

Overview

This standard identifies the competences you need to cold form wire extension springs, using hand forming methods and techniques, in accordance with approved procedures. You will be required to select the appropriate equipment to use, based on the forming operations required, the material to be formed and the accuracy to be achieved, and this will include such items as coiling mandrels, hand coiling machine, coiling tools, shearing tools and fly presses. The wire extension springs to be produced will include right and left-handed helix, garter springs and other specific extension springs.

Your responsibilities will require you to comply with organisational policy and procedures for the spring forming activities undertaken, and to report any problems with the tools and equipment, materials or 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 produce. **

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying hand forming procedures to extension springs. You will understand the cold forming processes, the equipment used and its application, and will know about the materials and forming techniques in adequate depth to provide a sound basis for carrying out the activities, correcting faults and producing the springs to the required specification.

You will understand the safety precautions required when working with the hand forming machines, and with their 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.

Performance criteria

You must be able to:

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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 this will be achieved
4. use the appropriate tools and equipment for the pressure shaping operations and check that they are in a safe and usable condition
5. shape the materials to the required specification using appropriate methods and techniques
6. check that all the required shaping operations have been completed to the required standard
7. 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:

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1. how to work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. the personal protective clothing and equipment (PPE) to be worn when carrying out the spring making activities
3. the hazards associated with carrying out extension spring hand forming operations (such as handling spring wire, using hand coiling machines and equipment, using dangerous or badly maintained tools and equipment), and how to minimise them and reduce any risks
4. terminology used in the manufacture of the extension springs
5. the principles of operation of extension springs
6. how to obtain the necessary drawings, specifications and work instructions
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. the interpretation of the drawings in first or third angle, projection to relevant standard(s)
9. hand tools used in the extension spring forming activities, and how to check that they are in a safe and usable condition
10. the various hand and power operated coiling machines that can be used to produce a range of open and closed end springs
11. the various types of coiling/forming tool that are used, and how they are selected, prepared and mounted to the machine
12. how to set up the hand coiling machine and tooling to produce the required helix, pitch, number of coils and arm extension required
13. the techniques used to feed the wire into the hand coiling machine in order to produce the spring to the required specification
14. ways of avoiding and correcting inaccuracies in the coil forming activities
15. how the spring wire materials are to be prepared for the coiling operations, and why some materials may require a heating process prior to forming

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16. the characteristics of the various materials used with regard to the coiling and forming process
17. the variations in manufacturing methods and spring characteristics that will occur with different ferrous and non-ferrous metals
18. the use of fly presses and tooling for forming bends and loops in the spring ends/legs and for coil setting
19. how to check that the tools and equipment used are in a safe and serviceable condition, and their care and maintenance procedures
20. organisational quality control procedures, and recognition of coil forming defects
21. dimensional and coil forming inspection checks to be carried out, and the tools and equipment to be used for this
22. limitations of the various coil forming processes, and the accuracy that may realistically be achieved
23. the importance of completing all relevant documentation on conclusion of the spring making activities
24. 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 Ensure that the tools and equipment to be used are appropriate to the application and are in a safe and usable condition, by carrying out **all** of the following checks
 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, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
 3. check that the tools and spring forming equipment to be used are in a safe and usable condition
 4. carry out the hand forming activities, following good practice/approved procedures
 5. return all tools and equipment to the correct location on completion of the spring making activities
 6. leave the work area in a clean and safe condition on completion of the activities

- 2 Produce extension springs from **two** different materials from the following:
 - carbon steel
 - stainless steel
 - alloy steel
 - copper based alloy
 - nickel based alloys
 - titanium and other special material
 - other specific material

- 3 Form **two** of the following types of wire extension springs:
 - right-hand helix
 - left-hand helix

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- garter springs
- other extension springs

4 Use **all** of the following types of spring forming equipment:

- coiling machine (hand or power operated)
- spring measuring/checking equipment
- coiling mandrels
- hand tools
- fly press

5 Produce wire extension springs, to include carrying out **all** of the following:

- selecting the correct type and size of wire
- ensuring that any required wire pre-treatment activities have been carried out (where appropriate)
- selecting the correct type and size of coiling mandrel and securing it in the machine chuck
- setting the coiling rest to give the correct helix
- selecting the correct angle plate to obtain pitch and free length
- setting the coiling machine controls (such as wire guides, cams, upper and lower stops, cropping tool)
- setting up the correct coil start and finishing points
- using the appropriate techniques to form the springs to the required specification
- checking the re-coil amount after coiling and adjusting, as required (where appropriate)
- carrying out post coiling operations (such as forming bends or loops in ends/legs, pre-setting, coil setting and checking)
- preparing the springs for heat treatment (such as stress relieving, hardening

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and tempering)

6 Finish extension spring ends, to include producing **six** of the following:

- full round hook/full round eye
- long round end hook on centre
- coned end to hold long swivel eye
- eye and hook at right angles
- extended eye on centre or side
- small eye on centre
- square end
- English loop
- continental (German) loop
- enlarged loop
- side loop
- plain ends
- machine loop
- crossover
- double loop
- 45 degree loop
- extended leg

7 Use **four** of the following whilst checking the quality of the springs produced:

- vernier callipers
- micrometers
- spring testing machines
- vernier protractors

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- squares
 - electronic measuring equipment
 - gauges
 - jigs
- 8 Carry out checks of wire extension springs, to include **all** of the following:
- size of wire and material specification
 - dimensional accuracy of the overall length
 - dimensional accuracy of the outside diameter
 - dimensional accuracy of the inside diameter
 - the number of coils is as specified
 - the spring is wound with the correct hand helix
 - spring ends/legs are of the correct length, angle and shape
 - spring extension meets specification requirements
 - completed springs are free from tooling marks and deformation
- 9 Produce wire extension springs which comply with **one** of the following:
- BS, ISO or EN standards and procedures
 - customer standards and job requirements
 - company standards and procedures

Scope/range related to knowledge and understanding

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