

## Setting CNC spring making machines for production

---

### Overview

This standard identifies the competences you need to prepare and set up 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. You will be expected to select the appropriate material feed and guide devices, and to mount and secure them to the machine. You will also be required to select the appropriate forming and cropping tools, to mount and secure them to the appropriate tool holding devices, and to place the cutting/forming tools in the relevant positions within the tool posts, slides or tool change magazine/carousel, where this is applicable.

You will need to ensure that all the tools have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions is entered into the operating program and machine. This will involve loading and proving programs, checking for errors/faults, and editing and saving program changes. You must produce trial springs, and prove that the machine is working satisfactorily, before declaring the machine ready for production. Making adjustments to settings to achieve the spring 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 CNC spring making machine setting activities undertaken, and to report any problems with the equipment, tooling, programs or setting-up 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 the setting-up procedures used. You will understand the CNC spring making machine used, and its application, and will know about the material feed and ejection mechanisms, forming and bending tools, machine operating programs and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, 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.

## Setting CNC spring making machines for production

---

### 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 component drawing and any other related 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 correct forming tools and devices for the component being produced
5. set the machine operating parameters to achieve the required pressure shaping requirements and component specification
6. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
7. produce trial/first-off springs to prove the machine settings
8. complete the required production documentation
9. deal promptly and effectively with problems within your control and report those that cannot be solved

## Setting CNC spring making machines for production

## 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. how to start and stop the machine, in normal and emergency situations
3. the importance of ensuring that the machine is isolated from the power supply before setting up the operating mechanisms and forming tools
4. the importance of wearing the appropriate protective clothing (PPE) and equipment, and of keeping the work area clean and tidy
5. 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
6. how to handle and store forming tools and verified tapes and programs, safely and correctly
7. how to extract and use information from engineering drawings or data 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. how to carry out currency/issue checks on the specifications you are working with
10. the material holding and feeding devices that are used on CNC spring making machines
11. why it is important to set the material start point in relation to the machine datums and reference points
12. the methods of setting the forming tools, and the equipment that can be used for this
13. the range of forming and cropping tools that are used on the CNC spring making machine
14. how to check that the forming tools are in a safe and serviceable condition
15. the various tool holding devices that are used, and the methods of correctly mounting and securing the forming tools to the tool holders
16. the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures

## Setting CNC spring making machines for production

---

17. the use of tool posts, magazines and carousels, and how to position and identify the tools in relationship to the operating program
18. how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data (such as form tool datums, positions, lengths, offsets and radius compensation)
19. how to conduct trial runs using single block run, dry run, and feed and speed override controls
20. the items to check before allowing the machine to operate in full program run mode
21. how the various types of material used will affect the production speeds that can be used
22. typical problems that can occur with the setting up of the CNC mechanisms and tooling, and what to do if they occur
23. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

## Setting CNC spring making machines for production

## Scope/range related to performance criteria

| --- ||

1. Carry out all of the following during the setting up of the CNC spring making machines:
  1. obtain and interpret correctly the documentation for the type of spring being made
  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
  3. confirm that the correct operating program has been loaded
  4. check that forming tools and other required tooling is in a usable condition
  5. carry out the setting-up activities, following good practice/approved procedures
  6. update the program tool data, as applicable
  7. ensure that correctly adjusted machine guards are in place
  8. leave the machine and work area in a safe and clean condition on completion of the setting-up activities
2. Set up CNC spring making machine operating control mechanisms/systems, to include three of the following devices:
  1. material guide/wire feed mechanisms (such as feed rollers, pneumatic, magazine)
  2. mechanical actuators
  3. feed fingers
  4. pneumatic/hydraulic actuators
  5. de-reeler
  6. electro-mechanical actuators
  7. inspection equipment (such as cameras)
  8. ejection chutes/storage systems
  9. spring sorter
  10. hook touch sensor
3. Select and mount, in the appropriate holding device, four of the following types of spring forming tool:
  1. pitching
  2. coiling tools
  3. cutting/cropping tools
  4. bending tools
  5. looping tools
  6. forming tools
  7. straightening tools
  8. other special-purpose tooling

## Setting CNC spring making machines for production

- 
4. Prepare the spring tooling by carrying out all of the following activities, as applicable to the machine type:
    1. pre-setting tooling, using setting jigs/fixtures
    2. setting tool datums
    3. mounting tools in the correct position in the tool posts, turrets, magazine or carousel
    4. checking that tools have a specific tool number in relationship to the operating program
    5. entering all relevant tool data to the operating program (such as tool lengths, tool offsets, radius compensation)
    6. making adjustments to program settings for spring-back
    7. saving changes to the program
  5. Set up CNC spring making machines for the production of four of the following:
    1. open ended right-hand helix
    2. single torsion
    3. variable pitch
    4. power
    5. open ended left-hand helix
    6. double torsion
    7. barrel
    8. scroll/spiral
    9. closed end right-hand helix
    10. conical
    11. garter spring
    12. volute
    13. closed end left-hand helix
    14. hourglass
    15. clock
    16. other wire forms
  6. Set the machine to finish the spring ends, to include three of the following:
    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

## Setting CNC spring making machines for production

- 
17. hinge end
  18. extended leg
  19. English loop
  20. continental (German) loop
  21. other specific end configuration
  7. Set up the machine to 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 and other special material
    7. other specific material
  8. 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
  9. Make trial springs to prove that the machine is operating to the required specification, and check **all** of the following:
    1. the first-off springs are heat treated for inspection/verification
    2. size of wire/strip and material specification
    3. dimensional accuracy of the finished spring
    4. the number of coils is as specified
    5. the spring is wound with the correct hand helix
    6. spring ends are flat and square to spring axis (where appropriate)
    7. spring ends/legs are of the correct length, angle and shape (where appropriate)
    8. spring load/tension meets specification requirements
    9. completed springs are free from tooling marks and deformation
  10. Set up CNC spring making machines to produce springs to one of the following:
    1. BS, ISO or EN standards and procedures
    2. customer standards and job requirements
    3. company standards and procedures

## Setting CNC spring making machines for production

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	SEMMME3133
Relevant Occupations	Engineering, Engineering and Manufacturing Technologies, Engineering Technicians
Suite	Mechanical Manufacturing Engineering Suite 3
Keywords	mechanical engineering; spring making; CNC machine; setting; pitching; bending; coiling; forming; looping; straightening; cutting; cropping; open ended; closed end; right hand helix; left hand helix; conical; hour glass; barrel; garter; variable pitch;