

SEMPEO1-12 - SQA Unit Code H029 04

Carrying out sheet metal cutting, forming and assembly activities



Overview

This standard covers a range of basic sheet (up to and including 3 mm) metalworking competences that will prepare you for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or that will provide a basis for the development of additional skills and occupational competences in the working environment.

You will be expected to prepare for the sheet metalworking activities by obtaining all the necessary job instructions, materials, tools, equipment and any documentation that may be required.

In producing the sheetmetal components, you will be expected to use appropriate tools and equipment to mark out the material for a range of features to be produced, and then to use hand tools, portable power tools and simple machines to produce a variety of shapes, profiles and forms. You will also be expected to produce simple sheet metal assemblies, using self-secured joints, thermal methods or mechanical fastening devices. On completion of the sheet metalworking activities, you will be expected to return all tools and equipment to the correct location, and to leave the work area in a safe and tidy condition.

Your responsibilities will require you to comply with health and safety requirements and organisational policy and procedures for the sheet metalworking activities undertaken. You will need to report any difficulties or problems that may arise, and to carry out any agreed actions. You will work under a high level of supervision, whilst taking responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide an understanding of your work, and will enable you to apply appropriate sheet metalworking techniques and procedures safely. You will understand the sheet metal cutting, forming and assembly process, and its application, and will know about the equipment, materials and consumables, to the required depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when carrying out the sheet metalworking activities, and when using the various tools and equipment, especially guillotines and bending/forming 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.

Specific Standard Requirements

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At least one of the components produced must combine different features and techniques, for example: by producing a component which involves cutting the sheet material to size using guillotines, marking out bends and rivet positions, bending the material, drilling the rivet holes and joining the materials using blind rivets.

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Performance criteria

You must be able to:

- P1 work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines
- P2 obtain the appropriate tools and equipment for the sheet metalworking operations, and check that they are in a safe and usable condition
- P3 mark out the components for the required operations, using appropriate tools and techniques
- P4 cut and shape the materials to the required specification, using appropriate tools and techniques
- P5 use the appropriate methods and techniques to assemble and secure the components in their correct positions
- P6 check that the finished components meet the standard required
- P7 report any difficulties or problems that may arise with the sheet metal activities, and carry out any agreed actions
- P8 leave the work area in a safe and tidy condition on completion of the sheet metal activities

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Knowledge and understanding

You need to know and understand:

- K1 the health and safety requirements, and safe working practices and procedures required for the sheet metalworking activities undertaken
- K2 the personal protective clothing and equipment (PPE) to be worn when carrying out the sheet metal activities (such as leather gloves, eye protection, ear protection), and the importance of keeping the work area safe and tidy
- K3 how to handle sheet materials safely and correctly and the need to wear gloves and other related safety equipment
- K4 safe working practices and procedures to be observed when using manual and power operated tools
- K5 the hazards associated with carrying out sheet metalworking activities (such as handling sheet materials, using dangerous or badly maintained tools and equipment, operating guillotines and bending machines, and when using hand and bench shears), and how they can be minimised
- K6 the procedure for obtaining the required drawings, job instructions and other related specifications
- K7 how to use and extract information from engineering drawings and related specifications (to include BS or ISO standard symbols and abbreviations, imperial and metric systems of measurement, workpiece reference points and system of tolerancing)
- K8 how to prepare the materials in readiness for the marking out activities, in order to enhance clarity, accuracy and safety (such as visually checking for defects, cleaning the materials, removing burrs and sharp edges, applying a marking-out medium)
- K9 how to select and establish a suitable datum; the importance of ensuring that marking out is undertaken from the selected datum, and the possible effects of working from a different datum
- K10 the methods of marking out cutting guidelines, square and rectangular profiles, circular and radial profiles, angles and hole positions
- K11 ways of laying out the marking-out shapes or patterns to maximise use of materials
- K12 how to cut sheet metal (using such tools as tin snips, bench shears, guillotines, portable power tools, bench drills, saws)
- K13 how to form sheet metal (using such tools and equipment as hammers, mallets, stakes, formers, sand bags folding and rolling machines)
- K14 the various forming operations that can be carried out (such as bends, box sections, cylinders and curved sections, safe/folded edges. wired edges and swages)
- K15 the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment
- K16 the various methods of securing the assembled components, and the range of mechanical fastening devices that are used (such as nuts and bolts, screws, rivets, special fasteners, resistance and tack welding)

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- methods and techniques, adhesive bonding of components, and self-secured joints such as knocked up, paned down, swaged and joggled)
- K17 the preparations to be carried out on the components prior to assembling them
- K18 how to set up and align the various components, and the tools and equipment that is used
- K19 methods of temporarily holding the joints together to aid the assembly activities (clamps, rivet clamps)
- K20 the problems that can occur with the sheet metalworking activities (such as defects caused by incorrectly set or blunt shearing blades), and how these can be overcome
- K21 when to act on your own initiative and when to seek help and advice from others
- K22 the importance of leaving the work area in a safe and clean condition on completion of activities (such as removing and storing power leads, isolating machines, cleaning the equipment, and removing and disposing of waste)

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Additional Information

Scope/range related to performance criteria

- You must be able to:*
1. Carry out **all** of the following during the sheet metalworking activities:
 - 1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
 - 1.2 ensure that all power tool cables, extension leads or air supply hoses are in a tested and serviceable condition
 - 1.3 apply safe and appropriate sheet metal cutting and forming techniques and procedures at all times
 - 1.4 return all tools and equipment to the correct location on completion of the sheet metalworking activities
 2. Use marking-out methods and techniques, including **one** of the following:
 - 2.1 direct marking using instruments
 - 2.2 use of templates
 - 2.3 tracing/transfer methods
 3. Use a range of marking-out equipment, to include **five** of the following:
 - 3.1 scribe
 - 3.2 rule or tape
 - 3.3 square
 - 3.4 dividers or trammels
 - 3.5 punch
 - 3.6 straight edge
 - 3.7 protractor
 - 3.8 chalk, bluing or paint
 4. Mark out material, to include **four** of the following features:
 - 4.1 datum and centre lines
 - 4.2 curved profiles
 - 4.3 square/rectangular profiles
 - 4.4 cutting and bending detail (including allowances)
 - 4.5 angles
 - 4.6 hole centring and outlining (such as circular or linear)
 - 4.7 circles
 5. Cut and finish material to the marked-out shape, using **two** of the following hand tools:
 - 5.1 tin snips

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- 5.2 bench shears
 - 5.3 hacksaw
 - 5.4 files
 - 5.5 hand power tools (such as drill, nibbling, saw)
 - 5.6 pneumatic tools
 - 5.7 trepanning
 - 5.8 thermal device
 - 5.9 other specific tool
6. Cut and finish material to the marked-out shape, using **one** of the following machine tools:
- 6.1 guillotine
 - 6.2 punch/cropping machine
 - 6.3 mechanical saw
 - 6.4 pillar drill
 - 6.5 nibbling machine
7. Perform cutting operations to produce components that have **three** of the following shapes:
- 7.1 square or rectangular profiles
 - 7.2 angled profiles
 - 7.3 external curved contours
 - 7.4 notches
 - 7.5 internal curved contours
 - 7.6 round holes
 - 7.7 square holes
8. Use **two** of the following types of sheet metal forming equipment/techniques:
- 8.1 bending machine (hand or powered)
 - 8.2 stakes and formers
 - 8.3 swaging machine
 - 8.4 rolling machine (hand or powered)
 - 8.5 jenny/wiring machine
 - 8.6 shrinking techniques
 - 8.7 hammers/panel beating equipment
 - 8.8 wheeling machine
 - 8.9 stretching techniques
 - 8.10 presses
9. Carry out forming operations, to produce sheet metal components that have **three** of the following shapes:
- 9.1 bends or flanges
 - 9.2 tray/box sections
 - 9.3 folds/safe edges
 - 9.4 cylindrical sections

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- 9.5 wired edges
 - 9.6 cowlings and rounded covers
 - 9.7 swages
 - 9.8 square to round trunking
 - 9.9 curved panels
10. Assemble sheet metal components using **one** of the following methods:
- 10.1 temporary tack welding
 - 10.2 adhesive bonding
 - 10.3 soldering or brazing
 - 10.4 flanged and mechanically fastened (such as bolts, screws)
 - 10.5 resistance spot welding
 - 10.6 self-securing joints (such as knocked up, paned down, swaged, joggled)
 - 10.7 riveting (such as hollow or solid)
11. Use sheet metal (up to and including 3 mm) in **one** appropriate material from the following:
- 11.1 hot rolled mild steel
 - 11.2 brass
 - 11.3 cold rolled mild steel
 - 11.4 copper
 - 11.5 coated mild steel (such as primed, tinned, galvanised)
 - 11.6 lead
 - 11.7 stainless steel
 - 11.8 titanium
 - 11.9 aluminium
12. Produce sheet metal components which meet **all** of the following:
- 12.1 all dimensions are within +/- 3.0mm or +/- 0.125"
 - 12.2 finished components are correctly formed and meet the required shape/geometry (square, straight, angles free from twists)
 - 12.3 completed components are free from excessive tool or bending marks, stretching or distortion, cracking, sharp edges, slivers or burrs
 - 12.4 all components are correctly assembled and have secure and firm joints

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