

Overview

This standard identifies the competences you need to operate Computer Numerical Control (CNC) three-axis or multi-axis machines, or CNC machining centres, in accordance with approved procedures. You will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. In operating the machine, you will be expected to follow the correct procedures for calling up the operating program, dealing with any error messages and executing the program activities safely and correctly.

You will be expected to produce a range of components that combine a number of different features, such as flat faces, angled faces, internal and external profiles, slots, steps, holes which are linearly or radially pitched, and special profiles such as convex or concave. You will be required to operate the CNC machine in line with safe working practices and approved procedures, to continuously monitor the machining operations and, where necessary, make minor adjustments or seek the help of the setter to make the required adjustments, in order to ensure that the work output is to the required quality and accuracy. Meeting production targets will be an important issue, and your production records must show consistent and satisfactory performance.

Your responsibilities will require you to comply with organisational policy and procedures for the machining activities undertaken, and to report any problems with the machining activities that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work to instructions, with a minimum of supervision, taking personal responsibility for your actions and for the quality and accuracy of the work that you produce.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying CNC milling procedures. You will have an understanding of the CNC milling process and its application, and will know about the equipment, materials and consumables in adequate depth to provide a sound background for carrying out the activities to the required specification.

You will understand the safety precautions required when working with the machine, its associated tools and equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

Setting up of the machine, its programming, tooling and associated workholding devices, is the subject of another standard and is the responsibility of the machine-tool setter.

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Operating CNC milling machines

Performance criteria

- You must be able to:*
- P1 work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
 - P2 confirm that the machining equipment is set up and ready for operation
 - P3 follow the defined procedures for starting and running the operating system
 - P4 deal promptly and effectively with error messages or equipment faults that are within your control and report those that cannot be solved
 - P5 operate the machine to produce machined components
 - P6 monitor the computer process and ensure that the production output is to the required specification
 - P7 complete the required production documentation
 - P8 shut down the equipment to a safe condition on conclusion of the activities

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Knowledge and understanding

You need to know and understand:

- K1 the specific safety precautions to be taken when working with CNC milling machines and equipment
- K2 the safety mechanisms on the machine, and the procedures for checking that they are operating correctly
- K3 how to start and stop the machine in both normal and emergency situations and the procedure for restarting after an emergency
- K4 the hazards associated with working on CNC milling machines (such as use of power operated work holding devices, moving machinery, automatic machine operation, handling cutting tools, hot and airborne metal particles), and how to minimise them and reduce any risks
- K5 the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
- K6 the personal protective equipment (PPE) to be worn, and where this can be obtained
- K7 the main features of the CNC milling machine, and the accessories that can be used
- K8 the various CNC milling operations that can be performed, and the methods and equipment used
- K9 the operation of the various hand and automatic modes of machine control (such as program operating and control buttons)
- K10 how to use the visual display and understand the various messages displayed
- K11 the function of error messages, and what to do when an error message is displayed
- K12 how to find the correct restart point in the program when the machine has been stopped before completion of the program
- K13 where to obtain the component drawings, specifications and/or job instructions required for the components to be machined
- K14 how to extract and use information from engineering drawings or data and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken
- K15 how to use imperial and metric systems of measurement
- K16 the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy
- K17 the application of cutting fluids with regard to a range of different materials
- K18 the effects of clamping the work piece in a chuck/work holding device, and how this can cause distortion in the finished components
- K19 how to recognise CNC milling faults, and how to identify when tools need re-sharpening/replacing
- K20 the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used

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- K21 the problems that can occur with the CNC milling activities, and how these can be overcome
- K22 the extent of your own authority and to whom you should report if you have problems that you cannot resolve

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Additional Information

Scope/range related to performance criteria

You must be able to:

1. Confirm that the machine is ready for operation by checking **all** of the following:
 - 1.1 obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation)
 - 1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
 - 1.3 confirm with the machine setter that the machine is ready for production
 - 1.4 where appropriate, seek any necessary instruction/training on the operation of the machine
 - 1.5 ensure that machine guards are in place and are correctly adjusted
 - 1.6 hold components securely, without distortion
 - 1.7 check that the operating program is at the correct start point and the work piece is clear of the machine spindle
 - 1.8 follow the defined operating procedures and apply safe working practices and procedures at all times
 - 1.9 ensure that machine settings are adjusted as and when required (either by yourself or the setter) to maintain the required accuracy
 - 1.10 ensure that the components produced meet the required specification for quality and accuracy
 - 1.11 leave the work area and machine in a safe and appropriate condition on completion of the activities

2. Operate **one** of the following CNC milling machines:
 - 2.1 CNC three-axis milling machine
 - 2.2 CNC multi-axis milling machine
 - 2.3 CNC machining centre

3. Produce machined components which combine different operations and cover **six** of the following:
 - 3.1 flat faces
 - 3.2 holes on pitched circles
 - 3.3 external profiles
 - 3.4 steps/shoulders
 - 3.5 parallel faces
 - 3.6 holes linearly pitched
 - 3.7 enclosed slots/recesses
 - 3.8 angular faces
 - 3.9 circular/curved profiles
 - 3.10 internal profiles
 - 3.11 open ended slots

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- 3.12 tapped holes
 - 3.13 special forms (such as concave, convex)
 - 3.14 faces that are square to each other
4. Machine components made from **one** of the following types of material:
- 4.1 ferrous
 - 4.2 non-ferrous
 - 4.3 non-metallic
5. Produce components with dimensional accuracy, form and surface texture within **all** the relevant quality and accuracy standards as is applicable to the operations performed:
- 5.1 dimensional tolerance equivalent to BS EN 20286 or BS 1916 Grade 9
 - 5.2 surface finish 63 μin or 1.6 μm
 - 5.3 reamed and bored holes within H8
 - 5.4 flatness and squareness within 0.001" per inch or 0.025mm per 25mm
 - 5.5 angles within +/- 0.5 degree
6. Use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of **three** of the following:
- 6.1 dimensions
 - 6.2 hole size/fit
 - 6.3 angles
 - 6.4 slots
 - 6.5 squareness
 - 6.6 surface finish
 - 6.7 flatness
 - 6.8 recesses

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