

SEMFWE3-29 – SQA Unit Code HF32 04

Bonding engineering materials using adhesives



Overview

This standard identifies the competencies you need to undertake the joining of engineering materials using adhesive bonding processes in accordance with approved procedures. You will be required to identify and select suitable or specified bonding agents for the materials to be joined that meet the specified conditions and subsequent operating conditions to be demanded of the joint. Particular attention will be needed in the preparation of the materials and the application of the bonding agent as well as the means of securing the joint until the setting or curing process has been completed so that the finished component meets the level of accuracy required. The adhesive bonding agents used will include impact adhesives, cold curing adhesives, rubber mastic, solvent adhesives, epoxy resins and thermally cured adhesives. The joint will be of two or more materials and may include metallic and/or non-metallic materials and joints of dissimilar materials.

Your responsibilities will require you to comply with organisational policies and procedures, and/or those of the bonding agent manufacturers. You will be expected to seek out the relevant information and to report any problems with the bonding agents, materials or bonding activities that you cannot resolve yourself, or are outside your permitted authority, to the relevant people. You will be expected to work with minimum supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you produce.

Your underpinning knowledge will provide a good understanding of your work, and provide an informed approach to the adhesive bonding activities carried out. You will understand the basic characteristics of the materials to be joined, the bonding agents used and the procedures that go with them in adequate depth to provide a sound basis for carrying out the activities safely and correctly and for achieving a sound and cohesive joint fit for purpose. You will need to understand the precautions required when working with the various bonding agents and safeguards necessary for undertaking the process. You will be required to demonstrate safe working practices throughout, and will understand the responsibilities you owe to yourself and others in the workplace.

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Performance criteria

- You must be able to:*
- P1 work safely at all times, complying with health and safety and other relevant regulations and guidelines
 - P2 follow the relevant bonding procedure specification and job instructions
 - P3 check that the materials to be bonded and bonding agents comply with the specification
 - P4 correctly prepare the parent materials and bonding agents in line with the bonding specification
 - P5 carry out the bonding operations using the specified processes and techniques to position and bond the materials in their correct locations
 - P6 ensure that any equipment used to maintain surface contact during the bonding activities is set up and used correctly
 - P7 achieve bonds of the required quality and within the specified dimensional accuracy
 - P8 deal promptly and effectively with problems within your control and report those that cannot be solved

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Knowledge and understanding

You need to know and understand:

- K1 the specific safety precautions to be taken when bonding engineering materials using adhesives in a fabrication environment (general workshop and site safety, appropriate personal protective equipment (PPE), accident procedure; statutory regulations, risk assessment procedures and COSHH regulations)
- K2 the personal protective clothing and equipment that needs to be worn when carrying out bonding as part of the fabrication activities (such as gloves, eye protection, safety helmets, respiratory protection)
- K3 the importance of good workshop practice and house keeping, ventilation and fume control equipment, first aid procedures and actions, hazardous substances and relevant sections of COSHH
- K4 the correct methods of moving or lifting sheet or plate materials
- K5 the hazards associated with bonding fabricated components and how they can be minimised
- K6 how to obtain the necessary drawings and joining specifications
- K7 how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate British, European or relevant International standards in relation to work undertaken)
- K8 how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
- K9 the material preparations that are required and the equipment and consumables that are used
- K10 the importance of working to organisational and bonding agent manufacturers' instructions whilst carrying out the bonding activities
- K11 the methods and techniques used for bonding the materials (such as gluing, impact, chemical and thermal reaction techniques)
- K12 the basic characteristics of the adhesives that are to be used adhesives
- K13 the use and precautions to be taken when using adhesives and solvents
- K14 maintenance and care of tools and equipment
- K15 methods of degreasing components and producing a keying surface
- K16 type and suitability of adhesives, setting or curing requirements and time, strength and appearance
- K17 common causes of defects associated with the bonding processes and how to avoid them
- K18 the effects of the environment on the bonding process such as temperature, humidity, cleanliness
- K19 how to identify, select, use, and clean, the appropriate bonding agent holding vessels, brushes, stirrers and spatulas, scrapers, knives, clamps and weights

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- K20 the importance of cleaning up after use to ensure everything can be used again and minimising the need for replacement of equipment
- K21 reasons for checking components are assembled in the correct sequence, are positioned dimensionally accurately and to the correct orientation in accordance with the specifications prior to bonding
- K22 how to check that completed joints are firm, sound and fit for purpose
- K23 procedures for cleaning off surplus adhesive and tidying up the appearance of joints
- K24 the problems that can occur with the bonding operations and how these can be avoided
- K25 the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve
- K26 reporting lines and procedures, line supervision and technical experts

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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 adhesive bonding process:
 - 1.1 correctly prepare the materials for bonding
 - 1.2 select the right constituents and bonding methods
 - 1.3 check the surfaces to be bonded mate properly to make a sound joint possible
 - 1.4 ensure the joint is rigidly secure during the curing period
 - 1.5 remove surplus material and clean up at the appropriate time
 2. carry out adhesive bonding activities using **two** of the following types of material:
 - 2.1 metallic
 - 2.2 non-metallic
 - 2.3 combinations
 3. use **two** of the following types of adhesives:
 - 3.1 impact adhesives
 - 3.2 rubber mastic
 - 3.3 epoxy resins
 - 3.4 cold curing adhesives
 - 3.5 solvent adhesives
 - 3.6 thermally cured adhesives
 4. produce bonded joints in **three** of the following types of component:
 - 4.1 flat and flanged joints on flat surfaces
 - 4.2 circular trunking
 - 4.3 flat and flanged joints on curved surfaces
 - 4.4 access flanges, panels and cover plates
 - 4.5 vertical components
 - 4.6 tanks and tank covers
 - 4.7 horizontal components
 - 4.8 pipe work
 - 4.9 rectangular trunking
 5. use a range of bonding equipment and devices to include **four** of the following:
 - 5.1 mixing vessels
 - 5.2 jigs
 - 5.3 presses
 - 5.4 spatulas, brushes, knives
 - 5.5 formers
 - 5.6 weights
 - 5.7 spray equipment

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- 5.8 clamps
- 5.9 temporary fixtures (clips, wiring)
- 6. use a range of preparation and cleaning agents to include **two** of the following:
 - 6.1 detergents
 - 6.2 solvents
 - 6.3 petroleum products
 - 6.4 acids
- 7. produce bonded joints which comply with **all** of the following quality and accuracy standards:
 - 7.1 components are dimensionally accurate and of the correct orientation
 - 7.2 joints meet the required application standard
 - 7.3 completed joints are clean and free from surplus adhesive
 - 7.4 the completed joint has the required appearance

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Developed by	SEMTA
Version number	2
Date approved	December 2011
Indicative review date	December 2016
Validity	Current
Status	Original
Originating organisation	SEMTA
Original URN	29
Relevant occupations	Engineering and manufacturing technologies; engineering; Metal Forming, Welding and Related Trades
Suite	Fabrication and Welding Engineering Suite 3
Key words	engineering, welding, fabrication, bonding, adhesives, metallic components, non-metallic to metallic, epoxy resins, impact adhesives, cold curing adhesives