

## Qualification Pack



# CNC Operator - Vertical Machining Centre

QP Code: CSC/Q0116

Version: 2.0

NSQF Level: 4

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## Qualification Pack

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## Qualification Pack

### CSC/Q0116: CNC Operator - Vertical Machining Centre

#### Brief Job Description

A CNC Operator - Vertical Machining Centre is responsible for setting up Vertical Machining Centre (VMC), cutting tools and work holding devices for machining a variety of metal and non-metal components as per the given specifications. The individual conducts trial runs, proves the program in single block mode, and performs the necessary checks before allowing the machine to operate in full program run mode.

#### Personal Attributes

The individual must be physically fit to work for long durations with concentration. The person must have the computational and numerical ability, along with problem-solving and coordination skills. The individual must have basic skills in oral and written communication.

#### Applicable National Occupational Standards (NOS)

##### Compulsory NOS:

1. [CSC/N1335: Follow the health and safety practices at work](#)
2. [CSC/N1336: Coordinate with co-workers to achieve work efficiency](#)
3. [CSC/N0123: Set the CNC VMC for operations](#)
4. [CSC/N0116: Carry out machining using the CNC VMC](#)

#### Qualification Pack (QP) Parameters

Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Machining
Country	India
NSQF Level	4

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Aligned to NCO/ISCO/ISIC Code	NCO-2015/7223.40
Minimum Educational Qualification & Experience	<p>8th Class Pass + ITI (2years) with 2 years of experience in the relevant field</p> <p>OR</p> <p>10th Class Pass with 2 years of experience in the relevant field</p> <p>OR</p> <p>10th Class Pass + ITI (1 year) with 1 year of experience in the relevant field</p> <p>OR</p> <p>10th Class Pass + ITI (2 years)</p> <p>OR</p> <p>12th Class Pass with 6 months of experience in the relevant field</p> <p>OR</p> <p>Certified in NSQF-L3 Operator - Calibration and Instrumentation with 2 years of experience in the relevant field</p>
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	
Next Review Date	
Deactivation Date	
NSQC Approval Date	
Version	2.0
Reference code on NQR	2015/CCM/GCSC/00006
NQR Version	1.0

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### CSC/N1335: Follow the health and safety practices at work

#### Description

This OS unit is about following the appropriate health and safety practices at work. It covers responsibilities towards self and others to ensure a safe work environment.

#### Scope

This unit/task covers the following:

- Maintain personal health and safety
- Assist in hazard management
- Check the first aid box, firefighting and safety equipment
- Assist in waste management
- Follow the fire safety guidelines
- Follow the emergency and first-aid procedures
- Carry out relevant documentation and review

#### Elements and Performance Criteria

##### *Maintain personal health and safety*

To be competent, the user/individual on the job must be able to:

- PC1.** follow the recommended practices to ensure protection from infections and transmission to others, such as the use of hand sanitiser and face mask
- PC2.** check the work conditions, assess the potential health and safety risks, and take appropriate measures to mitigate them
- PC3.** select and use the appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions
- PC4.** follow the recommended techniques while lifting and moving heavy objects to avoid injury
- PC5.** follow the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment

##### *Assist in hazard management*

To be competent, the user/individual on the job must be able to:

- PC6.** identify existing and potential hazards at work
- PC7.** assess the potential risks and injuries associated with the identified hazards
- PC8.** coordinate with the supervisor or other relevant personnel to prevent or minimise the identified hazards
- PC9.** handle hazardous materials safely and store them in the designated storage

##### *Check the first aid box, firefighting and safety equipment*

To be competent, the user/individual on the job must be able to:

- PC10.** check the first aid box to ensure it is updated with the relevant first aid supplies
- PC11.** check and test the firefighting and various safety equipment to ensure they are in usable condition
- PC12.** coordinate with the supervisor for the repair and replacement of firefighting and safety equipment

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### *Assist in waste management*

To be competent, the user/individual on the job must be able to:

- PC13.** segregate waste into appropriate categories
- PC14.** recycle the recyclable waste appropriately
- PC15.** dispose of the non-recyclable waste in an environment-friendly manner, complying with the applicable regulations

### *Follow the fire safety guidelines*

To be competent, the user/individual on the job must be able to:

- PC16.** use the appropriate type of fire extinguisher to extinguish different types of fires safely
- PC17.** follow the recommended practices for a safe rescue during a fire emergency
- PC18.** coordinate with the fire department to request assistance to extinguish a serious fire

### *Follow the emergency and first-aid procedures*

To be competent, the user/individual on the job must be able to:

- PC19.** follow the organisational health and safety guidelines during workplace emergencies to ensure own and co-workers' safety
- PC20.** follow the recommended practices to minimise loss to organisational property during an emergency
- PC21.** follow the recommended procedure to free a person from electrocution
- PC22.** administer appropriate first aid to the injured personnel
- PC23.** perform Cardiopulmonary Resuscitation (CPR) on a potential victim of cardiac arrest
- PC24.** coordinate with the emergency services to request medical assistance for seriously injured/ill personnel requiring professional medical attention or hospitalisation

### *Carry out relevant documentation and review*

To be competent, the user/individual on the job must be able to:

- PC25.** carry out appropriate documentation following a health and safety incident at work, including all the required information
- PC26.** coordinate with the relevant personnel to review health and safety conditions at work regularly or following an incident
- PC27.** assist in implementing appropriate changes to improve the health and safety conditions at work

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1.** the recommended practices to be followed to ensure protection from infections and transmission to others, such as the use of hand sanitiser and face mask
- KU2.** the importance and process of checking the work conditions, assessing the potential health and safety risks, and taking appropriate measures to mitigate them
- KU3.** the importance and process of selecting and using the appropriate PPE relevant to the task and work conditions
- KU4.** the recommended techniques to be followed while lifting and moving heavy objects to avoid injury
- KU5.** the importance of following the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment
- KU6.** the importance and process of identifying existing and potential hazards at work
- KU7.** the process of assessing the potential risks and injuries associated with the various hazards

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- KU8.** how to prevent or minimise different types of hazards
- KU9.** how to handle and store hazardous materials safely
- KU10.** the importance of ensuring the first aid box is updated with the relevant first aid supplies
- KU11.** the process of checking and testing the firefighting and various safety equipment to ensure they are in a usable condition
- KU12.** the criteria for segregating waste into appropriate categories
- KU13.** the appropriate methods for recycling the recyclable waste
- KU14.** the process of disposing of the non-recyclable waste safely and the applicable regulations
- KU15.** use of different types of fire extinguishers to extinguish different types of fires
- KU16.** the recommended practices to be followed for a safe rescue during a fire emergency
- KU17.** how to request assistance from the fire department to extinguish a serious fire
- KU18.** the appropriate practices to be followed during workplace emergencies to ensure safety and minimise loss to organisational property
- KU19.** common health and safety hazards present in a work environment, associated risks, and how to mitigate them
- KU20.** safe working practices to be followed while working at various hazardous sites and using electrical equipment
- KU21.** the importance of ensuring easy access to firefighting and safety equipment
- KU22.** the appropriate preventative and remedial actions to be taken in the case of exposure to toxic materials, such as poisonous chemicals and gases
- KU23.** various causes of fire in different work environments and the recommended precautions to be taken to prevent fire accidents
- KU24.** different methods of extinguishing fire
- KU25.** different materials used for extinguishing fire, such as sand, water, foam, CO<sub>2</sub>, dry powder, etc.
- KU26.** the applicable rescue techniques to be followed during a fire emergency
- KU27.** the importance of placing safety signs and instructions at strategic locations in a workplace and following them
- KU28.** different types of first aid treatment to be provided for different types of injuries
- KU29.** potential injuries associated with incorrect manual handling
- KU30.** how to move an injured person safely
- KU31.** various hazards associated with the use of various machinery, tools, implements, equipment and materials
- KU32.** the importance of ensuring no obstruction and free access to fire exits
- KU33.** how to free a person from electrocution safely
- KU34.** how to administer appropriate first aid to an injured person
- KU35.** how to perform Cardiopulmonary Resuscitation (CPR)
- KU36.** the importance of coordinating with the emergency services to request urgent medical assistance for persons requiring professional medical attention or hospitalisation
- KU37.** the appropriate documentation to be carried out following a health and safety incident at work, and the relevant information to be included
- KU38.** the importance and process of reviewing the health and safety conditions at work regularly or following an incident
- KU39.** the importance and process of implementing appropriate changes to improve the health and safety conditions at work

### Generic Skills (GS)

User/individual on the job needs to know how to:



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- GS1. maintain work-related notes and records
- GS2. communicate clearly and politely with co-workers and clients
- GS3. read the relevant literature to get the latest updates about the field of work
- GS4. listen attentively to understand the information being shared
- GS5. plan and prioritise tasks to ensure timely completion
- GS6. take quick decisions to deal with workplace emergencies and accidents
- GS7. identify possible disruptions to work and take appropriate preventive measures
- GS8. coordinate with the co-workers to achieve the work objectives
- GS9. evaluate all possible solutions to a problem to select the best one

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### National Occupational Standards (NOS) Parameters

NOS Code	CSC/N1335
NOS Name	Follow the health and safety practices at the work
Sector	Capital Goods
Sub-Sector	Machine Tools, Process Plant Machinery, Dies, Moulds and Press Tools, Electrical and Power Machinery, Plastics Manufacturing Machinery, Light Engineering Goods, Textile Manufacturing Machinery
Occupation	Machining
NSQF Level	3
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
Deactivation Date	
NSQC Clearance Date	

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### CSC/N1336: Coordinate with co-workers to achieve work efficiency

#### Description

This OS unit is about working in coordination with co-workers to achieve the work objectives efficiently. It also covers practising inclusion at work.

#### Scope

This unit/task covers the following:

- Work effectively with co-workers
- Communicate effectively with co-workers
- Practice inclusion at work

#### Elements and Performance Criteria

##### *Work effectively with co-workers*

To be competent, the user/individual on the job must be able to:

- PC1.** plan daily tasks at work to ensure their timely completion and efficient use of time
- PC2.** carry out work responsibilities adhering to the limits of authority
- PC3.** follow the supervisor's instructions to ensure adherence to the applicable quality standards and timescales
- PC4.** coordinate with the co-workers to achieve the work objectives efficiently
- PC5.** prepare the relevant documents and reports as per the supervisor's instructions, providing appropriate information clearly and systematically
- PC6.** coordinate with the supervisor or relevant personnel to deal with out of authority tasks and concerns
- PC7.** mentor and assist subordinates in the execution of their work responsibilities
- PC8.** identify possible disruptions to work through coordination with the relevant stakeholders and take appropriate preventive measures
- PC9.** use various resources efficiently to ensure maximum utilisation and minimum wastage
- PC10.** follow the recommended practices to avoid and resolve conflicts at work
- PC11.** follow the relevant organisational policies to ensure disciplined behaviour with maximum productivity at work

##### *Communicate effectively with co-workers*

To be competent, the user/individual on the job must be able to:

- PC12.** follow the organisational policy for the efficient and timely dissemination of information to the authorised personnel
- PC13.** communicate clearly and politely to ensure effective communication with co-workers
- PC14.** follow the appropriate techniques for active listening during interactions

##### *Practice inclusion at work*

To be competent, the user/individual on the job must be able to:

- PC15.** empathise with Persons with Disabilities (PwD)
- PC16.** adopt gender-neutral behaviour at work

#### Knowledge and Understanding (KU)

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The individual on the job needs to know and understand:

- KU1.** the importance and process of effective communication in the workplace
- KU2.** the barriers to effective communication and how to overcome them
- KU3.** the importance of teamwork in an organisation's and individual's success
- KU4.** the importance of active listening in the work environment
- KU5.** the appropriate techniques to be followed for active listening
- KU6.** importance of tone and pitch in effective communication
- KU7.** importance of avoiding casual expletives and unpleasant terms while communicating professional circles
- KU8.** the importance of maintaining discipline and ethical behaviour at work
- KU9.** the common reasons for interpersonal conflict and how to resolve them
- KU10.** the importance of developing effective working relationships for professional success
- KU11.** how expressing and addressing grievances appropriately and effectively
- KU12.** the importance and process of planning daily tasks to ensure their timely completion and efficient use of time
- KU13.** the importance of adhering to the limits of authority at work
- KU14.** the importance of following the applicable quality standards and timescales at work
- KU15.** the importance of coordinating with the co-workers to achieve the work objectives efficiently
- KU16.** the relevant documentation requirements
- KU17.** the importance of providing appropriate information clearly and systematically in work documents
- KU18.** the escalation matrix to be followed to deal with out of authority tasks and concerns
- KU19.** the importance and process of mentoring and assisting subordinates in the execution of their work responsibilities
- KU20.** how to identify possible disruptions to work prevent them
- KU21.** how to use various resources efficiently to ensure maximum utilisation and minimum wastage
- KU22.** the recommended practices to be followed at work to avoid and resolve conflicts at work
- KU23.** the importance and process of efficient and timely dissemination of information to the authorised personnel
- KU24.** how to communicate clearly and politely to ensure effective communication
- KU25.** the importance of following the recommended practices to ensure an inclusive environment for PwD and all genders at work

## Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** maintain work-related notes and records
- GS2.** read work-related and other relevant literature
- GS3.** communicate politely and -professionally
- GS4.** listen attentively to understand the information or instructions being shared
- GS5.** plan and prioritise tasks to ensure timely completion
- GS6.** take prompt decisions to deal with workplace emergencies and accidents
- GS7.** evaluate all possible solutions to a problem to select the best one

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### National Occupational Standards (NOS) Parameters

NOS Code	CSC/N1336
NOS Name	Coordinate with co-workers to achieve work efficiency
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Machining
NSQF Level	3
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
Deactivation Date	
NSQC Clearance Date	

## Qualification Pack

# CSC/N0123: Set the CNC VMC for operations

## Description

This OS unit is about setting up CNC VMC for carrying out machining operations on a variety of components as per the given specifications.

## Scope

This unit/ task covers the following:

- Prepare for setting the CNC VMC machine
- Set the CNC VMC machine

## Elements and Performance Criteria

### *Prepare for setting the CNC VMC machine*

To be competent, the user/individual on the job must be able to:

- PC1.** determine how the CNC VMC machine needs to be set up by referring to the appropriate sources of job specification documents such as approved engineering drawings, component drawings and sketches, process specifications, quality control documents, etc.
- PC2.** prepare the work area for setting the CNC VMC machine according to the as given specifications and applicable procedure
- PC3.** clean the CNC VMC machine using the recommended cleaning agent and accessories
- PC4.** check the coolant and lubricant have the recommended levels, and replenish them, as required
- PC5.** check the machine sub-systems to ensure they their functioning as expected
- PC6.** set the zero referencing return position on the machine
- PC7.** check the readiness of components and cutters
- PC8.** check the availability of appropriate cutting, measuring and hand tools as per the job requirements
- PC9.** check that all the measuring equipment are calibrated and approved for usage
- PC10.** identify tool requirements from tooling layout and assess their suitability for producing various features and profiles
- PC11.** select the suitable work holding or fixturing device as per the job requirement
- PC12.** ensure the tools and fixtures are free from breakage and damage and calibrated appropriately
- PC13.** check the correct and latest part-program is uploaded onto the CNC system
- PC14.** pre-set the tooling using setting jigs/fixtures

### *Set the CNC VMC machine*

To be competent, the user/individual on the job must be able to:

- PC15.** mount and set the required work-holding devices, work-piece and cutting tools
- PC16.** align the work-holding device appropriately
- PC17.** position cutters according to the workpiece, tool presetter, and cutter Revolutions Per Minute (RPM); check the machine guards and safety switches/devices/ mechanisms are installed and working appropriately
- PC18.** set the recommended linear/table feed rate, cutting fluid flow rate, depth of cut for roughing

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and finishing

- PC19. check that the tools have the recommended tool number in relation to the operating program
- PC20. enter all the relevant tool data in the operating program on the CNC VMC
- PC21. set tool datum, position, length, offset and radius compensation
- PC22. mount the work holding device/fixture onto the machine
- PC23. set the work holding device/fixture in relation to the machine datum and reference points
- PC24. set the machine tool operating parameters such as hydraulic pressure and clamping according to the component requirements
- PC25. set the machine in the correct operating mode, and enter the tooling data by accessing the program edit facility
- PC26. conduct trial runs using the single block run, dry run, feed and speed override controls
- PC27. prove the program tool in the single block mode
- PC28. measure and correct the dimensions of the first component before allowing the machine to operate in full program run mode
- PC29. record the dimensions of the first component as per the organizational procedure
- PC30. check for safe electrical power supply and insulation of power cables
- PC31. check interlocking, and security of pipes and couplings
- PC32. check the oil level, temperature and pressure are as recommended
- PC33. carry out relevant documentation as per organisational procedure
- PC34. coordinate with an expert to resolve any complex issues encountered while setting up the CNC VMC machine

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1. the importance of carrying appropriate documentation in the job role
- KU2. applicable CNC machining procedures, environmental regulations and safe working practices
- KU3. hazards associated with setting and machining operations on a CNC VMC and how to minimize them
- KU4. use of the relevant Personal Protective Equipment (PPE) during the setting and machining activities on a CNC VMC
- KU5. the appropriate sources to get the job specifications, such as job or worksheet/card; work drawings and instructions; planning documentation; quality control documents; operation sheets; process specifications; instructions from supervisor, etc.
- KU6. the uses of different types of VMCs
- KU7. the common terminology associated with VMCs
- KU8. the features, working parts and accessories of VMC machines
- KU9. how to read and interpret first and third angle component drawings
- KU10. how to extract information from engineering drawings or data and related specifications
- KU11. different operating systems in CNC machine tools, such as open-loop and closed-loop systems, control systems, etc.
- KU12. types and function of position rotary type transducers and their digital control
- KU13. the importance of following the recommended machining sequences and procedures
- KU14. the importance of ensuring workpieces/materials and consumables are suitable for the specified job and related procedures
- KU15. various characteristics considered for the selection of materials for engineering applications, such as magnetism, machining ability, physical properties of materials on processing techniques
- KU16. the importance and procedures to be followed to ensure that tools and equipment are in a

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safe and usable condition

- KU17.** different methods and equipment used for carrying out various VMC machining operations
- KU18.** different work holding methods and devices used with a VMC
- KU19.** the methods of setting work holding devices, and the use of relevant tools and equipment
- KU20.** the use of a range of cutting tools during VMC machining operations, such as mills, drills, boring tools, reamers, etc.
- KU21.** various materials used to make cutting tools such as High Carbon Steel (HCS), High-Speed Steel (HSS) tungsten carbide, carbide, etc.
- KU22.** use of various tool holding devices
- KU23.** the methods of mounting and securing the cutting tools to the tool holders appropriately
- KU24.** the basic principles of operation of the various VMCs, and various operations that they can perform
- KU25.** how to handle and store VMC cutters safely
- KU26.** how to extract and use information from engineering drawings and related specifications in relation to the work to be undertaken
- KU27.** the British and metric(SI) systems of measurement
- KU28.** workpiece reference points and the system of tolerancing
- KU29.** the factors that determine the selection and use of indexable tips, such as hardness and cutting characteristics of the material; tolerances, component surface finish and specifications to be achieved
- KU30.** various factors that determine the speed and feed to be used during machining
- KU31.** the importance of following the correct procedures according to form of supply/ shape of raw materials
- KU32.** the impact of non-metals, ferrous and non-ferrous metals on the feed and speed during machining
- KU33.** the appropriate precautions to be taken while handling and using different types of cutting fluids during machining
- KU34.** the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures
- KU35.** use of tool posts, magazines and carousels, and how to position and identify the tool in relation to the operating program
- KU36.** the importance of carrying out machining according to the hardness of the material
- KU37.** different kinds of inserts for using higher parameters for faster machining
- KU38.** the need for clamping the workpiece to avoid distortion
- KU39.** different types of error messages displayed by a CNC VMC and how to deal with them
- KU40.** the importance and process of proving the program and the CNC VMC machine
- KU41.** the applicable inspection checks and quality control procedures, and the use of relevant equipment in the process
- KU42.** the basic maintenance needs of a CNC VMC machine and how to carry out the maintenance
- KU43.** the importance of reporting work-related problems to the relevant authority promptly

## Generic Skills (GS)

User/individual on the job needs to know how to:

- GS8.** maintain work-related notes and records
- GS9.** read work-related and other relevant literature
- GS10.** communicate politely and -professionally
- GS11.** listen attentively to understand the information or instructions being shared
- GS12.** plan and prioritise tasks to ensure timely completion
- GS13.** take prompt decisions to deal with workplace emergencies and accidents
- GS14.** evaluate all possible solutions to a problem to select the best one

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### National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0123
NOS Name	Set the CNC VMC for operations
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Machining
NSQF Level	5
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
Deactivation Date	
NSQC Clearance Date	

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### CSC/N0116: Carry out machining using the CNC VMC

#### Description

This OS unit is about carrying out machining on CNC Vertical Machining Centre (VMC) on a variety of workpieces.

#### Scope

This unit/task covers the following:

- Prepare for machining activities on VMC
- Perform machining operations
- Use resources optimally

#### Elements and Performance Criteria

##### *Prepare for machining activities on VMC*

To be competent, the user/individual on the job must be able to:

- PC1.** determine the job specification by referring to job instruction sheet/job card; work drawings and instructions; planning documentation; quality control documents; instructions from supervisor, etc.
- PC2.** analyse the component drawings and approved sketches/ illustrations/ reference charts/ tables/ graphs/ machining/ assembly drawings to determine the machining requirements
- PC3.** identify the incorrect and inconsistent information in the job specification documents
- PC4.** coordinate with the relevant personnel for the rectification of incorrect and inconsistent information in the job specification documents, following the organizational procedure
- PC5.** identify the type of raw materials or components required for the job, including the quality and quantity requirements
- PC6.** select the appropriate raw materials/ components/ workpieces with the recommended limits and tolerances, and surface texture requirements
- PC7.** check the raw material or components to be used to ensure they are free from foreign objects, dirt or other contamination
- PC8.** plan the activities to be performed in a logical sequence
- PC9.** select the required tools and check them to ensure they are not worn out or damaged
- PC10.** extract the relevant information such as tapping sizes and threads; feeds and speeds; component ratings; machining symbols and tolerances from reference charts, tables, graphs
- PC11.** prepare the work area for the machining operations as per the operational specification and applicable procedures
- PC12.** conduct the preliminary check of the readiness of the vertical machining centre
- PC13.** select the appropriate cutting, measuring tools and hand tools as per the job requirements
- PC14.** ensure all the measuring equipment are calibrated and approved for usage
- PC15.** set the workpieces/ components using the appropriate positioning and/or holding devices and support mechanisms as per the job requirements
- PC16.** coordinate with the supervisor or relevant personnel to resolve any issues identified with the tools, equipment and workpieces/ components
- PC17.** check the operating program is at the correct start point and the workpiece is clear of the machine spindle

##### *Perform machining operations*

To be competent, the user/individual on the job must be able to:

- PC18.** load and unload components using the pre-determined fixtures or work holding devices/

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fixtures as per the work instructions

- PC19. carry out a trial run by taking back the tool offsets by a minimum amount, keeping margin error rectification
- PC20. measure the critical parameters of the machined component such as length, width, flatness and cylindricity without removing it from the machine
- PC21. correct the offsets based on the measurements by accessing the program edit facility and entering the appropriate tooling data, such as offsets compensation and radius compensation
- PC22. conduct multiple trial runs and subsequent adjustment of offsets to ensure accuracy in the critical parameters of the machined components
- PC23. measure the component after unloading to check for accuracy in the critical parameters as per the job specifications
- PC24. produce machined components with the required features such as flat, square, parallel and angular faces, open-ended or enclosed recesses, etc.
- PC25. follow the recommended machining sequence and procedure as per the job specifications
- PC26. identify the error codes and inbuilt alarms on equipment and take appropriate action to resolve them as per operating manual/organizational guidelines
- PC27. carry out regular inspections during the machining process as per the recommended inspection frequency
- PC28. record the measured values as per the organisational procedure
- PC29. use the relevant Industry 4.0 manufacturing technologies to ensure interconnectivity, automation, machine learning, and real-time data collection and analysis
- PC30. identify inconsistencies in dimensions due to tool wear and correct the offsets accordingly
- PC31. adjust the machine settings whenever required to maintain the required accuracy
- PC32. identify the need of sharpening or replacing the tools
- PC33. sharpen or replace the worn-out/ damaged tools, using the necessary equipment and following the relevant safety guidelines
- PC34. perform the relevant maintenance checks on the machine and carry out maintenance after the machining operations
- PC35. follow the organisational procedure while handling the machined components
- PC36. ensure the machined components conform to the applicable quality standards
- PC37. store the appropriate tools and equipment after use at the designated location
- PC38. comply with the applicable turnaround time to achieve the production targets
- PC39. coordinate with the appropriate personnel to report any issues with machining operations and resolve them promptly to ensure minimum or no impact on machining operations
- PC40. carry out necessary documentation such as entries in the logbook on the completion of machining operations
- PC41. follow the applicable health and safety guidelines to maintain the work area in a safe and hygienic condition after the completion of work
- PC42. ensure compliance with the applicable national and international standards

### *Use resources optimally*

To be competent, the user/individual on the job must be able to:

- PC43. optimise the usage of electricity and other resources in various tasks and processes
- PC44. connect the electrical tools and equipment safely, and turn them off when not in use

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

- KU1. the applicable documentation requirements in the job role
- KU2. the concepts and benefits of Industry 4.0 and Industrial Internet of Things (IIoT)

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- KU3.** the safe working practices to be followed while working on a CNC VMC, such as ensuring the correct isolation of the machine before mounting work holding devices and tooling; fitting and adjusting machine guards; and ensuring that the work-piece is secure and that tooling is free from work-piece before starting the machine
- KU4.** VMC machining procedures and the relevant environmental regulations to be adhered to
- KU5.** the importance of using the relevant Personal Protective Equipment (PPE) during the CNC machining activities such as face shield with safety glasses, gloves, hard hat, steel toe boots, etc.
- KU6.** the preliminary check to be performed on the CNC machine, such as the cleanliness of the machine, referencing-zero return, recommended lubrication and coolant levels, appropriate working of sub-systems, etc.
- KU7.** various safety mechanisms on a CNC VMC machine and how to check if they are functioning properly
- KU8.** various hazards associated with carrying out the machining operations on a VMC such as revolving/moving parts of the machine; airborne and hot metal particles; sharp cutting tools, and how to minimize them
- KU9.** the importance of determining the job specification and various sources of that, such as job instruction sheet/job card, work drawings and instructions; planning documentation, quality control documents, operation sheets, process specifications, and instructions from the supervisor
- KU10.** common terminology used in VMC machining
- KU11.** how to extract information from engineering drawings, dimensioning and labelling data
- KU12.** the features, uses and applications of a CNC VMC, and relevant tools and accessories
- KU13.** the working parts of the VMC
- KU14.** how to read and interpret first and third angle component drawings
- KU15.** the importance of following the applicable machining sequences and procedures
- KU16.** the importance of ensuring the suitability of workpieces/materials and consumables for the specified job and related procedures
- KU17.** the tools and equipment used for machining operations on a VMC
- KU18.** the importance and process of checking that tools and equipment are in a safe and usable condition
- KU19.** the use of appropriate tools and equipment in various CNC machining operations
- KU20.** applicable CNC machining methods and techniques to achieve the best results
- KU21.** the relevant factors that affect feed and speed, such as type and condition of material; work holding devices and method; tooling used; tolerance to be achieved; finish to be achieved; machine working condition
- KU22.** the importance of using correct procedures according to the shape of raw material
- KU23.** various error messages encountered during CNC VMC machining and how to resolve them
- KU24.** the importance of securing the workpiece/raw material correctly and the use of appropriate devices and mechanisms for the purpose
- KU25.** the importance of setting the work holding device according to the machine axis and reference points
- KU26.** the common problems that may occur in VMC machining operations and their implications
- KU27.** the appropriate procedures to be followed to address common problems encountered during VMC machining operations
- KU28.** the importance of reporting problems accurately and promptly to the supervisor
- KU29.** the meaning and importance of quality in relation to final and intermediate job output
- KU30.** how to inspect the shaped components against the specified quality standards
- KU31.** various ferrous and non-ferrous metals used in VMC machining operations such as carbon steel, stainless steel, cast iron, tool steel, bronze, aluminium, copper, copper alloy, etc.
- KU32.** the mechanical properties of various materials and their effect on machining
- KU33.** the British and metric (SI) systems of measurement

### Qualification Pack

- KU34.** the absolute and incremental systems of tool positioning and offsetting
- KU35.** workpiece zero/reference points and system of tolerances
- KU36.** the use of tungsten carbide, ceramic and diamond indexable tips, and the factors that determine their selection and use, such as hardness and cutting characteristics of the material, tolerances to be achieved, component surface finish, and component specifications
- KU37.** the use of tool magazines and carousels
- KU38.** the importance of conducting trial runs
- KU39.** the items to be checked before allowing the machine to operate in full program run mode
- KU40.** the importance of conducting periodic maintenance checks on the CNC VMC machine
- KU41.** the common maintenance activities, such as replenishing of coolant lubrication oil; cleaning of all parts, and removing swarf i.e. turnings, filings or shavings
- KU42.** the importance of adhering to the limits of authority when dealing with problems
- KU43.** the applicable support and escalation mechanisms
- KU44.** the importance of informing the supervisor/ relevant personnel regarding the completion of operations
- KU45.** the importance of leaving the work area and machine in a safe condition on the completion of daily operations
- KU46.** the safe conditions to be ensured with respect to the CNC machine, such as correct isolation; closure of operating programs, machine cleaning, and removal of any spilt cutting fluids

### Generic Skills (GS)

User/individual on the job needs to know how to:

- GS1.** maintain work-related notes and records
- GS2.** read the relevant literature to get the latest updates about the field of work
- GS3.** communicate politely and professionally
- GS4.** listen attentively to understand the information being shared
- GS5.** plan and schedule tasks for efficient time management
- GS6.** identify possible disruptions to work and take appropriate preventive measures
- GS7.** take quick decisions to deal with workplace emergencies/ accidents
- GS8.** evaluate all possible solutions to a problem to select the best one



## Qualification Pack

### National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0116
NOS Name	Carry out machining using the CNC VMC
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Machining
NSQF Level	4
Credits	TBD
Version	2.0
Last Reviewed Date	
Next Review Date	
Deactivation Date	
NSQC Clearance Date	



## Qualification Pack

### Assessment Guidelines and Assessment Weightage

#### Assessment Guidelines

1. Criteria for assessment for the Qualification Pack will be created by CGSC.
2. Performance Criteria (PC) have been assigned marks proportional to its importance in NOS. SSC will also lay down the proportion of marks for Theory and Skills Practical for each PC.
3. The assessment for the theory part will/may be based on a knowledge bank of questions approved by CGSC.
4. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
5. Assessment Agencies will create Assessor Guides comprising of Theory and Practical Assessment Set and Guidelines for each examination/training centre (as per assessment criteria below). The same will be approved by CGSC for adequacy.
6. To successfully attain Certification on the Qualification Pack, the trainee must score a minimum of 70% in each Core NOS and a minimum of 50% in all non-core NOS. In addition, a candidate needs to attain a minimum overall pass percentage of 70% for certification.
7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

#### Minimum Aggregate Passing % at QP Level: 70

(Please note: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

#### Assessment Weightage

##### Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage



### Qualification Pack

<b>Total</b>						

## Qualification Pack

### Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
CNC	Computer Numerically Controlled
VMC	Vertical Machining Center
3 D	3 Dimensional
CAD	Computer Aided Design
CAM	Computer Aided Manufacture
DTI	Dial Test Indicators
HCS	High Carbon Steel
CO <sub>2</sub>	Carbon Dioxide
CPR	Cardiac Pulmonary Resuscitation
PPE	Personal Protective Equipment

## Qualification Pack

### Glossary

<b>Sector</b>	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
<b>Sub-sector</b>	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
<b>Occupation</b>	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
<b>Job role</b>	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
<b>Occupational Standards (OS)</b>	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
<b>Performance Criteria (PC)</b>	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
<b>National Occupational Standards (NOS)</b>	NOS are occupational standards which apply uniquely in the Indian context.
<b>Qualifications Pack (QP)</b>	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
<b>Unit Code</b>	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
<b>Unit Title</b>	Unit title gives a clear overall statement about what the incumbent should be able to do.
<b>Description</b>	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
<b>Scope</b>	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.

## Qualification Pack

<b>Knowledge and Understanding (KU)</b>	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.
<b>Organisational Context</b>	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
<b>Technical Knowledge</b>	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
<b>Core Skills/ Generic Skills (GS)</b>	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
<b>Electives</b>	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
<b>Options</b>	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.