EWF Guideline
EUROPEAN PLASTICS WELDER

Minimum Requirements for the Education, Training, Examination and Certification

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MINIMUM REQUIREMENTS FOR THE EDUCATION, TRAINING, EXAMINATION AND CERTIFICATION

EWF GUIDELINE

EUROPEAN PLASTICS WELDER

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Definitions and Abbreviations

Approved Training Body (ATB)	Educational establishment for training plastics welding personnel that has been assessed and approved by an ANB.
ECTFE	Ethylene-chlorotrifluoroethylene copolymer.
Electrofusion welding	Semi-automatic welding process concerning a joint between a socket or saddle electrofusion fitting and pipe or fitting with spigotted ends. The electrofusion fittings are heated by the Joule effect of the heating element incorporated at their jointing surfaces, causing the material to melt and the pipe and fitting surfaces to weld.
Extrusion welding	Manual welding process in which an extruder unit with a melting chamber produces extruded filler material that is fed into the joint. The thickness and shape of the joint is determined by a profiled shoe on the end of the extrusion gun. Hot air or inert gas heats the base material simultaneously.
FEP	Fluorinated ethylene propylene copolymer.
Heated wedge welding	Lining membrane welding process in which the membranes to be welded are gripped by rollers which guide and propel the welding machine forward. A heated tool in the form of a wedge, which is heated either electrically or using hot gas, is inserted between the two lining membranes to be welded.
Heated tool welding	Manual or semi-automatic welding process in which the joint surfaces are adequately heated by exposure, through contact or non-contact, to heated elements and are welded under pressure.
High-speed nozzle	Manual welding process in which the welding material is suitably guided and pre-heated, the nozzle tip is provided with a profiled area to apply the welding pressure.
Hot gas welding	Manual welding process in which the materials to be unified are softened by hot air or inert gas and are pressed together.
Invigilator	Qualified person approved by the ANB who can supervise the practical and theoretical tests. The required experience of an invigilator is given in Clause 5 of Section II.
Manual machine	A machine where all welding parameters are set and controlled by the welder (except for temperature, which can be controlled automatically).
Manufacturer	Company, contractor or organisation that is responsible for the welding.
Mx.y	Denotes the module within the schedule covering specific welding processes and materials.
PFA	Perfluoroalkoxy resin.

Plastics Welder	Person making a welded assembly, whose skill and knowledge are two of the determining factors influencing the quality of the welded joint.
Plastics Welding Examiner (PWE)	Qualified person acceptable to the contracting parties who verifies the compliance with this document and who examines according to this schedule. The required experience of a PWE is given in Clause 4 of Section II.
Plastics Welding Instructor (PWI)	Qualified person responsible for the initial assessment and instruction in the safe and correct practical welding skills and/or theoretical knowledge required by the trainee to meet this guideline. The required experience and qualifications of a PWI are given in Clause 3 of Section II.
Px.y	Denotes the practical exercise or training unit to prepare for the practical test.
Examination	Theoretical and practical tests in order to verify the knowledge and the skill of the welder.
Test certificate	A document confirming that an individual has satisfied a defined set of job competence criteria through theoretical and practical tests. Certificates cover a specific area of activity which is stated on the certificate and they are valid for a limited period, which is also stated. The precise conditions for validity and renewal are governed by EN 13067.
Range of approval	Welding processes, types of joint, materials, thicknesses and diameters for which a welder is approved.
Round nozzle	Welding process in which the pressure is applied via the welding material or a suitable attachment such as a pressure roller.
Semi-automatic machine	A machine where at least one of the welding parameters, time or pressure, is set and controlled by an electronic device.
Solvent welding	Manual welding process, which involves the softening of pipe and fitting surfaces by means of a solvent cement, which after curing, dries to leave a welded joint.
Test house	Establishment having all relevant mechanical test equipment to carry out the required tests.
Test piece	Welded assembly which is used in the test.
Test specimen	Part or portion cut from the test piece for the test specified.
Tx.y	Denotes the test piece specification to meet the relevant sub-group approval.
Ux.y	Denotes the theoretical training unit.

Welding Procedure Specification (WPS)	Document providing in detail the required variables for a specific application to assure repeatability.
Welding process - general	Technique characterised by the method of melting or softening thermoplastic materials to obtain a permanent assembly.
Welding Record Sheet	Document providing in detail the variables used for making the weld.

Minimum Requirements for the Education, Training, Examination and Certification of European Plastics Welder

Section I: Minimum Requirements for Education and Training

1. INTRODUCTION

This guideline for the education and training of Plastics Welders has been devised and formulated by a Special Working Group acting on behalf of the EWF General Assembly. It is designed to provide a harmonised scheme for the comprehensive education and training of Plastics Welders. This guideline provides a combination of high skill and the necessary theoretical background, leading to examinations in accordance with EN 13067. Welders successfully completing the examination(s) in specific modules or combinations of modules will be awarded the relevant EWF certificate(s) in accordance with EN 13067.

The guideline covers the range of plastic welding processes and materials covered within EN 13067. A modular format has been designed to accommodate a 'mix and match' approach to suit the variety of needs within the plastics industry.

European Plastics Welders have proven skills in plastics welding and can carry out welding independently. They are able to read and understand working instructions and are well informed about production methods concerning welded products, for both new constructions and repair work.

This guideline covers the recommended minimum requirements for education and training, agreed upon by all national welding and joining organisations 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 that may affect the state-of-the-art. Candidates having successfully completed this course of education will be expected to be capable of applying plastics welding technology as covered by this guideline. The subsequent Section II of this document covers the recommended minimum requirements for examination and certification.

The structure is divided into five modules, to cover the range of welding processes and material. The guideline follows the European Standard (EN 13067 Plastics welding personnel – Qualification testing of welders – Thermoplastics welded assemblies) and welders will achieve certificates in accordance with this standard. Each module will require one theoretical test and then one or more practical tests to approve the candidate for specific sub-groups of materials and/or product forms (i.e. sheet, pipe or lining membrane) for each welding process, Table 1.

Module 1			Module 2			Module 3			Module 4			Module 5		
Welding Process	**Material**	**EN13067 Sub-groups**	**Welding Process**	**Material**	**EN13067 Sub-groups**	**Welding Process**	**Material**	**EN13067 Sub-groups**	**Welding Process**	**Material**	**EN13067 Sub-groups**	**Welding Process**	**Material**	**EN13067 Sub-groups**
Hot gas round nozzle	PVC (sheet) e_n= 5	1.1	Heated tool	PVC (sheet) e_n= 5	1.3	Electrofusion - socket	PP Ø63, SDR ≤17,6	2.7	Solvent Welding	PVC Ø40 and 110 SDR≤21	1.4	Hot gas manual	PVC-P membrane e_n=2	6.1
Hot gas high speed nozzle	PVC (sheet) e_n= 5	1.2	Heated tool	PP (sheet) e_n= 9 or 10	2.3	Electrofusion - socket	PE Ø90≤dn≤125 SDR ≤17.6	3.6	Solvent Welding	PVC Ø≥160 SDR≤21	1.5	Hot gas by machine	PVC-P membrane e_n=2	6.2
Hot gas high speed nozzle	PP (sheet) e_n= 9 or 10	2.1	Heated tool	PP Ø110 SDR≤17,6	2.4	Electrofusion - socket	PE ≥Ø355, SDR ≤17,6	3.7				Heated wedge by hot gas	PVC-P membrane e_n=2	6.3
Extrusion	PP (sheet) e_n= 9 or 10	2.2	Heated tool	PP Ø ≥400, SDR≤17.6	2.5	Electrofusion - saddle	PE ≤Ø63 on 90≤dn≤125, SDR ≤17,6	3.8				Heated wedge electric	PVC-P membrane e_n=2	6.4
Hot gas high speed nozzle	PE (sheet) e_n= 10	3.1	Heated tool - socket	PP Ø63, SDR ≤17.6	2.6							Hot gas manual	PE membrane $2 \le e_n \le 2,5$	7.1
Extrusion	PE (sheet) e_n= 10	3.2	Heated tool	PE (sheet) e_n= 10	3.3							Hot gas by machine	PE membrane $2 \le e_n \le 2,5$	7.2
Hot gas high speed nozzle	PVDF (sheet) e_n= 4	4.1	Heated tool	PE Ø110≤dn≤ 180, SDR ≤17,6	3.4							Heated wedge by hot gas	PE membrane $2 \le e_n \le 2,5$	7.3
Hot gas high speed nozzle	ECTFE, PFA or FEP (sheet) e_n= 2,3	5.1	Heated tool	PE Ø ≥400, SDR≤17.6	3.5							Heated wedge electric	PE membrane $2 \le e_n \le 2,5$	7.4
			Heated tool - socket	PE Ø63, SDR 11	3.9							Extrusion manual	PE membrane $2 \le e_n \le 2,5$	7.5
			Heated tool - saddle	PE Pipe (32 on 90 mm), SDR11	3.10							Hot gas manual	ECB membrane e_n=2	8.1
			Heated tool	PVDF (sheet) e_n= 4	4.2							Hot gas by machine	ECB membrane e_n=2	8.2
			Heated tool	PVDF Ø110, en=5,3	4.3							Heated wedge by hot gas	ECB membrane e_n=2	8.3
			Heated tool - socket	PVDF Ø63, en=3	4.4							Heated wedge electric	ECB membrane e_n=2	8.4
			Heated tool	ECTFE, FEP or PFA	5.2							Hot gas manual	PP membrane $1 \le e_n \le 2$	9.1

												Hot gas by machine	PP membrane $1 \leq e_n \leq 2$	9.2
												Heated wedge by hot gas	PP membrane $1 \leq e_n \leq 2$	9.3
												Heated wedge electric	PP membrane $1 \leq e_n \leq 2$	9.4
												Extrusion manual	PP membrane $1 \leq e_n \leq 2$	9.5

Table 1 Practical Examination Sub-Group in Modules 1 to 5

2. ROUTES TO CERTIFICATION

The structure is divided into five modules to cover the range of welding processes and materials defined in EN 13067. The routes to certification are shown in Figure 1. Each module will require a theoretical test and then one or more practical tests to approve the candidate for specific sub-groups of materials and/or product forms for each welding process.

Candidates may reduce their theoretical education and practical training providing they can show that they have had the relevant practical experience in the processes concerned by submitting an experience checklist.

An example of an experience checklist is shown in Appendix I.

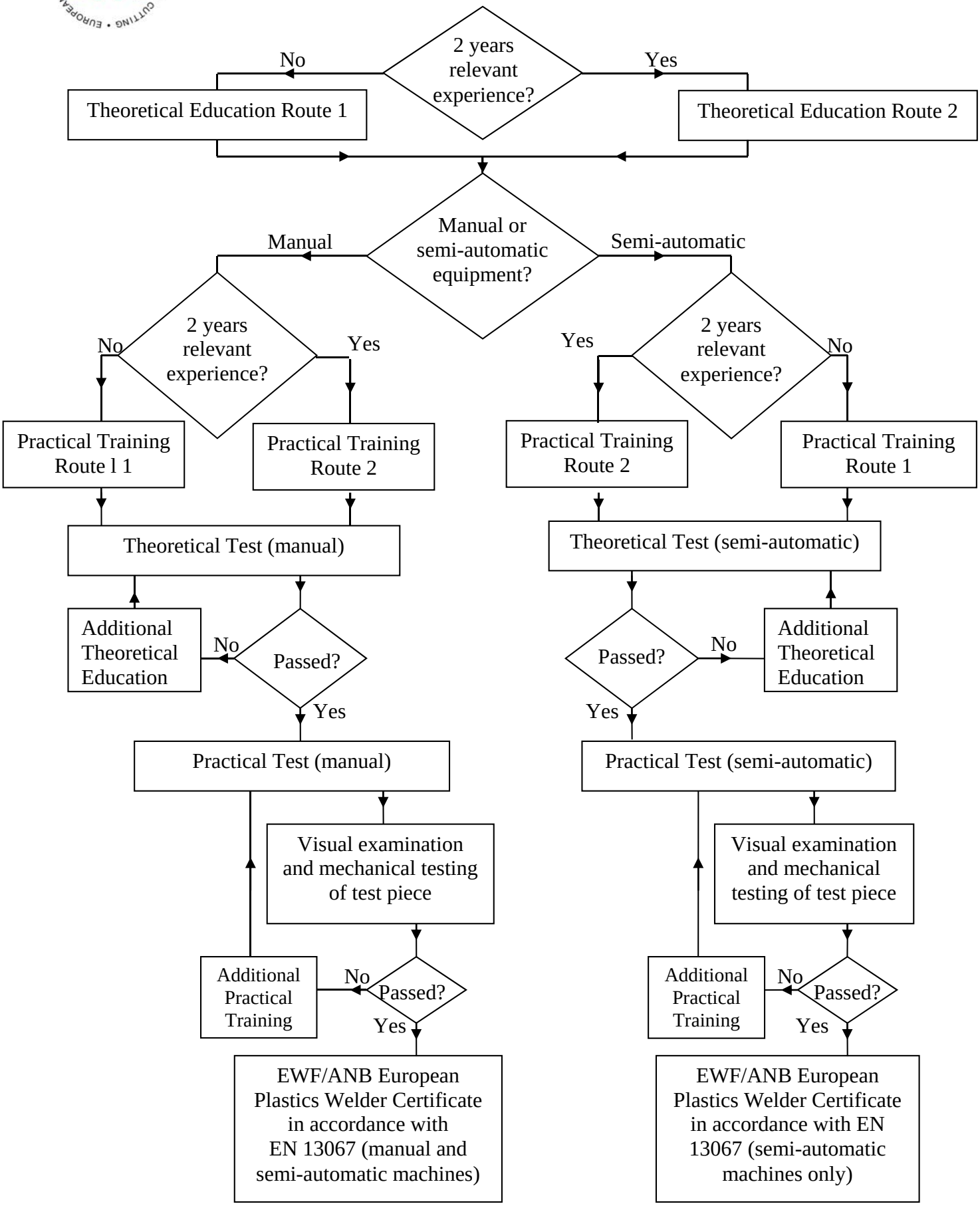


Figure 1 Structure of Plastics Welder training and examination routes

3. ACCESS TO THE COURSE

Entry to the training courses requires suitable physical and mental capability. Candidates should have good command of the course language so they can successfully participate in the instruction part of the course. If this is not the case, refer to IIW OP-14.

4. INSTRUCTION PROGRAMME

The instruction programme consists of theoretical and practical exercises structured through Modules, Fig.1.

The theoretical instruction given to the candidates aims at a basic understanding of the process and the materials behaviour including standards and safety regulations. A 'teaching hour' will contain at least 50 minutes of direct teaching time. Where appropriate, candidates can be trained and tested in various Modules. Since the units on Materials technology and processing of thermoplastics, Health and safety, and Documentation of the theoretical training are common to each module, these theoretical units do not have to be repeated, providing that all of the information for each module is covered.

The practical training provides hands on training by means of demonstration and welding trials. The practical training is designed to simulate production welding applications.

The periods of time given in Tables M1.1 to M5.2 represent the minimum time required to attain the expected level of skill. The actual time needed may vary according to the capability of the candidate.

For each individual training programme it is at the discretion of the PWI to establish the sequence of exercises, both practical and theoretical, to ensure the candidate gains the required skills to enable entry to the tests.

After each training programme, one or more practical tests and one theoretical test are performed once all entry requirements are met. The test pieces to be welded are given by the standard EN 13067; the general rules for the qualification test are given in Section II of this guideline.

5. TRAINING MODULES

The EWF education and training courses for Plastics Welders consists of modules M1, M2, M3, M4 and M5:

M1 Hot Gas and Extrusion Welding

M2 Heated Tool Welding

M3 Electrofusion Welding

M4 Solvent Welding

M5 Welding of Lining Membranes

5.1 MODULE M1 – HOT GAS AND EXTRUSION WELDING

Module 1 provides theoretical education and practical training in hot gas and extrusion welding.

The theoretical education for this module is described in Table M1.1, which contains instruction in plastics materials and then education on hot gas and extrusion welding.

The unit U1.7 is only for those candidates taking the extrusion welding approval test.

Table M1.1 Theoretical units for Module 1 – hot gas and extrusion welding.

U1.1 Materials technology and processing of thermoplastics	**Route 1**	**Route 2**
Objective: Understand and describe the principles of plastic materials and processing of thermoplastics and designation of plastics.	5	2
Scope: Introduction to thermoplastics (PP, PE, PVDF, ECTFE, PTFE relevant to candidate's needs). Abbreviations for plastics. Advantages and disadvantages of plastics. Manufacturing of plastics. Production of plastic sheets, pipes and fittings. Applications of plastics. Principles of plastics welding. Welded joint types and symbols.		
Learning Outcomes: Explain the differences between the various types of plastics. Identify the advantages and disadvantages of various types of plastics over other materials. Know how plastic sheets, pipes and fittings are produced. Describe the designation and marking of products. Describe how plastics weld. Describe the types of welded joints used in plastics fabrication. Identify standard joint symbols.		

U1.2 Basics and applications of hot gas welding	**Route 1**	**Route 2**
Objective: Understand the basics of hot gas welding.	3	1
Scope: Principles of hot gas welding. Procedure for round nozzle and high speed nozzle welding. Effect of material on welding procedure. Joint preparation. Welding parameters. Types of hot gas welding equipment. Influence of weather conditions. Applications of hot gas welding. Type of welding rod. Ancillary equipment. Temperature measurement of gas.		
Learning Outcomes: Describe the hot gas welding process. Explain the correct procedure for hot gas welding of plastic fabrications including joint preparation and finishing. Identify the circumstances where this procedure cannot be used and what shall be done in this event. Understand the effect welding parameters have on weld quality. Describe how the hot gas welding parameters are affected by different base materials.		

Identify when and why hot gas welding is selected. Describe the different nozzle types and when they should be used. Identify the different types of welding rod and explain when they should be used. Explain how to measure the hot gas temperature.

U1.3 Health and Safety	**Route 1**	**Route 2**
Objective: Understand the risks and hazards related with the hot gas welding process and the standard safety procedures.	2	0.5
Scope: Hazard sources. Burns and fires. Fume control. Safe handling of base materials. Basic personal protection. Consequences of misapplying critical welding parameters. Mandatory requirements.		
Learning Outcomes: Explain how to manage fire extinguishers and put out fires. Correctly describe necessary personal protection equipment and how and when it is to be used. Explain how lifting and handling of fabrications is carried out in a safe way. Explain the safety implications of not following the correct welding procedures or incorrect setting of welding parameters. Explain how to use electrical/hand tools safely.		

U1.4 Imperfections in hot gas welded joints	**Route 1**	**Route 2**
Objective: Understand welding imperfections, their origin and influence on the performance of the joint in service in accordance with EN 14728.	2	0.5
Scope: Types of imperfection. Origin of imperfections. Effects of imperfections on performance. Acceptance criteria (eg EN 16296 or equivalent national requirements). Repair procedures.		
Learning Outcomes: Identify different types of imperfections and explain the possible origins. Explain effects of imperfections on joint performance. Correctly describe acceptance criteria and actions to be taken if a weld doesn't meet acceptance criteria. Correctly describe influence of imperfections due to using incorrect welding parameters.		

U1.5 Testing of hot gas welded joints	**Route 1**	**Route 2**
Objective: Understand the various testing methods available for welded joints in accordance with EN12814-1, EN12814-2, and EN13100-1.	1	0.5
Scope: Visual inspection. Bend test. Tensile test. Tensile creep rupture test.		
Learning Outcomes: Explain how to perform visual inspection before and after welding. Describe the bend test in general and the performance criteria. Describe the tensile tests in general and explain the various failure modes.		

U1.6 Documentation for welding	Route 1	Route 2
Objective: Understand the basic documents usually required in quality assurance and control.	1	0.5
Scope: Weld Procedure Specification (WPS). Completing welding reports. Reporting of test results. Awareness of standards (where available).		
Learning Outcomes: Be able to complete written reports and explain electronic reports for weld traceability. Describe the content of the WPS and its essential variables. Discuss the content of reports regarding the quality control of the joints. Describe how welding records should be stored. Basic knowledge of relevant standards.		

U1.7 Basics and applications of extrusion welding *	Route 1	Route 2
Objective: Understand the basics of extrusion welding.	3.5	1.5
Scope: Principles of extrusion welding. Extrusion welding procedure. Joint preparation. Welding parameters. Types of extrusion welding equipment. Applications of extrusion welding. Shoe types. Ancillary equipment. Temperature measurement of gas and extrudate. Types and origins of imperfections in extrusion welds. Acceptance criteria.		
Learning Outcomes: Describe the extrusion welding process. Explain the correct procedure for extrusion welding of plastic fabrications including joint preparation and finishing. Identify the circumstances where this procedure cannot be used and what shall be done in this event. Understand the effect welding parameters have on weld quality. Identify when and why extrusion welding is selected. Describe the different shoe types and when they should be used. Explain how to measure the hot gas and extrudate temperature. Identify different types of imperfections in extrusion welds and explain the possible origins. Correctly describe the acceptance criteria and actions to be taken if a weld does not meet these criteria.		

* This unit is only for those candidates wishing to take the extrusion welding approval test.

The practical training units are given in Table M1.2, and show the minimum time required to train a candidate for entry to the practical test.

Table M1.2 Practical exercises for Module 1 – hot gas and extrusion welding.

Practical Training Unit	Material	Instruction Unit	Minimum time, hours		Entry to following Test Units (EN 13067 sub-groups)
			Route 1	Route 2	
P1.0		Introduction: material identification, equipment, joint preparation	2	1	
P1.1	PP	Hot gas high speed nozzle V, V, X, ⊥	35	4	T1.1 (2.1) T1.2 (3.1)
P1.2	PE	Hot gas high speed nozzle V, V, X, ⊥	35	4	T1.2 (3.1)
P1.3	PVC	Hot gas round nozzle V, V, X, ⊥	35	4	T1.3 (1.1)
P1.4	PVC	Hot gas high speed nozzle V, V, X, ⊥	35	4	T1.4 (1.2)
P1.5	PVDF	Hot gas high speed nozzle V, V, X, ⊥	35	4	T1.5 (4.1)
P1.6	ECTFE or FEP or PFA	Hot gas high speed nozzle V, V, X, ⊥	35	4	T1.6 (5.1)
P1.7	PP	Extrusion	15	2	T1.7 (2.2) T1.8 (3.2)
P1.8	PE	Extrusion	15	2	T1.8 (3.2)

Any single (or groups of) practical training unit(s) in the various materials/processes must be preceded by the introductory unit P1.0 – tailored to the relevant materials/processes.

Candidates for the extrusion welding training (Practical Training Units P1.7 and P1.8), must first demonstrate their capability in hot gas welding (e.g. have achieved hot gas welder approval or have received appropriate hot gas welder training), before receiving the extrusion welding practical training leading to the relevant qualification test.

The training elements will be composed by the training organisation, including appropriate breaks in the practical training to avoid the wrist fatigue possible with hot gas welding.

5.2 MODULE M2 - HEATED TOOL WELDING

Module 2 provides theoretical education and practical training in machine heated tool welding.

The theoretical education for this module is described in Table M1.1, which contains instruction in plastics materials and then education on heated tool welding.

Table M2.1 Theoretical units for Module 2 - heated tool welding

U2.1 Materials technology and processing of thermoplastics	**Route 1**	**Route 2**
Objective: Understand and describe the principles of plastic materials and processing of thermoplastics and designation of plastics.	5	2
Scope: Introduction to thermoplastics (PP, PE, PVDF, ECTFE relevant to candidate's needs). Abbreviations for plastics. Advantages and disadvantages of plastics. Manufacturing of plastics. Production of plastic pipes and fittings (or sheet, if applicable). Applications of plastics. Principles of plastics welding.		
Learning Outcomes: Explain the differences between the various types of plastics. Identify the advantages and disadvantages of various types of plastics over other materials. Know how plastic pipes and fittings and/or sheets are produced. Describe the designation and marking of products. Describe how plastics weld.		

U2.2 Basics and applications of heated tool butt welding	**Route 1**	**Route 2**
Objective: Understand the basics of heated tool butt welding.	3	2
Scope: Principles of heated tool butt welding. Procedure for welding plastic pipes including joint preparation. Welding parameters. Types of heated tool butt welding equipment. Effect of material. Influence of weather conditions. Applications of heated tool butt welding.		
Learning Outcomes: Describe the heated tool butt welding process. Identify the correct procedure for heated tool butt welding of plastics. Identify the circumstances where this procedure cannot be used and what shall be done in this event. Understand the different welding parameters based on the specification. Explain the differences between manual and semi-automatic welding equipment. Describe how plastic material is affected by heated tool welding. Describe when weather conditions are unsuitable and what measures must be taken to continue welding. Identify when and why heated tool butt welding is selected.		

U2.3 Basics and applications of socket and saddle welding*	Route 1	Route 2
Objective: Understand the basics of socket and saddle welding.	1	0.5
Scope: Principles of socket welding. Principles of saddle welding. Joint preparation for socket and saddle welding. Welding parameters. Effect of material. Applications of socket and saddle welding. Influence of weather conditions.		
Learning Outcomes: Describe the socket welding process. Describe the saddle welding process. Explain how the joint preparation is made for the two types of welding. Understand different welding parameters based upon specifications for the two types of welding. Describe how plastic material is affected by heated tool welding. Identify when and why socket or saddle welding is selected. Describe when weather conditions are unsuitable and what measures must be taken to continue welding.		

U2.4 Health and Safety	Route 1	Route 2
Objective: Understand the risks and hazards related with the heated tool welding processes and the standard safety procedures.	2	1
Scope: Hazard sources. Burns and fires. Fume control. Safe handling of pipes and/or sheets. Basic personal protection. Consequences of misapplying critical welding parameters. Mandatory requirements.		
Learning Outcomes: Explain how to prepare a welding site from a safety point of view. Manage fire extinguishers and put out fires. Correctly describe necessary personal protection equipment and how and when it is to be used. Explain how lifting and handling of pipes and/or sheets is carried out in a safe way. Explain the safety implications of not following the correct welding procedures or incorrect setting of welding parameters.		

U2.5 Imperfections in heated tool welded joints	Route 1	Route 2
Objective: Understand welding imperfections, their origin and influence on the performance of the joint in service in accordance with EN 14728.	2	1
Scope: Types of imperfection. Origin of imperfections. Effects of imperfections on performance. Acceptance criteria (eg EN 16296 or equivalent national requirements).		
Learning Outcomes: Identify different types of imperfections from the different welding methods and explain the possible origins. Explain effects of imperfections on joint performance. Correctly describe acceptance criteria and actions to be taken if a weld doesn't meet acceptance criteria.		

Correctly describe influence of imperfections due to using incorrect welding parameters.

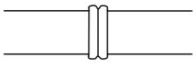
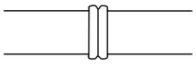
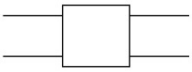
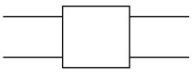
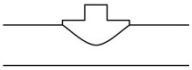
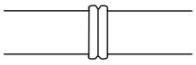
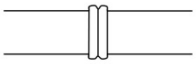
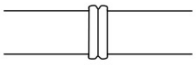
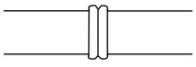
U2.6 Testing of heated tool welded joints	**Route 1**	**Route 2**
Objective: Understand the various testing methods available for welded joints in accordance with EN12814-1, EN12814-2, and EN13100-1.	1	0.5
Scope: Visual inspection. Bend test. Tensile test. Hydrostatic pressure test (where applicable).		
Learning Outcomes: Explain how to perform visual inspection before and after welding. Describe the bend test in general and the performance criteria. Describe the tensile tests in general and explain the various failure modes. Describe the hydrostatic pressure test in general and the performance criteria (where applicable).		

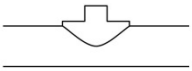
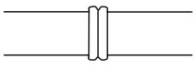
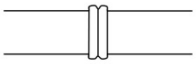
U2.7 Documentation for welding	**Route 1**	**Route 2**
Objective: Understand the basic documents usually required in quality assurance and control.	2	1
Scope: Weld Procedure Specification (WPS). Completing welding reports. Reports from manual and semi-automatic welding. Reporting of test results. Awareness of standards (where available).		
Learning Outcomes: Be able to complete written reports and explain electronic reports for weld traceability. Describe the content of the WPS and its essential variables. Discuss the content of reports regarding the quality control of the joints. Describe how welding records should be stored. Basic knowledge of relevant standards.		

* This unit is only for those candidates wishing to take the socket and saddle welding approval test.

The practical training units are given in Table M2.2, and show the minimum time required to train a candidate for entry to the practical test.

Table M2.2 Practical exercises for Module 2 - heated tool welding.

Practical Training Unit	Material	Instruction Unit	Minimum time, hours		Entry to following Test Units (EN 13067 sub-groups)
			Route 1	Route 2	
P2.0		Introduction: material identification, equipment, joint preparation	2	1	
P2.1	PP or PE pipe (diameter ≤315mm)	Butt manual machine 	3	1	T2.1 (2.4 manual) T2.2 (3.4 manual) T2.11 (2.4 semi-automatic) T2.12 (3.4 semi-automatic)
P2.2	PVDF pipe	Butt manual machine 	3	1	T2.3 (4.3 manual) T2.13 (4.3 semi-automatic)
P2.3	PP or PE pipe	Socket machine 	2	1	T2.7 (2.6) T2.8 (3.9)
P2.4	PVDF pipe	Socket machine 	2	1	T2.9 (4.4)
P2.5	PE pipe	Saddle manual machine 	1	1	T2.10 (3.10 manual) T2.17 (3.10 semi-automatic)
P2.6	PP or PE pipe (diameter >315mm)	Butt manual machine 	3	1	T2.5 (2.5 manual) T2.6 (3.5 manual) T2.15 (2.5 semi-automatic) T2.16 (3.5 semi-automatic)
P2.7	ECTFE or FEP or PFA pipe	Butt manual machine 	3	1	T2.4 (5.2 manual) T2.14 (5.2 semi-automatic)
P2.8	PP or PE pipe (diameter ≤315mm)	Butt semi-automatic machine 	1.5	1	T2.11 (2.4 semi-automatic) T2.12 (3.4 semi-automatic)
P2.9	PVDF pipe	Butt semi-automatic machine 	1.5	1	T2.13 (4.3 semi-automatic)

Practical Training Unit	Material	Instruction Unit	Minimum time, hours		Entry to following Test Units (EN 13067 sub-groups)
			Route 1	Route 2	
P2.10	PE pipe	Saddle semi-automatic machine 	1	1	T2.17 (3.10 semi-automatic)
P2.11	PP or PE pipe (diameter >315mm)	Butt semi-automatic machine 	3	1	T2.15 (2.5 semi-automatic) T2.16 (3.5 semi-automatic)
P2.12	ECTFE or FEP or PFA	Butt semi-automatic machine 	2	1	T2.14 (5.2 semi-automatic)
P2.13	PVC (sheet) e_n = 5 or PVDF (sheet) e_n = 4	Butt semi-automatic machine][	3	1	T2.18 (1.3 semi-automatic) T2.21 (4.2 semi-automatic)
P2.14	PP or PE (sheet) e_n = 9 or 10	Butt semi-automatic machine][	3	1	T2.19 (2.3 semi-automatic) T2.20 (3.3 semi-automatic)

Any single (or groups of) practical training unit(s) in the various materials/processes must be preceded by the introductory unit P2.0 – tailored to the relevant materials/processes.

Training unit, P2.6, on manual equipment for large diameter pipe can only be taken when the candidate has either passed a specific qualification test (T2.1 or T2.2 in Table M2.3 for either PP or PE) or has completed the practical training unit, P2.1, for the smaller diameter pipe and the theoretical education.

Training unit, P2.11, on semi-automatic machines for large diameter pipe can only be taken when the candidate has either passed a specific approval test (T2.1, T2.2, T2.11 or T2.12 in Table M2.3 for either PP or PE) or has completed the practical training unit, P2.1 or P2.8, for the smaller diameter pipe and the theoretical education.

There are two practical training units, P2.13 and P2.14, devoted to training on sheets, leading to separate practical tests in the relevant materials (four sub-groups).

5.3 MODULE M3 - ELECTROFUSION WELDING

Module 3 provides theoretical and skills training in electrofusion welding.

The theoretical education for this module is described in Table M3.1, which contains instruction in plastics materials and then education on electrofusion welding of plastics pipes.

Table M3.1 –Theoretical units for Module 3 - electrofusion welding of plastics pipes

U3.1 Materials technology and processing of thermoplastics	**Route 1**	**Route 2**
Objective: Understand and describe the principles of plastic materials and processing of thermoplastics and designation of plastics.	5	2
Scope: Introduction to thermoplastics (PP, PE, PVDF, ECTFE relevant to candidate's needs). Abbreviations for plastics. Advantages and disadvantages of plastics. Manufacture of plastics. Production of plastic pipe and fittings. Applications of plastics. Principles of plastics welding.		
Learning Outcomes: Explain the differences between the various types of plastics. Identify the advantages and disadvantages of various types of plastics over other pipe materials. Know how plastic pipes and fittings are produced. Describe the designation and marking of products. Describe how plastics weld.		

U3.2 Basics of electrofusion welding	**Route 1**	**Route 2**
Objective: Understand and describe the principles of the electrofusion welding process.	2	1
Scope: Principles of socket and saddle welding. Ancillary equipment. Welding machines and their characteristics. Joint preparations and fit-up. Welding procedures. Setting of appropriate welding parameters.		
Learning Outcomes: Explain the principle of the electrofusion welding process. Describe the characteristics of the welding machines for electrofusion. Describe the typical joint preparations. Explain the welding procedures adopted. Be able to set up the appropriate welding parameters for each joint type.		

U3.3 Application of electrofusion welding	Route 1	Route 2
Objective: Understand and describe the most common application of the electrofusion welding process.	1	0.5
Scope: Effect of material. Selection of socket and saddle welding. Advantages and disadvantages in comparison with heated tool welding. Typical applications: gas, water distribution; other applications.		
Learning Outcomes: Describe the influence of the base material on the weld. Discuss the possible selection of socket or saddle welding. Explain the advantages and disadvantages of the process. Describe the most common applications such as water, gas distribution.		

U3.4 Health and Safety	Route 1	Route 2
Objective: Understand the risks and hazards related with the electrofusion welding process and the standard safety procedures.	2	1
Scope: Hazard sources. Burns and fires. Fume control. Safe lifting/handling. Basic personal protection and related individual safety devices. Consequences of misapplying critical welding parameters. Mandatory requirements.		
Learning Outcomes: Explain how to prepare a welding site from a safety point of view. Manage fire extinguishers and put out fires. Correctly describe necessary personal protection equipment and how and when it is to be used. Explain how lifting and handling of pipes is carried out in a safe way. Explain the safety implications of not following the correct welding procedures or incorrect setting of welding parameters.		

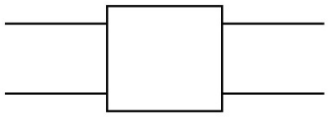
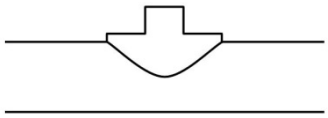
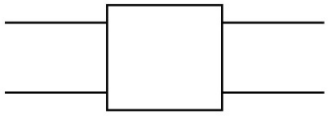
U3.5 Imperfections in electrofusion welded joints	Route 1	Route 2
Objective: Understand welding imperfections, their origin and influence on the performance of the joint in service in accordance with EN14728.	2	1
Scope: Types of imperfection. Origin of imperfections. Effect of imperfections on performance. Acceptance criteria (e.g. EN 16296 or equivalent national requirements).		
Learning Outcomes: Identify different types of imperfections from the different welding methods and explain the possible origins. Explain effects of imperfections on joint performance. Correctly describe acceptance criteria and actions to be taken if a weld doesn't meet acceptance criteria. Correctly describe influence of imperfections due to using incorrect welding parameters.		

U3.6 Testing electrofusion welded joints	Route 1	Route 2
Objective: Understand the destructive and non destructive tests adopted for the quality control of electrofusion welded joints in accordance with EN12814-4, and EN13100-1.	1	0.5
Scope: Visual inspection. Crush test. Peel test. Hydrostatic pressure test (where applicable).		
Learning Outcomes: Explain how to perform visual inspection before and after welding. Describe the crush and peel tests in general and the performance criteria. Describe the hydrostatic pressure test in general and the performance criteria (where applicable).		

U3.7 Documentation for welding	Route 1	Route 2
Objective: Understand the basic documents usually required in quality assurance and control.	2	1
Scope: Weld Procedure Specification (WPS) Completing welding reports. Reports from manual and automatic welding. Reporting of test results. Awareness of standards (where available).		
Learning Outcomes: Be able to complete written reports and explain electronic reports for weld traceability. Describe the content of the WPS and its essential variables. Discuss the content of reports regarding the quality control of the joints. Describe how welding records should be stored. Basic knowledge of relevant standards.		

The practical training units are given in Table M3.2, and show the minimum time required to train an inexperienced candidate for entry to the practical test.

Table M3.2 – Practical exercises for Module 2 - electrofusion welding of plastics pipes.

Practical Training Unit	Material	Instruction Unit	Minimum time, hours		Entry to following Test Units (EN 13067 sub-groups)
			Route 1	Route 2	
P3.0		Introduction: material identification, equipment, joint preparation	2	1	
P3.1	PP or PE pipe (diameter ≤315mm)	Socket 	2.5	1	T3.1 (2.7) T3.2 (3.6)
P3.2	PE pipe	Saddle 	2	1	T3.4 (3.8)
P3.3	PE pipe (diameter >315mm)	Socket 	3	1	T3.3 (3.7)

Training can be conducted in socket or saddle welding individually or combined, but in all cases the introductory unit P3.0 must be included.

Training unit P3.3, on large diameter pipe, can only be taken when the candidate has either passed qualification test T3.2 in Table M3.3 or has completed the practical training unit P3.1, for the smaller diameter pipe and the theoretical education.

5.4 MODULE M4 - SOLVENT WELDING

Module 4 provides theoretical and skills training in solvent welding of plastics pipes.

The theoretical education for this module is described in Table M4.1, which contains instruction in plastics materials and then education on solvent welding of plastics pipes.

Table M4.1 –Theoretical units for Module 4 - solvent welding of plastics pipes

U4.1 Materials technology and processing of thermoplastics	**Route 1**	**Route 2**
Objective: Understand and describe the principles of plastic materials and processing of thermoplastics and designation of plastics.	4	2
Scope: Introduction to thermoplastics (PVC-U, PVC-C, ABS relevant to candidate's needs). Abbreviations for plastics. Advantages and disadvantages of plastics. Manufacture of plastics. Production of plastic pipe and fittings. Applications of plastics. Principles of plastics welding.		
Learning Outcomes: Explain the differences between the various types of plastics. Identify the advantages and disadvantages of various types of plastics over other pipe materials. Know how plastic pipes and fittings are produced. Describe the designation and marking of products. Describe how plastics weld.		

U4.2 Basics of solvent welding	**Route 1**	**Route 2**
Objective: Understand and describe the principles of the solvent welding process.	3	2
Scope: Principles of solvent welding. Solvent cements, primers and cleaners. Ancillary equipment. Joint preparation. Preparation of the pipe and fitting surfaces. Welding procedure. Removal of excess solvent cement. Set and cure times. Influence of ambient conditions.		
Learning Outcomes: Explain the principle of the solvent welding process. Describe the characteristics of the solvent welding equipment, solvent cements, primers and cleaners. Describe the procedure for preparing the pipe, fitting and joint. Explain the welding procedures adopted. Describe what effect ambient conditions have on the welding procedure and the cure time.		

U4.3 Application of solvent welding	Route 1	Route 2
Objective: Understand and describe the most common application of the solvent welding process.	1	0.5
Scope: Effect of material. Typical applications.		
Learning Outcomes: Describe the influence of the base material on the weld. Explain the advantages and disadvantages of the process. Describe the most common applications for solvent welding.		

U4.4 Health and Safety	Route 1	Route 2
Objective: Understand the risks and hazards related with the solvent welding process and the standard safety procedures.	1	0.5
Scope: Hazard sources. Fume control. Safe handling and storage of solvent cements, primers and cleaners. Safe lifting of pipes. Basic personal protection. Consequences of misapplying critical steps within the welding procedure. Mandatory requirements.		
Learning Outcomes: Explain how to prepare a welding site from a safety point of view. Manage fire extinguishers and put out fires. Correctly describe necessary personal protection equipment and how and when it is to be used. Explain how to safely use and store solvent cements, primers and cleaners. Explain how lifting and handling of pipes is carried out in a safe way. Explain the safety implications of not following the correct welding procedures.		

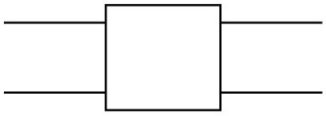
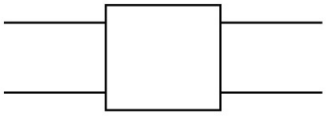
U4.5 Imperfections in solvent welded joints	Route 1	Route 2
Objective: Understand welding imperfections, their origin and influence on the performance of the joint in service.	1	0.5
Scope: Types of imperfection. Origin of imperfections. Effect of imperfections on performance.		
Learning Outcomes: Identify different types of imperfections and explain the possible origins. Explain effects of imperfections on joint performance.		

U4.6 Testing solvent welded joints	Route 1	Route 2
Objective: Understand the destructive and non-destructive tests adopted for the quality control of solvent welded joints.	1	0.5
Scope: Visual inspection. Sectioning of longitudinal cross-sections. Hydrostatic pressure test.		
Learning Outcomes: Explain how to perform visual inspection before and after welding. Describe the procedure for visual inspection of sectioning of longitudinal cross-sections and the acceptance criteria. Describe the hydrostatic pressure test in general and the performance criteria.		

U4.7 Documentation for welding	Route 1	Route 2
Objective: Understand the basic documents usually required in quality assurance and control.	2	1
Scope: Weld Procedure Specification (WPS) Completing welding reports. Reporting of test results. Awareness of standards (where available).		
Learning Outcomes: Be able to complete written reports for weld traceability. Describe the content of the WPS and its essential variables. Discuss the content of reports regarding the quality control of the joints. Describe how welding records should be stored. Basic knowledge of relevant standards.		

The practical training units are given in Table M4.2, and show the minimum time required to train an inexperienced candidate for entry to the practical test.

Table M4.2 – Practical exercises for Module 4 - solvent welding of plastics pipes.

Practical Training Unit	Material	Instruction Unit	Minimum time, hours		Entry to following Test Units (EN 13067 sub-groups)
			Route 1	Route 2	
P4.0		Introduction: material identification, equipment, joint preparation	2	1	
P4.1	PVC-U, PVC-C or ABS pipe (diameter <160mm)	Socket 	2	1	T4.1 (1.4)
P4.2	PVC-U, PVC-C or ABS pipe (diameter ≥160mm)	Socket (machine) 	3	1	T4.2 (1.5)

Training units P4.1 and/or P4.2 must be preceded by the introductory unit P4.0.

5.5 MODULE M5 - WELDING OF LINING MEMBRANES

Module 5 provides theoretical and skills training in welding of lining membranes.

The theoretical education for this module is described in Table M5.1, which contains instruction in plastics materials and then education on welding processes relevant to lining membranes.

Table M5.1 –Theoretical units for Module 5 – welding of lining membranes

U5.1 Materials technology and processing of thermoplastics	**Route 1**	**Route 2**
Objective: Understand and describe the principles of plastic materials and processing of thermoplastics and designation of plastics.	4	1.5
Scope: Introduction to thermoplastics (PP, PE, PVC relevant to candidate's needs). Abbreviations for plastics. Advantages and disadvantages of plastics. Manufacture of plastics. Production of lining membranes. Applications of plastics. Principles of plastics welding.		
Learning Outcomes: Explain the differences between the various types of plastics. Identify the advantages and disadvantages of various types of plastics over other lining membrane materials. Know how lining membranes are produced. Describe how plastics weld.		

U5.2 Basics of hot gas and extrusion welding	**Route 1**	**Route 2**
Objective: Understand and describe the principles of the hot gas and extrusion welding processes and their typical applications.	3	1
Scope: Principles of hot gas and extrusion welding. Ancillary equipment. Welding machines and their characteristics. Joint preparation. Welding procedures. Setting of appropriate welding parameters.		
Learning Outcomes: Explain the principles of the hot gas and extrusion welding processes. Describe the characteristics of the welding machines for hot gas and extrusion welding. Describe the correct joint preparation procedure. Be able to set the appropriate welding parameters. Explain the correct procedures for hot gas and extrusion welding. Identify the circumstances where these procedures cannot be used and what shall be done in this event. Understand the effect welding parameters have on weld quality. Explain how to measure the gas and extrudate temperature.		

U5.3 Basics of heated wedge welding	Route 1	Route 2
Objective: Understand and describe the most common application of the heated wedge welding process.	1.5	0.5
Scope: Principles of heated wedge welding. Hot gas and electric wedge welding equipment. Setting the appropriate welding parameters.		
Learning Outcomes: Explain the principle of the heated wedge welding process. Describe the characteristics of the welding equipment. Explain the welding procedure. Identify the circumstances where this procedure cannot be used and what shall be done in this event. Be able to set the appropriate welding parameters. Understand the effect welding parameters have on weld quality.		

U5.4 Site working/ Health & Safety	Route 1	Route 2
Objective: Understand the procedures, risks and hazards related with the welding and handling of lining membranes on site.	2	1
Scope: Storage of materials. Cleaning procedures. Weather protection. Subgrade acceptance. Hazard sources, including burns and fire/explosion hazards. Safe lifting/handling of lining membranes. Basic personal protection. Consequences of misapplying critical welding parameters. Mandatory requirements.		
Learning Outcomes: Explain how to prepare for welding on site from a safety point of view. Explain when it is dangerous to carry out welding. Correctly describe necessary personal protection equipment and how and when it is to be used. Explain how lifting and handling of lining membrane is carried out in a safe way. Explain the safety implications of not following the correct welding procedures or incorrect setting of welding parameters.		

U5.5 Imperfections in welded joints in lining membranes	Route 1	Route 2
Objective: Understand welding imperfections, their origin and influence on the performance of the joint in service.	1.5	0.5
Scope: Types and origins of imperfection. Effect of imperfections on performance. Acceptance criteria (e.g. EN 16296 or equivalent national requirements). Repair procedures.		
Learning Outcomes: Identify different types of imperfections from the different welding methods and explain the possible origins. Explain effects of imperfections on joint performance. Correctly describe acceptance criteria and actions to be taken if a weld doesn't meet acceptance criteria. Correctly describe influence of imperfections due to using incorrect welding parameters.		

U5.6 Testing welded joints in lining membranes	Route 1	Route 2
Objective: Understand the destructive and non destructive tests adopted for the quality control of welded joints in lining membranes (e.g. EN12814-4, and EN13100-1).	1.5	0.5
Scope: Visual inspection. Peel test. Shear test. Pressure test. Spark test. Vacuum box test.		
Learning Outcomes: Explain how to perform visual inspection before and after welding. Describe the peel and shear tests in general and the performance criteria. Explain how to perform the various non-destructive tests and the performance criteria.		

U5.7 Documentation for welding	Route 1	Route 2
Objective: Understand the basic documents usually required in quality assurance and control.	1	0.5
Scope: Weld Procedure Specification (WPS) Completing welding reports. Reporting of test results. Awareness of standards (where available).		
Learning Outcomes: Be able to complete written reports for weld traceability. Describe the content of the WPS and its essential variables. Discuss the content of reports regarding the quality control of the joints. Describe how welding records should be stored. Basic knowledge of relevant standards.		

The practical training units are given in Table M5.2, and show the minimum time required to train an inexperienced candidate for entry to the practical test.

Table M5.2 – Practical exercises for Module 5 – welding of lining membranes.

Practical Training Unit	Material	Instruction Unit	Minimum time, hours		Entry to following Test Units (EN 13067 sub-groups)
			Route 1	Route 2	
P5.0		Introduction: material identification, equipment, joint preparation	2 (1)	1	
P5.1	PVC-P	Hot gas manual	15 (2)	2	T5.1 (6.1)
P5.2	PE or PP	Hot gas manual	15 (2)	2	T5.5 (7.1) T5.14 (9.1)
P5.3	PE, PVC-P, ECB or PP	Hot gas by machine	8 (2)	2	T5.2 (6.2) T5.6 (7.2) T5.11 (8.2) T5.15 (9.2)
P5.4	PE or PVC-P or ECB or PP	Heated wedge by hot gas	8 (2)	2	T5.3 (6.3) T5.7 (7.3) T5.12 (8.3) T5.16 (9.3)
P5.5	PE or PVC-P or ECB or PP	Heated wedge electric	8 (2)	2	T5.4 (6.4) T5.8 (7.4) T5.13 (8.4) T5.17 (9.4)
P5.6	PE	Extrusion manual	15 (2)	2	T5.9 (7.5)
P5.7	ECB	Hot gas manual	15 (2)	2	T5.10 (8.1)
P5.8	PP	Extrusion manual	15 (2)	2	T5.18 (9.5)

Any single (or group of) practical training unit(s) in the various materials/processes must be preceded by the introductory unit P5.0 – tailored to the relevant materials/processes.

Section II: Minimum Requirements for Examination and Certification

1. INTRODUCTION

This part of the guideline seeks to achieve harmonisation and common standards in examination and certification of professional Plastics Welders. The national welding and joining organisations, being members of the EWF, mutually acknowledge the Certification awarded by any Authorised National Body (ANB) approved to implement this Guideline.

Education must have followed Section I of this EWF guideline, and the examination must have been conducted by the ANB.

The training and examinations must be carried out at organisation(s) approved by the ANB in accordance with the requirements of this Guideline, Doc. EWF-416, and EN 13067. A Plastics Welding Examiner (PWE) or Invigilator shall witness all examinations and a PWE shall assess all examinations.

2. APPROVAL OF THE TRAINING COURSE

Training courses leading to the EWF qualification test must be approved by the Authorised National Body, in accordance with Doc. IAB-001.

3. PLASTICS WELDING INSTRUCTOR

A Plastics Welding Instructor (PWI) must have:

- A minimum of three years welding experience relevant to the training module.
- Teaching ability - evidence of pedagogic training in lecturing/teaching.
- Passed the relevant qualification test(s) for which they will be instructing. If an instructor has passed the qualification test in a key category he/she can instruct in more than one category, see below:

Test	Practical Instruction Units
PP hot gas high speed nozzle	P1.1, P1.2
PVC hot gas high speed nozzle	P1.1, P1.2, P1.3, P1.4
PVDF hot gas high speed nozzle	P1.1, P1.2, P1.3, P1.4, P1.5, P1.6
PP extrusion	P1.7, P1.8
PVC-P heated wedge by hot gas	P5.3, P5.4, P5.5
PE heated tool, Sub-group 3.5	P2.1, P2.4, P2.6, P2.8

- Approval of the ANB to undertake the training modules.

The PWI for the theoretical training and practical training does not necessarily have to be the same person.

4. PLASTICS WELDING EXAMINER

The Plastics Welding Examiner (PWE) is a person approved by the ANB on the recommendation of the relevant Board of Examiners to comply with the requirements given in Doc. IAB-001. The Board of Examiners must specify the range of modules/tests/sub-groups the PWE is approved to examine, with due recognition of their experience. The PWE must have a minimum of five years of experience in plastics welding, knowledge of relevant standards (e.g. EN 13067, EN 13100-1), and familiarity

with the EWF qualification/certification system. It is not necessary for the PWE to have passed relevant qualification tests him/herself.
The duties of the PWE are to:

- Check the identity of the candidate and the approval of the test house and training centre (ATB).
- Check the materials, WPS, machines and equipment available for the practical test.
- Supervise the theoretical test.
- Supervise the welding of the test piece.
- Visually check the test piece after completion by the candidate.
- Select test pieces for the specified mechanical test at an approved test house.
- Mark the test piece selected for testing with the number or mark of the PWE and the candidate.
- Terminate the test if the welding conditions are not in compliance with the WPS or the candidate does not have the skill required to obtain a satisfactory result.
- Evaluate the mechanical test results.

The PWE shall not examine any candidate that they have trained themselves and shall make their professional decisions independently.

5. INVIGILATOR

The Invigilator is a person approved by the ANB on the recommendation of the relevant Board of Examiners to comply with the requirements given in Doc. IAB-001. The Board of Examiners must specify the range of modules/tests/sub-groups the Invigilator is approved to supervise, with due recognition of their experience. The Invigilator must have a minimum of five years of experience in plastics welding, knowledge of relevant standards (e.g. EN 13067, EN 13100-1), and familiarity with the EWF qualification/certification system. It is not necessary for the Invigilator to have passed relevant qualification tests him/herself.

The duties of the Invigilator are to:

- Check the identity of the candidate and the approval of the test house and training centre (ATB).
- Check the materials, WPS, machines and equipment available for the practical test.
- Supervise the theoretical test.
- Supervise the welding of the test piece.
- Mark the test piece with the number or mark of the Invigilator and the candidate.
- Terminate the test if the welding conditions are not in compliance with the WPS or the candidate does not have the skill required to obtain a satisfactory result.
- Forward the theoretical test papers and practical test pieces and relevant paperwork to the PWE.

6. ADMISSION TO THE EXAMINATION

Admission to the examination leading to the award of the European Plastics Welder certificate will be restricted to those who have successfully completed the relevant course(s).

The maximum period of time between completing the training course and completing the associated examination shall be three years.

7. EXAMINATION PROCEDURES

The examination comprises both theoretical and relevant practical part(s).

Theoretical Test

The theoretical test paper following each theoretical module shall consist of at least 20 multiple-choice questions and will be set under the authority of the Board of Examiners of the ANB. The theoretical test paper shall include at least one question from each theoretical training unit in the Module(s) being examined. Where appropriate, candidates can be tested in various Modules. For candidates that

wish to take the examination in Modules 2 and 3, a combined theoretical test, with a total of at least 20 multiple-choice questions, is sufficient.

The PWE shall sign all completed papers to confirm that the test has been conducted in a proper manner.

Practical Test

The candidate shall weld the required test piece for each test unit (Tables M1.3, M2.3, M3.3, M4.3 and M5.3) under the supervision of the PWE or Invigilator, and shall complete the welding record sheet(s) controlled and witnessed by the PWE or Invigilator.

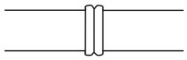
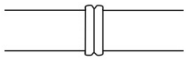
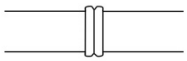
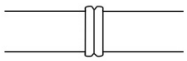
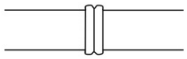
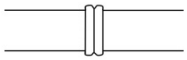
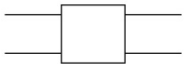
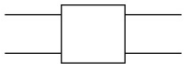
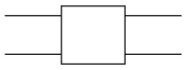
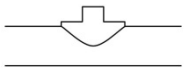
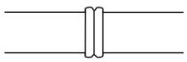
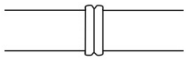
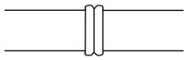
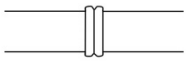
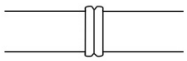
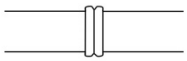
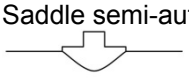
Candidates may take one or more practical tests.

Practical tests can only be completed following completion by the candidate, of the relevant practical training element. The only exceptions are that the test for hot gas welding of PE can be taken following the hot gas practical welder training of PP and the test for extrusion welding of PE can be taken following the extrusion practical welder training of PP. (The reverse is not possible).

Table M1.3 Test units for Module 1 – hot gas and extrusion welding of plastic.

Test Unit	Material	Weld process/form	Sheet thickness	EN 13067 sub-group
T1.1	PP	Hot gas high speed nozzle Double V-butt	9-10mm	2.1
T1.2	PE	Hot gas high speed nozzle Double V-butt	10mm	3.1
T1.3	PVC	Hot gas round nozzle V-butt	5mm	1.1
T1.4	PVC	Hot gas high speed nozzle V-butt	5mm	1.2
T1.5	PVDF	Hot gas high speed nozzle V-butt	4mm	4.1
T1.6	ECTFE or PFA or FEP	Hot gas high speed nozzle V-butt	2.3mm	5.1
T1.7	PP	Extrusion V-butt	9-10mm	2.2
T1.8	PE	Extrusion V-butt	10mm	3.2

Table M2.3 Test units for Module 2 - heated tool welding of plastic

Test Unit	Material	Weld form	Type of product	EN 13067 sub-group
T2.1	PP	Butt manual machine 	Pipe 110mm diameter, SDR≤17.6	2.4 manual
T2.2	PE	Butt manual machine 	Pipe 110-180mm diameter, SDR≤17.6	3.4 manual
T2.3	PVDF	Butt manual machine 	Pipe 110mm diameter, 5.3mm wall	4.3 manual
T2.4	ECTFE or PFA or FEP	Butt manual machine 	Pipe 110mm diameter, 3mm wall	5.2 manual
T2.5	PP	Butt manual machine 	Pipe ≥400mm diameter, SDR ≤17.6	2.5 manual
T2.6	PE	Butt manual machine 	Pipe ≥400mm diameter, SDR ≤17.6	3.5 manual
T2.7	PP	Socket machine 	Pipe 63mm diameter, SDR≤17.6	2.6
T2.8	PE	Socket machine 	Pipe 63mm diameter, SDR11	3.9
T2.9	PVDF	Socket machine 	Pipe 63mm diameter, 3mm wall	4.4
T2.10	PE	Saddle manual machine 	Pipe 32 on 90mm diameter, SDR11	3.10 manual
T2.11	PP	Butt semi-automatic machine 	Pipe 110mm diameter, SDR≤17.6	2.4 semi-automatic
T2.12	PE	Butt semi-automatic machine 	Pipe 110-180mm diameter, SDR≤17.6	3.4 semi-automatic
T2.13	PVDF	Butt semi-automatic machine 	Pipe 110mm diameter, 5.3mm wall	4.3 semi-automatic
T2.14	ECTFE or PFA or FEP	Butt semi-automatic machine 	Pipe 110mm diameter, 3mm wall	5.2 semi-automatic
T2.15	PP	Butt semi-automatic machine 	Pipe ≥400mm diameter, SDR ≤17.6	2.5 semi-automatic
T2.16	PE	Butt semi-automatic machine 	Pipe ≥400mm diameter, SDR ≤17.6	3.5 semi-automatic
T2.17	PE	Saddle semi-automatic machine 	Pipe 32 on 90mm diameter, SDR11	3.10 semi-automatic

Test Unit	Material	Weld form	Type of product	EN 13067 sub-group
T2.18	PVC	Butt semi-automatic machine][	Sheet thickness 5 mm	1.3 semi-automatic
T2.19	PP	Butt semi-automatic machine][	Sheet thickness 9 or 10 mm	2.3 semi-automatic
T2.20	PE	Butt semi-automatic machine][	Sheet thickness 10 mm	3.3 semi-automatic
T2.21	PVDF	Butt semi-automatic machine][	Sheet thickness 4 mm	4.2 semi-automatic

Table M3.3 Test pieces for Module 3 - electrofusion welding of plastics pipes.

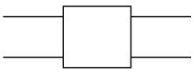
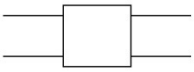
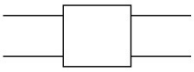
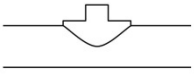
Test Unit	Material	Weld form	Type of product	EN 13067 sub-group
T3.1	PP	Socket 	Pipe 63mm diameter, SDR≤17.6	2.7
T3.2	PE	Socket 	Pipe 90-125mm diameter, SDR≤17.6	3.6
T3.3	PE	Socket 	Pipe ≥355mm diameter, SDR≤17.6	3.7
T3.4	PE	Saddle 	Pipe ≤63mm on 90-125mm diameter, SDR≤17.6	3.8

Table M4.3 Test pieces for Module 4 – solvent welding of plastics pipes.

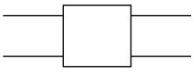
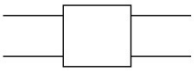
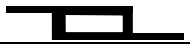
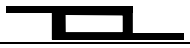
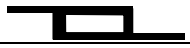
Test Unit	Material	Weld form	Type of product	EN 13067 sub-group
T4.1	PVC-U, PVC-C or ABS	Socket 	Pipe 40mm and 110mm diameter, SDR≤21	1.4
T4.2	PVC-U, PVC-C or ABS	Socket (machine) 	Pipe ≥160mm, SDR≤21	1.5

Table M5.3 Test pieces for Module 5 – welding of lining membranes.

Test Unit	Material	Weld process	Weld form	Lining membrane thickness	EN 13067 sub-group
T5.1	PVC-P	Hot gas manual		2mm	6.1
T5.2	PVC-P	Hot gas by machine		2mm	6.2
T5.3	PVC-P	Heated wedge by hot gas		2mm	6.3
T5.4	PVC-P	Heated wedge electric		2mm	6.4
T5.5	PE	Hot gas manual		2-2.5mm	7.1
T5.6	PE	Hot gas by machine		2-2.5mm	7.2
T5.7	PE	Heated wedge by hot gas		2-2.5mm	7.3
T5.8	PE	Heated wedge electric		2-2.5mm	7.4
T5.9	PE	Extrusion manual		2-2.5mm	7.5
T5.10	ECB	Hot gas manual		2mm	8.1
T5.11	ECB	Hot gas by machine		2mm	8.2
T5.12	ECB	Heated wedge by hot gas		2mm	8.3
T5.13	ECB	Heated wedge electric		2mm	8.4
T5.14	PP	Hot gas manual		1-2mm	9.1
T5.15	PP	Hot gas by machine		1-2mm	9.2
T5.16	PP	Heated wedge by hot gas		1-2mm	9.3
T5.17	PP	Heated wedge electric		1-2mm	9.4
T5.18	PP	Extrusion manual		1-2mm	9.5

If difficulties arise during the welding of a test piece, not caused by the candidate, the test may be repeated using a new test piece, upon approval of the PWE or Invigilator.

Errors made or occurring during the hot gas or extrusion welding may be repaired only after permission has been given by the PWE or Invigilator. This repair shall be duly noted by the PWE or Invigilator on the WPS.

All welded test pieces shall be made in accordance with EN 13067 and shall be subjected to visual examination. In order to obtain a certificate to EN 13067 the welded test pieces shall also be subjected to the destructive tests in accordance with EN 13067.

Candidates trained on a manual heated tool machine may enter examinations for manual or semi-automatic machines. A pass on a manual heated tool machine also qualifies the candidate for semi-automatic welding.

Candidates trained on semi-automatic heated tool machines may only enter examinations for semi-automatic heated tool machines, which will qualify them for welding using semi-automatic machines BUT NOT manual machines.

8. EVALUATION OF TEST RESULTS

The evaluation of test results shall be in accordance with EN 13067. Visual examination shall be carried out in accordance with EN 13100-1 and EN 14728.

9. RE-EXAMINATION AND APPEALS PROCEDURE

These are covered by the latest version of Doc. EWF-416.

10. EUROPEAN PLASTICS WELDER CERTIFICATE AND IDENTITY CARD

After successful practical and theoretical tests a certificate (and identity card), endorsed for the relevant sub-group is awarded to the candidate by the ANB.

The Test Certificate and identity card shall be issued in at least one of the official CEN languages (English, French or German) and shall contain at least the following information:

- Welder's full name.
- Date, place and country of birth.
- Clear photograph of good likeness.
- Reference to EN 13067 and the group of materials and sub-group number(s) of examination passed.
- Date of overall examination pass.
- Date of issue.
- Date of validity.
- ANB (full name and address)
- Individual certificate identification number according to Doc. EWF-416.

Those approved as 'European Plastics Welder' may be called European Plastics Welder in the national language and use the professional designation 'EPW' (invariable in all member countries). This professional designation must be accompanied by the relevant range of qualification.

The template for the Test Certificate is shown in Appendix II. An example of an Identity Card is shown in Appendix III.

11. PERIOD OF VALIDITY OF CERTIFICATION

11.1 INITIAL CERTIFICATION

The validity of the welder's certification begins from the date when all necessary tests have been passed. This date may be different to the date of issue marked on the certificate.

11.2 CONFIRMATION OF VALIDITY

A welder's certification shall remain valid for a period of two years providing the following conditions are fulfilled:

a. The welder shall be engaged with reasonable continuity on welding work within the range of approval corresponding to the test certificate. An interruption period longer than six months is not permitted;

b. There shall be no specific reason to question the welder's skill and knowledge;

c. Annually the manufacturer shall establish that the welder's quality is in accordance with the technical conditions for which the test certificate is awarded.

11.3 PROLONGATION OF CERTIFICATION

Prolongation is only allowed when the ANB is advised before expiry of the period of initial certification.

Prolongation is only allowed when proof of welding quality is available to the ANB who accepts that this is the case.

The validity within the range of certification is extended under the original certification for a further two years provided the conditions in 11.2 are fulfilled. When this prolongation expires a new examination is required.

12. TEST CERTIFICATE RENEWAL

An examination must be taken within three months before the expiry date of the test certificate to continue the validity of certification.

13. TRANSITION ARRANGEMENTS

An ANB can offer Transitional Arrangements for a period of up to three years from the implementation of the guideline by the ANB.

Practising Plastics Welders will be eligible for the award of the Test Certificate if they have passed a theoretical and practical test in accordance with this guideline or an examination under equivalent technical conditions.

Certificates may be awarded under Transitional Arrangements in the following cases:

a) By the ANB in the country in which the applicant received their national plastics welding certificate, or

b) By the ANB in the country in which the applicant is currently practising, in contact with the ANB of the country that issued the original national plastics welding certificate.

APPENDIX I

EXAMPLE OF EXPERIENCE CHECKLIST

EWF PLASTICS WELDER
EXPERIENCE CHECKLIST

Personal Details

Name of Applicant:	Date of Birth:
Current Employer Company name: Contact name: Tel. no:	Previous Employer (if within the last 2 years) Company name: Contact name: Tel. no:

Work Experience

*Please note that to qualify as an experienced welder you must demonstrate having **at least two years experience or have completed an apprenticeship** in the relevant welding technique(s).*

Welding Technique	No. of Years Experience	Pipe/Sheet Materials Installed	Pipe/Sheet Sizes Installed
Hot gas round nozzle			
Hot gas high speed nozzle			
Extrusion			
Heated tool butt			
Heated tool socket			
Heated tool saddle			
Electrofusion socket			
Electrofusion saddle			
Solvent			
Hot gas heated wedge			
Electric heated wedge			

I declare all the information given in this form is correct and true to the best of my knowledge.

Signature of Applicant_____Date:_____

Verified by representative from current employer:

Authorised Signature (Director/Manager) _____

Print Name_____

Position in Company_____

APPENDIX II

TEMPLATE FOR EWF TEST CERTIFICATE

Test Certificate

EN 13067: Plastics Welding Personnel - Qualification Testing of Welders – Thermoplastics Welded Assemblies

Certificate No:

Photograph of welder (if Identity Card is not issued)

This is to certify that

[Name of Welder]

[Date and Place of Birth]

has demonstrated proficiency as a European Plastics Welder in accordance with the requirements published in Document No EWF-XXX and amendments in force on the date of the examination. This certificate is valid for the special categories mentioned below:

[list of categories passed]

Date of issue:
Date of overall pass:
Date of expiry:

Examiner: [Title and full name] Signed:

PLEASE READ THE NOTES OVERLEAF | PHOTOCOPIES ARE UNAUTHORISED

Issued by :
[ANB]

Title and full name

ANB Chief Executive

(REVERSE OF TEST CERTIFICATE)

THIS IS A VALUABLE DOCUMENT WHICH SHOULD BE KEPT IN A SAFE PLACE. A FEE WILL BE CHARGED FOR DUPLICATES.

NOTES:

1. Some authorities require additional reassurance concerning equipment, quality of supervision and working conditions before permitting the use of a certificate holder on their work, which is outside the scope of this certificate.

2. Validity. Certificates are valid for a period of two years provided: they are within date; all fees have been paid; they are on standard EWF paper signed by an official of [ANB] and marked with the [ANB] stamp; and the following conditions have been fulfilled:

   a. The welder shall be engaged with reasonable continuity on welding work within the range of certification corresponding to the test certificate. An interruption period longer than six months is not permitted;

   b. There shall be no specific reason to question the welder's skill and knowledge;

   c. Annually the manufacturer shall establish that the welder's quality is in accordance with the technical conditions for which the test certificate is awarded.

IF ANY OF THESE CONDITIONS ARE NOT FULFILLED THE CERTIFICATE SHALL BE CANCELLED

VALIDITY MAY BE EXTENDED FOR A FURTHER TWO YEARS PROVIDED THAT:

   d. [ANB] is advised before the expiry date that extension is sought.

   e. Proof of welding quality is forwarded to [ANB]

   f. Conditions a), b) and c) have been satisfied.

   Please contact your ANB well in advance of the expiry date so that the above assessment can be made.

   Following a second two year period, renewal must be achieved by a new examination.

3. New employers who are shown this certificate shall satisfy themselves that the certificate holder has been employed with reasonable continuity, see 2(a) above, on work for which the certificate was granted.

Enquiries concerning this certificate may be addressed to the issuing ANB

PROSPECTIVE EMPLOYERS SHOULD ALWAYS ASK TO SEE THE CERTIFICATE HOLDER'S EWF PLASTICS WELDER ID CARD *(if issued)*

APPENDIX III

EXAMPLE OF IDENTITY CARD

Photo of Welder

ANB logo

ANB Address

European Plastics Welder
<Name of holder>

Reference No.
(Country code/number)

This card is the property of the <ANB> and must be surrendered on demand.
It is not valid without the EWF Test Certificate