This standard identifies the competences you need to operate computer numerically controlled (CNC) spring making machines, in accordance with approved procedures. The CNC machines covered by this standard include single head, multi-head and coiling and bending centres. 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 required to monitor the spring making operations continuously, making any necessary adjustments to machine parameters, in order to maintain the spring production within specification requirements. 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 CNC spring making activities undertaken, and to report any problems with the equipment, tooling, programs or production activities that you cannot personally resolve, or that 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 and accuracy 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 applying CNC spring making procedures. You will understand the CNC spring making machine used, and its application, and will know about the tooling, materials, spring making activities and consumables, in adequate depth to provide a sound background to the machine operation and for carrying out the activities, correcting faults and ensuring that the springs output are to the required specification.

You will understand the safety precautions required when working with the CNC spring making machine, and with its associated tools and equipment. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Note: Machine programming and setting up of the machine, its tooling and associated workholding devices, are the subjects of other
Operating CNC spring making machines

standards.
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 equipment is set up and ready for operation
3. follow the defined procedures for starting and running the operating system
4. deal promptly and effectively with error messages or equipment faults that are within your control and report those that cannot be solved
5. monitor the computer process and ensure that the production output is to the required specification
6. produce machined components
7. complete the required production documentation
8. shut down the equipment to a safe condition on conclusion of the activities
Knowledge and understanding

You need to know and understand:

1. the safe working practices and procedures to be followed while operating CNC spring making machines
2. the safety mechanisms on the machine, and the procedure for checking that they function correctly
3. the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency
4. the hazards associated with working on CNC spring making machines (such as moving machinery, automatic machine operation, handling coils of spring materials), and how to minimise them and reduce any risks
5. the importance of wearing the appropriate protective clothing (PPE) and equipment, and of keeping the work area clean and tidy
6. how to handle and store software media and programs, safely and correctly
7. how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN 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. how to carry out currency/issue checks on the specifications you are working with
10. how to read the visual display and understand the various messages displayed
11. how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter or update tooling data (such as form tool datums, positions, lengths, offsets and radius compensation)
12. the function of error messages, and what to do when an error message is displayed
13. how to find the correct restart point in the program when the machine has been stopped before completion of the program
14. the operation of the various hand and automatic modes of machine control (such as program operating and control buttons)
15. how to operate the machine using single block run, full program
run and feed/speed override controls
16. how to make adjustments to the program operating parameters to take account of tool wear or material spring-back
17. the various types of bending and forming tools used, and how they are located and secured to the machine tool posts, turrets, slides and tool magazine or carousel
18. how to check that the bending and forming tools are in a serviceable condition, and the effects that worn tooling will have on the finished springs
19. how to recognise machine faults, and how to identify when tooling needs refurbishment
20. how to handle and store all bending and forming tools and kit, safely and correctly
21. the problems that can occur with the spring making activities, and how these can be overcome
22. the quality control procedures used, inspection checks to be carried out, and the equipment that is used for this
23. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve
1. Carry out **all** of the following during the CNC spring making activities:
   
   1. obtain and interpret correctly the documentation for the type of spring being made (such as job instructions, spring drawings and quality documentation)
   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
   3. check that machine guards/safety mechanisms are in place and correctly adjusted
   4. check that forming tools and other required tooling is in a usable condition
   5. check that material stocks are sufficient for the springs being made
   6. ensure that the operating program is at the correct start point
   7. use safe working practices and machine start-up and operating procedures
   8. adjust machine settings, as required, to maintain spring accuracy and quality
   9. leave the machine and work area in a safe and clean condition on completion of the activities

2. Produce springs/forms from **two** different types of material from the following:
   
   1. carbon steel
   2. alloy steel
   3. nickel based alloys
   4. stainless steel
   5. copper based alloy
   6. titanium
   7. other specific material

3. Produce a range of springs, to include **four** of the following:
   
   1. open ended right-hand helix
   2. double torsion
   3. open ended left-hand helix
   4. conical
   5. closed end right-hand helix
6. hourglass
7. closed end left-hand helix
8. constant pitch
9. single torsion
10. variable pitch
11. power
12. barrel
13. scroll/spiral
14. garter spring
15. volute
16. clock
17. other wire forms

4. Produce springs that have **three** of the following finished ends:
   1. full round hook/full round eye
   2. straight offset
   3. long round end hook on centre
   4. enlarged loop
   5. coned end to hold long swivel eye
   6. side loop
   7. eye and hook at right angles
   8. plain ends
   9. extended eye on centre or side
  10. machine loop
  11. small eye on centre
  12. crossover
  13. square end
  14. double loop
  15. short hook end
  16. 45 degree loop
  17. hinge end
  18. extended leg
  19. English loop
  20. continental (German) loop
  21. other specific end configuration

5. Use **four** of the following whilst checking the quality of the springs produced:
   1. vernier callipers
   2. vernier protractors
3. gauges
4. micrometers
5. squares
6. jigs
7. spring testing machines
8. electronic measuring equipment

6. Complete all relevant documentation on conclusion of the spring making activities, to include one of the following:
   1. job cards
   2. computer records
   3. quality control documentation
   4. test documents
   5. company-specific documentation

7. Produce springs to one the following relevant quality and accuracy standards:
   1. BS, ISO or BSEN standards and procedures
   2. customer standards and job requirements
   3. company standards and procedures
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