

LEARNING OUTCOMES

- 1 Produce sheet metal components and assemblies
- 2 Know how to produce sheet metal components and assemblies

Performance evidence must be the main form of evidence gathered. Candidates are required to demonstrate competence of all practical skills (outcome one) on **three** separate occasions and essential knowledge (outcome two) on at least **one** occasion.

OUTCOME ONE

PRODUCE SHEET METAL COMPONENTS AND ASSEMBLIES

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
1 Work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines.			
2 Carry out all of the following during the sheet metalworking activities: <ul style="list-style-type: none"> • adhere to procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations • ensure that all power tool cables, extension leads or air supply hoses are in a serviceable condition • return all tools and equipment to the correct location on completion of the sheet metalworking activities • check that all measuring equipment is within calibration date. 			
3 Plan the sheet metalworking activities before you start them.			

CONTINUED ON PAGE 2

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
4 Use sheet metal (up to and including 3 mm) in two different materials from the following: <ul style="list-style-type: none"> • black mild steel • bright mild steel • coated mild steel (such as tinned, galvanised) • stainless steel • aluminium • brass • copper • lead • titanium. 			
5 Obtain the appropriate tools and equipment for the sheet metalworking operations, and check that they are in a safe and usable condition.			
6 Use a range of marking out equipment, to include all of the following: <ul style="list-style-type: none"> • scribe • punch • rule or tape • straight edge • square • protractor • dividers or trammels • chalk, blueing or paint. 			
7 Mark out the components for the required operations, using appropriate tools and techniques.			

CONTINUED ON PAGE 3

OUTCOME ONE (CONTINUED)

PRODUCE SHEET METAL COMPONENTS AND ASSEMBLIES

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
8 Use marking out methods and techniques, including: <ul style="list-style-type: none">• direct marking using instruments plus one more from the following:• use of templates• tracing/transfer methods.			
9 Mark out material, to include all of the following features: <ul style="list-style-type: none">• datum and centre lines• square/rectangular profiles• angles• circles• curved profiles• cutting and bending detail (including allowances)• hole centring and outlining (such as circular or linear).			
10 Cut and shape the materials to the required specification, using appropriate tools and techniques.			
11 Cut and finish material to the marked out shape, using both of the following hand tools: <ul style="list-style-type: none">• tin snips• bench shears plus two more from the following: <ul style="list-style-type: none">• hacksaw• hand power tools (such as drill, nibbling, saw)• trepanning• files• pneumatic tools• plasma burner.			

CONTINUED ON PAGE 4

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
<p>12 Cut and finish material to the marked out shape, using the following machine tool:</p> <ul style="list-style-type: none"> • guillotine <p>plus two more of the following:</p> <ul style="list-style-type: none"> • pillar drill • bench saw • punch/cropping machine • nibbling machine • trepanning machine • band saw. 			
<p>13 Perform cutting operations to produce components with all three of the following shapes:</p> <ul style="list-style-type: none"> • square or rectangular profiles • angled profiles • external curved profiles <p>plus two more from the following:</p> <ul style="list-style-type: none"> • notches • internal curved contours • round holes • square holes. 			
<p>14 Use both of the following types of forming equipment/techniques:</p> <ul style="list-style-type: none"> • bending machine (hand or powered) • rolling machine (hand or powered) <p>plus two more from the following:</p> <ul style="list-style-type: none"> • hammers/panel beating equipment • stakes and formers • presses • jenny/wiring machine • wheeling machine • swaging machine • shrinking techniques • stretching techniques. 			

CONTINUED ON PAGE 5

OUTCOME ONE (CONTINUED)

PRODUCE SHEET METAL COMPONENTS AND ASSEMBLIES

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
15 Carry out forming operations which produce components having all of the following shapes: <ul style="list-style-type: none">• bends/upstands• folds/safe edges• tray/box sections• cylindrical sections plus one more from the following: <ul style="list-style-type: none">• wired edges• swages• curved panels• ribbed components• cowlings and rounded covers• square to round trunking• lobster-back trunking• concertina ducting or trunking.			
16 Use the appropriate methods and techniques to assemble and secure the components in their correct positions.			
17 Assemble sheet metal components, using two of the following methods: <ul style="list-style-type: none">• temporary tack welding• soldering or brazing• resistance spot welding• riveting (such as hollow or solid)• adhesive bonding• flanged and mechanically fastened (such as bolts, screws)• self securing joints (such as knocked up, paned down, swaged, joggled).			

CONTINUED ON PAGE 6

PRODUCE SHEET METAL COMPONENTS AND ASSEMBLIES

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
18 Measure and check that all dimensional and geometrical aspects of the component are to the specification.			
19 Produce sheet metal components which meet all of the following: <ul style="list-style-type: none"> • all dimensions are within +/- 3.0mm or +/- 0.125" • finished components meet the required shape/geometry (square, straight, angles free from twists) • completed components are free from excessive tooling marks, deformation, cracking, sharp edges, slivers or burrs • all components are correctly assembled and have secure and firm joints. 			
20 Deal promptly and effectively with problems within your control, and seek help and guidance from the relevant people if you have problems that you cannot resolve.			
21 Leave the work area in a safe and tidy condition on completion of the fitting activities.			

OUTCOME TWO

KNOW HOW TO PRODUCE SHEET METAL COMPONENTS AND ASSEMBLIES

Knowledge required You must be able to:	Evidence reference number
1 Describe the health and safety requirements, and safe working practices and procedures required for the sheet metalworking activities undertaken.	
2 Describe the personal protective clothing and equipment 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.	
3 Describe the correct methods of moving or lifting sheet materials.	
4 Describe the safe working practices and procedures to be observed when using manual and power operated tools.	
5 Describe 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.	
6 Describe the procedure for obtaining the required drawings, job instructions and other related specifications.	
7 Explain how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate bs or iso standards) in relation to work undertaken.	
8 Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing.	
9 Explain 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).	
10 Explain 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.	

CONTINUED ON PAGE 8

Knowledge required You must be able to:	Evidence reference number
11 Describe the use of marking out conventions when marking out the workpiece (including datum lines, cutting guidelines, square and rectangular profiles, circular and radial profiles, angles, holes linearly positioned, boxed and on pitch circles).	
12 Describe the ways of laying out the marking-out shapes or patterns to maximise use of materials.	
13 Describe the tools and techniques available for cutting and shaping sheet metal (such as tin snips, bench shears, guillotines, portable power tools, bench drills, saws).	
14 Describe the use and care of tools and equipment (including checks that must be made to ensure that the tools are fit for purpose - such as sharp, undamaged, plugs and cables secure and free from damage, machine guards or safety devices operating correctly).	
15 Describe the hand tools used in sheet metal forming activities (such as range of hammers, stakes, formers, sand bags), and typical operations that they are used for.	
16 Describe the various machine tool forming equipment that can be used to produce a range of shapes (such as bends, box sections, cylinders and curved sections, wired edges and swages).	
17 Describe the methods of stretching and shrinking materials, and the tools, equipment and techniques used for this.	
18 Explain how to set up the various machines to produce the required forms (setting up of rolls; setting fingers on bending machines; setting forming tools for swaging).	
19 Describe the ways of limiting distortion, marking, creases, flats (in curved sections).	
20 Describe the characteristics of the various materials used (with regard to the bending and forming process).	

CONTINUED ON PAGE 9

OUTCOME TWO (CONTINUED)

KNOW HOW TO PRODUCE SHEET METAL COMPONENTS AND ASSEMBLIES

Knowledge required You must be able to:	Evidence reference number
21 Explain how the materials are to be prepared for the forming operations, and why some materials may require a heating process prior to forming.	
22 Describe the importance of using tools or equipment only for the purpose intended; the care that is required when using the tools or equipment; the proper way of preserving tools or equipment between operations.	
23 Describe the various methods of securing the assembled components, and the range of mechanical fastening devices that are used (such as nuts and bolts, rivets, screws, special fasteners), resistance and tack welding methods and techniques, adhesive bonding of components and self secured joints (such as knocked up, paned down, swaged and joggled).	
24 Describe the preparations to be carried out on the components prior to assembling them.	
25 Explain how to set up and align the various components, and the tools and equipment that are used for this.	
26 Describe the methods of temporarily holding the joints together to aid the assembly activities (such as clamps, rivet clamps).	
27 Describe the inspection techniques that can be applied to check that shape (including straightness) and dimensional accuracy are to specification and within acceptable limits.	
28 Describe 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.	
29 Explain when to act on your own initiative and when to seek help and advice from others.	
30 Describe the importance of leaving the work area and equipment in a safe and clean condition on completion of the sheet metal activities (such as storing power leads, isolating machines, cleaning the equipment and removing and disposing of waste).	

CANDIDATE DECLARATION

I confirm that all the evidence submitted for this qualification is my own work.

Signature of candidate:

Date:

ASSESSOR DECLARATION

I can confirm that the evidence presented is valid, authentic, current and sufficient within the context of the qualification criteria and demonstrates the candidate's competence across the outcomes claimed.

Signature of assessor:

Name of assessor:

Date:

Internal verifier signature:

Internal verifier name:

Date:

External verifier signature:

External verifier name:

Date: