

PREPARING AND USING MANUAL METAL ARC WELDING EQUIPMENT

LEARNING OUTCOMES

1 Prepare and use manual metal arc welding equipment

2 Know how to prepare and use manual metal arc welding equipment

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

PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

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 Prepare for the manual metal arc welding process by carrying out all of the following: <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 • check the condition of, and correctly connect, welding leads, earthing arrangements and electrode holder • prepare the work area for the welding activities (such as positioning welding screens and fume extraction) • prepare the materials and joint in readiness for welding (such as cleaning of joint faces, grinding weld preparations, setting up the joint, supporting the joint) • make sure that the work area is maintained and left in a safe and tidy condition. 			

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OUTCOME ONE (CONTINUED)

PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
3 Plan the welding activities before you start them.			
4 Obtain and prepare the appropriate welding equipment and welding consumables.			
5 Use manual metal-arc welding and related equipment to include either of the following: <ul style="list-style-type: none"> • alternating current (AC) equipment • direct current (DC) equipment. 			
6 Use two types of electrode from the following: <ul style="list-style-type: none"> • rutile • basic • cellulosic • other suitable electrodes. 			
7 Prepare and support the joint, using the appropriate methods.			
8 Prepare and support the joint, using the appropriate methods.			
9 Weld the joint to the specified quality, dimensions and profile.			
10 Produce three of the following welded joints, of at least 150mm long, using single or multi-run welds (as appropriate), with at least one stop and start included: <ul style="list-style-type: none"> • fillet lap joints • Tee fillet joints • corner joints • butt joints. 			

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OUTCOME ONE (CONTINUED)

PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
11 Produce joints as follows: one type of material from the following: <ul style="list-style-type: none">• carbon steel• stainless steel and one form of material from the following: <ul style="list-style-type: none">• sheet (less than 3mm)• plate• section• pipe/tube• other forms.			
12 Weld joints in good access situations, in two of the following EN ISO 6947 positions: <ul style="list-style-type: none">• Flat (PA)• Horizontal vertical (PB)• Horizontal (PC)• Vertical upwards (PF)• Vertical downwards (PG).			
13 Use appropriate methods and equipment to check the quality, and check that all dimensional and geometrical aspects of the weld are to the specification.			
14 Check that the welded joint conforms to the specification by checking all of the following: <ul style="list-style-type: none">• dimensional accuracy• alignment/squareness• size and profile of weld• number of runs.			

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PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
15 Carry out non destructive testing of the welds, using one of the following: <ul style="list-style-type: none"> • dye penetrant • fluorescent penetrant • magnetic particle. 			
16 Carry out destructive tests on weld specimens, using one of the following: <ul style="list-style-type: none"> • macroscopic examination • nick break test • bend tests (such as face, root or side, as appropriate). 			
17 Identify all of the following weld defects: <ul style="list-style-type: none"> • lack of continuity of the weld • uneven and irregular ripple formation • incorrect weld size or profile Plus four more of the following: <ul style="list-style-type: none"> • undercutting • overlap • inclusions • porosity • surface cracks • internal cracks • lack of fusion • lack of penetration. 			

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OUTCOME ONE (CONTINUED)

PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
<p>18 Produce welded joints which meet all of the following (with reference to BS 4872 Part 1 Weld test requirements):</p> <ul style="list-style-type: none">• welds meet the required dimensional accuracy• fillet welds are equal in leg length and slightly convex in profile, with the size of the fillet equivalent to the thickness of the material welded• the weld contour is linear, of uniform profile, free from excessive undulations, with regular and even ripple formation• the welds are adequately fused, and with minimal undercut, overlap and surface inclusions• weld finishes are built up to the full section of the weld• joins at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface• tack welds are blended in to form part of the finished weld, without excessive hump• corner joints have minimal burn through to the underside of the joint or, where appropriate, penetration is present to a maximum depth of 3mm for at least 75% of the joint• the weld surface is free from cracks, and substantially free from porosity, shrinkage cavities and trapped slag• the weld surface and adjacent parent metal is substantially free from arcing or chipping marks.			

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PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

Performance evidence required You must be able to:	Evidence reference number	Evidence reference number	Evidence reference number
19 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.			
20 Shut down and make safe the welding equipment on completion of the welding activities.			

OUTCOME TWO

KNOW HOW TO PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

Knowledge required You must be able to:	Evidence reference number
1 Describe the safe working practices and procedures to be followed when preparing and using MMA welding equipment (such as general workshop safety; appropriate personal protective equipment; fire prevention; protecting other workers from the effects of the welding arc; safety in enclosed/confined spaces; fume extraction/control).	
2 Describe the hazards associated with MMA welding (such as live electrical components; poor earthing; the electric arc; fumes and gases; spatter; hot slag and metal; grinding and mechanical metal/slag removal; elevated working; welding in enclosed spaces; slips, trips and falls), and how they can be minimised.	
3 Describe the personal protective equipment to be worn for the welding activities (such as correctly fitting overalls; leather aprons, welding gloves/gauntlets; safety boots; head/eye shield with correct shade of filter).	
4 Describe the manual metal arc welding process (such as basic principles of fusion welding, AC and DC power sources, power ranges).	
5 Describe the types of electrodes used, and the correct control, storage and drying of electrodes.	
6 The types of welded joints to be produced (such as lap joints, corner joints, tee joints, butt welds, single and multi-run welds).	
7 Describe the terminology used for the appropriate welding positions.	
8 Explain how to prepare the materials in readiness for the welding activity (such as ensuring that the material is free from excessive surface contamination such as rust, scale, paint, oil/grease and moisture); ensuring that edges to be welded are correctly prepared (such as made flat, square or bevelled).	
9 Explain how to set up and restrain the joint, and the tools and techniques to be used (such as the use of jigs and fixtures, restraining devices - such as clamps and weights/blocks; setting up the joint in the correct position and alignment).	

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KNOW HOW TO PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

Knowledge required You must be able to:	Evidence reference number
10 Describe the tack welding size and spacing in relationship to material thickness.	
11 Describe the checks to be made prior to welding (such as confirming the correct set-up of the joint; condition of electrical connections, welding return and earthing arrangements; checking operating parameters).	
12 Describe the techniques of operating the welding equipment to produce a range of joints in the various joint positions (such as striking and initiating the arc; fine adjustment of parameters; correct manipulation and welding speed of electrode; blending in stops/starts and tack welds).	
13 Explain how to close down the welding equipment safely and correctly.	
14 Explain how to control distortion (such as welding sequence; deposition technique).	
15 Describe the problems that can occur with the welding activities (such as causes of distortion and methods of control; effects of welding on materials and sources of weld defects), and how these can be overcome.	
16 Describe the safe working practices and procedures to be adopted when preparing the welds for examination (such as handling hot materials, using chemicals for cleaning and etching, using equipment to fracture welds).	
17 Explain how to prepare the welds for examination (such as removing slag, spatter and surface irregularities; cleaning the weld, polishing and making saw cuts on welds to be fracture tested).	
18 Explain how to check the welded joints for uniformity, alignment, position, weld size and profile.	
19 Describe the various procedures for visual examination of the welds for cracks, porosity and slag inclusions (such as dye penetrant, fluorescent penetrant; magnetic particle testing).	

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OUTCOME TWO (CONTINUED)

KNOW HOW TO PREPARE AND USE MANUAL METAL ARC WELDING EQUIPMENT

Knowledge required You must be able to:	Evidence reference number
20 Describe the various procedures for carrying out destructive tests on the welds (such as macroscopic examination, bend tests, nick break tests).	
21 Describe the methods of removing a specimen of weld from a suitable position in the joint (such as a stop/start position using a non-thermal process, such as hand saws, power saws, abrasive discs).	
22 Explain how to examine the welds after the tests and check for such things as the degree of penetration and fusion, inclusions, porosity, cracks, undercut and overlap, uneven and irregular ripple formation.	
23 Explain when to act on your own initiative and when to seek help and advice from others.	
24 Describe the importance of leaving the work area and equipment in a safe condition on completion of the welding activities (such as isolation of electrical supplies; safely storing welding cables and electrode holders; storing electrodes; 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: