SEMPEO2-31 - SQA Unit Code H2M1 04
Preparing and using manual flame brazing and braze welding equipment

Overview

This standard covers a broad range of basic manual flame brazing and braze welding 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 the manual flame brazing or braze welding equipment, and to check that all hoses and equipment are correctly connected, free from leaks or damage, and are ready for use. You will also need to obtain and check that all the workholding equipment required is in a safe and usable condition.

You must operate the equipment safely and correctly, and set and adjust the brazing or braze welding conditions, in line with instructions and safe operating procedures. You will be expected to check the quality of the brazed or braze welded joints by visual examination and destructive testing techniques, as appropriate to the aspects being checked. You will need to be able to recognise brazing or braze 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 brazing or braze welding activities, you will be expected to return all tools, equipment and workholding devices to their designated location, and to leave the brazing or braze 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 brazing or braze welding activities undertaken. You will need to take account of any potential difficulties or problems that may arise with the brazing or braze welding activities, and to seek appropriate help and advice in determining and implementing a suitable solution. 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 manual flame brazing or braze welding techniques safely. You will understand the brazing or braze welding 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 working with the manual flame brazing or braze welding equipment, and with the 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.

Specific Standard Requirements
Brazed or braze welded joints must be at least 100mm long (except for joints in pipe or tube).

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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 plan the brazing or braze welding activities before you start them

P3 obtain and prepare the appropriate manual flame brazing or braze welding equipment and consumables

P4 prepare and support the joint, using the appropriate methods

P5 tack the joint at appropriate intervals, and check the joint for accuracy before final brazing or braze welding

P6 produce the brazed or braze welded joints of the required quality and of specified dimensional accuracy

P7 use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the joint are to the specification

P8 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

P9 shut down and make safe the brazing or braze welding equipment on completion of the activities

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Knowledge and understanding

You need to know and understand:

K1 the safe working practices and procedures to be observed when working with manual flame gas brazing and braze/braze welding equipment (such as general workshop safety; appropriate personal protective equipment; fire and explosion prevention, protecting other workers, safety in enclosed/confined spaces; fume extraction/control)

K2 the hazards associated with flame brazing and braze/braze welding (such as naked flames, explosive gas mixes, oxygen enrichment, fumes and gasses, hot metal, enclosed spaces), and how they can be minimised

K3 the personal protective equipment to be worn for the brazing and braze welding activities (such as correctly fitting overalls; leather aprons, eye protection with the appropriate 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 manual flame brazing and braze welding process (such as basic principles of the process, wetting and capillary flow, deposition of brazed beads, role of fluxes)

K7 types of filler metal and fluxes; forms of filler metal

K8 the types of joints to be produced (such as lap, tee, corner, butt)

K9 setting up and supporting the joint (such as methods of cleaning joint faces; use of jigs and fixtures, restraining devices; self-locating joints; pre-placement of filler metal and flux)

K10 preparing the brazing and braze welding equipment, and the checks to be made to ensure that it is safe and ready to use (such as connection of hoses, torch, flashback arrestors, hose check valves and regulators)

K11 checking hose connections for leaks, and the methods that are used

K12 setting gas working pressures; reading the gauges to establish content and pressures

K13 how to prepare the materials in readiness for the brazing and braze welding activity (such as ensuring that the material is free from surface contamination -such as rust, scale, paint, oil/grease and moisture; ensuring edges to be brazed/braze welded are correctly prepared - such as made flat, square)

K14 the correct use of the torch to produce a range of joints (such as selection of nozzle, adjustment of the flame, application of flux and the correct manipulation of torch and filler wire)

K15 control of heat input to prevent filler material and parent material faults (such as brazing/braze welding sequence; deposition technique)
K16 the safe and correct sequence for shutting down the brazing or braze welding equipment (such as sequence of turning off the gases, extinguishing the flame and closing valves on gas supply/cylinders)
K17 the importance of complying with job instructions and the joining procedure specification
K18 problems that can occur with the joining activities (such as incorrect heat pattern (hot or cold spots); fluxing technique; formation of oxides during the process; distortion of the joint due to overheating), and how these can be overcome
K19 methods of removing flux residues and cleaning the finished joint
K20 the safe working practices and procedures to be adopted when preparing the brazed and braze welded joints for examination (such as handling hot materials, using chemicals for cleaning, using equipment to fracture joints)
K21 how to prepare the joints for examination (such as removing surface irregularities; cleaning and degreasing the brazed or braze welded joint, making saw cuts on joints to be fracture tested)
K22 how to check the brazed or braze welded joints for uniformity, alignment, position, joint size and profile
K23 the various procedures for carrying out destructive tests on the joints (such as macroscopic examination and nick break tests)
K24 how to examine the joints after the tests and check for such defects as the degree of penetration, inclusions, porosity, cracks
K25 when to act on your own initiative and when to seek help and advice from others
K26 the importance of leaving the work area and equipment in a safe condition on completion of the brazing or braze welding activities (such as isolation of gas cylinders; safely storing cylinders, hoses and torches; storing filler rods; 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 manual flame brazing or braze welding process by 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 that hoses, regulators and valves are securely connected and free from leaks and damage
   - 1.3 check/fit the correct size gas nozzle to the torch
   - 1.4 check that a flashback arrestor and check valves are fitted
   - 1.5 set appropriate gas pressures
   - 1.6 use the correct procedure for lighting, adjusting and extinguishing the flame
   - 1.7 use appropriate and safe procedures for handling and storing of gas cylinders (where appropriate)
   - 1.8 prepare the work area for the activities (such as positioning screens and fume extraction equipment)
   - 1.9 prepare the materials and joint in readiness for brazing or braze welding (such as cleaning of joint faces, setting up the joint, supporting the joint)
   - 1.10 make sure the work area is maintained and left in a safe and tidy condition

2. Set up, check, adjust and use **both** of the following manual flame processes and related equipment:
   - 2.1 brazing
   - 2.2 braze welding

3. Use specified consumables appropriate to the parent metals, to include **one** of the following:
   - 3.1 self fluxing rods
   - 3.2 powder/paste flux and rods
   - 3.3 flux coated/impregnated rods

4. Produce joints in **two** of the following materials
   - 4.1 copper to copper
   - 4.2 copper to carbon

4.3 brass to brass
4.4 copper to brass
4.5 other appropriate materials

5. Produce joints in good access situations, covering **two** of the following:
   5.1 lap joints
   5.2 Tee joints
   5.3 corner joints
   5.4 butt joints
   5.5 socket joints

6. Produce joints in the following positions:
   For brazing, use **one** of the following:
   6.1 horizontal flow
   6.2 vertical up flow
   6.3 vertical down flow
   For braze welding, use **one** of the following:
   6.4 flat position
   6.5 horizontal-vertical position

7. Produce joints in **both** of the following:
   7.1 sheet/plate
   7.2 pipe/tube

8. Carry out destructive tests on weld specimens, using **one** of the following:
   8.1 macroscopic examination
   8.2 nick break test

9. Identify **all** of the following brazing and braze welding defects:
   9.1 lack of continuity of the brazed and braze welded joint
   9.2 uneven and irregular ripple formation
   9.3 incorrect joint size or profile
   Plus **three** more of the following:
   9.4 overlap
   9.5 surface cracks
   9.6 inclusions
   9.7 lack of penetration
   9.8 porosity

10. Produce brazed and braze welded components which meet **all** of the following:
    10.1 achieve the specified joint quality
    10.2 meet the required dimensional accuracy within specified tolerance

10.3 are of good appearance, free from flux residues and excess filler metal

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