SEMMME225

Operating CNC gear cutting machines

Overview

This standard identifies the competences you need to carry out gear cutting operations, in accordance with approved procedures, using Computer Numerical Control (CNC) machines. 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 internal and external spur gears, helical gears, involute splines, straight splines, serrations, racks and bevel gears.

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 machining procedures. You will have an understanding of the CNC gear cutting 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.

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 CNC gear cutting machine is set up and ready for operation

P3 operate the machine controls in accordance with safe working practices and operational procedures

P4 deal with problems within your control and report those that cannot be solved

P5 operate the CNC gear cutting machine to produce machined components

P6 monitor the computer process and ensure that the production output is to the required specification

P7 complete and store all relevant documentation in accordance with organisational requirements

P8 shut down the equipment to a safe condition on conclusion of the activities

Knowledge and understanding

You need to know and understand:

K1 how to work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
K2 the safety mechanisms on the machine, and the procedures for checking that they are operating correctly
K3 how to stop the CNC gear cutting machine in both normal and emergency situations, and the procedure for restarting after an emergency
K4 the importance of wearing the appropriate protective clothing (PPE) and equipment, and of keeping the work area clean and tidy
K5 the main features of the CNC gear cutting machine, and the accessories that can be used
K6 the various CNC gear cutting operations that can be performed, and the methods and equipment used
K7 the operation of the various hand and automatic modes of machine control
K8 how to use the visual display and understand the various messages displayed
K9 the function of error messages, and what to do when an error message is displayed
K10 how to find the correct restart point in the program when the machine has been stopped before completion of the program
K11 where to obtain the component drawings, specifications and/or job instructions required for the components to be machined
K12 how to extract and use information from engineering drawings or data and related specifications in relation to work undertaken
K13 how to use imperial and metric systems of measurement
K14 the application of roughing and finishing cuts, and the effect on cutter life, surface finish and dimensional accuracy
K15 the application of cutting fluids with regard to a range of different materials
K16 the effects of clamping the work piece in a chuck/work holding device, and how this can cause distortion in the finished components
K17 how to recognise CNC gear cutting faults, and how to identify when tools need re-sharpening/replacing
K18 the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used
K19 the issues that can occur with the CNC gear cutting activities, and how these

can be overcome

K20 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. 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, 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 workpiece 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 gear cutting machines:
2.1 CNC gear cutting machine
2.2 CNC gear hobbing machine
2.3 CNC gear shaving machine

3. Produce machined components which cover four of the following, as applicable to the machine type used:
3.1 external spur gears
3.2 involute splines
3.3 internal spur gears
3.4 serrations
3.5 external helical gears
3.6 bevel gears

3.7 internal helical gears
3.8 racks
3.9 straight splines
3.10 worm gears

4. Machine one of the following types of material:
4.1 ferrous
4.2 non-ferrous
4.3 non-metallic

5. Use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following
5.1 gear blanks
5.2 involute form
5.3 surface texture
5.4 lead and helix angle
5.5 composite error rolling test
5.6 gear tooth thickness

6. Produce components with dimensional accuracy, form and surface texture within all the relevant quality and accuracy standards as is applicable to the operations performed:
6.1 components to be free from false tool cuts, burrs and sharp edges
6.2 straight splines and serrations to relevant standards
6.3 spur and helical gears to relevant standard
6.4 involute splines to relevant standard
6.5 tolerance to relevant standard
6.6 surface texture 63 µin or 1.6 µm

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