
Overview

This standard identifies the competences you need to prepare and set up milling machines, such as horizontal, vertical, universal machines, planer/gantry milling machines and boring machines with milling attachments, in accordance with approved procedures. This involves selecting the appropriate workholding devices, and mounting and positioning them to the machine in the correct location for the type of operation being carried out.

You will also be expected to select the appropriate milling cutters, check them for defects, and mount and secure them to the relevant tool holding devices and machine spindle. You will also be expected to set up and align the workpiece in the correct relationship to the machine spindle, and to set the machine operating parameters to produce the workpiece to the required specification. You must produce trial cuts, and prove the machine is working satisfactorily before declaring the installation ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for the machine setting activities undertaken, and to report any problems with the machine, cutters, equipment or setting up activities that you cannot resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to the setting up procedures used. You will understand the milling machine used, and its application, and will know about the workholding devices, milling cutters, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output is to the required specification.

You will understand the safety precautions required when working with the milling machines and their 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.

This standard does not cover CNC activities, for which other standards apply.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. follow the correct specifications for the component to be produced
3. determine what has to be done and how the machine will be set to achieve this
4. mount, set and secure the required workholding devices, workpiece and cutting tools
5. set the machine tool operating parameters to achieve the component specification
6. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
7. complete the required production documentation
8. deal promptly and effectively with problems within your control and report those that cannot be solved

Knowledge and understanding

You need to know and understand:

1. how to work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. the hazards associated with setting milling machines and how to minimise them and reduce any risks
3. operation of the machine controls in both hand and power modes, and how to stop the machine in an emergency
4. the importance of ensuring that the machine is isolated from the power supply before mounting milling cutters and workholding devices
5. the importance of wearing the appropriate protective clothing (PPE) and equipment, and of keeping the work area clean and tidy
6. the basic principles of operation of the various milling machines, and typical operations that they can perform
7. how to handle and store milling cutters safely and correctly
8. how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate standards) 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. terminology used in milling in relation to the activities undertaken
11. the range of workholding methods and devices that are used on machines
12. the methods of mounting and setting the workpiece in/on the workholding devices, and the tools and equipment that can be used
13. the different types of milling cutters that are used, and how they are selected, prepared and mounted to the machine tool holding devices
14. factors which determine speeds and feeds to be used
15. how the various types of material will affect the feeds and speeds that can be used
16. the types of cutting fluid that are used, and precautions to be taken when handling and using them
17. how to set up the various machines for the particular operations being performed
18. the need to conduct trial runs, and to check that the machine is set up and

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running safely and correctly

19. problems that can occur with setting up the milling cutters, workholding devices and machine operating parameters, and what to do if problems occur

20. the extent of your own authority and to whom you should report if you have problems that you cannot resolve

Scope/range related to performance criteria

1. Carry out all of the following activities during setting up:
 - 1.1 obtain and use the appropriate documentation
 - 1.2 adhere to procedures or systems in place for risk assessment, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
 - 1.3 follow safe practice/approved setting up procedures at all times
 - 1.4 ensure that correctly adjusted machine guards are in place
 - 1.5 check that cutting tools are in a suitable condition
 - 1.6 hold components securely without distortion
 - 1.7 leave the work area and machine in a safe and appropriate condition on completion of the activities
2. Prepare one of the following types of milling machine for production:
 - 2.1 horizontal milling machine
 - 2.2 vertical milling machine
 - 2.3 universal milling machine
 - 2.4 planer /gantry milling machine
 - 2.5 boring machines with milling attachments
3. Mount, set and secure the workpiece using three of the following:
 - 3.1 clamping direct to machine table
 - 3.2 angle plate
 - 3.3 chucks
 - 3.4 pneumatic or magnetic table
 - 3.5 vee block and clamps
 - 3.6 indexing head/device
 - 3.7 machine vice
 - 3.8 fixtures
 - 3.9 rotary table
4. Select and mount milling cutters to include six of the following:
 - 4.1 face mills
 - 4.2 slotting cutters
 - 4.3 twist drills
 - 4.4 slot drills
 - 4.5 slab mills/cylindrical cutters
 - 4.6 slitting saws
 - 4.7 boring tools
 - 4.8 straddle milling
 - 4.9 side and face cutters
 - 4.10 profile cutters
 - 4.11 end mills
 - 4.12 gang milling
5. Set up the machine in accordance with instructions and specifications, to include all of the following:

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- 5.1 alignment of workholding device
- 5.2 milling cutter revs per minute
- 5.3 position of cutters in relationship to workpiece
- 5.4 machine guards/safety mechanisms
- 5.5 linear/table feed rate
- 5.6 cutting fluid flow rate
- 5.7 depth of cut for roughing and finishing
6. Set up the machine to produce internal and external profiles that include eight of the following:
 - 6.1 flat faces
 - 6.2 open ended slots
 - 6.3 bored holes
 - 6.4 square faces
 - 6.5 enclosed slots
 - 6.6 profile forms (such as vee, concave, convex, gear forms)
 - 6.7 parallel faces
 - 6.8 recesses
 - 6.9 serrations
 - 6.10 angular faces
 - 6.11 tee slots
 - 6.12 indexed or rotated forms
 - 6.13 steps/shoulders
 - 6.14 drilled holes
 - 6.15 special forms
7. Machine components made from one of the following types of material:
 - 7.1 ferrous
 - 7.2 non-metallic
 - 7.3 non-ferrous
8. Set the machine to produce components within all of the following quality and accuracy standards as applicable to the operations performed:
 - 8.1 components to be free from false tool cuts, burrs and sharp edges
 - 8.2 general dimensional tolerance $\pm 0.15\text{mm}$ or $\pm 0.006\text{"}$
 - 8.3 one or more specific dimensional tolerances within $\pm 0.05\text{mm}$ or $\pm 0.002\text{"}$
 - 8.4 flatness & squareness within 0.001" per inch or 0.025mm per 25mm
 - 8.5 surface finish $63\mu\text{in}$ or $1.6\mu\text{m}$
 - 8.6 angles within ± 0.5 degree
 - 8.7 bored holes within H8

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