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RAINBOW
RELATING INTERNATIONAL QUALIFICATIONS TO EQF

Relating International qualifications to the EQF – the Welding case

RAINBOW November 2018

GUIDELINE OF EWF METHODOLOGY FOR WRITING THE LEARNING OUTCOMES

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EWF

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Introduction

This document comprehends EWF´s (European Federation for Welding, Joining and Cutting) updated strategy for Qualifications design based on the work carried out in the past years, where EWF has started to implement a shift into a learning outcomes approach in its Qualifications.

This document was also prepared, and the methodology aligned with the requirements and needs of other sectors that would benefit with the implementation of International Qualifications.

The International Education, Training, Qualification and Certification System managed by EWF, is a harmonized scheme for the education, training and examination of personnel involved in welding, joining and related technologies. The EWF system is used in 30 European countries, covering all EU members, and has a worldwide recognition as International qualification system.

EWF system started in 1992 with the development of Guidelines for the higher level (International Welding Engineer Qualification) and has since then been developed to encompass all professional levels of welding.

EWF's Qualification and Certification system is an open system that ensures that any person, anywhere in the world, has unrestricted access to education, training, qualification and certification in welding and related technologies, in accordance with international standards, (e.g. ISO, CEN, etc) for different professional Profiles.

At the moment, 46 countries are using the EWF/IIW qualifications and certifications, in a total with 44 Authorised Nominated Bodies (ANBs), 683 Authorised Training Bodies (ATBs), and 26 Authorised National Bodies for Companies Certification (ANBCCs). The network also includes 55.000 companies worldwide.

In terms of structure, this document is divided into three sections, which are:

- EWF Methodology for Qualifications design
- EWF Approach into practice, which include the examples to the work developed for the Welding Coordinators' and Welders Qualifications (Please refer to the appendix section)
- Conclusion

EWF Methodology for Qualifications Design

EWF´s methodological approach to the design of Qualifications implies the use of a common terminology applicable to all its Qualifications and is developed on a modular basis where each Qualification comprehends a set of Competence Units, organized in Learning Outcomes. EWF also considers CEDEFOP "Terminology of European Education and Training Policy" to facilitate the understanding of VET main concepts.

This methodological approach is currently being applied both to the redesign of existing qualifications and to design of new qualifications.

It is structured into a top down approach, where based on the professional profile, the mapping of the major job functions and related activities lead to the development of Competence Units with description of Learning Outcomes in terms of Knowledge and Skills to guarantee that the learners are fully competent in a specific job requirement. This approach is based on the principles of functional analysis to define the occupational competencies and in setting boundaries between different occupations within EWF´s Qualifications.

The professional profile offers the "big picture" about a certain profession. Therefore, the definition of the professional profile must contain a general description of the main objective of the profession, it's general responsibilities and tasks.

The grounding for this description is defined based on the labour market current requirements and anticipation of future needs as well as on existing International, European and/or National Standards related with the regulation of professional activities.

Necessarily, the professional profile shall be directly interlinked with a reference proficiency level, providing the general descriptors in terms of knowledge, skills, autonomy and responsibility that a specific Qualification will address.

To support the design of a Qualification, the following questions should be answered (figure 1):

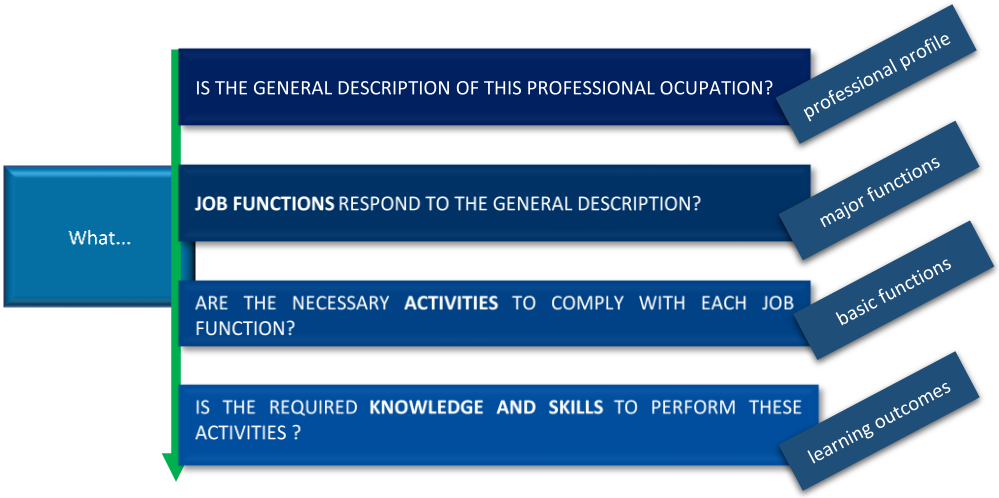

Figure 1 - Questions supporting the design of qualifications

The mapping of the major job functions is made based on the professional profile, subsequently from the previously defined general descriptions, specifying which are the core tasks of such professional activity.

Each main job function is then broken down into sub-functions/activities.

Based on the definition of the job function and related required activities, it becomes possible to identify the required knowledge and skills that learners should achieve during training, thus settling the framework for the definition of a qualification/learning pathway structured into competence units, organized in learning outcomes.

This principle enables the operationalization of a cumulative system and individual learning pathways, where learners validate each Competence Unit independently and whereas such Competence Unit is part of several Qualifications, it is automatically recognized once it has been successfully completed. This flexibility allows the EWF system to work as a full Qualification System instead of an individual and completely “isolated” Qualification. Meaning that a student/professional can easily progress inside the System by updating his/her knowledge and skills, and consequently obtaining higher Qualifications, or can change his/her career path by getting qualified in a different area but without needing to repeat lessons addressing Competence Units he/she have already completed in the past.

A Competence Unit is the smallest learning component of a Qualification and can be implemented individually or as a part of a complete Qualification. In this way, all Competence Units have a specific level of proficiency, assigned workload, and are autonomously and individually validated. The same Competence Unit can also be part of different Qualifications, whenever its Learning Outcomes are necessary for the qualifications expected results. This modular structure for of the qualification also enables an easier integration/adoption of the Technical International modules/competence units as a part of a national qualification.

Within EWF´s qualifications, there are two types of Competence Units:

Cross-cutting Competence Unit - A competence unit whose learning outcomes are not directly linked with one job function since the knowledge and skills achieved will be mobilized in several job functions and activities.

Functional Competence Unit - A competence unit whose learning outcomes are directly linked with at least one job function and in which the knowledge and skills achieved will be mobilized in specific job functions and related activities (figure 2):

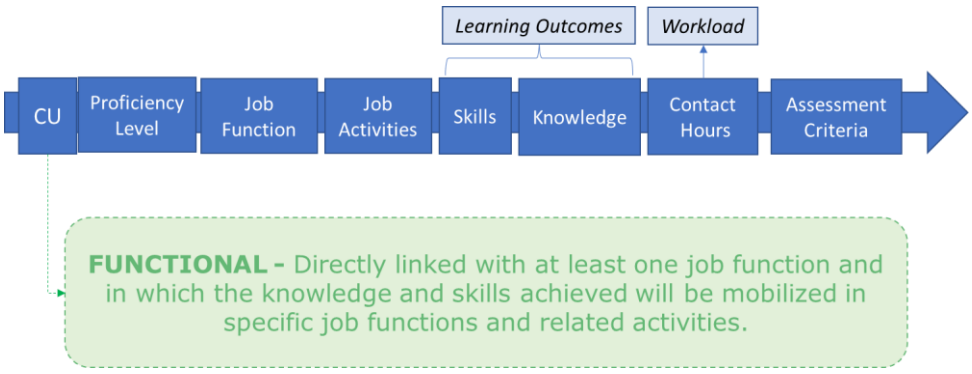

Figure 2 - Structure of Functional Competence Unit

EWF´s qualifications are also designed in a way that enhance and allow upskilling pathways, either within the same field of activity (such as Welding Coordinators – vertical upskilling), or among different specialization areas (such as Welding Inspection and Welding Coordination – horizontal upskilling).

Similarly to SOLO Taxonomy principles structure (Biggs and Collis, 1982), EWF´s methodology for design of upskilling qualifications encompasses the assignment of levels of increasing complexity in learners understanding of subjects, that can be resumed as follows:

- The progression of levels is made from the lowest to the highest level in building blocks
    - The highest levels start the training courses along with the lowest levels ensuring the development of solid fundamental knowledge and skills of concepts and principles
    - Upon successful completion of the lowest levels, learners start more complex levels

The Curricula Design of EWF's Qualifications encompasses the definition of the following activities:

- Competence Units organized in learning outcomes in terms of Knowledge (contents) and Skills, containing the minimum required contact hours (including theory, practice/laboratory hours) and workload
- Methods and tools for a harmonized assessment of the learning outcomes
- Minimum requirements for the necessary resources for the training implementation (resources – activities, equipment, etc)

The EWF System assures harmonised knowledge, skills, autonomy and responsibility for any holder of a diploma in any region of the world, and comprises Education, Examination and Qualification Guidelines for different professional/proficiency levels.

For that purpose, EWF System has its own reference framework (Table 1), containing seven different proficiency levels, currently organized in statements of general descriptors defined in terms of knowledge, skills, autonomy and responsibility for each proficiency level that its qualifications encompass, enabling EWF´s Qualifications transparency, recognition and linkage to both National (NQF) and European Qualifications frameworks (EQF).

EWF System Framework is a result deriving from 2013th first self-referencing process to the European Qualifications Framework comprehending an early mapping of EWF´s qualifications and their alignment with EQF, the Framework for Qualifications of the European Higher Education Area (QF-EHEA) and the International Standard Classification of Education (ISCED).

Table 1. EWF System Framework

General reference descriptors transversal to all qualifications. Each Qualification has its own specific descriptors in terms of knowledge, skills, autonomy and responsibility.

FIELD OF ACTIVITIY		EWF LEVEL	KNOWLEDGE	SKILLS	AUTONOMY AND RESPONSIBILITY
INSPECTORS &SUPERVISORS/ COORDINATORS/MANAGERS	WELDERS & OPERATORS	EXPERT	Highly specialised and forefront knowledge including *original thinking,* research and critical assessment of theory, principles and applicability of metal additive manufacturing or 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 metal additive manufacturing or welding related technologies, in complex and unpredictable conditions	Manage and transform the metal additive manufacturing or welding and related technologies processes in a highly complex context. Fully responsible for the definition and revision of personnel's tasks.
		ADVANCED	Advanced knowledge and critical understanding of the theory, principles and applicability of metal additive manufacturing or welding and related technologies.	Advanced problem-solving skills including critical evaluation, allowing to choose the proper technical and economical solutions, when applying metal additive manufacturing or welding and related technologies, in complex and unpredictable conditions	Manage the applications of metal additive manufacturing or welding and related technologies in a highly complex context. Act autonomously in decision making and definition in the definition of the metal additive manufacturing or welding and related personnel's tasks.
		SPECIALIZED	Specialised, factual and theoretical of theory, principles and applicability of metal additive manufacturing or welding and related technologies	Specialised range of cognitive and practical skills, allowing to develop solutions or choose the appropriate methods, when applying metal additive manufacturing or welding and related technologies, in common/regular problems.	Manage and supervise common or standard metal additive manufacturing or welding applications and related technologies, in an unpredictable context. Take responsibility in standard work and supervise the metal additive manufacturing or welding and related personnel's tasks.
		INDEPENDENT	Factual and broad concepts in the field of metal additive manufacturing or welding technology	Fundamental cognitive and practical skills required to develop proper solutions and application of procedures and tools on simple and specific metal additive manufacturing or welding problems.	Self-manage of professional activities and simple standard applications of metal additive manufacturing or welding and related technologies in predictable contexts but subject to change. Supervise routine tasks and similar function workers, as well as take responsibility for decision making in basic work.
		BASIC	Basic facts, principles, processes and general concepts of welding, joining and related technologies	Be able to check and follow the information on the welding procedure specification, to produce butt and fillet welds in plates and or tubes, and or profiles in a variety of geometries and positions to the required quality and of specified dimensional accuracy	Work under supervision, taking personal responsibility for own actions and for the quality and accuracy of the work produced.
		ELEMENTARY	Elementary principles of welding, joining and related technologies	Able to check and follow the information on the welding procedure or adhesive bounding specification, and to produce weld/joints in a variety of geometries and positions to the required quality and of specified dimensional accuracy	Work under supervision.

EWF approach into practice

This section addresses the EWF approach for designing and mapping the International Welding qualifications and aims at illustrating how the methodology was applied to EWF's core qualifications, ranging from the elementary to the expert levels. As such, the examples that are presented in the following pages was conceived to review both Welding Coordination (annex 1) and Welders Qualifications (annex 2).

The "Welding Coordination", is EWF's core and most mature qualifications, which is fully described in the guideline EWF-IAB-252 (latest revision) (issued by EWF/International Authorisation Board of the International Institute of Welding). The guideline encompasses 4 different professional profiles also referred in the international standards ISO 17431, which are the:

- European Welding Engineer (EWE);
- European Welding Technologist (EWT);
- European Welding Specialist (EWS);
- European Welding Practitioner (EWP).

The guideline was initially structured in 4 Modules of theoretical education and fundamental practical skills:

1. Welding Processes and Equipment;
2. Materials and their Behaviour during Welding;
3. Construction and Design;
4. Fabrication, Applications Engineering.

The "Welders" Qualifications addressed by the EWF-IAB-089 guideline (latest version), comprised three levels of education and training: Fillet Welder, Plate Welder and Tube Welder.

The education and training programme consist on Theoretical competence units "A", B" and C", which provide basic knowledge in welding and six practical modules (3 pairs) corresponding to three levels of skills. Special requirements for each welding process are given in Competence Units "S". Special requirements per "material" (group) are described in Competence Unit "P".

The shift to a learning outcomes-based structure was a quite challenging quest due to the:

- Absence of a common European guideline/format according to the European Qualifications Framework (EQF);
- Good uptake by the EWF members of the welding coordinators guideline in force, which has a specific syllabus structure;

- Guideline comprehends a wide scope of professional profiles and levels (EWE, EWT, EWS, EWP, Fillet Welder, Plate Welder and Tube Welder);
- Most of the professional tasks and responsibilities are shared among the 4 coordination professional profiles, being distinguished by the level of complexity of the welded constructions (ranging from any type of construction to basic specific works), in which these professionals are required to coordinate.
- Most of the scope/topics and learning objectives were common to the qualifications (following-up on the previous statement).

The methodology developed has been based upon a research (trial path) build-up on the next sequence of steps /stages of the methodology:

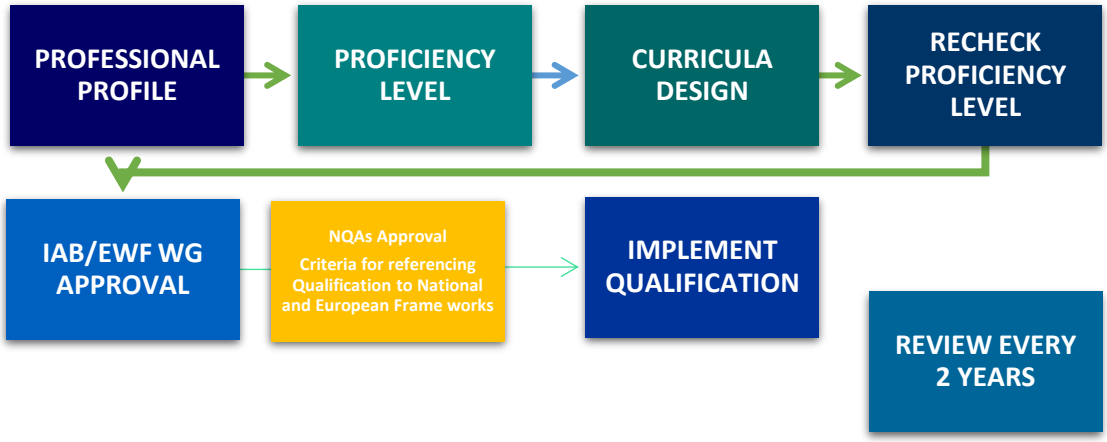

Figure 3 – Steps of the EWF methodology for the design and implementation of international qualifications

1st - Description of each qualification professional profile (based on professional standards and on the EQF general descriptors).

2nd - Self-declared assignment of EQF levels for the qualification profiles, based on EWF´s Qualifications System Framework.

3rd - Definition of the Job Functions + Job Activities + Competence Units organized in learning outcomes (having as reference the tasks and responsibilities mentioned in ISO 14731).

4th – Definition of different LOs for each qualification, using specific verbs and adverbs to distinguish the profiles (having as reference the revision of Blooms' Taxonomy[1]).

5th – Harmonizing LOs and proficiency level settlement (whenever teaching hours, scope and LOs are the same, the alignment is done having as reference only one level (e.g. EWE/EWT = EQF6; EWS/EWP = EQF4).

[1] Anderson, L. W., & Krathwohl, D.R. (2001). *A Taxonomy for Learning, Teaching, and Assessing: a Revision of Bloom's Taxonomy of Educational Objectives*. Abridged Edition: Boston, MA.

6th - Estimation of student workload (WL) by welding experts and trainers.

7th - Revision of proficiency level (majority of Competence Unit levels/LOs determines the qualification level).

8th - Involvement of EWF experts in the revision and evaluation/validation of the LOs (Working Group and Technical Committee).

9th - Validation of the LOs by EWF Working Group.

10th - Final version of the LOs.

11th - Evaluation of the LOs by European experts in the EQF and the ECVET.

12th - External independent organisations (National Qualification Authorities - NQAs and Industry) uptake/use technical aspects of qualification and build up a National Qualification; responsible for alignment with NQF and EQF, allocation of ECVET points.

Conclusion

The EWF methodology and tools for describing learning outcomes in all International Welding Qualifications undertaken in the RAINBOW project, was a hard-working achievement, comparable to a sailing journey with up and downs, where several interactions and involvement of several (with different levels of expertise and experience) stakeholders was needed.

The development process was based on a research path, build up from: i) the needs identification; ii) description of professional standards; iii) assignment of level of complexity; iv) curriculum design and v) content agreement, which was followed by a validation process involving representatives from the industry, R&D, VET, HE institutions and standardisations bodies, as well as European policy makers and national qualifications authorities. This was actually one of the main strengths of the project, which brought all of these organizations' ideas into a final recommendation addressing the development, implementation and impact of International Qualifications.

Since the beginning of the project, back in June 2016, the methodology was fine-tuned and consolidated, which reflects the maturity and lessons learned from its implementation.

A turning point in the process was the workshop aiming at "Aligning International Qualifications with EU Tools and Policies", where experts from the welding sector and education gave specific recommendations for designing the methodology. Such as:

- The use a common terminology when referring to EWF qualifications – creation of the glossary;
- The definition of "responsibility and autonomy" in a transversal way, meaning that it should be linked to the Professional Profile and not to all Competence Units;
- The use of ISO standards addressing professional tasks and responsibilities for existing qualifications;
- The avoidance of the definition of an extended list of complex learning outcomes;
- The use of precise verbs to illustrate the assessment of the skills.

The above recommendations were important for the update of the existing welding profiles, which are in use by the industry and labour market for more than 25 years.

However, the need for designing new international qualifications to tackle the emergent technologies, represented the opportunity to implement the modular approach and to test the EWF methodology, which has been presented along this document. Key lessons learnt from this experience were:

- To establish a sectoral framework containing a clear statement of general descriptors defined in terms of knowledge, skills, autonomy and responsibility for each proficiency level;
- To use EQF recommendation as guidance document;
- To use the CEDEFOP European Handbook for writing and applying learning Outcomes as an inspiration to describe learning outcomes for occupations standards and training curricula.

Finally, despite the RAINBOW results can be applied to other International Qualifications and specific sector of activity, it is easier to apply them to new rather than to existing qualifications.

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Annex 1 - Example for Welding Coordinators' Qualifications: EWE, EWT, EWS and EWP

Table 2. QUALIFICATION DESCRIPTORS - General description of the European Welding Engineer (EWE), European Welding Technologist (EWT), European Welding Specialist (EWS) and the European Welding Practitioner (EWP) qualifications according. The KSC descriptors used are in line with the EQF qualification levels 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.

Table 3. QUALIFICATION COMPETENCE PROFILES - Professional standards vs expected learning outcomes. The cross-reference table demonstrates the relationship between the tasks and responsibilities of the professional profiles and the learning outcomes to be achieved under each Competence Unit.

Note: The statements regarding the actions/achievements, is defined/developed by the EWF working group that is developing the qualification guideline, or they can be redraw from a standard that defines the tasks and responsibilities, as example the ISO 17431.

Cross-reference table of professional standards vs expected learning outcomes								
Profiles & Construction complexity				**Tasks and responsibilities**	**Modules**			
EWE	**EWT**	**EWS**	**EWP***		**1**	**2**	**3**	**4**
Any type of construction with high level of complexity	**Any type of construction with lower level of complexity**	**Regular and common**	**Basic specific works**		**Welding processes and equipment**	**Materials and their behaviour during welding**	**Construction and design**	**Fabrication, applications engineering**
X	X	X		1. Review contract requirements;	X	X	X	X
X	X	X		2. Perform and technically review the construction;	X	X	X	X
X	X	X		3. Specify requirements and assessment protocol of subcontracting activities;	X	X	X	X
X	X	X	X	4. Specify, supervise and manage welding personnel; Supervise and monitor welding personnel; *				X
X	X	X	X	5. Specify, validate and manage the means and equipment, including the calibration, if needed; Understand and supervise the proper means and equipment needed for the construction; *	X			X
X	X	X	X	6. Specify, develop, validate and manage a production plan; Monitor and implement a production plan; *	X	X	X	X
X	X	X	X	7. Specify, develop, evaluate and manage the welding procedures needed; Understand and implement welding procedures needed for the construction; *	X	X		X
X	X	X	X	8. Specify, develop, evaluate and manage welding procedure specifications; Understand and implement welding procedure specifications;*	X	X		X

X	X	X	X	9. Specify, develop, evaluate and manage working instructions; Understand and implement working instructions; *	X	X		X
X	X	X	X	10. Specify, validate and manage welding consumables; Monitor and supervise the proper use of welding consumables; *	X	X		X
X	X	X	X	11. Specify, validate and manage base materials; Monitor and supervise the proper use of base materials; *		X		X
X	X	X	X	12. Specify, review, develop, evaluate, validate and manage an inspection testing plan; Understand, implement and monitor an inspection testing plan; *			X	X
X	X	X	X	13. Specify, develop, evaluate and manage post-weld heat treatments; Understand, implement, supervise and monitor post-weld heat treatments; *		X		X
X	X	X	X	14. Specify, review, develop, evaluate, validate and manage corrective actions to solve welded construction non-conformances; Implement, monitor and control corrective actions to solve welded construction non-conformances; *	X	X		X
X	X	X	X	15. Specify, calibrate, evaluate, validate and manage measuring, inspection and testing equipment; Monitor the correct use of measuring, inspection and testing equipment;*				X
X	X	X	X	16. Specify, develop, evaluate, validate and manage processes of identification and traceability to be used in welding manufacturing; Understand, control and supervise processes of identification and traceability to be used in welding manufacturing; *				X
X	X	X	X	17. Specify, develop, evaluate, validate and manage processes related to monitor and control of construction's quality records; Collect, control, perform and supervise the processes related to monitor and control construction's quality records. *				X

*The tasks marked with * are applicable only to the European Welding Practitioner (EWP), despite other are qualified to perform them as well.

Table 4. SHIFT FROM MODULES INTO COMPETENCE UNITS - The qualification is restructured into smaller individual learning components - Competence Units (CU).

MODULES	CONTACT HOURS*	COMPETENCE UNITS	CONTACT HOURS*
Module 1 - Welding Processes and Equipment	32 - 95	CU 1- Introduction to Welding Technology and Arc Power Source	14 - 28
		CU 2 - Welding and Cutting Conventional Processes	14 - 63
		CU 3 – Advanced Welding Processes	7 - 21
Module 2 - Materials and Their Behaviour During Welding	23 - 115	CU 4- Introduction to Metallic Materials	7 - 14
		CU 5- Steels and Their Weldability	14 - 63
		CU 6 - Wear, Corrosion, Fractures and Application of Structural and High Strength Steels	7 - 14
		CU 7 - Other Materials Then Steel	7 - 21
Module 3 -Construction and Design	6 - 62	CU 8 -Introduction to Design for Welding & Brasing	7 - 63
Module 4 - Fabrication, Applications, Engineering	29 - 116	CU 9- General Features for Quality Management	7 - 28
		CU 10 - Quality Assurance/Quality Control on Welded Joints	7 - 28
		CU 11 - Tests Used for The Quality Control of Welded Joints	7 - 28
		CU 12 – Case Studies	14 - 42

*refers to lowest and the higher qualification level (EWP; EWS; EWT or EWE), established contact hours.

Table 5. COMPETENCE UNIT (Functional) - The qualification is structured into Competence Units, containing the definition of the relevant learning outcomes in terms of knowledge and skills in order to perform a given Job Functions and related Activities.

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

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.

Annex 2 - Example for Welder Qualifications

Table 6. QUALIFICATION DESCRIPTORS - General description of the European Welder (Fillet, Plate and Tube). The KSC descriptors used are in line with the EQF qualification levels descriptors, Guideline EWF-IAB-089r5-14.

QUALIFICATION	EQF/ EWF LEVEL	KNOWLEDGE	SKILLS	AUTONOMY AND RESPONSIBILITY
ARC WELDER 2 (Fillet and Plate)	**2/ELEMENTARY**	Basic factual knowledge of welding technology and related materials.	Basic cognitive and practical skills required to carry out fillet and butt welds in all welding positions, by applying one of the arc welding processes and allied technologies.	Perform welding under supervision with some autonomy. Occasionally takes responsibility for the completion of simple tasks.
ARC WELDER 3 (Tube)	**3/BASIC**	Knowledge of facts principles, processes and general concepts of welding technology and related materials.	A range of cognitive and practical skills required to carry out fillet, butt and pipe welds in all welding positions, by applying one of the arc welding processes and allied technologies	Regularly takes responsibility for the completion of complex tasks. Adapt own behaviour to circumstances in solving problems in known conditions.

Tables 7. JOB FUNCTIONS AND RELATED ACTIVITIES DEFINITION -. Mapping and relationship between job functions and related activities for the European Welder Qualification.

JOB FUNCTIONS	ACTIVITIES	EQF/ EWF LEVEL
1.Review and planning of parameters necessary for the course of production process	1.1 Review technical-technological documentation, e.g.: WPS, working instructions, inspection test plan (if allocated to be performed by the welder), safety requirements, etc. 1.2 Plan the execution of welding process for a specific task 1.3 Plan the work space	
2.Preparation of the work place, necessary equipment, tools and materials	2.1 Prepare, and check the welding equipment, preheat devices (if applicable) and other relevant tools that are necessary to perform the weldment. 2.2 Request, pick up, handle and maintain consumables on the workplace 2.3 Prepare, check materials and work area ready for welding.	
3. Execution of a welded joint in one of the following chosen arc welding process and material, in accordance with the demands from Welding Procedure Specification (WPS)	3.1 Position the work piece for welding 3.2 Adjust welding parameters according to WPS or working instruction 3.3 Prepare the edges of base metal for welding process (if applicable) 3.4 Prepare and execute the Joint fit up for welding (if applicable) 3.4 Control preheat and interpass temperature (if applicable) 3.5 Weld the joint according to WPS or working instruction and apply welding techniques when executing different types of welded joints in different welding positions with different conditions 3.6 Clean the weld, base metal and work place.	
4. Filling the work documentation	4.1 Fill in the work order 4.2 Fill in the delivery/return note for the material 4.3 Take records regarding the state of tools, equipment, machines and protective equipment	**2/ELEMENTARY**
5. Professional communication	5.1 Exchange information with all stakeholders in work process 5.2 Take part in resolution of problems that occurred during job execution 5.3 Use occupational terminology	
6. Inspect the quality of welded joints applying visual inspection and dimensional control	6.1 Carry out visual inspection and dimensional control (if applicable) of welded joints. 6.2 mark/label welds with their identification tag in accordance with the quality assurance system (if applicable). 6.3 include elements of self-control in accordance with the quality assurance system. 6.4 Complete and check the finished weld ready for inspection and report into the production control system (if applicable).	
7 - Taking care of people and environment	7.1 Apply regulations and means for occupational safety, fire protection and environment protection	

Table 8. COMPETENCE UNIT (Cross Cutting) - The qualification is structured into Competence Units, containing the definition of the relevant learning outcomes in terms of knowledge and skills.

Competence Unit –M3- Weldability of Austenitic Stainless Steels

LEARNING OUTCOMES – WELDABILITY OF AUSTENITIC STAINLESS STEELS		Contact Hours	Workload
Qualification	**ARC WELDER 2 (Fillet and Plate)**		
KNOWLEDGE	Basic factual knowledge of: Stainless steels Weldability of stainless steels Welding consumables for stainless steels Corrosion, post weld treatment	8	16
SKILLS	• Define the characteristics of stainless steel and explain the concept of protective oxide film formation; • Explain the difference between welding stainless steel and unalloyed carbon steel; • Outline the grades of stainless steel and their characteristics: austenitic, ferritic, martensitic, duplex (austenitic-ferritic); • Identify common welding processes for stainless steel; • Outline the commonly used welding joints and the methods of joint preparation regarding stainless steel; • Explain the importance of controlling heat input and interpass temperature; • Name the influence of alloying elements on weld properties; • Explain the effect of heat input on stainless steel; • Outline typical problems when welding stainless steels; • Recognize the main types and classification of welding consumables for stainless steel; • Determine and measure required backing gas; • Identify equipment and tools for backing gas.		