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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: **Machining**

Reference ID: **CSC/ Q 0115, Version 1.0**

NSQF Level 3

CNC – Operator Turning

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"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

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: ' **CNC - Operator Turning** ' QP No. ' **CSC/Q0115 NSQF Level 3** '

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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.

CNC Operator – Turning operates Computer Numerically Controlled (CNC) lathe machine, in order to perform turning operations on metal and plastic components, as per specifications provided.

It involves removal of metal from the outer diameter of a rotating cylindrical workpiece. It also involves inspecting the components and continuously monitoring of the machining operations and making minor adjustments in order to ensure that the work output is to the required quality and accuracy.

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

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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 CNC operator 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 a CNC operator

Unit 1.1: Understanding of Capital Goods Industry

Unit Objectives

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

1. Understanding in 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.

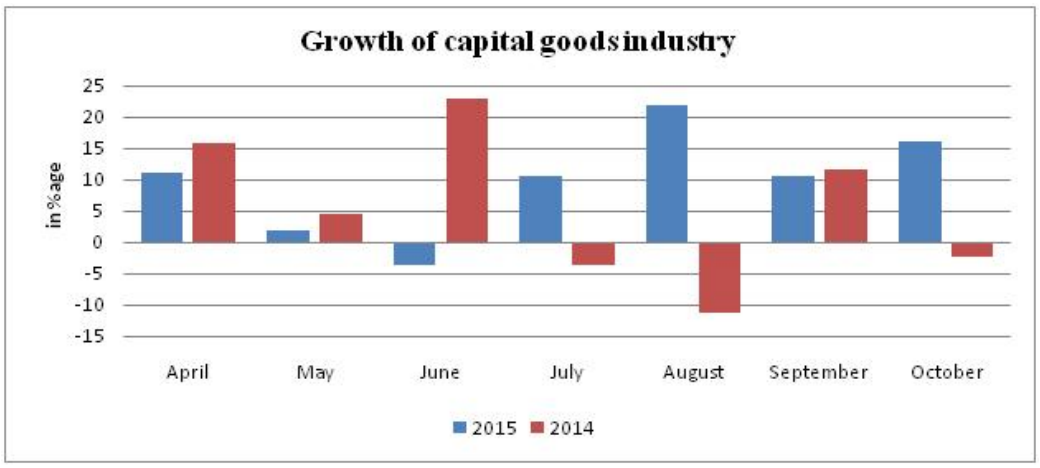

Fig. 1.1.3 Growth of Capital Goods Industry

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

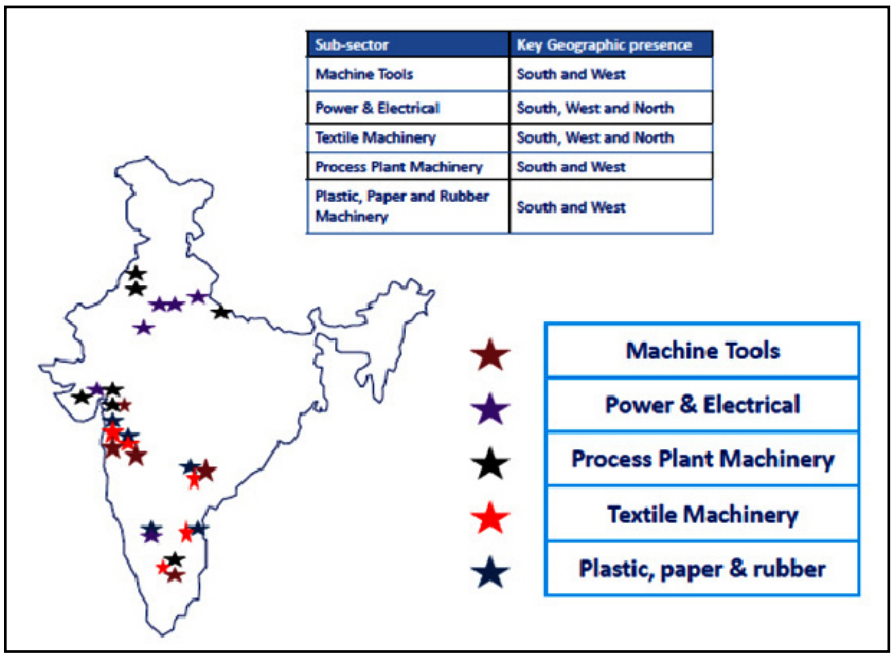

Fig. 1.1.4 Spread of capital goods industry in India

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.
- In most product groups, the output is firstly concentrated with a top few companies 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.

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5. CNC turning

Unit 5.1 – Turning process

Unit 5.2 – CNC turning machine

Unit 5.3 – Cutting tools and inserts

Unit 5.4 – Cutting parameters

Unit 5.5 – CNC turning operations

CSC/N0115

Key Learning Outcomes

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

1. Discuss about turning process
2. Know about turning process cycle
3. Discuss about raw material requirements for turning
4. Know about CNC turning machine
5. Know about cutting tools
6. Know about tool holders and inserts
7. Know about features of cutting tools and inserts
8. Know about turning process cutting parameters
9. Discuss about basic turning operations

Unit 5.1: Turning process

Unit Objectives

After the completion of this session you will be able to:

1. Discuss about turning process
2. Know about turning process cycle
3. Know about cutting process

5.1.1 Turning

It is referred as a basic machining process. Turning process helps in taking out work piece material through cutting tool and also it can create wide range of product. The turning process requires work piece, Lathe machine, fixture and cutting tools.

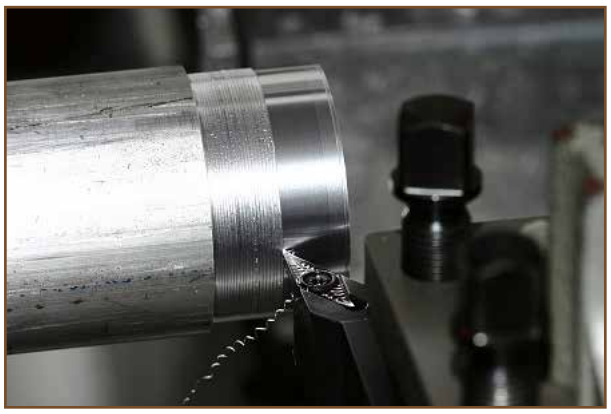
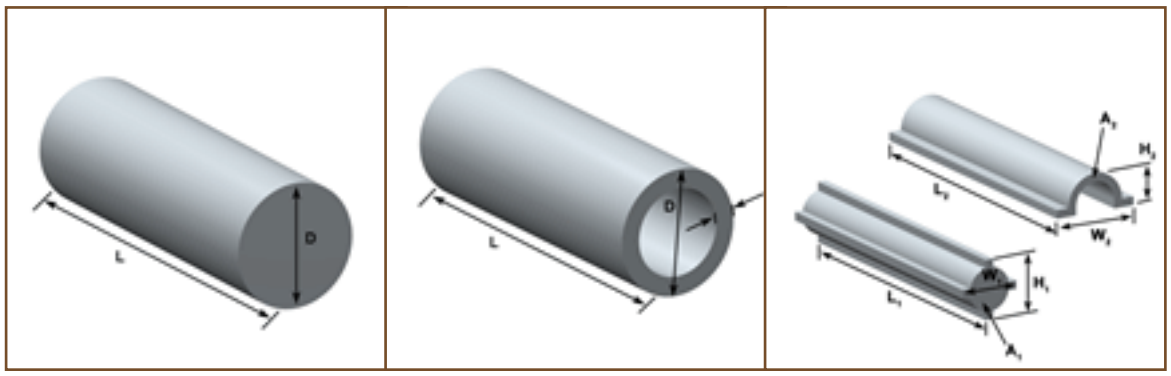


Fig 5.1.1 Turning operation

Axi – symmetric parts are a result of turning which include, grooves, threads, tapers, various diameter steps, and also contoured surfaces. Like custom designed shaft, fasteners etc components manufactured completely using turning process is less used.

5.1.2 Raw material requirements for turning

In turning, the work pieces are cut from a piece of stock, which is taken as a raw form of material. Casting and forging are used to make custom stock and stock may have shapes like cylindrical bar, hollow tubes or custom shape.



Round bar Round tube Custom extrusions

Fig 5.1.2 Raw material shapes for turning operation

Generally used materials for turning are metal and plastic .Others are given below:

- Aluminum
- Brass
- Magnesium
- Nickel
- Steel
- Thermoses plastics
- Titanium
- Zinc

There are multiple factors to be taken into consideration while selecting a material such as strength, machinability, resistance to wear and cost. Following attributes are required for a machinable material:

- Surface should be smooth
- It shouldn't easily damage the tool
- Materials must not require more power to turn
- Whose chips should be such that it can be gathered easily

5.1.3 Turning process cycle

Turning process duration for making a number of parts can be divided as initial setup time and the cycle time for every part. Set up time is divided as set up time for machine, planning of tool movements by machine/manual and the time required to put in fixture device to machine. Cycle time includes the following:

1. **Load/Unload time –**This include time for fitting work piece to the machine, the locking of work piece to fixture and time taken to unload completed part. Factors which affect load time are type of fixture, work piece size, weight and complexity of the work piece decides the load time.
2. **Cut time –** In each and every operation on the work piece the time taken by the cutting tool to make all required cuts is called cut time and can be calculated as

   Cut time= Total cut length for operation/feed rate.

   Feed rate is the tool speed in relation to work piece
3. **Idle time –**Process cycles in which work piece not engaged are called idle time in which no production takes place. Machine setting correction time, time taken to change the tools, tool movements between features, time taken by tool to approach and retract from work piece.
4. **Tool replacement time –** It is the time needed to change a tool which has completed its life time and does not perform well. For an individual part a factor cut time/tool life time gives us the no of tools required for a specific cut .No of replacements multiplied by replacement time gives total replacement time.

   Process cycle time is over with above 4 steps and after this surface finish can be done which can be considered as secondary processes. Cutting tool and lubricant together throws away the scraps like tiny chips of material from work piece during their operation and hence no cycle time is used to remove scrap material. After the job scraps are collected and removed from machine.

5.1.4 Cutting process

Cleaning the material apart with a thin knife or wedge is the idea of a cutting process. The cutting edge is to be wedge shaped with long slope and sharp like a knife so that shearing action happens when tool is moved on work piece. Continuous shearing will be done by the tool as it is pressed by the chip profoundly on the top face .Cutting can be done by moving either work piece or tool. In the figure tool is moved and work piece is fixed.

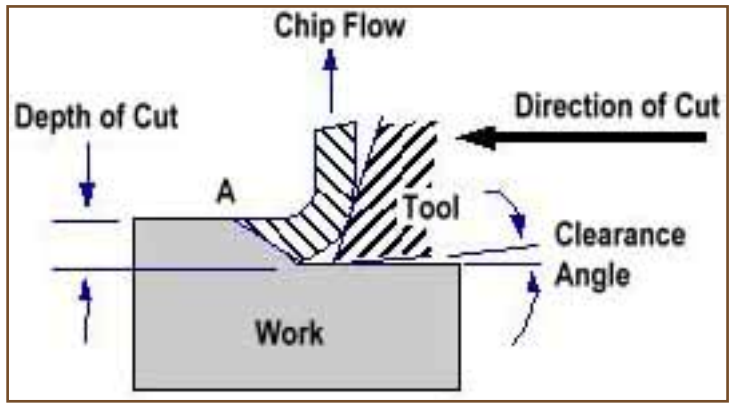


Fig 5.1.3 Turning operation cutting process

Notes

Unit 5.2: CNC turning machine

Unit Objectives

After the completion of this session you will be able to:

1. Know about CNC turning machines
2. Know about machine components

5.2.1. Turning machine

Turning machines mentioned as lathes are available in a various sizes and styles. Vertical turning machines are used for giant diameter work pieces even though most lathes are horizontal turning machines. Classification of lathe machines according to the way of managing machines is.

A manual lathe machine: -An operator manually moves the cutting tool during operation.

CNC machine: - According to the commands programmed in a pc the machine rotates the work piece or tool during turning process. The full form is computer numerical control (CNC) lathe and they have high accuracy. In CNC machine cutting tool fed into the work piece must be good so that it stay stable. The elements that change the work piece to be turned must be also stable. And also these elements embrace the following:

- **Bed –** It is basically an expansive construct that sits in light of the ground or a table and supports various parts of the lathe
- **Headstock assembly –** It is the front section of the machine that is situated on bed and it consists of motor and drive mechanism

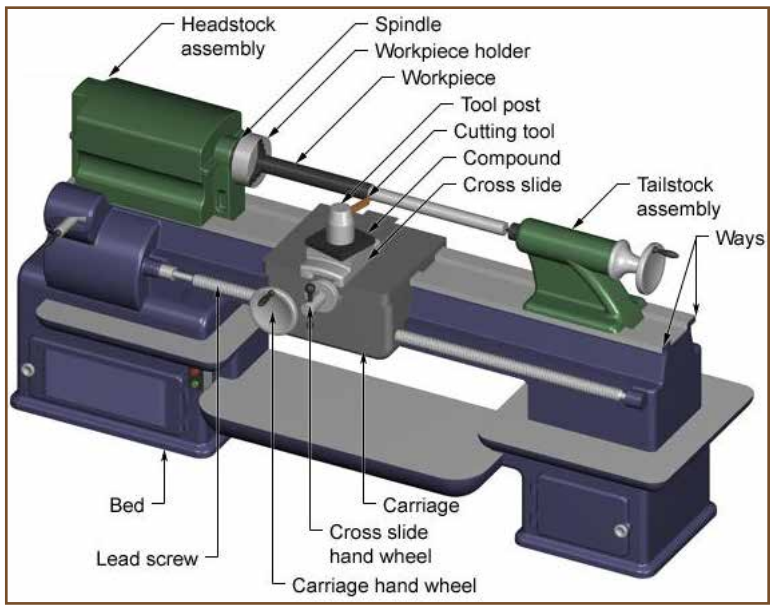


Fig 5.2.1 Lathe machine

to control the spindle. The spindle holds and turns the work piece by work piece holder. Example of work piece holder is a chuck or collet.

- **Tailstock assembly –** It is back area of the lathe that is also attached to bed. This holds the other end of work piece by allowing it to rotate.
- **Carriage –** As the carriage contains the tool post and tools its movement close to the work piece cuts the material away from the work piece. It is situated on tracks on bed and the movement is done using a lead screw driven by a motor/hand wheel.
- **Cross slide –** Depth of cut is decided by this part which moves the tool away/towards the work piece and it is connected at the top of carriage. Cross slide is also operated by a motor or hand wheel.
- **Compound –** Tool post which holds cutting tool is situated on compound. Turning of compound adjusts the cutting tool with respect to work piece.
- **Turret –** A turret is a device which holds various cutting tools to cut the work piece differently. We can select and work using any of tools on turret and turrets hold the tools in position against work piece.

Notes

Unit 5.3: Cutting tools

Unit Objectives

After the completion of this session you will be able to:

1. Discuss about cutting tools
2. Know about cutting tools features
3. Discuss about tool holders and inserts

5.3.1 Cutting tools

Tools used in turning are normally sharp cutting tool. Those are normally sharp single-point cutting device or sharp ended tool with a rectangular shaft. Square, triangle, are normal shapes available and sometimes tools are precious stone mold piece also. They vary in sizes too. These qualities can be used in developing various elements. Work piece is handled by tools installed on turret or tool holder. Some of tools are

- Style A – Lead angle is zero 0 degree for turning tools
- Style B – Lead angle is 15 degree for turning tools
- Style C - square nose tools with 0 degree angle
- Style D - pointed-nose tools with 80 degree included angle
- Style E - pointed-nose tools 60 degree included angle
- Cutoff tools
- Form tools

These cutting tools will be checked regularly for correctness of the path /way on work piece it moves during a cutting operation

Time is constantly squandered if a shamefully formed tool is utilized. The cutting activity of the instrument relies on upon its shape and its modification in the holding device. Lathe cutter bits might be considered as wedges which are constrained into the material to cause pressure, with cutting of the material. To machine metal productively and precisely, it is vital that the cutter bits have sharp, very much upheld edges, and that they be ground for the specific metal being

machined and the kind of cut fancied.

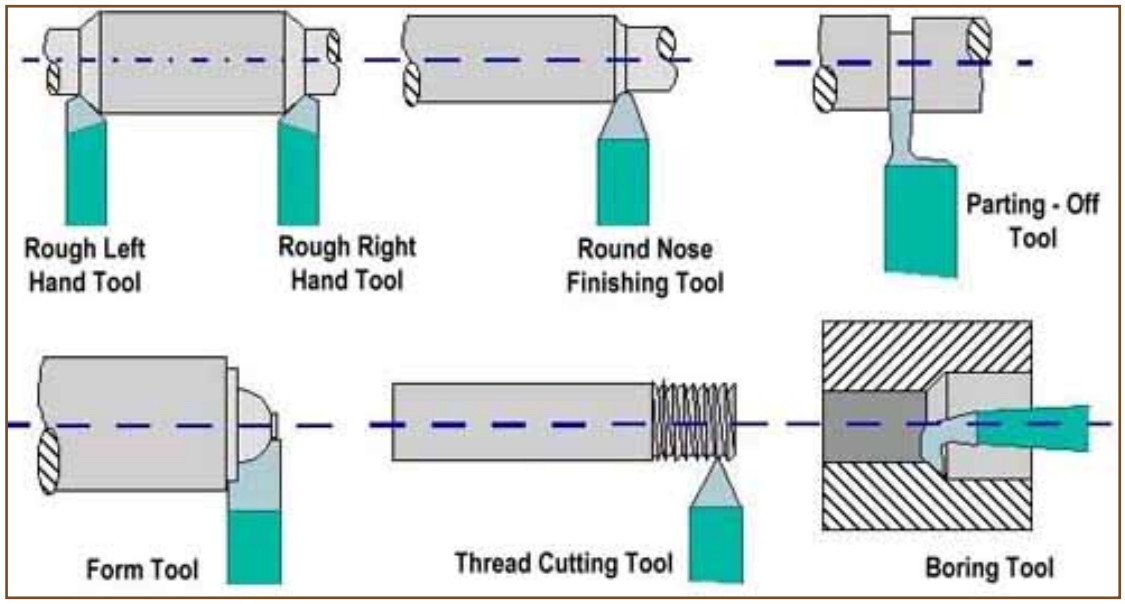


Fig 5.3.1 Cutting tools

5.3.2 Cutting tool characteristics

Following are characteristics of a good quality cutting tool

- Hardness and strength: Must not change with high temperature.
- Toughness: It is required without compromising the damage/crack of tool.
- Wear resistance: Tool life of cutting tools is to be high so that replacement will be less.

Cutting tool materials are classified as steady and unsteady

- Unstable material They have low hardness normally and can be heat treated to make it hard by formation of hard particles like carbide in first grid. Since turning produces heat such materials' properties may vary during turning.
- Stable materials Their hardness doesn't change with temperature increase in activities like machining .Example are tungsten carbide. Wear happens on them because of scraped area, however for the most part don't change their properties much amid utilize.

5.3.3 Cutting tool material selection

Every single cutting tool that are utilized as a part of lathe machine are made with a variety of materials and they decide the property of tools and the work piece types for which they can be used. The tools are generally hard, strong and immune to wear because of above properties. While choosing material for cutting tool, you have to take below points in to consideration:

- Stable materials are extremely delicate because they are enough hard to break before flexing.
- Tools made with special materials with blunt edge provide higher cutting powers because of expanded cutting zone and it refrain the chipping at cutting edge. Rather than steel tools, tungsten carbide tools can be made sharper. Machining of compounds using ultrasonic machine is an example.
- Most stable materials are having high cutting powers and are delicate .So they are not used in any applications other than extensive, substantial and unbending machinery and fixtures.
- Because the unstable materials, are more softer ,tougher and flexible they are used in uneasy machine conditions like in hand tools and light machinery .Because of the flexibility they stand a bit flexing than breaking during operations.

Some of the frequently utilized cutting tool resources are:

1. **Carbon Tool Steel**
   - Unstable, Very reasonable, greatly delicate to warm.
   - It is not usually found in today's machining world ,but used in hobbyist or MRO machining, where low rate drill bits, taps and dies, hacksaw edges and reamers are made out of it
   - HRC 65 is the hardness
   - Possible to make sharp cutting edges with this tool.
2. **High speed steel (HSS)**
   - They are cheap and unsteady type.
   - Change in temperature doesn't affect their hardness.
   - They are mostly used tool material in current machining jobs.

Fig 5.3.2 HSS cutting tools

- Bore and tap making machines use tool of this material
- HRC 67is the hardness.
- Can produce sharp cutting edges.

3. **HSS cobalt**

- Costly and unsteady
- Suitable for tools of rough and solidifying substances like titanium and stainless steel and are resistant to heat.
- Milling cutters and drill bits are made with this
- HRC 70 is the hardness.
- Can be used to make tools with sharp edges.

Fig 5.3.3 HSS cobalt cutting tools

4. **Cemented carbide**

- Stable and reasonably costly.
- The most basic material utilized as a part of the business .Depends on the content of tungsten carbide and cover(normally cobalt) it is available in several “grade”
- They are immune to wear.
- Increments of tantalum carbide and niobium carbide for steel utilization is required for high solvency in iron.
- Even though it is basically used in mill cutters and saw blade it is also used in turning tools.
- HRC 90 is the hardness.
- Not recommended for sharp edge tools.

Fig 5.3.4 Cemented carbide cutting tools

5. **Ceramics**

- It is modest and steady
- They are resistant to heat, inactive to chemicals, but fragile and are preferable in fast applications.
- They are not used in difficult conditions.
- Alumina (aluminum oxide), silicon nitride and

silicon carbide are commonly used types and are used to make turning tool bits.

- HRC 93 is the hardness
- Not used for tools of sharp cutting edges. Also avoid positive rake points .

6. **Cermets**

- Steady while expensive
- It is a hard material made with titanium carbide (TiC). Nickel is used to make cover
- It is more resistant to wear than tungsten carbide but have lesser strength.

Fig 5.3.5 Ceramic cutting tool

- It is inert to chemicals than tungsten carbide
- Even though test is being carried on delivering other cutting tools ,this is used to produce turning tool bits
- HRC 93 is the hardness
- Not good to make sharp edges.

7. **Diamond**

- Heavily expensive but steady
- Strongest substance
- High chemical activity with iron makes them not suitable for steel machining but they are very resistant to wear.
- Used to machine extreme rough materials which cannot be machined with some other material.

Fig 5.3.6 Cermets cutting tool

- Very fragile
- Even it can be used to cover various tools it is normally used to produce turning tools

- Not preferred for sharp edged tools.

Fig 5.3.7 Diamond cutting tool

5.3.4 Cutting tools for different operations

The accompanying is a rundown of the most widely recognized machine particular instrument sorts. Even if most commonly types we would use only few number of tools are there which are actually available.

1. **Face/Turn:** Unbending device like Round, square, or 80 degree diamond is used to deal with harsh turning. More flexible tool like 55 or 35 degree diamond may require for finishing work like to reach and contour part subtle elements. Embeds must be of correct sort, size, shape, and cinching feature(s) with respect to the tool holder.

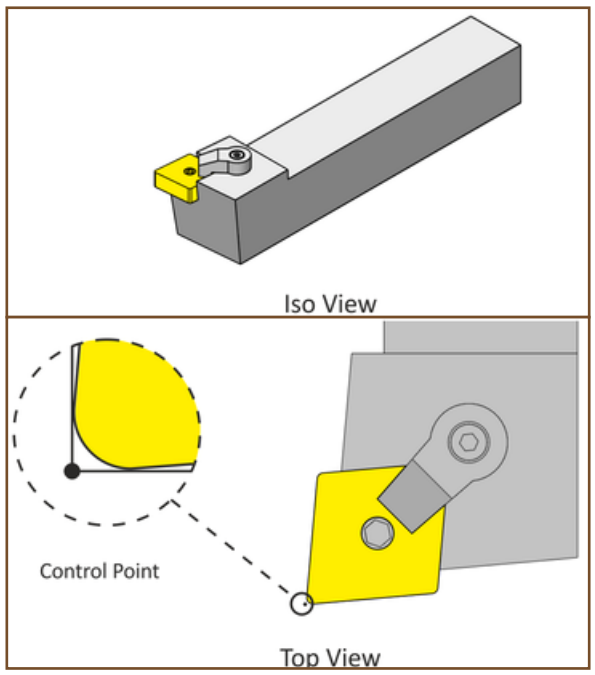


Fig 5.3.8 Face/Turn Tool (Left Hand)

2. **Groove:** Groove tools are grouped to some degree by their width and corner radii. In spite of the fact that utilized for the most part to make groove components, for example, O-ring or snap-ring cuts. They are used in works where diamonds and other shapes cannot be fit even if they not the best option for rough and finishing work. Many types of grove holders are available depending upon the part on cut bearing for the tool like grove holders for OD, ID, and face grooves with right hand and left hand operation

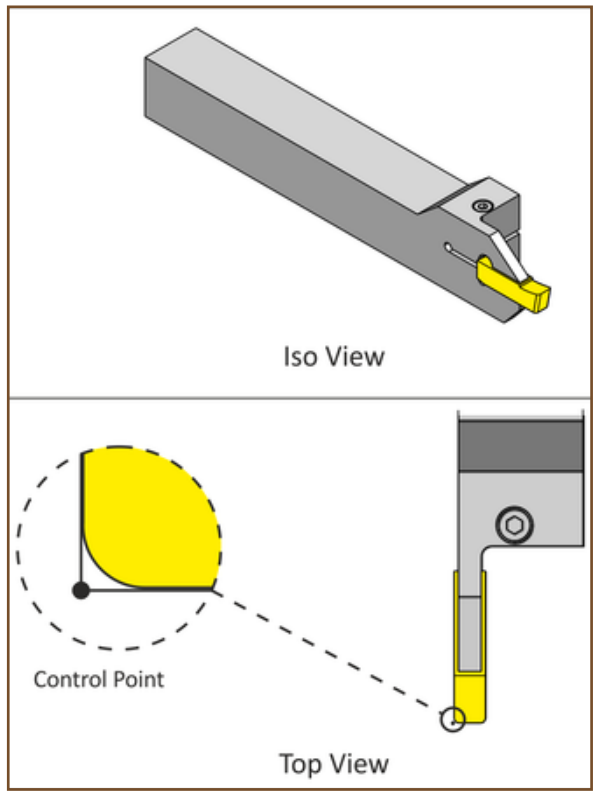


Fig 5.3.9 Groove Tool (Left Hand)

3. **Bore:** Boring tools are used to finish holes exactly. Machine spindle are mounted parallel to Boring bar tools .A primary hole is required for the tools to start the boring and exit from the bore.

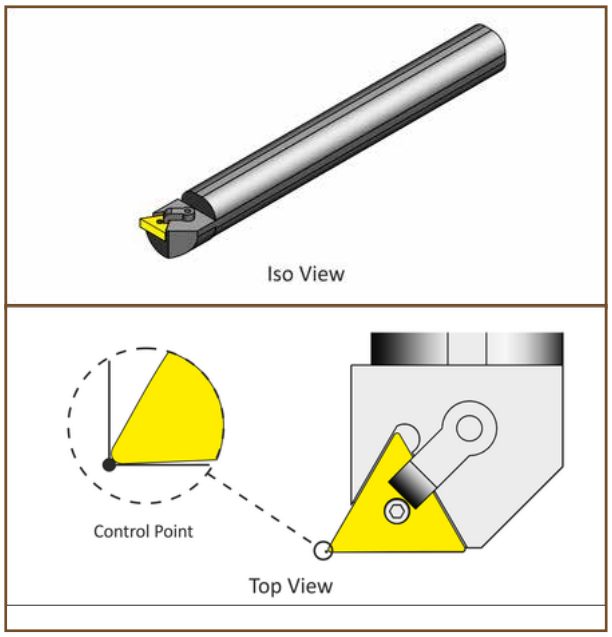


Fig 5.3.10 Boring Bar (Left Hand)

4. **Thread:** Form or cutting tap is used to tap holes at the middle of part, equal to about one inch diameter. Larger ID threads and all ID threads use thread insert.

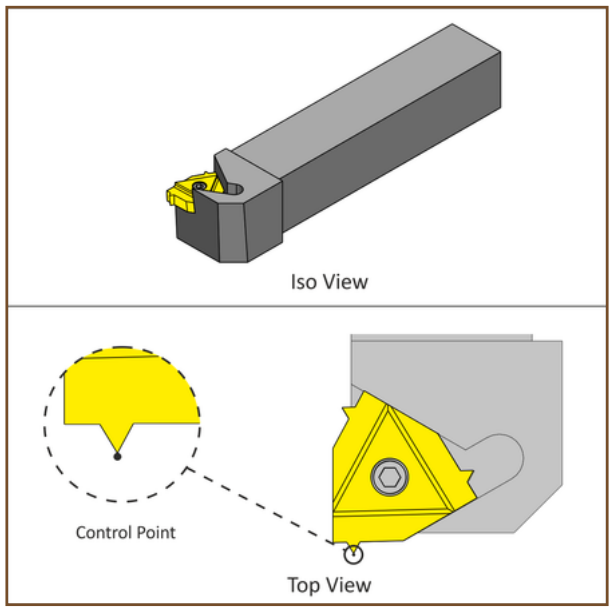


Fig 5.3.11 OD Thread Tool (Left Handed)

5. **Cutoff:** A part is divided or cut off from the stock when completed. Deeper cuts are made by this tool and it is an uncommon groove tool. According to the width and highest cutting depth these tools can be classified. These make deeper cut than groove tool because of their blade shape

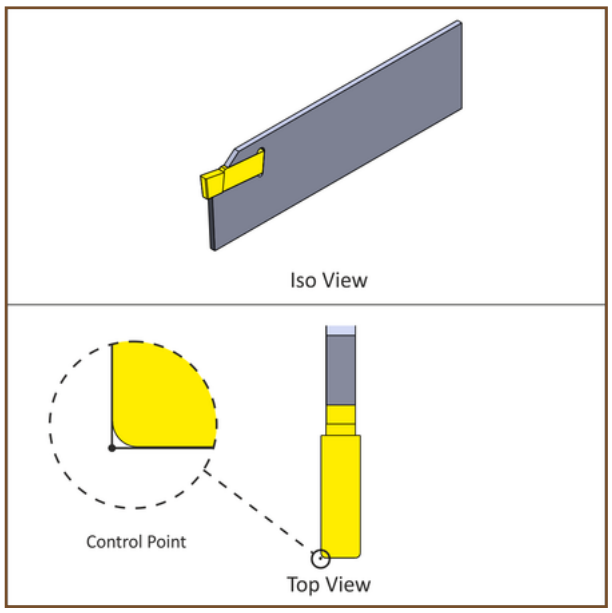


Fig 5.3.12 Cutoff Tool

6. **Center drills:** These are used to make conic on the material of the part and are short and hard. They make accurate hole because of their easiness to go to a sharp point and opposition to bowing. It can drill straightly because of prevention of

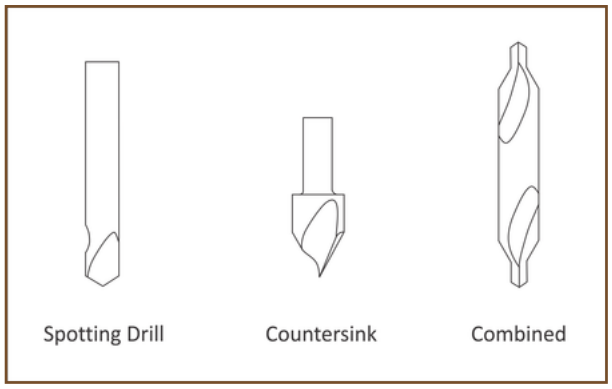


Fig 5.3.13 Countersink and Center Drill

penetration from wobbling by conical shape.

Tapered face for a machine screw is made with countersink drills. Also used to make a tighten leeway hole and in countersink one operation.

Centre, countersink, and joined drills are available in various sizes and tip angles. Since drill measurement is more important than the screw head width, tip edge of the countersink must match the included point of the machine screw

7. **Twist Drill:** Twist drills are available in various sizes and lengths and are made of fast steel, carbide, or cobalt. They may have titanium nitride (TiN) cover for longer life. 118 degrees will be the tip edge of most twist drills.

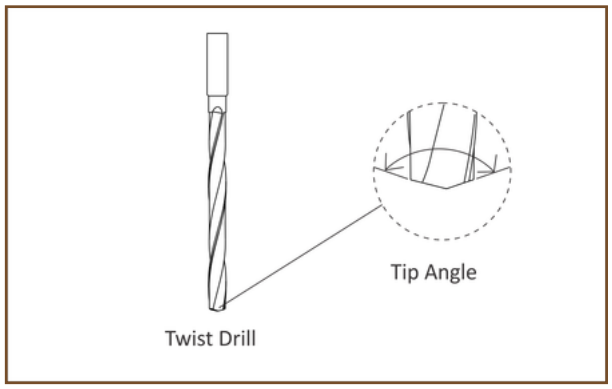


Fig 5.3.14 Twist Drill

8. **Taps:** Cutting taps make holes by removing materials. Frame taps are used to framing the metal to thread shape. For delicate materials including aluminum, copper, metal and plastics Shape taps are used which do not produce any chips .

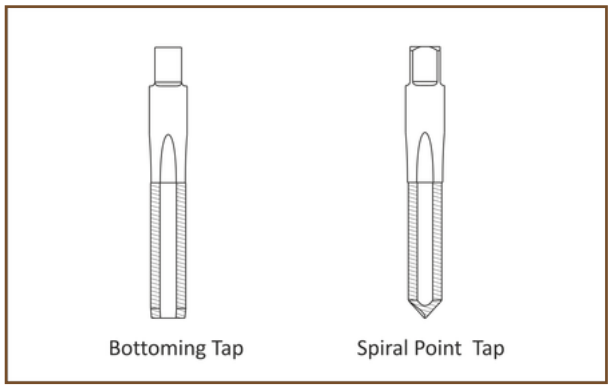


Fig 5.3.15 Taps

Daze holes are made with bottoming taps. Spiral point taps make holes by remove the chip ahead and out the base of a through hole.

Most CNC Machine tap tools are hold in an unbending holder, which support inflexible tapping. Thread lead into the hole is made with a tap of size same as thread. Tap is run at a sustained rate. Axle at that point stops, invert, and pull out of the hole.

9. **Reamer:** Reamer: Precise shaped holes with excellent surface finish are made with reamers. Accuracy of reamed holes is within .0002 inches diameter. Ground pins and bushings holes are made by a reamer.

A specific sized hole must be drilled to use reamer.

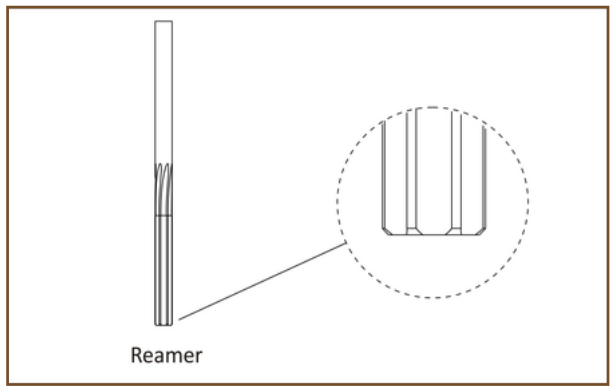


Fig 5.3.16 Reamer

5.3.5 Tool holder and inserts

Carbide embeds are used to finish most turning. Spot drills, drills and taps are used by machines which are portion of instruments that mill utilizes. Holders are installed in turret and hold any additional tools. A holder blend is shown in figure .It is a left-gave type holder, on the basis that the device forefront focuses to one side when seeing the holder from the top.

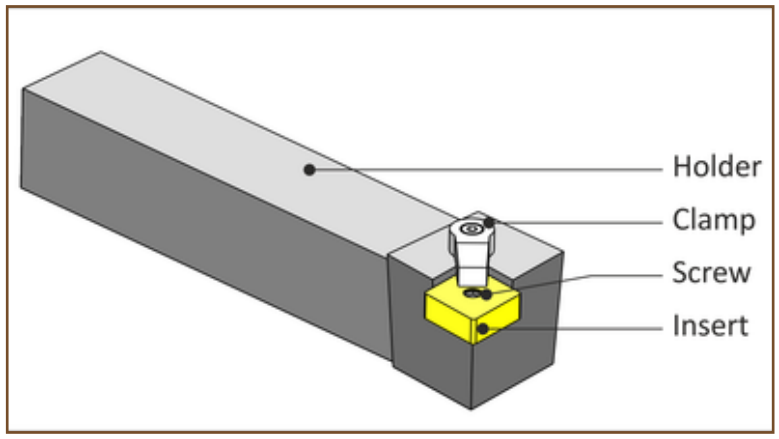


Fig 5.3.17 Typical Lathe Tool Holder

To achieve good precision and high material expulsion rates Carbide embeds use exceptionally designed composite structures, coatings, and geometry components. Additional tools can be used for different edges when they worn. The replacement of tools is done very quickly and efficiently.

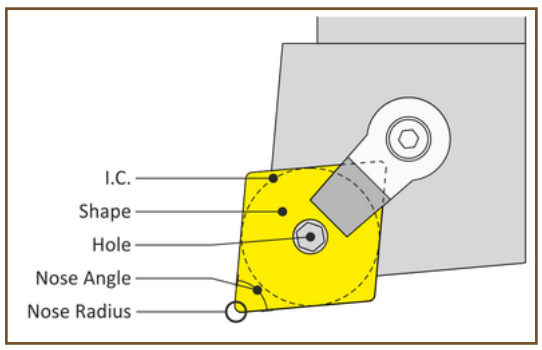


Fig 5.3.18 Insert Terms

CNC – Operator Turning

Participant Handbook

Skill India
कौशल भारत-कुशल भारत

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GOVERNMENT OF INDIA
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& ENTREPRENEURSHIP

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