

EWF Guideline EUROPEAN ALUMINOTHERMIC WELDER



Minimum Requirements for the Education, Training, Examination, Qualification and Certification



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RAILSAFE

Education, Qualification and Certification

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MINIMUM REQUIREMENTS FOR THE EDUCATION, TRAINING, EXAMINATION, QUALIFICATION AND CERTIFICATION OF A EUROPEAN ALUMINOTHERMIC WELDER (EAW)

Interim Guideline of the European Welding Federation
Prepared by RAILS SAFE



RAILSAFE is a LEONARDO DA VINCI
Community Vocational Training Action Programme Project

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Preface

This document has been prepared by the partners in the RAILSAFE project.

The aim of the RAILSAFE project is the “Development of a Harmonised System for Education, Qualification and Certification of Railway Track Welders”

The project is financially supported by the European Union *LEONARDO DA VINCI* Community Vocational Training Action Programme.

The project has started on 1 October 2004 and has a duration of 3 years.

Partners in the project are:

- Schweißtechnische Lehr- und Versuchsanstalt Hannover, Germany
- Istituto Italiano della Saldatura, Italy
- Ir. J.B. van den Brug Raadgevend Ingenieur, the Netherlands, Project coordinator
- VolkerRail, the Netherlands
- European Federation for Welding, Joining and Cutting Secretariat, Portugal
- Instituto de Soldadura e Qualidade, Portugal
- Swedish Welding Commission, Sweden
- First Welding Company, Slovakia
- TWI (TWI Ltd), UK, Project promoter

The document is based on the input of in total 50 railway welding experts from seven different European countries by discussions in workshops in Copenhagen, Cambridge, Genoa, Hannover and Bratislava in 2005.

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References

- EN 14730 Railway applications – Track – Aluminothermic welding of rails
- EN 13674 -1 Railway applications – Track – Rail – Part 1: Vignole railway rails 46 kg/m and above
- Development of a Harmonised System for Education, Qualification and Certification of Railway Track Welders; Report made after discussions with 50 railway track welding experts from seven different European countries, RAILS SAFE/GUIDE/CO/RI/JB/060113/4, 25 July 2006

Terms and definitions

European Rail Welding Organisation (ERWO)

Organisation which operates the education, training, qualification and certification system in Europe (organisation to be assigned or established by the European rail welding community; the nature of this organisation and its feasibility are still subject of discussion).

Rail Welding Specialist Group

Group responsible for the maintenance of the harmonised education, training, qualification and certification system in Europe on behalf of the European Rail Welding Organisation. Members of the Group are railway authorities, contractors, process suppliers, training bodies and Authorised National Bodies.

RAILSAFE Authorised National Body (RANB)

Organisation authorised by the European Rail Welding Organisation (ERWO), which operates the education, training, qualification and certification system in its country.

National Rail Welding Specialist Committee

Committee responsible for the implementation of the education, training, qualification and certification system on behalf of the Governing Board of the RANB.

Members of the Committee are national railway authorities, contractors, process suppliers and training bodies.

Approved Training Body (ATB)

Aluminothermic welder training organisation approved by the RAILS SAFE Authorised National Body (RANB).

European Aluminothermic Welder Instructor

Instructor teaching theoretical knowledge and practical skills for courses leading to EAW qualifications.

Authorised Examiner (AE)

Person authorised by the RAILS SAFE Authorised National Body to examine knowledge and/or skills of a welder for a Diploma and/or a Certificate.

Process supplier

Company which supplies aluminothermic welding processes.

Employer

Company which employs aluminothermic welders.

Contractor

Company which builds and/or repairs railways.

Railway Authority

Owner of a railway infrastructure.

Aluminothermic welder

Person who is a certified or qualified or is being trained for the joining of rails by aluminothermic welding process.

Diploma

Lifelong valid document issued to a person having successfully passed an examination after his/her education and training for knowledge and skills.

Certificate

Document with limited validity issued to a Diploma holder showing current knowledge and skills.

Welding process

One of a range of aluminothermic welding processes provided by a process supplier

Minimum requirements for the Education, Training, Examination, Qualification and Certification of a European Aluminothermic Welder (EAW)

1. Introduction

The specific requirements for the theoretical education, practical training, examination, qualification and certification of aluminothermic welders are described in this guideline. The guideline applies to welding of tracks and describes the know-how and skills which the welder requires to produce welded joints independently on rails according to EN 13674-1.

Welding joints on other rails, in other combinations and applying other processes will be subject of special training course modules which are based upon the know-how and skills described in this document.

2. Overall structure

Qualification, resulting in the issue of the Aluminothermic Welder Diploma, requires theoretical education, practical training and theoretical and practical, 'out-of-track', examination.

Certification requires qualification as above plus track welding experience and an 'in-track' assessment. Figure 1 shows the overall structure.

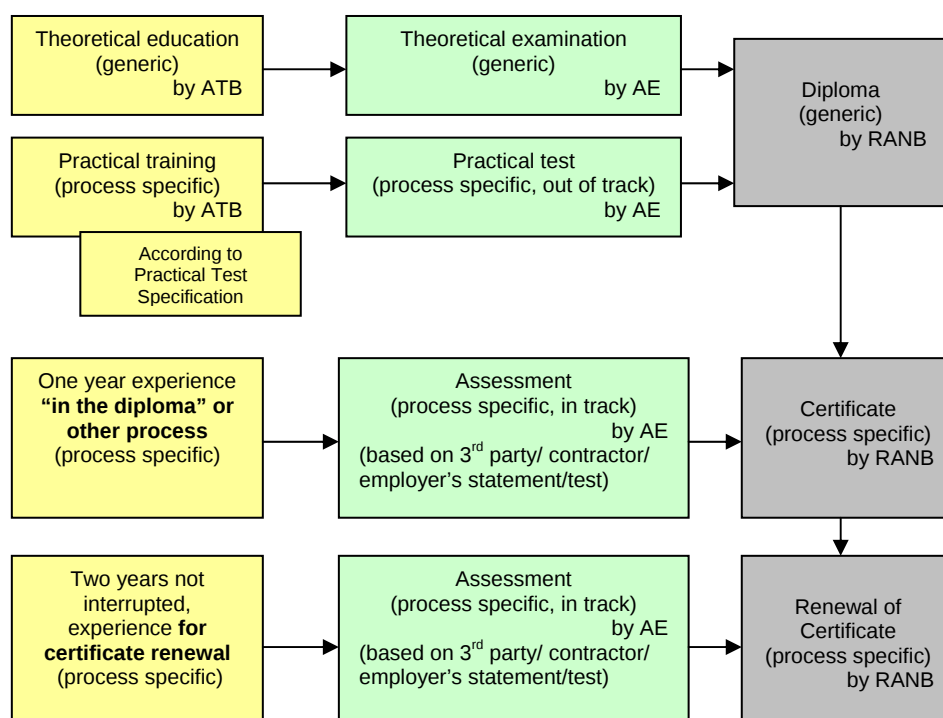


Figure 1 Overall structure of education, training, qualification and certification

Legend: RANB = RAILS SAFE Authorised National Body

ATB = Approved Training Body

AE = Authorised Examiner

See separate document for organisational structure

The theoretical education and examination for a Diploma is generic and the practical training and examination for a Diploma is process specific according the Practical Test Specification (Appendix 1), which is specific for each aluminothermic process/ process supplier. After passing the examinations the welder will receive a generic Diploma valid his/her whole life.

Diploma holders are required to demonstrate a period of supervised, documented and satisfactory experience to receive a process specific Certificate covering the process in which the welder has been trained for the Diploma. If the Diploma holder is successful in passing the experience assessment, the Certificate is awarded; if not, the Diploma holder must undergo an 'in-track' practical test. To get a Certificate in another process, the welder must also undergo practical training and an 'in-track' practical test in that process.

Certificates are valid for two years. In order to renew a Certificate for another two-year period, holders are required to demonstrate supervised, documented and satisfactory experience in the process for which the certificate was awarded during the period of validity of the Certificate. If the Certificate holder is successful in passing the experience assessment, the Certificate is renewed; if not the Certificate holder must undergo an 'in-track' practical test.

All theoretical and practical tests shall be in accordance with EN 14730-2 or equivalent.

Diplomas and Certificates issued under the authority of one RANB shall be recognised by all other RANBs.

3. Access to the course

For entry to the course, appropriate health, physical and mental capability is assumed. The participants are required to have knowledge and skills on health and safety, track construction, cutting and grinding as specified by the RANB

The minimum age is 18 years. Participants must have a spoken and written command of the language in which the course is offered.

4. Instruction programme

The EAW course consists of a theoretical education module and practical training module, as shown in Table 1. Both modules are divided into sub modules, each with a recommended number of teaching hours.

Module	Sub Module	Recommended teaching hours
1. Theoretical education	1. Health, safety and environment	7
	2. Track fabrication	1
	3. Materials and their behaviour during welding	8
	4. Application of Aluminothermic welding to rails	23
	Theoretical examination	1
	Total Module 1	40
2. Practical training	1. Pre-welding activities	77
	2. Aluminothermic welding	
	3. Post-welding activities	
	4. Variants of welds	
	Practical test	3
	Total Module 2	80
Total Course		120

Table 1 - Parts composing the training course including examinations

Although the theoretical part of the course covers the different proprietary aluminothermic welding process variants, it is intended that the bulk of the training will be on one process variant, to be selected by the student or employer.

The recommended periods of time in the practical part represent the average time required to attain the expected level of knowledge. The time needed may vary individually according to the capability of the student.

A teaching hour will contain at least 50 minutes of direct teaching time. It is not obligatory to follow exactly the order of the topics given in this guideline.

The theoretical education given to the students aims at a basic understanding of the process and the materials behaviour including standards and safety regulations. The themes and keywords are given as “scope” in the module descriptions, together with the “objective” and the “expected result”.

The practical training advised in this guideline will bring the students to the skill, required for practical work in industry.

The duration of the training course is derived from the training course content (section 5 and 6). The order of theoretical education and practical training is at the discretion of the training establishment.

Training courses are conducted by Authorised Training Bodies (ATBs). The courses are normally conducted in the training school, but parts of the course may be conducted at the track site, at the discretion of the ATB.

Participants will only be admitted to the examination if they have participated in all aspects of the training course.

ATBs must include in the training programme any applicable national requirements defined by the Railway Authority.

5. Module 1 Theoretical education

In the following paragraphs the minimum requirements for education and training courses are given, with the indication of teaching hours, making particular reference to the ‘expected results’ (welder performance objectives).

	<u>teaching hours recommended</u>
1. Theoretical education	40
1.1. Health, safety and environment	7
Objective:	
Interpret health and safety hazards associated with welding and fabrication processes	
Welders responsibility with respect to health and safety during welding of rail track joints	
Scope:	
- Introduction to health and safety requirements - Risks of electrical equipment - Personal safety equipment - Risk of gases, fumes and vapours in use of oxy-fuel- and mechanical cutting - Fire prevention and control/ extinguishing agent - First aid - Handling and transportation of compressed-gas cylinders in the area of the track	

teaching hours
recommended

- Oxy-fuel cutting measures in areas where there is a risk of fire and explosions in the vicinity of the track
- Oxy-fuel cutting measures on bridges with an open carriageway and in tunnels
- Risk of aluminothermic welding equipment and operation (moist crucible, moist welding portions, handling slag pans, firing welding portions, welding in places where there is a risk of fire and explosion)
- Risk connected to ancillary operation (mechanical cutting, grinding, etc.)
- Noise levels and ear protection
- Standards and regulations
- Protection of the workplace in respect of train circulation
- Manual handling of heavy welding and ancillary equipment
- Environmental consideration for welding waste

Expected results:

1. Describe the risks associated with welding processes and equipment, including transportation of gases and other consumables in accordance with regulations and published guidance documents.
2. Interpret Health and Safety regulations with respect to the above hazards.
3. Understand risk and risk assessments associated with welding operations.
4. Describe safe working procedures to ensure the requirements are met.
5. Correctly use protection devices
6. Recognise and have an understanding of the relevant safety documentation
7. Understanding measures of prevention of fire, environmental pollution

1.2. Track fabrication**1****Objective:**

Describe the effects and limitations when welding on railway infrastructure

Scope:

- Methods of building, maintaining and repair of railway tracks by welding
- Basic knowledge of track welding project
- Different type of rail track construction (e.g. sleepers, ballast, slab, etc)
- Causes and effects of thermal expansion and contraction
- Restrictions on the location of welded joints

Expected results:

1. Describe the phases of rail track construction, including rail tensioning
2. Know and interpret the relevant rail fabrication standards, specifications and documents.
3. Correctly describe measures of thermal movement control in welding

1.3. Materials and their behaviour during welding**8****1.3.1. Basics of metallurgy****2****Objective:**

Understand the basics of metallurgy of steels, phenomena due to heating and cooling and mechanical properties with regard to the rail steel

Scope:

- Alloying elements (influence of carbon and manganese in rail steel)
- Composition of rail steel
- Purpose and events at the heat treatment of the rails
- Quenching phenomena and relevant factors
- Destructive testing (tensile test, hardness test)
- Concepts of brittle and ductile behaviour

Expected results:

1. Describe properties of steel
2. Understand the effects of heat treatment and cooling rate
3. Interpret mechanical properties

1.3.2. Welding metallurgy and structure of welded joints

1

Objective:

Understand the formation of the different metallurgical structures within an aluminothermic weld and the significant factors involved, with regard to rail steel

Scope:

- Thermal cycle
- Preheat
- Cooling rate
- Structure of the weld
- Weld metal
- Solidification of weld metal
- Dilution
- Heat-affected zone (HAZ)

Expected results:

1. Understand the effect of the preheat on rail welds
2. Name the main regions constituting a weld
3. Identify the effects of the welding parameters on the thermal cycle and resulting thermal stresses

1.3.3. Rails

5

Objective:

Describe welding problems dealing with the fundamental aspects of steels used for the rails.

Scope:

- Type of rail profiles and steel grades (EN 13674)
- Rail steels, properties, classifications, marking, rail wear measurement and limitations
- Marking minimum tensile strengths and /or hardness on rail rolling marks
- Rail cutting and weld preparation
- Oxy-fuel cuts in CWR (continuously welded rails)
- Production and creation of plane line and S&C (switches and crossings)
- Welding processes on rails
- Weldability of rail steels, depending on rail defects (e.g. production and traffic)

Expected results:

1. Identify different type of rail steel grades and profiles using the roll markings and rail wear measurements
2. Appraise the susceptibility to cracking by reference to chemical composition of steels
3. Identify welding processes depending on different factors affecting weldability
4. Describe the correct procedure for oxy-fuel cutting of CWR
5. Identify the properties of the rail steel
6. Understand the need for heat treatment of rails prior to oxy-fuel cutting
7. Have basic knowledge of the production of plane line and S&C
8. Have a basic knowledge of failures from production and traffic

1.4. Application of aluminothermic welding to rails**23****1.4.1. Principles of Aluminothermic welding****2****Objective:**

Understand principles of the aluminothermic welding process

Scope:

- Principles of aluminothermic welding
- Chemical reaction in aluminothermic welding
- The application of the aluminothermic process in rail welding
- Process suppliers active in Europe and the principles of each process variant

Expected results:

1. Understand the principles of the aluminothermic chemical reaction
2. Understand the principles of aluminothermic welding of rails
3. Understand the variants of the main process suppliers

1.4.2. Cutting processes for rails**7****Objective:**

Application of cutting processes for weld gap preparation (oxy-fuel cutting and mechanical cutting), and associated equipment, applications, procedures and common problems

Scope:

- Mechanical and oxy-fuel cutting:
 - Principles and limitations
 - Equipment (including gases used for oxy-fuel cutting)
 - Parameters and techniques
 - Cutting rails
 - Accident and damage prevention
 - Duties and competences of the cutting operator

Expected results:

1. Recognise gas equipment and explain the principle of oxy-fuel cutting
2. Know how to use (including assembly, testing, lighting up and closing down), and care for, the equipment and accessories (mechanical and oxy-fuel cutting)
3. Explain limitations of oxy-fuel cutting, e.g. need of pre-heating

4. Compare mechanical and oxy-fuel cutting
5. Identify the main activities to be performed during rail cutting (mechanical and oxy-fuel)

1.4.3. Aluminothermic welding application per process supplier (to be repeated for each additional supplier, as required)

11

Objective:

Apply principles of the aluminothermic welding process and associated equipment, applications and procedures, outlining the main phases and operations

Scope:

- Equipment for the aluminothermic welding process (pre-heating and hardware)
- Welding consumables, weld gap preparation, tolerances and preparations
- Horizontal, vertical and lateral alignment
- Fitting and luting (pasting) of the moulds
- Assemble welding hardware (including slag pans)
- Pre-heating the welding joint (pre-heating torch, aligning the pre-heating torch, gas pressures, adjusting the flame, pre-heating time, observation of pre-heating)
- Preparation of and charging the crucible
- Igniting the welding portion
- Monitoring the aluminothermic reaction (welding portion response time, casting and waiting time)
- Removing the hardware and observing the waiting time
- Shearing off
- Different techniques:
 - New – new, identical height
 - Equalising joints (identical profile, different height)
 - Transition joints (different profiles of rails)
 - Wide gaps
 - Limited access applications (e.g. crossings, bridges, viaducts and concrete slabs)
 - Stress relieving using heat during welding in CWR.
 - Use of tensors
- Use, handling and storage of moulds and sealing materials for welding
- Use, handling and storage of welding portions and ignition rods
- Re-usable crucible
- One-shot crucible systems
- Typical defects, origin and factors

Expected results:

1. Identify correct equipment, consumables, parameters and procedures for the execution of both normal and wide gap welds
2. Understand the detailed steps to make an aluminothermic welds using a specific process
3. Know how to avoid welding defects by correct process control
4. Know how to use and care for the equipment (pre-heating and hardware) and consumables
5. Identify good and bad practices in welding and in storage and transportation of welding and related equipment

1.4.4. Grinding of completed welds

2

Objective:

Explain grinding processing of rail, equipment, procedures and associated problems

Scope:

- Principles of rail grinding
- Equipment and accessories (grinding tools) for rail grinding
- Influence of rail temperature on grinding operation
- Procedures for the rail grinding (rough grinding, fine grinding)
- Checking the height and side position

Expected results:

1. Select correct equipment and grinding material
2. Understand working temperatures
3. Identify the correct tolerances to be achieved

1.4.5. Welding imperfections and defects

1

Objective:

Explain the most common imperfections which can occur during the rail welding execution

Scope:

- Metallurgical imperfections
- Process anomalies
- Pre-heating deficiencies
- Operative imperfections (before, during and after welding)
- Geometric imperfections
- Acceptance criteria
- Control and testing of welded joints
- Marking of welds
- Typical documents, procedures and specifications in use

Expected results:

1. Understand common types of welding imperfections and defects and their causes, e.g. cracks, porosities, mould off centre, stresses in track, preheating offset, sand inclusions, moisture
2. Understand and apply defect acceptance criteria
3. Identify actions to be taken after rejections of welds
4. Understand the documentation to be completed by the welders

1.4.6. Arc welding application for repair and building up of rail

0

This subject is not part of the teaching, but should be included in the handout material

Scope

- Equipment and accessories for the arc welding repair and building up of rails (welding generator, covered electrodes, etc)
- Procedures for the repair and building up of rail

1.4.7. Other joining processes

0

This subject is not part of the teaching, but should be included in the handout material

Scope

- Enclosed arc welding of rails (principle, parameters, field of application and testing)
- Flash butt welding of rails (principle, parameters, field of application and testing)
- Adhesive bonding of rails (principle, parameters, field of application and testing)

Theoretical examination

1

6. Module 2 Practical Training

This Guideline applies to rail steels, see table 1 of EN 13674-1.

In paragraphs 2.1, 2.2, 2.3 and 2.4 below the items to be covered in the practical training are given. The typical training time is reported, assumed as average teaching hours to be spent on every item, however subject to evaluation by the trainers, taking into consideration students' skill and experience.

The practical training is designed to give the student know-how and skill to produce welded joints. The practical training as described below is intended to cover a range of process variants, but limited to one process supplier. If skill is required in relation to further process suppliers the practical part would need to be repeated for each supplier.

teaching hours recommended

2. Practical training

77

2.1. Pre-welding activities

Objective:

Preparation of the working place, creating the welding gap and alignment of the rail ends, in accordance with the process suppliers manual and the rules of the national railway authority

Scope:

- Checking and use of personal protection equipment (PPE)
- Availability of relevant documentation
 - Process Manual
 - Practical test specification
 - Weld acceptance criteria
- Regarding the rails to be welded:
 - Identify grade and profile
 - Measure rail head wear
 - Check for defects
- Selection, assembly and checking the suitability of:
 - Measuring equipment
 - Gas cutting/heatig equipment
 - Mechanical cutting equipment defects
- Creating a welding gap (groove)
 - Through mechanical cutting

**teaching hours
recommended**

- Through oxy-fuel cutting
- Cleaning of rail ends
- Alignment of the rail joint
- Loosening the rail fixings
- Aligning the height and side of the ends of the rails

Expected results:

1. Correct preparation of the welding place
2. Safe and correct use of mechanical cutting equipment (including selection, inspection and mounting of abrasive wheels)
3. Safe and correct use of oxy-fuel cutting equipment
4. Correct alignment of rail ends

2.2. Aluminothermic welding

Objective:

Execution of aluminothermic welds in accordance with the process suppliers manual and the rules of the national railway authority

Scope:

- Welding preparations
 - Pre-heating the crucible (only for long-life crucible)
 - Selecting the moulds
 - Setting on the mould clamps
 - Adjusting, securing and sealing (luting) moulds
 - Attaching slag bowls and splash guard covers
- Preparing the welding crucible (single use crucible)
 - Setting on and adjusting the crucible
- Performing the welding
 - Pre-heating the rail ends
 - Inserting the sand core
 - Adjusting the crucible and igniting the welding portion
 - Monitoring the aluminothermic reaction and the casting process
 - Removing the crucible, slag bowls and splash guard covers

Expected results:

1. Competent and full execution of an aluminothermic rail weld, using both standard moulds and step moulds
2. Adopt good practice in the execution of welds
3. Correct use of process suppliers manual

2.3. Post-welding activities

Objective:

Removing excess material, grinding, inspecting and marking, in accordance with the process suppliers manual and the rules of the national railway authority

Scope:

- Removing excess material and grinding the weld
 - Parting the moulds and removing the head riser
 - Shearing off the excess metal from the rail head
 - Rough grinding (if applicable)
 - Running edge and head control
 - Removing the risers
 - Fine grinding, cleaning the weld
- Inspection and marking
 - Track alignment and weld geometry
- Welding defects
 - Visual inspection of the weld
 - Marking the weld
-

Expected results:

1. Carry out all pre-start checks on the rail grinding machine and to understand correct use
2. Grind welds to the required standard
3. Verify track alignment and weld geometry after welding and grinding
4. Visually inspect the weld and decide on acceptability for service, before leaving the site
5. Mark the weld and complete all necessary documentation before leaving site

2.4. Variants of welds

Objective:

Dealing with different kinds of joints (if acceptable by railway authorities)

Scope:

- Transition joints (different profiles of rails)
- Wide gaps
- Three-part mould
- Alternative pre-heating methods

Expected results:

1. Competent and full execution of rail welds in the above variants

Practical test (for one process variant and one process supplier)**3**

7. European Aluminothermic Welder Instructors

Instructors teaching theoretical knowledge and practical skills for courses leading to EAW qualifications must possess:

- (i) Qualification to International Welding Practitioner (IWP) or equivalent with additional training in the area of railway track welding
- (ii) Competence in instructional techniques (transfer of practical skills and theoretical knowledge)

- (iii) Aluminothermic Welder (for instructors for practical skills) with appropriate industrial experience of 3 years (minimum)

The Approved Training Body (ATB) must install a system for ensuring that instructors keep up to date and maintain their competence.

8. Examinations and Tests

8.1. Authorised Examiner (AE)

The RANB shall administer the European Aluminothermic Welder examinations and tests through the appointment of competent persons, to be known as RANB Authorised Examiners, who shall be responsible for the functions listed below and for complying with the rules concerning re-examination.

RANB Authorised Examiners shall be competent to perform the duties they are requested to undertake and may be specific appointees of the RANB or an RANB approved appointee of another organisation, for example the Approved Training Body (ATB) or a rail welding contractor.

Authorised Examiners must be able to demonstrate impartiality in reaching decisions about the results of the examinations they are supervising.

All examinations shall be conducted under the general supervision of an Authorised Examiner. It is the responsibility of the RANB Authorised Examiner to verify compliance with EN 14730-2 or equivalent, in particular with respect to:

- (i) fitness for purpose of welding equipment
- (ii) checking welding parameters
- (iii) approving the Practical Test Specification
- (iv) availability of a welding procedure specification for each test
- (v) compliance of test piece materials, consumables and joint preparations with specifications. All materials and consumables must be properly identified
- (vi) conduct of qualification tests, including check of candidate's ID
- (vii) visual examination of the welds and reporting the results; where appropriate further tests required must be authorised
- (viii) conduct and marking of theoretical examinations
- (ix) reporting results to the RANB for the issue of the appropriate Diplomas and Certificates

8.2. Examinations leading to the EAW Diploma

The examination/test centre for the final theoretical examinations and qualification tests may be a part of the training body or a separate organisation. In either case it shall be independent of the training activities and subject to RANB approval. The operation of the centre shall be controlled by a quality manual.

8.2.1. Theoretical examination

After the theoretical training modules, there is a final theoretical examination of the multi-choice type covering the whole syllabus: examination papers shall comprise questions selected by the Authorised Examiner from a bank of questions approved by the RAILS SAFE Authorised National Body.

The minimum time to be allocated to the theoretical examination should be a minimum of 1 hour. The examination should take place at the ATB.

The theoretical examination pass mark is 60%. Failure requires re-examination. A second failure requires re-entry into the training module leading to the examination.

Appendix 2 contains sample questions of the theoretical examination.

8.2.2. Practical test

After the practical training modules, there is a final practical test in a specific aluminothermic welding process selected by the candidate and/or his/her employer according to the Practical Test Specification, which is specific for each aluminothermic process/ process supplier (Appendix 1). The test shall be in accordance with EN 14730-2 or equivalent. It shall be administered by the Authorised Examiner and shall take place at a location approved by the AE.

The candidate is allowed assistance during the practical test.

The minimum time to be allocated to the practical test should be a minimum of 6 hours.

An example of an assessment regime that could be used by the AE to carry out practical tests in accordance with EN 14730-2 is attached as Appendix 3.

There are no special rules concerning re-examination in the event of failure in the practical test. However, more than one failure is an indication that further training is required.

8.2.3. Award of EAW Diploma

After successfully completing the theoretical examination and the practical test, the candidate is awarded the EAW Diploma. The specific process used for the practical test is indicated on the Diploma. An example of a diploma is shown in Appendix 4.

Diplomas are the property of the holder and are valid for the life of the holder.

8.3. Certification as an EAW

Certificates as described in the current document are not 'Permits to Weld' as described in EN 14730-2, but railway authorities may use such certificates as a basis for issuing 'Permits to Weld'.

8.3.1. Initial certification

For a Certificate in any process the Diploma holder is required to demonstrate a period of supervised, documented and satisfactory experience in that process with a minimum of 50 welds per year. RANBs are permitted to accept a lower number of welds per year as dictated by the circumstances. Justification for doing so must be documented.

If the process to be used for certification is not the same as the process indicated on the diploma, the candidate must also provide evidence of at least 8 hours of training in the process to be used for certification.

Evaluation of the supervised, documented and satisfactory experience and training, if applicable, is carried out by the RANB Authorised Examiner, based on a 3rd party/contractor/employer's statement specifying process and inspection reports on completed (including rejected) welds.

The Authorised Examiner conducts an 'in-track' practical test of the welder in the process indicated on the Diploma, if the welder is not successful in passing the experience assessment.

In case of a process which is different from the process indicated on the Diploma the "in-track" practical test is obligatory.

After successful assessment a Certificate is awarded to the candidate by the RAILS SAFE Authorised National Body.

The Certificate shall be issued in at least one of the official CEN languages (English, French or German).

An example of a Certificate and Identity Card (optional) are shown in Appendix 5.

There are no special rules regarding re-examination in the event of failure in the practical test for certification (or re-certification). However, more than one failure is an indication that further training is required.

The validity of the certificate begins from the date when all necessary tests have been passed.

A certificate 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 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 employer shall establish that the welder's quality is in accordance with the technical conditions under which the certificate is awarded.

8.3.2. Renewal of certification

For prolongation of their Certificate after it has been expired, Certificate holders are required to demonstrate a 2 year period of supervised, documented and satisfactory experience with a minimum of 50 welds per year and with no interruption of work longer than a period of 6 months. RANBs are permitted to accept a lower number of welds per year and a longer period of un-interruption of work as dictated by the circumstances. Justification for doing so must be documented.

If the welder is not successful in passing the experience assessment, the renewal candidate is then required to repeat the 'in-track' practical test in the process concerned.

Success in the practical assessment leads to the issue of a new Certificate, in accordance with section 8.3.1 above.

In order to ensure continuity of certification it is recommended that the RANB is advised well before the expiry date of the certificate. A successful renewal test taken within three months before the

expiry date of the existing certificate shall result in a new certificate being issued from the date of expiry of the existing certificate.

8.4. Transition Arrangements

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

Practising aluminothermic welders will be eligible for the award of the Diploma and Certificate if they have passed a theoretical and practical test in accordance with this guideline or under equivalent technical conditions.

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

- a) by the RANB in the country in which the applicant received his/her welding certificate, or
- b) by the RANB in the country in which the applicant is currently practising, in contact with the RANB of the country that issued the original certificate.

9. Entry in database (optional)

There is an option to upload the all the details of the welder's Diplomas and Certificates to the aluminothermic welders database on the RAILS SAFE website. Details are to be found in Document RAILS SAFE/Guide/PR/EFWJ/IF/070109.

Installing any data on the database requires the permission of both the welder and the employer concerned.

Appendix 1

Practical Test Specification (PTS) form

1. GENERAL			
PTS reference number			
Welding process supplier			
Type of weld			
2. WORK DESCRIPTION			
Rail profile/ rail head wear differences			
Material / Standard designation		welded to	
(EN 13674-1) Group		welded to	
(EN 13674-1) Profile		welded to	
3. CONSUMABLES			
Kit reference (process supplier and designation)			
Designation/ Reference No.	Portion	Moulds	Crucible
4. JOINT DETAILS			
Rail end preparation/cutting method			
Joint relevant dimensions to be achieved before welding			
Vertical alignment (mm)		Sketch area	
Horizontal alignment (mm)			
Nominal welding gap (mm)			
Requirements for datum marking			
Requirements on mould adjustments			
5. WELD DETAILS			
Heating equipment			
Pre-heating gas pressure			
Temperature / time			
Length from weld face to be pre-heated			
Critical process timings / temperatures			
Time / temperature from ignition to tap			
Rate of cooling or time/temperature until mould removal			
Time/temperature before course grinding			
PTS ref.:	Date:	Approved by:	Page No. 1 of 2

Practical Test Specification (PTS) form

Stripping			
Mould removing instructions			
Equipment			
Method description			
Final Grinding			
Equipment			
Method description			
Maximum grinding length (mm)			
Finished profile requirements			
6. WELD COLLAR / INTERNAL MOULD GEOMETRY (drawing is from EN 14730)			
Weld collar width (W1)			
Maximum collar depths at section B-B (D1 and D2)			
Minimum collar depths at section B-B (d1 and d2)			
7. ACCEPTANCE REQUIREMENTS			
Geometry			
Visible defects			
Vertical misalignment			
Horizontal misalignment			
Surface quality			
PTS ref.:	Date:	Approved by:	Page No. 2 of 2

Note: It will be necessary to specify the procedure for carrying out the practical test including an indication of the criticality in terms of competence in each element of the test.

Appendix 2

Specimen theoretical examination questions for the European Aluminothermic Welder

1. Which of the following elements is added to iron to make steel?
 - a. Silicon a. _____
 - b. Oxygen b. _____
 - c. Carbon c. _____
 - d. Tungsten d. _____

2. The preparation of rail ends for aluminothermic welding can be carried out with which of the following processes?
 - a. Disc cutting a. _____
 - b. Oxy-acetylene gas cutting b. _____
 - c. Oxy-propane gas cutting c. _____
 - d. All of the above d. _____

3. What does the mark 60 E 1 mean according to EN 13674-1?
 - a. rail profile S 49 a. _____
 - b. rail profile UIC 50 b. _____
 - c. rail profile UIC 60 c. _____
 - d. rail profile R 65 d. _____

4. According to EN 559 the colour of an acetylene hoses is:
 - a. Blue a. _____
 - b. Red b. _____
 - c. Black c. _____
 - d. Yellow d. _____

5. Drying of a re-usable crucible before its first use is performed by the:
 - a. flame of a preheating torch a. _____
 - b. aluminothermic reaction portion b. _____
 - c. free air c. _____
 - d. furnace heating d. _____

Appendix 3

Example of Assessment Regime for Practical Test for Qualification (Diploma)

Pass/Fail

Practical test evaluation form

Pre-welding activities

Checking and use of personal protection equipment (PPE)

Availability of relevant documentation

Process manual

Practical test specification

Weld acceptance criteria

Regarding the rails to be welded:

Identify grade and profile

Measure rail head wear

Check for defects

- Selection, assembly and checking the suitability of:
 - Measuring equipment
 - Gas cutting/heating equipment
 - Mechanical cutting equipment
 - Welding equipment
 - Stripping and grinding equipment
- Creating a welding gap:
 - By mechanical cutting and/or by oxy-fuel cutting
 - Checking and cleaning of rail ends
- Alignment of the rail joint
 - Loosening the rail fixings
 - Aligning the height and side of the ends of the rails

Aluminothermic welding

- Welding preparations
 - Pre-heating the crucible (only for long-life crucible)
 - Selecting the moulds
 - Setting on the mould clamps
 - Adjusting, securing and sealing (luting) moulds
 - Attaching slag bowls and splash guard covers
- Preparing the welding crucible (single use crucible)
 - Setting on and adjusting the crucible
- Performing the welding
 - Pre-heating the rail ends
 - Inserting the sand core
 - Adjusting the crucible and igniting the welding portion
 - Monitoring the aluminothermic reaction and the casting process
 - Removing the crucible, slag bowls and splash guard covers

Post-welding activities

- Removing excess material and grinding the weld
 - Parting the moulds and removing the head riser
 - Shearing off the excess metal from the rail head
 - Rough grinding (if applicable)
 - Running edge and head control
 - Removing the risers
 - Fine grinding, cleaning the weld
- Inspection and marking
 - Track alignment and weld geometry
- Welding defects
 - Visual inspection of the weld
 - Marking the weld

Variants of welds

- Transition joints (different profiles of rails)
- Wide gaps
- Three-part mould
- Alternative pre-heating methods

Appendix 4

European Aluminothermic Welder Diploma



RAILSAFE

Education, Qualification and Certification

Having met the education and training requirements of RAILSAFE Guideline
RAILSAFE/GUIDE/PR/SLV/TB/060227/14 (pilot courses April 2007)
and by examination having satisfied the
requirements of the Board of Examiners of the
RAILSAFE Authorised National Body

[Name (forenames, given name)]*

Date of birth: [(day, month, year)]*

is hereby awarded the Diploma of

EUROPEAN ALUMINOTHERMIC WELDER

in the aluminothermic welding process: [process/ process supplier]*.

Cutting methods: *

Category of alignment achieved according to EN 14730-2:2006:

Vertical alignment: *

Horizontal alignment: *

Date of examination: [day, month, year]*

Diploma No.: [ISO country code/
category/ unique serial code]*

[Signature]*

[Signature]*

[Name]*
Authorised Examiner

[Name of person]*
Head of: [Training Body]*

RAILSAFE Authorised National Body: [Name of ANB and Country]*

[logo or stamp of ANB]*(optional)

* - TO BE PRINTED BY THE ANB

Appendix 5

European Aluminothermic Welder Certificate



RAILSAFE
Education, Qualification and Certification

ANB
Logo*

EUROPEAN ALUMINOTHERMIC WELDER CERTIFICATE

Certificate No: [ISO country code/
category/unique serial code]*

Employer: [Name of employer and Country]*

This is to certify that:

[Name (forenames, given name)]*

Date of birth: [(day, month, year)]*

Photo of Welder (if
an Identity Card is
not issued).

has demonstrated proficiency as a European Aluminothermic Welder in accordance with the requirements published in Document RAILS SAFE/GUIDE/PR/SLV/TB/060227/14 and amendments in force on the examination date.

This certificate is valid for:

The aluminothermic welding process: [process/ process supplier]*.

Cutting methods: *

Line categories: *

Category of alignment achieved according to EN 14730-2:2006:

Vertical alignment: *

Horizontal alignment: *

Date of issue: [day, month, year]*

Date of expiry: [day, month, year]*

Issued by: [Name of ANB and Country]*

[Signature]*

[Signature]*

Date: [day, month, year]*

[Name]*

Authorised Examiner

Signature of holder

PLEASE READ THE NOTES OVERLEAF

Photocopies are unauthorised

* - TO BE PRINTED BY THE ANB

(REVERSE OF CERTIFICATE)

THIS IS A VALUABLE DOCUMENT WHICH SHOULD BE KEPT IN A SAFE PLACE. A FEE WILL BE CHARGED FOR DUPLICATES WHICH WILL ONLY BE ISSUED AFTER EXTENSIVE ENQUIRIES.

NOTES:

1. This Certificate is not a Permit to weld. However the Railway Authority may issue a Permit to weld in accordance with EN 14730-2 on the basis of this Certificate.
2. Some authorities require additional reassurance concerning equipment, quality of supervision and working conditions before permitting the use of a certificate holder on their work. This certificate does not constitute such approval which should be sought from the authority concerned.
3. Validity. Certificates are valid only if: a) they are within date; b) all fees have been paid; c) they are on standard cream [ANB] paper bearing the [ANB] logo, signed by an official of [ANB] and embossed with the [ANB] stamp; d) they are signed by the individual to whom the certificate is awarded. The approval shall remain valid for the two year period providing that all the following conditions are fulfilled:
 - a) The welder shall be engaged with reasonable continuity on welding work within the current range of approval corresponding to the certification. An interruption for a period no longer than 6 months is permitted. The manufacturer shall advise the [ANB] at twelve monthly intervals that this is the case.
 - b) The welder's work shall be in general accordance with the technical conditions under which the approval test was carried out.
 - c) There shall be no specific reason to question the welder's knowledge and skill.

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

In order to renew your certificate, a renewal test is required.

Please contact your ANB well in advance of the expiry date so that the above renewal test can be arranged.

4. New employers who are shown this certificate should 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:

*Address of ANB**

* - TO BE PRINTED BY THE ANB

Identity Card

<i>Photo of Welder</i>	<i>ANB Logo</i>
	<i>ANB Address*</i>
European Aluminothermic Welder <i>Name of holder*</i> <i>Processes covered*</i> <i>Expiry date*</i>	
RAILSAFE Education, Qualification and Certification	
This card is the property of the ANB* and must be surrendered on demand. Validity may be checked at www.ewf.be/railsafe	

* - TO BE PRINTED BY THE ANB