



Bangladesh Technical Education Board
Agargaon, Shere Bangla Nagar, Dhaka

Transport Equipment Industry Sector Committee
Bangladesh

National Competency Standards
For
Machine Shop Practice, NTVQF Level 4

Sponsored
By
The Project for Capacity Development Program of TTC, Rajshahi

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INTRODUCTION:

These Competency Standards were developed by the Technical Sub Committee (TSC) that was established under **The Project for Capacity Development Program of TTC, Rajshahi** which is implemented by KOICA (Korea International Cooperation Agency) funded by the Government of Korea. The rules of Skill Development Policy are maintained to develop the standards. The competency standards are the foundation on which new competency based curriculum will be developed that responds better to the needs of industry for skilled workers. The members of the TSC are primarily from industry but with representatives from BKTTC, Chittagong, TTC, Rajshahi and BKTTC, Dhaka. Persons who will successfully complete the new TVET programs based on these competency standards will receive a qualification in the new National Technical and Vocational Qualification Framework (NTVQF).

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Endorsed by

Industry Skills Council

Date:

Bangladesh Technical Education Board (BTEB)

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**National Competency Standards for Machine Shop Practice in the
Transport Equipment Sector**

Proposed Bangladesh NTVQF with Job Classifications

NTVQF Levels	Education Sectors			Job Classification
	Pre Vocation Education	Vocational Education	Technical Education	
NTVQF 6			Diploma in Engineering or Equivalent	Middle level Manager/ Sub Assistant Engineer etc.
NTVQF 5		National Skill Certificate 5 (NSC 5)		High Skilled Worker/Supervisor
NTVQF 4		National Skill Certificate 4 (NSC 4)		Skilled Worker
NTVQF 3		National Skill Certificate 3 (NSC 3)		Semi Skilled Worker
NTVQF 2		National Skill Certificate 2 (NSC 2)		Medium Skilled Worker
NTVQF 1		National Skill Certificate 1 (NSC 1)		Basic Skilled Worker
Pre-Voc 2	National Pre-Vocation Certificate in NPVC 2			Pre-Vocation Trainee
Pre-Voc 1	National Pre-Vocation Certificate in NPVC 1			Pre-Vocation Trainee

NTVQF level Descriptors

NTVQF level	Knowledge	Skill	Responsibility	Job Class
6	Comprehensive actual and theoretical knowledge within a specific study area with an awareness of the limits of that knowledge	Specialized and restricted range of cognitive and practical skills required to provide leadership in the development of creative solutions to defined problems	Manage a team or teams in workplace activities where there is unpredictable change . Identify and design learning programs to develop performance of team members.	Supervisor/Middle Level Manager/Sub Assistant Engr. Etc.
5	Very broad knowledge of the underlying. Concepts, principles, and processes in a specific study area	Very broad range of cognitive and practical skills required to generate solutions to specific problems in one or more study areas.	Take overall responsibility for completion of tasks in work or study. Apply past experiences in solving similar problems	Highly Skilled Worker/ Supervisor.
4	Very broad knowledge of the underlying. Concepts, principles, and processes in a specific study area	Range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying the full range of methods, tools, materials and information.	Take responsibility, within reason, for completion of tasks in work or study. Apply past experiences in solving similar problems	Skilled Worker
3	Moderately broad knowledge in a specific study area.	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools.	Work or study under supervision with some autonomy	Semi- Skilled Worker.
2	Basic underpinning knowledge in a specific study area	Basic skills required to carry out simple tasks	Work or study under indirect supervision in a structured context.	Medium Skilled Worker
1	Elementary understanding of the underpinning knowledge in a specific study area	Limited range of skills required to carry out simple tasks	Work or study under direct supervision in a structured context	Basic Skilled Worker
Pre-Voc 2	Limited general knowledge	Very limited range of skills and use of tools required to carry out simple tasks	Work or study under direct supervision in a structured context	Pre-Vocation Trainee
Pre-Voc 1	Extremely limited general knowledge	Minimal range of skills required to carry out simple tasks	Simple work or study exercises, under direct supervision in a clear, well defined structured context	Pre-Vocation Trainee

**Course Structure
for
MACHINE SHOP PRACTICE (NTVQF LEVEL IV)**

Sl. No.	Unit Code and Title		UoC Level	Nominal Duration (Hours)
Generic - Compulsory (1 UoC required)				
1.	GN4006A1	Lead a small team	4	20
Occupation Specific – Compulsory (5 UoCs required)				
2	TRAMACH4026A1	Perform Complex Lathe Operations	4	70
3	TRAMACH4027A1	Perform CNC Milling Machine Operations	4	50
4	TRAMACH4028A1	Perform Tool and Cutter Grinding Operations	4	50
5	TRAMACH4029A1	Perform CNC wire cut EDM	4	30
6	TRAMACH4030A1	Perform maintain tools and equipment.	4	30
7	TRAMACH 4031A	Apply CAD/CAM Program	4	60
Total Nominal Learning Hours				310

GENERIC UNIT

National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competence

UNIT CODE & UNIT TITLE	GN100512A Lead small team	
NOMINAL HOURS	20 hours	
UNIT DESCRIPTOR	This unit covers the knowledge, skills, and attitude required to lead small team. It includes setting and maintaining team and individual performance standards.	
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables	
1. Provide team leadership	1.1	<i>Work requirements</i> are identified and presented to team members
	1.2	Reasons for instructions and requirements are communicated to team members
	1.3	<i>Team members' queries and concerns</i> are recognized, discussed and dealt with.
2. Assign responsibilities	2.1	Duties, and responsibilities are allocated having regard to the skills, knowledge and aptitude required to properly undertake the assigned task.
	2.2	Duties are allocated having regard to individual preference, domestic and personal considerations, whenever possible.
3. Set performance expectations for team members	3.1	Performance expectations are established based on client needs and according to assignment requirements.
	3.2	Performance expectations are based on individual team members duties and area of responsibility
	3.3	Performance expectations are discussed and directed to implement in the work place.
4. Supervised team performance	4.1	<i>Monitoring of performance</i> takes place against defined performance criteria and/or assignment instructions and corrective action taken if required
	4.2	Team members are provided with <i>feedback</i> , positive support and advice on strategies to overcome any deficiencies.
	4.3	<i>Performance issues</i> which cannot be rectified or addressed within the team are referenced to appropriate personnel.
	4.4	<i>Team members</i> are kept informed of any changes in the priority allocated to assignments or tasks which might impact on client/customer needs and satisfaction
	4.5	Team operations are monitored to ensure that employer/client needs and requirements are met.
	4.6	Follow-up communication is provided on all issues affecting the team
	4.7	All relevant documentation is completed.

Range of Variables

Variable	Range (May include but not limited to):
Work requirements	1.1. Client Profile 1.2. Assignment instructions
Team member's concerns	2.1. Roster 2.2. shift details
Monitor performance	3.1. Formal process 3.2. Informal process
Feedback	4.1. Formal process 4.2. Informal process Sandwich process
Performance issues	5.1. Work output 5.2. Work quality 5.3. Team participation 5.4. Compliance with workplace protocols 5.5. Safety 5.6. Customer service

Evidence Guide

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <p>1.1 Maintained or improved individuals and/or team performance given a variety of possible scenario.</p> <p>1.2 Assessed and monitored team and individual performance against set criteria</p> <p>1.3 Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf</p> <p>1.4 Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed</p> <p>1.5 Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members</p>
<p>2. Underpinning knowledge</p>	<p>2.1 Company policies and procedures</p> <p>2.2 Relevant legal requirements</p> <p>2.3 How performance expectations are set</p> <p>2.4 Methods of Monitoring Performance</p> <p>2.5 Client expectations</p> <p>2.6 Team member's duties and responsibilities</p>
<p>3. Underpinning skills</p>	<p>Communication skills required for leading teams</p> <p>3.1 Informal performance counseling skills</p> <p>3.2 Team building skills</p> <p>3.3 Negotiating skills</p>
<p>4. Required Attitude</p>	<p>4.1 Commitment to occupational health and safety</p> <p>4.2 Environmental concerns</p> <p>4.3 Eagerness to learn</p> <p>4.4 Tidiness and timeliness</p> <p>4.5 Respect of peers and seniors in workplace</p>
<p>5. Resource implications</p>	<p>The following resources MUST be provided:</p> <p>5.1 Workplace</p> <p>5.2 Tools, equipment and facilities appropriate to processes or activity</p> <p>5.3 Materials relevant to the proposed activity</p> <p>5.4 Equipment and outfits appropriate in applying safety measures</p> <p>5.5 Relevant drawings, manuals, codes, standards and reference material</p>
<p>6. Method of assessment</p>	<p>Competency must be assessed through:</p> <p>6.1 Written test.</p> <p>6.2 Demonstration</p> <p>6.3 Oral Questioning/Interview</p>
<p>7. Context for assessment</p>	<p>For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module</p>
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by Bangladesh Technical Education Board (BTEB), the national quality assurance body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any national qualification.</p> <p>Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by BTEB.</p>	

OCCUPATION SPECIFIC UNITS

National Technical and Vocational Qualification Framework for Bangladesh
Unit of Competence

UNIT CODE & UNIT TITLE	TRAMACH4026A Perform Complex Lathe Operations	
NOMINAL HOURS	70	
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required to setting up work, selecting and preparing tooling and performing complex turning operations Work would be performed autonomously using predetermined standards of quality and safety.	
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables	
1. Follow OSH practices	1.1	Safe work practices observed and personal proactive equipment (PPE) worn as required for the work performed.
2. Determine sequence and job requirements	2.1	Sequence of operations including job set-up is determined for maximum efficiency and to meet job specifications.
	2.2	Routine maintenance is performed to prepare the machine for required operation as per manufacturer's instruction.
	2.3	Drawings are interpreted to produce component to specifications.
	2.4	Sequence of operation is determined to produce component to specifications.
3. Select and prepare tooling	3.1	Tooling, Lathe accessories and consumables are selected appropriate to task, specifications and material .
	3.2	Cutting tool modifications required to perform complex turning operations are determined. (Where necessary)
	3.3	Tooling and accessories are prepared and modified as required.
	3.4	International Standard Organization(ISO) standards for cutting tools or other appropriate standards to suit cutting parameters, applied as necessary.
4. Perform complex turning	4.1	Speeds and feeds are correctly calculated using appropriate mathematical techniques and reference material.
	4.2	Complex turning is undertaken to specifications and workplace procedures.
	4.3	Work piece is measured and verified to be in accordance with specification using precision measuring equipment .
5. Clean and store tools and equipment	5.1	Waste materials are disposed of in accordance with environmental requirements.
	5.2	Cleaning of equipment is performed in accordance with standard procedures.
	5.3	Tools and equipment are stored safely in appropriate location according to standard place procedures.

RANGE OF VARIABLES

Variable	Range (May include but not limited to):
1. PPE	1.1 Hand Gloves. 1.2 Goggles. 1.3 Safety Shoes. 1.4 Apron. 1.5 Safety Cap/Helmet.
2. Routine Maintenance	2.1 Checking and adjust Machine guards. 2.2 Checking and use coolant and lubricant. 2.3 Checking and adjust chips extraction devices. 2.4 Checking machine performance.
3. Drawings	3.1 Views and projections. 3.2 Drawing symbols. 3.3 Dimensions and features. 3.4 Limit, fit and Tolerance.
4. Cutting Tools	4.1 Inserts 4.2 Tool bits > High speed steel > Carbide tips 4.3 Drills 4.4 Cutting tools 4.5 Form tools 4.6 Boring bars 4.7 Thread chasers 4.8 Tapping heads 4.9 Reamers etc.
5. Work piece	5.1 Mild Steel 5.2 Carbon Steel 5.3 Stainless Steel 5.4 Gun metal 5.5 Brass 5.6 Aluminum 5.7 Bright Steel 5.8 Cast Iron Etc. 5.9 Alloy steel
6. Lathe Accessories	6.1 3- and 4 Jaw chucks 6.2 Lathe center 6.3 Drill chucks 6.4 Knurling tools 6.5 Boring bar 6.6 Face plate 6.7 Ball Bearing center 6.8 Steady rest 6.9 Follower rest 6.10 Lathe dog 6.11 Dead center 6.12 Live center

7. Complex Lathe Operations	<ul style="list-style-type: none"> 7.1 Gear blank 7.2 Acme and square thread 7.3 Eccentrics turning 7.4 Taper thread 7.5 Counterbalancing work on face plates 7.6 Mandrel work 7.7 Heavy (multi-tone) shafts etc.
8. Precision/ Non precision Measuring Tools	<ul style="list-style-type: none"> 1.2 Steel rule 1.3 Gage block 1.4 Ring gage 1.5 Snap gage 1.6 Go and not go gage 1.7 Telescopic gage 1.8 Outside and Inside caliper 1.9 Vernier calipers 1.10 Micrometer calipers 1.11 Gages (thread, drill, depth, surface gage, radius, screw pitch, slip)

EVIDENCE GUIDE

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1 Followed OSH in the work place. 1.2 Performed Routine maintenance to prepare the machine for required operation. 1.3 Determined job requirements. 1.4 Interpreted Drawing. 1.5 Setup and clumped the work piece . 1.6 Performed lathe operations. 1.7 Checked/measured and adjust the work piece.
<p>2. Underpinning knowledge</p>	<ol style="list-style-type: none"> 2.1 precision measuring equipment and measuring techniques within the scope of this unit. 2.2 reasons for selecting different measuring equipment. 2.3 procedures for accurately setting up work for a variety of techniques. 2.4 ISO or other standards applicable to cutting tool inserts. 2.5 cutting parameters for the given task. 2.6 feeds and speeds for complex turning operation(s). 2.7 formulae and data relating to feeds and speeds. 2.8 techniques and procedures for carrying out the following turning operations:
<p>3. Underpinning skills</p>	<ol style="list-style-type: none"> 3.1 Setting up work to the required level of accuracy using appropriate precision measuring equipment. 3.2 Setting and supporting work to avoid distortion on release of clamping devices. 3.3 Selecting correct cutting tools or inserts as appropriate to turning operation. 3.4 Selecting and using appropriate feeds and speeds. 3.5 Performing complex turning operations - counter balancing work on face plates: <ul style="list-style-type: none"> • Mandrel work • Trepanning • Heavy (multi-tonne) shafts 3.6 Calculating cutting parameters, speeds and feeds. 3.7 Planning and sequencing operations. 3.8 Checking and clarifying task related information. 3.9 Entering routine and familiar information onto pro-forma and standard workplace forms. 3.10 Checking for conformance to specifications. 3.11 Using precision measurement equipment. 3.12 Measuring components to specified tolerances.
<p>4. Required Attitude</p>	<ol style="list-style-type: none"> 4.1 Commitment to occupational health and safety. 4.2 Environmental concerns. 4.3 Eagerness to learn. 4.4 Tidiness and timeliness. 4.5 Respect of peers and seniors in workplace. 4.6 Abiding Institutional/Organizational rules.
<p>5. Resource implications</p>	<p>The following resources MUST be provided:</p> <ol style="list-style-type: none"> 5.1 Workplace. 5.2 Tools, equipment and facilities appropriate to processes or activity. 5.3 Materials relevant to the proposed activity.

	5.4 Equipment and outfits appropriate in applying safety measures. 5.5 Relevant drawings, manuals, codes, standards and reference material.
6. Method of assessment	Competency must be assessed through: 6.1 Written test. 6.2 Demonstration. 6.3 Oral Questioning/Interview.
7. Context for assessment	For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module.
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by Bangladesh Technical Education Board (BTEB), the national quality assurance body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any national qualification.</p> <p>Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by BTEB.</p>	

National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competence

UNIT CODE & UNIT TITLE	TRAMACH 4027A Perform CNC Milling Machine Operations	
NOMINAL HOURS	50	
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required to perform CNC Milling machine operations. It includes facing, Slotting, square pocket, Round pocket, drilling and Boring operation.	
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA	
	Bold & Italic terms are elaborated in the Range of Variables.	
1. Prepare for CNC mill Operation	1.1	Safe work practices observed and personal proactive equipment (PPE) worn as required for the work performed.
	1.2	Tool and equipment are selected and collected conforming to the job requirement
	1.3	Necessary Materials for CNC operation are selected conforming to the job requirement
	1.4	Performed routine maintenance to prepare the machine for required operation
	1.5	Drawings are interpreted to produce component to specifications.
2. Set- up machine ,cutting tools and work piece	2.1	Machine Zero position Is set according to the required job position (offset setting)
	2.2	Cutting tools and <i>driven</i> tools are set according to required sequence of operations.
	2.3	Work holding and clamping devices are tightened according to standard operating procedures.
	2.4	Work piece is mounted on clamping device using tools and instruments in accordance with workplace procedures
	2.5	Work piece zero position is set to the required position.
3. Input/write program	3.1	Program Is inputted USB/written to the machine using appropriate devices .
	3.2	Program is checked to determine the correctness of work parameters .
4. Simulate the program	4.1	Program simulation/ Dry run is performed to check the desired tool path movement.
	4.2	Where necessary, program is edited for the desired tool path movement.
5. Perform CNC operation in Auto mode	5.1	The door is closed in order to safe operation Program is reset to ensure start position from the first program block.
	5.2	CNC Milling operations are performed to produce component in accordance with the prepared program.
	5.3	Corrective measures/adjustments are performed if necessary.
	5.4	Work piece is checked and measured in conformance to specification using appropriate methods, measuring tools and equipment.
6. Check and measure work piece	6.1	Defective work pieces are marked, recorded and reported for proper action
	6.2	Waste materials are disposed of in accordance with environmental requirements.
	6.3	Cleaning of machine and equipment is performed in accordance with standard procedures.

	6.4	Tools and equipment are stored safely in appropriate location according to standard work place procedures
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Variable	Range (May include but not limited to):
1. PPE	1.1 Hand Gloves. 1.2 Goggles . 1.3 Safety Shoes. 1.4 Apron
2. Tools and equipment	3.1 Drilling tools 3.2 End mill Cutter 3.3 Facing Cutter 3.4 T-Slotting Cutter
3. Necessary materials	2.1 Mild Steel, Carbon Steel, Stainless Steel, Gum metal, Bright Steel. Alloy Steel. Copper , Bronze. 2.2 Aluminum, Brass 2.3 Plastic bar/rod 2.4 Teflon shaft
4. Routine maintenance	4.1 Checking and adjust Machine guards, 4.2 Checking and use coolant and lubricant 4.3 Checking & adjusting Air And Hydraulic Pressure 4.4 Checking and adjust chips extraction devices. 4.5 Checking machine performance
5. Tool and Cutter set-up	5.1 Scratch method 5.2 Tool-setting device method
6. Work holding and clamping device	6.1 Table Vice 6.2 Magnet
7. Measuring tools and equipment	7.1 Tool pre - setting device (<i>optional</i>) 7.2 Dial indicator 7.3 Dial test indicator 7.4 Gauges (go-no go, pitch, plug, radius, etc.) 7.5 Coordinate measuring machine (CMM) (<i>optional</i>) 7.6 Precision Measuring Tools 7.7 Bevel protractor 7.8 Profile projector 7.9 Surface-texture tester
8. Program	8.1 Canned cycle programing 8.2 Absolute programing 8.3 Incremental programing
9. Appropriate input Devices	9.1 Machine Key board 9.2 Computer/Laptop 9.3 Flash drive 9.4 Pen drive
10. CNC Milling Operations	10.1 Facing, 10.2 Slotting, 10.3 Square pocket, 10.4 Round pocket, 10.5 Drilling 10.6 Boring
11. Corrective measures/adjustments	11.1 Replacement of cutting tools 11.2 Adjustment of tool offset 11.3 Adjustment of cutting speed and feed rate

Evidence Guide

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1 Used safety rules and procedure 1.2 Performed machine set-up with multiple axis 1.3 Performed cutting tools and driven tools setting 1.4 Wrote / inputted programs 1.5 Performed work piece set-up 1.6 Simulated/ Dry Run the program 1.7 Turned work piece 1.8 Checked and measured work piece
<p>2. Underpinning knowledge</p>	<ol style="list-style-type: none"> 2.1 Emergency stop 2.2 Machine axis 2.3 G-Code programing 2.4 M-code programing 2.5 Coordinate <ul style="list-style-type: none"> • Absolute position • Relative position • Machine position 2.6 Mode <ul style="list-style-type: none"> • Edit (Program) mode • JOG (Handle) mode • MDI mode (Manual Data Input) • DNC mode 2.7 Single block mode 2.8 Auto mode 2.9 Feed rate over write 2.10 Spindle speed over write 2.11 Rapid travels 2.12 Tool offset and tool geometry 2.13 Zero return 2.14 Memory lock key 2.15 Cycle start and cycle stop
<p>3. Underpinning skills</p>	<ol style="list-style-type: none"> 3.1 Selection of cutting tools 3.2 Computation of feed, cutting speed and machine rpm 3.3 Application of G - codes and M - codes 3.4 Setting machine with multiple axis 3.5 Writing /inputting programs 3.6 Setting work piece 3.7 Simulating/ Dry Run the program 3.8 Applying techniques to turn work piece 3.9 Using measuring tools and equipment to check and measure work piece
<p>4. Required Attitude</p>	<ol style="list-style-type: none"> 4.1 Commitment to occupational health and safety[OHS]. 4.2 Environmental and Institutional/Organizational concerns. 4.3 Eagerness to learn. 4.4 Tidiness and timeliness. 4.5 Respect of peers and seniors in workplace.
<p>5. Resource implications</p>	<p>The following resources must be provided:</p> <ol style="list-style-type: none"> 5.1 Work place. 5.2 Tools and equipment appropriate to workplace. 5.3 Materials relevant to the proposed activity/task. 5.4 Drawings and specifications relevant to the task. 5.5 Relevant manuals, codes, standards and reference material.
<p>6. Method of assessment</p>	<p>Competency must be assessed through:</p> <ol style="list-style-type: none"> 6.1 Written test. 6.2 Demonstration. 6.3 Oral Questioning/Interview.

7. Context for assessment	For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module.
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Accreditation Requirements

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**National Technical and Vocational Qualification Framework for Bangladesh
Unit of Competency**

UNIT CODE & UNIT TITLE	TRAMACH4028A Perform Tool and Cutter Grinding Operations	
NOMINAL HOURS	50	
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required to setup and grind cutting tools and cutters. It includes the requirements for grinding tools and cutters generally used in a mechanical workshop to perform various type of jobs autonomously to predetermined standards of quality and safety.	
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables.	
1. Follow OSH practices	1.1	Safe work practices observed and personal proactive equipment (PPE) worn as required for the work performed.
	1.2	Machine guards, coolant and dust extraction devices are checked.
	1.3	Correct safety procedures are observed, and protective clothing and safety glasses are worn.
2. Determine job requirements	2.1	Drawings are interpreted and sequence of operations is determined.
	2.2	Tool holding devices are selected according to the requirements of the operation.
	2.3	Tool and cutter grinding wheels are selected, based on knowledge of grinding wheel structure, and are balanced and dressed.
	2.4	Accessories are selected to facilitate production to specification.
	2.5	Machine guards, coolant and dust collection devices are checked according to worksite procedure.
3. Perform tool and cutter grinding	3.1	Grinding machine is adjusted in accordance with worksite procedures.
	3.2	Cutting tool is hold or clamped to avoid damage.
	3.3	Coolant is used to reduce heat of tool and prevent damages.
	3.4	Universal tool and cutter grinding machines are operated to sharpen and shape the full range of tools and cutters .
	3.5	Parallel grinding is carried out.
	3.6	Proper grinding is carried out according to drawing specifications.
	3.7	Components are checked for conformance to specification using appropriate techniques, tools and equipment.
4. Clean and store tools and equipment	4.1	Waste materials are disposed of in accordance with environmental requirements.
	4.2	Cleaning of equipment is performed in accordance with standard procedures.
	4.3	Tools and equipment are stored safely in appropriate location according to standard procedures.

Range of Variables

Variable	Range (May include but not limited to):
1. PPE	1.1 Hand Gloves. 1.2 Goggles . 1.3 Safety Shoes. 1.4 Apron. 1.5 Helmet.
2. Grinding wheels	2.1 Taper Cup type grinding wheel 2.2 Disc type grinding wheel 2.3 Double and single angle type grinding wheel 2.4 Recess and Double Recess Type grinding wheel 2.5 Copulate grinding wheel
3. Tools and cutter	3.1 Side And Face Cutters, 3.2 End Mill, 3.3 Form Relieved Milling Cutters, 3.4 Flat V And Circular Form Tools And Hobs, 3.5 Slitting Saws, 3.6 Drills.
4. Accessories	4.1 Wheel dresser 4.2 Diamond pen 4.3 Various collates 4.4 Tools holder
5. Grinding machine	5.1 Pedestal grinder 5.2 Cutter grinder 5.3 Universal tool and cutter grinder.
6. Grinding operations	6.1 Angles to a square shoulder 6.2 Different form (radius nose, square nose, V nose to cut)

Evidence Guide

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1 Followed OSH 1.2 Selected holding device as required. 1.3 Selected wheels and accessories 1.4 Performed grinding operations 1.3 Checked cutting tools angles
<p>2 Underpinning knowledge</p>	<ol style="list-style-type: none"> 2.1 Reasons for selecting the chosen sequence of operations 2.2 Function of coolant and dust extraction devices 2.3 Criteria for grinding wheel selection: <ul style="list-style-type: none"> • Grain size of abrasive particles • Grade or strength of bond • Bond material 2.4 Grinding wheel dressing procedures and wheel dressing tools 2.5 Source(s) of data on tool geometry for the full range of tools and cutters, including the terminology used to describe the tool geometry 2.6 Procedures to be followed when parallel grinding on a tool and cutter grinder 2.7 Procedures to be followed when grinding tapers on a tool and cutter grinder 2.8 Tools, techniques and equipment used to check ground components for conformance with the following specifications: <ul style="list-style-type: none"> • Dimensions and tolerances. • Geometry and tolerances. • Surface finish. 2.9 Hazards and control measures associated with tool and cutter grinding, including housekeeping.
<p>3 Underpinning skills</p>	<ol style="list-style-type: none"> 3.1 Reading, interpreting and following information on written job instructions, specifications, charts, lists, drawings and other applicable reference documents. 3.2 Checking and clarifying task related information. 3.3 Preparing operational work plan. 3.4 Planning and sequencing operations. 3.5 Performing safety checks of equipment. 3.6 Selecting tool and cutter grinding accessories. 3.7 Balancing/dressing grinding wheels. 3.8 Sharpening/shaping tools and cutters. 3.9 Checking components for conformance with specification.
<p>4 Required Attitude</p>	<ol style="list-style-type: none"> 4.1 Commitment to occupational health and safety. 4.2 Environmental concerns. 4.3 Eagerness to learn. 4.4 Tidiness and timeliness. 4.5 Respect of peers and seniors in workplace. 4.6 Abiding Institutional/Organizational rules.
<p>5 Resource implications</p>	<p>The following resources MUST be provided:</p> <ol style="list-style-type: none"> 5.1 Workplace. 5.2 Tools, equipment and facilities appropriate to processes or activity. 5.3 Materials relevant to the proposed activity. 5.4 Equipment and outfits appropriate in applying safety measures. 5.5 Relevant drawings, manuals, codes, standards and reference

	material.
6 Method of assessment	Competency must be assessed through: 6.1 Written test. 6.2 Demonstration. 6.3 Oral Questioning/Interview.
7 Context for assessment	For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module.
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by Bangladesh Technical Education Board (BTEB), the national quality assurance body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any national qualification.</p> <p>Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by BTEB.</p>	

National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competency

UNIT CODE & UNIT TITLE	TRAMACH4029A Perform CNC Wire Cut machine Operation
NOMINAL HOURS	30
UNIT DESCRIPTOR	This unit covers writing and executing program for a range of CNC wire cut EDM machines. Programming includes 2 axis tool paths, and auto multi-cavity work pieces.
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables
1. Prepare for CNC Operation	1.1 Safe work practices observed and personal proactive equipment (<i>PPE</i>) worn as required for the work performed.
	1.2 Tool and <i>Wire(Electrode)</i> for CNC operation are selected conforming to the job requirement.
	1.3 Performed <i>routine maintenance</i> to prepare the machine for required operation.
	1.4 Drawings are interpreted to produce component to specifications.
2. Set- up machine ,wire and work piece	2.1 Machine Zero Position Is set according to the required job position. (Offset setting)
	2.2 <i>Wire(electrode)</i> and <i>feed roller</i> are set according to required sequence of operations.
	2.3 Work holding and clamping devices are tightened according to standard operating procedures.
	2.4 Work pieces mounted on clamping device using tools and <i>instruments</i> in accordance with workplace procedures.
3. Write program	3.1 Engineering drawings are understood and interpreted to define optimum tool path geometry.
	3.2 <i>Tool path</i> is programmed using advanced operations, canned cycles and sub-routines or other appropriate sub-routines within system.
	3.3 <i>Program</i> is written in standard code format, also confirmed and edited as necessary using appropriate routine and standard operating procedures.
	3.4 Program is stored in accordance with standard operating procedures.
	3.5 Operation sheet is produced to standard operating procedures.
4. Perform CNC Wire cut operation in Auto mode	4.1 The door is closed in order to safe operation .
	4.2 Program is <i>inputted USB</i> , and machining parameters that may include wire offset, wire speed, power settings are selected.
	4.3 Machine is prepared, work piece are loaded and aligned, also data and reference points are established in accordance with standard operating procedures.
	4.4 Program is reset to ensure start position is from the first program block.
	4.5 Machine is operated in appropriate mode to test and prove program, work piece positioning.
	4.6 Finished components are checked for conformance with drawing specifications.
5. Clean & Store Tools and Equipment	5.1 Waste <i>materials</i> are disposed of in accordance with environmental requirements.
	5.2 Cleaning of machine and equipment is performed in accordance with workplace procedures.
	5.3 Tools and equipment are stored safely in appropriate location according to standard work place procedures.

Range of Variables

Variable	Range (May include but not limited to):
1. PPE	1.1 Hand Gloves 1.2 Goggles 1.3 Safety Shoes 1.4 Apron 1.5 Safety Cap 1.6 Safety Mask
2. Materials	2.1 Bronze 2.2 Copper 2.3 Aluminum 2.4 Carbon steel 2.5 Alloy steel 2.6 Stainless steel 2.7 Cast alloy 2.8 Alloy steel
3. Routine Maintenance	3.1 Checking and adjusting Machine guards. 3.2 Checking and using coolant and lubricant. 3.3 Checking & adjusting Air and Hydraulic Pressure. 3.4 Checking and adjusting chips extraction devices. 3.5 Checking machine performance.
4. Cutting electrode	3.6 Titanium/chromium-coated. 3.7 Brass wire. 3.8 Diffusion-annealed.
5. CNC operation and Program	5.1 Absolute programming. 5.2 Incremental programming. 5.3 Nesting tool paths. 5.4 Chained linear tool paths. 5.5 Differential profiles.
6. Appropriate input Devices	6.1 Machine Key board. 6.2 Computer/Laptop. 6.3 Flash drive. 6.4 Pen Drive
7. Corrective measures/adjustments	7.1 Replacement of tool electrode. 7.2 Adjustment of tool offset. 7.3 Adjustment of cutting speed and feed rate.
8. Measuring Tools	8.1 Vernier caliper (Digital or read out). 8.2 Micrometer (Digital or read out).

Evidence Guide

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1 Used safety rules and procedure. 1.2 Performed machine set-up with multiple axis. 1.3 Performed tool electrode and wheel dram setting. 1.4 Wrote / Loaded inputted programs. 1.5 Performed work piece set-up. 1.6 Simulated / Dry Run the program. 1.7 Execute machine. 1.8 Checked and measured work piece.
<p>2. Underpinning knowledge</p>	<ol style="list-style-type: none"> 2.1 The operations to be controlled by the program to be written. 2.2 The tool path(s) to be followed when producing the part or product. 2.3 The sequence of operations. 2.4 The reasons for selecting the chosen tool path(s) and sequence of operations. 2.5 The zero Position of the wire cut machine. 2.6 The canned cycles and sub-routines accessible in the particular. NC/CNC machine. 2.7 The machining parameters that may be entered into the machine controller. 2.8 Work holding fixtures/devices/tools. 2.9 Procedures for mounting work holding fixtures/devices tools. 2.10 Purpose of datum setting. 2.11 Pre-start checks. 2.12 Safety features and equipment of the NC/CNC machine. 2.13 The procedures to be followed when using the machine in this mode. 2.14 The relative position of the work piece to the machine datum or zero. 2.15 The specifications of the part or product.
<p>3. Underpinning skills</p>	<ol style="list-style-type: none"> 3.1 Interpreting working drawings, specifications and instructions. 3.2 Calculating coordinates of all relevant points on the part or product to be produced. 3.3 Storing programs. 3.4 Producing NC/CNC operation sheet(s). 3.5 Setting machine parameters. 3.6 Mounting work holding fixtures/ devices/tools. 3.7 Testing and proving NC/CNC program.. 3.8 Checking parts or products produced for conformance with specifications.
<p>4. Required Attitude</p>	<ol style="list-style-type: none"> 4.7 Commitment to occupational health and safety. 4.8 Environmental and Institutional/ Organizational concerns. 4.9 Eagerness to learn. 4.10 Tidiness and timeliness. 4.11 Respect of peers and seniors in workplace.
<p>5. Resource implications</p>	<p>The following resources MUST be provided:</p> <ol style="list-style-type: none"> 5.6 Workplace. 5.7 Tools, equipment and facilities appropriate to processes or activity. 5.8 Materials relevant to the proposed activity. 5.9 Equipment and outfits appropriate in applying safety measures. 5.10 Relevant drawings, manuals, codes, standards and reference material.

6. Method of assessment	Competency must be assessed through: 6.4 Written test. 6.5 Demonstration. 6.6 Oral Questioning/Interview.
7. Context for assessment	For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module.
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National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competency

UNIT CODE & UNIT TITLE	TRAMACH 4030A Perform maintain tools and equipment.	
NOMINAL HOURS	30	
UNIT DESCRIPTOR	This unit covers identifying and analysing defects in tooling, disassembling and assessing tooling components, manufacturing or repairing tooling components to conform to specifications, and assembling tooling components.	
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables	
1. Select and Identify defective tools and equipment	1.1	Use <i>PPE</i> as required.
	1.2	Defects are determined from any of production components produced, production reports or tool inspections.
	1.3	Sequence of maintenance operations is planned.
	1.4	<i>Workplace procedures</i> relevant to the use of <i>tools and equipment</i> are selected.
	1.5	Work instructions are identified and clarified.
	1.6	Appropriate tools and equipment are selected as required by work instructions.
2. Use tools and operate equipment	2.1	<i>Tools and equipment</i> are checked to ensure they are correct and safe to use according to workplace procedures.
	2.2	Tools and equipment are used according to manufacturer instructions.
	2.4	Observations are noted during the use of tools/equipment.
3. Service and maintain workplace tools and equipment	3.1	Tooling is disassembled and assessed as per manufacturer's manual.
	3.2	Worn/damaged parts are replaced/reconditioned conformity to the performance.
	3.3	<i>Machine Tools</i> and equipment are regularly checked against manufacturer/ component supplier recommendations.
	3.4	Basic maintenance of tools and equipment is carried out according to manufacturer specifications and workplace procedures.
	3.5	<i>Machine</i> are serviced, adjusted and/or maintained as per manufacturer/component <i>supplier's schedule</i> .
	3.6	Tool and equipment maintenance records are completed.
4. Repair and assemble tooling components	4.1	Appropriate <i>hand and hand held power tools</i> are selected and used.
	4.2	Appropriate machining process is chosen from a range of standard tool room machines.
	4.3	Components are assembled in conformance with specifications.
5. Store and secure tools and equipment	5.1	Tools and equipment are cleaned, checked and stored.
	5.2	Tools and equipment are securely stored.
	5.3	Documents are completed according to enterprise policies and procedures.

Range of Variables

Variable	Range (May include but not limited to):
1. PPE	1.1 Hand Gloves 1.2 Goggles 1.3 Safety Shoes 1.4 Helmet /Cap 1.5 Apron 1.6 Mask
2. Tools	2.1 Adjustable wrench 2.2 Spanner 2.3 Ring wrench 2.4 Socket / Power wrench 2.5 Monkey wrench 2.6 Pipe wrench 2.7 Flat screw driver 2.8 star screw driver 2.9 long screw driver 2.10 Ling nose pliers 2.11 Combination pliers 2.12 cutting screw 2.13 driver 2.14 Hand grip vice 2.15 Ball pin Hammer 2.16 Slag Hammer Centre Punch 2.17 Dot Punch, Chisel 2.18 Scriber, Soiled shaft 2.19 Emery paper, Slitter 2.20 Files, Grinding machine 2.21 Drilling machine etc.
3. Equipment's / Machines	3.1 Lathe machine 3.2 Shaper machine 3.3 Pedestal grinder 3.4 Drill machine 3.5 Milling machine 3.6 Universal grinder 3.7 Boring machine
4. Supplier's Schedule	4.1 Daily 4.2 Weekly 4.3 Fortnightly 4.4 Monthly 4.5 Quarter yearly 4.6 Half yearly 4.7 Yearly
5. Maintenance	5.1 Assemble 5.2 Disassemble 5.3 Rapier 5.4 Replace machine components
6. Measuring tools and equipment	6.1 Vernier calipers 6.2 Micrometers 6.3 Gages 6.4 Dial indicator 6.5 Height Gage

Evidence Guide

1. Critical aspects of competency	<p>Assessment requires evidence that the candidates:</p> <ul style="list-style-type: none"> 1.1 Followed OSH in the work place. 1.2 Maintenance to prepare the maintain tools and equipment. 1.3 Tooling is disassembled. 1.4 Damaged parts are replaced. 1.5 Assembled tool correctly.
2. Underpinning Knowledge	<ul style="list-style-type: none"> 2.1 Common tooling defects from a range of sample products/components. 2.2 The probable causes of tooling failure. 2.3 The reasons for selecting the probable causes of tooling failure. 2.4 The reasons for establishing a sequential plan for the repair/maintenance of defective tooling. 2.5 Components for repair or replacement. 2.6 The required physical properties of the tooling to be replaced. 2.7 The reasons for selecting the chosen machining parameters. 2.8 The common causes of tooling failure 2.9 Commonalities of causes of failures or trends/events associated with tooling failure.
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Interpretation of working drawing. 3.2 Obtaining all relevant information with respect to defective tooling. 3.3 Examining the defective tooling for breakage, wear. 3.4 Preparing a sequential plan for the repair/maintenance of the equipment. 3.5 Applying Disassembling techniques. 3.6 Marking worn/damaged components. 3.7 Initiating design modifications/alterations to rectify recurring faults or failure.
4. Required Attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety. 4.2 Environmental concerns. 4.3 Eagerness to learn. 4.4 Tidiness and timeliness. 4.5 Respect of peers and seniors in workplace. 4.6 Abiding Institutional/Organizational rules.
5. Resource implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 Work place. 5.2 Tools and equipment appropriate to workplace. 5.3 Materials relevant to the proposed activity/task. 5.4 Drawings and specifications relevant to the task. 5.5 Relevant manuals, codes, standards and reference material.
6. Method of assessment	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 6.1 Written test. 6.2 Demonstration 6.3 Oral Questioning/Interview
7. Context for assessment	For certification competency must be assessed individually in the actual work place or simulated environment after completion of the module
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National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competency

UNIT CODE & UNIT TITLE	TRAMACH 4031A Apply CAD/CAM Program (Advance)	
NOMINAL HOURS	60	
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required to apply CAD/CAM program for creating of 3D CAD drawings and CAM programming for G code generate .	
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA	
	Bold & Italic terms are elaborated in the Range of Variables.	
1. Prepare for application CAD/CAM Program	1.1	Safe work practices observed in accordance with work place requirement.
	1.2	Work piece, drawing, model or a concept of a new design are analyzed to produce CAD drawing and CAM program
	1.3	CNC Parameters are selected according to the requirements of the operation
	1.4	Tools and equipment are gathered to produce drawing as per requirement.
	1.5	All relevant materials, instructions manuals and operating procedures are obtained according to job requirements
2. Create / import CAD drawing	2.1	Basic parameters of CNC machine are set in accordance with instructions manual.
	2.2	Drawing reference point is established based on job requirement/ work piece.
	2.3	Profile, shape, contour of the work piece are created / imported using CAD according to job requirements and drawing standards .
	2.4	Created / imported drawings are edited according to drawing standards.
	2.5	Created / edited drawing is saved according to job requirements.
3. Create / Edit CNC programs	3.1	Tools are selected from the tool library and loaded based on job requirements.
	3.2	Coordinates are set for tool path or machining functions based on the CNC machine
	3.3	Work piece Zero Position is identified based on the CNC machine.
	3.4	Tool paths generated in accordance with the software used.
	3.5	Tool paths are simulated and determined the correctness of the tool movements and other work parameters
	3.6	CNC program generated through post processor in accordance with selected CNC machine
4. Load and run program at CNC machine	4.1	Program is loaded using the appropriate devices.
	4.2	Dry run/simulation is performed in the machine in accordance with established procedures.
	4.3	Program is executed to produce part/ work piece.
	4.4	Problems encountered are documented, reported or referred to concerned personnel in accordance with worksite procedures.
	4.5	Cleaning of equipment is performed in accordance with standard procedures.

Range of Variables

Variable	Range (May include but not limited to):
1. CNC Parameters	1.1 Coordinates of CNC machine 1.2 Tools position
2. Drawing standards	2.1 ISO 2.2 American (ANSI) And other existing standards
3. Software	3.1 Master CAM 3.2 Edge CAM 3.3 CATIA
4. Machine and Machine control	4.1 Fanuc 4.2 Sinumerik 4.3 Mitsubishi
5. Problems encountered	5.1 Incorrect machine set-up 5.2 Incorrect parameter setting 5.3 Defective raw materials
6. Concerned personnel	6.1 Production supervisor 6.2 CNC Programmer 6.3 Designer 6.4 Other operators 6.5 Quality control inspector 6.6 Service Engineer

Evidence Guide

1.Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Observed computer hardware safety practice 1.2 Determined job requirements 1.3 Created / imported CAD drawing 1.4 Set CNC parameters 1.5 Created / edited CNC programs 1.6 Loaded and run program at CNC machine
2.Underpinning knowledge	<ul style="list-style-type: none"> 2.1 Safely operating milling machine. 2.2 Methods of CNC Lathe machine operations 2.3 Determination of materials specifications 2.4 Fundamental common and specific G-codes and M-codes 2.5 Fundamentals of CAD/CAM software 2.6 Connection technique to CNC machines 2.7 Basic file management Tool offset and tool geometry 2.8 Zero return 2.9 Memory lock key 2.10 Cycle start and cycle stop
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Drafting and designing work piece <ul style="list-style-type: none"> ➤ Lathe operation job ➤ Milling operation job ➤ Weir cutting job 3.2 Selection of cutting tools 3.3 Using CAD/CAM software 3.4 Generating codes 3.5 Application of G - codes and M – codes 3.6 Edit code as different control machine. 3.7 Transferring program to CNC machine 3.8 Direct connect to machine 3.9 USB Transfer System 3.10 Applying techniques to turn work piece 3.11 Using measuring tools and equipment to check and measure work piece
4. Required Attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety[OHS]. 4.2 Environmental and Institutional/Organizational concerns. 4.3 Eagerness to learn. 4.4 Tidiness and timeliness. 4.5 Respect of peers and seniors in workplace.
5. Resource implications	<p>The following resources must be provided:</p> <ul style="list-style-type: none"> 5.1 Work place. 5.2 Tools and equipment appropriate to workplace. 5.3 Materials relevant to the proposed activity/task. 5.4 Drawings and specifications relevant to the task. 5.5 Relevant manuals, codes, standards and reference material.
6. Method of assessment	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 6.1 Written test. 6.2 Demonstration. 6.3 Oral Questioning/Interview.
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