

# SEMPEO1-17 – SQA Unit Code HH8R 04

## Using semi-automatic MIG or MAG welding equipment



### Overview

This standard covers a range of basic semi-automatic MIG, MAG or flux cored-wire arc welding equipment 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 welding activities by obtaining all the necessary job instructions, materials, tools, equipment and any documentation that may be required. You will also be expected to check the welding equipment and to ensure that all the leads/cables, shielding gas system, hoses and wire feed mechanisms are securely connected and free from damage.

In preparing to weld, you will need to set and adjust the welding conditions, in line with instructions and/or the welding procedure specification. You must operate the equipment safely and correctly, and make any necessary adjustments to settings in line with your permitted authority, in order to produce the welded joints to the required specification. You will need to be able to recognise basic welding defects, to take appropriate action to limit any faults that occur and to ensure that the finished workpiece is within the specification requirements. On completion of the welding activities, you will be expected to return the workholding devices to their designated location, and to leave the welding equipment and 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 semi-automatic MIG/MAG welding 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 semi-automatic MIG/MAG welding techniques and procedures safely. You will understand the MIG/MAG welding process, and its application, and will know about the equipment, materials and consumables used, 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 working with the semi-automatic MIG/MAG welding equipment, and with its associated tools and 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.

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#### **Specific Standard Requirements**

Welded joints must be at least 100mm long, using single or multi-run welds (as appropriate), with at least one stop and start included.

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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 and prepare the appropriate welding equipment and welding consumables
  - P3 prepare and support the joint, using the appropriate methods
  - P4 tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding
  - P5 weld the joint to the required quality, dimensions and profile specified
  - P6 report any difficulties or problems that may arise with the welding activities, and carry out any agreed actions
  - P7 shut down the equipment to a safe condition on conclusion of the welding activities
  - P8 leave the work area in a safe and tidy condition on completion of the welding activities

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### Knowledge and understanding

*You need to know and understand:*

- K1 the safe working practices and procedures to be followed when preparing and using MIG, MAG or flux cored wire arc 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)
- K2 the hazards associated with using MIG, MAG or flux cored-wire arc 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; enclosed spaces; slips, trips and falls), and how they can be minimised
- K3 the personal protective equipment (PPE) 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)
- K4 the correct handling and storage of gas cylinders (such as manual handling and use of cylinder trolley, leak detection procedures, relevant BCGA codes of practice, cylinder identification, gas pressures, cylinder and equipment safety features)
- K5 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
- K6 the major parts of the welding equipment, and their function
- K7 types, selection and application of electrode wires (such as solid and cored)
- K8 reasons for using shielding gases, and the types and application of the various gases
- K9 gas pressures and flow rates (in relation to the type of material being welded)
- K10 the types of welded joints to be produced (such as lap joints, corner joints, tee joints and butt welds)
- K11 terminology used for the appropriate welding positions
- K12 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)
- K13 how to set up and restrain the joint, and the tools and techniques that are 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)
- K14 tack welding size and spacing (in relation to material thickness)
- K15 the techniques of operating the welding equipment to produce a range of

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- joins in the various joint positions (such as fine adjustment of parameters; correct manipulation of the welding gun; blending in stops/starts and tack welds)
- K16 methods/modes of metal transfer and their uses (such as dip, globular, free flight, spray and pulsed)
- K17 how to close down the welding equipment safely and correctly
- K18 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
- K19 how to check the welded joints for uniformity, alignment, position and weld size and profile
- K20 when to act on your own initiative and when to seek help and advice from others
- K21 the importance of leaving the work area in a safe and clean condition on completion of welding activities (such as isolation of electrical supplies, safely storing equipment and consumables, removing and disposing of waste)

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### Additional Information

#### Scope/range related to performance criteria

- You must be able to:*
1. Prepare for the MIG, MAG or flux cored-wire welding process, to include carrying out **all** of the following:
    - 1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
    - 1.2 check the condition and security of welding leads/cables, hoses, shielding gas supply and wire feed mechanisms
    - 1.3 set and adjust the welding conditions/parameters, in accordance with the welding procedure specification
    - 1.4 prepare the work area for the welding activities (such as positioning welding screens and fume extraction)
    - 1.5 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)
  
  2. Use manual/semi-automatic welding and related equipment, to include **one** of the following:
    - 2.1 MIG
    - 2.2 MAG
    - 2.3 other flux cored wire welding equipment
  
  3. Use consumables appropriate to the material and application, to include the following: **one** of the following wire types:
    - 3.1 solid wire
    - 3.2 cored wire

Plus **one** of the following types of shielding gas:

    - 3.3 inert
    - 3.4 active
  
  4. Produce **two** of the following welded joints of at least 150mm long, by single or multi-run (as appropriate), with at least one stop and start included:
    - 4.1 fillet lap joints
    - 4.2 Tee fillet joints
    - 4.3 corner joints
    - 4.4 butt joints

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5. Produce joints in **one** of the following types of material:
  - 5.1 carbon steel
  - 5.2 stainless steel
  - 5.3 aluminium
  
6. Produce welded joints in **one** of the following forms of material:
  - 6.1 plate
  - 6.2 sheet (less than 3mm)
  - 6.3 other forms
  - 6.4 section
  - 6.5 pipe/tube
  
7. Weld joints in good access situations in **one** of the following BS EN ISO 6947 positions:
  - 7.1 Flat (PA)
  - 7.2 Horizontal (PC)
  - 7.3 Vertical downwards (PG)
  - 7.4 Horizontal vertical (PB)
  - 7.5 Vertical upwards (PF)
  
8. Check that the welded joint conforms to the specification, by checking **all** of the following:
  - 8.1 dimensional accuracy
  - 8.2 size and profile of weld
  - 8.3 number of runs
  - 8.4 alignment/squareness
  
9. Produce welded joints which meet **all** of the following: (with reference to BS 4872 Part 1 Weld test requirements)
  - 9.1 welds meet the required dimensional accuracy
  - 9.2 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
  - 9.3 the welds are adequately fused, and there is minimal undercut, overlap and surface inclusions
  - 9.4 joins at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface
  - 9.5 tack welds are blended in to form part of the finished weld, without excessive hump
  - 9.6 the weld surface is free from cracks and substantially free from porosity, shrinkage cavities and trapped slag
  - 9.7 the weld surface and adjacent parent metal is substantially free from arcing or chipping marks

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