Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

CGSC
CAPITAL GOODS SKILL COUNCIL

# Participant Handbook


Sector: **Capital Goods**

Sub-Sector
**Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods**

Occupation: **Design**

Reference ID: **CSC/ Q 0402, Version 1.0**
**NSQF Level 4**

## Draughtsman - Mechanical

**Published by**

**VIKAS® PUBLISHING HOUSE PVT. LTD.**
E-28, Sector-8, Noida-201301 (UP)
Phone: 0120-4078900 • Fax: 0120-4078999
Regd. Office: 7361, Ravindra Mansion, Ram Nagar, New Delhi-110055
Website: www.vikaspublishing.com • Email: vocational@vikaspublishing.com


First Edition, October 2017
ISBN 978-93-5271-529-9
**Published by**



**Capital Goods Skill Council**
Address: Federation House, 1, Tansen Marg, New Delhi 110001
E-mail: support@cgsc.in
Phone: +91 11 65002121



"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

**Shri Narendra Modi**
Prime Minister of India

Skill India
कौशल भारत-कुशल भारत

CGSC
CAPITAL GOODS SKILL COUNCIL

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

# Certificate

**COMPLIANCE TO**
**QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS**

is hereby issued by the

## Capital Goods Skill Council

for

**SKILLING CONTENT : PARTICIPANT HANDBOOK**

Complying to National Occupational Standards of
Job Role/ Qualification Pack: ' **Draughtsman Mechanical** ' QP No. ' **CSC/Q0402 NSQF Level 4** '

Date of Issuance: April 9th, 2016
Valid up to*: April 10th, 2018

*Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)

Authorised Signatory
Capital Goods Skill Council

## Acknowledgements

Capital Goods Skill Council would like to thank Capital Goods member company representatives for believing in our vision to enhance the employability of the aspiring workforce pool. CGSC facilitates this by developing and enabling the implementation of courses relevant to projected industry needs.

The aim is to address two key requirements, of closing the industry-academia skill gap, and of creating a talent pool that can reasonably meet current competitiveness requirements and weather future externalities in the Capital Goods Sector providing impetus to the Make in India program.

CGSC believes that this is an initiative of great importance for all stakeholders concerned – the industry, academia, and the aspirants. The tremendous amount of work and ceaseless support offered by the members of CGSC in developing a meaningful strategy for the content and design of program training materials has been truly commendable.

We would like to thank all concern stakeholders who have help us in bringing much needed focus to this effort.

Inder Gahlaut

CEO

CGSC

## About this book

This Participant Handbook is designed to enable training for the specific Qualification Pack (QP) of Capital Goods Industry.

Draughtsman - Mechanical Creates and modifies of 2D mechanical engineering design using CAD system. It also involves the detail drafting of component drawings for manufacturing, assembly, sub-assembly, installation.

It involves select the appropriate equipment and drawing software to use based on the type and complexity of the drawing functions to be carried out and the use of a CAD system linked bills of material, file management and associated customization of installed software including the use of macros, menus and default settings.

Key Learning Objectives for the specific NOS mark the beginning of the Units for that NOS. The symbols used in this book are described below.

## Symbols Used


Key Learning Outcomes


Steps


Exercise


Tips


Notes


Unit Objectives

# Table of Contents

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

CGSC
CAPITAL GOODS SKILL COUNCIL

# 1. About Capital Goods Industry

Unit 1.1 - Understanding of capital goods industry

Unit 1.2 - Understanding various types of capital goods Industry

Unit 1.3 – Role of mechanical drafter in industry

## Key Learning Outcomes

**At the end of this module, you will be able to:**

1. Discuss about capital goods industry
2. Discuss about development activities in industry
3. Discuss about employment opportunities in India
4. Explain about industry structure
5. List job responsibilities of mechanical drafter

Unit 1.1: Understanding of Capital Goods Industry

## Unit Objectives

**At the end of this unit, you will be able to:**

1. Discuss about industry
2. Understand development activities in the industry
3. Know about manpower requirements in industry

## 1.1.1 Introduction

Capital Goods are used in producing other products but are not incorporated into the new product. Capital Goods industry involves plant and machinery, equipment / accessories required for manufacture / production, either directly or indirectly, of goods or for rendering services, including those required for replacement, modernization, technological up gradation and expansion. It also includes packaging machinery and equipment, refrigeration equipment, power generating sets, equipment and instruments for testing, research and development, quality and pollution control. The Capital Goods industry is the "mother" of all manufacturing industry. The capital goods industry contributes 1.8% to the GDP which is 12% of the total manufacturing sector. For achieving goal of 9% growth in GDP during the 12th Five Year Plan, it is essential for the manufacturing industry to grow at least by 11-13% per annum. The Capital Goods sector, which plays vital role in manufacturing sector, should grow at around 17-19%.


*Fig. 1.1.1 Capital Goods*

## 1.1.2 Development activities in the industry

Sectors such as engineering, construction, infrastructure, and consumer goods play a strong base for Indian Capital industry. It can be further divided into ten broad sub-sectors namely heavy electrical equipment; Food Processing machinery; Printing Machinery; process plant equipment; earth moving equipment; dies, moulds and tool textile machinery; machine tools; metallurgical machinery and plastic processing machinery. It generates not only employment but also supports national security and hence boost to economy. 1.4 million people and is estimated to employ 2.8 million by 2017. The industry contributes 12% to the total manufacturing output of India and around 1.8% to the national GDP. The total market size of the industry around $92 billion and production valued at $32 billion. Instead of core industries such as power, railway, Infrastructure, etc, capital goods sector is growing year after year. There is a lack of domestic and global demand so this sector is currently facing insufficient off-take but it does not mean it has no potential. It is believed that it can boost the sector to approximately Rs. 7 lakh crore over next 4-5 years.

*Fig. 1.1.2 Capital Goods Workshop*

Increasing demand leads to the growth of the Capital Goods sector in India, and sectoral production has increased 2.5 times in 2013-15 as compared to 2004-05.

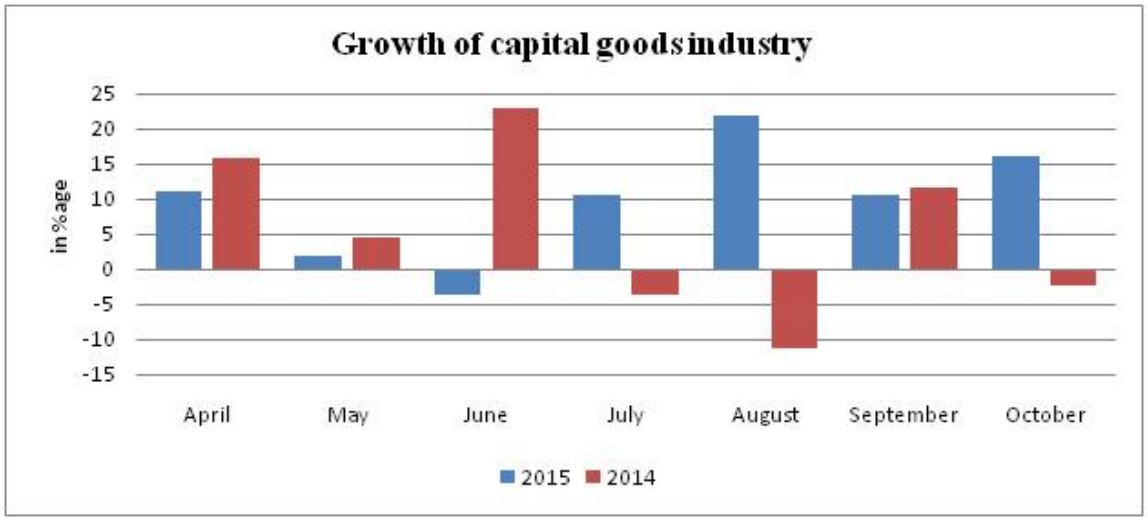



*Fig. 1.1.3 Growth of Capital Goods Industry*

## 1.1.3 Government policy of capital goods industry

There are some objectives of draft of a national capital goods policy:

- Increase total production: To achieve total production in excess of Rs. 50,000 crore by 2025 from the current Rs. 220,000 crore, there should be a friendly ecosystem for a globally competitive capital goods sector.
- Increase employment: To increase domestic employment from the current 1.4 million to at least 5 million by 2025 thus providing additional employment to over 3.5 million people.
- Increase domestic market share: It also envisages increasing the share of domestic production in capital's goods market from 56% to 80% by 2025 and for this improves domestic capacity utilization to 80-90%.
- Increase exports: To increase exports to 40% of total production (from Rs 62,000 crore to Rs 200,000 crore) by 2025, enabling India's share of global exports in capital goods to increase to 2.5%.
- Improve skill availability: To achieve higher productivity in the capital goods sector with enhance availability of skilled manpower by training 50 lakh people by 2025, and establish institutions to deliver the human resources with the skills, knowledge and capabilities to boost growth and profitability.
- Improve technology depth: To improve 'technology depth' in capital goods sub-sectors by increasing research intensity in India from 0.9% to at least 2.8% of GDP to rank amongst the Top-10 countries in research intensity and achieve global benchmarks for intellectual property in the capital goods sector.
- Promote standards: Technical and safety measure are up to the international standards and to achieve this, inflow of sub-standard capital goods need to be curb.
- Promote SMEs: To compete with established domestic and international firms and become national and global champions of capital goods in the future, growth and capacity of SMEs sector need to be increased.

## 1.1.4 Spread of capital goods industry in India

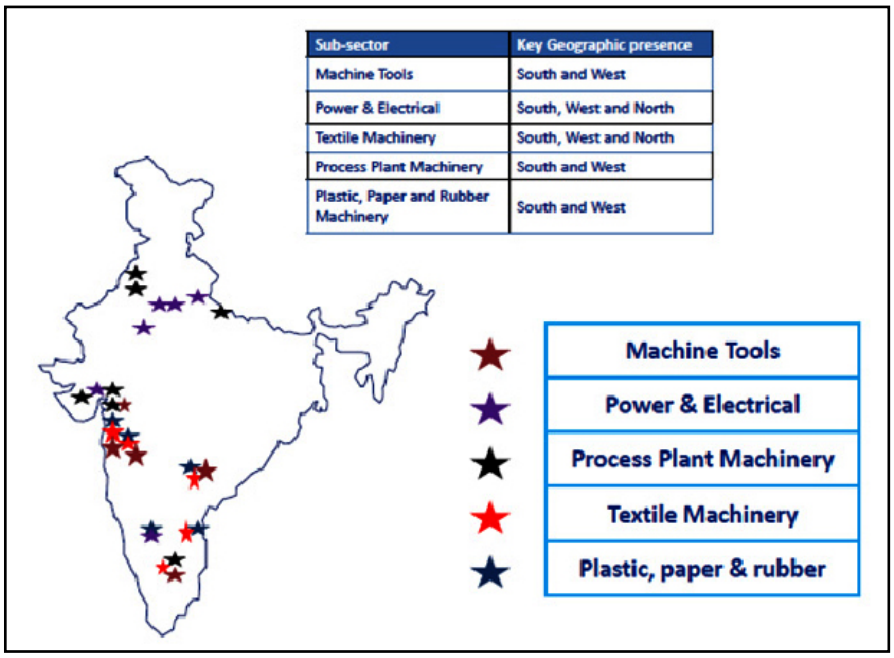



*Fig. 1.1.4 Spread of capital goods industry in India*

## 1.1.5 Manpower requirement in the industry

KPMG supported by NSDC, FICCI and CGSC study on Human Resource and Skills Requirement in the field of Capital Goods Sector and assign manpower requirement in 2017 across the six sub-sectors is approximately 2,085,000. The distribution of the same across subsectors and functions are as follows:

| Manpower requirement in 2017 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Function | Machine Tools | Power & Electrical | Process Plant Machinery | Textile Machinery | Plastic, Paper & Rubber Machinery | Light Engineering Goods | Total |
| Production | 237,200 | 679,000 | 227,500 | 1,313,000 | 90,700 | 573,300 | 1,939,400 |
| Support Functions | 17,900 | 51,100 | 17,100 | 9,900 | 6,800 | 43,100 | 146,000 |
| | 255,000 | 730,100 | 244,600 | 141,700 | 97,500 | 616,400 | 2,085,400 |

*Table 1.1.1 Manpower requirement in 2017*

The study projects the manpower requirement in 2022 across the six sub-sectors is approximately 3,940,800. The distribution of the same across subsectors and functions are as follows:

| Manpower requirement in 2022 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Function | Machine Tools | Power & Electric-als | Process Plant Ma-chinery | Textile Ma-chinery | Plastic, Paper & Rubber Ma-chinery | Light En-gineering Goods | Total |
| Produc-tion | 477,500 | 1,240,000 | 385,400 | 226,300 | 215,600 | 11,203,000 | 3,665,100 |
| Support Functions | 35,900 | 93,300 | 29,000 | 17,000 | 16,200 | 843,000 | 275,700 |
| Total | 513,400 | 1,333,300 | 414,400 | 243,300 | 231,800 | 1,204,600 | 3,940,800 |

*Table 1.1.2 Manpower requirement in 2022*

## Notes

Unit 1.2: Understanding structure of Capital Goods Industry

## Unit Objectives

**At the end of this unit, you will be able to:**

1. Discuss about capital goods industry structure
2. Know about features of industry

## 1.2.1 Capital goods sub-sectors

On the basis of end-usage, the sector is normally divided into 8-10 major sub-sectors. The main sub-sectors thus identified as sub-sectors of the capital goods sector are:

| S. No | Sub Sectors | Brief Description |
|---|---|---|
| 1 | Machine Tools | Constitutes machines related to metal cutting and forming |
| 2 | Power & Electrical equipment | Constitutes machines related to power generation, transmission and distribution |
| 3 | Process Plant Machinery | Constitutes machines such as pressure vessels, evaporators, stirrers, heat exchangers etc. are used in energy, metallurgy, oil and gas, industry etc. |
| 4 | Textile Machinery | Constitutes machines used in various steps of textile fabrication such as spinning weaving, processing, testing etc. |
| 5 | Plastic, Paper & Rubber Machinery | Constitutes machinery used in various fabrication steps of paper, plastic and rubber manufacturing |
| 6 | Light Engineering Goods | Constitutes machines related to roller bearing, process control, instruments, castings, steel forgings, and pipes etc used in oil & gas, power, automotive etc. industries |
| 7 | Earthmoving, Construction and Mining Equipment | Constitutes machines such as graders, dozers, excavators etc for mining and mixers, tippers, road millers etc. For constructions. |
| 8 | Material Handling and Lifting Equipment | Constitutes primarily of forklifts and cranes. |
| 9 | Agricultural Machinery | Constitutes machines used in various steps of agriculture such as land development, sowing weeding, harvesting etc. |

*Table 1.2.1 Sub Sectors of Capital Goods Industry*

## 1.2.2 Features of capital goods industry

- Economic performance of the sector is linked with that of manufacturing industry which is the key end-user of the Capital Goods industry.

*Fig. 1.2.1 Economic performance of the Industry*

- Capability to manufacture most of the major capital goods limited to domestic purpose. However, imported machineries from foreign give a stiff competition because of better technology and competitive pricing.
- The output of the sector is concentrated with a top few companies in most product groups, followed by a section of companies comprising medium to small scale players.
- Indian companies primarily target on the domestic market leaving export market intact. However, some of the larger players are exploring export market growth targeted especially towards the Middle East and Asian markets. The sector is expected to depend on government support on areas like export financing and promotion to tap vast global capital goods market opportunity.

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

CGSC
CAPITAL GOODS SKILL COUNCIL

# 4. Engineering drawing

Unit 4.1 – Introduction

Unit 4.2 – Presentation of engineering drawings

Unit 4.3 – Standards of drawing

Unit 4.4 – Sectional views

CSC/N0402

## Key Learning Outcomes

**At the end of this module, you will be able to:**

1. Discuss about engineering drawing
2. Discuss about presentation of engineering drawing
3. Know about drawing projections
4. Know about orthographic projection
5. Know about 1st angle and 3rd angle projection
6. Discuss about drawing standards
7. Know about types of lines
8. Know about drawing sheet size standards
9. Discuss about dimensions
10. Discuss about sectional views
11. Know about full section view
12. Know about half section view
13. Know about auxiliary section

UNIT 4.1: Introduction

## Unit Objectives

**Towards the end of this segment, you will be able to:**

1. Discuss about basics of engineering drawing
2. Know about classification of drawings

## 4.1.1 Introduction of engineering drawing

**Engineering drawing:** It is a graphical language utilized by specialists and other specialized faculty related with this profession. The reason for engineering drawing is to pass on graphically the thoughts and fundamental data for the development or examination of structures, machines or frameworks. These are point by point technical drawings drawn precisely and accurately. These are line drawings, drawn with the guide of numerical instruments by recording and transmitting the specialized data. They provide accurate and entire explanation of machines or machine components which have to fabricate or manufacture.

- Technical drawings can't sow the actual view of articles as they appear to the eye.
- Drawings do the utilization of many particular symbols and traditions keeping in mind the end goal to transmit specialized data unmistakably and precisely.
- To learn and accurately translate specialized drawings, you have to familiarize with the essentials of specialized drawing.

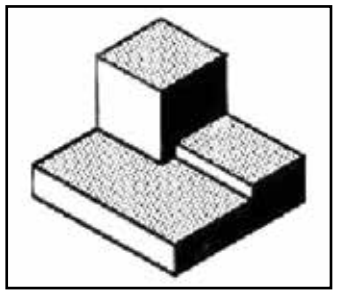


***Fig 4.1.1*** *Machine block*

## 4.1.2 Need for correct drawings

Any specialized individual must be clear while creating the drawings, meaning and interpretation should be correct, otherwise confusion can rise. In various agreements, the drawing is a formal report. The success and failure of a structure relies on the clarity of points given in the drawing. There should not be any scope for any confusion even by accident in the drawing.

It is not possible to create the vehicles/machines on a large scale where various assembling and sub-assembling are included, without clear, right and precise drawings. To accomplish this, the

specialized individual must pick up a careful learning of both the standards and accustomed practices of draughting. If these practices are not accomplished properly, the drawings arranged by one may cause unavoidable delays and costs during production in workshop.

## 4.1.3 Classification of drawings

1. **Machine drawings**: It is relating to the parts of machine or segments. It is exhibited by various orthographic perspectives, the state of the segment and size is completely clear. Machine drawing is classified into part drawing and assembly drawing. Below example shows a machine drawing Fig.

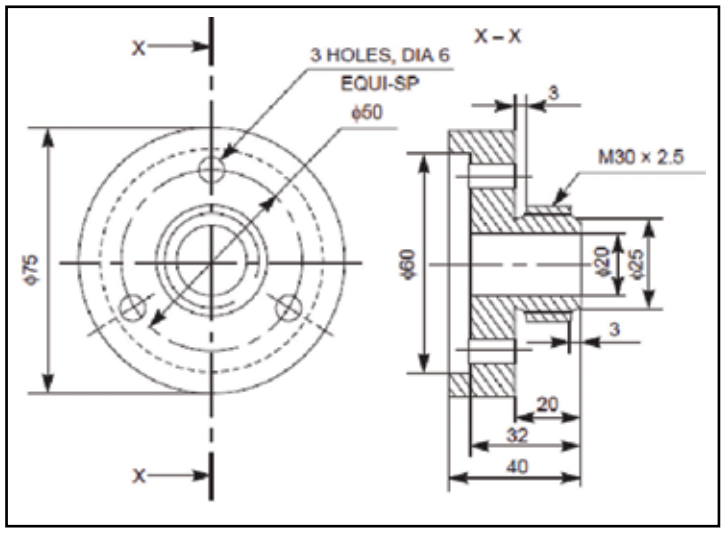



***Fig 4.1.2*** *Machine drawing*

2. **Production drawing:** Working drawing is indicate as production drawing. It outfits every dimension and finishing procedures, like surface finish, heat treatment, lapping, sharpening etc., to instruct the expert in workshop for producing the part. Mentioning of used material, required amount of parts for the collected unit, etc. should be there in the title.

   Ordinarily one component will be made at a time, so production drawing of every section should be prepared on a distinct page. In few circumstances, at times the drawings of associated segments might be mention on a similar sheet. An example of a production drawing is shown in Fig.

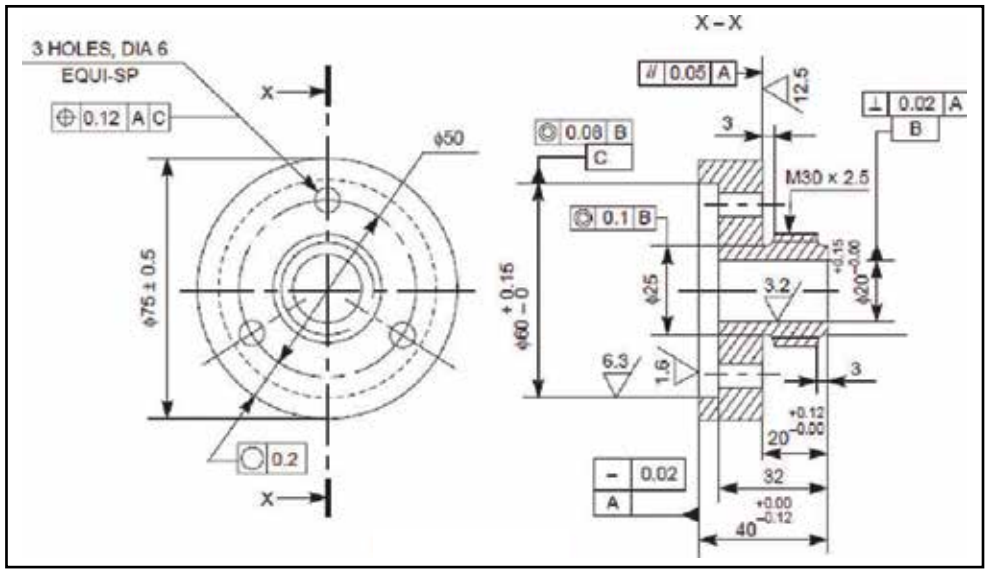
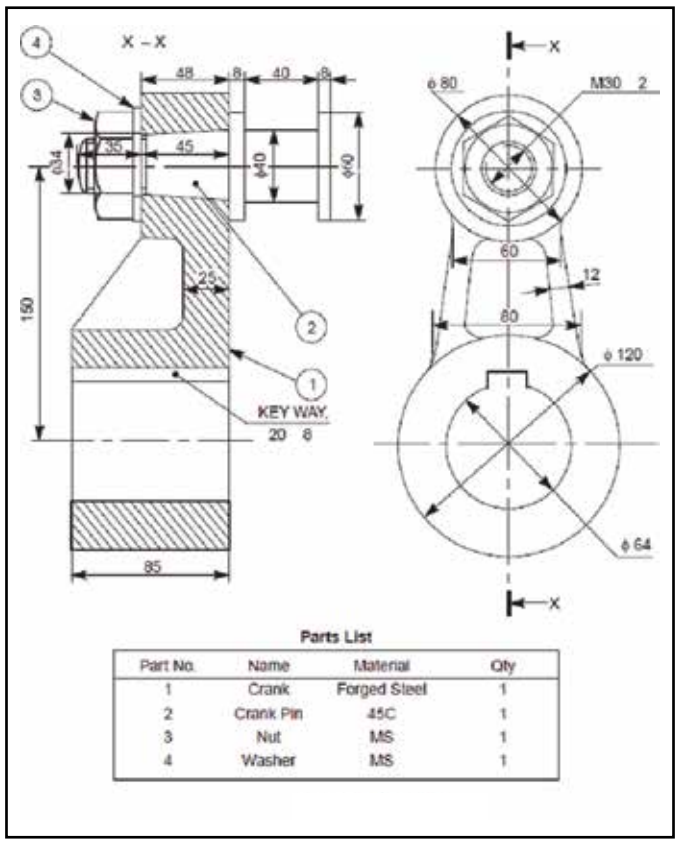



*Fig 4.1.3* *Production drawing*

3. **Parts drawing:** An elaborated drawing of an element to make manufacturing easy, parts drawing is used. Each one of the procedure of graphic presentation must be taken into the consideration and the standards of orthographic projection to convey the subtle elements in a part drawing. A part drawing with production points of interest are appropriately known as a working drawing or production drawing.

4. **Assembly drawing:** An assembly drawing demonstrates the different parts of a machine in their accurate working areas. Few examples of these drawings




**Parts List**

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

*Fig 4.1.4* *Assembly drawing*

i. **Design assembly drawing:** For designing a machine, firstly design assembly drawing is required for envisaging the machine performance, shape and clearance of parts.

ii. **Detailed assembly drawing:** This drawing is generally used for simple machines having small number of simple parts. All information and measurements required for forming and assembling of machine is given on this drawing. Separate views and fitting of parts together is also shown in this drawing.

iii. **Sub - assembly drawing:** Many assemblies before assembling require separate parts and pre-assembled components. These pre-assembled parts are called sub-assemblies. Sub-assembly drawing is utilized to show the assembly of parts of complex machines like diesel engine fuel pump, lathe tail-stock, carburetor, etc.

iv. **Installation assembly drawing:** This drawing shows dimensions and position of necessary parts. It also shows total dimensions of assembled part. This drawing shows correct working position of all machine parts and also gives necessary information required for machine assembly.

v. **Assembly drawing for catalogues:** Special assembly drawings are used for company catalogues. These drawings demonstrate just the relevant points of interest and measurements that would intrigue the potential purchaser. The overall and principal dimensions shown in figure and shows a typical catalogue drawing.

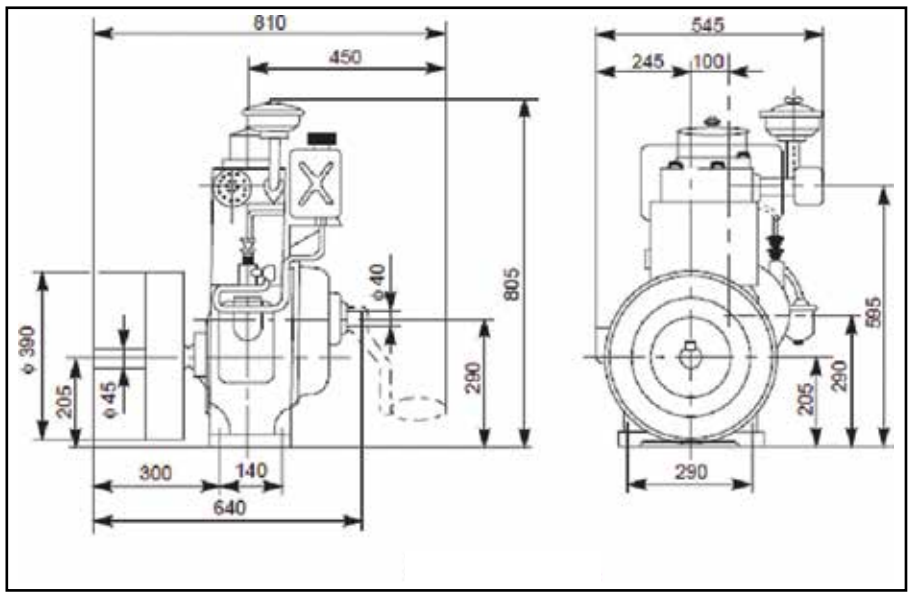



***Fig 4.1.5*** *Catalogue drawing*

vi. **Assembly drawing for instruction manuals:** These drawings as assembly drawings are to be utilized when a machine, transported away in collected situation, is knocked down with a specific end goal to check every one of the parts before reassembly

**vii. Exploded assembly drawings:** At times, exploded pictorial perspectives are provided to meet guideline manual prerequisites. These drawings by and large are placed in the parts list area of a company direction manual. Fig. demonstrates drawings of this sort which might be effectively seen even by those with less involvement in the perusing of drawings; in light of the fact that in these exploded views, the parts are situated in the arrangement of assembly, yet isolated from each other.

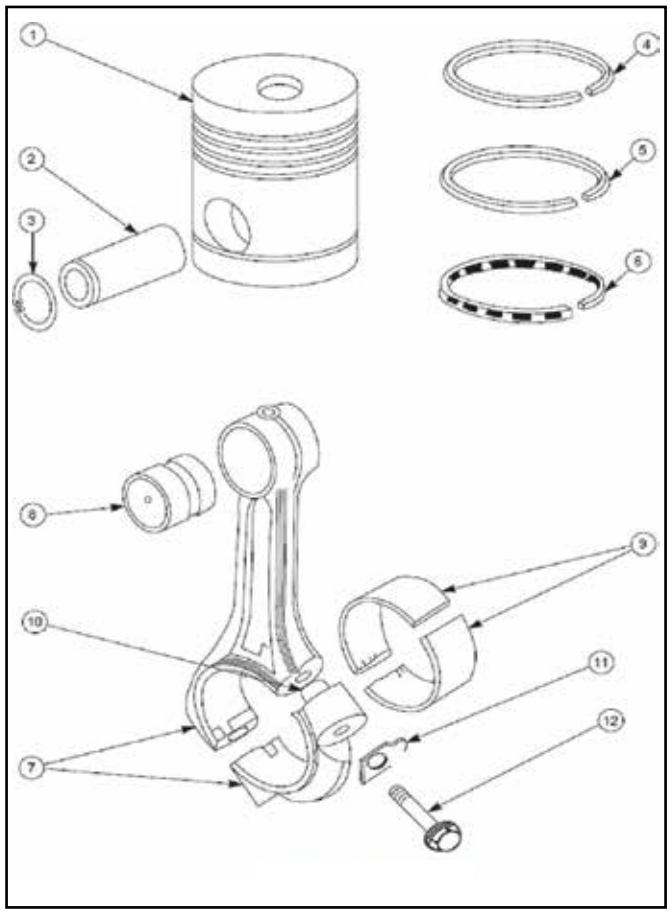



***Fig 4.1.6*** *Exploded assembly drawing*

**viii. Schematic assembly drawings:** It is exceptionally hard to comprehend the working standards of complicated machine, just from the assembly drawings. Schematic portrayal of the unit encourages simple comprehension of its working standard. It is an improved outline of the machine or of a framework, replacing every one of the components, by their individual traditional representations. Fig. demonstrates the schematic portrayal of of a gearing graph.

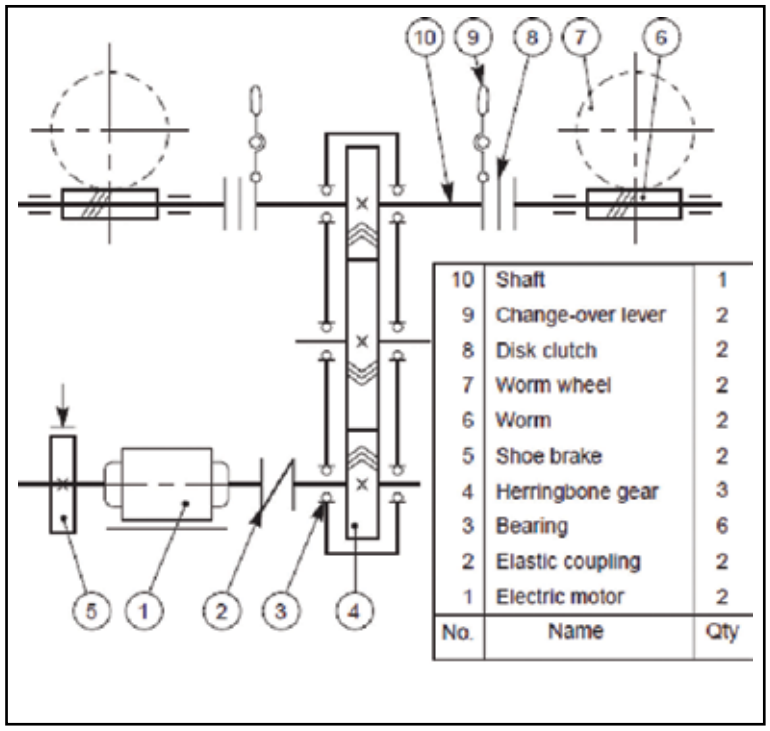



***Fig 4.1.7*** *Schematic assembly drawing*

ix. **Machine shop drawing:** For finishing operations, forgings and uneven castings are move to machine workshop. Machine shop drawing only gives information about machining. In view of a similar standard, one may have forge shop drawing, sheet metal drawing, pattern shop drawing, etc.

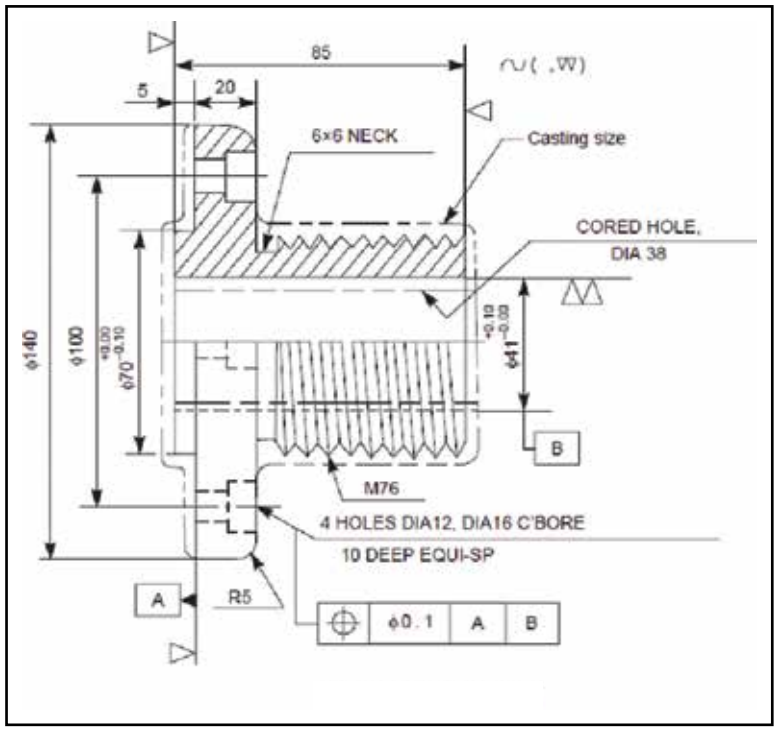



***Fig 4.1.8*** *Machine shop drawing*

Unit 4.2: Presentation of engineering drawing

## Unit Objectives

**Towards the end of this segment, you will be able to:**

1. Discuss about various drawing projections
2. Discuss about orthographic projection views
3. Know about concept of quadrants
4. Know about 1st angle and 3rd angle views

## 4.2.1 Presentation of engineering drawing

Engineering drawings can be present in following ways:

1. Axonometric (Pictorial) Projections
2. Orthographic projections

**Axonometric (Pictorial) Projections**

When three dimensions (3-D) are used to draw an object, i.e. object is visible from all three sides in one drawing, this type of projection is called axonometric projections. Usually single drawing is prepared.

- Their extensive use is in creative drawing.
- A three dimensions (3-D) view (i.e. at the same time it shows all three aspects of object i.e. length, width and height).
- By enabling the observer to see three of its sides and also its three general measurements.
- The explanation of its shape should be correct and complete, especially as connected to its spaces on the basement is inadequate.

Currently used standards for axonometric projections are:

- **Dimetric Projection:** In dimetric projection, dimensions of two axes shown are of TRUE SIZE. Dimension of third axis shown is HALVED. Dimetric projection is considered mostly for those projections, where preference is given to one view of object over other two views

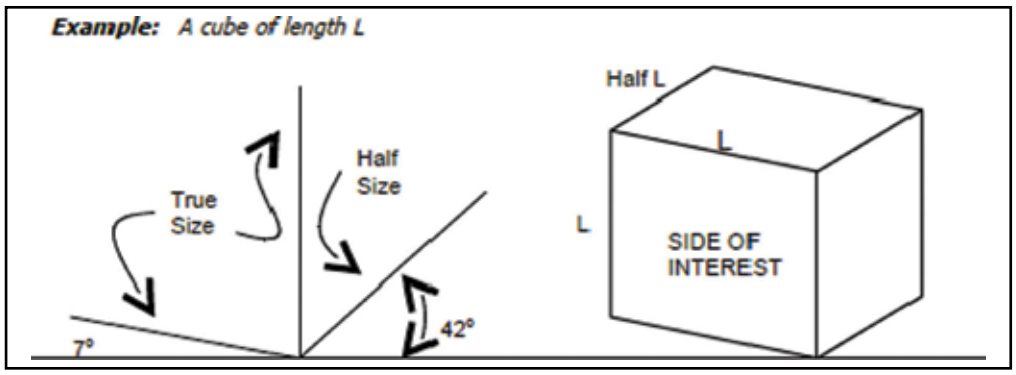



***Fig 4.2.1*** *Dimetric projection*

**Isometric Projection**

In this projection, dimensions of all three axes shown are of TRUE SIZE. When all the three views of object have equal preference, then isometric projection is preferred.

***Example:*** *Cube of length L*

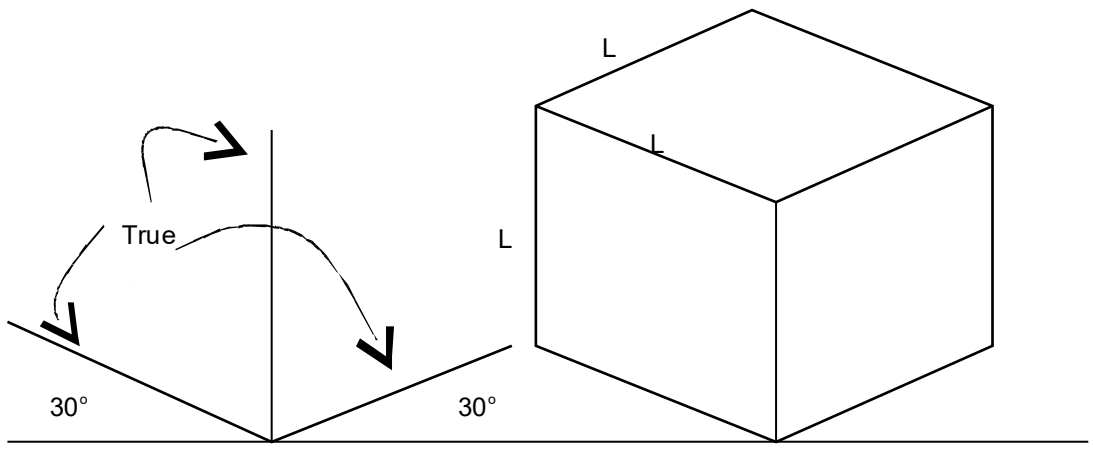



***Fig 4.2.2*** *Isometric projection*

**Orthographic Projections**

In basic engineering drawing, orthographic projection method is used. Here in industry to communicate technical information through engineering drawing, we generally use orthographic views (OV) instead of pictorial views.

- OV records the exact shape of objects.
- OV only shows one side of an object and overall dimensions of two and its two-dimensional (2-D) drawing.
- At least couple of OV is needed to demonstrate the object in 3-D and to illustrate its complete shape.

So, here we are going to only study about orthographic projections.

## 4.2.2 Orthographic projection

Orthographic drawings are the establishment of technical and machine drawings. These drawings generate complete data for development and repair, and in addition exhibit the object in its actual extents i.e. its size and shape. The orthographic projection demonstrates the object like it views from the front, right, left, base, top or back, as per the projections in first-angle or third-angle projection. Third angle orthographic projection is standard projection for every single mechanical drawing.

Orthographic projection is the technique for speaking to the correct state of an object in at least two perspectives, on projection planes commonly at right angle position to each other or by drawing perpendiculars from object to planes.

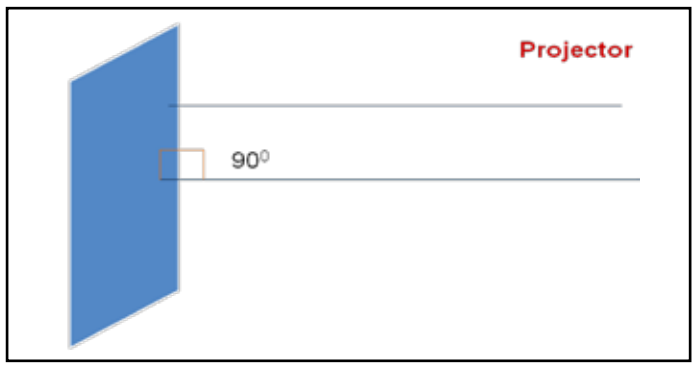



***Fig 4.2.3*** *Plane of projection*

One of these perspectives is alluded to as the “plane” or top view, which describes the object as it shows up from specifically overhead. Other view is known as the “elevation” or front view, which describes the object as it shows up specifically from the front. Still another, assigned as “side elevations” or side view, supplements the top and front perspectives by giving data not given in these perspectives.

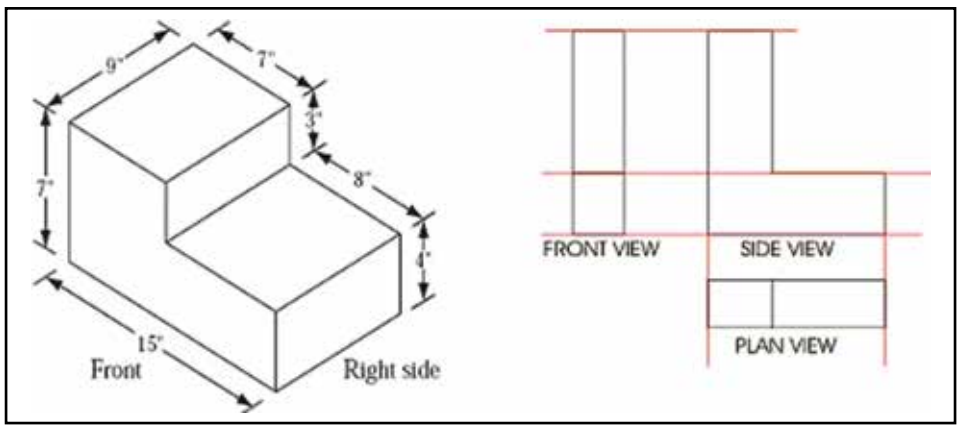



***Fig 4.2.4*** *Orthographic projection views*

**View arrangement:** Concentrate the course of action of the three perspectives in figure. The front view is the starting point of drawing. Front view is chosen as base view because it highlights the important attributes of the object. The right side view is anticipated straightforwardly to right of the front view. Top view is placed over the front. It is subsequent to concentrate each view, attempt to envision or picture the presence of the object.

**Principal Plane Line:** Drawings are divided into zones. Each zone of drawing carries OV, combine with the symbols and data needed to draw that view. The zones are isolated by principle plane lines which are also known as crossed (90°) development lines. These lines are like a coordinate system. These lines are excluded in completed drawings. Principle plane lines are characterized as shown in fig.

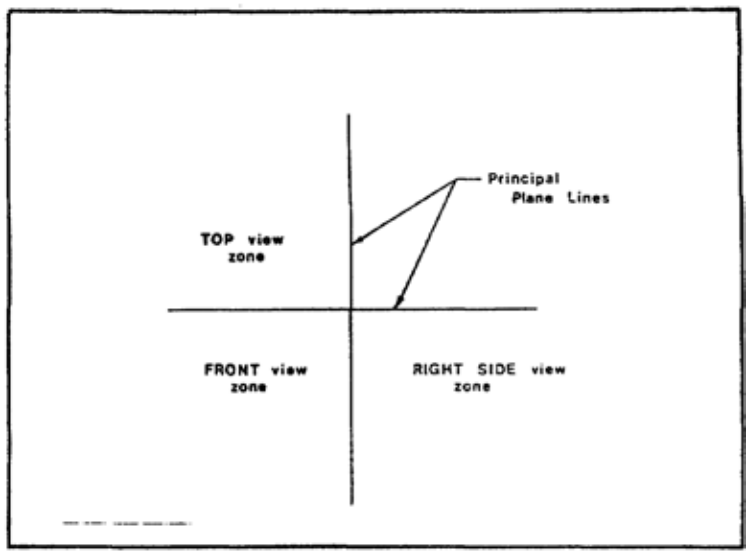



***Fig 4.2.5*** *Principle plane of line*

**For example:** Orthographic views of a cylinder are

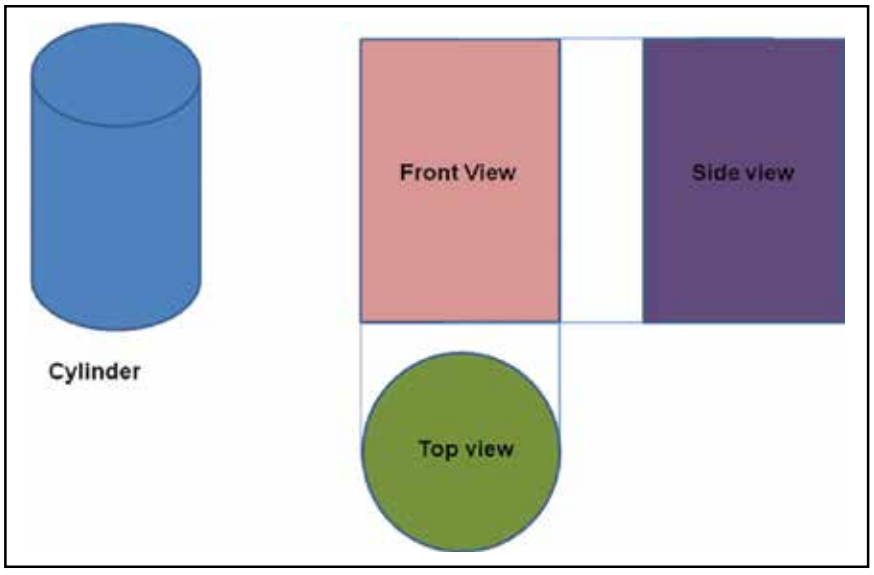



***Fig 4.2.6*** *Orthographic views of cylinder*

To understand how to draw these views, first we need to understand the planes of projection and concept of quadrants.

## 4.2.2.1 Concept of Quadrants

See the projection of cylinder in all the four quadrants as shown

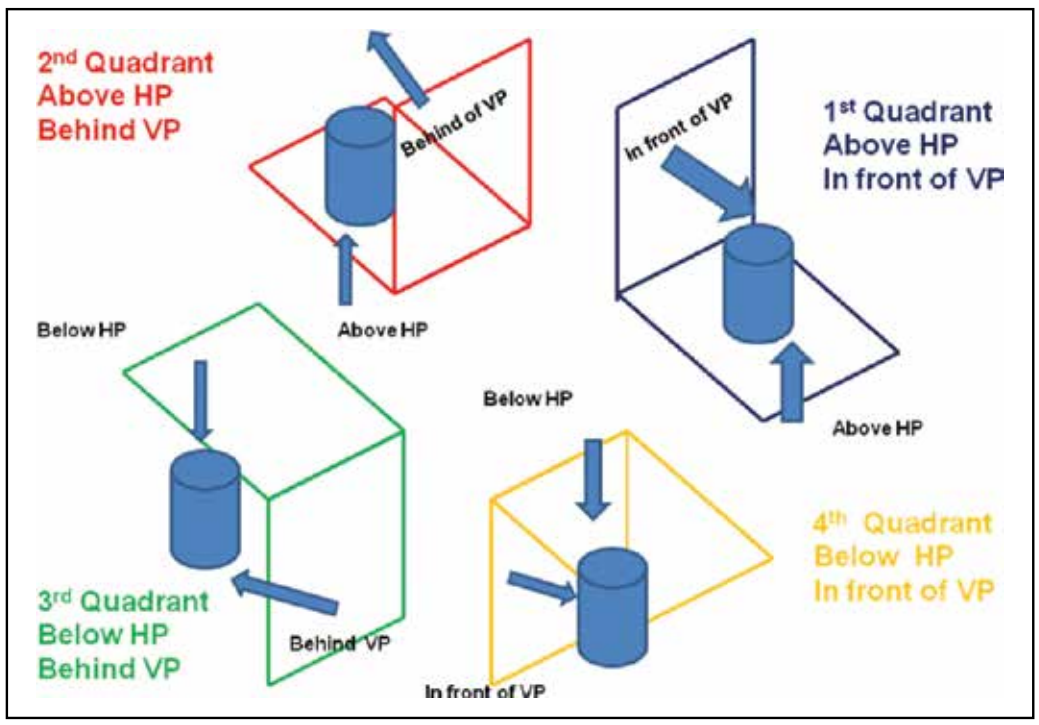



***Fig 4.2.7*** *Projection of cylinder in four quadrants*

- If we imagine the projection in 1st quadrant, then it is called 1st angle projection.
- If we imagine the projection in 2nd quadrant, then it is called 2nd angle projection.
- If we imagine the projection in 3rd quadrant, then it is called 3rd angle projection.
- If we imagine the projection in 4th quadrant, then it is called 4th angle projection.

For basic engineering drawings; two guidelines are regularly being used in orthographic projection; the first angle projection also known as European projection and third angle projection also known as American projection. Perspectives are indistinguishable in both techniques for projection with the exception of their relative positions on the drawing paper. So, let's understand them:

**1st angle Projection – Rotation of Planes**

In 1st angle projection, the front view is reference VIEW and other views are drawn as "shadows" of that view. For example, the left hand side view is drawn on the right side of front view. So, the top view (plan) is drawn at the base of front view, and so on.

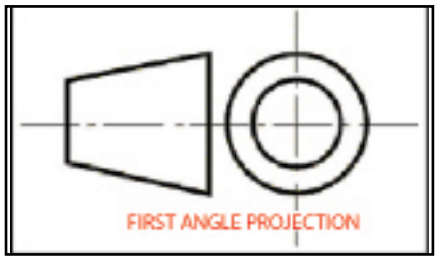
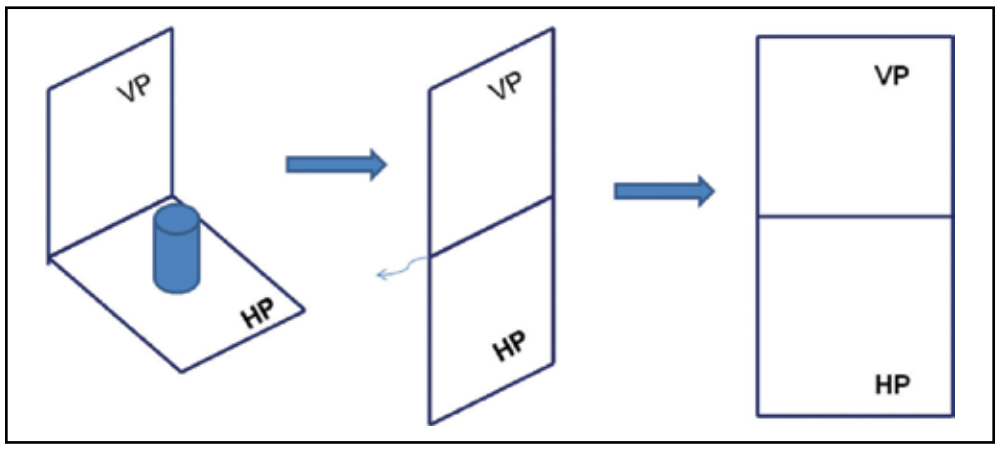



***Fig 4.2.8*** *1st angle projection*

**Step 1:** Rotate the Horizontal Plane Clockwise through $90^{0.}$

**Step 2:** Rotate the planes clockwise through $90^{0}$ to face the observer.




**3rd angle Projection – Rotation of Planes:**

In 3rd angle projection, the front view is the premise (similarly as before) however other views are drawn as "reflections" of font view. In this projection, the left hand side view is drawn on the left hand side of front view. Additionally, the top view (plan) is drawn over the front view.

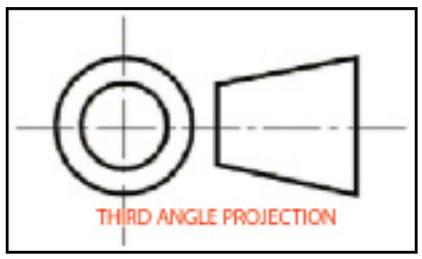
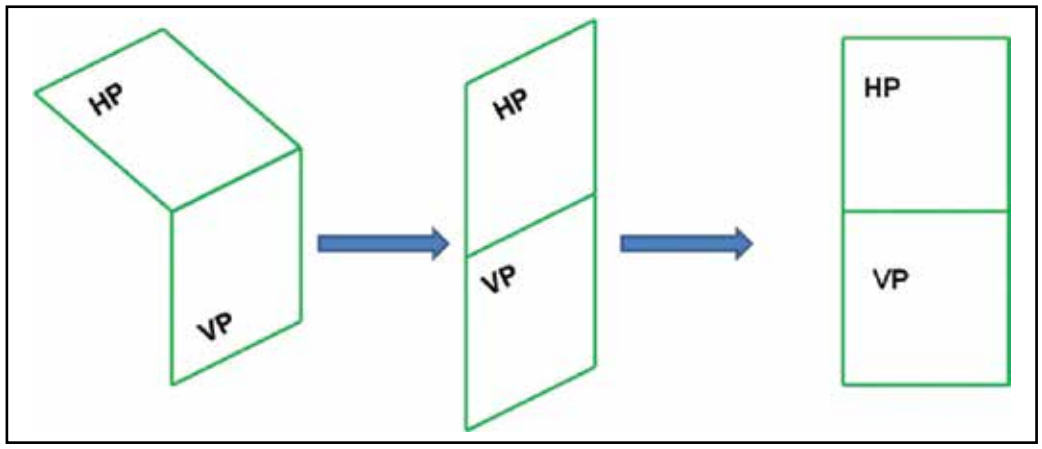


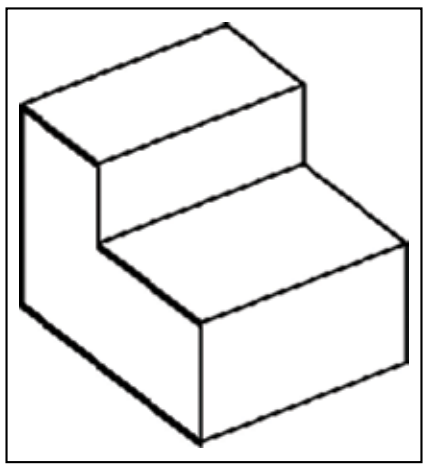

***Fig 4.2.9*** *3rd angle projection*



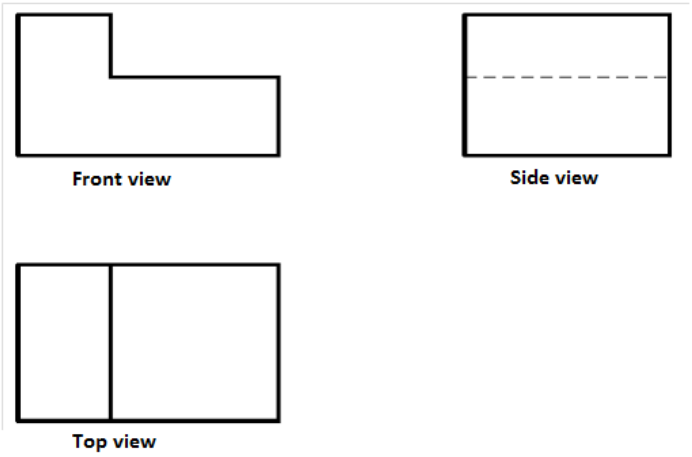

**Step 1:** Rotate HP through $90^0$ in the clockwise direction

**Step 2:** Rotate the planes through $90^0$ in the clockwise direction to face the observer

**For example**: The Left Hand Side View (LHSV), Top View (PLAN) and the Front View (FV), and of the below object



In 1st angle projection is:



In 3rd angle projection is:

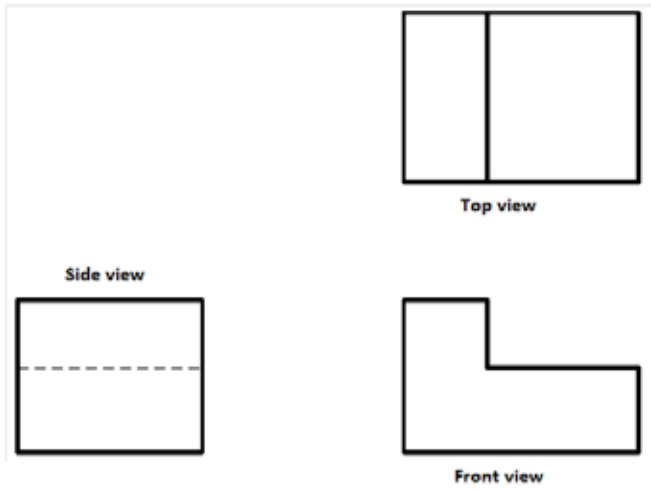



*Fig 4.2.10 Example of 1st angle and 3rd angle projection*

## 4.2.2.2 Tips for drawing the sketches

For drawing technical drawings, some tips given are:

- **Visualize Object:** Visualize the definite and clear picture of object in mind, and then a decent graphical picture can be created.
- **Determine Views:** The perspectives might possibly be the same with respect to a scale drawing; e.g., the thickness or state of the line can be utilized to draw a view.
- **Determine Size:** Determine the size of sheet of paper for portraying the object. Size of the sheet should be enough to show all details the object, however permit a lot of space for measurements, notes, and particulars.
- **Locate Center Lines:** When going to start drawing, always locate the inside lines of object.
- **Block in Main Outlines:** Check the extents of width to height in drawing. Select one edge of the object as a unit and assess the proportionate lengths of alternate edges.
- **Complete Detail:** Once the primary blueprint is acceptable, fill the points of interest for right extent.
- **Dimension Lines and Arrowheads:** When the state of the object has been drawn completely, then include the measurement arrowheads and lines. Don't make any estimation until the work is finished.
- **Dimensions:** Now embed the measurements on the drawing. These measurements can be

obtained by a steel cable. Take all estimations from completed surfaces.

- **Titles and Notes:** Titles and notes should be embedded together with the date mentioned on sheet.
- **Check:** Make a last check after completing the draw. Do it carefully.

## Notes

Draughtsman – Mechanical

Participant Handbook

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

CGSC
CAPITAL GOODS SKILL COUNCIL

**Address:** Federation House, 1, Tansen Marg, New Delhi 110001
**E-mail:** support@cgsc.in
**Web:** www.cgsc.in
**Phone:** +91 11 65002121
**Regn. No.:** S/ND/274/2013

978-1-111-22222-45-7

**Price: ₹160/-**

"This book is provided free to students under the PMKVY (Pradhan Mantri Kaushal Vikas Yojana)."

CGSC