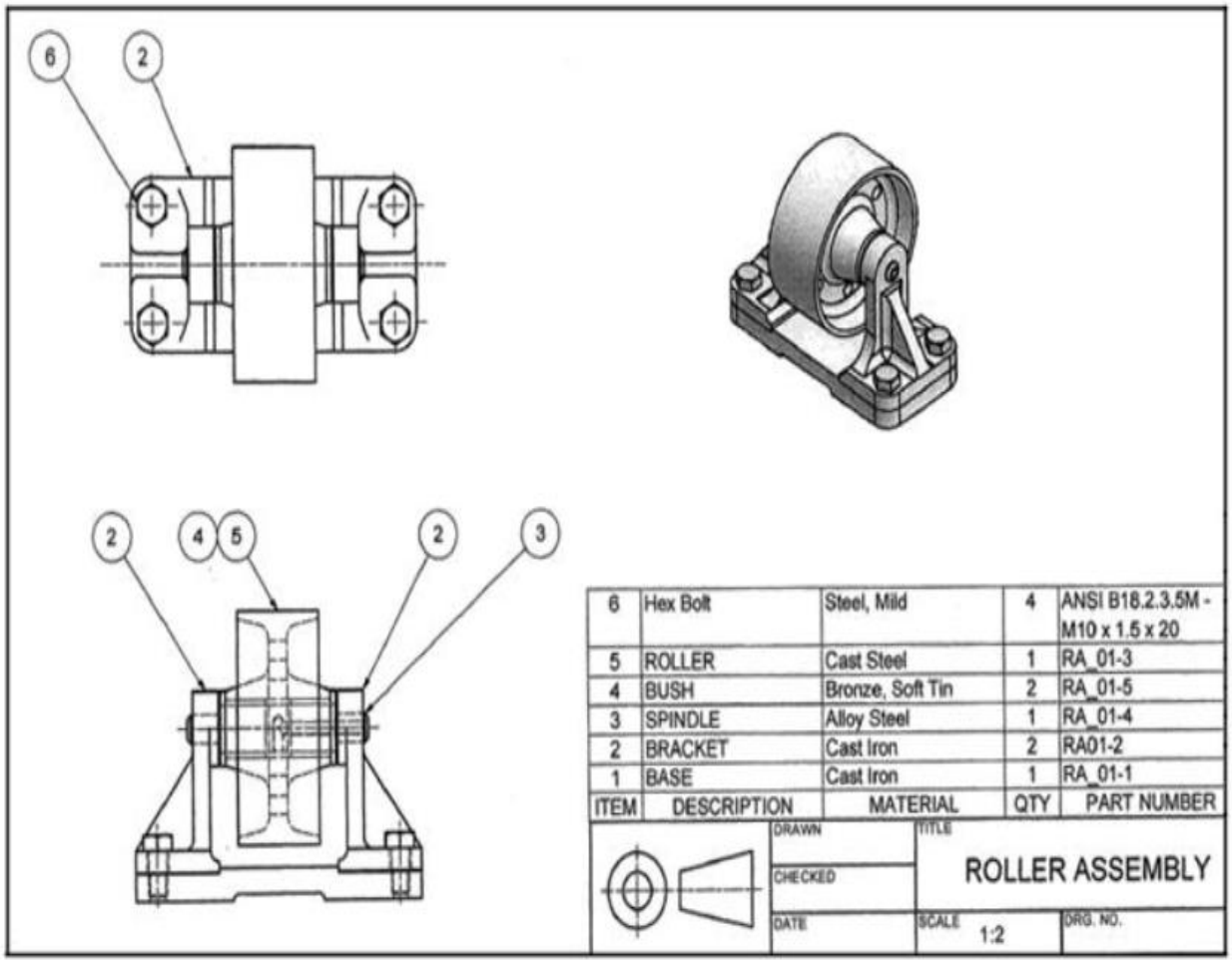
_____ Drawings are in the form of hard copy photo graphic slide or transparency form

.

Operation Sheet- 4

- **Operation title:**opying and issuing drawing and norm parts lists
- **Purpose:** To practice and demonstrate the knowledge and skill required in Copying and issuing drawing and norm parts lists
- **Instruction:** Use the given figure below (Figure 2.13), the tools and Copying and issuing drawing and norm parts listsFor this operation you have given 3Hour and you are expected to provide the answer on the given table.
- **Tools and requirement:**
  1. operation sheet
  2. Ruler,
  3. Scale
  4. Pencil
- **Precautions:**Ckeck at least three times before recording the result on the given format
- **Procedures in doing the task**
  - Step 1- Resave the sketch, from the designer.
  - Step 2- Print or copy the drawing.
  - Step 3- Make the catalog
  - Step 4- Store on appropriate cabin

.



ITEM	DESCRIPTION	MATERIAL	QTY	PART NUMBER
6	Hex Bolt	Steel, Mild	4	ANSI B18.2.3.5M - M10 x 1.5 x 20
5	ROLLER	Cast Steel	1	RA_01-3
4	BUSH	Bronze, Soft Tin	2	RA_01-5
3	SPINDLE	Alloy Steel	1	RA_01-4
2	BRACKET	Cast Iron	2	RA01-2
1	BASE	Cast Iron	1	RA_01-1

DRAWN
CHECKED
DATE
TITLE: ROLLER ASSEMBLY
SCALE: 1:2
DRG. NO.

.

LAP Test 4	Practical Demonstration

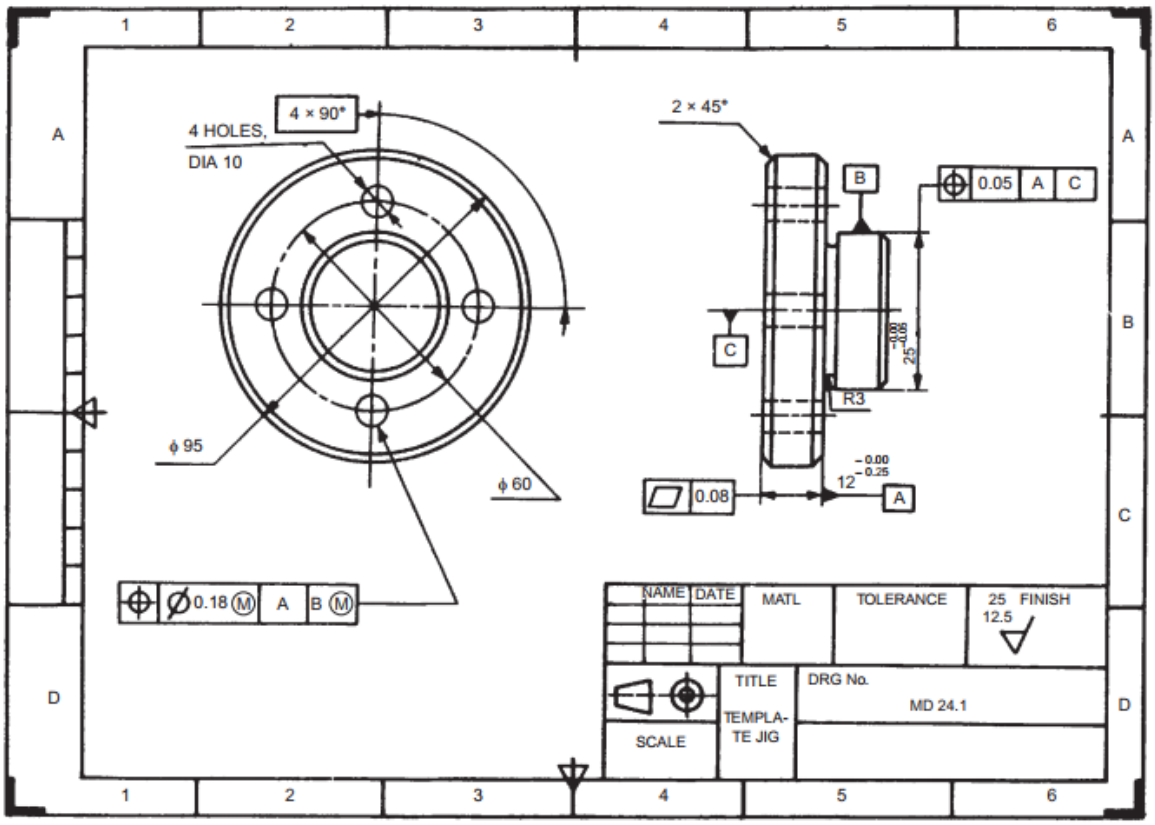
Name: _____ Date: _____

Time started: _____ Time finished: _____

Instruction I: Given necessary templates, tools and materials you are required to perform the following tasks within 1 hours.

Task 1 Storing, copying and issuing drawing according to standard.

.



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Reference Materials

1. Machine Drawing- P.S. Gill, S.K. Kataria& Sons, 17th Edition, 2012.
2. Machine Drawing- Dhawan, S.Chand Publications, 1st Revised Edition, 1998.
3. Machine Drawing – Ajeet Singh, McGraw Hill, 2012
4. Machine Drawing- Luzzader, PHI Publishers, 11th Edition.
5. Textbook of Machine Drawing-K.C.John, 2009, PHI learning, 1st Edition.
6. Machine Drawing- DR.K.L. Narayana, Dr. P.Kannaiah, K. Venkata Reddy, 3th Edition, 2006.

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