WORK BASED LEARNING OPPORTUNITIES IN WELDING

WP2

Deliverable 2.1 – Quality Assurance Guideline for the recognition of work-based learning

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1. Introduction

This document is intended to provide technical guidance on the management and quality assurance for training performed through Work Based Learning. It was developed under the EU funded Project WOW "*Work-based learning Opportunities in Welding*".

As EWF has its own quality assurance process, this document is intended to provide guidance to ATBs and ANBs to support participants attending EWS and EWP training Courses to include Work Based Learning in their training Curricula. The principle is getting recognition of activities performed under the appropriate control of the EWF Authorized Training Body as non-formal training to cover specific topics of the European Welding Practitioner and Specialist Level, as considered in the EWF Guideline for the education and training of personnel with responsibility for welding coordination.

This guideline includes the minimum requirements to get the process recognized within the EWF qualification system. However, it is relevant to point out that the developed methodology can be applied to other non-EWF qualifications.

2. Reference documents

The following documents are referred to in this guideline (the latest revision applies):

- EWF-IAB-252 Personnel with Responsibility for Welding Coordination;
- EWF-416 Rules for the implementation of EWF Guidelines for the education, examination and qualification of welding personnel;
- EWF-656 EWF operational System

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3. Definitions

For the scope of this document, the following definitions apply:

ANB: **Authorized Nominated Body** An organization that has been assessed and authorized by EWF in accordance with EWF rules (EWF-416, latest revision, guidelines, requirements and business plan and is responsible for ensuring that the standards of implementation of the EWF education, examination, qualification systems and/or personnel certifications schemes are maintained (EWF 656).

Apprenticeships: Schemes based on the integration of companies as training providers together with VET schools or other education/training institutes (European Commission, 2013)

ATB: **Authorized Training Body** - An organization that has been assessed and approved by an EWF Operational System ANB in accordance with EWF rules (EWF-416, latest revision) for training organizations. By awarding ATB status, the ANB confirms that the ATB fulfils the requirements for delivering training in accordance with one or more EWF guidelines (EWF 656)

Dual Training System: Education or training combining periods in an educational institution or training center and in the workplace. The alternance scheme can take place on a weekly, monthly or yearly basis. Depending on the country and applicable status, participants may be contractually linked to the employer and/or receive a remuneration. (Cedefop, 2008)

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Mentor:	Someone who provides guidance and support provided in a variety of ways to a young person or novice (i.e. someone joining a new learning community or organization by an experienced person who acts as a role model, guide, tutor, coach or confidante. (Cedefop, 2008)
On-the- Job Training:	Vocational training given in the normal work situation. It may constitute the whole training or be combined with off-the-job training. (Cedefop, 2008)
WBL training Path:	The path based on the dual system and used to get successful participation to the course and access the applicable final examinations.
Training programme:	The personalized programme used by each trainee and the company to fulfill the requirements of this guideline.
Trainee:	The person undergoing the training program attending the classroom teaching and the WBL at the company. He/she may be an apprentice in the company.
Tutor:	A person responsible for offering a learner guidance, counselling or supervision by an experienced and competent professional. The tutor supports the learner throughout the learning process (at school, in training centers or on the job. Tutoring covers various activities: academic subjects (to improve educational achievement); careers (to ease the transition from school to work; personal development (to encourage learners to make wise choices). (Cedefop, 2008).

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VET: Education and Training which aims to equip people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly on the labour market. (Cedefop, 2008)

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4. WBL training path

Candidates to the Qualification as EWS or EWP may consider attending Work-based Learning as an alternative to standard routes for qualification as given in doc. EWF-IAB 252.

This can be done by following the WBL training path as intended by this document and pass the final standard examinations.

The WBL training path is composed of the following:

- formal training performed according to the applicable revision of the EWF Guideline doc EWF-IAB 252;
- work-based learning performed at the company according to the requirements of this guideline
- end-point assessment, to evaluate the WBL process.

The following diagram shows the applicable concepts.

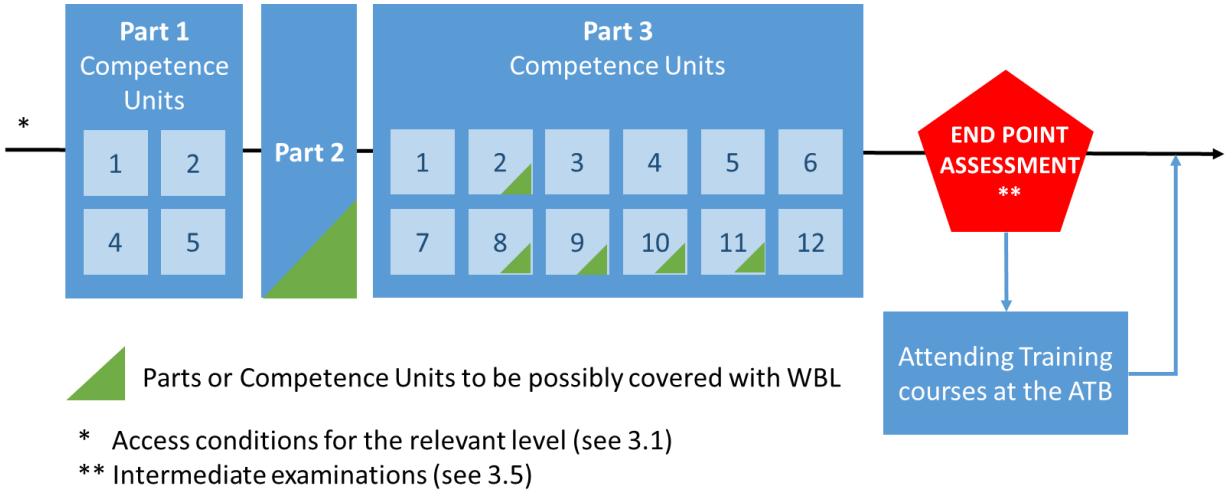

Figure 1 – The WBL training path (diagram)

Not all the competence units may be considered in Work Based Learning approach. It is up to the ATB to evaluate and define which areas may be covered (see 5.2).

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ATBs shall be authorized by the ANB according to this guideline in order to perform this approach.

Each trainee will have his/her specific training program, which shall define all the necessary training steps (formal training, WBL, assessments) with the respective timings. The training program shall be agreed with the company and authorized by the ATB based on the criteria given in the guideline.

To demonstrate effectiveness of the work-based learning, candidates will be required to pass an end point assessment. Based on the result of the assessment and at the discretion of the ATB, candidates may be requested to attend the formal training ATB for one or more items.

4.1. Roles associated to the qualification path

Upon authorization from the ANB, ATB has to put in place a procedure to manage and assess WBL according to this guideline.

Based on such a procedure, ATBs select the companies where trainees can attend the Work Based Learning approach and monitors the progress of trainee. The selection shall be based on the specific requirements as given in paragraph 2. ATBs should also supervise companies and trainees throughout the process.

Tutors will be assigned by ATBs to trainees to assist them during the WBL process. Within the company, a Mentor shall be identified, who is responsible of the training performed in the company; based on the specific needs, in-company-trainers may be used to train the participant on specific Subjects. Figure 2 shows a diagram with the applicable concepts.

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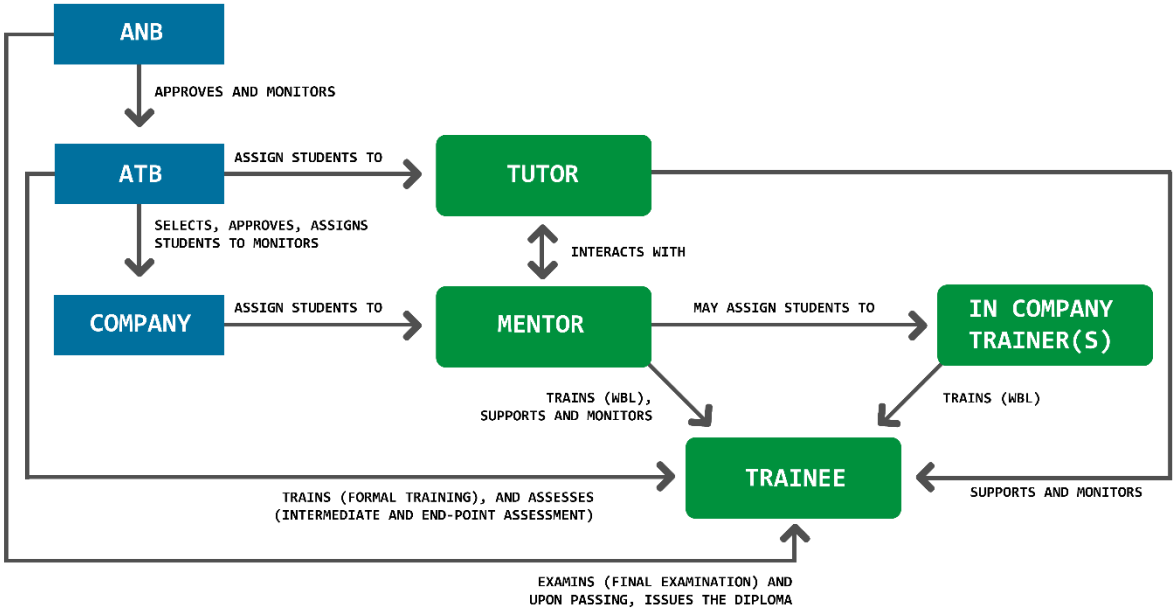

Figure 2 - Roles in WBL

5. Technical requirements for the WBL training path

In general, the requirements considered in doc. EWF-416 and EWF-IAB 252 apply. The following additional requirements and/or deviations shall be considered for the use of the guideline.

5.1. Requirements for the company

The company shall be certified according to ISO 3834-2 or 3834-3; the certificate shall be issued by and Approved Nominated Body for Company Certification (ANBCC) of the EWF (or IIW) or by an accredited certification body. This is needed to ensure that the company is capable of correct fabrication using welding.

The company shall agree on the training program, in line with its operations and with the learning outcomes as defined in the applicable guideline (see item 3.2). Access to welding and associated equipment shall be granted to participants for WBL as needed. A contract amongst involved parties has to be signed, including the appropriate bindings to

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the training program, in line with applicable national requirements (including safety, insurance, liabilities, as applicable). A possible template is included in Appendix C.

The company shall assign the trainee to a mentor. He/she is responsible for training and supporting the candidates in the company. As a minimum, he/she shall be qualified according to doc. IAB 252 at the level of qualification foreseen for the participant or higher, and properly experienced in welding coordination tasks (e.g. holding a role in the Welding Coordination tasks for at least two years in the last three years or holding of an EWF Certification as CEWE/T/S/P).

To train the candidate, mentor may select in-company-trainers, based on their qualification and experience on the specific subject to be dealt with the WBL training (refer to Appendix 1), e.g. in NDT at least Level 2 ISO 9712, welder for welding laboratory, etc.

The training activities and the role of trainers and mentor shall be recorded (e.g. through a logbook).

The approval of the company to conduct the WBL in compliance with this guideline is under the responsibility of the ATB. Approved companies shall be registered with all the relevant information included in the platform of the project. (A checklist example is provided in appendix D).

For companies not yet certified by an Approved Nominated Body for Company Certification (ANBCC) of the EWF (or IIW), the first engagement in a WBL path can be considered as part of the company certification process, where guidance and support will be provided by an ANB.

5.2. Requirements for the ATB

The ATB shall be approved by the ANB for the specific scope of this guideline, based on a written procedure.

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The ATB is responsible for approving the companies and the qualification program against the requirements as provided in this guideline and the other applicable guidelines, including:

- compliance of the companies with the applicable requirements (see 2.1)
- time and schedule of delivery
- compliance with the Learning Outcomes of the relevant guideline.

The ATB is responsible for assigning specific items to be dealt with in WBL, based on applicable subjects as reported in Appendix A. The assignment shall be performed taking into account, per each subject, competence unit and level:

- job functions and activities
- learning outcomes
- detailed knowledge.

Training duration in WBL has to be estimated by the ATB, based on different factors, including (but not limited to):

- the structure of the company;
- the type of production and/or work performed;
- accessibility of equipment, resources and materials.

A tutor shall be assigned to each trainee. He/She is responsible to provide support to the trainee and shall be fully knowledgeable about the applicable requirements of the guideline and the Welding coordination activities. He/she is responsible for the periodical assessment of the training activities.

The ATB responsibilities include:

- providing companies with templates to record training activities;
- providing companies with appropriate instructions including information on the part of doc. EWF-IAB 252 which is relevant to their activities;
- providing candidates with all appropriate training materials (i.e. including the scopes dealt with Work-based learning);

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- performing of the end-point assessment (see 3.3).

ATBs may also cooperate with VET assigning specific tasks in respects to this guideline. However, the responsibility remains with the ATB.

6. Requirements for the WBL training path

6.1. Access requirements

To access the qualification path, access conditions for EWS or EWP shall be considered as applicable (see EWF 252, last revision – Appendix A).

For EWP only and in case of Apprenticeship, it may be considered that the trainee satisfy the access conditions (scholarship diploma or welder certificate) and experience only after the internship at the company. In such a case, the EWF Diploma will be awarded by the ANB only after the scholarship diploma/certificate is issued by the relevant organization.

6.2. Training program

The training program shall be designed balancing time spent in formal training at the ATB and in the company. The training structure (order of modules as designed in doc. EWF-IAB 252) should be followed or, at least, part 2 should be performed before part 3). However, it may be accepted that the WBL is performed following a different order under particular circumstances, including (but not limited):

- when distances to be covered by trainees require;
- depending on the availability of mentors and in-company trainers;
- depending on the availability of welding related work in the company.

Within the training program, an introduction of the company to the trainees shall be included, as necessary, in order to introduce the company (structure, products, standards, etc.), the health and safety and any other applicable rules.

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The training program shall be presented to the ATB for evaluation and approval, and it shall include information on:

- the introduction (see above)
- items to be covered
- information on mentors and in-company trainers covering the items (including information on their qualifications – knowledge and experience - on the items taught)
- time and place of delivery (when and where WBL will be performed)
- information on how the WBL is monitored by the mentor.

The training program shall be also presented to the trainee before he/she starts the WBL part of his training.

6.3. Program subjects

Depending on availability of resources in the company, only the items given in appendix 1 (as per doc. EWF-IAB 252) may be covered in the WBL training. All the other items shall be covered in formal training at the ATB.

6.4. Continuous Monitoring

It is under the responsibility of the ATB to continuously monitor the success of the WBL training performed in the company. This shall be done contacting periodically both the company and the trainee, and verifying periodically the training through different approaches, e.g. interviews, questionnaires, overviewing of specimens and documents (e.g. logbook or other means).

It is expected that tutors take care of keeping liaisons with the Company and the Trainee, keeping periodical contact.

6.5. End-point assessment

At the end of the training program, candidates are subject to the end point assessment, as defined in the ATB written procedure.

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The assessment shall ensure the participant accessed proper knowledge against the Learning Outcomes as defined in the training program and the relevant scopes of EWF/IAB 252. The assessment shall be addressed only at items dealt with Work Based Learning, and, at discretion of the ATB, it may be performed with:

- essay questions
- questionnaires
- projects or products produced
- professional interview.

During the evaluation, the following resources may be used at the discretion of the ATB or the Board of Examiners:

- production documents used in the company;
- training materials (books, formulary, etc.);
- programmable calculators, smartphones, tablets, laptops or other devices.

Based on the approved procedure of the ATB failure of the end-point assessment may lead to the requirement for the trainee to attend one or more items in formal training at the ATB.

Trainee successfully passing the end-point assessment will be granted the right to seat in the final examination for each module as having the training considered as formally attended.

The results of the end-point assessment shall be scored and recorded together with the other applicable documents (e.g. logbook).

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Appendix A – Welding Coordinators Guideline

1 Introduction

Section I of the guideline covers the minimum requirements for education and training, which have been agreed upon by all EWF - ANBs, in terms of objectives, scope, Learning Outcomes and the contact (teaching) hours to be devoted to achieving them. It will be revised periodically by EWF Technical Committees Competence Area Qualification Systems to take into account changes to reflect the "state of the art". Students successfully completing a course of education and examinations will be expected to be capable of applying the welding technology at a level consistent with the qualification diploma.

The modular course contents are given in the following structure (overview):

Competence Units	Contact Hours*							
	EWE		EWT		EWS		EWP	
	CUT	P1	CUT	P1	CUT	P1	CUT	P1
CU 1- Introduction to Welding Technology and Arc Power Source	0	0	7	4	7	3	14	6
CU 2 - Welding and Cutting Conventional Processes	7	2	28	13	14	5	14	10
CU 3 – Advanced Welding Processes	7	0	7	0	7	0	0	0
CU 4- Introduction to Metallic Materials	0	0	7	7	0	0	7	7
CU 5- Steels and Their Weldability	7	0	21	4	21	2	14	5
CU 6 - Wear, Corrosion, Fractures and Application of Structural and High Strength Steels	0	0	7	2	7	1	0	0
CU 7 - Other Materials Then Steel	7	0	7	0	7	0	0	0
CU 8 - Design for Welding & Brasing	14	0	21	5	21	4	7	0
CU 9- General Features for Quality Management	7	0	7	0	7	0	7	0
CU 10 - Quality Assurance_Quality Control on Welded Joints	7	0	7	0	7	0	7	0
CU 11- Tests Used for The Quality Control of Welded Joints	7	0	7	0	7	0	7	0
CU 12– Case Studies	14	0	14	0	14	0	0	0
Subtotal Per Level	**77**	**2**	**140**	**35**	**119**	**15**	**77**	**28**
Cumulated Subtotal	**413**	**80**	**336**	**78**	**196**	**43**	**77**	**28**
Fundamental Practical Skills (Part 2)	**60**		**60**		**60**		**60**	
Total	**473**		**396**		**256**		**137**	
WORKLOAD **								
Per Level	**214**		**340**		**298**		**214**	
Total	**886**		**732**		**452**		**214**	

* Contact Hours are the minimum for the Standard Route, see **Error! Reference source not found.**;

** Workload is the amount of self-study hours;

CUT = Competence Unit Total (Part 1 + Part 3);

P1 = Part 1;

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Figures under P1 are given for the Standard Route (see **Error! Reference source not found.**).

It is to be noted that the overall structure of the syllabus for all levels (EWE, EWT, EWS, and EWP) is similar, but some topics are not considered in all levels of qualification. These topics are indicated by 0 hours in this guideline. The depth of knowledge and skills to achieve is specified for all levels and all competence units (see I.2) and will be reflected in the scope and depth of the examination.

The expected results are described in two ways: generic outcome descriptors for each level, organized in knowledge, skills, autonomy and responsibility; and in detail for each level and competence unit, organized in job function, knowledge and skills.

Additionally, a classification for all levels is also assigned, reflecting the EWF Systems Framework (see Appendix IV) levels and its correlation with the European Qualifications Framework for Lifelong Learning (EQF).

The text on the following page is the EWF view of the relevant **Task Descriptions** and should be considered only as guidance to explain the level of knowledge, competence and skills, for each qualification level under this guideline.

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Task Descriptions: Knowledge, skills and competence levels achieved for each qualification level and their correlation with ISO 14731

EWE – Knowledge, Competence and Management

A candidate completing the EWE training under this program is expected to acquire advanced knowledge and critical understanding of welding technology application.
He / she shall have advanced competence and skills at a level that is required in the field of welding technology which demonstrate:

- technology mastery and required innovation
- being able to solve high-level complex and unpredictable problems
- the ability to manage high complex technical and professional activities or projects related to welding applications
- taking responsibility for decision making in unpredictable work or study context
- taking responsibility for managing professional development of individuals and groups

EWT – Knowledge, Competence and Management

A candidate completing the EWT training under this program is expected to acquire an overall knowledge and understanding of welding technology application.
He / she shall have competence and skills at a level that is required in the field of welding technology which demonstrate:

- being able to solve low-level complex problems
- the ability to manage in detail the welding applications and related professional activities or projects
- taking responsibility for decision making in low-level complex work or study context
- taking responsibility to define the tasks of welding or related personnel
- being able to manage professional development of individuals and groups

EWS – Knowledge, Competence and Management

A candidate completing the EWS training under this program is expected to acquire a specialized and factual knowledge in the field of welding technology.
He / she shall have competence and skills at a level that is required in the field of welding technology which demonstrate:

- being able to develop solutions on common/regular problems
- being able to manage and supervise common or standard welding applications and related professional activities
- taking responsibility for decision making in common or standard work
- taking responsibility to supervise the tasks of welding and related personnel.

EWP – Knowledge, Competence and Management

A candidate completing the EWP training under this program is expected to acquire a basic knowledge in the field of welding technology.
He / she shall have competence and skills at a level that is required in the field of welding technology which demonstrate:

- being able to develop solutions on basic and specific problems
- being able to supervise basic welding applications and related professional activities
- taking responsibility for decision making in basic work
- taking responsibility to supervise the tasks of welding and related personnelIn correlation with essential coordination tasks as detailed in EN ISO 14731, the previous mentioned competences and skills will enable the candidate to effectively perform the following tasks:

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Type of Construction concerned	EWE	EWT	EWS	EWP
	Any type	With a low level of complexity	Regular and common	Basic specific works
Welding construction contract requirements	able to review			not able to perform
Technical review of the welding construction	able to perform the task			not able to perform
Subcontracting activities	able to specify requirements and assessment protocol, to supervise implementation and monitor			able to supervise implementation and monitor
Welding personnel and related personnel needs and competences/ skills;	able to specify, supervise and manage			able to supervise the welding personnel and monitor
Equipment and means needed for the construction;	able to specify, validate and manage the equipment, including the calibration if needed			able to understand and supervise the proper use
Manufacturing plan;	able to specify, develop, validate and manage			able to monitor and implement
Welding procedures needed for the construction;	able to specify, develop, evaluate, validate and manage			able to understand, implement
Working instructions;	able to specify, develop, evaluate and manage			able to understand, implement
Base materials and welding consumables;	able to specify, validate and manage			able to monitor and supervise the proper use
Inspection Testing Plan;	able to specify, review, develop, evaluate, validate and manage			able to understand, implement and monitor
Heat treatments;	able to specify, develop, evaluate, validate and manage			able to understand, implement, supervise and monitor
Corrective actions to solve welded construction non-conformances;	able to specify, review, develop, evaluate, validate and manage			able to implement, monitor and control
Identification and traceability used in welding manufacturing;	able to specify, develop, evaluate, validate and manage processes			able to understand, control and supervise
Construction quality records.	able to specify, develop, evaluate, validate and manage processes related to monitor and control			able to collect, control, perform and supervise

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Section I: Theoretical and Practical Education – Qualification Descriptors and Learning Outcomes

I.1. Qualification Outcome Descriptors

QUALIFICATION	EQF/ EWF LEVEL	KNOWLEDGE	SKILLS	AUTONOMY AND RESPONSIBILITY
EWE	**7 / EXPERT**	Highly specialised and forefront knowledge including original thinking, research and critical assessment of theory, principles and applicability of welding related technologies.	Highly specialised problem- solving skills including critical and original evaluation, allowing to define or develop the best technical and economical solutions, when applying welding processes and related technologies, in complex and unpredictable conditions.	Manage and transform the welding processes and related technologies in a highly complex context. Act as the full responsible person for the definition and revision of the welding and related personnel's tasks.
EWT	**6 /ADVANCED**	Advanced knowledge and critical understanding of the theory, principles and applicability of welding and related technologies.	Advanced problem-solving skills including critical evaluation, allowing to choose the proper technical and economical solutions, when applying welding and related technologies, in complex and unpredictable conditions.	Manage the applications of welding and related technologies in a highly complex context. Act autonomously as the responsible person for the decision making and the definition of the welding and related personnel's tasks.
EWS	**5/SPECIALIZED**	Specialised, factual and theoretical knowledge of the theory, principles and applicability of the welding and related technologies.	Specialised range of cognitive and practical skills, allowing to develop solutions or choose the appropriate methods, when applying welding and related technologies, in common/regular problems.	Manage and supervise common or standard welding applications and related technologies, in an unpredictable context. Take responsibility with limited autonomy for decision making in common or standard work and supervise the welding and related personnel's tasks.
EWP	**4/INDEPENDENT**	Factual and theoretical knowledge (basic understanding) in the field of welding technology	Fundamental/basic cognitive and practical skills required to develop proper solutions on simple and specific welding problems.	Self-manage of professional activities and simple standard applications. Take responsibility for supervising routine welding tasks and related personnel, as well as for decision making in basic work.

I.2. Competence Units Learning Outcomes

Competence Unit 1: Introduction to Welding Technology and Arc Power Source

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - INTRODUCTION TO WELDING TECHNOLOGY AND ARC POWER SOURCES (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	EWE same as EWT		
EWT	**6 /ADVANCED**	1. Manage arc welding conditions to minimize arc instability and arc blow 2. Manage and specify the most suitable power sources for a given application and/or environment 3. Manage and specify welding consumables (shielding gases, filler materials and electrodes) for any kind of application	7	14
EWS	**5/SPECIALIZED**	1. Chose the most suitable power sources for a given application and/or environment 2. Manage and specify welding consumables (shielding gases, filler materials and electrodes) for regular applications	7	14
EWP	**4/INDEPENDENT**	1. Determine solutions to solve basic and simple arc welding instability and arc magnetic deflection problems 2. Check if the welders are using the proper power source for a given application 3. Supervise the use of welding consumables	14	28

LEARNING OUTCOMES – INTRODUCTION TO WELDING TECHNOLOGY AND ARC POWER SOURCES				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	EWE same as EWT	Advanced knowledge and critical understanding of the theory, principles and applicability of: Welding technology The arc Power sources for arc welding Consumables, standards, storage and handling	Specialised and theoretical, principles and applicability of: Welding technology The arc Power sources for arc welding Consumables, standards, storage and handling	Factual and broad of: Welding technology The arc Power sources for arc welding Consumables, standards, storage and handling

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SKILLS		**Skills defined for EWP and EWS shall be added to the EWT and EWE bellow skills** • Describe the join/bound techniques (mechanical, adhesive, welding) enumerating the differences between them and types of energy used to generate the join/bound. • Justify in detail all the differences between each major type of welding process (e.g. fusion arc, resistance, flame, forge, etc.). • Explain in detail the fundamental physics of an electrical arc including the arc characteristics (e.g. the plasma, temperature profiles, radiation and electrical features' as all arc welds contain these aspects), arc parameters influencing arc stability and arc blow. • Explain in detail the arc characteristics for DC and AC including control and limitations. • Choose the most suitable power source for a certain arc welding application and/or environment, and implement its correct use, including the definition of the welding cables and workpiece clamps. • Define if special requirements concerning welding consumables are necessary (or not), based on the contract technical review. • Define the welding shielding gases, filler materials and electrodes requirements needed for a certain application of any welding process	**Skills defined for EWP shall be added to the EWS bellow skills** • Describe the influence of magnetic field in welding. • Outline for each type of arc welding power source the various static characteristic, operation point and control of arc stability. • Identify the difference between conventional power sources, CPU controlled of power sources and inverter power sources. • Elaborate simple purchase specifications of shielding gases, filler materials and electrodes for a given construction, relating the consumables with the standards for shielding gases, consumables and filler materials (at least for non-alloy steels) that classifies it. • Verify the shielding gases, filler materials and electrodes trough documental (namely against consumable standards and purchase order) and physical (quantity, dimensions and surface status) analysis upon its reception. • Outline the welding filler material and gases requirements needed for a certain application for a given welding process using standards for shielding gases, filler materials and electrodes (at least for non-alloy steels). • Select the baking treatment applied before welding for filler materials	• Associate the most common welding processes to their common abbreviation and their identification code, applications, advantages and disadvantages. • Apply and fluently use the welding terminology /glossary on daily activities. • Outline the relation between current, voltage and electrical resistance, defining each electrical parameter. • Describe an electrical arc, naming its main areas and their importance to welding, arc stability and how the heat is generated in the arc. • Give assistance to welders and check with limited autonomy arc welding implementation with the goal of minimising arc instability factors and arc blow during arc welding. • List the major functions of the most important components of welding power sources. • List the major differences between DC and AC current referenced in applications to different welding processes. • List the most important power source electrical characteristics, such as: open circuit voltage, arc voltage short circuit current, duty cycle of a power source, voltage losses, and current to cable section relationship. • Check if the consumables applied in a certain project are according to consumables standards classification (at least for non-alloy steels).

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LEARNING OUTCOMES – INTRODUCTION TO WELDING TECHNOLOGY AND ARC POWER SOURCES				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
		using standards for filler materials, electrodes and gases. • Define the type of treatment before the use of welding consumables (shielding gases, filler materials and electrodes) on the production. • Interpret the appropriate standards for shielding gases, filler materials and electrodes (at least for non-alloy steels).		• Outline the appropriate methods of handling, control, storage and baking of the various types of shielding gases, filler materials and electrodes. • Apply the correct methods for safe handling and storage of shielding gases, filler materials and electrodes.

Competence Unit 2: Welding and Cutting Conventional Processes

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - WELDING AND CUTTING CONVENTIONAL PROCESSES (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	Choose for high complex constructions the appropriate welding, brazing and cutting process including the parameters and filler materials Decide on meccanization, automation and or robot methods for welding and cutting applications and all necessary means for implementation Analyse weld beads and cut surfaces on high complex constructions, in order to determine process problems	**7**	**14**
EWT	**6 /ADVANCED**	1. Manage the activities regarding the implementation of the most common welding and cutting processes and potential problems to be overcome 2. Choose for complex constructions the appropriate welding, brazing and cutting process including the parameters and filler materials 3. Decide on meccanization, automation and or robot methods for welding and cutting applications 4. Analyse weld beads and cut surfaces on complex constructions, in order to determine process problems	**28**	**56**
EWS	**5/SPECIALIZED**	1. Supervise the activities regarding the implementation of the most common welding and cutting processes and potential problems to be overcome 2. Choose for basic constructions the appropriate welding, brazing and cutting process including the parameters range and filler materials 3. Recommend meccanization, automation and or robot methods for welding and cutting applications 4. Analyse weld beads and cut surfaces on basic constructions, in order to determine process problems	**14**	**28**

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EWP	**4/INDEPENDENT**	1. Verify the activities regarding the implementation of the most common welding and cutting processes and potential problems to be overcome 2. Choose for simple constructions the appropriate welding and cutting process including the parameters range and filler materials	**14**	**28**

LEARNING OUTCOMES – WELDING AND CUTTING CONVENTIONAL PROCESSES				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability of: Conventional welding/cutting/brazing/soldering processes working principles, welding/cutting parameters, most common applications, advantages and disadvantages Fully mechanised processes and robotics applications, advantages and disadvantages	Advanced knowledge and critical understanding of the theory, principles and applicability of: Conventional welding/cutting/brazing/soldering processes working principles, welding/cutting parameters, most common applications, advantages and disadvantages Fully mechanised processes and robotics applications, advantages and disadvantages	Specialised and theoretical, principles and applicability of: Conventional welding/cutting/brazing/soldering processes working principles, welding/cutting parameters, most common applications, advantages and disadvantages Fully mechanised processes and robotics applications, advantages and disadvantages	Factual and broad of: Conventional welding/cutting processes working principles, welding/cutting parameters, most common applications, advantages and disadvantages

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SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** • Review different applications for each welding, cutting and gouging process. • Review different applications for each welding process when applied to narrow gap or orbital welding. • Predict the best solution for higher productivity in welding using robotics, automation and mechanisation. • Evaluate weld beads and cut surfaces, in order to predict process problems.	**Skills defined for EWP and EWS shall be added to the EWT bellow skills** For the following cutting and gouging processes: electron beam, laser, and water jet cutting For the following welding processes: Oxi-gas, TIG, MIG/MAG, Flux Cored, SAW, MMA For brazing and soldering processes For each process • Characterise the Oxy-gas fuel gases, Flame combustion reactions and flame temperature distribution. • Interpret arc characteristics associated with each type of shielding gas used for each process. • Explain the factors and predict the influence on the weld bead shape and morphology (internal and external) or cutting surface, according to the welding/cutting parameters used. • Manage and assess the activities regarding the choice of gases, filler materials, electrodes and fluxes for arc welding processes. • Explain in detail the principles of each welding process, including arc ignition methods, their application and problems to be overcome. • Select and justify for each welding process for a certain application: the appropriate type of current, polarity, shielding gas, electrode (specific for TIG, electrode choices associated with dopants, thermionic emission and correct tip shapes), filler material and fluxes.	**Skills defined for EWP shall be added to the EWS bellow skills** For brazing and soldering processes For the following welding processes: TIG, MIG/MAG, SAW, MMA • Recognize the influence of the process parameters on the weld bead shape, cutting/gouging surface, choosing the appropriate range of values for welding/cutting/gouging parameters for a certain application. • Indicate the range of application, appropriate joint preparations and potential problems to be overcome. • Define the appropriate electrode type, size and correct tip shapes, gas cups and the use of gas lenses for a particular application (for TIG only). • Identify MIG/MAG special techniques and their applications: electro-gas welding, high efficiency processes, spot welding, single wire and multiple wire techniques, flat wire, brazing, electronic stability control (arc and wire feed), etc. • Identify the several types of MMA electrodes covering, their application, the functions of the electrodes coating and rod. • Identify the relationship between MMA electrode diameter, current range, rod material, electrode length and welding position to be applied. • Identify the influence of the SAW wire-flux combination regarding the characteristics of deposited material.	For the following welding processes: Oxi-gas, TIG, MIG/MAG, Flux Cored, SAW, MMA For the following cutting and gouging processes: Oxi-flame, Plasma, carbon arc, oxi-arc, shielded metal arc For each process, either welding or cutting/gouging: • Outline its working principles, including arc ignition methods (when applicable), their most common applications, advantages and disadvantages. • Outline the characteristics of the electrical arc or the flames types due to the type of gases and current (when applicable). • Identify the required equipment for each process referencing the purpose and working principle of the main components of the equipment and accessories. • Outline the role of gases (for flame applications and for shielding, differentiate inert and active), filler materials, electrodes and fluxes in given applications. • Identify gases, filler materials, electrodes and fluxes according to the related standards classifications. • Outline the basic rules to select consumables (filler materials, electrodes, gases and fluxes). • Identify the metal transfer modes for MIG/MAG and relate them with the welding application, e.g. thickness and position. • Identify the process parameters on the weld bead shape, cutting/gouging surface, choosing

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		• Describe the various settings and switches on different welding process power sources and their effects on the welded joint. • Determine the range of application for joint preparations and joint fit up and potential problems to be overcome. • Deduce welding parameters range for welding processes application and its influence on the weld bead. • Explain the principles of MIG/MAG welding including metal transfer modes and their application. • Interpret and apply the appropriate standards that classify the welding consumables (gases, filler materials, electrodes and fluxes) to be choose for a particular material, polarity and current. • Detail the influence of the MMA electrode coating constituents on the arc stability and on the droplet transfer and weld metal properties, the slag-metal and gas-metal reactions on weld metal properties. • Select the correct MMA electrode-coating classification and diameter, current and materials for a certain material to be weld and the welding attitude (position). • Detail the backing methods used for one side welding. • Explain the influence on the SAW of the slag-metal and gas-metal reactions on weld metal properties, justifying all the influencing factors and their particular effects.	• Outline SAW single-wire and multi-wire applications and specific problems to overcome. • Describe the different techniques and standards operating procedures identifying the main variables for brazing and soldering techniques. • Outline the influence of surface preparation, types and characteristics of consumables and fluxes employed on brazing and soldering techniques. • Outline the advantages and disadvantages of robotics, automation and mechanisation of welding processes pointing out the techniques used for seam tracking and their differences. • Indicate the features of the most common industrial applications (e.g. narrow gap and orbital welding). • Outline potential risks, hazards and methods of safe handling and working related with automatic, mechanised and robotics in welding processes. • Supervise the implementation of solutions for higher productivity in welding using robotics, automation and mechanisation.	the appropriate range of values for welding/cutting/gouging parameters for a certain application. • Describe the welding/cutting/gouging techniques methods for a given application and potential problems to overcome. • Indicate the potential hazards and simple methods of safe handling, storage and working practices.

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LEARNING OUTCOMES – WELDING AND CUTTING CONVENTIONAL PROCESSES				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
		• Select flux-wire classification and materials used for Submerged-Arc Welding. • Explain in detail the principles of working and delimit the range of application for the following cutting and gouging process: mechanical, flame, arc, plasma, electron beam, laser, and water jet cutting. • Discuss the influence of each parameter for the above-mentioned processes on the edge surface quality. • Predict the potential risks, hazards for Cutting, Drilling and other edge preparation processes. • Explain the differences between off-line and on-line programming. • Explain the principle, benefits and application of each type of seam tracking system and of narrow gap and orbital welding. • Select solutions for higher productivity in welding using robotics, automation and mechanisation. • Deduce the different applications for each brazing and soldering techniques, including joint preparations and potential problems to be overcome.		

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Competence Unit 3: Advanced Welding Processes

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - ADVANCED WELDING PROCESSES (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	1. Choose for high complex constructions the appropriate advanced welding processes including the parameters and filler materials 2. Analyse weld beads and cut surfaces on high complex constructions, in order to determine process problems	**7**	**14**
EWT	**6 /ADVANCED**	1. Manage the activities regarding the implementation of advanced welding processes and potential problems to be overcome 2. Choose for complex constructions the appropriate advance welding processes, including the parameters and filler materials 3. Analyse weld beads and cut surfaces on complex constructions, in order to determine process problems	**7**	**14**
EWS	**5/SPECIALIZED**	1. Supervise the implementation of the activities regarding the application of the joining processes 2. Under limited guidance, verify the parameters and settings of the welding processes, spraying and surfacing	**7**	**14**
EWP	**4/INDEPENDENT**			

LEARNING OUTCOMES – ADVANCED WELDING PROCESSES				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability Advanced welding processes, processes parameters, applications, advantages and disadvantages. Methods for surfacing and spraying, characteristics of each method, applications, advantages and disadvantages.	Advanced knowledge and critical understanding of the theory, principles and applicability Advanced welding processes, processes parameters, applications, advantages and disadvantages. Methods for surfacing and spraying, characteristics of each method, applications, advantages and disadvantages.	Specialised and theoretical, principles and applicability of Advanced welding processes, processes parameters, applications, advantages and disadvantages. Methods for surfacing and spraying, characteristics of each method, applications, advantages and disadvantages.	

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LEARNING OUTCOMES – ADVANCED WELDING PROCESSES				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** For the following welding processes: Laser, laser- hybrid, Electron Beam, Plasma, ceramics and composites • Deduce the influence of the welding parameters on the weld bead, defining appropriate joint preparations and potential problems to be overcome for each process for a given application. • Describe the various types and characteristics of consumables and activators employed for joining ceramics and composites.	**Skills defined for EWP and EWS shall be added to the EWT bellow skills** For the following welding processes: Laser, laser- hybrid, Electron Beam, Plasma electro-slag, friction; friction stir, magnetically impelled arc butt (MIAB); magnetic pulse welding, ultrasonic; explosive; diffusion; aluminothermic; high-frequency; stud, cold-pressure welding, resistance welding, surfacing and spraying, joining processes for plastics • Explain for each process the purpose and functions of the typical equipment's, accessories, main welding parameters and their influence on the weld and surface preparation characteristics. • Explain the influence of the welding parameters to achieve a sound weld/join. • For resistance welding, detail how to control the process, the systems monitoring, parameters measuring, and specific tests used to evaluate the weld. • For surfacing and spraying, state the pre-processing precautions that should be taken prior to surfacing to ensure integrity. • Interpret the appropriate standards for the electrodes, filler materials and gases (when applicable) associated with consumable selection, testing and processing variables.	For the following welding processes: Laser, Electron Beam, Plasma, Electro-slag, friction; friction stir, magnetically impelled arc butt (MIAB); magnetic pulse welding, ultrasonic; explosive; diffusion; aluminothermic; high-frequency; stud, cold-pressure welding, resistance welding, surfacing and spraying, joining processes for plastics • Outline the operating principles and range of application of the welding processes in the different industrial fields´. • Compare the applicability of the welding processes (Laser, Electron Beam and Plasma) • Outline the criteria for the selection of the correct pressure and current cycles. • Indicate for each process, the typical equipment's, main welding parameters and their influence on the weld. • List the typical consumables for each process (when applicable). • Describe the influence of the surface characteristics (for welding resistance, spraying and surfacing) on the final quality of the joints and the causes of the common discontinuities and their prevention. • Recognise potential hazards and methods of safe handling and working.	

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Competence Unit 4: Introduction to Metallic Materials

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - INTRODUCTION TO METALLIC MATERIALS (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	Same as EWT		
EWT	**6 /ADVANCED**	1. Specify a steel inspection certificate for a certain construction 2. Specify steels for a certain construction according to their standards designation 3. Specify the welding conditions to ensure the weld joint will achieve the proper level of mechanical properties	**7**	**14**
EWS	**5/SPECIALIZED**	Same as EWP		
EWP	**4/INDEPENDENT**	1. Interpret inspection certificates (i.e EN 10204) of steels. 2. Apply standards for steel designation and standards on rolling products 3. Supervise the welding of steels ensuring the weld joint will achieve the proper level of mechanical properties	**7**	**14**

LEARNING OUTCOMES – INTRODUCTION TO METALLIC MATERIALS				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Same as EWT	Advanced knowledge and critical understanding of the theory, principles and applicability of: Structure and properties of metals; Classification of steels; Behaviour of structural steels.	Same as EWP	Factual and broad of: Structure and properties of metals; Classification of steels; Behaviour of structural steels.

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SKILLS	Same as EWT	**Skills defined for EWP shall be added to the EWT bellow skills** • Describe the structures of pure metals and alloys. • Explain the effect of loading conditions and temperature on the mechanical properties of metallic materials. • Deduce the mechanical properties of metallic materials according to their structures. • Describe the differences between elastic, plastic, cold and hot deformation that can occur in metals. • Explain the advantages and disadvantages of metals recrystallization, work hardening and strain ageing. • Predict the changes in the crystallographic structures of metals following welding. • Interpret crystalline lattice distortion from given alloying elements and subsequent structural changes. • Compare the mechanisms of precipitation, types of precipitates and their location within the microstructure. • Explain, in detail, the principles of transformation and conditions of structure under which it occurs. • Interpret in detail the phase diagrams information and apply phase diagrams to define microstructures, mechanical properties and alloys. • Explain in detail the steel making possible processes.	Same as EWP	• Identify the basic mechanical properties of metals. • Outline the effect of loading conditions and temperature on the mechanical properties of metallic materials. • Outline a typical weld solidification structure and the most common principles of strengthening mechanisms. • Outline alloys and binary phase diagrams identifying alloy microstructures from given phase diagrams. • Describe steel making and processing of steel products (rolling and casting). • Identify the most common properties of a steel and types of steel. • Outline the influence of the weld thermal cycle, the peak temperature and the cooling rate when welding steels on the mechanical properties of a weld joint. • Identify on the weld joint the major regions, the HAZ sub regions, the reasons for grain size and microstructure changes and their effects on properties for a single pass weld versus a multi-pass weld including the microstructure formed during welding. • Recognize the weldability of steels, based on the factors (e.g. heat input, carbon equivalent, metal structure, cooling rate, weld pool solidification, single run, multi run) that will influence the weldability.

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LEARNING OUTCOMES – INTRODUCTION TO METALLIC MATERIALS				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
		• Compare the influence of impurities and chemical composition on basic mechanical properties. • Explain how steel is processed by rolling and casting . • Decide on acceptance methods and types of inspection documents regarding steels. • Differentiate the weldability of steels, based on the factors (e.g. heat input, carbon equivalent, metal structure, cooling rate, weld pool solidification, single run, multi run) that will influence the weldability. • Predict the effects of heat input, cooling rate and multi- pass operation on weld metal solidification and the microstructure formed for a single-pass weld versus a multi-pass weld. • Deduce the influence of the heat input and thermal cycle management in order to obtain the best mechanical properties and avoid cracking on the weld joint. • Discuss in detail binary and ternary alloy diagrams including the microstructures.		

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Competence Unit 5: Steels and Their Weldability

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - STEELS AND THEIR WELDABILITY (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	1. Define and manage the appropriate welding processes and filler materials for any type of steel 2. Define and manage post weld heat treatments for any type of welded construction	**7**	**14**
EWT	**6 /ADVANCED**	1. Define and manage the appropriate welding processes and filler materials for each type of steel 2. Evaluate weld joints and select options that may be applied to control the welding variables to avoid cracking 3. Define and select tests to verify crack susceptibility in steels 4. Define and manage post weld heat treatments. 5. Define and manage the process and consumable type to achieve quality requirements for dissimilar metal welds	**21**	**42**
EWS	**5/SPECIALIZED**	1. Evaluate weld joints and, under limited guidance, select options that may be applied to control the welding variables to avoid cracking 2. Select, under limited guidance, the process and consumable type to achieve quality requirements for a given dissimilar metal weld in a given application	**21**	**42**
EWP	**4/INDEPENDENT**	1. Implement the appropriate welding processes and filler materials for each type of steel 2. Apply with limited autonomy basic procedures to eliminate cracking phenomena. 3. Supervise with limited autonomy post weld heat treatment.	**14**	**28**

LEARNING OUTCOMES – STEELS AND THEIR WELDABILITY				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability of steels (including cast steels and iron): Weldability Main causes of cracking and how to avoid Types and goals of heat treatment techniques Joining dissimilar materials	Advanced knowledge and critical understanding of the theory, principles and applicability of steels (including cast steels and iron): Weldability Main causes of cracking and how to avoid Types and goals of heat treatment techniques Joining dissimilar materials	Specialised and theoretical, principles and applicability of steels (including cast steels and iron): Weldability Main causes of cracking and how to avoid Types and goals of heat treatment techniques Joining dissimilar materials	Factual and broad of steels (including cast steels and iron): Weldability Main causes of cracking and how to avoid Types and goals of heat treatment techniques Joining dissimilar materials

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SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** For the following types of steels: unalloyed, low, high alloy steels (including stainless), cast iron and steels. For the following type of steels applications: structural, creep, heat resistant, cryogenic and corrosion. • Explain in detail the different methods to obtain fine-grained steels, including the effects of micro-alloying, relating grain refinement to mechanical properties. • Decide the type of heat treatments requirements for a certain weld joint, inferring the heat treatment conditions (depending of the type and thickness of steel), the application and the code. • Define the welding conditions for a certain weld joint taking into account the material weldability, t 8/5 concept, preheat and interpass temperature, CE, and influence of welding process on HAZ (microstructure, properties). • Analyse stainless steels, their weldability and applications (fully austenitic, ferrite-containing steels, ferritic, martensitic, precipitation hardened, duplex stainless steels, chemically resistant, creep resistant, heat resistant steels, superferritic, supermartensitic and superaustenitic stainless steel e.g. duplex and lean duplex stainless steel).	**Skills defined for EWP and EWS shall be added to the EWT bellow skills** For the following types of steels: unalloyed, low, high alloy steels (including stainless), cast iron and steels. For the following type of steels applications: structural, creep, heat resistant, cryogenic and corrosion. • Predict the microstructure of a steel (Fe-C system) from a TTT or CCT diagram. • Compare the influences of alloying elements and cooling rate on steels and casts microstructure. • Explain the process and consequences on steels of grain growth and grain refinement, comparing the mechanical properties achieved through grain refinement or when there has grain growth. • Explain in detail the different methods to obtain fine-grained steels, including the effects of micro-alloying. • Compare the main grades and properties of unalloyed, low and high alloyed steels (including stainless) and cast iron and cast steels. • Predict the effect of welding process and filler metal selection on weld HAZ properties. • Explain in detail the fundamental aspects of the phenomena and phases of creep, relating the effects of alloying elements and steel structure to creep resistance.	**Skills defined for EWP shall be added to the EWS bellow skills** For the following types of steels: unalloyed, low, high alloy steels (including stainless), cast iron and steels. For the following type of steels applications: structural, creep, heat resistant, cryogenic and corrosion. • Read simple TTT and CCT diagrams. • Describe the different methods to obtain fine-grained steels. • Classify the different types of: stainless, high strengths, cast steels and cast irons. • Describe the Fe - C phase diagram with particular attention to carbon content over 2%, comparing the different types of cast irons and steels, their chemical composition and crystallographic structures. • Categorise the weldability, describing the common problems of the several types of steels and casts, applying the appropriate welding processes and filler materials and specific measures to overcome weldability problems for each type of steel and casts. • List the range of possible industrial applications for steels and casts. • Outline the aspects of the creep phenomena and phases of creep. • Describe the rules and principles governing corrosion phenomena. • Identify heat treatment conditions (in particular temperature) for given welding processes and steel grades	For the following types of steels: unalloyed, low, high alloy steels (including stainless). For the following type of steels applications: structural, creep, heat resistant, cryogenic and corrosion. • Identify phases in the Fe-C diagram, outlining the most relevant aspects of the Fe-C diagram (types of Fe-C alloys). • Recognise the effects of alloying elements on the steel and steel properties. • Recall the main types, grades and properties of unalloyed, low and high alloyed steels (including stainless). • Outline the relationship between grain refinement and mechanical properties of steels. • List the ways to prevent grain coarse on steels. • Compare hardness of steels according to their composition and cooling rate, hardenability, identifying carbide forming elements. • Point out the most common problems regarding the weldability of the several types of steels. • Outline the major heat treatments and their objectives used for based materials and on the welded joints. • List the necessary conditions/requirements needed to perform heat treatment after welding depending of the type and thickness of steel, the application and the product standards and/or construction codes and the code. • Identify the several types of cracking and the reason for its occurrence:

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	• Discuss and predict how to prevent Knife-line attack, 475 °C-embrittlement in a certain application or weld joint. • Predict creep life by use of tests such as Creep sensitivity, step cooling (Temper embrittlement) to decide the use of a certain creep material in a certain application or the influence of the weld in the creep life.	• Predict remaining creep life by use of the most common methods. • Explain the effect of nickel on crystallographic structure, comparing the effect of differing levels of nickel content on weldability of cryogenic steels. • Explain methods of toughness testing and the parameters affecting toughness, relating the creep and cryogenic steels microstructure to toughness. • Assess the weldability of creep, heat resistant steels, and cryogenic steels considering appropriate welding processes and types of consumables. • Explain the structures of the various types of stainless steels; parent metal, HAZ and weld metal. • Interpret the Fe-Cr-Ni phase diagram for a given high alloy welds with various carbon contents. • Explain the rules and principles governing embrittlement phenomena. • Explain the rules and principles governing in detail corrosion phenomena. • Compare heat resistance relative to the effects of alloying elements. • Explain the microstructural phenomena occurring in materials at high temperature • Compare the properties of creep resistant and heat resistant steels. • Infer welding metallurgical phases from Schaeffler / De Long /WRC diagram, considering the limitations	and casts, associating code requirements. • Recognise the type and cause of cracking from study of fractured material and its history. • Describe the main weldability aspects involved when joining dissimilar materials. • Choose appropriate consumables based on given Schaeffler / De Long /WRC diagrams.	cold cracking, hot cracking, and lamellar tearing. • Identify appropriate precautions that will reduce or eliminate the occurrence of cold cracking, hot cracking, and lamellar tearing in welded fabrication. • Outline the most common weldability aspects involved when joining dissimilar materials.

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		of using Schaeffler / De Long /WRC diagrams, selecting the welding process and consumables for each type of stainless steel using different diagrams. • Explain in detail for each type of cracking (cold cracking, hot cracking, reheat cracking and lamellar tearing): the mechanisms, the factors that influence it and prevention and control methods to avoid cracking. • Compare in detail, for each type of cracking, the weld joint susceptibility (type of materials, thickness, etc.), the effects of inclusions, joint configuration, stress and fatigue. • Infer the type and cause of cracking from study of fractured material and its history. • Select suitable tests that will assist in finding the solution of cracking problems. • Assess appropriate precautions to avoid cracking, appraising a welded joint and selecting options that may be applied to determine and control the welding variables to avoid cracking • Explain and compare in detail, the effect of each heat treatment on steels and casts microstructure • Interpret the code requirements for a certain heat treatment, predicting the heat treatment conditions after welding depending of the type and thickness of steel, the application and the code. • Predict the mechanical property outputs after heat treatment taking in		

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LEARNING OUTCOMES – STEELS AND THEIR WELDABILITY				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
		consideration of hardenability, mass effects and rolling sections. • Explain the metallurgical and weldability aspects involved when joining dissimilar materials		

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Competence Unit 6: Wear, Corrosion, Fractures and Application of Structural and High Strength Steels

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - WEAR, CORROSION, FRACTURES AND APPLICATION OF STRUCTURAL AND HIGH STRENGTH STEELS (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	Same as EWT		
EWT	**6 /ADVANCED**	1. Manage if the welding procedure is suitable for a certain job. 2. Define measures to avoid brittle fractures during welding and implement corrective actions for eliminating brittle fractures 3. Define measures to avoid corrosion problems due to the execution of welds 4. Define procedures and solutions for material wear problems with protective layers	**7**	**14**
EWS	**5/SPECIALIZED**	1. Verify if the welding procedure is suitable for a certain job. 2. Implement under supervision, solutions for material wear problems with protective layers	**7**	**14**
EWP	**4/INDEPENDENT**			

LEARNING OUTCOMES – WEAR, CORROSION, FRACTURES AND APPLICATION OF STRUCTURAL AND HIGH STRENGTH STEELS				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Same as EWT	Advanced knowledge and critical understanding of the theory, principles and applicability of: Fractures and different kinds of fractures Application of structural and high strength steels Types of corrosion and methods to control corrosion Types of wear and protective layers	Specialised and theoretical, principles and applicability of: Fractures and different kinds of fractures Application of structural and high strength steels Types of corrosion and methods to control corrosion Types of wear and protective layers	

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SKILLS	Same as EWT	**Skills defined for EWS shall be added to the EWT bellow skills** • Explain in detail the differences between cracks and fractures comparing the formation mechanisms of different types of fractures. • Assess fracture types given fracture surface information. • Apply Failure Assessment Diagrams (FADs) to a fracture case study, identify the type of fracture and predict its likely cause. • Explain in detail the chemical and electrochemical phenomena involved in corrosion. • Explain how welding of dissimilar metals, and formation of carbides and intermetallic compounds during welding creates electrode potentials that may cause corrosion coupling (galvanic cells). • Discuss the different mechanisms of the different types of corrosion. • Select corrosion protection methods. • Exemplify wear situations involving each of the mechanisms for the different types of wear. • Compare the methods and results of tests to define wear resistance. • Interpret the precautions and procedures designed to avoid excessive wear. • Explain methods of resolving problems with different types of protective layer.	• Describe the differences between cracks and fractures recognising the differences between ductile and brittle fractures. • Identify the type of fracture in a given case study and, under limited guidance, select the possible causes. • Show, using examples, the practical application of structural and high strength steels in design of bridges, cranes, pressure vessels, automotive equipment, buildings (architectures), ships, and pipelines etc. • Classify the most common types of corrosion, identifying the chemical and electrochemical phenomena involved in corrosion. • Identify wear situations that involve the mechanisms of the different types of wear. • Recognise the advantages and disadvantages of the various techniques for applying protective layers. • Categorise the problems associated with each method of applying protective layers.	

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LEARNING OUTCOMES – WEAR, CORROSION, FRACTURES AND APPLICATION OF STRUCTURAL AND HIGH STRENGTH STEELS				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
		• Assess the selection of materials used in weldment design with protective layers. • Predict the potential problems associated with different types of protective layer.		

Competence Unit 7: Other Materials then Steel

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - OTHER MATERIALS THEN STEEL (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	1. Define methods to avoid or prevent the cracking mechanisms	**7**	**14**
EWT	**6 /ADVANCED**	1. Define welding procedures to achieve the necessary quality level of weld joints 2. Select methods to avoid or prevent the cracking mechanisms	**7**	**14**
EWS	**5/SPECIALIZED**	1. Implement welding procedures to achieve the necessary quality level of weld joints 2. Implement methods to avoid or prevent the cracking mechanisms	**7**	**14**
EWP	**4/INDEPENDENT**			

LEARNING OUTCOMES – OTHER MATERIALS THEN STEEL				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability of: Copper, nickel, aluminium, titanium, magnesium, tantalum and zirconium weldability Main causes of cracking and how to avoid Types and goals of heat treatment techniques Joining dissimilar materials	Advanced knowledge and critical understanding of the theory, principles and applicability of: Copper, nickel, aluminium, titanium, and magnesium weldability Main causes of cracking and how to avoid Types and goals of heat treatment techniques Joining dissimilar materials	Specialised and theoretical, principles and applicability of: Copper, nickel, aluminium, titanium, and magnesium weldability Main causes of cracking and how to avoid Types and goals of heat treatment techniques Joining dissimilar materials	

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LEARNING OUTCOMES – OTHER MATERIALS THEN STEEL				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** For the following metals and alloys: copper, nickel, aluminium, titanium, magnesium, tantalum, zirconium and dissimilar joints: • Interpret the weldability of a certain material, including dissimilar joints. • Discuss the welding process application, recommending heat input, filler materials and shielding gases to achieve quality requirements for a specific construction. • Recommend methods to avoid hot cracking and solid-state microfissures in welding of various materials, providing alternatives where necessary.	**Skills defined for EWP and EWS shall be added to the EWT bellow skills** For the following metals and alloys: copper, aluminium, titanium, magnesium and dissimilar joints: • Define methods to avoid or prevent the cracking mechanisms. • Define heat treatment procedures for specific applications. • Interpret the weldability of a certain material, including dissimilar joints. • Discuss the welding process application recommending heat input, filler materials and shielding gases to achieve quality for a specific construction. • Explain in detail the metallurgical and weldability aspects involved when joining dissimilar materials. • Infer welding metallurgical phases from Schaeffler / De Long /WRC diagram. • Select the correct welding process and filler material for dissimilar metal welds.	For the following metals and alloys: copper, nickel, aluminium, titanium, magnesium and dissimilar joints: • Identify the factors that promote hot or solidification cracking and liquation cracking in weld metal and in HAZ. • Classify weldability giving examples of specific applications. • Select, under limited guidance, the welding process, filler material and shielding gas to achieve quality requirements for a given joining process. • Outline the most common weldability aspects involved when joining dissimilar materials and welding methods to minimize simple problems. • Choose appropriate consumables based on given Schaeffler / De Long /WRC diagrams.	

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Competence Unit 8: Design for Welding & Brasing

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - DESIGN FOR WELDING & BRASING (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	1. Define methods for improvement of the fatigue life welded joints. 2. Define the type of joint according to S-N diagrams for a construction 3. Define the types of joints and joints position to be used in a metallic structure or pressure equipment 4. Define the fracture mechanics testing and assessment methods for a certain application.	**14**	**28**
EWT	**6 /ADVANCED**	1. Define and select the weld joints and joint fit up for a certain application 2. Define which welding symbols should be used in a certain application 3. Calculate in detail weld size, nominal stresses and combined stresses in welds 4. Verify if the weld design used is acceptable for the construction 5. Select appropriate materials for specific applications using design data and appropriate calculations complying with strength / temperature requirements 6. Select methods for improvement of the fatigue life welded joints. 7. Select the type of joint according to S-N diagrams for a construction 8. Select the types of joints and joints position to be used in a metallic structure or pressure equipment 9. Select the fracture mechanics testing and assessment methods for a certain application.	**21**	**42**
EWS	**5/SPECIALIZED**	3. Calculate simple basic weld size 1. Recommend methods for improvement of the fatigue life of simple welded joints. 2. Recommend the type of joint according to S-N diagrams for a simple construction 3. Recommend the types of joints and joints position to be used in a simple metallic structure or pressure equipment	**21**	**42**
EWP	**4/INDEPENDENT**	4. Supervise the weld joint and joint fit up according to the drawings 1. Interpret welding symbols that are on the drawings 2. Carry out the implementation of recommendations for fatigue improvement of welded joints. 3. Assess weld joints to realize if notches or weld defects will decrease or not the fatigue life of the weld joint	**7**	**14**

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LEARNING OUTCOMES – DESIGN FOR WELDING & BRASING				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability of: Welding drawings interpretation and calculation for simple welding joints Specification of weld joints types and fit up based on drawings interpretation Behaviour of welded structures under different types of loading Methods to improve the fatigue strength on welding joints	Advanced knowledge and critical understanding of the theory, principles and applicability of: Welding drawings interpretation and calculation for simple welding joints Specification of weld joints types and fit up based on drawings interpretation Behaviour of welded structures under different types of loading Methods to improve the fatigue strength on welding joints	Specialised and theoretical, principles and applicability of: Welding drawings interpretation and calculation for simple welding joints Specification of weld joints types and fit up based on drawings interpretation Methods to improve the fatigue strength on welding joints	Factual and broad of: Welding drawings and symbols Identification of weld joints types and fit up based on drawings interpretation Identification of factors that influence the fatigue strength on welding joints

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SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** • Explain in depth the requirements according different types of loading and temperatures. • Deduce for a certain application the materials that meet strength/temperature requirements. • Predict appropriate materials for use in specific applications. • Explain in depth the principles of design of different connection zones. • Predict the stresses in frames and the stresses in welds of frames based on known or predicted forces. • Explain in depth the advantages and disadvantages of different types of welds under different types of loading. • Appraise, with full autonomy, alternative design solutions for welded metallic structure and pressure equipment fabrication. • Draw, interpret and explain in depth S-N diagram and the goal for their use. • Interpret appropriate standards for design and fabrication. • Design welded joints in accordance with given details. • Explain in depth the principles of linear-elastic and elastic-plastic fracture mechanics. • Predict the influence factors for linear-elastic and elastic-plastic fracture mechanics.	**Skills defined for EWP and EWS shall be added to the EWT bellow skills** • Explain in detail, the composition of forces, resolution of forces, the equilibrium conditions and the equilibrium of structural systems. • Explain in depth bearings, constraints and the basic types of connections. • Explain in depth the difference between a statically determinate and a statically indeterminate system. • Calculate internal forces and moments of simple statically determinate systems. • Interpret, using sketches, the shearing force and bending moment diagram of simple statically determinate systems. • Explain in depth and calculate the different types of stresses resulting from internal forces and moments in a weld joint. • Calculate the different types of cross section variables and nominal stresses in sections. • Analyse specific applications and verify if the calculation methods and results for a construction are acceptable. • Detail different types of welded joints, according to ISO 9692 or national standard. • Interpret appropriate standards to determine the shape and size of weld required.	**Skills defined for EWP shall be added to the EWS bellow skills** • Outline the composition and resolution of forces and the equilibrium conditions of structural systems. • Recognise bearings, constraints and the basic types of connections used on construction design. • Outline different types of stresses and stress-strain relationships in welded joints. • Identify the stresses resulting from internal forces and moments. • Calculate internal forces and moments of simple basic statically determinate systems. • Identify different types of welded joints, according to ISO 9692 or national standards. • Interpret, correctly, weld symbols to identify the shape, size and position of joints. • Outline the requirements for the construction according to different types of loading and temperatures. • Identify globally groups of materials which meet strength / temperature requirements. • Identify the materials groups that meet the construction requirements defined for a project. • Identify the different connections zones and verify that the weld geometry is appropriate to maximise integrity and safety. • Use an S-N diagram.	• Outline different types of welded and brazed joint, according to ISO 9692, CEN, and national standards. • Choose the correct design welding symbol according to ISO2553, making proper use of welded joints symbols. • Identify in the fabrication drawings the welding symbols and relating them to the specific weld joints. • Outline the most common joint geometrical form/shape, surface and types applied for if static loading. • Outline the most common methods for improving fatigue strengths value of the welded joint. • Interpret the effect of the most common notches and weld defects on quality and lifetime of welded details. • Point out the characteristics phenomenon of cyclic load of welded structures. • Show the correct use of weld joints according to the design of metallic structures, pressure equipment.

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	• Explain in depth the use of fracture mechanics for dynamically loaded structures. • Determine the fracture mechanics testing and assessment methods for a certain application.	• Appraise, autonomously, a certain welded fabrication project, analysing it to define the type and size of weld. • Produce a drawing to communicate the weld design required to achieve a specified performance. • Explain the requirements according to different types of loading and temperatures. • Explain the design of different connection zones. • Define the stresses in frames and nominate the stresses in welds in frames. • Using specified material data calculate the relevant weld stresses and the appropriate weld geometry and position to maximise integrity and safety. • Explain the methods applied to welds for improved fatigue performance. • Define the influence of notches and weld defects on the classification of welded joints. • Draw and use an S-N diagram and define its limitations with respect to accuracy. • Design welded joints in accordance with given details. • Calculate from a known level of stress the most appropriate circumferential and longitudinal joint size and advise on any positional or geometrical modifications. • Differentiate between the design requirements for steel and aluminium welded structures.	• Identify possible modifications on the weld joint or weld surface to improve fatigue performance. • List the most import precautions when welding a metallic structure or a pressure equipment. • Identify some typical applications of aluminium and describe the advantages against steel construction. • Identify typical aluminium joints and respective joint preparations.	

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LEARNING OUTCOMES – DESIGN FOR WELDING & BRASING				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
		• Explain the principles of linear-elastic and elastic-plastic fracture mechanics. • Define the influence factors for linear-elastic and elastic-plastic fracture mechanics. • Explain the use of fracture mechanics for dynamically loaded structures.		

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Competence Unit 9: General Features for Quality Management

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - GENERAL FEATURES FOR QUALITY MANAGMENT (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	1. Determine the welding costs, recommending methods for minimising the cost of welding and estimating the improvements. 2. Define and select the proper welding procedure to be applied in a certain welded reinforcement steels joint including all necessary measures to achieve the necessary level of quality	**7**	**14**
EWT	**6 /ADVANCED**	1. Define procedures to minimise distortion and stress in complex fabrication predicting the contraction and distortion in joints and structures. 2. Define the plant facilities and design of the layout to maximise productivity, safety and ergonomic benefits in welding manufacturing, including the selection of fixtures, jigs and positioners, heat treatment and temperature control equipment for a certain weld job. 3. Define the procedures for joint fit up and tack welding. 4. Perform risk assessment and formulate the management actions to mitigate the risks. 5. Define procedures for monitoring and measuring of welding parameters and temperatures 6. Define procedures for calibration and validation of testing and measuring equipment and monitoring of welding operations 7. Select and define working procedures for the correct measurement and control of welding parameters and heat treatments operations. 8. Define and select welding repair procedures for a certain job	**7**	**14**
EWS	**5/SPECIALIZED**	1. Define simple procedures to minimise distortion and stress 2. Select the fixtures, jig or positioner, and auxiliary equipment and cables, heat treatment and temperature control that will improve productivity, safety and comfort. 3. Supervise joint fit up and tack welding implementation 4. Check if testing and measuring equipment need calibration and or validation 5. Define the conditions to make a weld in reinforcement steels aiming to achieve the necessary quality level.	**7**	**14**
EWP	**4/INDEPENDENT**	1. Implement procedures to minimise distortion and residual stress in welded joints. 2. Implement the procedures for monitoring and measuring of welding parameters and temperatures 3. Check welding hazards and implement safe working procedures and regulations relating them to welding hazards. 4. Check and verify the need of calibration and validation of the testing and measuring equipment used in welding fabrication and implement the monitoring procedures to be applied during welding operations. 5. Supervise the implementation of welding repair procedures	**7**	**14**

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LEARNING OUTCOMES – GENERAL FEATURES FOR QUALITY MANAGMENT				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability of: Residual Stresses and Distortion in weld joints Specification of plant facilities, welding jigs and fixtures Measurement, Control and Recording in Welding Productivity, safety and comfort in welding manufacturing assessment and improvement Specification of Repair Welding procedures	Advanced knowledge and critical understanding of the theory, principles and applicability of: Residual Stresses and Distortion in weld joints Specification of plant facilities, welding jigs and fixtures Measurement, Control and Recording in Welding Productivity, safety and comfort in welding manufacturing assessment and improvement Specification of Repair Welding procedures	Specialised and theoretical, principles and applicability of: Residual Stresses and Distortion in weld joints Plant facilities, welding jigs and fixtures Measurement, Control and Recording in Welding Principles to improve productivity, safety and comfort in welding manufacturing Repair Welding specifications	Factual and broad of: Residual Stresses and Distortion in weld joints Plant facilities, welding jigs and fixtures Health and Safety applied to welding and cutting Control of welding parameters Repair Welding specifications

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SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** • Define in detail the relationship between the material at a certain temperature and its mechanical characteristics. • Explain in detail the techniques and technologies that can be applied to minimise welded production costs. • Determine the welding costs, recommending methods for minimising the cost of welding and estimating the improvements. • Interpret the design features of types of welded joint used for reinforcing steel in load bearing and non-load bearing locations. • Define and select the proper welding procedure to be applied in a certain welded reinforcement steels joint including all necessary measures to achieve the necessary level of quality.	**Skills defined for EWP and EWS shall be added to the EWT bellow skills** • Explain in detail the origin and influencing factors of residual stress and how the different factors interact between them. • Predict the distribution of residual stresses in a weld (parallel to the weld axis, perpendicular, and through thickness, influence of the material thickness). • Predict how residual stresses may affect the behaviour of a structure in service, selecting solutions to achieve the required level of weld quality and geometrical tolerances. • Explain in detail the health and safety hazards associated with electricity, gases, fumes, fire, radiation and noise, grinding, welding spatter, flame, fire, combustion, oxygen environment enrichment. • Predict the hazards, defining the health and safety requirements and working procedures, including the definition of the necessary PPE. • Explain in detail the methods of measurement used in the control and monitoring of welding. • Identify the factors affecting welding costs, how they are affected by changes in the welding variables (welding processes, parameters, conditions, etc.) comparing options to reduce the cost of welding and estimate the improvements. • Calculate and assess the cost of welding operations.	**Skills defined for EWP shall be added to the EWS bellow skills** • Describe the origin and influencing factors of residual stress and distortion in welded fabrications and its distribution at the welded joint (parallel to the weld axis, perpendicular, and through thickness, influence of the material thickness). • Recognise the principles to improve productivity, safety and comfort in welding manufacturing. • Identify the special requirements for joint fit up and tack welding. • Describe the methods of measurement used in the control and monitoring of welding. • Apply the requirements for calibration, validation and monitoring of welding operations given in working procedures. • Recognise the relevant welding and handling procedures that would reduce the cost of welding, and estimate the improvements calculating simple costs of welding operations. • Associate the types of welded joint used for reinforcing steel in load bearing and non-load bearing locations.	• Outline the origin and influencing factors of residual stress and distortion in welded fabrications and its distribution at the welded joint (parallel to the weld axis, perpendicular, and through thickness, influence of the material thickness). • Identify the relationship between the material at a certain temperature and its most relevant mechanical characteristics. • Identify the most common contraction and distortion in joints and structures. • Outline how residual stresses may affect the behaviour of a structure in service. • List the most common type of fixture, jig and positioner to be used in a certain welded construction. • Identify the type of auxiliary equipment and cables, heat treatment and temperature control equipment to be used in a welded fabrication. • Outline the general precautions related with joint fit up and tack welding. • List the health and safety hazards associated with electricity, gases, fumes, fire, radiation and noise, grinding, welding spatter, flame, fire, combustion, oxygen environment enrichment. • List the most common methods of measurement used in the control of welding. • Identify the elements comprising the cost of welded fabrication.

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LEARNING OUTCOMES – GENERAL FEATURES FOR QUALITY MANAGMENT				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
				• Outline the most common problems related with repair welds. • Measure and record, welding parameters and temperatures before, during and after welds, when applicable.

Competence Unit 10: Quality Assurance/ Quality Control on Welded Joints

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - QUALITY ASSURANCE/ QUALITY CONTROL ON WELDED JOINTS (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	Same as EWT but applicable to high complex construction projects	**7**	**14**
EWT	**6 /ADVANCED**	1. Prepare audit plans considering its influence in welded fabrication quality requirements. 2. Select and define the structure of the quality assurance, quality control and inspection testing plan for a particular quality outcome in welded fabrication 3. Select, define and interpret according to international/national standards how to develop and approve the WPSs/WPQRs/pWPSs BPSs/pBPSs/BPQRs to be used in a certain project 4. Select, define and interpret according to international/national standards how to approve the welders, brazers, welding and brazing operators to work in a certain project 5. Define the necessary conditions for the qualification of welding procedures, and approval of welder/operators for complex construction projects 6. Define the contents of WPSs/BPSs based in WPQRs/BPQRs for complex construction projects	**7**	**14**
EWS	**5/SPECIALIZED**	1. Implement WPSs, WPQRs, BPSs, BPQRs for a certain weld job in a certain 2. Select the standard for the approval of WPQRs, BPQRs and the standard to develop a WPSs and BPSs to be applied in a certain project 3. Select the standard for the approval of welders, brazers, welding and brazing operators to be applied in a certain project 4. Define the necessary conditions for the qualification of welding procedures, and approval of welder/operators for simple construction projects 5. Define the contents of WPSs/BPSs based in WPQRs/BPQRs for simple construction projects	**7**	**14**
EWP	**4/INDEPENDENT**	1. Implement quality control procedures and instructions for a certain project 2. Verify if the WPS and welder/welding operator documents can be used for a certain weld job in a certain project.	**7**	**14**

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LEARNING OUTCOMES – QUALITY ASSURANCE/ QUALITY CONTROL ON WELDED JOINTS				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability of: Quality assurance and control during manufacturing Specification of welders/operator's approvals, WPSs, WPQRs, BPSs, BPQRs	Advanced knowledge and critical understanding of the theory, principles and applicability of: Quality assurance and control during manufacturing Specification of welders/operator's approvals, WPSs, WPQRs	Specialised and theoretical, principles and applicability of: Quality assurance and control during manufacturing Interpretation of welders/operator's approvals, WPSs, WPQRs	Factual and broad of: Quality assurance and control during manufacturing Interpretation of welders/operator's approvals, WPSs, WPQRs

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LEARNING OUTCOMES – QUALITY ASSURANCE/ QUALITY CONTROL ON WELDED JOINTS				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** For high complex projects: • Select and define the welding coordination tasks, responsibilities and related personnel matrix. • Select, define and interpret according to international/national standards how to develop and approve the WPSs/WPQRs/pWPSs BPSs/pBPSs/BPQRs to be used in a certain project. • Select, define and interpret according to international/national standards how to approve the welders, brazers, welding and brazing operators to work in a certain project. • Select the requirements of relevant standards for base, filler material and weld joints traceability, defining the essential content of materials procedures and certificates for a certain project.	**Skills defined for EWP and EWS shall be added to the EWT bellow skills** • Design and define the essential elements of quality assurance, quality control procedures and quality plans in relation to welded fabrication quality requirements in a certain project. • Analyse the principles of quality assurance, quality control and inspection testing plan in relation to welded fabrication to realise its specific quality requirements. • Define audit principles, illustrating how each can affect the reliability of results and comparing their impacts on welded fabrication quality requirements. • Explain in detail the influence of personnel and equipment factors that have a major effect on welded fabrication quality. • Explain in detail the activities and responsibilities of the welding coordinator responsible for welded fabrication/ manufacture in relation with the impact of the specific tasks on weld quality. • Interpret Quality Assurance/ Quality Management standards (e.g. ISO 9000, and ISO 3834).	**Skills defined for EWP shall be added to the EWS bellow skills** • List the main differences between quality assurance, quality control and inspection testing plan describing their usage for welded fabrication. • Outline the role of the Welding Specialist in the metalworking manufacturing. • Outline the use and applications of Quality Assurance/ Quality Management standards (e.g. ISO 9000, and ISO 3834). • Provide the necessary inputs after plant quality audits, with the aim to solve the audit findings. • Recognise the main purpose of BPS/pBPS/BPQR and the advantages to the quality of welded fabrication. • Recognise the main variables for a particular WPQR and its range of approval in accordance with National and/or International standards. • Recognise the main variables for a particular welder, brazer, welding and brazing operator approval and its range of approval in accordance with National and/or International standards. • Outline the traceability requirements for base, filler materials and weld joints project.	• Identify the goals and the differences of quality assurance and quality control to the own practice and work. • Outline the most common factors related to personnel and equipment, which influence the quality of a welded construction. • Identify the role of the Welding Practitioner in the metalworking manufacturing. • List the main purpose of WPS/WPQR/pWPS and related them to their advantages to the quality of welded fabrication. • List the main purposes of welder and welding operator approval and relate them to the main advantages to the quality of welded fabrication. • Outline the most common ISO standards used for welder and welding operators approval, welding procedures approval and the content of welding procedures specifications. • Give examples of essential and non-essential variables for a certain WPS qualification. • Give examples of essential and non-essential variables for a certain welder, welding operator qualification.

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Competence Unit 11: Tests Used for The Quality Control of Welded Joints

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - TESTS USED FOR THE QUALITY CONTROL OF WELDED JOINTS (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	1. Assess if an imperfection is likely to be material related or induced during manufacturing. 2. Assess the need and the appliance of Critical Engineering Assessment 3. Define and select the appropriate acceptance criteria to monitor the results and make the fitness for service decision	**7**	**14**
EWT	**6 /ADVANCED**	1. Select and define the need for special testing to be specified for a certain project recommending specific tests to achieve specified quality requirements 2. Define and select acceptance standards for weld imperfections for a certain job determining the results. 3. Define and select the features of weld design that may prevent or adversely affect application of NDT methods 4. Define and select the type of destructive, non-destructive tests and personnel needed for a certain welded construction	**7**	**14**
EWS	**5/SPECIALIZED**	1. Select and define the correct acceptance level for welding imperfection for a certain job in basic constructions	**7**	**14**
EWP	**4/INDEPENDENT**	1. Identify the places where welding repair will be made based on the information given on NDT non-destructive tests reports 2. Implement the use of acceptance standards for weld imperfections.	**7**	**14**

LEARNING OUTCOMES – TESTS USED FOR THE QUALITY CONTROL OF WELDED JOINTS				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability of: Identification of imperfections and specification of acceptance criteria Specification of destructive and non-destructive testing of materials and welded joints	Advanced knowledge and critical understanding of the theory, principles and applicability of: Identification of imperfections and specification of acceptance criteria Specification of destructive and non-destructive testing of materials and welded joints	Specialised and theoretical, principles and applicability of: Identification of imperfections and application of acceptance criteria Identification of destructive and non-destructive testing of materials and welded joints	Factual and broad of: Identification of imperfections and application of acceptance criteria Identification of destructive and non-destructive testing of materials and welded joints

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LEARNING OUTCOMES – TESTS USED FOR THE QUALITY CONTROL OF WELDED JOINTS				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** • Justify the need for special testing to be specified for a certain project recommending specific tests to achieve specified quality requirements.	**Skills defined for EWP and EWS shall be added to the EWT bellow skills** • Describe the advanced testing methods [destructive (fracture mechanics, creep, creep fatigue) and non-destructive (digital radiographic, automatic UT, TOFD, Guided Waves, Phased Array, Acoustic emission, Eady Current, etc.)], their purpose and the parameters measured by each of them. • Discuss the significance of imperfection size, morphology and position relative to the effect of the imperfection on structural integrity. • Compare typical methods of Engineering Critical Assessment techniques. • Interpret destructive and non-destructive tests reports.	**Skills defined for EWP shall be added to the EWS bellow skills** • Describe the major testing methods (destructive and non-destructive), their purpose and the parameters measured by each of them. • Interpret the significance of identified imperfections in welded constructions their causes and avoidance and methods of detection. • Outline the features of weld design that may prevent or adversely affect application of NDT methods.	• Outline the objectives and limitations of the most common destructive and non-destructive testing. • List the most common destructive and non-destructive testing. • Outline the functionality, applications, advantages and disadvantages and quantitative or qualitative information from the most common destructive and non-destructive tests. • Identify the content of test reports either for destructive or non-destructive tests. • Identify the significance of the most common weld imperfections relative to their size, location and morphology, as given on acceptance standards. • Recall which NDT method is most suitable for the detection of each imperfection. • Recognise the safety requirements for the main NDT methods.

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Competence Unit 12: Case Studies

QUALIFICATION	EQF/ EWF LEVEL	JOB FUNCTIONS AND ACTIVITIES - CASE STUDIES (high levels can perform lower level functions)	CONTACT HOURS	WORKLOAD
EWE	**7 / EXPERT**	1. Define and select for a high complex construction the quality assurance, quality control, inspection and testing plan and welding conditions to achieve the specified level of quality requirements	**14**	**14**
EWT	**6 /ADVANCED**	1. Define and select for a complex construction the quality assurance, quality control, inspection and testing plan and welding conditions to achieve the specified level of quality requirements	**14**	**14**
EWS	**5/SPECIALIZED**	1. Define and select for a basic construction the quality assurance, quality control, inspection and testing plan and welding conditions to achieve the specified level of quality requirements	**14**	**14**
EWP	**4/INDEPENDENT**			

LEARNING OUTCOMES – CASE STUDIES				
Qualification	**EWE**	**EWT**	**EWS**	**EWP**
KNOWLEDGE	Highly specialised knowledge and critical assessment of theory, principles and applicability of: Analysis of high complex construction projects	Advanced knowledge and critical understanding of the theory, principles and applicability of: Analysis of complex construction projects Interpretation and evaluation of fractures on butt and fillet welds	Specialised and theoretical, principles and applicability of: Analysis of simple construction projects Interpretation and evaluation of fractures on butt and fillet welds	
SKILLS	**Skills defined for EWP, EWS and EWT shall be added to the EWE bellow skills** • Evaluate high complex construction projects on steel and lightweight structures, boilers and pressure vessels, chemical plants and pipelines, shipbuilding and offshore applications, transportation (automobiles, railways) and aerospace applications to define the best welding conditions to achieve the proper quality requirements.	**Skills defined for EWP, EWS and shall be added to the EWE bellow skills** • Evaluate complex construction projects on steel and lightweight structures, boilers and pressure vessels, chemical plants and pipelines, shipbuilding and offshore applications, transportation (automobiles, railways) and aerospace applications to define the best welding conditions to achieve the proper quality requirements.	• Evaluate basic construction projects on steel and lightweight structures, boilers and pressure vessels, chemical plants and pipelines, shipbuilding and offshore applications, transportation (automobiles, railways) and aerospace applications to define the best welding conditions to achieve the proper quality requirements. • Perform Visual Inspection including interpretation and evaluation of fractures on butt and fillet welds.	

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WOW
WORK BASED LEARNING OPPORTUNITIES IN WELDING

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I.3 Theoretical Education - Competence Unit 0: Basic Technical Knowledge

The Competence Unit 0: Basic Technical Knowledge aims at teaching basic technical knowledge, which in general is lacking in participants entering via the route 3 when compared to participants entering via routes 1 and 2. It provides the chance for professional workers and European Welding Practitioners to become qualified as European Welding Specialists.

The Competence Unit 0: Basic Technical Knowledge as the following Learning Outcomes:

LEARNING OUTCOMES – BASIC TECNHICAL KNOWLEDGE	
Qualification	**EWS**
KNOWLEDGE	Factual and broad of: Metrology applicable to Welding Technical Calculation and Drawings Electro-technology Chemistry Materials Metal Products Machining of Materials Technical Mechanics Joining Elements Calculation of strength

LEARNING OUTCOMES – BASIC TECNHICAL KNOWLEDGE	
Qualification	**EWS**
SKILLS	List all SI base units and their symbols for length, mass, time, electric current, voltage, temperature, plane angle and other commonly used units related to welding. List all SI derived units and their symbols for area, density, energy, force, frequency, power, pressure, volume, linear velocity, and other commonly used units related to welding. List and describe measuring instruments used in welding Calculate volumes, areas, speed, flow, consumptions and variables including linear and angular measurements and time related to welding Explain the definition of basic trigonometric functions of sine, cosine and tangent in terms of the ratios of the sides of a right-angled triangle. Use conversion tables “Metric versus Imperial system” for the length, speed and gas flow rate units, “Temperature value between Kelvin, Centigrade e Fahrenheit systems”. Read and describe basic technical drawings related to welding technology. Describe the difference between DC and AC current. Outline single-phase and 3-phase, AC power lines, peak value, mean value and RMS value for either AC current or voltage. Outline star (Y) and delta (Δ) connections. Use voltmeters, ammeter, ohmmeters and multi-meters including digital multi-meters applied to welding. Read connection diagrams and simple circuits. List basic chemical elements and their symbols in engineering steel, aluminium, nickel and copper, and their alloys. Outline chemical reaction and its representation by the chemical equation with examples of chemical reactions in steel manufacturing. Identify the chemical compositions of the various types of plain carbon, low alloy and high alloy steels. Identify the main metallic materials used in welding and their classification according to their main physical and mechanical properties. Outline the difference between the main properties of steel, cast iron, aluminium and copper. List the main types of wrought products naming their differences and the correct terms. Identify the most important machining methods describing the difference between cutting and abrasive machining. Calculate the forces found in welding activities including: graphically splitting of forces; the resultant force from more forces through one point; simple bending moments and bending forces and support forces (reactions). List different types of material joining methods Compare dismantling joining types versus welding (non-dismantling one). Identify and describe a tensile test diagram. Calculate and verify stresses, section modules, moment of inertia and cross-section area.

I.4. Practical Education – Part 2

I.4.1 For the EWE; EWT, and EWS

This part does not aim at providing practical skills to the welding engineer/technologist/specialist but on gaining knowledge on the control of the different welding processes. The students shall become as familiar as possible with the problems and typical defects associated with incorrect use of the different welding methods. During their exercises the students are guided by skilled welding teachers.

Practical Training	**hours:**
Oxygas welding and cutting	6
MMA	8
TIG	8
MIG/MAG + Flux Cored Arc Welding	16

It is possible to use the advantages of Virtual Weld Training systems but maximum to 50% of the practical training hours!

	hours:
Demonstration or video presentations of processes	22
Gouging	
Brazing	
Plasma welding	
Plasma cutting	
Submerged-arc welding	
Resistance welding	
Friction welding	
Electron beam welding	
Laser welding	
Other processes	
Total:	60

It is strongly recommended that ATBs provide demonstrations instead of videos wherever possible.

Candidates may be exempted by the ATB from the practical training, on a process by process basis, if they can demonstrate practical experience and/or training in the process concerned.

I.4.2 For the EWP

The practical training has to be done on an individual basis.

The main processes are: MMA, MIG/MAG, FCAW, TIG and Gas Welding. 40 hours shall be reserved to broaden the student's skill in other relevant materials within his welder qualification/s. This training shall end with a practical examination in more than one process or more than one group of material (according ISO 9606 or national standards). For MIG welding only material group 22 and for Gas welding only material groups 1.1 and 1.2 are relevant.

If a student can demonstrate existing practical skill in and an understanding of the welding of different materials, it is accepted that he can sit for the practical examination in these processes and materials without prior practical training.

Typical test pieces and positions are given in Table 1. The test pieces shall be welded as single side welding without backing, except for aluminium, where backing is allowed. Each ANB will work to a similar table based on comparable national standards.

Valid national certificates are accepted as replacements for the practical examinations with test pieces in Table 1.

Table 1: Recommended test pieces and positions for practical examinations:

The dimensions given in the table are recommended/proposed, but not mandatory, other dimensions are accepted.

Welding process		Practical Test		
ISO 9606	**ISO 9606**	**Material Group (ISO TR 15608)**	**Welding Position**	**Test Dimension(s) Diameter/Thickness**
MMA	111	1	PF/BW	6,0 – 13,0
		3	PF/BW	6,0 – 13,0
		4, 5, 6	H-L045/BW	∅60,3 – ∅114.3/ 3.9 – 7.11
		7	PF/BW	6,0 – 13,0
		8	PB/FW	6,0 – 13,0
TIG	141	1	H-L045/BW	∅60,3 – ∅114.3 3.9 – 7.11
		3	PF/BW	2,0 – 6,0
		4, 5, 6	H-L045/BW	∅60,3 – ∅114.3 3.9 – 7.11
		7	PF/BW	2,0 – 6,0
		8	H-L045/BW	∅60,3 – ∅114.3 3.9 – 7.11
		22	PF/BW	2,0 – 6,0
MIG	131	22	PF/BW	6,0 – 13,0
MAG (and/or metal cored)	135 (136)	1	PF/BW	6,0 – 13,0
		8	PB/FW	6,0 – 13,0
FCAW (flux cored only)	136	1	PF/BW	6,0 – 13,0
		8	PF/BW	6,0 – 13,0
		3	PA/FW	6,0 – 13,0
GAS	311	1	H-L045/BW	∅60,3 – ∅114.3 3.9 – 7.11

Twenty hours shall be reserved to give the student basic understanding of the possibilities and limitations of the other processes mentioned in Table 1. The purpose of this training is only to demonstrate the possibilities and limitations of these processes, and no practical examination is required. If the student can demonstrate to the training establishment skill in and understanding of the other processes, he may be exempted from this training.

Acceptance criteria for the practical examination:

The quality of welding shall comply with ISO 9606, or comparable quality levels defined in National welders qualification standards used by EWF Group A countries. A welder qualification certificate may be issued.

Appendix I: Abbreviations for Processes

The following abbreviations used in the document show the relation between the ISO designation, the process abbreviations used in Europe and those used in the USA.

ISO 4063	European (EA) and American (AA) abbreviations		Full name
111	EA	MMA	Manual Metal Arc Welding
	AA	SMAW	Shielded Metal Arc Welding
114	EA	FCAW	Self-shielded tubular cored arc
	AA	FCAW	Self-shielded tubular cored arc welding
12	EA	SAW	Submerged Arc Welding
	AA	SAW	Submerged Arc Welding
13	EA	GMAW	Gas Shielded Metal Arc Welding
	AA	GMAW	Gas Metal Arc Welding
131	EA	MIG	MIG welding with solid wire electrode
	AA	GMAW	Gas metal arc welding using inert gas and solid wire electrode
132	EA	MIG	MIG welding with flux cored electrode
	AA	FCAW	Flux cored arc welding
135	EA	MAG	MAG welding with solid wire electrode
	AA	GMAW	Gas metal arc welding using active gas with solid wire electrode
136	EA	MAG	MAG welding with flux cored electrode
	AA	FCAW	Gas metal arc welding using active gas and flux cored electrode
138	EA	MAG	MAG welding with metal cored electrode
	AA	FCAW	Gas metal arc welding using active gas and metal cored electrode
141	EA	TIG	TIG welding with solid filler material (wire/rod)
	AA	GTAW	Gas tungsten arc welding using inert gas and solid filler material (wire/rod)

ISO 4063	European (EA) and American (AA) abbreviations		Full name
142	EA	TIG	Autogenous TIG welding
	AA	GTAW	Autogenous gas tungstenarc weldingusing inert gas
21	EA		Resistance spot welding
	AA	RSW	Spot Welding
25	EA		Resistance Butt Welding
	AA	RSEW	Upset Welding
3	EA		Gas Welding
	AA	OFW	Oxy-fuel Gas Welding
311	EA		Oxy-acetylene Welding
	AA	OAW	Oxy-acetylene Welding
42	EA	FW	Friction Welding
	AA	FW	Friction Welding
43	EA	FSW	Friction Stir Welding
	AA	FSW	Friction Stir Welding
81	EA		Flame Cutting
	AA	OFC	Oxygen Cutting, oxyfuel cutting
86	EA		Flame Gouging
	AA		Thermal Gouging

Appendix B - Items for WBL

The following Items may be covered in Work based Learning, according to the applicable requirements of this guideline, and based upon evaluation from the ATB.

Part	Competence unit	Subject	Contact hours in classroom (cumulative)	Workload (cumulative)	Competence Unit Workload (Cumulative)	Workload ECVET	Competence Unit Credit Points
1	1 Introduction to welding technology and arc power source	-	-	-	-		
	2 Welding and cutting conventional processes	-	-	-	-		
	4 Introduction to metallic materials	-	-	-	-		
	5 Steels and their weldability	-	-	-	-		
2	Practical education	Oxygas welding and cutting	6[1]	12[1]			
		MMA	8[1]	16[1]	60 – EWP	60 – EWP	2 ECVET points
		TIG	8[1]	16[1]			
		MIG/MAG + Flux Cored Arc Welding	16[1]	32[1]	60 - EWS	60 - EWS	2 ECVET points
		Other welding processes	22[1]	44[1]			
3	2 Welding and cutting conventional processes	1.19 Welding laboratory	0-EWP[2] 4-EWS	0-EWP[2] 8-EWS	28 - EWP [2] 56 - EWS	30 – EWP 60 - EWS	1 ECVET point 2 ECVET points
	3 Advanced welding processes	-	-	-	-		-
	4 Introduction to metallic materials	-	-	-	-		-
	5 Steels and their weldability	-	-	-	-		-

	6 Wear, corrosion, fractures and application of structural and high strength steels	-		-	-	-		-
	7 Other materials then steel	-		-	-	-		-
	8 Design for welding & brasing	3.6	Design of welded structures with predominantly static loading	2-EWP 0-EWS[3]	4-EWP 0-EWS[3]			
		3.8	Design of cyclic loaded welded structures	0-EWP[2] 2-EWS	0-EWP[2] 4-EWS	14 - EWP	15 – EWP	0.5 ECVET points
		3.9	Design of welded pressure equipment	1-EWP 0-EWS [3]	2-EWP 0-EWS [3]	56 - EWS[3]	60 - EWS	2 ECVET points
	9 General features for quality management	4.4	Plant facilities, welding jigs and fixtures	1-EWP 2-EWS	2-EWP 4-EWS			
	9 General features for quality management	4.5	Health and safety	1-EWP 2-EWS	2-EWP 4-EWS	14 - EWP	15 – EWP	0.5 ECVET points
	9 General features for quality management	4.6	Measurement, control and recording in welding	1-EWP 1-EWS	2-EWP 2-EWS			
	9 General features for quality management	4.10	Repair welding	1-EWP 0-EWS [3]	2-EWP 0-EWS [3]	28 - EWS	30 - EWS	1 ECVET point
	10 Quality assurance, quality control on welded joints	4.2	Quality control during manufacture [4]	5,5-EWP 4,5-EWS	11-EWP 9-EWS			
	11 Tests used for the quality control of welded joints	4.7	Imperfections and acceptance criteria -level 2 will be exempted for each method they are qualified	1-EWP 1-EWS	2-EWP 2-EWS	14 - EWP	15 – EWP	0.5 ECVET points
	11 Tests used for the quality control of welded joints	4.8	Non-destructive testing	4,5-EWP 2-EWS	9-EWP 4-EWS	28 - EWS	30 - EWS	1 ECVET point
	12 Case studies	-		-	-	-		

[1] Same duration for EWP and EWS, to be performed only once - not cumulative hours

[2] Item not applicable to EWP

[3] Item not applicable to EWS

[4] It is recommended that WBL is performed after attending classroom training for item 4.1 -introduction to quality assurance in welded fabrication [5] Trainees already qualified as Level 2 according to ISO 9712 - or equivalent may be exempted for each method they are qualified. Trainees already qualified as IWI-B or higher -or equivalent may be exempted based on the relevant qualification		

Table A1 – Scopes for WBL

Appendix C – Template for a work-based learning contract (example)

Stakeholders Identification

Trainee Information

Name: Click or tap here to enter text.

Address: Click or tap here to enter text.

City: Click or tap here to enter text.

Country: Click or tap here to enter text. Phone number: Click or tap here to enter text.

Date of Birth: Click or tap to enter a date.

E-mail: Click or tap here to enter text.

EWF Qualification: Click or tap here to enter text.

Authorised Training Body Information

Identification: Click or tap here to enter text.

Address: Click or tap here to enter text.

City: Click or tap here to enter text.

Country: Click or tap here to enter text.

Phone number: Click or tap here to enter text.

E-mail: Click or tap here to enter text.

Name of the tutor assigned: Click or tap here to enter text.

Employer/Company Information

Identification: Click or tap here to enter text.

Address: Click or tap here to enter text.

City: Click or tap here to enter text.

Country: Click or tap here to enter text.

Phone number: Click or tap here to enter text.

Name of the mentor assigned: Click or tap here to enter text.

E-mail: Click or tap here to enter text.

Job position: Click or tap here to enter text.

EWF Qualification: Click or tap here to enter text.

Three-party agreement

1. Venue and period

Place and address: Click or tap here to enter text.

Period: From: Click or tap to enter a date. To: Click or tap to enter a date.

Schedule: Click or tap here to enter text.

2. Rights of the trainee

a) Develop under appropriate conditions provided by the company tasks in the field of welding technology, whose training programme is duly signed is in this contract.

b) Benefit from an accident insurance that protects against risks that may occur during and because of the activities developed under the in-company training programme.

c) Obtain free record of attendance at the end of the in-company training period.

d) That the company respects and enforces the safety and health conditions at the workplace to which it is obliged under the law.

3. Responsibilities of the trainee

a) Agree on the training program, in line with its operations and with the learning outcomes as defined in the applicable guideline

b) Be in assigned location on days and times scheduled.

c) Complete work assignments in a timely manner.

d) Complete activity log sheets on a regular basis.

e) Complete work hours verification on a regular basis.

f) Follow workplace health and safety work rules.

g) Follow all policies and procedures of both the programme and the company.

h) Bring work problems to attention of the assigned in-company trainer and/or mentor.

1. Rights of the Authorised Training Body

a) Perform visits to the venue where the trainee is undertaking the in-company training.

b) Intervene in case of conflict;

c) Intervene when the company is not complying with the requirements to host the trainee.

d) Intervene when informed that the trainee is not complying with the requirements and obligations.

2. Responsibilities of the Authorised Training Body

a) Agree on the training program, in line with its operations and with the learning outcomes as defined in the applicable guideline

a) Provide material to record in-company training activites to be undertaken (e.g. logbook).

b) Provide companies with appropriate instructions including information on the part of doc. EWF-IAB 252 which is relevant to their activities;

c) Performing continuous and end-point assessment of the achieved learning outcomes.

d) Providing trainees with all appropriate training materials (i.e. including the scopes dealt with Work-based learning);

e) ATBs may also cooperate with Vocational Education and Training providers assigning specific tasks in respects to this guideline. However, the responsibility remains with the ATB.

3. Rights of the employer/company

a) Demand from the trainee to be assigned location on days and times scheduled.

b) To be treated as its employees with respect by the trainee.

c) Be treated with loyalty by the trainee and do not see information that the trainee learns during and after the in-company training period disclosed to outsiders.

d) Demand from the trainee the apppropriate use of the equipment, materials and goods of the working space.

e) Suspend the trainee under the following conditions:

- more than 50% absencies;
- improper behaviour during training;
- complaints regarding respecting HSE regulations by the trainee.

4. Responsibilities of the company

a) Agree on the training program, in line with its operations and with the learning outcomes as defined in the applicable guideline.

b) Grant equipment and personal protective equipment to trainees as needed to perform the training programme.

c) Assign the trainee to one or more in-company trainers and one mentor.

d) Ensure alignment with applicable national requirements (including safety, insurance, liabilities, as applicable).

e) Perform continuous assessment of the trainee.

5. Absences

a) The absences are justified and unjustified according to the policies applicable to the generality of the workers of the hosting company.

6. Contract termination

a) The agreement may end by mutual written agreement, by complaint of at least one of the stakeholders engaged or by expiration of the contract.

b) In duly justified cases, compliance with the deadline referred to in the previous paragraph shall be notice shall be given as early as possible.

7. Description of the activities to be performed

Your signature below means that you have read carefully and understand completely the rules of the work-based learning program. Your signature acknowledges your agreement to the standards stated herein.

Date Click or tap to enter a date.

1. **Trainee's Name** Click or tap here to enter text.

   Trainee's Signature

2. **Name of the Authorised Training Body Head** Click or tap here to enter text.

   Authorised Training Body Head's Signature

3. **Mentor's Name** Click or tap here to enter text.

   Mentor's Signature

Appendix D – Checklist for companies

Requirements	
Available and adequate equipment for the trainee to perform the activities.	☐
Necessary personal and colective protective equipment.	☐
One mentor available to assign the trainee to.	☐
Mentor qualified according to doc. IAB 252 at the level of qualification foreseen for the participant or higher.	☐
One mentor with at least two years in the last three years in Welding Coordinationn activities or holding of an EWF Certification as CEWE/T/S/P).	☐
At least one in-company trainer available with expertise in the selected indivual training programme.	☐