SEMMME3062

Producing components by manual machining

Overview

This standard identifies the competences you need to produce components using manual machining techniques, such as milling, turning, grinding, shaping/slotting, drilling/boring and spark/wire erosion, in accordance with approved procedures. You will be expected to produce components that require you to use a range of different machines, and this will involve setting up the workholding arrangements, workpiece and machine tooling. The workpieces produced will have a combination of features, such as diameters, lengths, threads, flat faces, square faces, slots, profiles or special forms.

Your responsibilities will require you to comply with organisational policy and procedures for the machining activities undertaken, and to report any problems with the machines, tooling, materials or activities that you cannot personally resolve, or are outside your personal responsibilities, 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 and accuracy of the work that you produce.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying machining procedures and instructions. You will understand the machining processes, and their application, and will know about the machine, tooling, ancillary equipment, materials and consumables, in adequate depth to provide a sound basis for carrying out the machining activities, correcting faults and producing the components to the required specification.

You will understand the safety precautions required when working with the 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 using CNC equipment, 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. confirm that the machine is set up and ready for the machining activities to be carried out
3. operate the machine tool controls safely and correctly in line with operational procedures
4. produce components to the required quality and within the specified dimensional accuracy
5. carry out quality sampling checks at suitable intervals
6. deal promptly and effectively with problems within your control and report those that cannot be solved
7. complete the required production documentation
8. shut down the equipment to a safe condition on conclusion of the machining activities

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 safety mechanisms on the machine, and the procedure for checking that they are operating correctly
3. how to operate all the machine controls in both hand and power modes, and how to stop the machine in case of an emergency
4. the importance of wearing appropriate protective clothing (PPE) and equipment, and of keeping the work area clean and tidy
5. the hazards associated with carrying out machining operations, and how to minimise them and reduce any risks
6. where to obtain the component drawings, specifications and/or job instructions required for the components to be machined
7. 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
8. how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
9. the basic concepts of material removal using machines (such as lathes, milling, grinding, drilling, shaping, slotting and electro-discharge machining)
10. the various machining techniques that can be used to produce the required shapes, and the types of tooling and cutters required
11. types and applications of grinding wheels; methods of mounting; and why some wheels require balancing
12. types and application of electrodes used in spark erosion activities
13. the methods that can be used to position the workpiece in relation to the cutting tools
14. the effects of backlash in the machine slides and how this can be overcome
15. how to handle and store cutters, grinding wheels and tools, safely and correctly
16. factors which effect the selection of cutting feeds and speeds, the application of roughing and finishing cuts and the depth of cut that can be taken
17. how the various types of material will affect the feeds and speeds that can be used

18. the application of cutting fluids and dielectrics with regard to a range of different materials
19. the effects of clamping the workpiece, and how material removal can cause warping/distortion in the finished workpiece
20. the quality control procedures used, inspection checks to be carried out, and the equipment to be used
21. the problems that can occur with the machining activities, and how these can be overcome
22. the extent of your own responsibility 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 during the machining activities:
   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 ensure that machine guards and safety devices are in place and correctly adjusted
   1.4 hold components securely without distortion
   1.5 maintain cutting tools in a safe and usable condition
   1.6 apply safe working practices and appropriate machining techniques at all times
   1.7 ensure that components produced meet specification
   1.8 leave the work area and machine in a safe and appropriate condition on completion of the activities
2. Produce machined components using three of the following machining processes:
   2.1 turning
   2.2 milling
   2.3 grinding
   2.4 drilling
   2.5 electro-discharge machining
   2.6 shaping or slotting
3. Use a range of workholding devices, to include five of the following:
   3.1 three jaw chucks
   3.2 clamping arrangements
   3.3 face plates
   3.4 four jaw chucks
   3.5 angle plates
   3.6 special fixtures
   3.7 machine vices
   3.8 magnetic plates
   3.9 collet chucks
   3.10 vee blocks
   3.11 indexing devices
   3.12 other specific workholding device
4. Produce machined components which cover seven of the following features:
   4.1 external diameters
   4.2 threads
   4.3 slots/recesses
   4.4 internal diameters
   4.5 circular/curved/radial profiles
   4.6 drilled/bored/reamed holes

4.7 lengths/depths
4.8 faces that are square to each other
4.9 concave or convex forms
4.10 flat faces
4.11 angular/tapered surfaces
4.12 special forms
4.13 parallel faces
4.14 steps/shoulders

5. Machine three different types of material from:
5.1 low carbon steel
5.2 stainless steel
5.3 aluminium
5.4 plastic/synthetic
5.5 brass
5.6 high carbon steel
5.7 cast iron
5.8 composite
5.9 special steels or alloys
5.10 bronze

6. Carry out the necessary checks during manufacture, for accuracy of five of the following:
6.1 dimensions
6.2 flatness/squareness
6.3 thread size and fit
6.4 profile
6.5 angles
6.6 concentricity
6.7 hole size/fit
6.8 quality of surface finish

7. Produce components within all of the following standards, as applicable to the operation performed:
7.1 dimensional tolerance as specified in relevant standards
7.2 flatness and squareness 0.001″ per inch or 0.025mm per 25mm
7.3 reamed and bored holes within H8
7.4 surface finish 63 µin or 1.6 µµm

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Developed by	Enginuity
Version Number	3
Date Approved	30 Mar 2023
Indicative Review Date	31 Mar 2028
Validity	Current
Status	Original
Originating Organisation	Enginuity
Original URN	SEMMME3062
Relevant Occupations	Engineering, Engineering and Manufacturing Technologies, Engineering Technicians
Suite	Mechanical Manufacturing Engineering Suite 3
Keywords	Engineering; manufacturing; mechanical; manual machining; turning; drilling; grinding; shaping; milling; spark erosion; wire erosion