Technical and Vocational Education and Training (TVET) Council

Occupational Standards of Competence

Mechanical Manufacturing Engineering (CNC) Machining Level 3

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Qualification Overview

NVQB

in

Mechanical Manufacturing Engineering

Computer Numerical Control (CNC) Machining

Level 3

ACKNOWLEDGEMENTS

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Qualification Overview

The NVQ in Mechanical Manufacturing Engineering Computer Numerical Control (CNC) Machining Level 3 is designed to provide training, assessment and recognized certification for persons in the Mechanical Engineering and Manufacturing sectors. Candidates must be able to carry out CNC machine tool programming, load and prove CNC machine tool programmes, set CNC milling and turning machines for production, machine components using CNC turning and milling machines, work efficiently in engineering, use and interpret engineering data documentation and follow principles of occupational health and safety within the mechanical engineering and manufacturing sectors in accordance to industry standards.

Who is the qualification for?

This qualification is aimed at persons who have a level of autonomy within their job roles in the mechanical engineering and manufacturing sectors. Competencies are for persons who are likely to be in roles where their duties may include:

- Loading and proving CNC machine tool programmes
- Setting CNC turning and milling machines for production
- Machining components using CNC turning and milling machines
- Carrying out CNC machine tool programming
- Using and interpreting engineering data and documentation

Jobs within the occupational area

Relevant occupations include:

- CNC machine operator
- Mechanical engineer in CNC machining
- CNC machinists

This list is not exhaustive and only serves to illustrate the breadth of the qualification.

A06703 APPROVED NATIONAL VOCATIONAL QUALIFICATION STRUCTURE

MECHANICAL MANUFACTURING ENGINEERING COMPUTER NUMERICAL CONTROL (CNC) MACHINING- LEVEL 3

To achieve the full qualification, candidates must complete **all** nine (9) mandatory units.

Mandatory Units (all must be completed)	**CODES**
1. Carry out computer numerically controlled (CNC) machine tool programming	**U99003**
1.1 Prepare for CNC machine tool programming	
1.2 Produce CNC machine tool programmes	
1.3 Validate CNC programme operation	
2. Load and prove CNC machine tool programmes	**U99103**
2.1 Load CNC machine tool programmes	
2.2 Prove CNC machine and programmes	
2.3 Complete loading and proving of CNC machine tool programmes	
3. Machine components using CNC milling machines	**U99203**
3.1 Machine components	
3.2 Complete machining activities	
4. Machine components using CNC turning machines	**U99303**
4.1 Machine components	
4.2 Complete machining activities	
5. Set up CNC milling machines for production	**U99403**
5.1 Set up CNC milling machines for production	
5.2 Prepare tooling for operation	
6. Set up CNC turning machines for production	**U99503**
6.1 Set up CNC turning machines for production	
6.2 Prepare tooling for operation	

Mandatory Units (all must be completed)	CODES
7. Work in engineering	**U99603**
7.1 Prepare for engineering activity	
7.2 Work in engineering	
7.3 Complete work activity	
8. Use and interpret engineering data and documentation	**U99703**
8.1 Use engineering data and documentation	
8.2 Interpret engineering data and documentation	
9. Follow principles of occupational health and safety (OH&S) in engineering	**U99803**
9.1 Follow safe work practices	
9.2 Identify workplace hazards and risks	
9.3 Follow emergency procedures	

U99003 Carry out computer numerically controlled (CNC) machine tool programming

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to carry out computer numerically controlled (CNC) machine tool programming in accordance with approved procedures and applies to the mechanical engineering and industrial fields.

ELEMENT	PERFORMANCE CRITERIA
To be competent you must achieve the following:	
1. Prepare for CNC machine tool programming	1.1 Extract job requirements accurately according to job specification documents.
	1.2 Obtain the necessary **component data and information** to produce the programme.
	1.3 Prepare the machine controller to accept data from the appropriate source according to machine specifications.
2. Produce CNC machine tool programmes	2.1 Select appropriate **programming methods** to write programmes for **CNC machine tools** according to machine specifications.
	2.2 Select and use the programme and reference codes applicable to the type of machine controller.
	2.3 Confirm that computer control programmes contain the relevant data in the correct format for the engineering activity to be carried out according to company and industry standards and edit **programme details** within agreed control procedures.
3. Validate CNC programme operation	3.1 Deal with problems within your control in accordance with company policies and promptly **report** problems that you cannot resolve within the limits of your own role to the appropriate persons.

3.2 Confirm that the programme operates safely and correctly according to job specifications.

3.3 Save and backup programme details on the appropriate media and store in the appropriate format away from contaminants or sources of corruption according to company and industry requirements.

RANGE STATEMENT

All range statements must be assessed:

1. Component data and information:

- Component data file
- Geometry of the component
- Datum point
- Systems of measurement (absolute, incremental, imperial, metric)
- Safe start position
- Material parameters
- Reference codes
- Positional information

2. Programme methods:

- Computer aided machining (CAM)
- Conversational code
- G code
- Using computer software
- Information entered directly into the machine controller
- Other specific method (such as macros)

4. CNC machine tools:

- Turning
- Milling
- Grinding

5. Programme detail:

- Preparatory commands
- Machine management and auxiliary functions
- Repetitive programmes
- Sub-routines
- Canned cycles
- Labels
- Macros

6. Report:

- Verbal
- Written

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. How to accurately extract job requirements according to specifications.
2. How to interpret CNC drawings, first and third angle drawings, imperial and metric systems of measurement and systems of tolerancing.
3. What are the systems of measurement used on CNC drawings (including absolute and incremental).
4. What information and data are required to produce complete and accurate CNC machining programmes and how they are obtained.
5. How to extract and interpret general and technical data and information from different sources (such as drawings, computer models, symbols and conventions, BS or ISO standards) in order to produce the CNC machining programme.
6. What are the main available machine controllers and how to prepare them to accept data from the appropriate source according to specifications.
7. Why different machine controllers may use completely different codes for similar functions.
8. What are the specific safety precautions to be taken when working with computer controlled machines and remote computer systems.
9. What factors should be taken into account when producing CNC programmes.
10. How to set up and operate computer systems and peripheral devices.
11. How to correctly power up and activate computer systems and programming software.
12. What are the correct start-up and shutdown procedures to be used for computer systems and what are the implications if the correct procedure is not followed.
13. Why it is important to protect computer systems from viruses.
14. What are the programming methods for CNC machine tools and how to select the appropriate ones to write programmes according to specifications.
15. How to select and use the programme reference codes applicable to the type of machine controller.
16. What are the problems that can occur with the loading and running of CNC machining programmes and how to deal with them.
17. What are the different programming codes used to identify factors such as machine axes, positional information, tooling identification and selection, tool and cutter direction, material removal, speeds and feeds, machine management and auxiliary functions.
18. How to access specific programming software.

19. How to confirm that computer control programmes contain relevant data in the correct format for the engineering activity to be carried out according to company and industry standards and edit programme details within agreed control procedures.
20. How to use workpiece zero and reference points.
21. What are the different methods used to set tooling.
22. How to produce effective and efficient programmes to avoid unnecessary operations, tool movements and tool changes.
23. What are the methods and procedures used to check that the completed programme will produce the required component safely, accurately and efficiently.
24. Why and how to save completed programmes in the appropriate format safely and correctly away from contaminants and sources of corruption.
25. How to back up completed or edited programmes and the implications for not doing so.
26. How to use manuals and related documents to solve problems and aid with the efficient programming of CNC machines.
27. What are the organizational procedures for dealing with and reporting problems.
28. What is the extent of your own responsibility when resolving problems.
29. How to deal with problems within your control and to whom problems outside of the limits of your own role should be reported.
30. How to deal with system problems such as error messages received for peripherals which do not respond as required.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates have to prove that they can carry out **all** of the elements, meeting **all** the performance criteria, range and underpinning knowledge **on more than one occasion**. This evidence must come from a real working environment.

(2) Method of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U99103 Load and prove CNC machine tool programmes

Unit Descriptor: This unit describes the knowledge, skills and attitudes required to load and prove CNC machine tool programmes in accordance with approved procedures and applies to mechanical engineering and industrial fields.

ELEMENT	PERFORMANCE CRITERIA
To be competent you must achieve the following:	
1. Load CNC machine tool programmes	1.0 Follow health, safety and other relevant regulations and guidelines for loading machine tool programmes.
	1.1 Load the control programme from the **storage medium** into the **machine tool** controller according to manufacturer's and company standards.
	1.2 Confirm that the procedures for calling up the programme are followed and adhered to and that errors and faults are dealt with appropriately according to company procedures.
	1.3 Store programme media away from contaminants and electromagnetic sources according to company procedures.
2. Prove CNC machines and programmes	2.1 Check that the programme start-up position is safe and set according to industry standards.
	2.2 Confirm that **tooling information** is correctly entered into the machine controller and verify that the tooling change positions are safe and clear of the workpiece and other devices according to manufacturer's recommendations and company procedures.
	2.3 Check that tooling is selected at the appropriate points in the programme and that tooling and operational paths are executed safely and according to machine specifications.

		2.4	Confirm that all operations are carried out to the programme co-ordinates.
3.	Complete loading and proving of CNC machine tool programmes	3.0	Save edited programmes according to company procedures.
		3.1	Produce back-up copies of completed programmes on appropriate media according to company procedures.
		3.2	Store tools, equipment, materials and resources in the appropriate location according to company policies.
		3.3	Communicate any alterations to programmes to the appropriate personnel according to company procedures.
		3.4	Maintain records of programme proving activities using appropriate **reporting methods** according to company policies.

RANGE STATEMENT

All range statements must be assessed:

1. Storage medium:

- Machine controller
- Disk
- Tape (such as punched or magnetic)
- Remote or networked computer system
- Personal computer
- Handheld programmers
- Other specific media

2. Tooling information:

- Tool datums,
- Tool positions,
- Lengths
- Offsets
- Radius compensation

3. Workpiece and other devices:

- Clamps
- Jigs
- Fixtures

4. Reporting methods:

- Written or typed
- Verbally
- Electronically
- Specific company form

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. How to start and stop the machine in normal and emergency situations.
2. Why it is important to wear the appropriate personal protective equipment (PPE) and keep the work area clean and tidy.
3. How to handle and store programme media safely and correctly, away from contaminants and possible corruption sources.
4. What are the computer coding languages used in CNC programmes.
5. What are the machine tools and controller operations.
6. What are the function keys and operating systems of the machine computer control system.
7. How to load, execute, edit and exit programmes correctly.
8. How to set machine datums for each machine axis.
9. How to deal with error messages and faults on the programme and computer controlled equipment.
10. How to place the controller into the correct operating mode.
11. How to access the programme edit facility to enter data.
12. How to use tool posts, magazines and carousels.
13. How to identify the related tools for the operating programme.
14. How to conduct trial runs, using single block run, dry run and feed and speed override controls.
15. Which items should be checked before allowing the machine to operate in full programme run mode.
16. What is the application and output of the programme being proved.
17. What are the numbering system and codes used for identification of control input and outputs.
18. How to search the user programme within the controller for specific elements.
19. How to use and extract information from engineering drawings and related specifications in relation to work undertaken.
20. How to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing.
21. Which factors affect the feeds and speeds that can be used and why they may need to be adjusted from programme setting.

22. What is the application of cutting fluids with regards to a range of different materials.
23. Why some materials do not require the use of cutting fluids.
24. What are the typical problems that may occur with loading and editing of the operating programme.
25. How to resolve problems that may occur with loading and editing of the operating programme.
26. What is the extent of your own responsibility for resolving problems and whom you should report to if you have problems that you cannot resolve.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates have to prove that they can carry out **all** of the elements, meeting **all** the performance criteria, range and underpinning knowledge **on more than one occasion**. This evidence must come from a real working environment.

(2) Method of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U99203 Machine components using CNC milling machines

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to machine Computer Numerical Control (CNC) milling machines for production in accordance with approved procedures and applies to mechanical engineering and industrial fields.

ELEMENT	PERFORMANCE CRITERIA
To be competent you must achieve the following:	
1. Machine components	1.1 Use the appropriate **documentation** for **machine components** in accordance with company requirements.
	1.2 Confirm that the **machine** is set up and ready for operation and follows approved procedures for starting and running the operating system.
	1.3 Resolve error messages and equipment faults that are within the limits of your authority and promptly **report** those which cannot be resolved to the appropriate persons according to company procedures.
	1.4 Monitor the computer process to ensure that the production output is to the required specifications.
2. Complete machining activities	2.1 Shut down the equipment on conclusion of the activities to a safe condition according to manufacturer's specifications.
	2.2 Leave the work area and machine in a safe and tidy condition on completion of the activities.

RANGE STATEMENT

All range statements must be assessed:

1. **Documentation:**

    - Manufacturers' manuals, sketches and technical illustrations
    - Photographic and visual display
    - Technical
    - Drawings (component, assembly, modification, repair, welding and fabrication, distribution and installation)

2. **Machine components:**

    - Faces (flat, parallel, angular, square to each other)
    - Holes (on pitch circle, linear pitched, tapped)
    - Slots (enclosed, recesses, open-ended)
    - Profiles (external, internal, circular and curved)
    - Steps and shoulders
    - Special forms (such as concave, convex)

3. **Machine:**

    CNC three axis milling
    CNC five axis milling
    CNC machining centre

4. **Report:**

    - Verbally
    - In writing

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the specific safety precautions to be taken when working with CNC milling machines and equipment.
2. What are the safety mechanisms on the machine.
3. What are the procedures for checking that the safety mechanisms are operating correctly.
4. How to start and stop the machine in both normal and emergency situations.
5. What are the hazards associated with working on CNC milling machines and how to minimize these and reduce any risks.
6. Why it is important to wear the appropriate protective clothing and equipment.
7. Why it is important to keep the work area clean and tidy.
8. What is the range of CNC milling machines.
9. How to extract and use information from engineering drawings and related specifications.
10. How to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing.
11. How to interpret visual displays and understand the various messages displayed.
12. What is the function of error messages and what to do when an error message is displayed.
13. How to find the correct restart point in the programme when the machine has been stopped before completion of the program.
14. How to operate various hand and automatic modes of machine control.
15. How to operate the machine using a single block run, full programme run and feed/speed override controls.
16. How to make adjustments to the programme operating parameters to take account of tool wear.
17. How to set and secure the workpiece to the machine table and workholding device.
18. What are the effects of clamping the workpiece.
19. How material removal can cause warping and distortion of the finished workpiece.
20. What are the various types of milling cutters and how they are located and secured to the machine spindle, tool magazine and carousel.
21. How to handle and store tooling safely and correctly.
22. How to check that the milling cutters are in a serviceable condition.
23. What effects worn cutters will have on finished work.
24. What problems can occur with the milling activities and how these can be overcome.
25. How to apply cutting fluids with regards to different materials being machined.
26. What are the quality control procedures.

27. What inspection checks need to be carried out.
28. What equipment is used to carry out quality control procedures and inspection checks.
29. Where to obtain component drawings, specifications and job instructions required for the components being machined.
30. What is the extent of your own responsibility to resolve problems and to whom you should report if you have problems that you cannot resolve.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates have to prove that they can carry out **all** of the elements, meeting **all** the performance criteria, range and underpinning knowledge **on more than one occasion**. This evidence must come from a real working environment.

(2) Method of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U99303 Machine components using CNC turning machines

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to machine Computer Numerical Control (CNC) turning machines for production in accordance with approved procedures and applies to mechanical engineering and industrial fields.

ELEMENT	PERFORMANCE CRITERIA

To be competent you must achieve the following:

1.	Machine components	1.1 Use the appropriate **documentation** for **machine components** according to company requirements.
		1.2 Confirm that the **machine** is set up and ready for operation and follow approved procedures for starting and running the operating system.
		1.3 Resolve error messages and equipment faults that are within the limits of your authority and promptly **report** those which cannot be resolved to the appropriate persons according to company procedures.
		1.4 Monitor the computer process to ensure that the production output is to the required specification.
2.	Complete machining activities	2.1 Shut down equipment on conclusion of activities to a safe condition according to manufacturer's specifications.
		Leave the work area and machines in a safe and tidy condition on completion of activities.

RANGE STATEMENT

All range statements must be assessed:

1. **Documentation:**

    - Drawings (component, assembly, modification, repair, welding and fabrication, distribution and installation)
    - Diagrams (schematic, fluid power, piping, wiring and circuit, operational)
    - Photographic and visual display representations

2. **Machine components:**

    - Faces (flat, parallel, angular, square to each other)
    - Holes (on pitch circle, linear pitched, tapped)
    - Slots (enclosed, recesses, open-ended)
    - Profiles (external, internal, circular and curved)
    - Steps and shoulders
    - Special forms (such as concave, convex)

3. **Machine:**

    - CNC lathe
    - CNC machining centres

4. **Report:**

    - Verbally
    - In writing

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the specific safety precautions to be taken when working with CNC turning machines and equipment.
2. What are the safety mechanisms on the machine and the procedures for checking that they are operating correctly.
3. How to start and stop the machine in both normal and emergency situations.
4. What are the hazards associated with working on CNC turning machines and how to minimize them and reduce any risks.
5. Why it is important to wear the appropriate protective clothing and equipment.
6. Why it is important to keep the work area clean and tidy.
7. What is the application of a range of CNC turning machines.
8. How to extract and use information from engineering drawings and related specifications in relation to work undertaken.
9. How to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing.
10. How to use visual displays and understand the various messages displayed.
11. What is the function of error messages and what to do when an error message is displayed.
12. How to find the correct restart point in the programme when the machine has been stopped before completion of the programme.
13. How to operate various hand and automatic modes of machine control.
14. How to operate machines using a single block run, full programme run and feed and speed override controls.
15. How to make adjustments to the programme operating parameters to take account of tool wear.
16. How to set and secure the workpiece to the machine spindle and workholding device.
17. What are the effects of clamping the workpiece.
18. How can material removal cause warping and distortion of the finished workpiece.
19. What are the various types of cutting tools and how they are located and secured to the machine tool posts, turrets, slides and tool magazine or carousel.
20. How to handle and store tooling safely and correctly.
21. How to check that the indexable tooling is in a serviceable condition.
22. What effects worn tooling will have on the workpiece surface finish and tolerances.
23. What are the problems that can occur with turning activities and how these can be overcome.
24. How to apply cutting fluids with regards to different materials being machined.

25. What are the quality control procedures.
26. What inspection checks need to be carried out.
27. What equipment is used to carry out quality control and inspection checks.
28. Where to obtain component drawings, specifications and/or job instructions required for the components being machined.
29. What is the extent of your own responsibility to resolve problems and to whom you should report if you have problems that you cannot resolve.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

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(2) Method of Assessment

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Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U99403 Set up CNC milling machines for production

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to set computer numerical control (CNC) milling machines for production in accordance with approved procedures and applies to mechanical engineering and industrial fields.

ELEMENT	PERFORMANCE CRITERIA

To be competent you must achieve the following:

1.	Set up CNC milling machines for production	1.1 Adhere to the specifications for machine components according to **quality standards.**
		1.2 Analyze what is required and how the **machine** should be set to achieve the required outcomes.
		1.3 Mount and set the required **workholding devices**, workpiece and **cutting tools**.
		1.4 Set machine tool operating parameters to achieve the **machine component specifications** according to industry standards.
		1.5 Check that all safety mechanisms are in place and that equipment is set for the required operations according to manufacturer's specifications.
		1.6 Resolve problems within the limits of your authority and promptly **report** those that cannot be solved to the appropriate person according to company procedures.
		1.7 Leave the work area and machines in a safe and tidy condition on completion of the activities according to company procedures.
2.	Prepare tooling for operation	2.1 Place tools in the correct **positions** of the CNC machine according to manufacturer's specifications.

2.2 Confirm that the checking tool has a specific tool number in relation to the operating programme and enter all relevant **tool data** correctly.

2.3 Save changes to the programme on the appropriate media according to company procedures.

RANGE STATEMENT

All range statements must be assessed:

1. **Quality Standards:**

    - Dimensional tolerance equivalent to BS4500 or BS1916 Grade 7
    - Surface finish 63µin or 1.6µm
    - Reamed and bored holes within H8
    - Angles within +/- 0.5 degree
    - Screw threads BS medium fit

2. **Machines:**

    - CNC three axis milling machine
    - CNC five axis milling machine
    - CNC machining centre

3. **Workholding methods and devices:**

    - Machine vices
    - Pneumatic or magnetic table
    - Ancillary indexing devices
    - Fixtures
    - Direct clamping to machine table
    - Angle plate
    - Chucks

4. **Cutting tools:**

    - Drills (face, twist/core, end, slots)
    - Reamers
    - Special profile cutters
    - End mills
    - Boring tools

5. **Machine component specifications:**

    - Faces (flat, parallel, angular, square to each other)
    - Holes (on pitch circle, linear, pitched, tapped)
    - Slots (enclosed, recesses, open ended)
    - Profiles (external, internal, circular and curved)
    - Steps and shoulders
    - Special forms (such as concave, convex)

6. **Report:**

    - Verbally
    - In writing

7. **Positions:**

    - Tool posts
    - Turrets
    - Magazines
    - Carousels

8. **Tool data:**

    - Tool lengths
    - Tool offsets
    - Radius compensation
    - Datum points

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the specific safety precautions to be taken when setting up workholding devices and tooling on CNC milling machines.
2. How to start and stop the machine in normal and emergency situations.
3. Why is it important to ensure that the machine is isolated from the power supply before mounting cutters and workholding devices.
4. What are the hazards associated with working on CNC milling machines and how to minimize them and reduce any risk.
5. Why is it important to wear the appropriate protective clothing and equipment.
6. Why it is important to keep the work area clean and tidy.
7. How to handle and store milling cutters safely and correctly.
8. How to extract and use information from engineering drawings and related specifications in relation to work undertaken.
9. How to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and systems of tolerancing.
10. How to read and interpret CNC drawings and extract the relevant information.
11. What is the range of workholding methods and devices used on CNC milling machines.
12. Why is it important to set the workholding device in relation to the machine axis and reference points.
13. What are the methods of setting workholding devices.
14. What are the tools and equipment that can be used to set workholding devices.
15. What is the range of cutting tools that are used on CNC milling machines and their typical applications.
16. How to use tungsten carbide, ceramic and diamond indexable tips and what are the factors that will determine their selection and use.
17. How to check that cutting tools are in a safe and serviceable condition.
18. What are various tool holding devices used.
19. What are the methods of mounting and securing cutting tools to tool holders.
20. What the advantages of using pre-set tooling.
21. How to set the tooling using setting jigs.
22. How to use tool magazines and carousels.
23. How to position and identify tools in relation to the operating programme.
24. How to place the machine into the correct operating mode.

25. How to access the programme edit facility to enter tooling data.
26. How to conduct trial runs using a single block run, dry run and feed and speed override controls.
27. What checks need to be performed before allowing the machine to operate in full programme run mode.
28. How the various types of materials used will affect the feeds and speeds.
29. How to apply cutting fluids using a range of different materials.
30. Why some materials do not require the use of cutting fluids.
31. What are the typical problems that can occur with the setting up of tooling and workholding devices.
32. How to resolve problems that can occur with setting up tooling and workholding devices.
33. What is the extent of your own responsibility to resolve problems and to whom you should report if you have problems that you cannot resolve.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates have to prove that they can carry out **all** of the elements, meeting **all** the performance criteria, range and underpinning knowledge **on more than one occasion**. This evidence must come from a real working environment.

(2) Method of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U99503 Set up CNC turning machines for production

Unit Descriptor:

This unit describes the knowledge, skills and attitudes required to set computer numerical control (CNC) turning machines for production in accordance with approved procedures and applies to mechanical engineering and industrial fields.

ELEMENT	PERFORMANCE CRITERIA
To be competent you must achieve the following:	
1. Set up CNC turning machines for production	1.1 Adhere to the specifications for machine components according to **quality standards.**
	1.2 Analyze what is to be done and how the **machine** should be set to achieve it.
	1.3 Mount and set the required **workholding devices**, workpiece and **cutting tools**.
	1.4 Set the machine tool operating parameters to achieve **machine component specifications** according to industry standards.
	1.5 Check that all safety mechanisms are in place and that equipment is set for the required operations according to manufacturer's specifications.
	1.6 Resolve problems within the limits of your authority and promptly **report** those that cannot be solved to the appropriate person according to company procedures.
	1.7 Leave the work area and machines in a safe and tidy condition on completion of the activities according to company procedures.
2. Prepare the tooling for operation	2.1 Place tools in the correct **positions** of the CNC machine according to manufacturer's specifications.

2.2 Confirm that checking tool has a specific tool number in relation to the operating programme and enter all relevant **tool data** correctly.

2.3 Save changes to the program on the appropriate media according to company procedures.

RANGE STATEMENT

All range statements must be assessed:

1. **Quality Standards:**

    - Dimensional tolerance equivalent to BS4500 or BS1916 Grade 7
    - Surface finish 63µin or 1.6µm
    - Reamed and bored holes within H8
    - Angles within +/- 0.5 degree
    - Screw threads BS medium fit

2. **Machine:**

    - CNC lathes
    - CNC machining centres

3. **Workholding methods and devices:**

    - Chucks (soft/hard jaws, collet)
    - Fixtures
    - Drive centers
    - Faceplates
    - Magnetic and pneumatic devices
    - Jigs

4. **Cutting tools:**

    - Drills (centre, twist, core, tungsten carbide/ceramic/diamond/indexable tips, maxi tipped)
    - Screw thread
    - Roughing/finishing
    - Parting off
    - Form
    - Boring
    - Profiling
    - Reamers

5. **Machine component specifications:**

    - Diameters (parallel eccentric, stepped, tapered)
    - Profiles (internal, external)
    - Undercuts (internal, external)
    - Holes (tapped, drilled bored, reamed)

- Threads (internal/external screw)
- Flat faces
- Chamfers and radii
- Parting off
- Grooves

6. Report:

- Verbally
- In writing

7. Positions:

- Tool posts
- Turrets
- Magazines
- Carousels

8. Tool data:

- Tool lengths
- Tool offsets
- Radius compensation
- Datum points

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the specific safety precautions to be taken when setting up workholding devices and tooling on CNC lathes.
2. How to start and stop the machine in normal and emergency situations.
3. Why it is important to ensure that the machine is isolated from the power supply before mounting cutting tools and workholding devices.
4. Why is it important to wear the appropriate protective clothing and equipment.
5. Why is it important to keep the work area clean and tidy.
6. What are the hazards associated with working on CNC lathes.
7. How to minimize hazards associated with working on CNC lathes.
8. How to handle and store cutting tools and verified tapes and programmes safely and correctly.
9. How to extract and use information from engineering drawings and related specifications.
10. How to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and systems of tolerancing.
11. What are the range of workholding methods and devices that are used on CNC lathes.
12. Why it is important to set the workholding device in relationship to the machine datums and reference points.
13. What are the methods of setting the workholding devices and the tools and equipment that can be used.
14. What are the range of cutting tools that are used on CNC lathes and their typical applications.
15. How to check that the cutting tools are in a condition that will determine their selection and use.
16. What are the various tool holding devices that are used.
17. What are the methods of correctly mounting and securing the cutting tools to the tool holders.
18. What are the advantages of using pre-set tooling and how to set the tooling using setting jigs and fixtures.
19. How to use tool posts, magazines and carousels.
20. How to position and identify tools in relation to the operating programme.
21. How to place the machine into the correct operating mode.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates have to prove that they can carry out **all** of the elements, meeting **all** the performance criteria, range and underpinning knowledge **on more than one occasion**. This evidence must come from a real working environment.

(2) Method of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U99603 Work in engineering

Unit Descriptor: This unit describes the skills and knowledge required to work in the engineering industry in accordance with approved industry procedures and practices.

ELEMENT	PERFORMANCE CRITERIA
To be competent you must achieve the following:	
1. Prepare for engineering activity	1.1 Clear the work area of hazards according to industry standard procedures.
	1.2 Obtain and confirm job instructions according to company procedures.
	1.3 Obtain the necessary **personal protective equipment** and check that it is in full working order.
	1.4 Obtain the tools and equipment required and check that they are in full working order according to industry standards.
	1.5 Obtain drawings, specifications and associated **documentation** as required according to company procedures.
	1.6 Confirm that storage arrangements for work completed are appropriate according to industry standards.
	1.7 Obtain authorization to carry out the work from the appropriate personnel according to company procedures.
2. Work in engineering	2.1 Maintain effective working relationships with colleagues.
	2.2 Resolve problems within the limits of your authority and promptly **report** those that cannot be resolved to the appropriate personnel.

	2.3	Recommend opportunities for improvements to working practices and procedures to supervisors.
	2.4	Review personal training and development opportunities for your job role in engineering with supervisors.
3. Complete work activity	3.1	Store tools, equipment, materials and resources in the appropriate location according to company procedures.
	3.2	Arrange for the disposal of waste materials safely according to environmental and industry procedures.
	3.3	Tidy up the work area on completion of the engineering activity according to company procedures.
	3.4	Complete all necessary documentation in a legible format on completion of the work activity according to company procedures.
	3.5	Identify any unusable tools, equipment, components or other resources and store according to manufacturer's and company requirements.

RANGE STATEMENT

All range statements must be assessed:

1. **Personal protective equipment:**

    - Safety glasses/goggles
    - Overalls
    - Hard hat cap
    - Dust masks
    - Respirator
    - Gum boots
    - Ear plugs and muffs

2. **Documentation:**

    - Instructions (job, drawing, manufacturer's)
    - Specifications (for material, finish, process, contractual, calibration)
    - Reference materials (manuals, tables, charts, guides, notes)
    - Schedules
    - Operation sheets
    - Standard/procedures (health and safety, quality control etc.)
    - Service bulletins/test information

3. **Report:**

    - Verbally
    - In writing

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the safe working practices and procedures to be followed while preparing your work environment.
2. What are the safe working practices and procedures to be following while tidying up your work environment.
3. How to select and correctly use personal protective equipment.
4. What is the procedure for ensuring that all documentation relating to work being carried out is available and current prior to starting the activity.
5. What action should be taken if documentation received is incomplete and incorrect.
6. What is the procedure for ensuring all tools and equipment are available prior to undertaking the activity.
7. What are the checks to be carried out to ensure tools and equipment are in full working order prior to undertaking the activity.
8. What action should be taken if tools and equipment are not in full working order.
9. What checks are to be carried out to ensure all materials and resources required are correct and complete prior to undertaking the activity.
10. What action should be taken if materials/resources do not meet the requirements of the activity.
11. Who should be informed when the work activity has been completed.
12. What information and documentation are required to confirm with others that the activity has been completed.
13. What materials, resources, equipment and tools can be re-used.
14. What are the procedures to store, transfer and dispose waste materials and products.
15. Where tools and equipment are to be stored and located.
16. What is the importance of making recommendations to improving working practices.
17. What are the procedures and format for recommending improvements.
18. What are the benefits to you and the company if improvements are identified and implemented.
19. What is the importance of maintaining effective working relationships within the workplace.
20. What are the procedures to deal with and report problems that can affect working relationships.
21. What difficulties can occur in working relationships and how to resolve them.
22. What are the regulations that affect how you should be treated at work.
23. What are the benefits of continuous personal development.
24. What training opportunities are available in the workplace.
25. What is the importance of reviewing your training and development and with whom you should discuss training and development issues.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates have to prove that they can carry out **all** of the elements, meeting **all** the performance criteria, range and underpinning knowledge **on more than one occasion**. This evidence must come from a real working environment.

(2) Method of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U99703 Use and interpret engineering data and documentation

Unit Descriptor: This unit describes the skills, knowledge and attitudes required to interpret and use technical information extracted from engineering documentation in accordance with approved procedures.

ELEMENT	PERFORMANCE CRITERIA
To be competent you must achieve the following:	
1. Use engineering data and documentation	1.1 Use approved **information sources** to obtain engineering **data** and **documentation** according to company procedures.
	1.2 Check the currency and validity of the data and documentation used.
	1.3 Extract the necessary data and documentation to carry out required tasks according to work specifications.
	1.4 Resolve problems within the limits of your authority and report those that you cannot resolve to the appropriate persons.
	1.5 Use the information obtained to meet work specifications.
	1.6 Complete the required documentation on completion of the work activity according to company procedures.
	1.76 Return documentation to the approved location on completion of the work activity according to company procedures.
2 Interpret engineering data and documentation	2.1 Interpret data and documentation accurately according to work specifications.
	2.2 **Report** inaccuracies and discrepancies in data and documentation promptly according to company procedures.

2.3 Source additional information promptly where there are gaps or deficiencies in the information obtained.

RANGE STATEMENT

All range statements must be assessed:

1. **Information sources:**

    - Instructions (job, drawing, manufacturer's, company specific, technical)
    - Specifications (for material, finish, process, contractual, calibration)
    - Reference materials (manual, tables, charts, guides, notes)
    - Documentation (planning, quality control)
    - Standards/procedures (occupational health and safety, company, national and international)

2. **Data:**

    - Required materials and components
    - Specifications (tolerances, dimensions, build quality, timescales, installation requirements, finishes etc.)
    - Operations (dismantling and assembly, inspection and testing, repair and servicing, process etc.)
    - Financial information
    - Operating parameters (health and safety)
    - Customer requirements
    - Installation requirements

3. **Documentation:**

    - Drawings (component, assembly, modification, repair, welding and fabrication, distribution and installation)
    - Diagrams (schematic, fluid power, piping, wiring and circuit, operational)
    - Manufacturer's specifications
    - Photographic and visual display information
    - Technical sale and marketing
    - Contractual

4. **Report:**

    - Verbally
    - In writing

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the available information sources for the data and documentation used in engineering work activities.
2. What are the different types of documentation used, how to obtain them and how they interrelate.
3. How to check that documents are current and valid.
4. What are the basic principles of confidentiality and what are the company requirements for confidentiality relating to data and documentation.
5. What information should be available and to whom.
6. What are the different ways and formats that data and documentation can be presented.
7. How to use other sources of information to support data.
8. How to perform according to safety responsibilities and duties.
9. Why it is important to differentiate fact from opinion when reviewing data and documentation.
10. Why it is important to analyze all available data and documentation before making decisions.
11. What are the different ways of storing and organizing data and documentation to ensure easy access.
12. What are the procedures for reporting discrepancies in the data or documentation.
13. What are the procedures for reporting lost or damaged documents.
14. What it is important to keep data and documentation up to date during the work activity.
15. What are the care and control procedures for documents.
16. How damage or graffiti on documents can lead to errors in work produced.
17. Why it is important to return documents to the designated location on completion of the work activities.
18. What are the basic drawing conventions used.
19. What are the different types of drawings that are required.
20. What are the imperial and metric systems of measurement.
21. What are tolerance and referencing points.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates have to prove that they can carry out **all** of the elements, meeting **all** the performance criteria, range and underpinning knowledge **on more than one occasion**. This evidence must come from a real working environment.

(2) Method of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

- Observation
- Written/oral questioning
- Written evidence
- Witness testimony
- Professional discussion

Questioning techniques should not require language, literacy or numeracy skills beyond those required in this unit of competency.

(3) Context of Assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by a candidate working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

U99803 Follow principles of occupational health and safety (OH&S) in engineering

Unit Descriptor:

This unit describes the skills, knowledge and attitudes required to effectively perform work activities while following occupational health and safety requirements, and applies to all individuals working in the metal, engineering and maintenance industry.

ELEMENT	PERFORMANCE CRITERIA
To be competent you must achieve the following:	
1. Follow safe work practices	1.1 Work in accordance with company policy and procedures and industry requirements.
	1.2 Carry out housekeeping duties in accordance with company procedures.
	1.3 Adhere to occupational safety and health while carrying out day to day activities.
	1.4 Identify and follow safety signs and symbols according to company and industry requirements.
	1.5 Select and use **personal protective equipment** correctly according to occupational safety and health requirements, industry and company procedures.
	1.6 Operate **equipment** and safety devices according to legislative requirements, industry and company procedures and instructions.
	1.6 Perform manual handling in accordance with occupational safety and health requirements and company procedures.
2. Identify workplace hazards and risks	2.1 Identify **hazards and risks** within the work environment according to company and industry requirements.

	2.2	Deal with identified **hazards and risks** within the limits of your authority in accordance with company procedures.
	2.3	**Report hazards and risks** that cannot be dealt with within your authority to the appropriate persons in accordance with company procedures.
3. Follow emergency procedures	3.1	Identify and confirm the appropriate persons to be contacted in the event of an **emergency.**
	3.2	Identify and confirm the procedures to be followed in the event of an **emergency**.
	3.4	Follow company and occupational safety and health procedures and correctly carry out activities in the event of an **emergency.**
	3.5	Complete the required documentation and **report emergency** to the appropriate person according to company and occupational safety and health procedures.

RANGE STATEMENT

All range statements must be assessed:

1. Personal Protective Equipment:

- Safety glasses/goggles
- Overalls
- Hard hat/cap
- Safety boots/shoes
- Dust masks/respirator
- Ear plugs and muffs

2. Equipment:

- Electrical
- Mechanical
- Hydraulic
- Pneumatic
- Emergency

3. Report:

- Verbally
- In writing
- Electronically

4. Emergency procedures :

- Fire fighting
- Accident
- Evacuation

UNDERPINNING KNOWLEDGE AND SKILLS

You need to know and understand:

1. What are the company policies, procedures and industry requirements pertaining to the work environment.
2. What are housekeeping requirements.
3. How to adhere to occupational safety and health and company requirements in day to day activities.

   How to identify signs and symbols and what they mean.
4. What are the different types of personal protective equipment and how to select and use it according to company and occupational safety and health requirements.
5. How to operate equipment and safety devices according to legislative requirements and company procedures.
6. What is manual handling and how to perform it according to occupational safety and health and company procedures.
7. What are the hazards and risks in the workplace and how to identify them.

   What are the limits of your authority in dealing with hazards and risks.
8. Who are the persons to whom you should report hazards and risks, particularly those that cannot be dealt with within the limits of your authority.
9. Who are the persons to be contacted in the event of an emergency.
10. What are the procedures to be followed in the event of an emergency.
11. What documentation is to be completed in the event of an emergency and how to do so.

EVIDENCE GUIDE

For assessment purposes:

(1) Critical Aspects of Evidence

Candidates have to prove that they can carry out **all** of the elements, meeting **all** the performance criteria, range and underpinning knowledge **on more than one occasion**. This evidence must come from a real working environment.

(2) Method of Assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic.

Evidence may be collected in a variety of ways including:

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(3) Context of Assessment

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The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

Simulation **should not be used**, except in exceptional circumstances where natural work evidence is unlikely to occur.

Level 3 Glossary of Terms

Assessment methods

The methods which can be used to determine competence in performance and underpinning knowledge.

Assessors

The Assessor guides and assesses the candidate. His/her role is to determine whether evidence presented by a candidate for assessment within the programme, meets the required standard of competence in the relevant unit or element. The Assessor needs to be competent to assess to national standards in the area under assessment.

Approved Centre

Organization/Centre approved by the TVET Council to offer full National Vocational Qualifications.

Case Studies

In situations where it is difficult for workplace assessment to take place, case studies can offer the candidate an opportunity to demonstrate potential competence.

A case study is a description of an actual or imaginary situation presented in some detail. The way the case study is presented will vary depending upon the qualification, but the most usual methods are written, taped or filmed.

The main advantage of a case study is the amount of evidence of underpinning knowledge they can generate and the specific nature of the evidence produced.

Competence

In the context of vocational qualifications, competence means: the ability to carry out prescribed activities to nationally pre-determined standards in an occupation. The definition embraces cognitive, practical and behavioural skills, underpinning knowledge and understanding and the ability to react appropriately in contingency situations.

Elements

An element is a description of an activity which a person should be able to do. It is a description of an action, behaviour or outcome which a person should be able to demonstrate.

Explanation of NVQ Levels

NVQs cover five (5) levels of competence, from entry level staff at Level 1 through to senior management at Level 5.

Level 1 - Entry Level

Recognizes competence in a range of varied work activities performed in a variety of contexts. Most work activities are simple and routine. Collaboration with others through work groups or teams may often be a requirement. Substantial supervision is required especially during the early months evolving into more autonomy with time.

Level 3 Glossary of Terms

Level 2 - Skilled Occupations

Recognizes competence in a broad range of diverse work activities performed in a variety of contexts. Some of these may be complex and non-routine and involve some responsibility and autonomy. Collaboration with others through work groups or teams and guidance of others may be required.

Level 3 - Technician and Supervisory Occupations

Recognizes competence in a broad range of complex, technical or professional work activities performed in a wide variety of contexts, with a substantial degree of personal responsibility and autonomy. Responsibility for the work of others and the allocation of resources are often a requirement. The individual is capable of self-directed application, exhibits problem solving, planning, designing and supervisory capabilities.

Level 4 - Technical Specialist and Middle Management Occupations

Recognizes competence involving the application of a range of fundamental principles and complex techniques across a wide and unpredictable variety of contexts. Requires very substantial personal autonomy and often significant responsibility for the work of others, the allocation of resources, as well as personal accountability for analysis, diagnosis, design, planning, execution and evaluation.

Level 5 - Chartered, Professional and Senior Management Occupations

Recognizes the ability to exercise personal professional responsibility for the design, development or improvement of a product, process, system or service. Recognizes technical and management competencies at the highest level and includes those who have occupied positions of the highest responsibility and made outstanding contribution to the promotion and practice of their occupation.

External Verifier

The External Verifier is trained and appointed by the TVET Council and is competent to approve and ensure an approved Centre's quality of provision.

Internal Verifier

The Internal Verifier acts in a supporting role for Assessors to ensure consistent quality of assessment and competence. They need to be competent to assess to national standards in the area under assessment.

NVQ

National Vocational Qualifications (NVQs) are work-based qualifications that assess an individual's competence in a work situation and certify that the individual can perform the work role to the standards expected in employment.

NVQs are based on national occupational standards of competence drawn up by standards-setting bodies known as Industry Lead Bodies. The standards describe the level and breadth of performance that is expected of persons working in the industry or sector which the NVQ covers.

NVQ Coordinator

The NVQ Coordinator is the centre contact within each approved Centre offering NVQs. He/she has overall responsibility for the operation and administration of the NVQ system.

Level 3 Glossary of Terms

Observation

Observation of the candidate carrying out his/her job in the workplace is the assessment method recommended in the vast majority of units and elements. Observation of staff carrying out their duties is something that most supervisors and managers do every day.

Performance Criteria

Performance criteria indicate what is required for the successful achievement of an element. They are descriptions of what you would expect to see in competent performance.

Product of Work

This could be items produced during the normal course of work, which can be used for evidence purposes such as reports, menus, promotional literature, training plans, etc.

Questioning

Questioning is one of the most appropriate ways to collect evidence to assess a candidate's underpinning knowledge and understanding.

Questioning can also be used to assess a candidate in those areas of work listed in the range which cannot be assessed by observation. Guidance on when this assessment method can be used is given in the assessment guidance of each individual element.

As an assessment method, questioning ensures you have all of the evidence about a candidate's performance. It also allows you to clarify situations.

Range statements

The range puts the element of competence into context. A range statement is a description of the range of situations to which an element and its performance criteria is intended to apply.

Range statements are prescriptive therefore each category must be assessed.

Role-plays

Role-plays are simulations where the candidate is asked to act out a situation in the way he/she considers "real" people would behave. By using role-play situations to assess a candidate you are able to collect evidence and make a judgment about how the candidate is most likely to perform. This may be necessary if the range specified includes a situation in which the candidate is unlikely to find himself/herself in the normal course of their work, or where the candidate needs to develop competence, before being judged competently, for example, in a disciplinary situation,

Level 3 Glossary of Terms

Simulations

Where possible, assessment should always be carried out by observing **natural performance** in the workplace. **Simulated performance,** however, can be used where specified to collect evidence about an aspect of the candidate's work which occurs infrequently or is potentially hazardous; for example, dealing with fires.

By designing the simulated situation, briefing the candidate and observing his/her performance, you will be able to elicit evidence which will help you judge how a candidate is **most likely** to perform in real life.

Supplementary evidence

Supplementary evidence can be used to confirm and support performance evidence. Types of supplementary evidence include witness testimonies, reports, journals or diaries, records of activities, personal statements, simulation (see note in glossary).

Underpinning knowledge

Underpinning knowledge indicates what knowledge is essential for a person to possess in order to successfully achieve an element and prove total competence.

Units

A unit of competence describes one or more activities which form a significant part of an individual's work. Units are accredited separately but in combination can make up a vocational qualification. There are three categories of units:

Mandatory units - are core to a qualification and must to be completed.

Optional units - candidates must choose the required number of individual units, specified in the qualification structure, to achieve the qualification.

Work-based projects

Work-based projects are a useful way for you to collect evidence to support any decision you make about a candidate's performance. They are particularly appropriate in determining the level of a candidate's underpinning knowledge and understanding where it may be insufficient to rely only on questioning observation.

A project often involves the identification of a solution to a specific problem identified by you and/or the candidate (such as looking at ways to redress a recent drop in sales), or may be a structured programme of work built around a central situation or idea (such as the introduction of a new job rostering process).