EWF Guideline
EUROPEAN ADHESIVE BONDER

Minimum Requirements for the Education, Examination and Qualification

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Section I: Minimum Requirements for the Education of European Adhesive Bonder

The use of this guideline is restricted to organisations approved by the Authorised National Body (ANB). The section II of this guideline covers the examination and qualification of European Adhesive Bonders.

ANB is accredited according to EN ISO/CEI 17024

Introduction

This guideline for the European Education and training of Adhesive Bonders has been prepared, evaluated and formulated by Members of the Committee for Education and Training of the EWF. It is designed to provide the basic core education in adhesive technology required for a number of adhesive personnel being active in job functions such as foreman, instruction, technical sales etc. It is possible that additional training and/or experience may be required by the adhesive personnel beyond the basic core education to lead to qualification in the applicable job functions.

A European Adhesive Bonder has industrial experience and can carry out bonding without supervision. He is able to read and understand working instructions and is well informed about production methods concerning bonded products.

The guideline covers the minimum requirements for education and training, agreed upon by all national welding and joining societies within the EWF, in terms of themes, keywords and times devoted to them. It will be revised periodically by the Committee to take into account any changes which may affect the "state of the art". Students having successfully completed this course of education will be expected being capable of applying adhesive technology as covered by this guideline. The subsequent Part II of this document covers the examination and qualification.

The contents are given in the following structure.

Theoretical Education	Teaching hours
1. Fundamentals of Adhesion and Adhesives	1
2. Surface Preparation Before Adhesive Bonding	4
3. The Main Families of Adhesives and Sealants	3
4. Design and Construction of Adhesive Joints	1
5. Quality Control of Bonded Structures	3
6. Durability of Adhesively Bonded Joints	1
7. Benefits and Limitation of Adhesive Bonding Technology	2
8. Health and Safety	1
9. Practical	18
10. Examination	6
Total	40

A teaching hour will contain at least 50 minutes of direct teaching time. It is not obligatory to follow exactly the order of topics given in this guidance and choice in the arrangements of the syllabus is permitted.

It is to be noted that the overall structure of the syllabus for all levels (EAE, EAS and EAB) is similar, but some items are not considered appropriate in the Education of EAB. The depth to which each topic is dealt with is indicated by the number of hours allocated to it in the guideline. This will be reflected in the scope and depth of the examination.

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Adhesive Bonder Course
Theoretical Education - Total 16 hours

1. FUNDAMENTALS OF ADHESIVE AND ADHESIVES 1 Hour

Objective: Understand the separate stages of the bonding process

Definition of terms (see EN 923).

Different steps during the adhesive process.

Description of each step, i.e.:
- Application of the adhesive in the liquid form on the substrate in order to obtain optimal liquid/solid contact.

Expected Result for EAB:

1. Describe the stages of the bonding process.

2. SURFACE PREPARATION BEFORE ADHESIVE BONDING 4 Hours

Objective: Understand the purpose of surface pre-treatment and establish the link with adhesion theories.

Classify of materials as adherends - low energy surfaces/high energy surfaces.

2.1 DIFFERENT STEPS: (WITH A FOCUS ON THE NECESSITY OF THE COURSE)

Degreasing (with solvents, with aqueous alkaline agents).

Mechanical abrasion.

Chemical pre-treatments.

Primers - adhesion promoters.

Physical chemical treatments are introduced, but not explained in great depth

- Corona discharge.
- Plasma.
- Flame treatment.
- Others.

For each step, emphasis will be given on health and safety relating to the use of organic solvents and chemical products.

2.2 DIFFERENT SURFACE PREPARATIONS OF MATERIALS:

Metallic Materials.

Plastic Materials.

Composites.

Others (glass, ceramics, etc).

The different kinds of surface pre-treatments will be given, and examples will show the influence of the pre-treatment on the initial adhesion (specially for thermoplastic materials) and on the durability of the adhesive joint (specially for metallic adherends).

The importance of following the QA procedures for treatment (times, temperatures, control of the composition of solutions etc.) and to show, with examples, the consequences of non compliances.

Expected Result for EAB:

1. Describe the different types of surface pre-treatment
2. Describe the storage of pre-treated surfaces.
3. Understand the health and safety of using the pre-treatment.

3. THE MAIN FAMILIES OF ADHESIVES AND SEALANTS 3 -10 HOURS depending on specific requirements of the course

Objective: Understand/describe the principles of the adhesive types, their processing requirements and storage constraints

Presentation of the different families (without any details on their chemical composition) with emphasis on:

- Their form (films, tapes, liquids, pastes, one-part, two part).

- Processing (application, curing process, gap-filling).

- Mechanical and thermal properties.

- Long term behaviour (influence of temperature, environment).

With emphasis for each chemical family on:

- Storage conditions.
- Health and safety (for their use).
- Influence of environmental parameters on their curing process (temperature, relative humidity, cleanness of the workshop).

Expected Result for EAB:

4. Describe the different adhesive types and their forms
5. Describe the storage.
6. Understand the health and safety of using the adhesive.
7. Understand the effects of environmental factors on the cure.

4. DESIGN AND CONSTRUCTION OF ADHESIVE JOINTS 1 Hour

Objective: Understand the importance of doing the job correctly.

Design principles of bonded structures.

- Considerations unique to adhesives and sealants (compared to welded, spot welded, riveted, screwed structures).
- Design principles.
- Different types of bonded joints (lap, cylindrical and tubular joints).
- Tolerance requirements (related to gap-filling ability of different types of adhesives).
- Types of stress (tensile, shear, peel).
- Influencing factors (overlap length, stiffness of adherends, adhesive-layer thickness, adhesive behaviour, shape of the adhesive fillet).

Expected Result for EAB:

1. Explain the different types of bonded joints
2. Understand the factors influencing the performance of the joint

5. QUALITY CONTROL OF BONDED STRUCTURES 3 Hours

Objective: Understand in detail/understand/explain/describe the use of quality control techniques as applied to bonded structures

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Adherend or substrate prior to adhesive bonding.

- Surface energy: wetting, contact angle measurement.
- Roughness.
- Destructive testing on parallel test pieces (witness specimens) eg. peel tests and wedge cleavage test.

Adhesive (reception and during storage).

- Viscosity.
- Destructive testing on parallel test pieces (witness specimens): eg. peel tests, lap shear tests.

Adhesive (cured) in the bonded structure.

- Destructive testing on parallel test pieces (see above).

Non destructive inspection of the joint.

- Visual inspection (joint appearance, alignment, visible excess of adhesive).
- Tapping.

Expected Result for EAB:

1. Interpret the modes of operation of the principal methods, their advantages and disadvantages when applied to bonded structures.
2. Recognise safely aspects
3. Interpret acceptance standards for imperfections.

6. DURABILITY OF ADHESIVELY BONDED JOINTS 1 Hour

Objective: Understand the influence of environmental factors on bonded joints.

Influence of external parameters on the behaviour of bonded joints:

- Temperature.
- Environment (humidity, water, chemicals, other fluids).
- Mechanical stresses (creep, fatigue, vibrations).

Expected Result for EAB:

1. Understand in general the influence of temperature, environment and stress on bonded joints.
2. Define simple recommendations for protection and minimisation.

7. BENEFITS AND LIMITATION OF ADHESIVE BONDING TECHNOLOGY 2 Hours

Objective: Understand the benefits and limitations of using adhesive bonding

These benefits and limitations will be presented using industrial applications where the adhesive bonding technology will be compared with other assembly techniques.

Expected Result for EAB:

1. Describe the benefits and limitations of bonded assemblies compared with other assembly techniques.

8. HEALTH AND SAFETY 1 Hour

Objective: Understand the health and safety hazards associated with adhesives and associated fabrication processes, including techniques to minimise them.

Health and safety related to surface preparation, applying and curing.

Environmental protection aspects including waste disposal rules and regulations.

Expected Result for EAB:

1. Describe the risks associated with adhesives fumes and skin contact
2. Interpret Health and Safety regulations with respect to the above hazards.
3. Name the risks associated with bonding operations.
4. Describe safe working procedures to ensure the requirements are met.

Adhesive Bonder Course
Practical Training - Total 18 hours

9. PRACTICAL - (18 HOURS)

Surface Pre-treatment of Substrates **5 Hours**

Practical experience of each main surface pre-treatment type on different substrates (as defined in section 2 above).

For each type of surface pre-treatment, the influence of non-respect of the procedure on the quality of the joint will be demonstrated.

Table 1 summarises the basic requirements.

Health and Safety **1 Hour**

The considerations on health and safety, storage conditions, disposal and workshop environment (temperature, humidity, cleanliness etc) will be highlighted.

Use of Different Adhesives **6 Hours**

Storage conditions.

Opening of the pot.

Metering and mixing (for two part adhesives).

Dispensing adhesives (with different viscosities, different "pot-life", different forms), manually or with semi-automatic equipment such as pneumatic guns and cartridges.

Realisation of test specimens (single lap-shear, "pin and collar", peel specimens with different types of adhesives including the calibration of the bond-line thickness, the curing process.

For each type of adhesive used, the influence of not following the correct procedures (metering, mixing, curing) on the quality of the joint will be demonstrated.

Table 2 summarises the basic requirements.

Quality Control of Joints/Testing **5 Hours**

The different methods described for the quality control of the joint (at the different stages of the process) as in section 5 will be practically experienced.

The bonded joints produced on the second day will be tested destructively.

Table 3 summarises the basic requirements.

Safety Instruction **1 Hour**

Table 1 - Surface Pre-treatment of Substrates

Test Pieces for the Practical Exercises						
No.	Hours	Total Hours	Type of Joint	Examples of Surface Preparation	Adhesives	Remarks
1	2 ½	2 ½	Lap joint	Degrease, grit blast, degrease Primers Chemical Treatments (where appropriate)	2 Part Cold Cure: To be decided by the organisation in collaboration with the trainer	A representative cross section of joint types, surface preparation in conjunction with an appropriate adhesive shall be used to assess the candidate. Ensure that laboratory training and reduction to practice in industry are concordant.
2	2 ½	5	Peel joints e.g. bead peel test			
4	1	6	Examination			

Table 2 - The Use of Different Adhesive Systems

Test Pieces for the Practical Exercises						
No.	Hours	Total Hours	Type of Joint	Surface Preparation	Adhesives	Remarks
1	2	2	Lap joint	Degrease, grit blast, degrease	A compulsory core of adhesives shall be used: 2 part cold cure epoxy; 1 part moisture cure PU. Plus a selection from the following to meet the needs of the organisation: • Acrylic • Anaerobic • Cyanoacrylate	A representative cross section of joint types, adhesive systems (including dispensing techniques) shall be used to assess the candidate.
2	2	4	Peel Specimen			
3	1	5	Thread locking			
4	1	6	Examination			

Table 3 - Quality Control of Joints/Testing

Test Pieces for Practical Exercises				
No			Test	Remarks
	Hours	Total Hours		
1	The balance of the specific hours shall be decided by the group in conjunction with the trainer	The balance of the specific hours shall be decided by the group in conjunction with the trainer	Adherend Prior to Bonding	Joints to meet consistent values
2			Adhesive (Reception & Storage)	
3			Cured adhesive	
4			NDT	
5	1	6	Examination	

EXAMINATION - 6 Hours

The examination will take the form of an oral examination, linked to written and practical examination

The final theoretical examination papers shall be multi-choice or essay and will be set under the authority of the Board of Examiners of the ANB, sealed, and opened in the presence of the candidates and Authorised Examiner immediately before the examination begins. The Authorised Examiner must sign all completed papers to confirm that the examination has been conducted in a proper manner.

Appendix 0

Access to the Education:

For entry to the European Adhesive Bonder Course a minimum age of 16 is necessary. Basic skills in material processing are required otherwise a basic training is recommended. Course attendees and teachers shall have a good command of a common language; so that they can successfully participate in instruction and take part in theoretical tests.

SECTION II: EXAMINATION AND QUALIFICATION

1 Introduction

This guideline seeks to achieve harmonisation and common standards in examination and Certification of professional adhesive practitioners in Europe. The national welding and joining organisations, being members of the EWF, mutually acknowledge the Certification awarded in any Member State to European Adhesive Bonders, following examination conducted in accordance with this Guideline.

Education must have followed this EWF guideline "European Adhesive Bonder" section I, and the examination must have been conducted by the national Body authorised by EWF for this purpose.

For the practical tests, the test pieces given in the relevant tables have to be bonded and assessed by the training organisation, supervised by the Authorised Examiner. When not used immediately, the test pieces may be set aside during the period of the course for future reference. Test pieces set aside may be fully assessed if the candidate fails to achieve qualification at a higher level.

The final theoretical examination and practical test must be carried out at a test centre approved by the ANB in accordance with the requirements of this Guideline and, where necessary, also appointed by the contracting parties. An Authorised Examiner shall witness the examination and tests, and approve the test results. The test centre my form part of the training organisation.

This "Authorised National Body" will normally be the National Welding and Joining Organisation, but may be another organisation with the agreement of the EWF Member.

2. Approval of the Training Course

Any training course leading to the EWF examination must be approved by the Authorised National Body. The number of teachers required to give the course shall be sufficient to ensure, that the expert knowledge and industrial experience to cover the syllabus, is adequately represented in the team of teachers and visiting lecturers.

3. Board of Examiners

The Chairman and members of the Board of Examiners shall be nominated by the Authorised National Body. The examining board shall consist of:

a) The Chairman, who shall be a representative of the Authorised National Body, and shall be independent from the training school.

b) Main teachers of the subject.

c) A minimum of one expert from industry or other organisations.

The responsibilities of the Board of Examiners are given in the Doc EWF-416 latest edition

4. Admission to the Examination

Admission to the examination leading to the award of the European Adhesive Bonder certificate will be restricted to those:

a) who fulfil the access conditions defined in this guideline, and

b) who have attended the course, according to this guideline and approved by the Authorised National Body, for at least 90%. Exceptions are at the discretion of the ANB.

5. Examination Procedures

The examination will take the form of an oral examination, linked to written and practical examination.

Theoretical Examination

The final theoretical examination papers shall be multi-choice or essay and will be set under the authority of the Board of Examiners of the ANB, sealed, and opened in the presence of the candidates and Authorised Examiner immediately before the examination begins. The Authorised Examiner must sign all completed papers to confirm that the examination has been conducted in a proper manner.

6. Evaluation of Performance

In order to pass the examination candidates must achieve at least

60% of the maximum possible mark in each subject.

Successfully completed individual parts of the examination remain valid for a period of three years. The examination in all sections shall be completed within a period of three years from start of the course.

7. Re-examination and Appeals Procedure are covered by the Doc. EWF-416 Latest edition

8. European Adhesive Bonder's Diploma

After successful examination a Diploma is awarded to the candidate by the Authorised National Body.

Those qualified as "European Adhesive Bonder" may be called European Adhesive Bonder in the national language and use the professional designation "EAB" (invariable in all member countries).