

**National Competency Standards for  
MACHINIST and CNC MACHINE OPERATOR  
(Level-2,3&4)**

# TABLE OF CONTENTS

PURPOSE OF THE QUALIFICATION .....	3
DATE OF VALIDATION .....	3
PACKAGING OF QUALIFICATIONS .....	4
SUMMARY OF COMPETENCY STANDARDS .....	5
CODE OF QUALIFICATION .....	6
ENTRY REQUIREMENTS .....	6
QUALIFICATIONS DEVELOPMENT COMMITTEE .....	7
QUALIFICATIONS VALIDATION COMMITTEE .....	8
REGULATIONS FOR THE QUALIFICATION AND SCHEDULE OF UNITS .....	8
Demonstrate Communication Skills.....	9
Maintain Safe Work Environment .....	11
Carry out Calculations and Prepare Estimates for Mechanical Work .....	13
Carry-Out Bench Work.....	18
Perform Turning Operations.....	21
Perform Milling Operations.....	24
Perform Shaper Machine Operations.....	27
Perform Grinding Operations .....	30
Generate Gears.....	33
Develop Drawing and Design for Mechanical Components.....	36
Maintain CNC Machines and Tools .....	38
Perform CNC Milling Operations.....	43
Perform CNC EDM Wire-Cut Operations.....	46

## **INTRODUCTION**

A Machinist is a multidimensional tradesperson specialized in machine shop machines and related cutting and measuring tools, equipment or the maintenance and repair of existing machines infrastructure.

In order to meet the demand for machine shop, National Vocational and Technical Training Commission (NAVTTTC) in collaboration with TVET Sector Support Program (TVET-SSP) has developed National Vocational Qualifications comprising of generic, functional and technical competency standards for Machinist occupation.

To facilitate the process of developing National Qualifications for a Machinist, Qualification Development Committee (QDC) was established under NVQF Operational Manual-1. Competency standards, which are benchmarks for the performance, cover both the domestic and commercial aspects of a Machinist's job. While, setting standards for a Machinist's performance, required skills, underpinning knowledge and attitudes expected of a machinist have been inculcated in these competency standards.

Sector Skills Council (SSC) for Construction and experts from related industries have thoroughly reviewed and validated the competency standards as proposed by the QDC in terms of their relevancy and currency to the requirement of the job. The validated competency standards will provide the basis for further development of curricula, assessment materials and instructional materials that will support competency based training and assessment activities.

The training program shall be organized in an institute where Machinist labs are available for trainees.

## **PURPOSE OF THE QUALIFICATION**

The purpose of this training is to develop a range of skills and techniques, personal skills and attributes essential for successful performance as a Machinist while meeting the requirements of the industry. It also enables the trainee to pursue his career as a Machinist with greater employment and entrepreneurial skills to progress.

Specific objectives of these Qualifications are as under:

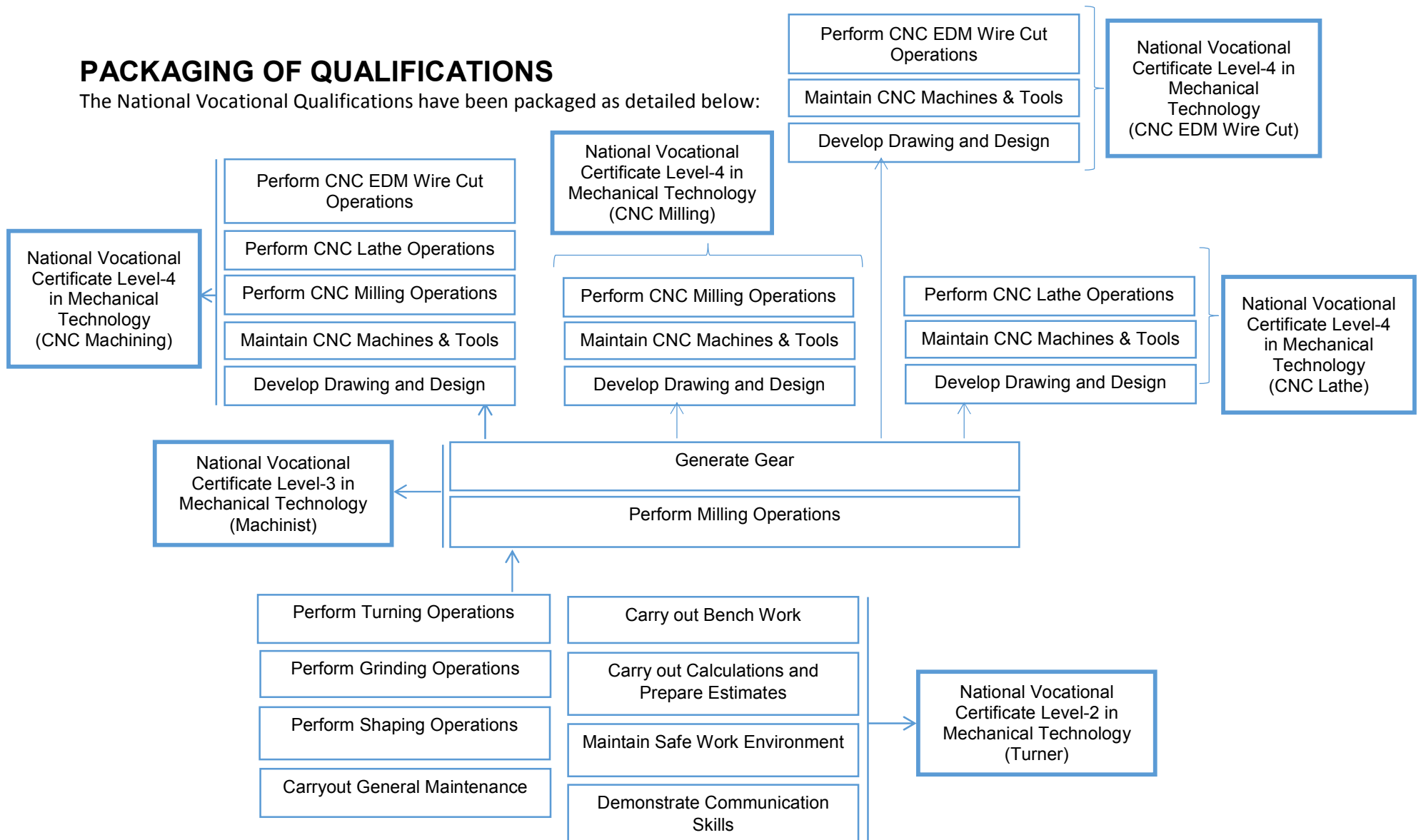
- Improve the overall quality of training delivery and setting national benchmarks for training of Machinists in the country
- Provide flexible pathways and progressions to learners enabling them to receive relevant and current skills set
- Provide basis for competency based assessment which is recognized and accepted by employers
- Establish a standardized and sustainable system of training for Machinists in the country

## **DATE OF VALIDATION**

These national qualifications have been validated by the Qualifications Validation Committee (QVC) on 13<sup>th</sup>& 14<sup>th</sup> February 2018 and they will remain in currency until 13<sup>th</sup> February 2021.

# PACKAGING OF QUALIFICATIONS

The National Vocational Qualifications have been packaged as detailed below:



## SUMMARY OF COMPETENCY STANDARDS

Code	Competency Standards	Level	Credits	Category
	Demonstrate Communication Skills	2	3	Generic
	Maintain Safe Work Environment	2	3	Generic
	Carry out Calculations and Prepare Estimates	2	4	Functional
	Carry out Bench Work	2	15	Technical
	Carryout General Maintenance	2	3	Technical
	Perform Grinding Operations	2	15	Technical
	Perform Shaping Operations	2	3	Technical
	Perform Turning Operations	3	36	Technical
	Perform Milling Operations	3	36	Technical
	Generate Gear	3	20	Technical
	Develop Drawing and Design	4	20	Technical
	Maintain CNC Machines and Tools	2	2	Functional
	Perform CNC Lathe Operations	4	15	Technical
	Perform CNC Milling Operations	4	15	Technical
	Perform CNC EDM Wire Cut Operations	4	12	Technical

## CODE OF QUALIFICATION

Qualification Title	Code
National Vocational Certificate Level-4 in Mechanical Technology (CNC Machinist)	0715MMT06
National Vocational Certificate Level-4 in Mechanical Technology (CNC Milling)	0715MMT07
National Vocational Certificate Level-4 in Mechanical Technology (CNC EDM Wire Cut)	0715MMT08
National Vocational Certificate Level-4 in Mechanical Technology (CNC Lathe)	0715MMT09
National Vocational Certificate Level-3 in Mechanical Technology (Machinist)	0715MMT10
National Vocational Certificate Level-2 in Mechanical Technology (Turner)	0715MMT11

## ENTRY REQUIREMENTS

The entry requirement for National Vocational Certificate Level-2 in Mechanical Technology (Turner) is at least Matric or equivalent.

## QUALIFICATIONS DEVELOPMENT COMMITTEE

The Qualifications Development Committee consisted of following members:

S.No.	Name	Designation & Organization
1.	Dr. Mirza Nadeem Baig	Principal Engineer Pakistan Welding, Islamabad
2.	Muhammad Asad Saeed	Engineer Infinity Engineering
3.	Furqan-Ur- Rahman	Director Pak Industries
4.	Muhammad ImranIhsan	In-Charge (CNC Machine Shop) Light Engineering, Gujranwala
5.	Umar Hayat	Executive Maintenance & Project Atlas Honda Ltd.
6.	Muhammad Younas	Ex. Assistant Manager Staff Training Collage, Lahore
7.	Hafiz Muhammad Saqib	Assistant Manager Dynamic Tooling Service
8.	Ahssan Ali	Production Operator Dic. Colour Comfort by Chemistry
9.	Shahzad Zafar	Facilitator (Ex. Assistant Manager) Staff Training Collage, Lahore
10.	Muhammad Ramzan	Sales Engineer Dynamic Tooling Service

## QUALIFICATIONS VALIDATION COMMITTEE

The Qualifications Validation Committee consisted of following members:

S.No.	Name	Designation & Organization
1.	Muhammad Aslam Khattak	Dy. General Manager HMC, Taxila
2.	Shamshad Gill	Junior Officer (Mechanical) HMC, Taxila
3.	Muhammad Imran	In-Charge, (CNC Machine Shop) Light Engineering, Gujranwala
4.	Muhammad Younas	Shift In-Charge Sultan Traders, Ferozpur Road, Lahore
5.	Abdul Redman	Assistant Manager Millet Tractors Ltd. Lahore
6.	Sadam Hussain	Trainer PITAC, Lahore
7.	Nawaz Malik	In-Charge Mechanical Workshop Kohinoor Textile Mills Limited
8.	Muhammad Ali Akhter	Assistant Manager (Industrial Relations & Administration) Kohinoor Textile Mills Limited
9.	Muhammad Tayyab Murtaza	CNC Shop Supervisor Tool Dies & Moulds Center, Gujranwala
10.	Gul Naseem Khan	SVTI Abbottabad
11.	Shahzad Zafar	Ex. Assistant Manager GSTC, Gulberg, Lahore

## REGULATIONS FOR THE QUALIFICATION AND SCHEDULE OF UNITS

Not Applicable



Code:

## Demonstrate Communication Skills

### Overview

This Competency Standard identifies the competencies required to apply communication skills at workplace in accordance with the organization's guidelines and procedures. You are expected to work in a team to achieve common organizational goals and avoid conflicts. This competency standard would also enable you to use basic computer skills to communicate effectively and prepare work related documents.

Competency Units	Performance Criteria
1. Work in Team	<p><b>P1.</b> Treat team members with respect and maintain positive relationship to achieve common organizational goals</p> <p><b>P2.</b> Listen to instructions carefully and follow them</p> <p><b>P3.</b> Provide work related information to team members and identify interrelated work activities to avoid confusion</p> <p><b>P4.</b> Adopt communication skills appropriate to work activities and company procedures</p> <p><b>P5.</b> Identify problems and resolve them through discussion and mutual agreement</p>
2. Deal with Clients	<p><b>P1.</b> Collect and confirm work requirements from clients using appropriate communication procedures</p> <p><b>P2.</b> Provide clear information to clients about work requirements including costs and time needed to accomplish the task</p> <p><b>P3.</b> Negotiate with clients regarding wages, time, labour requirements etc.</p>
3. Demonstrate Basic IT Skills	<p><b>P1.</b> Create folders and files and learn major commands of operating system/windows</p> <p><b>P2.</b> Type text and use major commands such as printing, editing, creating tables, header footer, footnotes, table of contents and page number etc.</p> <p><b>P3.</b> Make the document as per work specifications and client's requirement</p> <p><b>P4.</b> Generate reports for clients as required using appropriate computer applications</p> <p><b>P5.</b> Use internet for sending/receiving emails and connecting through social or other media</p>

## **Knowledge & Understanding**

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Principles of effective and interactive communication
- 7 C's of communication and their importance
- Cultural and organizational practices for effective communication
- Effective negotiation skills
- Role of team members and functionality of work teams
- Team dynamics and stages of team development
- Conflict resolution strategies
- Negotiation techniques
- Basic architecture of computer system
- Input / output devices of computer and their functions
- Basic computer skills using MS Word, MS Excel, use of internet, sending and receiving emails etc.
- Preparing documents and work related reports

## **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Communicate effectively with colleagues and clients
- Develop a job completion report for the work using computer technology

Code:

## Maintain Safe Work Environment

### Overview

This Competency Standard identifies the competencies required to apply Occupational Safety and Health (OSH) at workplace in accordance with the organization's approved guidelines and procedures. You will be expected to identify and use Personal Protective Equipment (PPE) according to the job requirement and potential hazards at workplace. The underpinning knowledge regarding OSH will be sufficient to provide the basis for your work.

Competency Units	Performance Criteria
1. Identify Hazards at Workplace	<p><b>P1.</b> Read and interpret work processes and procedures correctly to identify risk of hazards at workplace</p> <p><b>P2.</b> Recognize engineering processes, tools, equipment and consumable materials that have the potential to cause harm</p> <p><b>P3.</b> Identify any potential hazards and take appropriate action to minimize the risk</p>
2. Observe Occupational Safety and Health (OSH)	<p><b>P1.</b> Work safely complying with health and safety precautions, regulations and other relevant guidelines</p> <p><b>P2.</b> Identify health and safety hazards at the workplace, so that the potential for personal injury, damage to equipment or the workplace is prevented, and corrective action is taken</p> <p><b>P3.</b> Deal with problems which are within your control, and report those that cannot be resolved to the Safety Officer</p> <p><b>P4.</b> Wear, adjust, and maintain Personal Protective Equipment to ensure correct fit and optimum protection in compliance with company procedures</p> <p><b>P5.</b> Keep work area clean and clear of obstructions, and storing tools or equipment, so that the potential for accident or injury is prevented</p>

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Types of hazards that are most likely to cause harm to health and safety
- Health and safety precautions
- Health and safety signs and symbols
- Techniques and methods to identify the risks of hazards at workplace
- Dealing with hazards to avoid any accident or injury
- Following 5S and Kaizen Activities
- Safety reporting procedures and documentation
- Use of Personal Protective Equipment

- First aid treatment methods including methods of resuscitation
- Fire-fighting methods
- Safe methods of handling heavy loads

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Identify possible hazards at workplace
- Use correct Personal Protective Equipment (PPE) for the assigned job

### **List of Tools and Equipment**

<b>S.No.</b>	<b>Items</b>
<b>1.</b>	Health and Safety Manual
<b>2.</b>	Machine Installation Manual
<b>3.</b>	Fire Extinguisher
<b>4.</b>	Overall Combination
<b>5.</b>	Maintenance Box
<b>6.</b>	Safety Equipment - Safety Shoes, Safety Gloves, Safety Goggles, Safety Helmet and Ear Plugs
<b>7.</b>	Smoke Detecting Alarm
<b>8.</b>	First Aid Box

Code:

## Carry out Calculations and Prepare Estimates for Mechanical Work

### Overview

This competency standard identifies the competencies required to prepare estimates in accordance with client's guidelines. You will be expected to estimate, ensuring cost effectiveness, conforming to standards and regulations. The underpinning knowledge regarding calculations and estimation will be sufficient to provide the basis for your work.

Competency Units	Performance Criteria
1. Develop Basic Mechanical Drawing	<p><b>P1.</b> Take accurate measurements and collect information regarding work specifications</p> <p><b>P2.</b> Develop drawing according to the job requirement</p> <p><b>P3.</b> Confirm the job specifications, material(s) and drawing from client or supervisor and make necessary adjustments, where required</p>
2. Perform Estimation of Materials	<p><b>P1.</b> Identify requirements of the material(s) to be utilized for the work in accordance with the job specifications and drawing</p> <p><b>P2.</b> Check and confirm the requirement of the materials from the client or supervisor for accurate estimation</p> <p><b>P3.</b> Quantify the material as per drawing</p> <p><b>P4.</b> Use appropriate methods for the calculation of cost of material and accessories keeping in view the current market prices</p> <p><b>P5.</b> Check and present the cost estimates to the client or supervisor for approval</p> <p><b>P6.</b> Make necessary adjustments in estimates, where required</p>
3. Prepare Costing for the Work	<p><b>P1.</b> Calculate man-hours and machine-hours for work in accordance with the job requirements</p> <p><b>P2.</b> Prepare labour cost for the work using appropriate procedures</p>

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Basic mechanical terminologies including RPM, cutting speed, feed etc.
- Use of measuring and marking tools
- Mathematical calculations of the machines

- Basic mathematical formulas & numerical solving skills
- Interpretation of layout plans/diagrams, service manuals and manufacturer specifications, technical sketches, graphic symbols etc.
- Prepare 2D drawing using manual techniques
- Common Types of materials used in Machinist work
- Method of calculating labour costs/overheads/profit margin etc.
- Norms in interacting and negotiating with customers/clients
- Norms and standard formats of preparing estimates
- Record keeping and reporting

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Prepare a 2D drawing of a job including specifications

### **List of Tools and Equipment**

<b>S.No.</b>	<b>Items</b>
<b>1.</b>	Drafting Tables, T-Squares & Set-Squares
<b>2.</b>	Drawing Sheets & Tracing Papers (A0, A1, A2, A3, A4, & Others- Assorted Range)
<b>3.</b>	Geometry Box with Pencil, Rubber, Sharpener, Eraser & Steel Rule
<b>4.</b>	Paper Tape for Sheet Pasting on Drafting Table
<b>5.</b>	Markers (Blue, Green, Black & Red)
<b>6.</b>	Measuring Instruments, Marking Tools & Gauges (Assorted Range)
<b>7.</b>	Scientific Calculator & Multimedia Projector
<b>8.</b>	Paper Cutters, Paper Scissors, Highlighters, File Covers & Paper Punch
<b>9.</b>	Stencil of Various Shapes - Circle, Square Box, Ellipse, French Curves etc.
<b>10.</b>	Wooden Cabinet, Steel Almirah
<b>11.</b>	Surface Plate with Stand (Cast Iron / Graphite) 24 X 24 Inches
<b>12.</b>	Height Gauge, Step Gauge, Filler Gauge, Stubs Wire Gauge (Assorted Range)

Code:

## Carryout General Maintenance

### Overview

These Competency Standards identify the competencies required to perform maintenance functions by a Machinist in accordance with the organization's approved guidelines and procedures. You will be expected to perform preventive maintenance of machines and tools as well as general housekeeping and maintenance of tools and machines. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units		Performance Criteria
1. Perform Housekeeping & Maintenance	General	<p><b>P1.</b> Apply appropriate methods and techniques for cleanliness and maintenance of machines &amp; tools</p> <p><b>P2.</b> Clean and maintain all workplace tools &amp; machines as per housekeeping checklists or given instructions</p> <p><b>P3.</b> Prepare checklist for daily cleanliness of the workplace</p> <p><b>P4.</b> Respond appropriately to safety hazards on all bench-work tools and machines</p> <p><b>P5.</b> Place all the tools &amp; material in proper place to ensure safe work</p> <p><b>P6.</b> Prepare specific guidelines and checklists to conduct maintenance and housekeeping of machines &amp; tools</p>
2. Perform Maintenance	Preventive	<p><b>P1.</b> Read and interpret maintenance schedule carefully</p> <p><b>P2.</b> Prepare oiling and greasing chart (daily, weekly as per machine requirement)</p> <p><b>P3.</b> Prepare machine history record - date of installation, condition, oiling and maintenance</p> <p><b>P4.</b> Inspect and assess the general condition of an assigned machine on regular basis</p> <p><b>P5.</b> Observe problems and carry out routine maintenance as per given instructions and schedules</p> <p><b>P6.</b> Identify faulty/damaged/ worn out parts and take appropriate steps to replace them</p> <p><b>P7.</b> Report faults and problems of the machines, if not controllable, to the person concerned</p>
3. Perform Maintenance of Tooling		<p><b>P1.</b> Clean and maintain all bench-work tools and machines as per housekeeping checklists or instructions provided</p> <p><b>P2.</b> Prepare checklist for daily cleanliness of the workplace</p> <p><b>P3.</b> Respond appropriately to safety hazards on all</p>

	bench-work tools & machines <b>P4.</b> Identify all the tools and material in proper place to ensure safe work <b>P5.</b> Adopt methods and techniques for cleanliness and maintenance of tools
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## Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Knowledge of guidelines and checklists to conduct maintenance and housekeeping of machines & tools
- Adopt habit of daily cleanliness of workplace and lubrication of the machine as per given checklist of oiling
- Understand machine operations
- Knowledge of storing all tools and material in specific place
- Understand oiling, greasing and function of machine
- Identify faulty/damaged/ worn out parts which can be removed small fault
- Maintain history record of assigned machine
- Observe routine maintenance problems and find out their solution
- Demonstrate daily check of assigned machine on regular basis
- Write report to authority those problems which are beyond his scope
- Knowledge of guidelines and checklists to conduct maintenance and housekeeping of machines & tools

## Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Clean and maintain all bench-work tools and machines as per housekeeping checklists or instructions given
- Interpret guidelines and checklists of conducting maintenance and housekeeping of machines and tools

## List of Tools & Equipment

S.No.	Items
1.	Lubrication Oils, Kerosene Oil and WD-40 Cans (House Hold Chemicals or Penetrating Oils & Water Displacing Sprays etc.
2.	Lint Free Clothes & Cotton Rags
3.	Bearing Pullers
4.	Aluminum Ladder – 8 To 10 Feet Height
5.	Work-Bench, Work-Table & Stools
6.	Electric Table Lamps, Torch Lights
7.	Maintenance Tool-Kits
8.	Measuring & Marking Tools
9.	Machine Repairing Tool Kits
10.	Multiple Hand Tools
11.	Hammers & Shaft Pullers



<b>12.</b>	Spray Guns & Oil Containers
<b>13.</b>	Grease & Greasing Guns (Assorted Range)
<b>14.</b>	Steel Cabinets & Steel Almirah (Assorted Range)
<b>15.</b>	Anvil & Power Vice
<b>16.</b>	Tool Kit for General Purposes
<b>17.</b>	Personal Protective Equipment

Code:

## Carry-Out Bench Work

### Overview

These competency standards identify the competencies you need to perform bench work operations using different tools and equipment, in accordance with approved procedures. You will be expected to perform sawing, filing, threading and reaming using hand tools. You will be required to operate the tools and equipment safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
1. Carry-Out Sawing	<p><b>P1.</b> Select appropriate blade and set in hacksaw frame according to the job requirement</p> <p><b>P2.</b> Select appropriate marking tool(s), mark the workpiece and clamp it in the vice firmly as per standard practices</p> <p><b>P3.</b> Adopt sawing methods and techniques that are safe and suitable to produce the work-piece as needed</p> <p><b>P4.</b> Follow marked line during sawing of work piece to ensure accuracy</p>
2. File the Work-Piece	<p><b>P1.</b> Select appropriate file and marking tool(s) according to the job requirement</p> <p><b>P2.</b> Mark the work-piece and clamp it in the vice firmly as per standard practices</p> <p><b>P3.</b> Adopt filing method and technique which is safe and suitable to produce the work-piece as needed</p> <p><b>P4.</b> Follow drawing dimensions and surface finish of filed work-piece to ensure accuracy and precision</p>
3. Carry out Drilling	<p><b>P1.</b> Setup drill machine for producing hole in the work-piece according to the job requirement</p> <p><b>P2.</b> Select drill bit and marking tools according to the material and job requirement, respectively</p> <p><b>P3.</b> Mark the work-piece according to the drawing and clamp it in the vice firmly as per standard practices</p> <p><b>P4.</b> Adopt proper drilling method (manual/auto-feed, applying coolants) which is safe and suitable to produce the hole in work-piece</p> <p><b>P5.</b> Follow drawing dimensions of drilled hole to ensure accuracy and precision</p>
4. Produce Threads on Work-piece	<p><b>P1.</b> Select tap and die according to the type of thread to be produced on work-piece as per drawing</p> <p><b>P2.</b> Clamp the work-piece in the clamping device firmly as per standard practices</p>

	<p><b>P3.</b> Ensure the tap and die alignment as per prescribed standard</p> <p><b>P4.</b> Make thread with die and follow appropriate sequence in case of using taps</p> <p><b>P5.</b> Ensure the safety and dimensional accuracy of threads on work-piece as per drawing</p>
<b>5. Perform Hand Reaming</b>	<p><b>P1.</b> Select reamer according to the work-piece requirement</p> <p><b>P2.</b> Clamp the work-piece in the clamping device firmly as per standard practices</p> <p><b>P3.</b> Ensure the reamer alignment as per prescribed standard</p> <p><b>P4.</b> Produce reamed hole by following safety and prescribed method</p> <p><b>P5.</b> Ensure the accuracy and size of reamed hole of work-piece according to the drawing</p>

## Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Mechanical Properties and strength of materials
- Combination of feed and speed settings according to the work-piece, and tools & materials
- Usage of bench-work tools and equipment
- Interpret basic drawings
- Measurement systems
- Use of measuring and marking tools
- Usage of bench working tools
- Procedure of safe clamping the work-piece
- Personal Protective Equipment (PPEs) and workplace safety

## Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Utilization of tools (measuring, marking & cutting) equipment and their working method
- Produce a component containing the following operations marking, sawing & filing
- Produce a component containing the following operations with marking, drilling, threading & reaming

## List of Tools and Equipment

S.No.	Items
1.	Hand Hacksaws with Blades, Complete Sets (Assorted Range) with Standard Accessories
2.	Bench Vices, Machine Vices, C-Clamps, U-Clamps, Universal Clamping Vices & Swivel Vices
3.	Anvil& Hammers (Assorted Range)
4.	Personal Protective Equipment
5.	Work Bench & Stools
6.	Cabinets& Steel Almirah (Assorted Range)
7.	Measuring & Marking Tools
8.	First Aid Box
9.	Wooden Cabinets
10.	All Kind of Files
11.	Step Gauges Set
12.	Pillar Drilling Machines
13.	Drill Chuck With Key
14.	Drill Bits (Assorted Range)
15.	Reamers (Assorted Range)
16.	Plug Gauge (Assorted Range)
17.	Dies &Taps Set (Assorted Range)
18.	Center Drills (Assorted Range)
19.	Prick Punch (Assorted Range & Types)
20.	Coolants / Cutting Oils (Soluble/Non-Soluble)

Code:

## Perform Turning Operations

### Overview

This Competency Standard identifies the competencies required to perform lathe machine operations by a Machinist in accordance with the organization's approved guidelines and procedures. You will be expected to perform facing, turning drilling/boring, taper turning, knurling and threading operations using lathe machine. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>1. Prepare Materials for Lathe Operations</b>	<b>P1.</b> Interpret drawing and arrange the material accordingly <b>P2.</b> Prepare work-piece by required machining (sawing and filing etc.) and get it ready for clamping <b>P3.</b> Check and verify the dimensions of work-piece for lathe operations as per drawing
<b>2. Select Tools and Equipment</b>	<b>P1.</b> Select the tool(s) according to material of job and shape of the job requirements <b>P2.</b> Arrange the measuring instruments and holding devices to attain accuracy of the work as per prescribed method
<b>3. Set Lathe Machine for Operations</b>	<b>P1.</b> Clamp the material of work-piece and tool into its holding devices as per standard practice <b>P2.</b> Maintain the safe distance between work-piece and tooltip as per prescribed method <b>P3.</b> Adjust the revolution per minute (rpm) of chuck according to the specifications of work-piece. <b>P4.</b> Adjust the parameters of speed and feed from control unit as per prescribed method
<b>4. Carry-Out Lathe Operations</b>	<b>P1.</b> Ensure the proper clamping of work-piece and the tool into the holding devices according to the required operation <b>P2.</b> Maintain the alignment of work-piece and locate the tooltip at center position of the work-piece as per standard practice <b>P3.</b> Start the lathe operations as required according to the drawing and replacing the required tool <b>P4.</b> Check the work-piece by using appropriate measuring tools and instruments as per standard practice

## Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Mechanical Properties and strength of materials
- Personal Protective Equipment and workplace safety
- Interpret basic drawings
- Measurement systems
- Use of measuring and marking tools
- Knowledge of Lathe machines and its types
- Knowledge of holding devices and lathe attachments
- Knowledge of lathe tools
- True running of job(s) and center alignment of tooltip
- Calculation of feed and speed according to the work-piece and tool materials
- Procedure of safe clamping the work-piece
- Importance and usage of coolants

## Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Produce a component containing the following operations with marking as prescribed method:
  - Facing
  - Parallel Turning
  - Step Turning
  - Taper Turning
  - Chamfering
  - Form Turning
  - Eccentric Turning
  - Drilling
  - Boring
  - Reaming
  - Knurling
  - Threading (internal/external)
  - Grooving and Slotting
  - Parting-off

## List of Tools and Equipment

S.No.	Items
1.	Lathe Machine (with standard accessories)
2.	Power Hacksaw Machine
3.	Measuring and Marking Tools (Assorted Range)
4.	Work Holding Devices and attachments
5.	Standard Lathe Machine attachments
6.	Pedestal Grinder with Tools, Cutting Angle Support
7.	Twist Drill Bits and Boring Bars (Assorted Range)

<b>8.</b>	Threading Tools (Assorted Range)
<b>9.</b>	Knurling Tools (Assorted Range)
<b>10.</b>	Turning, Parting, Grooving and Forming Tools etc. (Assorted Range)
<b>11.</b>	Common Kinds And Sizes Of Files (Assorted Range)
<b>12.</b>	Coolants and Lubrication Oils
<b>13.</b>	Steel Cabinet and Steel Almirah
<b>14.</b>	Hammers (Assorted Range)
<b>15.</b>	Personnel Protective Equipment
<b>16.</b>	First Aid Box
<b>17.</b>	Maintenance Tool Kit, General Repairing Tool Kit and Hands Tool Kit
<b>18.</b>	Radius Gauge - Concave & Convex (Assorted Range)
<b>19.</b>	Threads Gauge -Inches / Millimeters (Assorted Range)

Code:

## Perform Milling Operations

### Overview

This competency standard identifies the competencies you need to perform milling operations on a Milling machine in accordance with approved procedures. You will be expected to perform Face milling, Plain milling, Step milling, Squaring, Gear milling, slotting, Grooving, Drilling and Boring. You will be required to operate the milling machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
1. Prepare Materials for Milling Operations	<p><b>P1.</b> Interpret drawing and arrange the material for milling operations according to the job requirement</p> <p><b>P2.</b> Prepare work-piece for required machining (sawing and filing etc.) and get it ready to clamp</p> <p><b>P3.</b> Check and verify the dimensions of work-piece for milling operations as per drawing</p>
2. Select Tools and Equipment	<p><b>P1.</b> Select the material, type, shape and size of cutter(s) according to the job requirements</p> <p><b>P2.</b> Arrange the measuring instruments and holding devices to attain accuracy of the work as per prescribed method</p>
3. Set Milling Machine for Operations	<p><b>P1.</b> Clamp the material of work-piece and tool into its holding devices as per standard practice</p> <p><b>P2.</b> Maintain the safe distance between work-piece and cutter as per prescribed method</p> <p><b>P3.</b> Adjust the revolution per minute (rpm) of spindle according to the specifications of work-piece.</p> <p><b>P4.</b> Adjust the parameters of speed and feed from control unit as per prescribed method</p>
4. Carry-Out Milling Operations	<p><b>P1.</b> Ensure the proper clamping of work-piece and the cutter into the holding devices according to the required operation</p> <p><b>P2.</b> Maintain the alignment of work-piece and locate the cutter at proper position of the work-piece as per standard practice</p> <p><b>P3.</b> Start the required operations as per drawing and job specifications</p> <p><b>P4.</b> Check the dimensions of the work-piece using appropriate measuring tools and make necessary adjustments</p>



## Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Interpret basic drawings
- Use of measuring and marking tools
- Measurement systems
- Knowledge of conventional and climb milling
- Knowledge of Milling machines and its types
- Knowledge of job and cutter holding devices
- Knowledge of milling attachments
- Knowledge of milling cutters and tools
- Proper clamping and tool alignment
- Calculation and setting of feed and speed according to the work-piece and tool materials
- Procedure of safe clamping the work-piece
- Importance and usage of coolant

## Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Produce a component containing the following operations with marking as prescribed method:
  - Plain milling
  - Side milling
  - Slotting
  - Grooving
  - Drilling
  - Boring
  - Reaming
  - Gear forming and generating

## List of Tools and Equipment

S.No.	Items
1.	Universal Milling Machine with Standard Accessories
2.	Power Hacksaw Machine with Blade
3.	Work Bench and Stools
4.	Machine Vices, Swivel Vices
5.	Measuring and Marking Tools (Assorted Range)
6.	Work Holding Devices and Attachments
7.	Standard Milling Machine Attachments
8.	Boring Head with Boring Tools
9.	Plug and Snap Gauges
10.	Twist Drill Bits and Boring Bars (Assorted Range)
11.	Cotton Rigs

<b>12.</b>	Side and Face Cutters, End Mill Cutters, Ball Mill Cutters, Shell-End Mill Cutters, Slotting Cutters, Grooving Cutters etc. (Assorted Range)
<b>13.</b>	Common Kinds and Sizes Of Files (Assorted Range)
<b>14.</b>	Coolants and Lubrication Oils
<b>15.</b>	Steel Cabinet and Steel Almirah (03 for Each Machine)
<b>16.</b>	Hammers (Assorted Range)
<b>17.</b>	Personal Protective Equipment
<b>18.</b>	First Aid Box
<b>19.</b>	Maintenance Tool Kit, General Repairing Tool Kit & Hands Tool Kit
<b>20.</b>	Radius Gauge - Concave & Convex (Assorted Range)
<b>21.</b>	Dial Indicator with Magnet Stand
<b>22.</b>	Involute Gear Cutter Sets
<b>23.</b>	Plug and Snape Gauges

Code:

## Perform Shaper Machine Operations Overview

This competency standard identifies the competencies you need to perform shaping operations on shaper machine in accordance with approved procedures. You will be expected to perform Facing, Step cutting, Squaring, Slotting, V-shape cutting with point cutting tool. You will be required to operate the shaper machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
<b>1. Prepare Materials for Shaping Operations</b>	<b>P1.</b> Interpret drawing and arrange the material accordingly <b>P2.</b> Prepare work-piece by required machining (sawing and filing etc.) and get ready to clamp <b>P3.</b> Check and verify the dimensions of work-piece for shaping according to the drawing
<b>2. Select Tools and Equipment</b>	<b>P1.</b> Select the material and shape of tool(s) according to the job requirements <b>P2.</b> Arrange the measuring instruments and holding devices to attain accuracy of the work as per prescribed method
<b>3. Set Shaper Machine for Operations</b>	<b>P1.</b> Clamp the material of work-piece and tool into its holding devices as per standard practice <b>P2.</b> Maintain safe distance between surface of work-piece and tooltip as per prescribed method <b>P3.</b> Adjust the ram placement and stroke length according to the length of job <b>P4.</b> Adjust the parameters of shaping (speed and feed) from control unit as per prescribed method <b>P5.</b> Start shaping operation by locating the initial touching point and adjust the depth of cut according to the prescribed procedure
<b>4. Perform Shaping Operations(Square Job)</b>	<b>P1.</b> Ensure the proper clamping of work-piece and the tool according to the standard practice <b>P2.</b> Start the shaping operation at top surface of work-piece to get flatness as per initial requirements <b>P3.</b> Re-clamp the work-piece by rotating 90° for next surface as per prescribed method <b>P4.</b> Shape entire work-piece by following the above stated method for next surface to get square shaped work-piece according to drawing
<b>5. Perform Shaping Operations(Angular Job)</b>	<b>P1.</b> Ensure proper clamping of the work-piece and the tool according to standard practice

	<p><b>P2.</b> Mark work-piece according to the drawing</p> <p><b>P3.</b> Set and align the sliding degree of head according to required angle</p> <p><b>P4.</b> Start the angular shaping operation to get required angle as per marked line</p> <p><b>P5.</b> Shape entire work-piece, by setting the required degree of head, to get angle of work-piece according to the drawing</p>
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## Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Interpret basic drawings
- Measurement systems
- Knowledge of shaping machines
- Types of shaping machines
- Ram and stroke settings
- Mechanical Properties and strength of materials
- Knowledge of shaping tools
- Feed and speed settings
- Working procedure of shaping
- Shaping tools and holding devices
- Housekeeping of tools and equipment

## Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Produce a component containing the following operations with marking:
  - Square job as prescribed method
  - Angular job as prescribed method
  - Setting of machine, tool and stork per minute

## List of Tools and Equipment

S.No.	Items
1.	Shaper Machine with Standard Accessories
2.	Work Bench and Stools
3.	Machine Vice Universal Clamping Vices
4.	Measuring and Marking Tools (Assorted Range)
5.	Work Holding Devices and Attachments
6.	Shaper Tools (Assorted Range)
7.	Dial Indicator

<b>8.</b>	Cotton Rigs
<b>9.</b>	Common Kinds and Sizes of Files (Assorted Range)
<b>10.</b>	Coolants and Lubrication Oils
<b>11.</b>	Steel Cabinet and Steel Almirah (3 for each Machine)
<b>12.</b>	Hammers (Assorted Range)
<b>13.</b>	Personal Protective Equipment
<b>14.</b>	First Aid Box
<b>15.</b>	Radius Gauge - Concave & Convex (Assorted Range)

Code:

## Perform Grinding Operations Overview

This competency standard identifies the competencies you need to perform grinding machine operations in accordance with approved procedures. You will be expected to perform different types of grinding which include off-hand, surface, universal cylindrical, and tool and cutter grinding. You will be required to operate the grinding machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
1. Perform Off-Hand Grinding	<p><b>P1.</b> Hold the work-piece firmly against the rotating wheel by placing it on the tool rest</p> <p><b>P2.</b> Grind the tool according to its required angle(s) as mentioned in the drawing</p> <p><b>P3.</b> Adopt grinding methods and techniques that are safe and suitable to produce the work-piece as needed</p> <p><b>P4.</b> Grind and check the tool angle(s) with protractor or tool gauge to ensure accuracy as per drawing</p>
2. Perform Surface Grinding	<p><b>P1.</b> Check and dress the grinding wheel as per requirement with diamond dresser, if required</p> <p><b>P2.</b> Mount the work-piece over the holding devices (magnet plate, vice or angle plate) as per standard practice</p> <p><b>P3.</b> Set the sliding of table traverses according to the length and width for grinding of work-piece as per prescribed method</p> <p><b>P4.</b> Maintain the safe distance between surface of work-piece and wheel as per prescribed method</p> <p><b>P5.</b> Start grinding by locating the initial touching point and adjust the depth of cut according to the table speeds</p> <p><b>P6.</b> Apply coolants and perform surface grinding of work-piece as per prescribed method</p>
3. Perform Cylindrical Grinding	<p><b>P1.</b> Check and dress the grinding wheel as per requirement with diamond dresser, if required</p> <p><b>P2.</b> Mount the work-piece over the holding devices (chuck, between centers and collet) as per requirements</p> <p><b>P3.</b> Set the sliding of table traverses according to work-piece dimensions for grinding of work-piece as per prescribed method</p> <p><b>P4.</b> Start grinding by locating the initial touching point and ensure the parallel grinding of work-piece as</p>

		per standard
		<p><b>P5.</b> Apply coolants and perform cylindrical grinding of work-piece as per prescribed method</p> <p><b>P6.</b> Complete the job according to the given dimensions and surface finish as per drawing</p>
<b>4.</b> Perform Grinding	Tool/Cutter	<p><b>P1.</b> Select the suitable size, type and shape of grinding wheel as per job requirements</p> <p><b>P2.</b> Select and mount the work-piece on its related attachment as per prescribed method</p> <p><b>P3.</b> Set the work-piece, wheel and table movements as per job requirements</p> <p><b>P4.</b> Grind the tool/cutter by following the safety and complete it by checking the angle(s) of sharp edges as per prescribed standard</p> <p><b>P5.</b> Maintain the surface quality of work-piece by dressing the wheel according to prescribed standard</p>
<b>5.</b> Perform Grinding	Center less	<p><b>P1.</b> Adjust the distance between grinding wheel, driving wheel and work-rest according to the diameter of the work-piece</p> <p><b>P2.</b> Grind the work-piece and check its diameter according to the required dimension and adjust its diameter if required, to maintain the precision of work-piece</p> <p><b>P3.</b> Apply coolants and perform grinding of work-piece as per prescribed method</p>

### Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Interpret basic drawings
- Measurement systems
- Introduction of grinding machines and its attachments (Pedestal Grinding Machine, Surface Grinding Machine, Cylindrical Grinding Machine, Tool/Cutter Grinding Machine and Centerless Grinding Machine)
- Shape and structure of grinding wheels
- Types of dressers and method of dressing
- Feed and table movements settings on machine accordingly
- Importance and method of grinding wheel balancing
- Importance and usage of coolant
- Proper house keeping

### Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Produce a component containing the following operations with marking:
  - Single point cutting tool on pedestal grinding machine as prescribed method
  - Grinding of square job on surface grinding machine as prescribed method
  - Internal and external grinding of cylindrical job on cylindrical grinding machine as prescribed method
  - Grinding of milling cutter(s) and special tools on tool/cutter grinding machine as prescribed method
  - Grinding of cylindrical pin/hollow pipe on centerless grinding machine as prescribed method

## List of Tools and Equipment

S.No.	Items
1.	Pedestal Grinding Machine, Surface Grinding Machine, Cylindrical Grinding Machine, Tool/Cutter Grinding Machine and Centerless Grinding Machine along with Standard Accessories
2.	Work Holding Devices and Attachments
3.	Diamond Dressing Tip with Stand
4.	Grinding Wheels (Surface Grinding Machine, Pedestal Grinding Machine, Cylindrical Grinding Machine (Assorted Size and Shape)
5.	Measuring and Marking Tools
6.	Grinding Wheel Balancing Stand with Standard Accessories
7.	Coolants / Cutting Oils (Soluble/Non-Soluble)
8.	Plug and Snape Gauge
9.	Diamond Disc Grinding Wheels for Carbide Materials (Assorted Range)
10.	Maintenance Tool Kit, General Repairing Tool Kit and Hands Tool Kit
11.	Steel Cabinet and Steel Almirah (03 for Each Machine)
12.	Surface Analysis and Inspection Gauges (Assorted Range)
13.	Anti-Rust Oil
14.	Personal Protective Equipment



Code:

## Generate Gears

### Overview

This competency standard identifies the competencies you need to perform gear cutting on Milling and Hobbing machine in accordance with approved procedures. You will be expected to perform different types of gear cutting which include spur gear, helical gear and bevel gear etc. You will be required to operate the Milling and Hobbing machine safely in compliance with the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
1. Prepare Blank for Generating the Gear	<p><b>P1.</b> Interpret drawing and arrange the material according to job requirement</p> <p><b>P2.</b> Prepare the work-piece by required machining (sawing and filing etc.) and get it ready for turning the blank</p> <p><b>P3.</b> Check and verify the dimensions of blank for generating gear as per drawing</p>
2. Select Tools and Equipment for Gear Cutting	<p><b>P1.</b> Select the material, type, shape and size of cutter(s) according to the job requirements</p> <p><b>P2.</b> Arrange the measuring instruments and holding devices to attain accuracy of the work as per prescribed method</p>
3. Set Hobbing Machine for Operations	<p><b>P1.</b> Clamp the gear blank and hob cutter into their holding devices as per standard practice</p> <p><b>P2.</b> Maintain safe distance between gear blank and hob cutter as per prescribed method</p> <p><b>P3.</b> Adjust the revolution per minute (rpm) of hob cutter and table according to the specifications of work-piece</p> <p><b>P4.</b> Adjust the parameters of speed and feed from control unit as per prescribed method</p>
4. Carry out Hobbing Operations for Gear Generating	<p><b>P1.</b> Produce simple/angled/differential indexing and divide the gear into required number of divisions</p> <p><b>P2.</b> Check the hob cutter and the gear blank that both are positioned properly and adjust them, if required</p> <p><b>P3.</b> Operate Hobbing Machine according to given specifications and ensure all the parameters of the gear are met using relevant instruments</p> <p><b>P4.</b> Check and confirm the measurements with given specifications and finalize the gear by removing defects or shortcomings</p>

## Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Structure and functions of Hobbing Machine
- Accessories of Hobbing Machine and types of different tooling
- Use of gear cutters, marking tools, measuring instruments and gauges
- Types of gears
- Types of materials used for generating the gears
- Types of indexing such as single, angled and differential and techniques of producing indexing
- Interpreting drawings and specifications used for gear cutting
- Method of calculating machine speed, feed etc.
- Measurement techniques, mathematical calculations, indexing measurements etc.
- Use of various devices and attachments for holding the work-piece
- Method of setting up the Hobbing Machine for gear generating operations
- Method of positioning hob cutter and work-piece in the Hobbing Machine
- Procedure of gear generating
- How to avoid undercutting in gears

## Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Produce a component containing the following operations with marking as prescribed method:
  - Drilling
  - Reaming
  - Boring
  - Gear forming and generating

## List of Tools and Equipment

S.No.	Items
1.	Gear Generator Machine, Gear Hobbing Machine along with Standard Accessories
2.	Gear Generator Machine, Gear Hobbing Machine Attachments
3.	Hob Cutters Sets
4.	Lathe Machine, Power Hacksaw Machine along with Standard Accessories
5.	Work Bench and Stools
6.	Tooth Vernier
7.	Measuring and Marking Tools (Assorted Range)
8.	Work Holding Devices and Attachments
9.	Pedestal Grinder with Tools Cutting Angle Support
10.	Lathe Chucks and Steady Rests (Assorted Range)
11.	Twist Drill Bits and Boring Bars (Assorted Range)
12.	Turning, Parting, Grooving and Forming Tool setc. (Assorted Range)
13.	Common Kinds and Sizes of Files (Assorted Range)

<b>14.</b>	Coolants and Lubrication Oils
<b>15.</b>	Steel Cabinet and Steel Almirah
<b>16.</b>	Hammers (Assorted Range)
<b>17.</b>	Personal Protective Equipment
<b>18.</b>	First Aid Box
<b>19.</b>	Maintenance Tool Kit, General Repairing Tool Kit and Hands Tool Kit

Code:

## Develop Drawing and Design for Mechanical Components

### Overview

This competency standard identifies the competencies you need to interpret drawing requirements select, configure and use appropriate computer application for developing 2D sketch/drawing and develop 3D models of required product or component with accurate dimensions and compare it as per job requirements and in compliance with organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
1. Develop 2D Sketch /Drawings	<p><b>P1.</b> Interpret drawing requirements for the product(s) or component to be produced</p> <p><b>P2.</b> Select, configure and use appropriate computer application for developing drawing of required product or component</p> <p><b>P3.</b> Select and use appropriate user interface and apply relevant commands for developing mechanical drawing(s)</p> <p><b>P4.</b> Produce drawing(s) according to the required dimensions by use of various drawing standards to meet job requirements</p>
2. Develop 3D Models	<p><b>P1.</b> Check and inspect design requirements for the product or component to be produced</p> <p><b>P2.</b> Select, configure and use appropriate computer application for developing 3D model(s) for the product, component or assembly</p> <p><b>P3.</b> Select and use appropriate user interface and apply relevant commands for developing 3D model(s) or component</p> <p><b>P4.</b> Produce models with accurate dimensions and compare it as per job requirements</p>

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Operating of computer systems as well as IT skills
- Basic geometrical shapes e.g. circular, square, rectangular, cylindrical, conical, profiles etc.
- Orthographic representation of drawings
- 1<sup>st</sup>angle and 3<sup>rd</sup> angle projection method

- Measurement systems and their conversions
- Use of Computer Aided Design (CAD) software application for making drawing(s) and designs
- Method for configuring CAD software
- User interface customization of CAD software
- Common commands and tools used in CAD software
- Surfaces and solids in CAD
- File management in computer system

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Draw 2D sketch and 3D model of Connecting Rod / Crank-shaft
- 2D sketch and 3D model must be as per requirement

### **List of Tools and Equipment**

<b>S.No.</b>	<b>Items</b>
<b>1.</b>	Computer System
<b>2.</b>	Multimedia Projector
<b>3.</b>	White Board
<b>4.</b>	White Board Markers/Eraser
<b>5.</b>	Laser Printer and Document Scanner
<b>6.</b>	Measuring and Marking Tools
<b>7.</b>	Surface Table
<b>8.</b>	Notebooks
<b>9.</b>	Pens/Pencils
<b>10.</b>	CAD Software

Code:

## Maintain CNC Machines and Tools

### Overview

This competency standard identifies the competencies you need to be competent in Computerized Numerical Control (CNC) Machines operations in accordance with approved procedures. You will be expected to maintain fluid levels, check coolant condition and change if required. Inspect sharpness of cutting edges of tool/cutter to gain maximum precision and accuracy as per standard requirements. Ensure the selection and clamping of cutting tools as per standard method to avoid any injury or accident.

Competency Units	Performance Criteria
1. Maintain Proper Fluid Levels	<p><b>P1.</b> Check and maintain normal level of fluid(s) used in the CNC machine according to its requirements</p> <p><b>P2.</b> Check and attain the required pressure (hydraulic and pneumatic) according to the machine requirements</p>
2. Change Machine Oil /Coolant	<p><b>P1.</b> Check condition of coolant (color, smell, viscosity, etc.) and level of coolant according to the machine requirements</p> <p><b>P2.</b> Change coolant as per requirements of machine</p>
3. Maintain Cutting Tools	<p><b>P1.</b> Select appropriate tool/cutter and perform proper housekeeping of them for further uses as per prescribed procedure</p> <p><b>P2.</b> Inspect sharp and cutting edges of tool/cutter to gain maximum precision and accuracy as per standard requirements</p> <p><b>P3.</b> Ensure proper clamping of tool/cutter to avoid any injury or accident as per standard method</p> <p><b>P4.</b> Sharp blunt edges or change tool/cutter as and when required according to standard cutting operations</p> <p><b>P5.</b> Use appropriate cutting speed/feed and coolant as per standard machining features</p>

### Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Fluids and its properties
- Effects of heat and friction
- Importance and properties of coolants
- Maintain flow, pressure and level of fluids
- Tooling specifications, angles, cutting edges
- Proper housekeeping of tools and equipment

- Work holding devices

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Check and maintain the fluid levels, coolant level of the machine and carry out proper housekeeping of cutting tools as per prescribed procedure

### **List of Tools and Equipment**

<b>S.No.</b>	<b>Items</b>
1.	CNC Lathe or Milling Machine along with Standard Accessories
2.	Lathe Tools or Milling Cutters (Assorted Range)
3.	Work Holding Devices
4.	Machine Vice and Power Vice
5.	Surface Table
6.	Measuring Instruments (Vernier, Inside/Outside Calipers, Micrometer, Steel Rule, Tri-Square, Bevel Protractor etc.)
7.	Lubrication Oil and Cutting Oil
8.	White Board Markers/Eraser
9.	Tooling Catalogue
10.	CNC Maintenance Manual
11.	Complete Set Of Computer System with Multimedia Projector
12.	Tooling Cabinet and Steel Almira

Code:

## Perform CNC Lathe Operations

### Overview

This competency standard identifies the competencies you need to be competent in Computerized Numerical Control (CNC) Lathe Machine operations in accordance with approved procedures. You will be expected to set CNC Lathe Machine to perform turning operations. You will be required to operate the Lathe machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
1. Mount the Job	<p><b>P1.</b> Mount the work-piece by considering the working capacity of machine as well as job requirement according to the drawing/design</p> <p><b>P2.</b> Select appropriate work holding device(s) in order to achieve dimensional accuracy and clamp the job firmly as per standard practice</p> <p><b>P3.</b> Attain proper alignment of tool/cutter and work-piece e.g. concentricity of rotating jobs as per set practice</p> <p><b>P4.</b> Keep safe measures while mounting the work-piece so that unwanted operation by machine may not be initiated as per safety precautions</p>
2. Generate the Program	<p><b>P1.</b> Interpret job requirements, calculate extra material to be removed and define reference point as per drawing/design</p> <p><b>P2.</b> Define absolute or incremental coordinates system, tool path strategies, machining features and tool compensation for generating the tool path as per standard procedure</p> <p><b>P3.</b> Use appropriate part programming credentials (Sequence, G-codes, M-codes, coordinates, feed, speed, tooling information etc.) according to the CNC machine control unit</p> <p><b>P4.</b> Keep record of generated part program in soft/hard form in order to feed into machine control unit as per standard procedure</p>
3. Run Simulation	<p><b>P1.</b> Feed the generated part program into appropriate simulation platform and run simulation for checking the tool gouge according to safety measures</p> <p><b>P2.</b> Run simulation and verify movements of tool/cutter to get same results as per defined sequence</p> <p><b>P3.</b> Identify occurrence of errors and modify the program as per defined procedure</p>



<p><b>4. Feed the Program</b></p>	<p><b>P1.</b> Ensure proper synchronization between machine control unit and part program file as per standard operating procedure</p> <p><b>P2.</b> Switch machine to receiving mode and feed the desired part program file into machine control unit for further execution as per standard operating procedure</p> <p><b>P3.</b> Select the desired part program file for execution as per standard operating procedure</p>
<p><b>5. Perform CNC Lathe Operations</b></p>	<p><b>P1.</b> Ensure to control the safe operation of working on CNC machines before executing part program according to the safety measures</p> <p><b>P2.</b> Control the feeds, speeds and override of machine before operating according to the prescribed procedure</p> <p><b>P3.</b> Switch machine to execution mode (single block or auto) and press cycle start to run the machining sequence as per prescribed method</p> <p><b>P4.</b> Compare the block-wise movements of machining sequence thoroughly during operating of machine according to the part program file</p> <p><b>P5.</b> Complete the job and inspect its accuracy and precision according to the drawing/design</p>

## Knowledge & Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Work place safety and health considerations
- Use of Personal Protective Equipment
- Reading Drawing
- Mechanism of working of CNC lathe machine
- Use of control panel and commands
- Program debugging techniques
- Use of Simulation software
- Use of portable devices for CNC lathe
- Use of Turret / Magazine and their sequence of tool mounting
- Possible accidents and their counteractions
- Coolant types along with benefits and uses
- Methods of calculating Coordinates techniques
- G codes and M codes
- Feed and speed concepts in Lathe Machine
- Lathe operations such as Facing, Turning, Drilling, Grooving, Threading, Knurling, Boring etc.
- Use of Lathe tools and their types with respect to operations and materials

## Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Write program, feed it into the machine control unit and carry out cutting operations on connecting rod as per prescribed method

## List of Tools and Equipment

S.No.	Items
1.	CNC Lathe Machine or Turning Centre along with Standard Accessories
2.	Lathe Tooling (Assorted Range)
3.	CNC Programming Manual
4.	CAM Software with Simulation Module
5.	Measuring Instruments (Vernier, Inside/Outside Calipers, Micrometer, Steel Rule, Tri-Square, Bevel Protractor etc.)
6.	Work Holding Devices
7.	Measuring Gauges
8.	Tooling Catalogue
9.	CNC Manual
10.	Complete Set of Computer System with Multimedia Projector
11.	Personal Protective Equipment (PPE)
12.	Tooling Cabinet and Steel Almirah

Code:

## Perform CNC Milling Operations

### Overview

This competency standard identifies the competencies you need to be competent in Computerized Numerical Control (CNC) Milling Machine operations in accordance with approved procedures. You will be expected to set CNC Milling Machine to perform milling operations. You will be required to operate the Milling machine safely by complying with the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
1. Mount the job on Milling Machine	<p><b>P1.</b> Mount the work-piece by considering the working capacity of machine as well as job requirement according to the drawing/design</p> <p><b>P2.</b> Select appropriate work holding device(s) in order to achieve dimensional accuracy and clamp the job firmly as per standard practice</p> <p><b>P3.</b> Attain proper alignment of tool/cutter and work-piece e.g. co-axiality, concentricity of rotating jobs as per set practice</p> <p><b>P4.</b> Keep safe measures while mounting the work-piece so that unwanted operation by machine may not be initiated as per safety precautions</p>
2. Generate the Program for CNC Milling	<p><b>P1.</b> Select appropriate CAM software according to the machine control unit and import 3D model into it as per standard procedure</p> <p><b>P2.</b> Define reference point and apply material/stock for machining to the design/model as per job requirements</p> <p><b>P3.</b> Apply machining feature(s), toolpath strategies and leads/links as per prescribed procedure</p> <p><b>P4.</b> Generate part program file against the applied machining sequence according to the post processor of CNC machine</p> <p><b>P5.</b> Use appropriate part programming credentials (Sequence, G-codes, M-codes, Coordinates, Feed, Speed, Tooling Information etc.) according to the CNC machine control unit</p> <p><b>P6.</b> Keep record of generated part program file in order to feed into machine control unit as per standard procedure</p>
3. Run Simulation	<p><b>P1.</b> Feed the generated part program into appropriate simulation platform and run simulation for checking the tool gouge according to safety measures</p>

	<p><b>P2.</b> Run simulation and verify movements of tool/cutter to get same results as per defined sequence</p> <p><b>P3.</b> Identify occurrence of errors and modify the program as per defined procedure</p>
<p><b>4.</b> Feed the Program into CNC Milling</p>	<p><b>P1.</b> Ensure proper synchronization between machine control unit and part program file as per standard operating procedure</p> <p><b>P2.</b> Switch machine to receiving mode and feed the desired part program file into machine control unit for further execution as per standard operating procedure</p> <p><b>P3.</b> Select the desired part program file for execution as per standard operating procedure</p>
<p><b>5.</b> Perform CNC Milling Operations</p>	<p><b>P1.</b> Ensure to control the safe operation of working on CNC machines before executing part program according to the safety measures</p> <p><b>P2.</b> Control the feeds, speeds and override of machine before operating according to the prescribed procedure</p> <p><b>P3.</b> Switch machine to execution mode (single block or auto) and press cycle start to run the machining sequence as per prescribed method</p> <p><b>P4.</b> Compare the block-wise movements of machining sequence thoroughly during operating of machine according to the part program file</p> <p><b>P5.</b> Complete the job and inspect its accuracy and precision according to the drawing/design</p>

## Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Work place safety and health considerations
- Use of PPE's
- Use of CAM and 3D models
- Mechanism of working of CNC Milling Machine
- Use of control panel and commands
- Program debugging techniques
- Use of Simulation Software
- Use of portable devices for CNC Milling
- Use of turret / Magazine and their sequence of tool mounting
- Possible accidents and their counteractions
- Coolant types along with benefits and uses
- Methods of calculating Coordinates techniques
- G codes and M codes
- Use of Clamping devices and their types
- Feed and speed concepts in Milling machine

- Milling operations such as Facing, Drilling, Grooving, Threading, Boring etc.
- Use of Milling tools and their types with respect to operations and materials

### **Critical Evidence(s) Required**

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Generate program, feed into the machine and carry out machining operations on Shaft as per prescribed procedure

### **List of Tools and Equipment**

<b>S.No.</b>	<b>Items</b>
1.	CNC Milling Machine or Machining Centre along with Standard Accessories
2.	Lathe Tooling (Assorted Range)
3.	Zero Setter, Edge Finder and Dial Indicator
4.	Power Vice
5.	CNC Programming Manual
6.	CAM Software with Simulation Module
7.	Measuring Instruments (Vernier, Inside/Outside Calipers, Micrometer, Steel Rule, Tri-Square, Bevel Protractor etc.)
8.	Work Holding Devices
9.	Measuring Gauges
10.	Tooling Catalogue
11.	Complete Set of Computer System with Multimedia Projector
12.	CNC Manual
13.	Personal Protective Equipment (PPEs)
14.	Tooling Cabinet and Steel Almirah

Code:

## Perform CNC EDM Wire-Cut Operations

### Overview

This competency standard identifies the competencies you need to be competent in Computerized Numerical Control (CNC) EDM Wire-cut operations in accordance with approved procedures. You will be expected to set CNC EDM Wire-cut Machine to perform machining operations. You will be required to operate the EDM Wire-cut machine safely by complying with the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Competency Units	Performance Criteria
1. Mount the Job on EDM Wire Cut Machine	<p><b>P1.</b> Mount the work-piece by considering the working capacity of machine as well as job requirement according to the drawing/design</p> <p><b>P2.</b> Select appropriate work holding device(s) in order to achieve dimensional accuracy and clamp the job firmly as per standard practice</p> <p><b>P3.</b> Install and adjust proper alignment of installed wire to the vertical direction as per standard practice</p> <p><b>P4.</b> Keep safe measures while mounting the work-piece and installing the wire so that unwanted operation by machine may not be initiated as per safety precautions</p>
2. Generate the Program	<p><b>P1.</b> Select appropriate CAM software according to the machine control unit and import drawing/sketch into it as per standard procedure</p> <p><b>P2.</b> Define reference point also known as start point and apply toolpath by considering the wire compensation according to the prescribed procedure</p> <p><b>P3.</b> Execute the generated part program file in order to perform wire cutting operation as per prescribed method</p>
3. Run Simulation	<p><b>P1.</b> Refer to the simulation platform and run simulation of wire cutting sequence as per prescribed method</p> <p><b>P2.</b> Run simulation and verify movements of wire cutting to get same results as per defined sequence</p> <p><b>P3.</b> Identify occurrence of errors and modify the applied toolpath as per prescribed procedure</p>
4. Feed the Program	<p><b>P1.</b> Ensure proper synchronization between machine control unit and part program file as per standard operating procedure</p> <p><b>P2.</b> Select and execute the desired part program file as per standard operating procedure</p>

<p><b>5.</b> Perform CNC EDM Wire-cut Operations</p>	<p><b>P1.</b> Ensure to control the safe operation of working on EDM wire-cut machine before execution of part program according to the safety measures</p> <p><b>P2.</b> Adjust the feeds, speeds by adjusting amperes and current setting before operating according to the prescribed procedure</p> <p><b>P3.</b> Switch machine to execution mode and start to work on defined toolpath as per prescribed method</p> <p><b>P4.</b> Compare the movements of machining sequence thoroughly during operating of machine according to the part program file</p> <p><b>P5.</b> Complete the job and inspect its accuracy and precision according to the drawing/design</p>
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### Knowledge and Understanding

The candidate must be able to demonstrate underpinning knowledge and understanding required to carry out the tasks covered in this competency standard. This includes the knowledge of:

- Work place safety and health considerations
- Use of PPE's
- Use of CAD/CAM and 3D models
- Mechanism of working of CNC EDM wire cut machine
- Use of control panel and commands
- Program debugging techniques
- Use of Simulation
- Use of portable devices for CNC EDM wire cut
- Possible accidents and their counteractions
- Coolant types along with benefits and uses
- Methods of calculating Coordinates techniques
- G codes and M codes
- Use of Clamping devices and their types
- Feed and speed concepts

### Critical Evidence(s) Required

The candidate needs to produce following critical evidence(s) in order to be competent in this competency standard:

- Make drawing, feed it into the machine and carry out cutting operations as per prescribed method

### List of Tools and Equipment

S.No.	Items
1.	CNC EDM Wire-cut Machine along with Standard Accessories
2.	Wire Spool(s) with Wire Dia 0.18mm
3.	Wire-cut Software (YH, YL or HF)
4.	Measuring Instruments

<b>5.</b>	Measuring Gauges with Dial Indicator
<b>6.</b>	Tooling Catalogue
<b>7.</b>	CNC Manual
<b>8.</b>	Measuring Instruments (Vernier, Inside/Outside Calipers, Micrometer, Steel Rule, Tri-Square, Bevel Protractor etc.)
<b>9.</b>	Work Holding Devices
<b>10.</b>	Personal Protective Equipment (PPEs)
<b>11.</b>	Complete set of computer system with multimedia projector
<b>12.</b>	Tooling Cabinet and Steel Almirah