

EWF Guideline
Dedicated Knowledge for Personnel with the Responsibility
for Welding Coordination to comply with EN 1090-2



Minimum Requirements for the Education, Training,
Examination and Qualification



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MINIMUM REQUIREMENTS FOR THE EDUCATION, TRAINING, EXAMINATION AND QUALIFICATION

EWF GUIDELINE

DEDICATED KNOWLEDGE FOR PERSONNEL WITH THE RESPONSIBILITY FOR WELDING COORDINATION TO COMPLY WITH EN 1090-2

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Section 1: Minimum Requirements for the Education, Training, Examination and Qualification of European EN 1090 Welding Coordination Personnel for Steel Constructions for the Levels “Specific” and “Basic”

The use of this guideline is restricted to organizations approved by the EWF Authorized National Body (ANB).

1. Introduction

This guideline for the education and examination of European Welding Coordination Personnel (EWCP) for Steel Constructions was developed to cover only the levels “B” and “S”, as outlined in EN 1090-2 for Execution Class 2. (see white area of table 1). The guideline has been prepared, evaluated and formulated by members of the Technical Committee of EWF.

It is not designed to provide a comprehensive knowledge in welding technology (this can only be achieved through the qualification as specified in the IIW Guideline “Personnel With Responsibility For Welding Coordination”, doc. IAB-252), it is however meant to refresh and update the knowledge of personnel that have been working as welding coordination personnel in the field of metal construction as defined in the European Standard EN 1090-2 and required through the application of the European Directives 89/106/EEC and 93/68/EEC.

EXC	Steels (Steel group)	Reference standards	Thickness (mm)		
			$t \leq 25^a$	$25 - t \leq 50^b$	$t > 50$
EXC 2	S235 – S355 (1.1, 1.2, 1.4)	EN 10025-2, EN 10025-3, EN 10025-4, EN 10025-5, EN 10149-2, EN 10149-3, EN 10210-1, EN 10219-1	B	S	C ^c
	S420 – S700 (1.3, 2, 3)	EN 10025-3, EN 10025-4, EN 10025-6, EN 10149-2, EN 10149-3, EN 10210-1, EN 10219-1	S	C ^d	C
EXC 3	S235 – S355 (1.1, 1.2, 1.4)	EN 10025-2, EN 10025-3, EN 10025-4, EN 10025-5, EN 10149-2, EN 10149-3, EN 10210-1, EN 10219-1	S	C	C
	S420 – S700 (1.3, 2, 3)	EN 10025-3, EN 10025-4, EN 10025-6, EN 10149-2, EN 10149-3, EN 10210-1, EN 10219-1	C	C	C
EXC 4	All	All	C	C	C

^a Column base plates and endplates ≤ 50 mm
^b Column base plates and endplates ≤ 75 mm
^c For steels up to and including S275, level S is sufficient.
^d For steels N, NL, M and ML, level S is sufficient.

Table 1. Field of application of this guideline (white area)
(This table is equivalent to table 14 of EN 1090-2:2008)

This personnel needs to have a formal recognition of their knowledge to become “Responsible Welding Coordinators” at the level “B” and “S” of the EN 1090-2. The Objective of this scheme is to educate personnel to fulfil the criteria for (R)WC and who has essential know-how, best or good practice and solid knowledge to fulfil the need of the European welding metal fabrication industry in line with EN 1090-2 and ISO 14731 standards.

(Responsible) Welding Coordination on the higher level (“Specific”) in Execution Class 2 and the highest level (“Comprehensive”) in all Execution Classes is considered to be adequately covered by the E/WE/IWE and the EWT/IWT levels of education as outlined in detail in the document IAB-252.

For the lower levels (“B” and “S”, as defined for Execution Class 2), welding coordination personnel having a EWE/IWE, EWT/IWT, or an EWS/IWS diploma generally are accepted.

This Guideline covers the minimum requirements for education and examination which is related to welding coordination at the above given levels as defined in the ISO 14731, however is only related to the requirements for the (Responsible) Welding Coordinator for steel constructions as described in EN 1090-2, it shall not be applied for any other type of products.

The Guideline gives an open access through two routes as described in par. 2 and 3 of this document. Both routes are supplemented by a dedicated seminar. A subsequent section covers the examination and diploma.

Note: The diploma provides the proof that the general and specific technical knowledge of the candidate was positively assessed; it doesn't mean that the candidate will be automatically (R)WC, as this is considered to be a job function.

Students who have successfully completed this course of education and examination, may later apply for access to the relevant full IAB course, where the knowledge from this Guideline may be formally recognised following one of the alternative routes as described in document IAB 252, or in the case of the standard courses, at the discretion of the ANB, this Guideline may cover “Part 1” of the Guideline IAB-252.

2. The education

The contents are given in the following structure:

Theoretical Education

Teaching hours

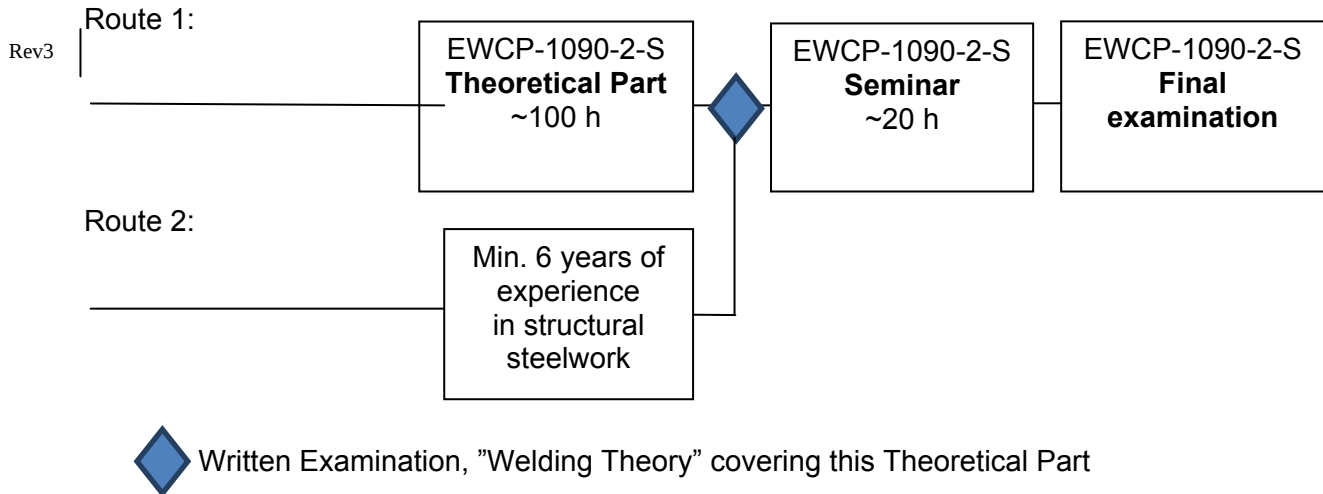
	EWCP-1090-2-S	EWCP-1090-2-B
Welding Theory		
Welding processes and equipment	20	14
Materials and their behaviour during welding	19	10
Construction and design	12	3
Fabrication, applications engineering	44	24
Seminar		
Seminar on EN 1090	21	13
Sub total	116	64
	(14,5 days)	(8 days)
Written examination (Welding theory and Final)	3h45	2h30
Total approximately:	120	65

A teaching hour will contain at least 50 minutes of direct teaching time.

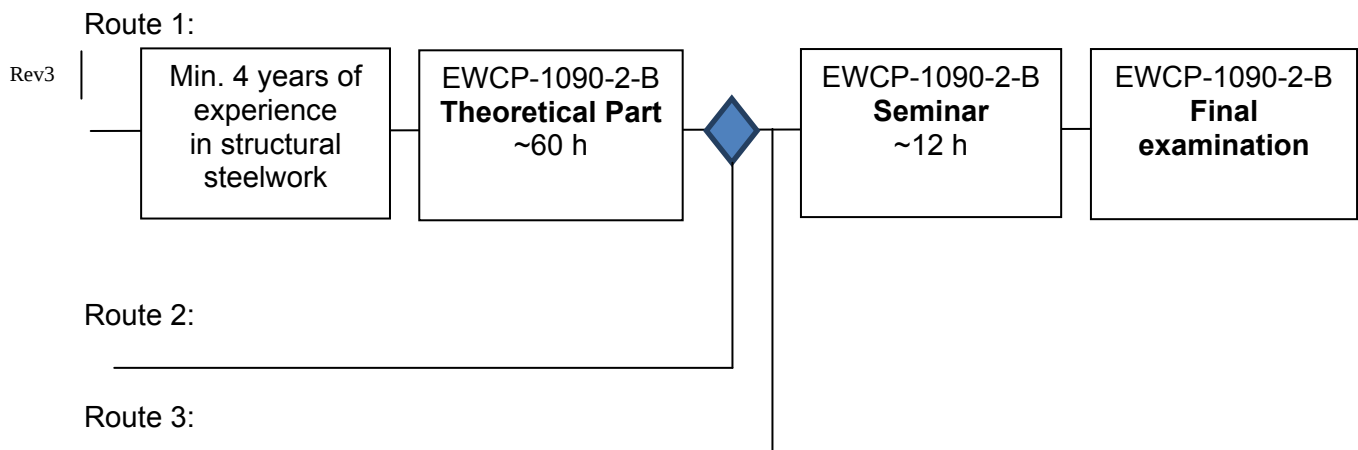
It is not obligatory to follow exactly the order of the topics given in this guideline. It is the choice in arrangement of the syllabus by the authorised training body (ATB).

The Guideline details the objectives of all topics, the scope and the Learning outcomes as required, to fulfil the requirements for welding coordination. The depth to which each topic is dealt with is indicated by the objectives and the number of hours allocated to it in the guideline. This will be reflected in the scope and depth of the examination to meet the required result.

2.1 Routes to Qualification for the “Specific” level



2.2 Routes to Qualification for the “Basic” level



2.3 Access Conditions for the “S” level

Route 1:

The minimum requirements for a candidate to enter the system through route 1 are at least:

1. Minimum education level equivalent to EWS/IWS for Route 1 or 2 national access conditions requirements and
 2. Must be active in the field of metal construction as a welding coordinator (as defined in EN ISO 14731) and three (3) years of experience in the last five (5) years. Experience in the material group and thickness range as defined in the appropriate table 14 or 15 of the EN 1090-2 shall be demonstrated, and
 3. Candidate’s CV showing relevant experience, training, and education must be endorsed by the employer, and approved by the ANB.
- OR

1. Minimum education level equivalent to EWT/IWT or EWE/IWE for Route 1 or 2 entry requirements and;
2. Two (2) years of experience in the last three (3) years. Experience in the material group and thickness range as defined in the appropriate table 14 or 15 of the EN 1090-2 shall be demonstrated, and;
3. Candidate's CV showing relevant experience, training, and education must be endorsed by the employer, and approved by the ANB.

Route 2:

The minimum requirements for a candidate to enter the system through route 2 are at least:

1. Minimum education level equivalent to EWS/IWS for Route 1 or 2 entry requirements, or higher and
2. Must be active in the field of metal construction and with six (6) years of experience in the last eight (8) years,
Experience in the material group and thickness range as defined in the appropriate paragraph of the EN 1090-2 shall be demonstrated. This experience shall show that the work has been performed at the level of a welding coordinator, and
3. Candidate's CV showing relevant experience, training, and education must be endorsed by the employer, and approved by the ANB.

2.4 Access Conditions for the “B” level

Route 1:

The minimum requirements for a candidate to enter the system through Route 1 are at least:

1. Four years of experience on the last six years, in the material group and thickness range as defined in the appropriate paragraph of the EN 1090-2 shall be demonstrated. This experience shall show that the work has been performed at the level of a welding coordinator.
2. Candidate's CV showing relevant experience, training, and education must be endorsed by the employer, and approved by the ANB.

Route 2:

The minimum requirements for a candidate to enter the system through Route 2 are at least:

1. Eight (8) years of experience on the last ten (10) years, in the material group and thickness range as defined in the appropriate paragraph of the EN 1090-2 shall be demonstrated. This experience shall show that the work has been performed at the level of a welding coordinator.
2. Candidate's CV showing relevant experience, training, and education must be endorsed by the employer, and approved by the ANB.

Route 3:

The minimum requirements for a candidate to enter the system through Route 3 are at least:

1. Those having a EWP/IWP diploma, and
2. Six (6) years of experience on the last eight (8) years, in the material group and thickness range as defined in the appropriate paragraph of the EN 1090-2 shall be demonstrated. This experience shall show that the work has been performed at the level of a welding coordinator.

3. Candidate's CV showing relevant experience, training, and education must be endorsed by the employer, and approved by the ANB.

2.5 Instruction programme

The full EWF course consists of four modules "Welding Theory", a Seminar and examination.

The recommended periods of time given in the modules 1 thru 4 and the Seminar represent the recommended time required to attain the expected level of knowledge.

The theoretical education "Welding Theory" given to the applicants aims at a basic understanding of the appropriate welding process, construction, materials and practical applications behaviour including standards and safety regulations. The themes and keywords are given as 'Scope' in the module descriptions, together with the 'Objective' and the 'Learning outcome'.

3 Instruction Programme Welding Theory

3.1 Module 1: Welding processes and equipment

Hours as indicated are minimum teaching hours: for EWCP-1090-2-S is 20 hours, for EWCP-1090-2-B is 14 hours.

3.1.1 General introduction to welding technology#			
Objective for level S and B Explain the different welding processes including terminology, standards and abbreviations.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		1	1
History		X	X
General applications for welding		X	X
Schematic presentation of welding processes		X	X
Brief description with characteristics		X	X
Applicability of the most common welding processes		X	X
Abbreviations used for welding processes		X	X
Hints in use for welding processes		X	X
Welding positions and Terminology (ISO 6947, ISO 17659).....		X	X
Symbolic representation of joints (overview)		X	X
Classification of welding processes (ISO, CEN and national standards) ..		X	X
Learning outcome for level S and B:			
1. Outline the major differences between each main type of welding process, e.g. fusion arc, resistance, flame, forge, etc.			
2. Differentiate between processes with reference to standards.			
3. Recognise a welding process by the common abbreviation.			

3.1.2 The arc			
Objective for level S and B: Describe an electric arc, its characteristics, limitations and application in welding.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		1	1
Arc physics (producing an electric arc, the main arc areas, stability of the arc, gas ionization, ionization potentials, arc forces)		X	X
Voltage distribution across the arc		X	X
Heat generation at the cathode and anode.....		X	X
Polarity and arc characteristics in AC and DC and its control for the key welding processes.....		X	X
Influence on the welding process		X	X
Temperature distribution in the arc and effects		X	X
Influence of the magnetic fields on the arc (why, how to solve)		X	X
Limits of application		X	X
Learning outcome for level S and B:			
1. Describe an electrical arc; its main areas and their importance to welding and arc stability.			
2. Outline the generation of heat in the arc.			
3. Give examples of the influence of magnetic fields on the electric arc.			
4. Outline appropriate solutions to solve magnetic deflection problems.			
5. Describe arc characteristics for DC and AC.			

3.1.3 Power sources for arc welding			
Objective for level S and B: Have an outline working knowledge of components of arc welding power sources.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	2	1
Power source classification, types and characteristics (static and generators, and each sub-group)		X	X
Power source electrical characteristics (static and dynamic).....		X	X
Relationship between static characteristic and welding process		X	X
Control of the electrical static characteristic (flat and drooping).....		X	-
Arc stability for the main processes (MMA, TIG, MIG/MAG, SAW, PAW).		X	X
The operation working point		X	X
Inverter technology (overview, in terms of the most important blocks).....		X	-
Power sources controlled by a CPU		X	-
Stability of processes in AC and DC		X	-
AC (sine wave and square wave) and DC power sources		X	X
Open circuit voltage, short circuit current, power factor of transformers		X	-
Duty cycle of a power source and typical values for the most common arc welding processes		X	X
Voltage losses, relationship between welding current value and cable section.....		X	X
Current and voltage setting (electromagnetic and electronic devices)			
Standards related with welding power sources and their requirements			
Learning outcome for level S and B:			
1. Outline how each type of welding power source works (AC and DC) including the most common devices used.			
2. Describe for each type of arc welding power source the static characteristic, operation point and control of arc stability.			
3. Outline the meaning of open circuit voltage, arc voltage short circuit current, duty cycle of a power source, voltage losses, and current to cable section relationship.			
4. Be able select the appropriate power sources for a given welding process.			
5. Recognise the various settings and switches on different power sources and their effects.			

3.1.4 TIG Welding			
Objective for level S and B: Outline the TIG welding fundamentals, equipment, applications, main variables, safety and specific problems.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		3	1
Power source characteristics		X	X
Methods for arc ignition and necessary equipment		X	X
Equipment and accessories: torches, gas lens, control panel, up and down slope, pulse techniques.....		X	X
Effect of current type and polarity: DC(+), DC(-) and AC.....		X	-
Specific requirements for different materials, e.g. Al.....		X	X
Consumables: shielding gases, filler materials, electrodes		X	X
Welding parameters: current, voltage, travel speed, gas flow rate.....		X	X
Joint preparation: typical joint design for welding, fit-up, cleaning.....		X	X
Special techniques: spot-welding, key-hole, hot-wire, orbital welding, tube to tube and tube to sheet, narrow gap and others.....		X	-
Standards for filler materials, (only for non alloy steels), and electrodes,		X	X
Welding applications, typical problems and how to solve them		X	X
Health and safety issues specific to the process		X	X
Learning outcome for level S:			
1. Describe and compare the principles of TIG welding including arc ignition methods and their applications.			
2. Explain the selection of appropriate type of current, polarity, shielding gas and electrode type according to the application.			
3. Identify the range of application, appropriate joint preparations and potential problems to be overcome.			
4. Identify an appropriate range of welding parameters for particular applications.			
5. Explain the purpose and functions of each component of the equipment and accessories.			
6. Interpret the use of appropriate standards.			
7. Describe potential hazards and methods of safe handling and working.			
Learning outcome for level B:			
1. Outline TIG welding including arc ignition methods and their most common applications.			
2. Give examples of the most common applications for each type of current, polarity and electrode Type.			
3. Give examples of the most important applications and select the appropriate values for welding parameters.			
4. Know how to use and care for the equipment and accessories.			
5. Read given standards for consumables.			
6. Give examples of TIG applications, joint preparation and potential problems to overcome.			
7. Outline potential hazards and methods of safe handling and working.			

3.1.5.1 MIG/MAG Welding			
Objective for level S and B: Outline the MIG/MAG fundamentals, including equipment, applications, main variables, safety and common problems.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		2	2
Power source characteristics for conventional process and CPU controlled power sources.....		X	X
Effect of current type and polarity.....		X	X
Equipment and accessories: torches, wire feeders, hose assembly, control panel.....		X	X
Metal transfer modes (dip, globular, spray, pulsed and rotating), and their Application.....		X	X
Welding parameters and settings: current, voltage, travel speed, gas flow rate, etc.....		X	X
Consumables: shielding gases, filler materials (solid wires), and their combinations.....		X	X
Joint preparation: fit-up, cleaning.....		X	X
Special techniques: electro-gas welding, high efficiency processes, spot welding, double wire, flat wire, electronic stability control (arc and wire feed), etc.....		X	-
Standards for filler materials, (only for non alloy steels).....		X	X
Welding applications, typical problems and how to solve them.....		X	X
Health and safety specific to the process.....		X	X
Learning outcome for level S and B:			
1. Describe and compare the principles of MIG/MAG welding including metal transfer modes and their applications.			
2. Identify the most common applications for each type of current, polarity and electrode.			
3. Identify the range of application, appropriate joint preparations and potential problems to be overcome.			
4. Identify the influence of the welding parameters on the weld bead and be able to outline welding parameters for particular applications.			
5. Describe potential hazards and methods of safe handling and working.			
6. Outline the various functions of the main components of the equipment and accessories.			
7. Demonstrate the use of appropriate standards for consumables			
8. Give examples on how consumables should be selected.			
9. Know how to use and care for the equipment and accessories			

3.1.5.2 Flux Cored Arc Welding

Objective for level S and B: Outline the FCAW fundamentals, including equipment, applications, main variables, safety and common problems.

Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		2	2
Power source characteristics for conventional process and CPU controlled power sources (only the specific aspects for FCAW).....		X	X
Effect of current type and polarity.....		X	X
Equipment and accessories: torches, wire feeders,		X	X
Relation between the consumables and the type of Metal transfer mode, and their applications.....		X	X
Welding parameters and settings: current, voltage, travel speed, gas flow rate, etc.....		X	X
Consumables: shielding gases, filler materials (flux cored wires), and their combinations.....		X	X
Joint preparation: fit-up, cleaning.....		X	X
Standards for filler materials (only for non alloy steels)		X	X
Welding applications, typical problems and how to solve them.....		X	X
Health and safety specific to the process.....		X	X
Learning outcome for level S and B: 1. Describe the principles of Flux Cored Arc welding including their applications. 2. Identify the most common applications for each type of current, polarity and electrode. 3. Identify the range of application, appropriate joint preparations and potential problems to be overcome. 4. Identify the influence of the appropriate welding parameters on the weld bead and be able to outline welding parameters for particular applications. 5. Describe potential hazards and methods of safe handling and working. 6. Outline the various functions of the main components of the equipment and accessories. 7. Demonstrate the use of appropriate standards for consumables 8. Give examples on how consumables should be selected. 9. Know how to use and care for the equipment and accessories.			

3.1.6 MMA Welding

Objective for level S and B: Outline the MMA fundamentals, including equipment, applications, safety and common problems.

Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		4	2
Process principles and arc characteristics		X	X
Effect of current type and polarity		X	X
Power source characteristics applicable to MMA (open circuit voltage, static and dynamic characteristics, types of current, arc striking methods)		X	X
Equipment and accessories.....		X	X
Process application range, typical problems and how to solve them.....		X	X
Covered electrodes (functions of the coating and rod, types of electrodes, slag-metal and gas-metal covered reactions)		X	X
Production of electrodes (how, typical defects)		X	-
Handling and storage of electrodes (storage environment, redrying).....		X	X
Standards for filler materials (only for non alloy steels))		X	X
Selection of covered electrodes for applications		X	X
Welding parameters: current, voltage, run out length, etc		X	X
Joint preparation: fit-up, cleaning, welding position.....		X	X
Relationship between electrode diameter and current range, rod material, electrode length and welding position		X	X
Special techniques (gravity welding, etc.).....		X	X
Health and safety specific to this process		X	X

Learning outcome for level S:

1. Describe the principles of MMA welding
2. Describe how to select the appropriate type of current, polarity and electrode according to application.
3. Identify the range of application, appropriate joint preparations and potential problems to be overcome.
4. Identify an appropriate range of welding parameters for particular applications.
5. Describe potential hazards and methods of safe handling and working.
6. Outline the purpose and functions of each component of the equipment and accessories.
7. Describe the appropriate methods of handling, control and storage of the various types of electrodes.
8. Demonstrate the use of appropriate standards.
9. Describe the influence of electrode coating on droplet transfer and weld metal properties.

Learning outcome for level B:

1. Outline the principles of MMA welding
2. Outline how to select the appropriate type of current, polarity and electrode according to application.
3. Identify the range of application, appropriate joint preparations and potential problems to be overcome.
4. Identify an appropriate range of welding parameters for particular applications.
5. List potential hazards and methods of safe handling and working.
6. Outline the purpose and functions of each component of the equipment and accessories.
7. List the appropriate methods of handling, control and storage of the various types of electrodes.
8. Demonstrate the use of appropriate standards.

3.1.7 Submerged Arc Welding			
Objective for level S and B: Outline the SAW fundamentals, including equipment, applications, main variables, safety and common problems.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		2	1
SAW process principles and arc characteristics		X	X
Effect of current type and polarity.....		X	X
Power source characteristics applicable to SAW (open circuit voltage, static and dynamic characteristics, types of current, arc striking methods)			
Equipment and accessories		X	X
Process application range, typical problems and how to solve them.....		X	X
Consumables (functions of the flux and wire -solid or flux cored-, types of flux and wire, wire-flux combination, slag-metal and gas-metal reactions).		X	X
Production of consumables (how, typical defects)		X	X
Handling and storage of consumables (storage environment, re-drying)			
Standards for filler materials wires and fluxes (only for non ally steels)....		X	X
Welding parameters: current, voltage, travel speed, type of flux and particle size, stick-out, etc		X	X
Joint preparation: fit-up, cleaning		X	X
Relationship between the wire-flux combination and the characteristics of deposited material.....		X	X
One side welding including backing methods.....		X	-
Single-wire and multi -wire techniques... ..		X	X
Special techniques (strip-cladding, iron-powder addition, cold and hot wire addition.....		X	-
Health and safety specific to SAW process.....		X	X
Learning outcome for level S and B:			
1. Explain the principle of the SAW process including arc striking methods and their applications.			
2. Explain the criteria for evaluating the applicable welding parameters.			
3. Identify the application range, joint edge preparation and potential problems to overcome.			
4. Clarify the procedures for the set-up of power sources.			
5. Explain the criteria for the selection of flux-wire combinations.			
6. Interpret appropriate standards and welding procedures.			
7. Define welding instructions for welders and operators.			
8. Define potential hazards and methods of safe handling and working.			

3.1.8 Stud Welding			
Objective for level S and B: Outline/the fundamentals and the field of application of stud welding. Including equipment, main variables and most common problems.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	1	1
Basic principles		X	X
Equipment and accessories		X	X
Typical process applications and problems		X	X
Consumables		X	-
Welding parameters		X	-
Standard EN-ISO 14555		X	X
Health and safety specific to the processes		X	X
Appropriate national and international standards for each process		X	X
Learning outcome for level S and B:			
1. Describe the principles of Stud welding and its application.			
2. Name some common applications of the processes in the different industrial fields.			
3. Define potential hazards and methods of safe handling and working.			
4. Know how to use and care for the equipment and accessories			

3.1.9 Cutting, Drilling and other edge preparation processes			
Objective for level S and B: Outline the basic principles and the field of application of the most common cutting and edge preparation processes used in weld construction, including equipment, main variables, safety and common problems.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	2	2
Survey of edge preparation processes		X	X
Mechanical cutting		X	X
Principles of flame and flame powder cutting, equipment, applications and auxiliaries		X	X
Flame cutting parameters, edge quality, oxygen purity grades		X	X
Materials suitable for flame cutting		X	X
Basic principles of the various arc cutting processes (arc-air, carbon and metal-arc, oxy-arc cutting, gauging with carbon electrode) equipment and auxiliaries		X	X
Materials suitable for arc-cutting, applications, cutting parameters for each process		X	X
Fundamentals of plasma and laser cutting, equipment and auxiliaries ..		X	X
Materials suitable for plasma cutting, applications, cutting parameters, cutting gases		X	X
Plasma gouging		X	-
Fundamentals of arc gouging and flame gouging, parameters and applications		X	X
Appropriate national and international standards for each process		X	X
Health and safety		X	X
Learning outcome for level S and B:			
1. Describe the principles of: mechanical, flame, arc, laser and plasma cutting.			
2. Identify the characteristic parameters for the above mentioned processes			
3. Make a comparison among different edge preparation processes, considering technical and economic aspects.			
4. List potential risks and hazards related with edge preparation processes.			

3.2 Module 2: Materials and their behaviour during welding

Hours as indicated are minimum teaching hours: for EWCF-1090-2-S is 19 hours, for EWCF-1090-2-B is 10 hours.

3.2.1 Structure and properties of metals			
Objective for level S and B: Acquire basic knowledge of structure and properties of metal materials			
Scope:	Qualification Teaching hours	EWCF- 1090-2-S	EWCF- 1090-2-B
		1	0
Crystalline structures.....		X	
Crystal lattice structure types and imperfections.....		X	
Deformation (elastic/plastic).....		X	
Cold and hot deformation.....		X	
Work hardening and strain aging		X	
Recrystallization.....		X	
Properties (influence of temperature, loading speed, environment).....		X	
Learning outcome for level S:			
1. List pure metals and alloys			
2. Outline basic mechanical properties of metals			
3. Outline effect of loading conditions on metals properties			
Learning outcome for level B:			
Not applicable			

3.2.2 Phase Diagrams and Alloys			
Objective for level S and B: Outline the principles of alloying, the structures of alloys and phase diagrams			
Scope:	Qualification Teaching hours	EWCF- 1090-2-S	EWCF- 1090-2-B
		1	0
Pure metals and alloys.....		X	
Alloying elements		X	
Binary diagrams (basic types, non-, fully- and partly soluble components).....		X	
Structure of alloys		X	
Strengthening mechanisms (solid solution, precipitation, grain size).....		X	
Ageing.....		X	
Mechanical properties versus microstructure		X	
Learning outcome for level S:			
1. Identify solidification structure and segregation on relevant examples..			
2. Outline the principles of strengthening mechanisms with appropriate examples.			
3. Interpret the relationship between microstructure and phase diagrams.			
4. Describe alloys and phase diagrams			
Learning outcome for level B:			
Not applicable			

3.2.3 Iron – Carbon Alloys			
Objective for level S and B: Basics to understand metallurgical processes occurring in welding of iron carbon alloys.			
Scope:	Qualification Teaching hours	EWCP-1090-2-S	EWCP-1090-2-B
		2	1
Iron solidification and changes in solid state.....		X	X
Fe-C equilibrium diagram.....		X	X
Microstructure of Fe-C alloys (perlite, ledeburite, etc.).....		X	-
Influence of alloying elements on the Fe-C equilibrium diagram.....		X	-
Carbide forming elements		X	X
Influence of cooling rate, hardenability.....		X	X
TTT and CCT diagrams.....		X	X
Influence of alloying elements on TTT diagrams.....		X	-
Grain growth effect.....		X	-
Classification of heat treatment.....		X	X
Learning outcome for level S: Having knowledge of:			
1. Fe-C alloys			
2. Influence of cooling rate, hardenability			
3. Prevention of coarse structure			
4. Classification of heat treatment			
Learning outcome for level B: Having knowledge of:			
1. Special items of the Fe-C diagram (types of Fe-C alloys)			
2. Influence of cooling rate, hardenability			
3. TTT and CCT diagrams			
4. Classification of heat treatment			

3.2.4 Classification of steels			
Objective for level S and B: Fundamentals of steel classification and standardization, steel semi-products			
Scope:	Qualification Teaching hours	EWCP-1090-2-S	EWCP-1090-2-B
		1	1
Processing of steel products (hot, cold rolling, casting, etc.)		X	X
Chemical composition and impurities.....		X	X
Properties of steels		X	X
Discontinuities and defects in steel		X	X
Classification of steel (purpose of use, ISO/TR 15608).....		X	X
Designation of steels (National, EN Standards, Wr. No.)		X	X
Steel products (plates, tubes, profiles).....		X	X
Inspection Certificate (i.e. EN 10204).....		X	X
Learning outcome for level S:			
1. Properties of steel semi-products			
2. Types of steel, particularly structural steels			
3. Use of standards for steel designation and standards on rolling products			
4. Knowledge of types of inspection documents			

3.2.5 Behaviour of structural steels in fusion welding			
Objective for level S and B: Metallurgical fundamentals of welding of all types of structural steels			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	2	1
Heat input and efficiency of heat input.....		X	X
Peak temperature		X	X
Cooling rate and thermal cycle, Δt 8/5.....		X	X
Heat flow.....		X	X
Heat-affected zone (grain growth and grain refinement, CCT diagrams)...		X	X
Properties of HAZ.....		X	X
Carbon equivalent.....		X	X
Weld pool, weld shape.....		X	X
Structure of weld metal.....		X	X
Effect of multi pass welding.....		X	X
Weld metal structure (weld protection, consumables, etc.).....		X	X
Solidification of weld pool.....		X	X
Relationship grain size – toughness.....		X	X
Transition temperature.....		X	X
Learning outcome for level S:			
1. Explain the temperature distribution in welds and the microstructure formed as a result for a single pass weld versus a multi-pass weld.			
2. Interpret the effects of heat input, cooling rate and multi -pass operation on weld metal solidification and the micro structure formed for a single pass weld versus a multi-pass weld.			
3. Explain the effects of the weld protection, the type of consumables on the microstructure of the weld metal and on it properties for a single pass weld versus a multi -pass weld.			
4. Draw areas of HAZ, the reasons for grain size and microstructure changes and their effects on properties for a single pass weld versus a multi-pass weld.			
5. Discuss the various aspects of weldability.			
Learning outcome for level B:			
1. Special items of the Fe-C diagram (types of Fe-C alloys)			
2. Influence of cooling rate, hardenability			
3. TTT and CCT diagrams			
4. Classification of heat treatment			

3.2.6 Heat treatment of base materials and welded joints			
Objective for level S and B: Name the metallurgical transformations of materials during different heat treatment.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		2	1
Heat treatment of base materials:			
Normalising.....		X	X
Hardening.....		X	-
Quenching and Tempering.....		X	X
Solution annealing.....		X	-
Homogenisation.....		X	X
Recrystallisation annealing.....		X	X
Precipitation hardening.....		X	-
Heat treatment of welded joints and work pieces:			
Post Weld Heat Treatment (Stress relieving, normalizing, hardening).....		X	X
Technical guidelines for heat treatment:			
Heat treatment procedures.....		X	X
Introduction to heat treatment equipment.....		X	X
Regulations/guidelines (codes and technical reports)			
ISO/TR 17663.....		X	-
Introduction to temperature measurement and recording			
ISO 13916.....		X	X
Learning outcome for level S:			
1. Explain each of the major heat treatments and their objectives.			
2. Describe code requirements for heat treatment.			
3. Predict the necessity to perform heat treatment after welding depending of the type and thickness of steel, the application and the code.			
Learning outcome for level B:			
1. Describe the major heat treatments and their objectives			
2. Discuss the necessity to perform heat treatment after welding depending of the type and thickness of steel, the application and the code.			

3.2.7 Structural Steels			
Objective for level S and B: Structural unalloyed steels and effect of welding processes on the weld joint			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	2	2
Steels group 1 according to ISO/TR 15608.....		X	X
Chemical composition.....		X	X
Grades of unalloyed steels		X	X
Carbon equivalent CE		X	X
Relationship CE – hardenability		X	X
Welding processes.....		X	X
Filler materials, choice, standards.....		X	X
HAZ microstructure and properties (hardness, toughness).....		X	-
Effects of weld heat treatment.....		X	X
Applications.....		X	-
Standards, global (ISO), regional (CEN) and national standards		X	X
Learning outcome for level S and B:			
Having knowledge of:			
1. Unalloyed structural steels			
2. Filler materials			
3. Determination of welding technology			
4. Application of standards for filler materials			

3.2.8 High Strength Steels		
Objective for level S and B: Explain the effects of micro-alloying elements on structure, mechanical properties and weldability with reference to fine-grained and high strength steels.		
Scope:	Qualification Teaching hours	EWCP- 1090-2-S
		EWCP- 1090-2-B
		2
		1
Steels group 2 and 3 according to ISO/TR 15608.....	X	X
Principles of treatment (controlled rolling, accelerated cooling, direct quench, thermo mechanical treatment etc.)	X	X
Normalised grades (Chemical composition, properties).....	X	X
Quenched and tempered grades (Chemical composition, properties)....	X	X
High strength steels (Chemical composition, Mechanical properties)	X	X
Weldability, $\Delta t_{8/5}$ concept, preheat and interpass temperature, CE.....	X	-
Influence of welding process on HAZ (microstructure, properties).....	X	-
Steels for automotive industries (TRIP, TWIP, dual phase, etc.).....	X	X
Applications	X	X
Standards, global (ISO), regional (CEN) and national standards	X	X
Choice of filler metal (mismatching, etc.).....	X	-
Learning outcome for level S:		
1. Explain the different methods to obtain fine-grained steels. 2. Explain the relationship between grain refinement and mechanical properties. 3. Outline appropriate applications. 4. Interpret the relationship between grade and weldability. 5. Identify applicable welding processes and potential problems. 6. Name the effects of heat treatment after welding and deduce the conditions (in particular temperature) of such treatment. 7. Use the appropriate filler metal		
Learning outcome for level B:		
1. List the different methods to obtain fine-grained steels. 2. Explain the relationship between grain refinement and mechanical properties. 3. Interpret the relationship between grade and weldability. 4. Identify applicable welding processes and potential problems. 5. Name the effects of heat treatment after welding and deduce the conditions of such treatment.		

3.2.9 Cracking Phenomena in welded joints

Objective for level S and B: Name the fundamentals of cracking mechanisms in welded joints and the way in which welding variables affect the incidence of cracking. Name causes and avoidance.

Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		2	1
For unalloyed, heat resistant and stainless steels as appropriate:			
Cold cracking:			
Cracking mechanisms in weld metal and HAZ, causes and avoidance.....		X	X
Effect of hydrogen.....		X	X
Source and diffusion of hydrogen		X	X
Control of hydrogen		X	X
Effect of microstructure.....		X	X
Susceptible microstructure and its control		X	X
Influence of alloying elements on susceptibility		X	X
Effect of stresses.....		X	X
Influence of restraint		X	X
Influence of preheat		X	X
Influence of austenitic weld metal		X	X
Determination of preheat and interpass temperature (diagrams)			
ISO/TR 17671-2 and ISO 13916		X	-
Lamellar tearing:			
Cracking mechanism; causes and avoidance		X	X
Effects of inclusions, joint configuration, stress.....		X	X
Control of lamellar tearing by material choice and joint configuration ISO/TR 17671-2		X	X
Steels with increased resistance to lamellar tearing.....		X	X
Learning outcome for level S:			
1. Compare the metallurgical mechanisms for each of the major types of cracking.			
2. Describe the effects of chemical and physical variables for each of the major types of cracking.			
3. Appraise the susceptibility to cracking and suggest appropriate precautions to avoid cracking.			
4. Name the type of cracking and the reason for its occurrence from study of fractured material and its history.			
5. Choose suitable tests which will assist in finding the solution of cracking problems.			
6. Propose alternatives which will reduce or eliminate the occurrence of lamellar tearing in welded construction/fabrication.			
Learning outcome for level B:			
1. Compare the metallurgical mechanisms for each of the major types of cracking.			
2. Appraise the susceptibility to cracking and suggest appropriate precautions to avoid cracking.			
3. Name the type of cracking and the reason for its occurrence.			
4. List alternatives, which will reduce or eliminate the occurrence of lamellar tearing in welded construction/fabrication. Name the effects of heat treatment after welding and deduce the conditions of such treatment.			

3.2.10 Stainless steels			
Objective for level S and B: Explain the fundamentals of the various types of stainless steels and their weldability including the principles of joining dissimilar materials and filler material choice.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	2	1
Effect of alloying elements on binary diagrams and phase composition...		X	X
Austenite and ferrite formers		X	X
Influence of nitrogen		X	X
Cr- and Ni-equivalent		X	-
Schaeffler diagram, DeLong and other constitution diagrams.....		X	-
Survey on stainless steels (fully austenitic, ferrite-containing steels, duplex stainless steels) TR ISO/TR 15608, groups 8 and 10.....		X	X
Welding of stainless steels		X	X
Applicable welding processes		X	X
Weldability and selection of consumables		X	X
Choice of filler materials		X	X
Shielding and backing gases		X	X
Details of joint design		X	X
Passivation		X	X
Standards, global (ISO), regional (CEN).....		X	X
Learning outcome for level S:			
1. Outline the structures of the various stainless steels and explain their behaviour during welding.			
2. State the rules and principles governing corrosion phenomena.			
3. Indicate the choice of welding process and consumables for each type of steel using different diagrams.			
4. Describe the different treatment after welding.			
Learning outcome for level B:			
1. Outline the structures of the various stainless steels.			
2. Outline welding processes and consumables for each type of steel.			
3. Outline the different treatment after welding.			

3.2.11 Testing of materials and welded joints			
Objective for level S and B: Name the fundamental aspects of testing materials with particular reference to welded test pieces.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		2	1
<u>Destructive testing</u>			
Tensile tests.....		X	X
Bend tests		X	X
Impact tests		X	X
Hardness tests.....		X	X
Fatigue tests		X	X
Fracture mechanics tests (CTOD, etc.)		X	-
Determination of hydrogen content.....		X	-
<u>Metallographic examination of materials and their welded joint</u>			
Preparation of specimens (grinding, polishing, etching).....		X	-
Equipment for preparation (manual, mechanical, automatic).....		X	-
Microscopes for examination (optical, electron).....		X	-
Microscopic and macroscopic examination of welds.....		X	X
Standards, global (ISO), regional (CEN) and national standards.....		X	-
Learning outcome for level S:			
1. Discuss the objectives of each destructive test and the limitations of the data generated.			
2. Outline each of the major testing methods and the parameters to be measured.			
3. State when and why special testing should be specified.			
4. Show competence in carrying out testing to a given schedule.			
Learning outcome for level B:			
1. Discuss the reasons for destructive testing.			
2. Describe the major testing methods and the parameters to be measured.			
3. Classify competence in carrying out testing to a given schedule.			

3.3 Module 3: Construction and design

Hours as indicated are minimum teaching hours: for EWCP-1090-2-S is 12 hours, for EWCP-1090-2-B is 3 hours.

3.3.1 Basic theory of structural systems			
Objective for level S: Understand the effect of external loads on structures, the types of structural systems and the relationship between external loads and internal forces.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours		
		2	0
Structural elements (cables, bars, beams, plates, slabs, shells)		X	
Theory of forces		X	
Combination and resolution of forces		X	
Equilibrium of forces and torques		X	
Bearings, constraints and basic types of connections		X	
Equilibrium of structural systems		X	
Statically determinate and indeterminate systems		X	
Stress in structural systems resulting from external actions		X	
Learning outcome for level S:			
1. Understand in general the composition of forces.			
2. Understand in general the resolution of forces.			
3. Name the conditions of equilibrium.			
4. Understand in general the equilibrium of structural systems.			
5. Name bearings, constraints and the basic types of connections.			
Learning outcome for level B:			
Not applicable			

3.3.2 Fundamentals of the strength of materials			
Objective for level S: Understand the principles governing the behaviour of metallic structures under loading.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours		
		2	0
Types of stresses (normal stress, shear stress)		X	
Types of deformation (axial strain, shear strain)		X	
Stress-strain relationship, yielding theories.....		X	
Elastic and plastic deformation		X	
Young's modulus, shear modulus, transverse contraction coefficient ...		X	
Characteristic material properties		X	
Different stresses resulting from internal forces and moments		X	
Different types of section properties		X	
Cross section variables		X	
Learning outcome for level S:			
1. Understand in general the different types of stresses (normal stress, shear stresses).			
2. Understand in general the different types of deformation (axial strain, shear strain etc.).			
3. Understand in general the stress-strain relationships.			
4. Understand in general the stresses resulting from internal forces and moments.			
Learning outcome for level B:			
Not applicable			

3.3.3 Joint design for Welding			
Objective for level S and B: Design and draw weld details related to a given material, wall thickness, accessibility, loading, welding process, welding position, welding symbols, available equipment, tolerances.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours		
		2	2
Introduction (importance of welding joint design and groove shapes, influence on welding stresses and distortion)		X	X
Types of welded/brazed joints.....		X	X
Importance of weld joint design and groove shapes, types of welded joints, design of welded joints		X	X
Classification of groove shapes (by material type, thickness, welding process, accessibility)		X	X
Tolerance requirements (ISO 13920)		X	X
Welding symbols on drawings, symbols for groove shapes		X	X
Symbolic representation of welded, brazed and soldered joints according to ISO 2553		X	X
Other Standards, global (ISO), regional (CEN) and national standards....		X	X
Learning outcome for level S:			
1. Identify different types of welded joints.			
2. Apply (EN-)ISO 9692 according to the given conditions.			
3. Identify and use appropriate weld symbols.			
4. Explain the symbolic representation of welded joints on drawings.			
Learning outcome for level B:			
1. Describe different types of welded joints.			
2. Know how to apply each type of joint in function of material, thickness and welding process			
3. Explain the symbolic representation of welded joints on drawings.			

3.3.4 Basics of weld design			
Objective for level S and B: Understand the relationship between external loads on structures, internal forces and the stresses induced with especially with regard to welds.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours		
		2	0
Types of stresses in welded joints (nominal stress, hot spot stress, notch stress)		X	
Stresses in butt welds, stresses in fillet welds		X	
Calculation of cross section variables of welded joints		X	
Determination of nominal stresses in single welded joints		X	
Learning outcome for level S:			
1. Understand in general the different types of stresses in welded joints (nominal stress, hot spot stress, notch stress).			
2. Understand simple welded joints (internal forces).			
3. Understand cross sections for welded joints.			
Learning outcome for level B:			
<u>Not applicable</u>			

3.3.5 Behaviour of welded structures under different types of loading			
Objective for level S and B: Understand the different types of loading and the influence of ambient conditions on structures.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		1	0
Static strength		X	
Influence of notches and weld defects		X	
Types of fracture (ductile fracture, fatigue fracture, brittle fracture, lamellar tearing)		X	
Selection of steel quality groups, Z-quality.....		X	
Learning outcome for level S:			
1. Understand the requirements for the construction according to different types of loading and temperatures.			
2. Identify globally groups of materials which meet strength requirements.			
3. Identify the various types of fracture.			
Learning outcome for level B:			
<u>Not applicable</u>			

3.3.6 Design of welded structures with predominantly static loading			
Objective for level S and B: Be able to identify joints and relevant details of welded metallic structures			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		3	1
Steel constructions including lightweight structures		X	
Structural details e.g. (stiffeners, knots, columns, base- and cap-plates, reinforced structures, supports, frame-corners, frame structures, trusses, nodal joints, weld connections, braces / bracing, lattice work structures, etc.)		X	-
Use of different types of welds related to joint types		X	X
Use of standards and specifications		X	X
Learning outcome for level S:			
1. Understand the requirements for the constructions under predominantly static loading.			
2. Identify globally the different types of welds related to joint types.			
3. Identify the relevant standards and rules.			
Learning outcome for level B:			
1. Name globally the different types of welds related to joint types.			
2. Know the relevant standards and rules.			

3.4 Module 4: Fabrication, applications engineering

Hours as indicated are minimum teaching hours: for EWCP-1090-2-S is 44 hours, for EWCP-1090-2-B is 24 hours.

3.4.1 Introduction to quality assurance in welded fabrication			
Objective for level S and B: Explain / Outline the principles of quality assurance and quality control and recognise the related standards and their application to welded fabrication as a special process.			
Scope:	Qualification Teaching hours	EWCP-1090-2-S	EWCP-1090-2-B
		2	1
Concept of quality assurance and quality control (including analysis, continuous improvement).....		X	X
Testing and Inspection Plan (goal, content and sources to develop it)...		X	X
Audit of plant.....		X	X
Personnel and Equipment.....		X	-
Maintenance.....		X	X
Inspection.....		X	X
Activities of the welding engineer/technologist/specialist/practitioner in the different functions in industry (ISO 14731).....		X	X
Standards (ISO 9000, ISO 3834, national, regional and international standards).....		X	-
Learning outcome for level S:			
Explain:			
1. Main differences between quality assurance, quality control and inspection systems and their usage for welded fabrication.			
2. Writing quality control procedures.			
3. Interpretation of standards (e.g. ISO 3834).			
4. Basic factors related to personnel and equipment, which influence the quality in a welded fabrication.			
5. Role of the Welding Coordinator in the fabrication industry..			
Learning outcome for level B:			
Outline of knowledge in:			
1. Goals for quality assurance and quality control.			
2. Recognition some factors related to personnel and equipment, which influence the quality of a welded construction.			
3. Role of the Welding Coordinator in the fabrication industry.			

3.4.2 Quality control during manufacture			
Objective for level S and B: Explain / Outline the requirements and function of Quality Control during manufacture . Explain the standards related to welders/operators and welding procedure qualification including weld joint traceability methods. Need for calibration and monitoring of welding parameters.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	7	3
Advantages to the quality of welded constructions		X	X
Welding sequence		X	-
Welding coordination and inspection personnel; qualification tasks and responsibilities (ISO 14731, ISO 9712, CEN and National standards).....		X	X
Welder Approval /Qualification and Welding Procedure Qualification - Introduction/Overview.....		X	X
Welder Approval/Qualification (ISO 9606, CEN and National Standards).		X	X
Welding Procedure Specification – The goal, how to create and develop (ISO 15607 and 15609, CEN and National Standards).....		X	X
Welding Procedure Qualification (ISO 15610, 15611, 15612, 15613 and 15614), Regional and National standards).....		X	X
Welding Operator Qualification (ISO 14732, CEN and national standards).....		X	X
Traceability (materials identification, welder/operator, procedures, certificates)		X	X
Practical exercises:			
Welding procedure qualification		2 hours	1 hour
Welder and welder operator qualification		2 hours	1 hour
Learning outcome for level S:			
<u>Explain:</u>			
1. Main purpose of a WPS/ WPQR/pWPS and the advantages to the quality of welded fabrication.			
2. Compile and review WPSs for welded components in accordance with national and international standards.			
3. Interpretation of the standard for the qualification of a WPS, determine the main variables for a particular WPS qualification and its range of qualification in accordance with National and/or International standards.			
4. Main purpose of a welder qualification and the main advantages to the quality of welded fabrication.			
5. Interpretation of the standard for a welder qualification, determine the main variables for a particular welder qualification and its range of qualification.			
6. Main purpose of a welding operator qualification and the main advantages to the quality of welded fabrication.			
7. Interpretation of the standard for a welding operator qualification, determine the main variables for a particular welding operator qualification and its range of qualification.			
8. Definition of the traceability requirements for materials procedures and certificates and give examples.			
Learning outcome for level B:			
Outline of knowledge in:			
1. Purpose of a WPS, and the advantages to the quality of the welded construction.			
2. Recognition the main variables for a certain WPS qualification and its range of approval.			
3. Welder qualification purpose, and the advantages to the quality of the welded construction.			
4. Recognition the EN and ISO/other valid standard for a welder qualification, and outline the main variables for a certain welder qualification and its range of approval.			
5. Traceability requirements for materials procedures and certificates and give examples.			

3.4.3 Residual Stresses and Distortion		
Objective for level S and B: Explain the main factors affecting welding stress and distortion in welded fabrications and how these effects can be measured and minimised.		
Scope:	Qualification	EWCP-1090-2-S
	Teaching hours	EWCP-1090-2-B
		2
		1
Influencing factors	X	X
Origin of the residual stresses and deformation	X	X
Relationship between the material at a certain temperature and its mechanical characteristics.....	X	X
Magnitude of longitudinal and transverse shrinkage stresses	X	X
Distribution of the residual stresses at weld (parallel to the weld axis, perpendicular, and through thickness, influence of the material thickness)	X	X
Relationship between heat input, shrinkage stresses and distortion	X	X
Welding sequence techniques.....	X	X
Effects of residual stresses on the behaviour of the structure in service...	X	X
Methods of reducing residual stresses or distortion	X	X
Examples to prevent and control of distortion.....	X	X
Weld straightening, correction and removal of welding deformation (pressing, rolling, local heating, etc.).....	X	X
Learning outcome for level S:		
Outline:		
1. The origin, influencing factors and magnitude of residual stress and distortion in welded fabrications.		
2. Relationship between the material at a certain temperature and its mechanical characteristics		
3. Distribution of the residual stresses at weld (parallel to the weld axis, perpendicular, and through thickness, influence of the material thickness)		
4. Predict contraction and distortion in joints and structures.		
5. Develop procedures to minimise distortion and stress.		
6. How residual stresses may affect the behaviour of a structure in service.		
Learning outcome for level B:		
State:		
1. <u>The origin, influencing factors and magnitude of residual stress and distortion in welded fabrications.</u>		
2. <u>Relationship between the material at a certain temperature and its mechanical characteristics</u>		
3. <u>Distribution of the residual stresses at weld (parallel to the weld axis, perpendicular, and through thickness, influence of the material thickness)</u>		
4. <u>Predict contraction and distortion in joints and structures.</u>		
5. <u>Develop procedures to minimise distortion and stress.</u>		
6. <u>How residual stresses may affect the behaviour of a structure in service.</u>		

3.4.4 Plant facilities, welding jigs and fixtures		
Objective for level S and B: Explain / Outline the need for, and function of, auxiliary equipment, jigs and fixtures from the viewpoint of quality, economics and the environment.		
Scope:	Qualification Teaching hours	EWCP- 1090-2-S
		EWCP- 1090-2-B
		4
		2
Layout of production line	X	X
Jigs, fixtures and positioners (types, applications, advantages, special precautions)	X	X
Roller beads, manipulators.....	X	X
Cables, electrical connections, and special precaution.....	X	X
Operational environment.....	X	X
Auxiliary equipment (for fit up, movement, backing gas devices, flow meters, etc).....	X	X
Joint fit up	X	X
Tack welding (specific cares, distribution, length and their removal).....	X	X
Equipment for preheat, postheat, and other heat treatments, also temperature control including furnace and local heat treatment.....	X	X
Learning outcome for level S:		
Explain:		
1. Principles for improved productivity, safety and comfort.		
2. The advantages of using fixtures, jigs and positioners.		
3. Select the type of fixture, jig or positioner to be used for a particular welded fabrication.		
4. Select the type of auxiliary equipment to be used in a particular welded fabrication, and cables, heat treatment and temperature control equipment.		
5. The special requirements related to joint fit up and tack welding.		
Learning outcome for level B:		
Outline of knowledge in:		
1. The layout importance to achieve a higher and easier production.		
2. Recognise the advantages of using fixtures, jigs and positioners.		
3. Recognise the type of fixture, jig and positioner to be used in a certain welded construction.		
4. Recognise the necessary characteristics for the auxiliary equipment to be used in a certain welded construction, cables, heat treatment equipment and temperature control.,		
5. Outline the general precautions related with joint fit up and tack welding.		

3.4.5 Health and Safety			
Objective for level S and B: Outline the health and safety hazards associated with welding and fabrication processes, including techniques to minimise them.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	4	4
Introduction to health and safety requirements		X	X
Survey of safety and environmental aspects, risk assessment		X	X
Hazards of electric power		X	X
Electro-magnetic fields		X	X
Connecting of equipment		X	X
Problems with shielding gases		X	X
Radiation and eye protection		X	X
Welding fume emission		X	X
Ventilation filters (ISO 15012) and fume extraction (type of equipment and airflow).....		X	X
Ergonomics		X	X
Noise levels and ear protection		X	X
Special risks for automated processes		X	-
Standards and National regulations		X	X
Protective clothing.....		X	X
Health effects of grinding (vibration and dust).....		X	X
Hazards regarding the heat (spatter, flame, combustion, fire).....		X	X
Oxygen environment enrichment.....		X	X
Learning outcome for level S and B:			
Outline:			
1. The risk factors associated with welding from electricity, gases, fumes, fire, radiation and noise.			
2. The interpretation of Health and Safety regulations with respect to the above hazards.			
3. Select the appropriate methods to reduce each type of welding risk factors.			
4. The health effects of grinding and hazards regarding the heat			
5. Safe working procedures to ensure the requirements are met.			
6. Using of protective clothing			
7. Oxygen environment enrichment			

3.4.6 Measurement, Control and Recording in Welding		
Objective for level S and B: Explain / Outline the requirements for measurement, control and recording during welding and allied operations.		
Scope:	Qualification Teaching hours	EWCP- 1090-2-S
		EWCP- 1090-2-B
		4
Methods of measurement (electrical parameters, gas flow rate, temperature, velocity)		X
Instruments (types, measuring applications)		X
Temperatures (ISO 13916), humidity, wind		X
Cooling time e.g. $\Delta t_{8/5}$		X
Welding parameters (voltage, current, speed, gas flow rate, etc.)		X
Laboratory exercises	1 hour	1 hour
Learning outcome for level S:		
<u>Explain:</u>		
1. The methods of measurement used in the control of welding and allied operations.		
2. Working procedures for the measurement of welding parameters.		
3. Working procedures for the measurement and control of heat treatment operations.		
4. Procedures for the calibration, validation and monitoring of welding operations.		
Learning outcome for level B:		
<u>Outline:</u>		
1. The methods of measurement used in the control of welding.		
2. Working procedures for the measurement of welding parameters.		

3.4.7 Non Destructive Testing		
Objective for level S and B: Outline the use of Non Destructive Testing as applied to welding fabrications.		
Scope:	Qualification Teaching hours	EWCP-1090-2-S
		EWCP-1090-2-B
	8	4
Types of weld imperfections according to EN ISO 6520 standards	X	X
General rules and quality levels for imperfections (e.g. EN ISO 17635, EN ISO 5817)	X	X
Fundamentals of NDT methods (visual, dye penetrant, magnetic particle, eddy current, acoustic emission, radiography, ultrasonic, etc.)	X	X
Field of application and limitations	X	X
Design in respect of NDT	X	X
Calibration	X	X
Interpretation (IIW Radiographic reference)	X	X
Recording of data	X	X
Correct selection of the NDT methods versus application (e.g. CEN/TR 15135)	X	X
Qualification and certification of NDT personnel (EN 473, ISO 9712).....	X	X
NDT procedures	X	X
Health and safety aspects	X	X
Review of documents and protocols from NDT test sites.....	X	-
Laboratory exercises	2 hours	2 hours
Learning outcome for level S:		
Outline:		
1. The modes of operation of the principal NDT methods, their advantages and disadvantages when applied to welded fabrications. 2. Weld imperfections, their causes and methods of detection. 3. Interpretation of acceptance standards for weld imperfections. 4. Identification of the principles of NDT interpretation. 5. Selection of weld configurations and design to allow adequate application of NDT methods. 6. Identification the qualification of NDT personnel. 7. Recognition of safety aspects		
Learning outcome for level B:		
State:		
1. The modes of operation of the principal NDT methods, their advantages and disadvantages when applied to welded fabrications. 2. Weld imperfections, their causes and methods of detection. 3. Interpretation of acceptance standards for weld imperfections. 4. Identification of the principles of NDT interpretation. 5. Selection of weld configurations and design to allow adequate application of NDT methods. 6. Identification the qualification of NDT personnel. 7. Recognition of safety aspects		

3.4.8 Economics and Productivity			
Objective for level S and B: Explain / Outline the economics of welding operations applied to welded fabrications.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		2	1
Analysis of welding costs.....		X	X
Deposition rate.....		X	X
Costs of labour.....		X	-
Costs of welding consumables.....		X	-
Costs of equipment.....		X	-
Welding processes operation factor		X	X
Calculation of welding costs		X	-
Cost awareness (labour, consumables, equipment, gases, energy, etc.).		X	X
Measures for decreasing welding costs		X	X
Mechanisation.....		X	-
Automation.....		X	-
Robotics.....		X	-
Learning outcome for level S:			
Outline:			
1. Elements of costs associated with welding.			
2. Costs of welding operations.			
3. Select welding and handling procedures including mechanisation and automation to minimise production costs.			
Learning outcome for level B:			
State:			
1. The make up of costs associated with welding.			
2. Welding and handling procedures including mechanisation and automation to minimise production costs.			
3. Welding processes operation factor			

3.4.9 Repair Welding			
Objective for level S and B: Outline the problems of repair welding both for in-manufacture and in-service situations.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		1	1
Welding repair procedure specification.....		X	X
Welding repair plan.....		X	X
Welding repair procedure qualification.....		X	X
NDT of the weld repair.....		X	X
Special precautions.....		X	X
Learning outcome for level S and B:			
Outline:			
1. Problems of making repair welds.			
2. Possible hazards likely to occur in making repair welds particularly for in-service repairs.			
3. Comprehensive procedures to be applied to weld repairs.			
4. Procedural and operator qualifications to be applied to repair welds.			

3.4.10 Case Studies			
Objective for level S and B: To understand and be able to handle welding related tasks in respect to the manufacture of specific welded products. The best way to give this education is a combination of experts from industry presenting special cases and project work of the students split up into groups followed by a general discussion and comments by the experts. All of the following subjects have to be dealt with, the depth to which, however, will depend on the national needs.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		10	5
Steel constructions.		X	X
Common items to be covered: Standards and specifications, design, Choice of materials, welding processes, Site welding (transport and final assembly), Consumables, welding procedures, Tolerances on weld preparation and fit-up, NDT and quality control, Visual Inspection practice (interpretation and evaluation of fractures and welds including interpretation of fracture tests of fillet welds)			
Learning outcome for level S and B:			
Not applicable			

4 Seminar

Recommended minimum teaching hours: for EWCP-1090-2-S is 21 hours, for EWCP-1090-2-B is 13 hours.

The contents of the seminar are fully based on “Annex B” from EN ISO 14731.

4.1 Background of the EN 1090-1			
Objective for level S and B: understanding the meaning of the harmonised part of the EN 1090: EN 1090-1.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP- 1090-2-B
		1	1
Meaning of Initial type testing and calculation according to EN 1090-1.....		X	X
Fabrication production control and the development of Inspection and Testing Plans, according to EN 1090-1.....		X	X
The CE marking methods of declaration, according to EN 1090-1.....		X	X
Review of the requirements mentioned on the item 7 of EN 1090-2.....		X	X
Learning outcome for level S and B: Explain how EN 1090 should control manufacturing of steel construction products.			

4.2 Review of requirements, technical review			
Objective for level S and B: understanding the importance of technical contracts regarding technical requirements. Evaluating the (sub) contractor's ability for welding fabrication.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours	2	1
EN 1090-2, together with any supplementary requirements.....		X	X
a) EN 10021: General technical delivery requirements for steel products.....		X	X
b) EN 10025-series: Hot rolled products of structural steels.....		X	X
c) the capability of the manufacturer to meet the requirements.....		X	X
Is the manufacturer ISO 9000 and /or ISO 3834 certified.....		X	X
a) the parent material(s) specification and welded joint properties			
• Examples of material specifications/ requirements.....		X	X
• Examples of impact-test requirements.....		X	X
• Examples of hardness requirements.....		X	X
b) the joint location with relation to the design requirements.....		X	X
• Examples of wrong weld-positioning.....		X	X
• Welds in highest tension area.....		X	X
• Weld-positioning regarding pre-heating.....		X	X
c) quality and acceptance requirements for welds			
• Acceptance criteria of EN ISO 5817.....		X	X
d) the location, accessibility and sequence of welds, including accessibility for inspection and non-destructive testing.....		X	X
• Examples of bad construction-design regarding weldability and Non Destructive Testing.....		X	X
e) Other welding requirements, e.g. batch testing of consumables, ferrite content of weld metal, ageing, hydrogen content, permanent backing, use of peening, surface finish, weld profile.....		X	X
• short illustration of the several methods.....		X	X
• which tools are available in the market.....		X	X
f) the dimensions and details of joint preparation and completed weld.....		X	X
• how can it be measured (available tools) and when should it be executed.....		X	X
g) performing an audit at the subcontractor.....		X	X
Learning outcome for level S and B:			
1. Illustrate the potential hazards of a contract			
2. Translate the appropriate standards to working documents			
3. Evaluating the (sub)contractor's ability for manufacturing			
4. Being capable of providing a professional judgement on subcontracting.			

4.3 Welding personnel		
Objective for level S and B: survey of welding personnel regarding qualifications.		
Scope:	Qualification Teaching hours	EWCP-1090-2-S EWCP-1090-2-B
		1 1
Range of approval regarding certificates (e.g. EN 287-1, EN ISO 9606-2)	X	X
Confirmation and prolongation of welders qualification.....	X	X
Guidance on the execution of welders qualifications.....	X	X
Learning outcome for level S and B:		
1. Decide about the quality of a welders qualification test performed		
2. Decide on the validity of a welders performance qualification		
3. Compile a list with welding personnel qualified for the project		

4.4 Equipment		
Objective for level S and B: the appropriate use, identification and availability of weld equipment.		
Scope:	Qualification Teaching hours	EWCP-1090-2-S EWCP-1090-2-B
		1 1
Welding Machine Performance in relation to weld thickness.....	X	X
Roll equipment --> load capacity, rubber wheels, etc.....	X	X
Machinery dimensions --> pipe diameter requirements.....	X	X
In which way are the several machine tagged /can be distinguished from others.....	X	X
How to perform shielding gas checks.....	X	X
Overview of available personnel protective tools.....	X	X
Equipment maintenance: obliged annual check(s) and registration of it....	X	X
Learning outcome for level S and B:		
1. safe and economic use of weld related equipment		

4.5 Production Planning			
Objective for level S and B: understand the workflow during manufacturing / the stages of fabrication, Application and identifying the limitations of the approvals during manufacturing, Providing documents to regulate production planning.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP-1090- 2-B
		3	1
Examples of sheets (Welding Inspection Sheets) in which the relation between PQR <-> WPS <-> drawing number can be seen.....		X	X
One-way relation between WPS and the product to be welded.....		X	X
Examples of welding procedures.....		X	X
Practical examples of weld sequences and the consequences explaining/providing transparent rules for on-site welding conditions.....		X	X
Shop conditions.....		X	X
Preheating: how and when.....		X	X
Are there more welding coordinators? Who's responsible for which part of the production? How and where is this being indicated?.....		X	X
Check of base material weld edge preparation: entrance-check.....		X	X
Fit-up approval.....		X	X
Visual check.....		X	X
Evaluating NDT-reports.....		X	X
Preparing correct assignment towards NDT-company (technical).....		X	X
Assessment of available machinery.....		X	X
Calibration scheme available.....		X	X
Examples of data storage <-> product digitalize.....		X	X
Use of hold points. Example: dye-penetrant check of root pass.....		X	X
Use of extension plates regarding destructive testing.....		X	X
Heat-input considerations regarding location of extension plates.....		X	X
Time of performing production test: day- or night-shift considerations.....		X	X
Learning outcome for level S and B:			
1. To follow up a total production planning and proceed accordingly.			
2. Capable of making adjustments if necessary			
3. To administer production data			

4.6 Qualification of the welding procedures			
Objective for level S and B: survey of welding procedure qualifications.			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP-1090- 2-B
		4	2
Total view of range of welding procedure qualifications (e.g. EN ISO 15610 – EN ISO 15614).....		X	X
Determine the required number and type of welding procedures for a project.....		X	X
Determine the required tests to be performed for new procedures		X	X
Learning outcome for level S and B:			
1. compile a list with welding procedure qualifications available / necessary for the project			

4.7 Welding procedure specifications and work instructions			
Objective for level S and B: to understand the requirements and purpose of a welding procedure specification and to understand the importance of toolbox meetings.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours		
		1	1
Essential variables in WPS according EN ISO 15609.....		X	X
Examples of toolbox meetings.....		X	X
Distribution of work instructions.....		X	X
Learning outcome for level S and B:			
1. To set-up and using welding procedures			
2. Setting up and organizing toolbox meetings			

4.8 Welding consumables			
Objective for level S and B: to categorize the welding consumables and their compatibility manufacturing requirements regarding storage. To understand the importance of certificates.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours		
		1	1
Application of new filler material? Consequences for range of approval PQR.....		X	X
Weldability tests on plates or on the real product?		X	X
Boxes, pallet-boards, vacuum packed, marathon pack.....		X	X
Entrance check of filler materials? Did you receive what you ordered! ...		X	X
Certificates of filler material (batch numbers).....		X	X
Temperature & humidity.....		X	X
Traceability.....		X	X
Ware house: in- and outgoing of filler material. Who is managing this?			
Preventing of exchanging filler-wires.....		X	X
Learning outcome for level S and B:			
1. Correct use of the appropriate welding consumables			

4.9 Materials			
Objective for level S and B: understand the standards. How to handle, categorizing and identifying materials during welding manufacturing.			
Scope:	Qualification	EWCP-1090-2-S	EWCP-1090-2-B
	Teaching hours		
		1	1
Material certificates according EN 10204.....		X	X
Additional requirements like: impact tests, hardness, Z-quality.....		X	X
Storage systems.....		X	X
Transport of materials.....		X	X
Handling of pre-protected materials (Oil, foils).....		X	X
How to deal with pieces of material.....		X	X
Re-marking of materials.....		X	X
Learning outcome for level S and B:			
1. Recognize essential differences in material certificates			
2. Ordering the applied materials in fabrication manuals			

4.10 Inspection and testing before, during and after welding			
Objective for level S and B: to understand the importance of inspection and testing before, during and after welding.			
Scope:	Qualification Teaching hours	EWCF- 1090-2-S	EWCF-1090- 2-B
		3	1
Before welding:			
• Validation of welder certificates.....		X	X
• Acceptance of WPS.....		X	X
• Material identification: how to handle if traceability is not given...		X	X
• Filler materials: code explanation.....		X	X
• Tags.....		X	X
• Coordination with planning / purchase department.....		X	X
• Entry-check.....		X	X
• Joint preparation (e.g. shape and dimensions).....		X	X
• Use of hold points.....		X	X
During welding:			
• Welding parameters: ways of measuring.....		X	X
• Measuring instruments.....		X	X
• Software (independent system).....		X	X
• Preheating/ interpass temperature: how, where and when		X	X
• Calibration (apparatus or tempil sticks).....		X	X
• Cleaning, shape, sequence of weld runs: ways of control.....		X	X
• Gouging: available systems. In- and outs, safety.....		X	X
• Distortion: measuring, joint preparation, prevention, calculation...		X	X
• Intermediate examination: how, where and when.....		X	X
• Hold points.....		X	X
After welding:			
• Visual inspection: eye test, light intensity.....		X	X
• Interpretation of EN ISO 5817.....		X	X
• Outsourcing NDT: levels of required competence.....		X	X
• NDT Acceptance criteria.....		X	X
• Destructive testing: laboratories, traceability of documents.....		X	X
• Standard EN ISO 13920 / welded constructions / tolerance classes.....		X	X
• Examples of registrations of records regarding post-operations (post weld heat treatment).....		X	X
Learning outcome for level S and B:			
1. Setting up and organizing welding inspection plans and response appropriate in case of deviations.			
2. To follow up and the interpretation of the welding inspection plan and response appropriate in case of deviations			
3. Follow up and the interpretation of the welding inspection plan and response appropriate in case of deviations			
4. Incorporation into fabrication manuals.			

4.11 Non-conformance, corrective actions and quality records			
Objective for level S and B: To understand the importance of NCR's and the submitted corrective actions. To understand the importance of manufacturing books			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP-1090- 2-B
		2	1
How to deal/ handle with NCR's		X	X
Examples of fabrication manuals		X	X
Storage requirements		X	X
Learning outcome for level S and B:			
1. The correct assigning and processing of NCR's			
2. Ordering the applied materials in fabrication manuals			
3. To set-up a fabrication manual			

4.12 Calibration and validation of measuring, inspection and testing equipment			
Objective for level S and B: to understand the importance of calibration, validation of measuring, inspection and testing equipment			
Scope:	Qualification Teaching hours	EWCP- 1090-2-S	EWCP-1090- 2-B
		1	1
Instrument assessment.....		X	X
Methods of registration.....		X	X
Calibration - independent - periodical / requirements.....		X	X
The correct use of testing equipment.....		X	X
Learning outcome for level S and B:			
1. The application of and/or the evaluation of the correct use of testing equipment			

Section II: Examination and Qualification

Note: Other rules/procedures are covered in Document IAB-001 / EWF-416.

1. Introduction

The guideline seeks to achieve harmonisation and common standards in the training and qualification of welding coordinators at the required level.

The national welding organisations, being members of EWF, mutually acknowledge the Diploma awarded in any Member State, following examination conducted in accordance with this Guideline.

Education must have followed this EWF guideline and the examination must have been conducted by the national body authorised by EWF for this purpose.

2. Approval of the course

Any training course leading to the EWF examination must be approved by the ANB. The number of teachers required to give the course shall be sufficient to ensure that the essential specialist knowledge and industrial experience to cover the syllabus is adequately represented in the team of teachers and visiting lecturers. Standard requirements are documented in Doc. EWF-416, "Rules for the implementation of European Federation for Welding, Joining and cutting (EWF) Guidelines for the education, examination, qualification and certification of welding personnel".

3. Examination Board

An Examination Board, acting on behalf of the ANB supervises the ANB National part of the examination process. In this way, independence, integrity and fairness of the examination system are maintained.

4. Admission to the Examination

Admission to the examination leading to the award of the qualification will be restricted to those who

- comply with the minimum requirements specified in the access conditions and
- have attended at least 90% of the course, approved by the ANB according to this guideline (not applicable for the intermediate examination).

Exceptions are at the discretion of the Board of Examiners.

5. Examination procedures

The examination procedure described below is designed to simulate the different situations of a Responsible Welding Coordinator active in the industry. The examination shall cover all topics in this guideline.

At the discretion of the Board of Examiners the written examination shall consist of:

- i. A series of essay questions covering the whole field of the subject
or
- ii. A series of multiple choice questions covering the whole field or the subject
or
- iii. A combination of a) and b).

The written examination “Theory” shall cover the content of the theoretical part “Welding Theory”.

Final examination:

- the written examination “Seminar” shall cover the seminar content;
- the oral examination shall cover the full syllabus (an oral examination for the part “Welding Theory” plus an oral examination for the seminar).

At the discretion of the ANB written examination “Theory” can be performed on the same day of the final exam.

Examination questions for written examinations either for the examination “Theory” or for the final written examination “Seminar” shall be taken from the IAB/EFWJ question database as per OP 17 for the relevant subjects for a minimum of 50% of the total duration of the examination.

The oral examination covering “Welding Theory” and “Seminar” of the guideline, complete the final examination.

6. Minimum Duration of Exams

Qualification Level	Written Examination	Final Examination	
	Welding Theory	Written Seminar	Oral Welding Theory and Seminar
EWCP-1090-2-S	1,5 hours	1,5 hours	45 minutes
EWCP-1090-2-B	1 hour	1 hour	30 minutes

7. Evaluation of performance

In order to pass the examination, candidates must achieve at least 60% of the maximum possible mark in “Welding Theory” and “Seminar” examination.

This means that:

- written plus oral (only applicable at the discretion of the ANB Board of Examiners and only when the written examination as a borderline mark above 50% but below 60%) for the theory must be $\geq 60\%$ and
- written plus oral for the seminar must be $\geq 60\%$ and
- each individual examination (written or oral for theory and seminar) must be $\geq 50\%$

8. Re-examination and appeals procedure

Failure in any individual examination “Welding Theory” or “Seminar” shall require re-examination only in the subject failed.

Examinations shall be retaken within 15 months of the initial examination and, in the case of a second failure one further attempt is permitted within 15 months from the date of the second examination.

If a candidate fails three times in any of the exams “Welding Theory” or “Seminar”, he/she has to retake the classes of the subject failed and the full examination of the subject failed.

Additionally he/she has to do the oral examination of the passed subjects again.

In the case of re-examination, the 3 years validity period of the examination may be extended by decision of the Lead Assessor, if it has not been possible for the ANB to organize the necessary re-examinations within the relevant period.

In such circumstances, the following conditions shall be fulfilled:

- i. The ANB must provide valid reasons for needing an extension.
- ii. Any re-examinations taken after the first period must include oral examinations covering the whole syllabus.
- iii. Under no circumstances shall the validity period exceed a total of six years.”
Candidates who feel they have been unfairly treated during the examination procedure have the right to appeal to the Authorised National Body.

9. European Diploma

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

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ANBs shall use the blank diploma and the wording shall be to the template that has been distribute by the Secretariat to print the diplomas.