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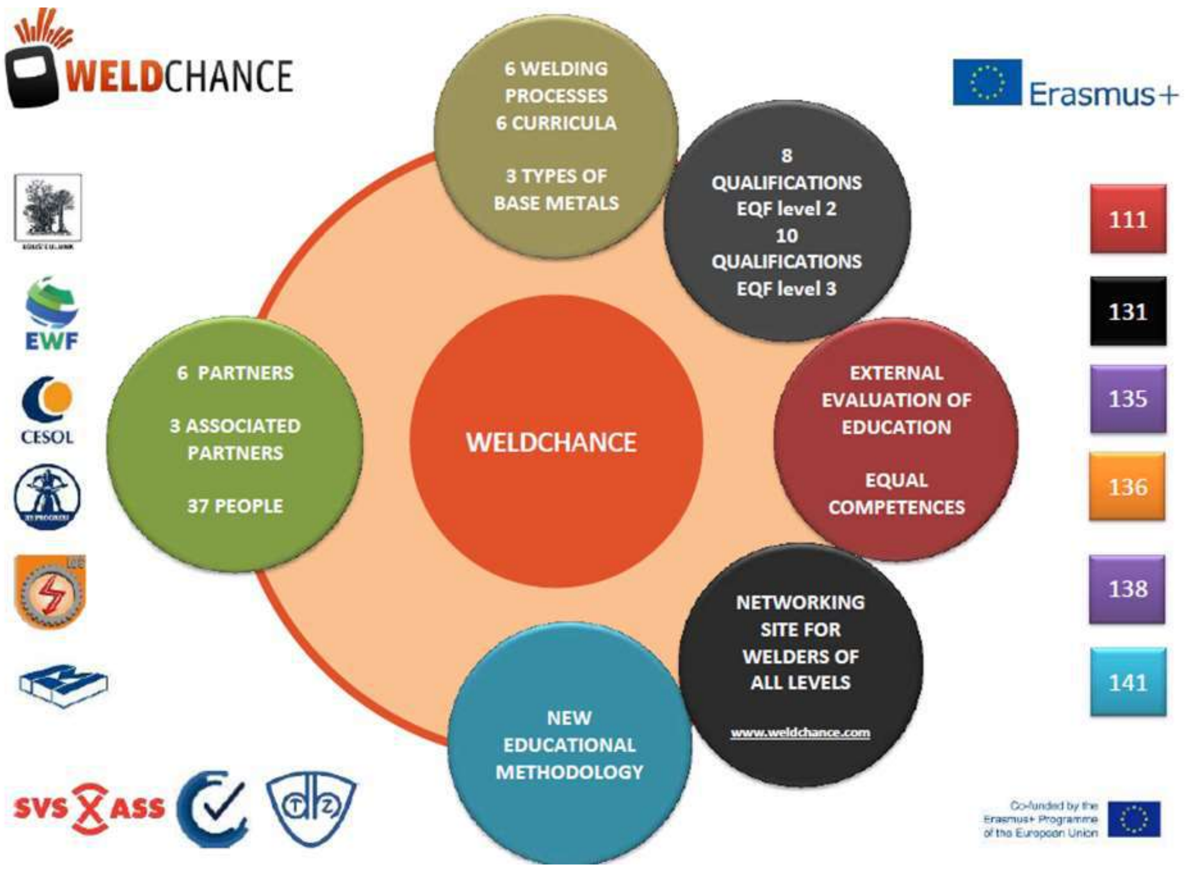
European framework curricula
ARC WELDER 2



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European framework curricula ARC WELDER 2

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LIST OF ABBREVIATIONS:

CEN – European Committee for Standardization

EN – European Standards

EQF – European Qualifications Framework

IAB – International Authorization Board

IT – Information Technology

ISO – International Organization for Standardization

NQF – National Qualifications Framework

VET – Vocational Education and Training

VWTS – Virtual Welding Training System

WPS – Welding Procedure Specification

Welding arc processes (EN ISO 4063)**:**

MMA (111) - manual metal arc welding

MIG (131) – Metal Inert Gas - welding with solid wire electrode

MAG (135) – Metal Active Gas - welding with solid wire electrode

FCAW (136) – Flux-Cored Arc Welding – MAG welding with flux cored electrode

MCAW (138) – Metal-cored Arc Welding - MAG welding with metal cored electrode

TIG (141) – Tungsten Inert Gas - welding with solid - filler material (wire/rod)

Welding positions:

PA - flat position

PB - horizontal vertical position

PC - horizontal position

PD - horizontal overhead position

PE - overhead position

PF - vertical up position

PG - vertical down position

H-L045 - inclined position welding upwards

J-L045 - inclined position welding downwards

PH - pipe position for welding upwards

PJ - pipe position for welding downwards

Weld details:

BW - Butt weld

FW - Fillet weld

PW – Plate weld

ss – single-side welding

mb - material backing

nb - welding with no material backing

gb - gas backing

fb - flux backing

bs - welding from both sides

ci - consumable insert

sl - single layer

ml - multi-layer

lw - leftward welding

rw - rightward welding

Non-Destructive Testing (NDT):

MT – Magnetic Particle Testing

PT – Liquid Penetrant Testing

RT – Radiographic Testing

UT – Ultrasonic Testing

VT – Visual Testing

Sadržaj

INTRODUCTION

1. GENERAL PART

1.1. Curriculum for qualification acquisition

Arc Welder 2

1.2. Curriculum objective

Acquisition of vocational competences prescribed in vocational qualification standard

Arc welder 2

1.3. Duration of education

2 years in vocational schools

According to the established minimum hours in adult education

1.4. Conditions for enrollment, duration and end of education

Completed elementary school or level 1

2. CURRICULUM/SYLLABUS

2.1. Teaching plan

Curriculum/syllabus is based on curriculum architecture (Fig.1) and in this document it is directed exclusively at vocational modules.

In this connection it is important to point out that the issue of correlation of subjects is very significant, so it needs to be emphasized that final objectives of welder education are reflected through following subjects:

- Mother tongue
- Foreign language
- Mathematics
- ICT
- Welding technique and technology
- Physical education

In addition, cross-curricular topics are:

- Learning how to learn,
- Soft skills,
- Technical-technological education and
- Environmental education

The concept of educational system for welders is based on three factors: Skills – Knowledge – Stability. The interrelation of these factors is visible in curricula architecture outlined in Figure 1.

The *Knowledge* component represents the theoretical part of welder education and consists of six modules (Modules 1-6) for EQF level 2 and five modules (Modules 19-23) for EQF level 3:

Level 2:

- M1 - Arc welding process
- M2 - Weldability of Ferritic Steels
- M3 - Weldability of Austenitic Stainless Steels
- M4 - Weldability of Aluminum and its alloys
- M5 - Welding application and quality
- M6 - Health and Safety

Level 3:

- M19 - Weldability: Cr-Mo steel, nickel steel, other stainless steels, cast irons (according to ISO/TR 15608 – Groups 5, 6, 7, 9, 10)
- M20 - Fabrication of welded structures (welding sequence)
- M21 - Flame and mechanical straightening
- M22 - Repairing of welds
- M23 – Introduction to mechanized, automatic and robotic welding

The *Skills* component represents the practical part of welder education and is divided into two parts: welding preparation and welding (technique, technology and training). The preparatory part consists of one basic module (Module 7) and three submodules that are connected with base metals that are welded. Consequently, M7.1. is connected with steels, M 7.2. with stainless steels, and 7.3. with aluminum. Modules 8-17, each individually, make for a whole that defines the profile of arc welder according to the welding process and welded material. Each practical module consists of three submodules: FW – for fillet welds, PW for plate welds and TW for tube welds.

The *Stability* component represents the psychophysical part of welder education and consists of one module – Module 18.

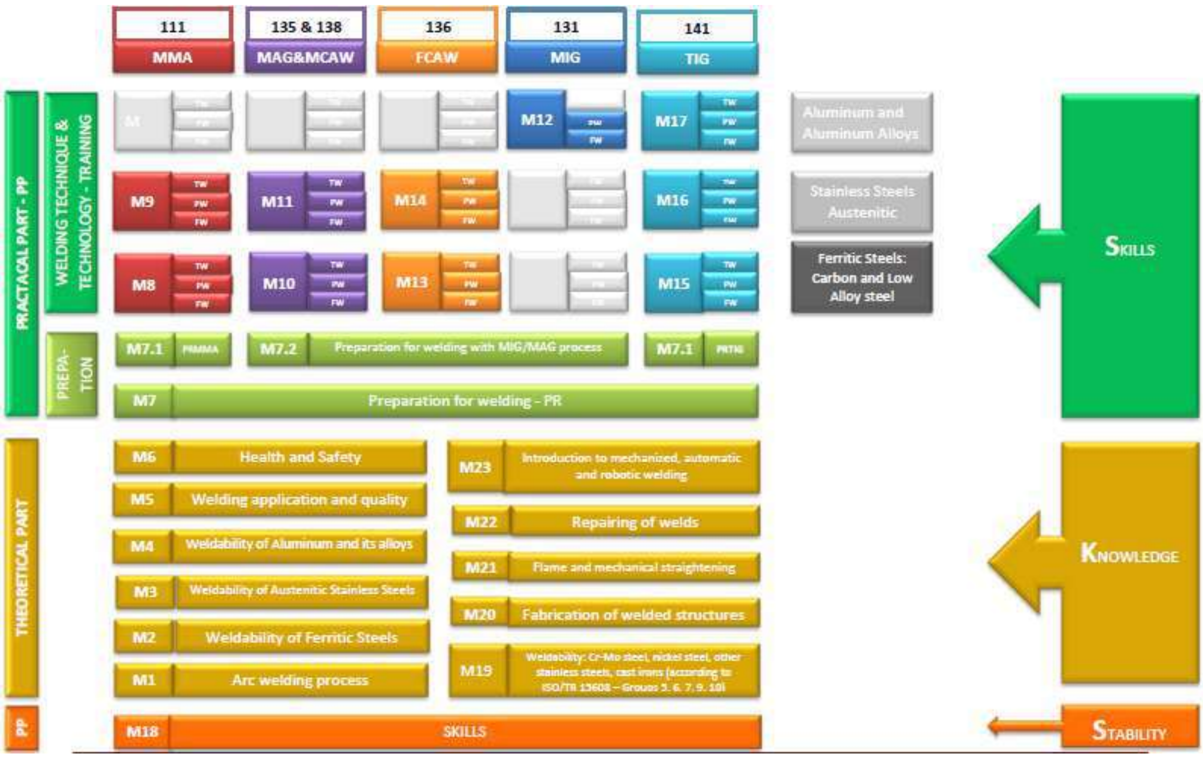


Figure 1 Curriculum architecture

The described architecture contains curricula for qualification levels EQF2 and EQF3.

The qualification level EQF2 (Arc welder 2) is made up of: theoretical modules 1-6, practical modules 8-17 individually with submodules FW and PW and psychophysical module 18.

The qualification level EQF3 (Arc welder 3) is made up of: theoretical modules 19-23, practical modules 8-17 individually with submodule TW and psychophysical module 18. Entry condition for qualification level 3 is that the participant possesses a proof of completed qualification level 2.

The aberrations from previously stated principles are in connection with the training on aluminum that is completely assigned to level 3. The reason is specific nature of welded joints execution, safety at work and protection of welder's health that demands a higher level of participant's previous knowledge and skills.

The execution of welded joints on different types of materials anticipates basic training on ferritic steels. Consequently, the theoretical and practical work on stainless steels is preceded by the theoretical and practical work on ferritic steels. The same is applied in training on aluminum.

The framework of vocational curricula for level 2 for all materials is shown in Figure 2.

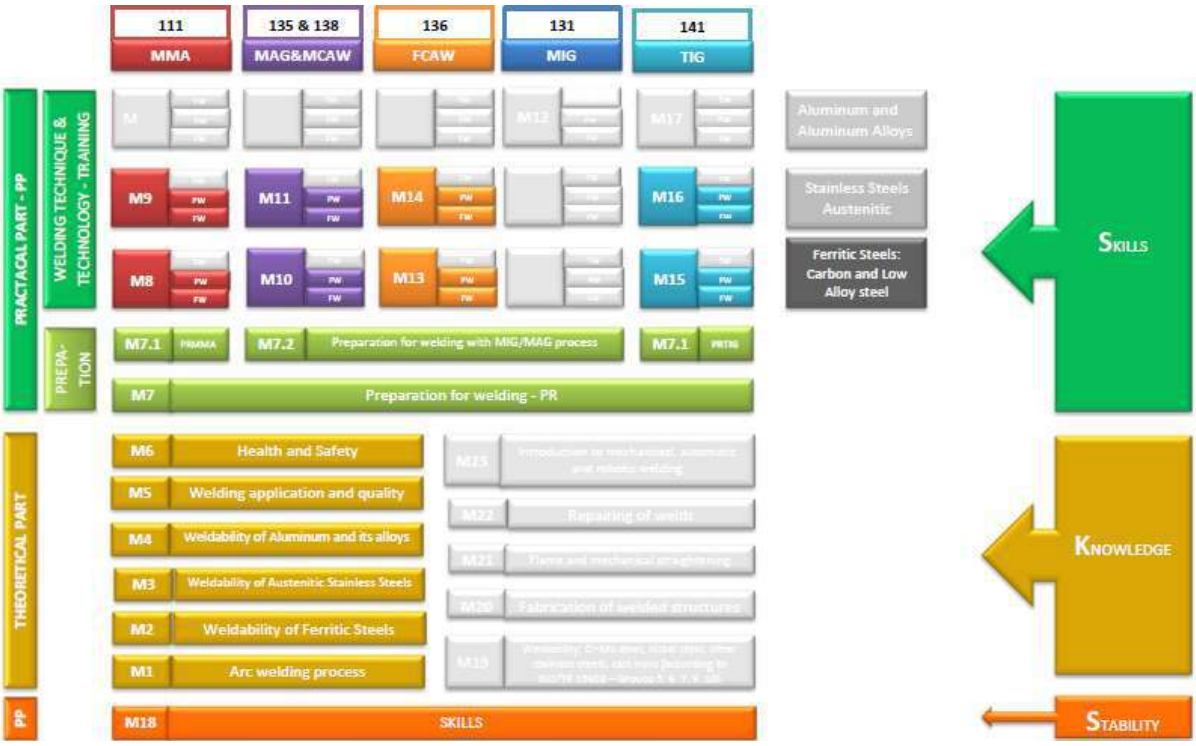
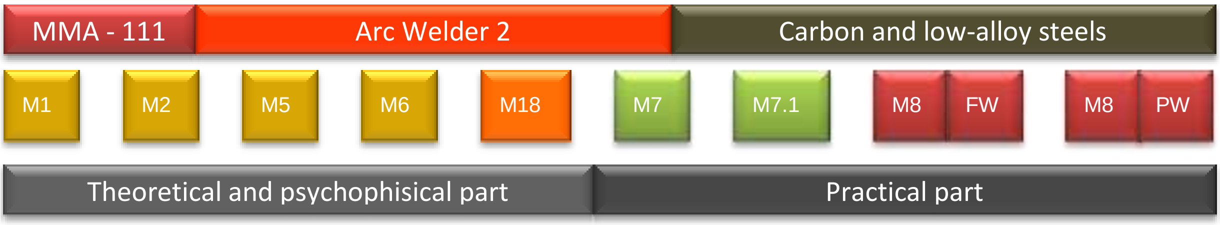


Figure 2 Framework vocational curricula level 2 for all materials

The participant, the VET institution or the employer can, according to the labor market demands, for base metals carbon and low-alloy steels choose the acquisition of qualification - Arc welder 2 for MMA, MAG, MCAW, FCAW and TIG welding processes according to the following schemes:

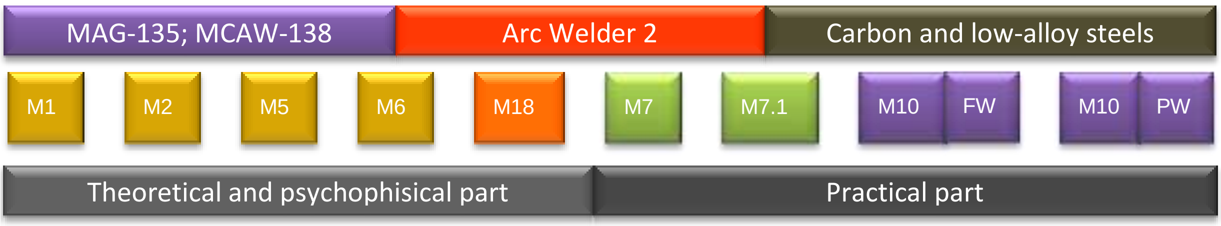
Scheme 1:

Arc welder 2 – welding process: MMA – 111 - Carbon and low-alloy steels:



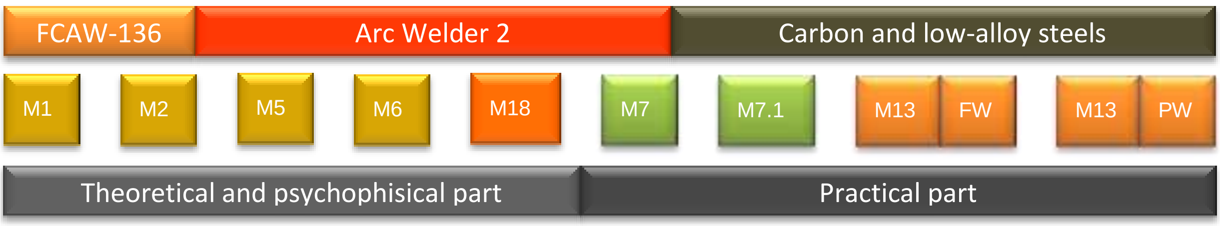
Scheme 2:

Arc welder 2 – welding process: MAG-135; MCAW-138 - Carbon and low-alloy steels:



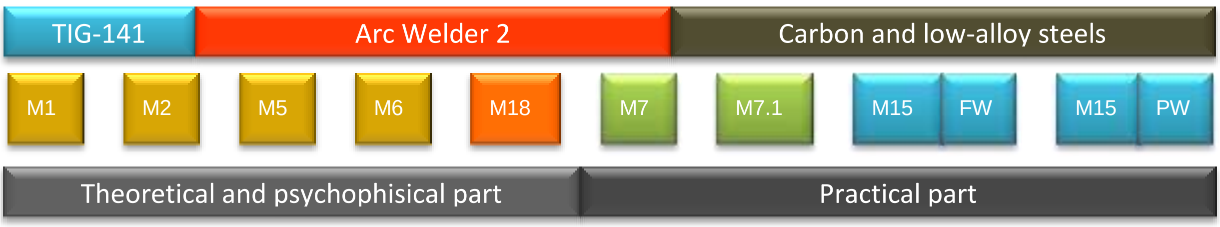
Scheme 3:

Arc welder 2 – welding process: FCAW-136 - Carbon and low-alloy steels:



Scheme 4:

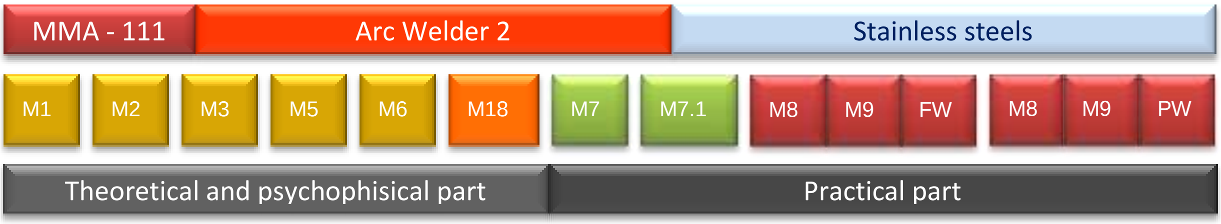
Arc welder 2 – welding process: TIG-141 - Carbon and low-alloy steels:



The participant, the VET institution or the employer can, according to the labor market demands, for base metals stainless steels choose the acquisition of qualification - Arc welder 2 for MMA, MAG, MCAW, FCAW and TIG welding processes according to the following schemes:

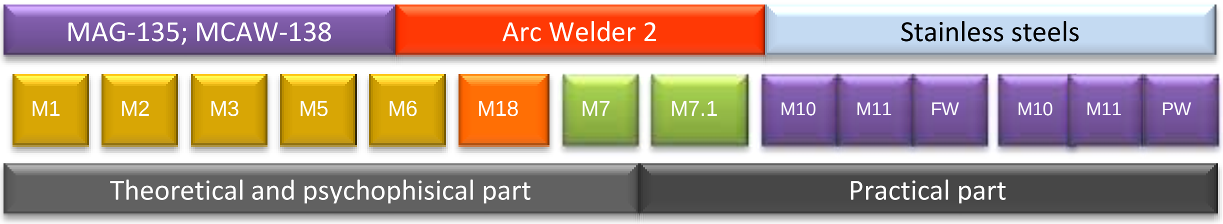
Scheme 5:

Arc welder 2 – welding process: MMA – 111 - Stainless steels:



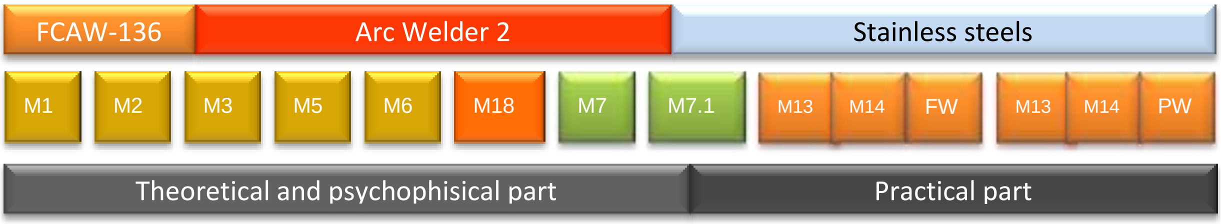
Scheme 6:

Arc welder 2 – welding process: MAG-135; MCAW-138 - Stainless steels



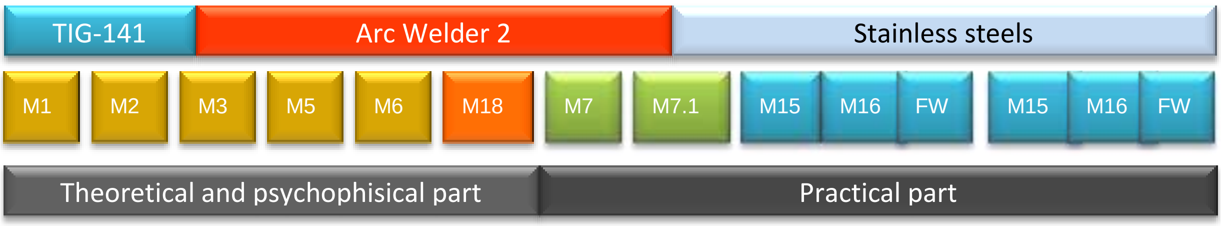
Scheme 7:

Arc welder 2 – welding process: FCAW-136 - Stainless steels:



Scheme 8:

Arc welder 2 – welding process: TIG-141 - Stainless steels:



2.2. Program of instruction

Program of instruction consists of theoretical vocational modules and individual practical vocational modules that finalize the vocational curriculum by welding process and welded material.

All the modules contain the minimum of necessary competences for acquisition of title Arc Welder 2 and do not exclude adding of content according to labor market demands.

2.2.1. Theoretical vocational modules

M1

Name of the module	ARC WELDING PROCESS
List of vocational units of learning outcomes from the qualification standard	1. Using electricity for arc welding 2. Welding equipment 3. Welding consumables 4. Welding practice 1 5. Overview of fusion welding processes
How to learn and work with this module:	
Module objective	1. Understand the principle of arc welding. 2. Describe the operating principles of welding equipment for arc welding. 3. Understand the basic principles of the use of welding consumables. 4. Know how to work to a WPS, knowing the use of welding parameters 5. Have an overview of the most frequently used fusion welding processes.
Module description	During realization of this module the participant will get familiar with electric arc and its properties as well as basic welding terminology.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	USING ELECTRICITY FOR ARC WELDING
Learning outcomes the participant will acquire through this subject	1. Describe the principle of arc welding. 2. Define the basic terms in welding. 3. Explain the heat generation in the arc. 4. Explain metal transfer through the arc. 5. Explain the formation of the weld pool.
Elaboration	
Electric arc	Basics of electricity Nature of the electric arc The arc as heat source Arc power
Introduction to Welding	Basic terminology for welds. (e.g.: run, layer, top, root, penetration) Welding processes (MMA, MIG/MAG, TIG) Welding consumables Metal transfer Weld metal Formation of the weld pool
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDING EQUIPMENT
Learning outcomes the participant will acquire through this subject	1. Describe the major components of welding equipment and their function. 2. Describe polarity and change of polarity. 3. Identify the essential parameters for arc welding.
Elaboration	
Welding equipment	Distribution of electricity; mains supply Converting mains to welding power; welding power source Transformers; use of AC Rectifiers for DC Open circuit and arc voltage; welding current Type of welding current and polarity Duty cycle Shielding gas supply Welding parameters
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDING CONSUMABLES
Learning outcomes the participant will acquire through this subject	1. Distinguish between use, types and functions of welding consumables. 2. Explain why and how to dry, store and handle welding consumables (following the recommendations of the manufacturer). 3. Identify the designation of welding consumables as used on WPSs of the training program (according to appropriate EN/ISO standards).
Elaboration	
Welding consumables	Principle of welding consumables and functions of each type of welding consumable (electrodes, rods and gases) Shielding gases Backing gases Classification of welding consumables Storage, drying and handling
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDING PRACTICE 1
Learning outcomes the participant will acquire through this subject	1. Interpret welding details and welding symbols on a drawing (ISO 2553). 2. Distinguish the welding positions per ISO 6947. 3. Identify the types of welded joints: “T”, lap, corner, etc. 4. Identify in the fillet weld: size, shape, tack weld, and excess weld metal. 5. Interpret a WPS in production. 6. Describe how to get the required parameters.
Elaboration	
Exercises	Welding Procedure Specifications (ISO 15609-1). Welding parameters, welding positions (ISO 6947). Types of welds and joints: characteristics, size, surface finish. Welding symbols according to ISO 2553.
Note	The teaching process is performed theoretically (exercises) 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	OVERVIEW OF FUSION WELDING PROCESSES
Learning outcomes the participant will acquire through this subject	1. Describe different welding processes: 111, 114, 121, 13, 141, 151, 311.
Elaboration	
Fusion welding processes	Revision of the MMA, MIG, MAG, TIG welding Principles of Self Shielding Metal Arc (114) welding Principles of gas welding (311) Principles of plasma welding (151) Principles of submerged-arc welding (121)
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

M2

Name of the module	WELDABILITY OF FERRITIC STEELS
List of vocational units of learning outcomes from the qualification standard	1. Introduction to steel 2. Weldability of steels 3. Materials other than non-alloy steels
How to learn and work with this module:	
Module objective	1. Summarize the basis of welding steel 2. Summarize the specific effects of welding heat on steel. 3. Outline the most important materials and their behavior.
Module description	During realization of this module the participant will get familiar with steels, non-alloy steels and other materials and their weldability.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	INTRODUCTION TO STEEL
Learning outcomes the participant will acquire through this subject	1. Outline the processes when: making steel, using continuous casting and hot working. 2. Explain the influence of welding on steel. 3. Compare non-alloy, stainless steels and other alloy steels. 4. Recognize the influence of alloying elements on the properties of steel. 5. Classify materials according to ISO (TR) 15608.
Elaboration	
Steels	Making of steel Nature of non-alloy steels Effects of welding on steel Adding elements to create alloys Basis of ISO (TR) 15608
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDABILITY OF STEELS
Learning outcomes the participant will acquire through this subject	1. Name the influence of alloying elements on the properties of weldable steel. 2. Describe the effect of plate thickness on the properties of weldable steel. 3. Explain the influence of carbon equivalent. 4. Interpret the heat input concept and its use.
Elaboration	
Weldability of steels	The concept of weldability Effects of composition, thickness and temperature (preheat and interpass) Heat input
Note	The teaching process is carried out 70 % of the time theoretically in order to meet the performance criteria of the said outcome, and 30% is used to correlate the acquired contents with theoretical terms and practical application. The exercises that need to be implemented are: 1. Calculation of carbon equivalent, 2. Calculation of pre-heat temperature
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	**MATERIALS OTHER THAN NON-ALLOY STEELS** (Introduction)
Learning outcomes the participant will acquire through this subject	1. Identify different kinds of materials such as stainless steels, other alloy steels and aluminum alloys.
Elaboration	
Other materials	Stainless steels and other alloy steels Aluminum alloys Copper alloys Nickel alloys Titanium and other special materials Typical problems when welding the above materials
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

M3

Name of the module	WELDABILITY OF AUSTENITIC STAINLESS STEELS
List of vocational units of learning outcomes from the qualification standard	1. Basis of stainless steels 2. Weldability, welded joints and distortion of stainless steels 3. Welding consumables for stainless steels 4. Corrosion, post weld treatment
How to learn and work with this module:	
Module objective	1. Know the basis of stainless steel; different grades of stainless steels; appropriate welding processes and the health aspects related to welding of stainless steel 2. Know the theoretical basis of welding stainless steel, the common welded joints and how to prevent distortion. Know about the weldability of different grades of stainless steels. 3. Know the basis of welding consumables and of backing gas 4. Know the basis of corrosion and post weld treatment of stainless steel
Module description	During realization of this module the participant will get familiar with properties of stainless steels, their weldability, as well as welding technology and techniques that are applied during the joining process.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	BASIC OF STAINLESS STEELS
Learning outcomes the participant will acquire through this subject	1. Define the characteristics of stainless steel and explain the concept of protective oxide film formation 2. Explain the difference between welding stainless steel and unalloyed carbon steel 3. Outline the grades of stainless steel and their characteristics: austenitic, ferritic, martensitic, duplex (austenitic-ferritic) 4. Identify common welding processes for stainless steel 5. Explain health risks related to welding of stainless steel and how to prevent them
Elaboration	
Stainless steels	Definition of stainless steel Identification of stainless steel Protective oxide film Welding processes Characteristics of stainless steel compared to unalloyed steel and aluminum alloys Grades of stainless steel and their characteristics: austenitic, ferritic, martensitic, duplex (austenitic-ferritic) Health aspects during welding of stainless steel, alloys in stainless steel and their effect on the health Methods for preventing health risks related to welding of stainless steel, breathing zone, welder's mask with fresh-air filters, hygiene Safety precautions for cutting
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDABILITIY, WELDED JOINTS AND DISTORTION OF STAINLESS STEELS
Learning outcomes the participant will acquire through this subject	1. Outline the commonly used welding joints and the methods of joint preparation regarding stainless steel 2. Explain the importance of controlling heat input and interpass temperature 3. Name the influence of alloying elements on weld properties. 4. Explain the effect of heat input on stainless steel. 5. Outline typical problems when welding stainless steels
Elaboration	
Weldability of stainless steels	Welded joints for stainless steel Methods for joint preparation in stainless steel Weldability of stainless steel, heat input, interpass temperature Effects of composition, temperature, heat input. Welding of dissimilar metals and clad metal (stainless steel-unalloyed steel) and control of dilution Distortion caused by welding stainless steel and the difference when compared to unalloyed steel Handling of stainless steel in the workshop and the use of tools for stainless steel
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDING CONSUMABLES FOR STAINLESS STEELS
Learning outcomes the participant will acquire through this subject	1. Recognize the main types and classification of welding consumables for stainless steel 2. Determine and measure required backing gas 3. Identify equipment and tools for backing gas
Elaboration	
Welding consumables for stainless steels	Welding consumables (filler metals and shielding gases) adequate for stainless steels, standards Measurements (ppm) of oxygen on backing gas, requirements for different grades of stainless steels Determination of required backing gas, density of gases compared to density of air Equipment for backing gas
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	CORROSION, POST WELD TREATMENT
Learning outcomes the participant will acquire through this subject	1. Outline methods to avoid corrosion in stainless steel 2. Identify the influence of welding in corrosion of stainless steel 3. Describe post weld treatment: pickling, blasting and brushing, grinding
Elaboration	
Corrosion, post weld treatment	Use of protective means, Corrosion types in stainless steel (pitting, intergranular, crevice corrosion), The influence on corrosion in stainless steel caused by welding and environment Post weld treatment: pickling, blasting, brushing and grinding Post weld heat treatment: austenitic, ferritic, martensitic, austenitic-ferritic (duplex)
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

M4

Name of the module	WELDABILITY OF ALUMINUM AND ITS ALLOYS
List of vocational units of learning outcomes from the qualification standard	1. Basics of aluminum, welding processes and health aspects 2. Weldability and welding technique 3. Welding consumables for aluminum welding 4. Welding joints and distortion in aluminum alloys 5. Welders´ qualification: ISO 9606-2
How to learn and work with this module:	
Module objective	1. Know the basics of aluminum, aluminum alloys, welding processes and the health aspects regarding welding of aluminum alloys 2. Know the theoretical basics of welding aluminum alloys and common welding technique. Know about weld imperfections, characteristic for welding of aluminum and its alloys. 3. Know the basics of how to choose filler metals and gases for aluminum welding 4. Know about different types of welding joints and distortion caused by welding 5. Explain demands from the standard ISO 9606-2
Module description	During realization of this module the participant will get familiar with properties of aluminum and its alloys, their weldability as well as welding technology and techniques applied during the joining process.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	BASICS OF ALUMINUM ALLOYS
Learning outcomes the participant will acquire through this subject	1. Define the characteristics of aluminum and aluminum alloys and explain the concept of protective oxide film formation 2. Outline the grades of aluminum and aluminum alloys, their characteristics and classification. 3. Explain the difference between welding aluminum alloys and unalloyed carbon steel. 4. Identify common welding processes for aluminum alloys. 5. Explain health risks related to welding and joint preparation of aluminum alloys and how to prevent them.
Elaboration	
Basics of aluminum alloys	Grades of aluminum and aluminum alloys, their characteristics and classification. Characteristics of aluminum compared to mild steel and stainless steel. Protective oxide film positive for welding? Welding processes for aluminum and aluminum alloys. Health aspects during welding of aluminum and its alloys. Methods for preventing health risks during welding and joint preparation of aluminum, breathing zone, welder's masks with fresh-air filters, hygiene.
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDABILITY AND WELDING TECHNIQUES
Learning outcomes the participant will acquire through this subject	1. Outline the essentials of weldability of aluminum alloys, heat input, preheating, post weld treatment 2. Compare welding processes TIG and MIG 3. Describe the correct handling of aluminum alloy material in workshop 4. Identify the imperfections characteristic to aluminum and explain how to avoid them. 5. Outline typical problems when welding aluminum alloys.
Elaboration	
Weldability and welding techniques	Weldability of aluminum heat input, preheating Post weld treatment Welding processes, TIG and MIG Handling of aluminum in the workshop Survey of specific imperfections and their cause (porosity, hot cracking, lack of fusion).
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDING CONSUMABLES FOR ALUMINUM ALLOYS
Learning outcomes the participant will acquire through this subject	1. Identify the main types and classification of welding consumables regarding aluminum alloys 2. Compare the two types of welding consumables – AlSi and AlMg.
Elaboration	
Welding consumables for aluminum alloys	Filler metals for aluminum, standards, consumable manufacturers recommendations Shielding gases for aluminum welding, standard, consumable manufacturers recommendations Handling of welding consumables Consumables selection based on required properties of the weld (strength, weldability, corrosion properties and anodizing properties.)
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDING JOINTS AND DISTORTION IN ALUMINUM ALLOYS
Learning outcomes the participant will acquire through this subject	1. Outline the commonly used welding joints and the methods of joint preparation regarding aluminum alloys 2. List methods to avoid distortion of aluminum alloys caused by welding
Elaboration	
Welding joints and distortion in aluminum alloys	Welding joints for aluminum alloys Methods of joint preparation in aluminum alloys Cleaning before welding Distortion caused by welding aluminum alloys compared to steel
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods: verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDERS´ QUALIFICATION: ISO 9606-2
Learning outcomes the participant will acquire through this subject	1. Explain different types of test pieces and welding conditions 2. Interpret the qualification certificate: essential variables and range of qualification 3. Explain confirmation of the validity and prolongation of qualification 4. Interpret the WPS
Elaboration	
Standard ISO 9606-2	Welders´ qualification
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

M5

Name of the module	WELDING APPLICATION AND QUALITY
List of vocational units of learning outcomes from the qualification standard	1. Qualification of welders ISO 9606-1 2. Shrinkage, residual stress, distortion 3. Weld imperfections 4. Inspection and testing 5. Quality assurance in welding 6. Review and consequences of failure 7. International welding standards 8. Welding practice 2
How to learn and work with this module:	
Module objective	1. Know the basics of welder qualification according to ISO 9606. 2. Know the effect of welding in terms of shrinkage, residual stresses and distortion. And know how to minimize distortion before, during and after welding. 3. Know about imperfections in welds. 4. Know the principles of basic NDT methods used in welding. 5. Have knowledge about the function of Quality Assurance (QA) in welding. 6. Know why welds may fail, what the consequences could be and what the role of the welder might be. 7. Have basic knowledge about the harmonized system of International Standards. 8. Know the effect of welding parameters on performance and their influence on the weld geometry.
Module description	During realization of this module the participant will get familiar with demands regarding the quality of welded joints and possible structural defects that could have a significant impact on it.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	QUALIFICATION OF WELDERS: ISO 9606-1
Learning outcomes the participant will acquire through this subject	1. Explain different types of test pieces and welding conditions 2. Interpret the qualification certificate: essential variables and range of qualification 3. Explain confirmation of the validity and prolongation of qualification 4. Interpret the WPS
Elaboration	
Qualification of welders	Objectives of qualification tests Interpretation of WPSs Welders qualification standard (ISO 9606) Essential variables; range of qualification; validity; test pieces and assessment of the welder.
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	SHRINKAGE, RESIDUAL STRESS, DISTORTION
Learning outcomes the participant will acquire through this subject	1. Describe the thermal cycle during welding. 2. Describe distortion resulting from shrinkage. 3. Describe residual stresses. 4. Name measures to minimize distortion. 5. Describe the main causes for weld shrinkage. 6. Outline the main effects on a weld due to residual stresses.
Elaboration	
Shrinkage, residual stress, distortion	The thermal cycle in welding Development of residual stresses due to solidification, cooling and shrinkage Effects of restraint on residual stress Significance of residual stress Preheating, post heating Relationship between heat input and shrinkage, residual stress and distortion. Development of distortion; effect of heat input, weld size, penetration, and number of runs single- and double-sided fillet welded joints and in butt welds. Corrective measures, procedure, welding technique, sequence, joint preparation, pre-setting Correction of distortion after welding
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELD IMPERFECTIONS
Learning outcomes the participant will acquire through this subject	1. Identify different types of weld imperfections in ISO 6520-1. 2. Describe the cause of the most common weld imperfections such as cracks, gas inclusions, solid inclusions, incomplete penetration and lack of fusion, geometrical imperfections and other imperfections.
Elaboration	
Weld imperfections	Origin of imperfections: parent metal; welding process; welder; joint preparation Survey of specific weld imperfections and their cause Influence of weld imperfections on product performance Influence of the weld geometry on the fatigue life of the product
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	INSPECTION AND TESTING
Learning outcomes the participant will acquire through this subject	1. Perform simple visual inspection of welds according to ISO 17637 and subsequently evaluate to ISO 5817 (for aluminum ISO 10042). 2. Explain the following destructive and non-destructive methods: bend tests, hardness tests, tensile tests and impact tests, VT, MT, PT, RT and UT.
Elaboration	
Inspection and testing	Review of weld imperfections (ISO 6520-1) Review of quality levels (ISO 5817) Checking dimensions, surface and distortion Surface inspection of cracks and other surface imperfections by visual testing (VT), penetrant testing (PT) and magnetic particle testing (MT) Detectability of internal imperfections of welds by radiographic testing (RT) and ultrasonic testing (UT) Destructive tests to measure mechanical properties of weld
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	QUALITY ASSURANCE IN WELDING
Learning outcomes the participant will acquire through this subject	1. Explain the concept of quality assurance (ISO 3834). 2. Explain the connection of ISO 3834 with the standards for welding personnel and welding procedures.
Elaboration	
Quality assurance in welding	Role of inspection and Quality control Key role of welders in assuring weld Quality Key role of inspection and NDT in identifying potentially dangerous weld defects Introduction of ISO 3834: Quality Requirements for Welding Introduction of ISO 14731: Welding Co-ordination and relationship to IIW qualifications
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	REVIEW AND CONSEQUENCES OF FAILURE
Learning outcomes the participant will acquire through this subject	1. Exemplify failures and their consequences. 2. Define the key role of the welder in avoiding failures
Elaboration	
Review and consequences of failure	Revision of safety requirements of welded products Review of product failures due to bad performance of welding Implication of failure; product liability
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	INTERNATIONAL WELDING STANDARDS
Learning outcomes the participant will acquire through this subject	1. Name the most important international and national standards for welding.
Elaboration	
International welding standards	Role and operation of CEN and ISO; relationship with National Standards Organizations Standards for welding equipment and welding consumables Standards for welding practice Product Standards which contain welding requirements Standards for Quality and Co-ordination in welding
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDING PRACTICE 2
Learning outcomes the participant will acquire through this subject	1. Describe the influence of the welding parameters on the weld geometry. 2. Describe the effect of incorrect welding parameters. 3. Perform visual inspection on a fillet weld and subsequently evaluate to ISO 5817. 4. Explain the principle of magnetic arc blow. 5. Describe methods of how to avoid magnetic arc blow.
Elaboration	
Welding practice 2	Introduction to weld imperfections, ISO 5817. The control of welding parameters. The effect of welding parameters on weld geometry. The effect of magnetic arc blow Visual inspection.
Note	The teaching process is performed theoretically (exercise) 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

M6

Name of the module	HEALTH AND SAFETY
List of vocational units of learning outcomes from the qualification standard	1. Health and safety 2. Safe working in the fabrication workshop 3. Safe working on site
How to learn and work with this module:	
Module objective	1. Know and understand hazards and basic safety requirements when welding. 2. Know how to perform welding activities in the fabrication shop in a safe manner. 3. Know how to perform welding activities on construction sites in a safe manner.
Module description	During realization of this module the participant will get familiar with health and safety risks during welding and application of personal protective equipment.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	HEALTH AND SAFETY
Learning outcomes the participant will acquire through this subject	1. Identify dangerous situations in relation to electricity, humidity, DC and AC. 2. Identify the health risks of welding fumes. 3. Recognize the signals for escape routes. 4. Name adequate means of personal protection. 5. List measures to be taken to prevent fire. 6. List measures to prevent noise hazards. 7. Summarize the specific rules and regulations for health and safety.
Elaboration	
Health and safety	Electric shock UV- and heat radiation Eye hazards Burns and fires, fire prevention, fire fighting Welding fumes Respiratory hazards Personal protective equipment and clothing Noise hazards Specific rules and regulations
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	SAFE WORKING IN THE FABRICATION WORKSHOP
Learning outcomes the participant will acquire through this subject	1. Identify the general hazards in a fabrication shop. 2. Explain the need for ventilation. 3. Identify the risk of explosions. 4. Explain safe handling of gas cylinders.
Elaboration	
Safe working in the fabrication workshop	The working environment of the fabrication shop; general hazards, dust, heavy and hot material, electrical cables Welding in the fabrication shop; protection of other workers from welding hazards, General ventilation to minimize background pollution levels from welding hazards, Control of the welder's local environment; fume disposal, Safety measures in case of personal accident; monitoring of operations; escape procedures Working in confined spaces; build-up of pollutants; risk of explosion; enrichment of gases like argon, helium, etc. Handling gas cylinders
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	SAFE WORKING ON SITE
Learning outcomes the participant will acquire through this subject	1. Identify the hazards for welding when working on site. 2. Name basic precautions to be taken.
Elaboration	
Safe working on site	The site environment; special problems of open air working; working at height for example gantries and fixed staging; poor ground conditions; extremes of heat and cold; wind and rain effects Welding in the site environment Earthing arrangements Protection of other workers from welding hazards
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods: verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

M7

Name of the module	PREPARATION FOR WELDING
List of vocational units of learning outcomes from the qualification standard	1. Methods of preparation for welding 2. Welded joints in plates 3. Welded joints in pipes 4. Preparation of work place and operative work
How to learn and work with this module:	
Module objective	1. Know the available methods for joint preparation for welding. 2. Know the basics of welded joints and their terminology. 3. Know the different connections in pipe welding. 4. Prepare the work place 5. Prepare the operative work
Module description	During realization of this module the participant will get familiar with joint preparation and preparation of production process in welding.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	METHODS OF PREPARATION FOR WELDING
Learning outcomes the participant will acquire through this subject	1. Outline methods used for joint preparation and their specific application. 2. Explain essential parameters and results of thermal cutting (plasma and flame cutting). 3. Select suitable cutting and gouging processes for the main types of steel.
Elaboration	
Methods of preparation for welding	Suitable cutting processes for different types of steel to achieve a suitable cutting surface. Flame cutting: principles and parameters, cutting blow pipes, cutting machines; quality of cut surfaces (e.g. ISO 9013). Arc gouging and gas gouging principles Other cutting processes as: plasma, laser, mechanical cutting
Note	The teaching process is performed theoretically (exercise) 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods: verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDED JOINTS IN PLATES
Learning outcomes the participant will acquire through this subject	1. Identify different types of welds and joints (plate weld, fillet weld, plate joint, T-joint, lap joint and corner joint). 2. Identify characteristics of welds such as throat thickness, leg length, penetration, and number of runs. 3. Identify single- and multi-run welds, excess weld metal, weld profile. 4. Name different types of joint preparations and their main dimensions.
Elaboration	
Welded joints in plates	Types of welds: plate and fillet Types of joints: plate, “T”, lap and corner (EN 12345, ISO 17659) Characteristics of fillet welds; leg length, throat thickness, penetration, number of runs, surface finish Characteristics of plate welds; types of joint preparation; single and multi-run welds; excess weld metal; weld profile, penetration, surface finish, permanent and temporary backing Examples
Note	The teaching process is performed theoretically (exercise) 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

Subject	WELDED JOINTS IN PIPES
Learning outcomes the participant will acquire through this subject	1. Identify the following joint preparations: I-, V-, X-, and U- preparations. 2. Identify and draft tube to plate welds, branch connections. 3. Describe the different methods for joint preparation of pipes.
Elaboration	
Welded joints in pipes	Plate welds in pipes; in-line and at an angle; the importance of gas backing Tube to plate welds Branch connections (set-on, set-in and set-through) Adaptation of joint preparation methods for pipes
Note	The teaching process is performed theoretically (exercise) 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam.

M7.1

Subject	PREPARATION FOR WELDING WITH MMA PROCESS
Learning outcomes the participant will acquire through this subject	1. Prepare the work place 2. Prepare the operative work for welding with MMA process
Elaboration	
Preparation for welding with MMA process	Safety at work in the production plant. Working environment for a safe and quality work using MMA process. Choosing the tools, equipment, base, filler and auxiliary metals for welding based on demands from technical and technological documentation. Choosing the corresponding protective and work equipment and means for working in a safe manner. Identification of demands from technical and technological documentation for MMA welding, especially the WPS. Weld preparation and cleaning of the welding surface. Preparation of equipment for pre-heating if necessary. Setting the defined welding parameters on the welding machine.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** training with feedback (training on VWTS – Virtual Welding Training System) and guided training (training of real welding with trainer/instructor) **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

M7.2

Subject	PREPARATION FOR WELDING WITH MIG / MAG PROCESS
Learning outcomes the participant will acquire through this subject	1. Prepare the work place 2. Prepare the operative work for welding with MIG/MAG process
Elaboration	
Preparation for welding with MIG / MAG process	Safety at work in the production plant. Working environment for a safe and quality work using MIG / MAG process. Choosing the tools, equipment, base, filler and auxiliary metals for welding based on demands from technical and technological documentation. Choosing the corresponding protective and work equipment and means for working in a safe manner. Identification of demands from technical and technological documentation for MIG / MAG welding, especially the WPS. Weld preparation and cleaning of the welding surface. Preparation of equipment for pre-heating if necessary. Setting the defined welding parameters on the welding machine.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** training with feedback (training on VWTS – Virtual Welding Training System) and guided training (training of real welding with trainer/instructor) **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

M7.3

Subject	PREPARATION FOR WELDING WITH TIG PROCESS
Learning outcomes the participant will acquire through this subject	1. Prepare the work place 2. Prepare the operative work for welding with TIG process
Elaboration	
Preparation for welding with TIG process	Safety at work in the production plant. Working environment for a safe and quality work using TIG process. Choosing the tools, equipment, base, filler and auxiliary metals for welding based on demands from technical and technological documentation. Choosing the corresponding protective and work equipment and means for working in a safe manner. Identification of demands from technical and technological documentation for TIG welding, especially the WPS. Weld preparation and cleaning of the welding surface. Preparation of equipment for pre-heating if necessary. Setting the defined welding parameters on the welding machine.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** training with feedback (training on VWTS – Virtual Welding Training System) and guided training (training of real welding with trainer/instructor) **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

2.2.2. Practical vocational modules

Material

Ferritic Steels: Carbon and Low Alloy steel

M8	MMA Welding for Ferritic steels: Carbon and Low Alloy steel	Process 111

Name of the module	MMA welding (process 111) for carbon and low alloy steel; ferritic steels PRACTICAL TRAINING
List of vocational units of learning outcomes from the qualification standard	1. Introduction to MMA Welding of Ferritic Steels 2. Introduction to Fillet Welds 3. Fillet Welds 4. Introduction to Plate (Butt) Welds 5. Plate (Butt) Welds
How to learn and work with this module:	
Module objective	1. To obtain basic experience in using the machine and equipment for process 111 (MMA welding). 2. To obtain basic experience in (MMA welding) and to be able to produce fillet welds in plate in PA, PB, PF and PG positions. 3. To obtain basic experience in (MMA welding) and to be able to produce fillet welds in plate in PD position and in tube to plate joints in PB,PD, PH positions 4. To obtain experience in process 111 (MMA welding) and to be able to produce single or both sided plate welds in PA, PC positions with or without gouging and grinding. 5. To obtain experience in process 111 (MMA welding) and to be able to produce fillet welds in corner joints in PF position, T - plate joints in PB and PF positions single and both sided plate welds in PF position and single sided plate welds in PF position.
Module description	By mastering the content of this module, the participants will be able to execute joining of steel materials using fillet and butt welds, MMA welding process (process 111) in different welding positions, apply measures and personal protective means and safety at work as well as do visual inspection of the welded joint.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	**Introduction to MMA Welding of Ferritic Steels**
Learning outcomes the participant will acquire through this subject	1. Apply the instructions from WPS (joint preparation, welding sequence, pre-heating, etc.). 2. Adjust the welding parameters according to the WPS. 3. Perform safe welding according to the WPS and using the necessary PICs. 4. Perform root face and gap preparation with grinding tools. 5. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control. 6. Maintain the welding equipment (welding torch, cables, etc.). 7. Select suitable tools, jigs and work place for ferritic steels. 8. Implement the appropriate necessities for the storage and the cleanliness of the consumables.
Elaboration	
Practical training	Execution of weld according to WPS
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work type are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

M8 **FW**

Ferritic Steels: Carbon and Low Alloy steel
Material group 1, 2, 3, 11 (ISO /TR 15608)

Practical training – M 8.1

Subject	**Introduction to Fillet Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make fillet welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)
Elaboration	
Practical training 1	Execution of fillet weld according to table M 8.1.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60% **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M8.1 FW

Table 8.1 FW

No.	8.1 FW Process 111				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Both rutile and basic electrodes shall be used in both single and multi run welding.
2	Bead on plate	Unlimited	PA/PF/PC		
3	Fillet weld, T-joint	t 8 - 12	PA		
4	Fillet weld, T-joint	t 8 - 12	PB		Welding around the corner
5	Fillet weld, T-joint	t 8 - 12	PF		
6	Fillet weld, corner joint	t 8 - 12	PB		
7	Fillet weld, T-joint	t 8 – 12	PB		Iron powder electrodes. Welding around the corner.
8	Fillet weld, T-joint	t 8 - 12	PG		

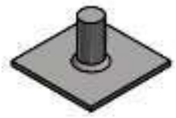
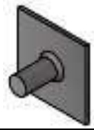
..Welding and evaluation of test pieces, visual testing and fracture testing required 8.1 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Evaluation criteria**
1.	Fillet weld, T-joint	t 10	PB		ml	ISO 5817 C
2.	Fillet weld, T-joint	t 10	PF		ml	ISO 5817 C

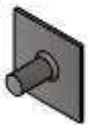
Practical training – MMA 8.2

Subject	Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make fillet welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)
Elaboration	
Practical training 2	Execution of fillet weld according to table MMA 8.2
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60% **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M8.2 FW

Table 8.2 FW

No.	8.2 FW Process 111				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Both rutile and basic electrodes shall be used in both single and multi run welding.
2	Fillet weld, T-joint	t 8 – 12	PD		Welding around the corner.
3	Fillet weld, tube to plate	t 5 – 10 D 80 - 120	PB		
4	Fillet weld, tube to plate	t 5 – 10 D 80 - 120	PH		
5	Fillet weld, corner joint	t 5 – 10 D 80 - 120	PD		Iron powder electrodes. Welding around the corner.

..Welding and evaluation of test pieces, visual testing and fracture testing required 8.2 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Evaluation criteria**
1.	Fillet weld, tube to plate	t 5 – 10 D 80 - 120	PH		sl, both, plate and tube with nearly the same thickness	ISO 5817 C

M8 **PW**

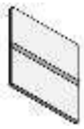
Ferritic Steels: Carbon and Low Alloy steel
Material group 1, 2, 3, 11
(ISO /TR 15608)

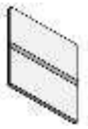
Practical training – MMA 8.3

Subject	Introduction to Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)
Elaboration	
Practical training 3	Execution of plate weld according to table MMA 8.3.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60% **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M8.3 PW

Table 8.3 PW

No.	8.3 PW Process 111				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Grinding, flame gouging and arc gouging	Optional			
3	Butt weld	t 8 - 12	PA		bs with grinding or gouging
4	Butt weld	t 8 - 12	PA		bs without grinding or gouging
5	Butt weld	t 8 - 12	PA		ss nb
6	Butt weld	t 8 - 12	PC		ss nb

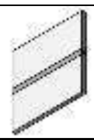
..Welding and evaluation of test pieces, visual testing and fracture testing required 8.3 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Evaluation criteria**
1	Butt weld	t 8 - 12	PC		ml ss nb	ISO 5817 C

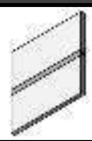
Practical training - MMA 8.4

Subject	Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)
Elaboration	
Practical training 4	Execution of plate weld according to table MMA 8.4.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60% **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M8.4 PW

Table 8.4 PW

No.	8.4 PW Process 111				
	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Fillet weld, corner joint	t 8 - 12	PF		
3	T- butt weld	t 8 - 12	PF		bs with grinding or gouging
4	Butt weld	t 8 - 12	PE		ss nb
5	Butt weld	t 8 - 12	PF		bs with grinding or gouging
6	Butt weld	t 8 - 12	PF		ss nb
7	Double bevel T- butt weld	t 8 - 12	PB		

Welding and evaluation of test pieces, only visual testing required (each run) 8.4 PW						
No.	Type of weld	Recommended material thickness, [mm]	Welding position	Sketch	Remarks	Standard/class
1.	Butt weld	t 8 - 12	PE		ss nb	ISO 5817 C
2.	Butt weld	t 8 - 12	PF		ss nb	ISO 5817 C

EVALUATION LIST
Practical examination

M8

Welding process: **MMA – 111**
Material: **Ferritic Steels:**
Carbon and Low Alloy steel and Stainless Steels Austenitic
Material group: **1, 2, 3, 8, 10 and 11 ISO /TR 15608**

Ferritic + Filler material FM1

Practical examination	Joint	Connection IAB 089r5	Description		Test reports: Methods	Test reports: Evaluation criteria	EQF level
Grading during education – VET and adult	FW	E1	PB, t=10mm, ml	PF, t=10mm, ml	VT + fracture	ISO 5817 / C	2
		E2	PH, D=80 – 120mm, t=5 – 10mm, sl both, plate and tube with nearly the same thickness		VT	ISO 5817 / C	
	PW	E3	PC, t=8 – 12mm, ss nb		VT each run	//	
		E4	PF, t=8 – 12mm, ss nb		VT each run	//	
			PE, t=8 – 12mm, ss nb				
External evaluation	FW		PD t=8 – 12mm, 3 passes		Test coupon according to ISO 9606-1	ISO 9606-1	2
	PW		PF, t=8 – 12mm, bs				

M10	MAG Welding for Ferritic steels: Carbon and Low Alloy steel	Process 135/138

Name of the module	MAG welding (Process 135 or 138) for carbon and low alloy steel; ferritic steels PRACTICAL TRAINING
List of vocational units of learning outcomes from the qualification standard	1. Introduction to MAG (Process 135 or 138) Welding of Ferritic Steels 2. Introduction to Fillet Welds 3. Fillet Welds 4. Introduction to Plate (Butt) Welds 5. Plate (Butt) Welds
How to learn and work with this module:	
Module objective	1. To obtain basic experience in using the machine and equipment for process 135 or 138 (MAG welding). 2. To obtain basic experience in the MAG welding process (135 and 138) and to be able to produce fillet welds in plate in PA, PB, PD, PF and PG positions. 3. To obtain experience in the MAG welding process (135 and 138) and produce fillet welds in tube-to-plate joints in PB, PH and PD positions.. 4. To obtain experience in the MAG welding process (135 and 138) and to be able to produce plate welds in PA, PC and PG positions with and without gouging. 5. To obtain experience in the MAG welding process (135 and 138) and to be able to produce single sided plate welds in PB, PD, PE and PF positions.
Module description	By mastering the content of this module, the participants will be able to execute joining of materials using fillet welds in different welding positions, apply measures and personal protective means and safety at work as well as do visual inspection of the welded joint.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	Introduction to MAG (Process 135 or 138) Welding of Ferritic Steels
Learning outcomes the participant will acquire through this subject	1. Apply the instructions from WPS (joint preparation, welding sequence, pre-heating, etc.). 2. Adjust the welding parameters according to the WPS. 3. Perform safe welding according to the WPS and using the necessary PICs. 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control. 5. Maintain the welding equipment (welding torch, cables, etc.). 6. Select suitable tools, jigs and work place for ferritic steels. 7. Implement the appropriate necessities for the storage and the cleanliness of the consumables.
Elaboration	
Practical training	Execution of weld according to WPS
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of forms	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M10 **FW**

Ferritic Steels: Carbon and Low Alloy steel
Material group 1, 2, 3, 11 (ISO /TR 15608)

Practical training – M 10.1

Subject	Introduction to Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 1	Execution of fillet weld according to table M 10.1
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60% **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M10.1 FW

Table 10.1 FW

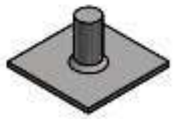
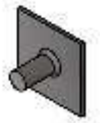
No.	10.1 FW Process 135 and 138				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Bead on plate	Unlimited	PA/PF/PG		process 135
3	Fillet weld, T-joint	t 1 - 3	PA		single layer, 135-D
4	Fillet weld, T-joint	t 1 - 3	PB		single layer, 135-D, welding around corner
5	Fillet weld, T-joint	t 1 - 3	PG		Single layer, 135-D
6	Fillet weld, corner joint	t 1 - 3	PG		Single layer, 135-D, Full penetration not required
7	Fillet weld, T-joint	t 8 - 10	PB		Process 135 and 138. Welding around the corner
8	Fillet weld, T-joint	t 8 - 10	PF		Process 135 and 138.
9	Fillet weld, T-joint	t 8 - 10	PD		Process 135 and 138. Welding around the corner

Welding and evaluation of test pieces, only visual testing (VT) required (each run) 10.1 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/class**
1	Fillet weld, T-joint	t 1 - 3	PB		short arc single layer, 135-D	ISO 5817 C
2	Fillet weld, T-joint	t 8 - 12	PB		spray arc multi layer VT + fracture	ISO 5817 C
3	Fillet weld, T-joint	t 1 - 3	PF		short arc single layer, 135-D	ISO 5817 C
4	Fillet weld, T-joint	t 8 - 12	PF		spray arc multi layer VT + fracture	ISO 5817 C

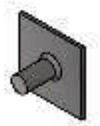
Practical training – MAG 10.2

Subject	Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 2	Execution of fillet weld according to table M 10.2
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60% **Type of work:** individual work. **Remark:** methods and types of work type are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

Table 10.2 FW

No.	10.2 FW Process 135 and 138				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PB		process 135
3	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PH*		Process 135 and 138
4	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PD		Process 135 and 138

*According to ISO 6947 welding position PF for tubes has been changed to test position PH covering PE, PF and PA

Welding and evaluation of test pieces, only visual testing required (each run) 10.2 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PH		Single layer both, plate and tube with nearly the same thickness	ISO 5817 C

M10 **PW**

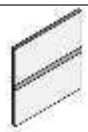
Ferritic Steels: Carbon and Low Alloy steel
Material group 1, 2, 3, 11 (ISO /TR 15608)

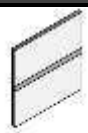
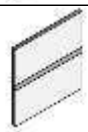
Practical training – M 10.3

Subject	**Introduction to Plate (Butt) Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 3	Execution of plate weld according to table M 10.3.
Note	The teaching process is performed t practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60% **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M10.3 PW

Table 10.3 PW

No.	10.3 PW Process 135 and 138 Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	t 1 - 3	PA		process 135 ss nb 135-D for root run
3	Butt weld	t 1 - 3	PG		process 135 ss nb 135-D for root run
4	Butt weld	t 8 - 12	PA		Process 135 ss nb
5	Butt weld	t 8 - 12	PC		Process 135 ss nb

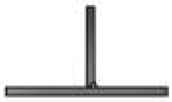
Welding and evaluation of test pieces, only visual testing required (each run) 10.3 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Butt weld	t 1 - 3	PC		ss nb VT each run	//
2	Butt weld	t 8 - 12	PC		ss nb VT each run	//

Practical training – M 10.4

Subject	Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 4	Execution of plate weld according to table M 10.4.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M10.4 PW

Table 10.4 PW

No.	10.4 PW Process 135 and 138				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t 1 - 3	PE		Process 135 ss nb 135-D for root run
3	Butt weld	t 5 - 10	PF		Process 135 ss nb
5	Single bevel butt weld, T-joint	t 5 - 10	PB		Process 135
6	Single bevel butt weld, T-joint	t 5 - 10	PD		Process 135 ss nb
7	Single bevel butt weld, T-joint	t 5 - 10	PF		Process 135 ss nb

Welding and evaluation of test pieces, only visual testing required (each run) 10.4 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Butt weld	t 1 - 3	PF		ss nb VT each run	//
2	Butt weld	t 8 - 12	PF		ss nb VT each run	//
3	Butt weld	t 1 - 3	PE		ss nb VT each run	//
4	Butt weld	t 8 - 12	PE		ss nb VT each run	//

M10

EVALUATION LIST
Practical examination

Welding process: **MAG – 135** and **MCAW – 138**
Material: **Ferritic Steels: Carbon and Low Alloy steel and Stainless Steels Austenitic**
Material group: **1, 2, 3, 8, 10 and 11 ISO /TR 15608**

Practical examination	Joint	Connection IAB 089r5	Description	Test reports		EQF level
				Methods	Evaluation criteria	
Grading during education – VET and adult	FW	M1	**PB**, t=1 - 3mm (short arc) , sl **PB**, t=8 – 12mm (spray arc), ml **PF**, t=1 - 3mm (short arc), sl **PF**, t=8 – 12mm (spray arc), ml	VT VT + fracture VT VT + fracture	ISO 5817 / C	2
		M2	**PH**, D=80 – 120mm, t=5 – 10mm, sl both, plate and tube with nearly the same thickness	VT	ISO 5817 / C	
	PW	M3	**PC**, t=1 – 3mm, ss nb **PC**, t=8 – 12mm, ss nb	VT each run	//	
		M4	**PF**, t=1 – 3mm, ss nb **PF**, t=8 – 12mm, ss nb **PE**, t=1 – 3mm, ss nb **PE**, t=8 – 12mm, ss nb	VT each run	//	
External evaluation	**FW**		**PD** t=8 – 12mm, 3 pass	Test coupon according to ISO 9606-1	ISO 9606-1	**2**
	PW		**PA**, t=8 – 12mm, ss nb			

M13	FCAW Welding for Ferritic steels: Carbon and Low Alloy steel	Process 136

Name of the module	MAG welding (Process 136) for carbon and low alloy steel; ferritic steels PRACTICAL TRAINING
List of vocational units of learning outcomes from the qualification standard	1. Introduction to MAG (Process 136) Welding of Ferritic Steels 2. Introduction to Fillet Welds 3. Fillet Welds 4. Introduction to Plate (Butt) Welds 5. Plate (Butt) Welds
How to learn and work with this module:	
Module objective	1. To obtain basic experience in using the machine and equipment for process 136 (MAG welding). 2. To obtain basic experience in the MAG welding process (136) and to be able to produce fillet welds in plate in PA, PB, PD, PF and PG positions. 3. To obtain experience in the MAG welding process (136) and produce fillet welds in tube-to-plate joints in PB, PH and PD positions.. 4. To obtain experience in the MAG welding process (136) and to be able to produce butt welds in plate in PA, PC and PG positions with and without gouging. 5. To obtain experience in the MAG welding process (136) and to be able to produce single sided butt welds in plate in PB, PD, PE and PF positions.
Module description	By mastering the content of this module, the participants will be able to execute joining of materials using fillet welds in different welding positions, apply measures and personal protective means and safety at work as well as do visual inspection of the welded joint
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	Introduction to MAG (Process 136) Welding of Ferritic Steels
Learning outcomes the participant will acquire through this subject	1. Apply the instructions from WPS (joint preparation, welding sequence, pre-heating, etc.). 2. Adjust the welding parameters according to the WPS. 3. Perform safe welding according to the WPS and using the necessary PICs. 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control. 5. Maintain the welding equipment (welding torch, cables, etc.). 6. Select suitable tools, jigs and work place for ferritic steels. 7. Implement the appropriate necessities for the storage and the cleanliness of the consumables.
Elaboration	
Practical training I	Execution of welds according to WPS
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

M13 **FW**

Ferritic Steels: Carbon and Low Alloy steel
Material group 1, 2, 3, 11 (ISO /TR 15608)

Practical training – M 13.1

Subject	**Introduction to Fillet Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 1	Execution of fillet weld according to table M 13.1
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M13.1 FW

Table 13.1 FW

No.	13.1 FW Process 136				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Wherever possible (136) both rutile and basic wires shall be use din both single and multi run welding.
2	Fillet weld, T-joint	t 8 - 12	PB		ml
3	Fillet weld, T-joint	t 8 - 12	PF		ml
4	Fillet weld, T-joint	t 8 - 12	PD		ml

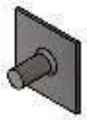
Welding and evaluation of test pieces, only visual testing required (each run) 13.1 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, T-joint	t 8 - 12	PB		multi layer VT + fracture	ISO 5817 C
2	Fillet weld, T-joint	t 8 - 12	PF		multi layer VT + fracture	ISO 5817 C

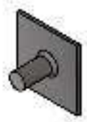
Practical training – MAG 13.2

Subject	Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 2	Execution of fillet weld according to table M 13.2
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M13.2 FW

Table 13.2 FW

No.	13.2 FW Process 136				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Wherever possible (136) both rutile and basic wires shall be used in both single and multi run welding.
2	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PB		
3	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PH*		
4	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PD		
*According to ISO 6947 welding position PF for tubes has been changed to test position PH covering PE, PF and PA					

Welding and evaluation of test pieces, only visual testing required (each run) 13.2 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PH		Single layer both, plate and tube with nearly the same thickness	ISO 5817 C

M13 **PW**

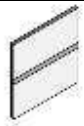
Ferritic Steels: Carbon and Low Alloy steel
Material group 1, 2, 3, 11 (ISO /TR 15608)

Practical training – M 13.3

Subject	**Introduction to Plate (Butt) Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 3	Execution of plate weld according to table M 13.3.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M13.3 PW

Table 13.3 PW

No.	13.3 PW Process 136				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t 8 – 12	PA		Process 136 bs with grinding or gouging or process 136 ss nb and 136 bs with grinding or gouging
3	Butt weld	t 8 – 12	PC		ss nb

Welding and evaluation of test pieces, only visual testing required (each run) 13.3 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
4	Butt weld	t 8 – 12	PC		ss mb VT each run	//

Practical training – M 13.4

Subject	**Plate (Butt) Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 4	Execution of plate weld according to table M 13.4.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M13.4 PW

Table 13.4 PW

No.	13.4 PW Process 136				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t 8 - 12	PE		ss mb
3	Butt weld	t 8 - 12	PF		Process 136 bs with grinding or gouging or process 136 ss mb and 136 bs with grinding or gouging

Welding and evaluation of test pieces, only visual testing required (each run) 13.4 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
2	Butt weld	t 8 - 12	PF		ss mb VT each run	//
4	Butt weld	t 8 - 12	PE		ss mb VT each run	ISO 5817 C

M13

EVALUATION LIST
Practical examination

Welding process: **FCAW – 136**
Material: **Ferritic Steels: Carbon and Low Alloy steel and Stainless Steels Austenitic**
Material group: **1, 2, 3, 8, 10 and 11 ISO /TR 15608**

Practical examination	**Joint**	**Connection IAB 089r5**	**Description**	**Test reports**		**EQF level**
				Methods	**Evaluation criteria**	
Grading during education – VET and adult	**FW**	M1	**PB**, t=8 – 12mm, ml **PF**, t=8 – 12mm, ml	VT + fracture	ISO 5817 / C	**2**
		M2	**PH**, D=80 – 120mm, t=5 – 10mm, sl both, plate and tube with nearly the same thickness	VT	ISO 5817 / C	
	PW	M3	**PC**, t=8 – 12mm, ss mb	VT each run	//	
		M4	**PF**, t=8 – 12mm, ss mb **PE**, t=8 – 12mm, ss mb	VT each run	//	
External evaluation	**FW**		**PD** t=8 – 12mm, 3 passes	Test coupon according to ISO 9606-1	ISO 9606-1	**2**
	PW		**PF**, t=8 – 12mm, ss mb – ceramic/strip and without root examination			

M15	TIG Welding for Ferritic steels: Carbon and Low Alloy steel	Process 141

Name of the module	TIG welding (Process 141) for carbon and low alloy steel; ferritic steels PRACTICAL TRAINING
List of vocational units of learning outcomes from the qualification standard	1. Introduction to TIG (Process 141) Welding of Ferritic Steels 2. Introduction to Fillet Welds 3. Fillet Welds 4. Introduction to Plate (Butt) Welds 5. Plate (Butt) Welds
How to learn and work with this module:	
Module objective	1. To obtain basic experience in using the machine and equipment for process 141 (TIG welding). 2. To obtain basic experience in process 141 (TIG welding) and to be able to make fillet welds in plate in PA, PB and PF positions. 3. To obtain experience in process 141 (TIG-welding) and produce fillet welds in plate in PD position and in tube-to-plate joints in PB, PD and PH positions using both single and multiple layer technique. 4. To obtain experience in process 141 (TIG-welding) and to be able to produce single side butt welds in plate in PA and PC positions. 5. To obtain experience in process 141 (TIG-welding) and to be able to produce single side butt welds in plate in PE and PF position.
Module description	By mastering the content of this module, the participants will be able to execute joining of materials using fillet welds in different welding positions, apply measures and personal protective means and safety at work as well as do visual inspection of the welded joint
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	Introduction to TIG (Process 141) Welding of Ferritic Steels
Learning outcomes the participant will acquire through this subject	1. Apply the instructions from WPS (joint preparation, welding sequence, pre-heating, etc.). 2. Adjust the welding parameters according to the WPS. 3. Perform safe welding according to the WPS and using the necessary PICs. 4. Perform root face and gap preparation with grinding tools. 5. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control. 6. Maintain the welding equipment (welding torch, cables, etc.). 7. Select suitable tools, jigs and work place for ferritic steels. 8. Implement the appropriate necessities for the storage and the cleanliness of the consumables.
Elaboration	
Practical training	Execution of welds according to WPS
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

M15 **FW**

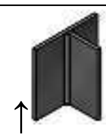
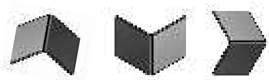
Ferritic Steels: Carbon and Low Alloy steel
Material group 1, 2, 3, 11 (ISO /TR 15608)

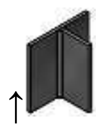
Practical training – M 15.1

Subject	Introduction to Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make fillet welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5 Perform preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 1	Execution of fillet weld according to table M 15.1
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 60% Training on the welding machine: minimum 40%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M15.1 FW

Table 15.1 FW

No.	15.1 FW Process 141				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Remelting (dressing) the top layer is not permitted
2	Bead on plate	Unlimited	PA/PF/PC		
3	Fillet weld, T-joint	t > 1	PA		
4	Fillet weld, T-joint	t > 1	PB		
5	Fillet weld, T-joint	t > 1	PF		
6	Outside fillet weld, corner joint	t > 1	PA, PF, PC		Full penetration weld

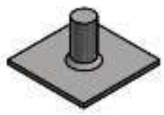
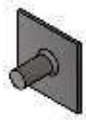
Welding and evaluation of test pieces, visual for positions PB and PF and fracture test for position PF, 15.1 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, T-joint	t 1 - 2	PB		sl	ISO 5817 C
2	Fillet weld, T-joint	t 6 - 8	PF		ml	ISO 5817 C

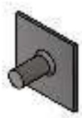
Practical training – M 15.2

Subject	Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make fillet welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5 Perform preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 2	Execution of fillet weld according to table M 15.2
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 60% Training on the welding machine: minimum 40%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M15.2 FW

Table 15.2 FW

No.	15.2 FW Process 141				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Fillet weld, T-joint	t > 1	PD		
3	Fillet weld, tube to plate	t > 1 40 ≤ D ≤ 80	PB		
4	Fillet weld, tube to plate	t > 1 40 ≤ D ≤ 80	PD		
5	Fillet weld, tube to plate	t > 1 40 ≤ D ≤ 80	PH*		
*According to ISO 6947 welding position PF for tubes has been changed to test position PH covering PE, PF and PA					

Welding and evaluation of test pieces, only visual testing required, 15.2 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, T-joint	t 1 – 2 40 ≤ D ≤ 80	PH		sl	ISO 5817 C

M15 **PW**

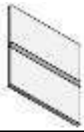
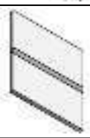
Ferritic Steels: Carbon and Low Alloy steel
Material group 1, 2, 3, 11 (ISO /TR 15608)

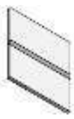
Practical training – M 15.3

Subject	Introduction to Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5 Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 3	Execution of plate weld according to table M 15.3.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 60% Training on the welding machine: minimum 40%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M15.3 PW

Table 15.3 PW

No.	15.3 PW Process 141				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t > 1	PA		ss nb
3	Butt weld	t > 5	PA		ss nb
4	Butt weld	t > 1	PC		ss nb
5	Butt weld	t > 5	PC		ss nb

Welding and evaluation of test pieces, only visual testing required, 15.3 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Butt weld	t 2 – 6	PC		ss nb	ISO 5817 C

Practical training – M 15.4

Subject	**Plate (Butt) Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 4	Execution of plate weld according to table M 13.4.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 60% Training on the welding machine: minimum 40%. **Type of work:** individual work. **Remark:** methods and types of work t are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

Table 15.4 PW

No.	15.4 PW Process 141				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t > 1	PF		ss nb
3	Butt weld	t > 5	PF		ss nb
4	Butt weld	t > 1	PE		ss nb
5	Butt weld	t > 5	PE		ss nb

Welding and evaluation of test pieces, only visual testing required, 15.4 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Butt weld	t 2 - 6	PF		ss nb	ISO 5817 C
2	Butt weld	t 2 – 4	PE		ss nb	ISO 5817 C

M15

EVALUATION LIST
Practical examination

Welding process: **TIG – 141**
Material: **Ferritic Steels: Carbon and Low Alloy steel and Stainless Steels Austenitic**
Material group: **1, 2, 3, 8, 10 and 11 ISO /TR 15608**

Practical examination	Joint	Connection IAB 089r5	Description	Test reports		EQF level
				Methods	Evaluation criteria	
Grading during education – VET and adult	FW	T1	**PB**, t=1 - 2mm, sl **PF**, t=6 - 8mm, ml	VT VT + fracture	ISO 5817 / C	2
		T2	**PH**, D=40 – 80mm, t=1 – 2mm, sl	VT	ISO 5817 / C	
	PW	T3	**PC**, t=2 – 6mm, ss nb	VT	ISO 5817 / C	
		T4	**PF**, t=2 – 6mm, ss nb	VT	ISO 5817 / C	
			PE, t=2 – 4mm, ss nb	VT	ISO 5817 / C	
External evaluation	FW		**PD** t=3– 5mm, sl	Test coupon according to ISO 9606-1	ISO 9606-1	2
	PW		**PF**, t=3– 5mm, bs			

2.2.3. Practical vocational modules

Material

Stainless steel

M9	MMA Welding for Stainless steels	Process 111

Name of the module	MMA welding (process 111) for stainless steel
List of vocational units of learning outcomes from the qualification standard	1. Introduction to MMA Welding of Stainless Steels 2. Introduction to Fillet Welds 3. Fillet Welds 4. Introduction to Plate (Butt) Welds 5. Plate (Butt) Welds
How to learn and work with this module:	
Module objective	1. To obtain basic experience in using the machine and equipment for process 111 (MMA welding). 2. To obtain basic experience in process 111 (MMA welding) and to be able to produce fillet welds in plate in PA, PB, PF, PG positions. 3. To obtain basic experience in process 111 (MMA welding) and to be able to produce fillet welds in plate in PD position and in tube to plate joints in PB,PD, PH positions 4. To obtain experience in process 111 (MMA welding) and to be able to produce single or both sided butt welds in PA, PC positions with or without gouging and grinding. 5. To obtain experience in process 111 (MMA welding) and to be able to produce fillet welds in corner joints in PF position, T - butt joints in PB and PF positions single and both sided welds in PF position and single sided butt welds in plate in PF position.
Module description	By mastering the contents of this module the participants will be able to execute joining of steel materials with fillet and plate welds using MMA welding process (process 111) in different welding positions; apply measures and personal protective means for safety at work as well as perform visual inspection of the welded joint.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	Introduction to MMA Welding of Stainless Steels
Learning outcomes the participant will acquire through this subject	1. Apply the instructions from WPS (joint preparation, welding sequence, pre-heating, etc.). 2. Adjust the welding parameters according to the WPS. 3. Perform safe welding according to the WPS and using the necessary PICs. 4. Perform root face and gap preparation with grinding tools. 5. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control. 6. Maintain the welding equipment (electrode holder, cables, etc.). 7. Select suitable tools, jigs and work place for stainless steels. 8. Implement the appropriate necessities for the storage and the cleanliness of the consumables.
Elaboration	
Practical training	Execution of welds according to WPS
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

M9 **FW**

Stainless Steels
Material group 8, 10 (ISO /TR 15608)

Practical training – M 9.1

Subject	**Introduction to Fillet Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make fillet welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)
Elaboration	
Practical training 1	Execution of fillet weld according to table M 9.1.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M9.1 FW

Table 9.1 FW

No.	9.1 FW Process 111				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Both rutile and basic electrodes shall be used in both single and multi run welding.
2	Bead on plate	Unlimited	PA/PF/PC		
3	Fillet weld, T-joint	t 8 - 12	PA		
4	Fillet weld, T-joint	t 8 - 12	PB		Welding around the corner
5	Fillet weld, T-joint	t 8 - 12	PF		
6	Fillet weld, corner joint	t 8 - 12	PB		
7	Fillet weld, T-joint	t 8 – 12	PB		Iron powder electrodes. Welding around the corner.
8	Fillet weld, T-joint	t 8 - 12	PG		

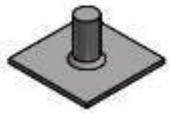
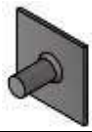
..Welding and evaluation of test pieces, visual testing and fracture testing required 9.1 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Evalution criteria**
1.	Filet weld, T-joint	t 10	PB		ml	ISO 5817 C
2.	Filet weld, T-joint	t 10	PF		ml	ISO 5817 C

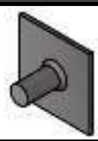
Practical training – M 9.2

Subject	Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make fillet welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)
Elaboration	
Practical training 2	Execution of fillet weld according to table M 9.2
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M9.2 FW

Table 9.2 FW

No.	9.2 FW Process 111				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Both rutile and basic electrodes shall be used in both single and multi run welding.
2	Fillet weld, T-joint	t 8 – 12	PD		Welding around the corner.
3	Fillet weld, tube to plate	t 5 – 10 D 80 - 120	PB		
4	Fillet weld, tube to plate	t 5 – 10 D 80 - 120	PH		
5	Fillet weld, corner joint	t 5 – 10 D 80 - 120	PD		Iron powder electrodes. Welding around the corner.

..Welding and evaluation of test pieces, visual testing and fracture testing required 9.2 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Evaluation criteria**
1.	Fillet weld, tube to plate	t 5 – 10 D 80 - 120	PH		sl, both, plate and tube with nearly the same thickness	ISO 5817 C

M9 **PW**

Stainless Steels
Material group 8, 10 (ISO /TR 15608)

Practical training – MMA 9.3

Subject	Introduction to Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)
Elaboration	
Practical training 3	Execution of plate weld according to table MMA 9.3.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M9.3 PW

Table 9.3 PW

No.	9.3 PW Process 111				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Grinding, flame gouging and arc gouging	Optional			
3	Butt weld	t 8 - 12	PA		bs with grinding or gouging
4	Butt weld	t 8 - 12	PA		bs without grinding or gouging
5	Butt weld	t 8 - 12	PA		ss nb
6	Butt weld	t 8 - 12	PC		ss nb

..Welding and evaluation of test pieces, visual testing and fracture testing required 9.3 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Evaluation criteria**
1	Butt weld	t 8 - 12	PC		ml ss nb	ISO 5817 C

Practical training - M 9.4

Subject	Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)
Elaboration	
Practical training 4	Execution of plate weld according to table M 9.4.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M9.4 PW

Table 9.4 PW

No.	9.4 PW Process 111				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Fillet weld, corner joint	t 8 - 12	PF		
3	T-butt weld	t 8 - 12	PF		bs with grinding or gouging
4	Butt weld	t 8 - 12	PE		ss nb
5	Butt weld	t 8 - 12	PF		bs with grinding or gouging
6	Butt weld	t 8 - 12	PF		ss nb
7	Double bevel T-butt weld	t 8 - 12	PB		

Welding and evaluation of test pieces, only visual testing required (each run) 9.4 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/class**
1.	Butt weld	t 8 - 12	PE		ss nb	ISO 5817 C
2.	Butt weld	t 8 - 12	PF		ss nb	ISO 5817 C

M9

EVALUATION LIST
Practical examination

Welding process: **MMA – 111**
Material: **Stainless Steels Austenitic**
Material group: **1, 2, 3, 8, 10 and 11 ISO /TR 15608**

<table>
<tr><th rowspan="2">Practical examination</th><th rowspan="2">Joint</th><th rowspan="2">Connection IAB 089r5</th><th rowspan="2" colspan="2">Description</th><th colspan="2">Test reports</th><th rowspan="2">EQF level</th></tr>
<tr><th>Methods</th><th>Evaluation criteria</th></tr>
<tr><td rowspan="5">Grading during education – VET and adult</td><td rowspan="2">FW</td><td>E1</td><td>PB, t=10mm, ml</td><td>PF, t=10mm, ml</td><td>VT + fracture</td><td>ISO 5817 / C</td><td rowspan="5">2</td></tr>
<tr><td>E2</td><td colspan="2">PH, D=80 – 120mm, t=5 – 10mm, sl
both, plate and tube with nearly the same thickness</td><td>VT</td><td>ISO 5817 / C</td></tr>
<tr><td rowspan="3">PW</td><td>E3</td><td colspan="2">PC, t=8 – 12mm, ss nb</td><td>VT each run</td><td>//</td></tr>
<tr><td rowspan="2">E4</td><td colspan="2">PF, t=8 – 12mm, ss nb</td><td rowspan="2">VT each run</td><td rowspan="2">//</td></tr>
<tr><td colspan="2">PE, t=8 – 12mm, ss nb</td></tr>
<tr><td rowspan="2">External evaluation</td><td>FW</td><td rowspan="2"></td><td colspan="2">PD t=8 – 12mm, 3 passes</td><td rowspan="2">Test coupon according to ISO 9606-1</td><td rowspan="2">ISO 9606-1</td><td rowspan="2">2</td></tr>
<tr><td>PW</td><td colspan="2">PF, t=8 – 12mm, bs</td></tr>
</table>

M11	MAG Welding for Stainless steels	Process 135/138

Name of the module	**MAG welding (Process 135 or 138) for stainless steels PRACTICAL TRAINING**
List of vocational units of learning outcomes from the qualification standard	1. Introduction to MAG (Process 135 or 138) Welding of Stainless Steels 2. Introduction to Fillet Welds 3. Fillet Welds 4. Introduction to Plate (Butt) Welds 5. Plate (Butt) Welds
How to learn and work with this module:	
Module objective	1. To obtain basic experience in using the machine and equipment for process 135 or 138 (MAG welding). 2. To obtain basic experience in the MAG welding process (135 and 138) and to be able to produce fillet welds in plate in PA, PB, PD, PF and PG positions. 3. To obtain experience in the MAG welding process (135 and 136) and produce fillet welds in tube-to-plate joints in PB, PH and PD positions.. 4. To obtain experience in the MAG welding process (135 and 136) and to be able to produce butt welds in plate in PA, PC and PG positions with and without gouging. 5. To obtain experience in the MAG welding process (135 and 136) and to be able to produce single sided butt welds in plate in PB, PD, PE and PF positions.
Module description	By mastering the content of this module, the participants will be able to execute joining of materials using fillet welds in different welding positions, apply measures and personal protective means and safety at work as well as do visual inspection of the welded joint.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	**Introduction to MAG (Process 135 or 138) Welding of StainlesSteels**
Learning outcomes the participant will acquire through this subject	1. Apply the instructions from WPS (joint preparation, welding sequence, pre-heating, etc.). 2. Adjust the welding parameters according to the WPS. 3. Perform safe welding according to the WPS and using the necessary PICs. 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control. 5. Maintain the welding equipment (welding torch, cables, etc.). 6. Select suitable tools, jigs and work place for stainless steels. 7. Implement the appropriate necessities for the storage and the cleanliness of the consumables.
Elaboration	
Practical training	Execution of welds according to WPS
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods: verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

M11 **FW**

Stainless Steels
Material group 8, 10 (ISO /TR 15608)

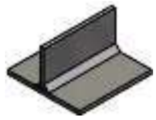
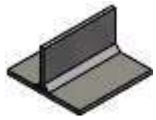
Practical training – M 11.1

Subject	**Introduction to Fillet Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 1	Execution of fillet weld according to table M 11.1
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M11 FW

Table M 11.1

No.	11.1 FW Process 135 and 138				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Bead on plate	Unlimited	PA/PF/PG		process 135
3	Fillet weld, T-joint	t 1 - 3	PA		single layer, 135-D
4	Fillet weld, T-joint	t 1 - 3	PB		single layer, 135-D, welding around corner
5	Fillet weld, T-joint	t 1 - 3	PG		Single layer, 135-D
6	Fillet weld, corner joint	t 1 - 3	PG		Single layer, 135-D, Full penetration not required
7	Fillet weld, T-joint	t 8 - 10	PB		Process 135 and 138. Welding around the corner
8	Fillet weld, T-joint	t 8 - 10	PF		Process 135 and 138.
9	Fillet weld, T-joint	t 8 - 10	PD		Process 135 and 138. Welding around the corner

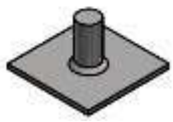
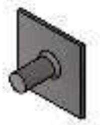
Welding and evaluation of test pieces, only visual testing (VT) required (each run) 11.1 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/class**
1	Fillet weld, T-joint	t 1 - 3	PB		short arc single layer, 135-D	ISO 5817 C
2	Fillet weld, T-joint	t 8 - 12	PB		spray arc multi layer VT + fracture	ISO 5817 C
3	Fillet weld, T-joint	t 1 - 3	PF		short arc single layer, 135-D	ISO 5817 C
4	Fillet weld, T-joint	t 8 - 12	PF		spray arc multi layer VT + fracture	ISO 5817 C

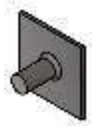
Practical training – MAG 11.2

Subject	Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 2	Execution of fillet weld according to table 11.2
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M 11.2 FW

Table M (10+11).2 FW

No.	11.2 FW Process 135 and 138				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PB		process 135
3	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PH*		Process 135 and 138
4	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PD		Process 135 and 138
*According to ISO 6947 welding position PF for tubes has been changed to test position PH covering PE, PF and PA					

Welding and evaluation of test pieces, only visual testing required (each run) 11.2 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PH		Single layer both, plate and tube with nearly the same thickness	ISO 5817 C

M10+ M11 **PW**

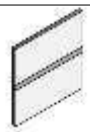
Stainless Steels
Material group 8, 10 (ISO /TR 15608)

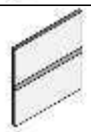
Practical training – M 11.3

Subject	Introduction to Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 3	Execution of plate weld according to table M 11.3
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M 11.3 PW

Table 11.3 PW

No.	11.3 PW Process 135 and 138				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t 1 - 3	PA		process 135 ss nb 135-D for root run
3	Butt weld	t 1 - 3	PG		process 135 ss nb 135-D for root run
4	Butt weld	t 8 - 12	PA		Process 135 ss nb
5	Butt weld	t 8 - 12	PC		Process 135 ss nb

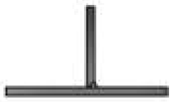
Welding and evaluation of test pieces, only visual testing required (each run) (10+11).3 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Butt weld	t 1 - 3	PC		ss nb VT each run	//
2	Butt weld	t 8 - 12	PC		ss nb VT each run	//

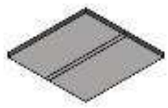
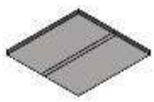
Practical training – M 11.4

Subject	Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 4	Execution of plate weld according to table M 11.4.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M 11.4 | PW

Table 11.4

No.	(10+11).4 PW Process 135 and 138				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t 1 - 3	PE		process 135 ss nb 135-D for root run
3	Butt weld	t 5 - 10	PF		Process 135 ss nb
5	Single bevel butt weld, T-joint	t 5 - 10	PB		Process 135
6	Single bevel butt weld, T-joint	t 5 - 10	PD		Process 135 ss nb
7	Single bevel butt weld, T-joint	t 5 - 10	PF		Process 135 ss nb

Welding and evaluation of test pieces, only visual testing required (each run) (10+11).4 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Butt weld	t 1 - 3	PF		ss nb VT each run	//
2	Butt weld	t 8 - 12	PF		ss nb VT each run	//
3	Butt weld	t 1 - 3	PE		ss nb VT each run	//
4	Butt weld	t 8 - 12	PE		ss nb VT each run	//

M 11

EVALUATION LIST
Practical examination

Welding process: **MAG – 135** and **MCAW – 138**
Material: **Stainless Steels Austenitic**
Material group: **1, 2, 3, 8, 10 and 11 ISO /TR 15608**

Practical examination	Joint	Connection IAB 089r5	Description	Test reports		EQF level
				Methods	Evaluation criteria	
Grading during education – VET and adult	FW	M1	**PB**, t=1 - 3mm (short arc) , sl **PB**, t=8 – 12mm (spray arc), ml **PF**, t=1 - 3mm (short arc), sl **PF**, t=8 – 12mm (spray arc), ml	VT VT + fracture VT VT + fracture	ISO 5817 / C	2
		M2	**PH**, D=80 – 120mm, t=5 – 10mm, sl both, plate and tube with nearly the same thickness	VT	ISO 5817 / C	
	PW	M3	**PC**, t=1 – 3mm, ss nb **PC**, t=8 – 12mm, ss nb	VT each run	//	
		M4	**PF**, t=1 – 3mm, ss nb **PF**, t=8 – 12mm, ss nb **PE**, t=1 – 3mm, ss nb **PE**, t=8 – 12mm, ss nb	VT each run	//	
External evaluation	**FW**		**PD** t=8 – 12mm, 3 pass	Test coupon according to ISO 9606-1	ISO 9606-1	**2**
	PW		**PA**, t=8 – 12mm, ss nb			

M14	FCAW Welding for Stainless steels	Process 136

Name of the module	MAG welding (Process 136) for Stainless steels PRACTICAL TRAINING
List of vocational units of learning outcomes from the qualification standard	1. Introduction to MAG (Process 136) Welding of Stainless steels 2. Introduction to Fillet Welds 3. Fillet Welds 4. Introduction to Plate (Butt) Welds 5. Plate (Butt) Welds
How to learn and work with this module:	
Module objective	1. To obtain basic experience in using the machine and equipment for process 136 (MAG welding). 2. To obtain basic experience in the MAG welding process (136) and to be able to produce fillet welds in plate in PA, PB, PD, PF and PG positions. 3. To obtain experience in the MAG welding process (136) and produce fillet welds in tube-to-plate joints in PB, PH and PD positions.. 4. To obtain experience in the MAG welding process (136) and to be able to produce butt welds in plate in PA, PC and PG positions with and without gouging. 5. To obtain experience in the MAG welding process (136) and to be able to produce single sided butt welds in plate in PB, PD, PE and PF positions.
Module description	By mastering the content of this module, the participants will be able to execute joining of materials using fillet welds in different welding positions, apply measures and personal protective means and safety at work as well as do visual inspection of the welded joint.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	Introduction to MAG (Process 136) Welding of Stainless steels
Learning outcomes the participant will acquire through this subject	1. Apply the instructions from WPS (joint preparation, welding sequence, pre-heating, etc.). 2. Adjust the welding parameters according to the WPS. 3. Perform safe welding according to the WPS and using the necessary PICs. 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control. 5. Maintain the welding equipment (welding torch, cables, etc.). 6. Select suitable tools, jigs and work place for stainless steels. 7. Implement the appropriate necessities for the storage and the cleanliness of the consumables.
Elaboration	
Practical training	Execution of welds according to WPS
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M14 **FW**

Stainless Steels
Material group 8, 10 (ISO /TR 15608)

Practical training – M 14.1

Subject	**Introduction to Fillet Welds**
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 1	Execution of fillet weld according to table M 14.1
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M14.1 FW

Table 14.1 FW

No.	14.1 FW Process 136				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Wherever possible (136) both rutile and basic wires shall be used in both single and multi run welding.
2	Fillet weld, T-joint	t 8 - 12	PB		ml
3	Fillet weld, T-joint	t 8 - 12	PF		ml
4	Fillet weld, T-joint	t 8 - 12	PD		ml

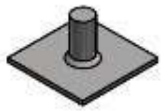
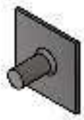
Welding and evaluation of test pieces, only visual testing required (each run) 14.1 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, T-joint	t 8 - 12	PB		multi layer VT + fracture	ISO 5817 C
2	Fillet weld, T-joint	t 8 - 12	PF		multi layer VT + fracture	ISO 5817 C

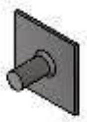
Practical training – M 14.2

Subject	Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 2	Execution of fillet weld according to table M 14.2
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M14.2 FW

Table 14.2 FW

No.	14.2 FW Process 136				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Wherever possible (136) both rutile and basic wires shall be used in both single and multi run welding.
2	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PB		
3	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PH*		
4	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PD		
*According to ISO 6947 welding position PF for tubes has been changed to test position PH covering PE, PF and PA					

Welding and evaluation of test pieces, only visual testing required (each run) 14.2 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, Tube to plate	t 5 - 10 D 80 - 120	PH		Single layer both, plate and tube with nearly the same thickness	ISO 5817 C

M14 **PW**

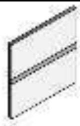
Stainless Steels
Material group 8, 10 (ISO /TR 15608)

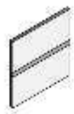
Practical training – M 14.3

Subject	Introduction to Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 3	Execution of plate weld according to table M 14.3.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M14.3 PW

Table 14.3 PW

No.	14.3 PW Process 136 Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Butt weld	t 8 – 12	PA		Process 136 bs with grinding or gouging or process 136 ss nb and 136 bs with grinding or gouging
3	Butt weld	t 8 – 12	PC		ss nb

Welding and evaluation of test pieces, only visual testing required (each run) 14.3 PW						
No.	Type of weld	Recommended material thickness, [mm]	Welding position	Sketch	Remarks	Standard/ class
4	Butt weld	t 8 – 12	PC		ss mb VT each run	//

Practical training – M 14.4

Subject	Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 4	Execution of plate weld according to table M 14.4.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 40% Training on the welding machine: minimum 60%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M14.4 PW

Table 14.4 PW

No.	14.4 PW Process 136				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t 8 - 12	PE		ss mb
3	Butt weld	t 8 - 12	PF		Process 136 bs with grinding or gouging or process 136 ss mb and 136 bs with grinding or gouging

Welding and evaluation of test pieces, only visual testing required (each run) 14.4 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
2	Butt weld	t 8 - 12	PF		ss mb VT each run	//
4	Butt weld	t 8 - 12	PE		ss mb VT each run	ISO 5817 C

M14

EVALUATION LIST
Practical examination

Welding process: **FCAW – 136**
Material: **Ferritic Steels: Carbon and Low Alloy steel and Stainless Steels Austenitic**
Material group: **1, 2, 3, 8, 10 and 11 ISO /TR 15608**

Practical examination	Joint	Connection IAB 089r5	Description	Test reports		EQF level
				Methods	Evaluation criteria	
Grading during education – VET and adult	FW	M1	**PB**, t=8 – 12mm, ml **PF**, t=8 – 12mm, ml	VT + fracture	ISO 5817 / C	2
		M2	**PH**, D=80 – 120mm, t=5 – 10mm, sl both, plate and tube with nearly the same thickness	VT	ISO 5817 / C	
	PW	M3	**PC**, t=8 – 12mm, ss mb	VT each run	//	
		M4	**PF**, t=8 – 12mm, ss mb **PE**, t=8 – 12mm, ss mb	VT each run	//	
External evaluation	**FW**		**PD** t=8 – 12mm, 3 passes	Test coupon according to ISO 9606-1	ISO 9606-1	**2**
	PW		**PF**, t=8 – 12mm, ss mb – ceramic/strip and without root examination			

M16	TIG Welding for Stainless steels	Process 141

Name of the module	TIG welding (Process 141) for Stainless steels PRACTICAL TRAINING
List of vocational units of learning outcomes from the qualification standard	1. Introduction to TIG (Process 141) Welding of Stainless steels 2. Introduction to Fillet Welds 3. Fillet Welds 4. Introduction to Plate (Butt) Welds 5. Plate (Butt) Welds
How to learn and work with this module:	
Module objective	1. To obtain basic experience in using the machine and equipment for process 141 (TIG welding). 2. To obtain basic experience in process 141 (TIG welding) and to be able to make fillet welds in plate in PA, PB and PF positions. 3. To obtain experience in process 141 (TIG-welding) and produce fillet welds in plate in PD position and in tube-to-plate joints in PB, PD and PH positions using both single and multiple layer technique. 4. To obtain experience in process 141 (TIG-welding) and to be able to produce single side butt welds in plate in PA and PC positions. 5. To obtain experience in process 141 (TIG-welding) and to be able to produce single side butt welds in plate in PE and PF position.
Module description	By mastering the content of this module, the participants will be able to execute joining of materials using fillet welds in different welding positions, apply measures and personal protective means and safety at work as well as do visual inspection of the welded joint.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	Introduction to TIG (Process 141) Welding of Stainless steels
Learning outcomes the participant will acquire through this subject	1. Apply the instructions from WPS (joint preparation, welding sequence, pre-heating, etc.). 2. Adjust the welding parameters according to the WPS. 3. Perform safe welding according to the WPS and using the necessary PICs. 4. Perform root face and gap preparation with grinding tools. 5. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control. 6. Maintain the welding equipment (welding torch, cables, etc.). 7. Select suitable tools, jigs and work place for stainless steels. 8. Implement the appropriate necessities for the storage and the cleanliness of the consumables.
Elaboration	
Practical training	Execution of weld according to WPS
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** combined work methods - verbal method, demonstration method, cooperative learning, mental maps, ICT programs, interactive quizzes. **Type of work:** frontal, group, pair and individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content acquisition, content application. **Types:** oral exam, written exam, making of test object.

M16 **FW**

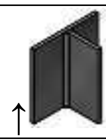
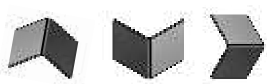
Stainless steels
Material group 8, 10 (ISO /TR 15608)

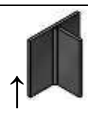
Practical training – M 16.1

Subject	Introduction to Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make fillet welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 1	Execution of fillet weld according to table M 16.1
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 60% Training on the welding machine: minimum 40%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M16.1 FW

Table 16.1 FW

No.	16.1 FW Process 141				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				Remelting (dressing) the top layer is not permitted
2	Bead on plate	Unlimited	PA/PF/PC		
3	Fillet weld, T-joint	t > 1	PA		
4	Fillet weld, T-joint	t > 1	PB		
5	Fillet weld, T-joint	t > 1	PF		
6	Outside fillet weld, corner joint	t > 1	PA, PF, PC		Full penetration weld

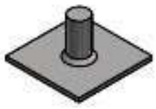
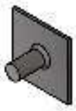
Welding and evaluation of test pieces, visual for positions PB and PF and fracture test for position PF, 16.1 FW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Fillet weld, T-joint	t 1 - 2	PB		sl	ISO 5817 C
2	Fillet weld, T-joint	t 6 - 8	PF		ml	ISO 5817 C

Practical training – M 16.2

Subject	Fillet Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make fillet welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 2	Execution of fillet weld according to table M 16.2
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 60% Training on the welding machine: minimum 40%. **Type of work:** individual work. **Remark:** methods and type of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M16.2 FW

Table 16.2 FW

No.	16.2 FW Process 141				
	Type of weld	Recommended material thickness [mm]	Welding position	Sketch	Remarks
1	Introduction				
2	Fillet weld, T-joint	t > 1	PD		
3	Fillet weld, tube to plate	t > 1 40 ≤ D ≤ 80	PB		
4	Fillet weld, tube to plate	t > 1 40 ≤ D ≤ 80	PD		
5	Fillet weld, tube to plate	t > 1 40 ≤ D ≤ 80	PH*		
*According to ISO 6947 welding position PF for tubes has been changed to test position PH covering PE, PF and PA					

Welding and evaluation of test pieces, only visual testing required, 15.2 FW						
No.	Type of weld	Recommended material thickness, [mm]	Welding position	Sketch	Remarks	Standard/ class
1	Fillet weld, T-joint	t 1 – 2 40 ≤ D ≤ 80	PH		sl	ISO 5817 C

M16 **PW**

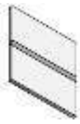
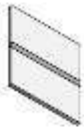
Stainless steels
Material group 8, 10 (ISO /TR 15608)

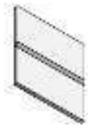
Practical training – M 16.3

Subject	Introduction to Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 3	Execution of plate weld according to table M 16.3.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 60% Training on the welding machine: minimum 40%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M16.3 PW

Table 16.3 PW

No.	16.3 PW Process 141				
	Type of weld	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t > 1	PA		ss nb
3	Butt weld	t > 5	PA		ss nb
4	Butt weld	t > 1	PC		ss nb
5	Butt weld	t > 5	PC		ss nb

Welding and evaluation of test pieces, only visual testing required, 16.3 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Butt weld	t 2 – 6	PC		ss nb	ISO 5817 C

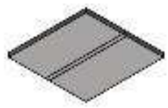
Practical training – M 16.4

Subject	Plate (Butt) Welds
Learning outcomes the participant will acquire through this subject	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)
Elaboration	
Practical training 4	Execution of plate weld according to table M 16.4.
Note	The teaching process is performed practically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods:** Integrated interactive training: Virtual Welding Training System (VWTS): up to 60% Training on the welding machine: minimum 40%. **Type of work:** individual work. **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements:** content application, technique application, execution of weld. **Types:** making of test object.

M16.4 PW

Table 16.4 PW

	16.4 PW Process 141				
No.	**Type of weld**	**Recommended material thickness [mm]**	**Welding position**	**Sketch**	**Remarks**
1	Introduction				
2	Butt weld	t > 1	PF		ss nb
3	Butt weld	t > 5	PF		ss nb
4	Butt weld	t > 1	PE		ss nb
5	Butt weld	t > 5	PE		ss nb

Welding and evaluation of test pieces, only visual testing required, 16.4 PW						
No.	**Type of weld**	**Recommended material thickness, [mm]**	**Welding position**	**Sketch**	**Remarks**	**Standard/ class**
1	Butt weld	t 2 - 6	PF		ss nb	ISO 5817 C
2	Butt weld	t 2 – 4	PE		ss nb	ISO 5817 C

M16

EVALUATION LIST
Practical examination

Welding process: **TIG – 141**
Material: **Ferritic Steels: Carbon and Low Alloy steel and Stainless Steels Austenitic**
Material group: **1, 2, 3, 8, 10 and 11 ISO /TR 15608**

Practical examination	Joint	Connection IAB 089r5	Description	Test reports		EQF level
				Methods	Evaluation criteria	
Grading during education – VET and adult	FW	T1	PB, t=1 - 2mm, sl PF, t=6 - 8mm, ml	VT VT + fracture	ISO 5817 / C	2
		T2	PH, D=40 – 80mm, t=1 – 2mm, sl	VT	ISO 5817 / C	
	PW	T3	PC, t=2 – 6mm, ss nb	VT	ISO 5817 / C	
		T4	PF, t=2 – 6mm, ss nb	VT	ISO 5817 / C	
External evaluation	FW		PD t=3– 5mm, sl	Test coupon according to ISO 9606-1	ISO 9606-1	2
	PW		PF, t=3– 5mm, bs			

2.2.4. ELECTIVE MODULES

M18 Aerobic training

Name of the module	Aerobic training
List of vocational units of learning outcomes from the qualification standard	1. Physical training 2. My body and I 3. Healthy living
How to learn and work with this module:	
Module objective	**1. The objective of physical training in welder education is:** 1.1. to permanently encourage harmonious growth and development 1.2. to adopt and be able to apply theoretical and motor knowledge of kinesiology 1.3. to strategically develop morphological characteristics, motor and functional abilities 1.4. to increase the work ability 1.5. to correctly choose and apply the content of physical training 1.6. to be able to carry out the physical training in a correct manner and on one's own **2. The objective of this unit of learning outcomes in welder education is:** 2.1. to have a responsible and objective attitude towards the state and development of one's anthropological characteristics 2.2. to be trained to monitor and evaluate one's personal achievements 2.3. to be able to apply basic theoretical and motor knowledge in everyday life 2.4. to achieve a suitable level of motor achievements to be able to perform as a welder **3. The objective of this unit of learning outcomes in welder education is:** 3.1. To develop awareness of the importance of preservation, improvement and promotion of health 3.2. To develop positive personality characteristics 3.4. To build humane interpersonal relations 3.5. To develop ecological awareness 3.6. To prevent deterioration process or premature decrease in characteristics, abilities and motor knowledge as a result of inadequate physical activity
Module description	By mastering the contents of this module the participants will be health-wise, physically and mentally capable for work and working conditions in occupation welder.
Linked to the guidelines	IAB-089r5-14-Part I-February-2014

Subject	**Physical training**
Learning outcomes the participant will acquire through this subject	1. Differentiate between and apply the basics in techniques for different motor activities 2. Demonstrate complex structure of the chosen motor activity 3. Apply elements of technique in complex structures of the chosen motor activity 4. Differentiate between specific (kinesiotherapeutic) exercises that are carried out 5. Adjust the exercises to the health condition and according to the endangered state of the movement system in order to prevent occupational injury 6. Repeat the assigned dynamic and rhythmic movements
Elaboration	
Practical training I	Execution of exercises according to trainer demands
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods of:** - display - oral method, demonstration method - exercising – interval method, variable method, continuous method - safety – prevention, protection and assistance method - supervision – exercise monitoring, directing and stopping method **Types:** - simple (individual, twos, threes, fours and parallel) - complex (parallel-alternating, successive-alternating, alternating, circular, station, track and range). **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions
Learning types	
Elements and types of testing and evaluation of participants	**Elements**: motor knowledge, motor accomplishments, kinanthropological accomplishments (of morphological characteristics, motor and functional abilities according to evaluation methodology), educational effects of work. **Types:** evaluation of participant's work should be done so as to take into consideration the condition of their anthropological status, real/actual possibilities of each individual participant and total progress during the course of school year**.**

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Subject	My body and I
Learning outcomes the participant will acquire through this subject	1. Identify the level of physical fitness and takes responsibility for its improvement 2. Exercise regularly in order to improve the level of fitness 3. Perform the chosen exercise complexes 4. Question the impacts of carried out exercise complexes on work ability 5. Adjust the manner of exercising to cognitions
Elaboration	
Practical training I	Execution of exercises according to trainer demands
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods of:** - display - oral method, demonstration method - exercising – interval method, variable method, continuous method - safety – prevention, protection and assistance method - supervision – exercise monitoring, directing and stopping method **Types:** - simple (individual, twos, threes, fours and parallel) - complex (parallel-alternating, successive-alternating, alternating, circular, station, track and range). **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements**: motor knowledge, motor accomplishments, kinanthropological accomplishments (of morphological characteristics, motor and functional abilities according to evaluation methodology), educational effects of work. **Types:** evaluation of participant's work should be done so as to take into consideration the condition of their anthropological status, real/actual possibilities of each individual participant and total progress during the course of school year**.**

Subject	Healthy living
Learning outcomes the participant will acquire through this subject	1. Recognize the influence of eating habits on health 2. Plan and carry out physical training for health preservation purposes 3. Carry out physical training outside/in nature 4. Coordinate physical training with work obligations 5. Carry out different types of recreational motor activities
Elaboration	
Practical training I	Execution of exercises according to trainer demands
Note	The teaching process is performed theoretically 100% of time in order to meet the performance criteria of the mentioned outcomes.
Other	
Methods and types of work	**Methods of:** - display - oral method, demonstration method - exercising – interval method, variable method, continuous method - safety – prevention, protection and assistance method - supervision – exercise monitoring, directing and stopping method **Types:** - simple (individual, twos, threes, fours and parallel) - complex (parallel-alternating, successive-alternating, alternating, circular, station, track and range). **Remark:** methods and types of work are determined for each class by the teacher/instructor, according to the syllabus/curricula, participants' personality as well as material and other conditions.
Learning types	
Elements and types of testing and evaluation of participants	**Elements**: motor knowledge, motor accomplishments, kinanthropological accomplishments (of morphological characteristics, motor and functional abilities according to evaluation methodology), educational effects of work. **Types:** evaluation of participant's work should be done so as to take into consideration the condition of their anthropological status, real/actual possibilities of each individual participant and total progress during the course of school year**.**

2.2.5. FINAL TESTING OF KNOWLEDGE AND SKILLS

2.2.5.1. VOCATIONAL EDUCATION AND EDUCATION OF ADULTS

Is carried out based on national laws and regulations for secondary vocational education and education of adults

2.2.5.2. EXTERNAL EVALUATION

External evaluation as a standardized procedure of preparation and implementation of testing and grading, as well as exam analysis will be carried out for students/participants in formal education system, but also for those candidates who have not acquired a certain qualification/competences through formal education, but rather through informal/non-formal learning/education and/or work. Introduction of external evaluation of knowledge and skills, as well as learning outcomes anticipated in curricula is of extreme importance for assurance of objective, valid and reliable information on the level of participant's knowledge and skills. Standardization of welder competences, alignment of qualification framework and occupation title, both at European level and wider, is very important for their credibility and value at the labor market, for both employees and employers.

External evaluation of learning outcomes is carried out according to curricula supplement 1 “Framework for external evaluation of learning outcomes acquired through formal, non-formal and informal education of welders“.

The Framework describes procedures/guidelines for external evaluation of welder knowledge, skills and competences prescribed in European curricula. External evaluation includes testing using different evaluation methods such as a written test and testing of practical welding skills, integral part of which is an interview with the candidate. External evaluation at national level should be conducted by a corresponding national agency, best be it an institution already in charge of external evaluation of education or a similar one with such experience. The authorized agency carries out the external evaluation in cooperation with all relevant stakeholders involved in welder education or employment. The Framework specifies the levels of qualification externally evaluated according to European Qualification Framework and which candidates are eligible for application and testing. Knowledge and skills that are evaluated, as well as how they are evaluated are described under elements and methods of evaluation. Developing of testing materials, scoring and grading are explained as well. The Framework also clarifies key institutions/stakeholders involved in external evaluation of welder knowledge and skills, as well as conditions for application depending on the type of education (formal, non-formal/informal), cost of evaluation and the process of acquisition of a diploma/certificate upon successful completion of exam.

3. LEARNING ENVIRONMENT

Institution for vocational education or education of adults and employers' facilities

4. PERSONNEL CONDITIONS

Teachers/instructors requirements:

- Teachers for theoretical education shall at least have an International Welding Specialist diploma or equivalent qualification that shall be assessed and approved by the ANB.

- Instructors teaching practical skills shall have either:

- A valid ISO 9606 certificate, or skill qualifications based on equivalent technical conditions, appropriate to the scope of training provided or
- An International Welding Practitioner diploma (covering the welding processes subject to teaching) and active in the field of welding in the last 3 years or
- An IW-diploma, covering the appropriate level (IFW,IPW or ITW), the welding processes and parent material subject to teaching, and active in the field or welding in the last 3 years or
- Instructor who at least the last 5 years has worked as instructor in practical welding will be evaluated by the ANB. If approved, he/she can work as International Welder Instructor for practical training.

- Teachers and instructors shall demonstrate competence in instructional techniques (transfer of practical skills and theoretical knowledge).

5. MINIMUM MATERIAL CONDITIONS

Training requirements:

- The welder training workshop must include the number of training booths required to cover the maximum number of students. The booths must be fully equipped, have correct ventilation and proper screening to protect other workers.

- The range of welding and auxiliary equipment must reflect the scope of approval and must be in sufficient quantity to cover the maximum number of students. It must be in good working order and fit for its propose.

- Protective clothing and eye protection for trainees must be provided. Such items must be clean and in safe, good condition.

- Instruments for checking welding parameters must be available and calibrated, validated or verified as appropriate (see ISO17662).

- Reference standards according to appendix 1 of the “IIW Guideline International Welder” shall be available for students during theoretical education and examination.

6. DOCUMENT REFERENCES

6.1. Reference numbers

2016-1-HR01-KA202-022187 – WCAW2

6.1. Members of work groups who participated in creation of vocational curriculum

Adelaide Almeida, Cristina Almeida, Heliana Gaspar Bibas, Goran Burazer, Aránzazu Casero Perpiñá, Pietro Connsoni, Dominik Gjuretek, Daniela Grüter, Jorge J. Huete Chugunowa, Željko Habek, Franjo Javor, Maja Jukić, Anja Konig, Marlena Lakić, Mario Lovrić, Edita Margeta, Giuseppe Mastrangelo, Dinis Garcia Nunes, Natalija Gjeri Robić, Juan Vicente Rosell González, Mariano Santoro, Mirta Szügyi, Robert Vidas, Daniel Wilke, Zlatko Zadelj.

7. EUROPEAN FRAMEWORK CURRICULA FOLLOWING THE EWF METHODOLOGY

7.1. ARC WELDER 2 - QUALIFICATION DESCRIPTORS

QUALIFICATION DESCRIPTION						
QUALIFICATION	KNOWLEDGE	SKILLS	AUTONOMY AND RESPONSABILITY	EQF LEVEL	WORKLOAD (hours)	ECVET POINTS
ARC WELDER 2 **(Fillet and Plate Weld)**	Basic factual knowledge of welding technology and related materials.	Basic cognitive and practical skills required to carry out fillet and plate 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.	**2**		

7.2. ARC WELDER 2 QUALIFICATION COMPETENCE PROFILES

7.2.1. JOB FUNCTIONS AND ACTIVITIES

Job functions	Activities	EQF LEVEL
1. Review and planning of parameters necessary for the course of production process	1.1 Review technical-technological documentation 1.2 Plan the execution of welding process for a specific task 1.3 Plan the work space	2
2. Preparation of the work place, necessary equipment, tools and materials	2.1 Prepare, position and check the welding equipment 2.2 Receive, handle and maintain consumables 2.3 Prepare, check and protect 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 3.3 Prepare the edges of base metal for welding process 3.4 Control preheat and interpass temperature 3.5 Weld the joint according to WPS and apply welding techniques when executing different types of welded joints in different welding positions 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	
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 professional terminology	

Job functions	Activities	EQF LEVEL
6. Inspect the quality of welded joints applying visual inspection and dimensional control	6.1 Carry out visual inspection and dimensional control of welded joints 6.2 mark/label welds with their identification tag in accordance with the quality assurance system. 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.	**2**
7 - Taking care of people and environment	7.1 Apply regulations and means for occupational safety, fire protection and environment protection	

7.2.2. JOB FUNCTIONS AND COMPETENCE UNITS OF LEARNING OUTCOMES

ARC WELDER 2 JOB FUNCTIONS	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 7.1	M 7.2	M 7.3	M 8.1 to 8.4	M 9.1 to 9.4	M 10.1 to 10.4	M 11.1 to 11.4	M 13.1 to 13.4	M 14.1 to 14.4	M 15.1 to 15.4	M 16.1 to 16.4	M 17.1 to 17.4	M 18
1.Analysis and planning of parameters necessary for the course of production process	X	X	X	X	X	X	X													
2.Preparation of the work place, necessary equipment, tools and materials	X	X	X	X	X	X	X													
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 - 111 (MMA) / Carbon and Low Alloy Steel	X	X	X	X	X	X	X	X			X									
3.2 - 111 (MMA) / Austenitic Stainless Steels	X	X	X	X	X	X	X	X				X								
3.3 – 131 (MIG) / Aluminum and Aluminum Alloys	X	X	X	X	X	X	X		X											
3.4 – 135/ 138 (MAG/MCAW) / Carbon and Low Alloy Steel	X	X	X	X	X	X	X		X				X							
3.5 - 135/ 138 (MAG/MCAW) / Austenitic Stainless Steels	X	X	X	X	X	X	X		X					X						
3.6 - 136 (FCAW) / Carbon and Low Alloy Steel	X	X	X	X	X	X	X		X						X					
3.7 -136 (FCAW)/ Austenitic Stainless Steels	X	X	X	X	X	X	X		X							X				
3.8 – 141 (TIG) / Carbon and Low Alloy Steel	X	X	X	X	X	X	X			X							X			
3.9 - 141 (TIG) / Austenitic Stainless Steels	X	X	X	X	X	X	X			X								X		
3.10 -141 (TIG) / Aluminum and Aluminum Alloys	X	X	X	X	X	X	X			X									X	

ARC WELDER 2 JOB FUNCTIONS																				
	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 7.1	M 7.2	M 7.3	M 8.1 to 8.4	M 9.1 to 9.4	M 10.1 to 10.4	M 11.1 to 11.4	M 13.1 to 13.4	M 14.1 to 14.4	M 15.1 to 15.4	M 16.1 to 16.4	M 17.1 to 17.4	M 18
4. Filling the work documentation	X										X	X	X	X	X	X	X	X	X	
5. Professional communication											X	X	X	X	X	X	X	X	X	
6. Inspect the quality of welded joints applying visual inspection and dimensional control					X						X	X	X	X	X	X	X	X	X	
7.Taking care of people and environment						X														X

7.3. QUALIFICATION COMPETENCE UNITS

Competence Unit –M1- **ARC WELDING PROCESS**

<table>
<tr><th>KNOWLEDGE
He/she will have factual knowledge about</th><th>SKILLS
He/she will be able to</th><th>CONTACT HOURS (teaching hours)</th><th>WORKLOAD (including study)</th><th>ECVET POINTS</th></tr>
<tr><td>Electric arc
• Basics of electricity
• Nature of the electric arc
• The arc as heat source
• Arc power
Introduction to Welding
• Basic terminology for welds. (e.g.: run, layer, top, root, penetration)
• Welding processes (MMA, MIG/MAG, TIG)
• Welding consumables
• Metal transfer
• Weld metal
• Formation of the weld</td><td>1. Describe the principle of arc welding.
2. Define the basic terms in welding.
3. Explain the heat generation in the arc.
4. Explain metal transfer through the arc.
5. Explain the formation of the weld pool.</td><td rowspan="2">12</td><td rowspan="2">24</td><td rowspan="2">1</td></tr>
<tr><td>Welding equipment
• Distribution of electricity; mains supply
• Converting mains to welding power; welding power source
• Transformers; use of AC
• Rectifiers for DC
• Open circuit and arc voltage; welding current
• Type of welding current and polarity
• Duty cycle
• Shielding gas supply
• Welding parameters</td><td>1. Describe the major components of welding equipment and their function.
2. Describe polarity and change of polarity.
3. Identify the essential parameters for arc welding.</td></tr>
</table>

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Welding consumables • Principle of welding consumables and functions of each type of welding consumable (electrodes, rods and gases) • Shielding gases • Backing gases • Classification of welding consumables • Storage, drying and handling	1. Distinguish between use, types and functions of welding consumables. 2. Explain why and how to dry, store and handle welding consumables (following the recommendations of the manufacturer). 3. Identify the designation of welding consumables as used on WPSs of the training program (according to appropriate EN/ISO standards).			
Exercises • Welding Procedure Specifications (ISO 15609-1). • Welding parameters, welding positions (ISO 6947). • Types of welds and joints: characteristics, size, surface finish. • Welding symbols according to ISO 2553.	1. Interpret welding details and welding symbols on a drawing (ISO 2553). 2. Distinguish the welding positions per ISO 6947. 3. Identify the types of welded joints: “T”, lap, corner, etc. 4. Identify in the fillet weld: size, shape, tack weld, and excess weld metal. 5. Interpret a WPS in production. 6. Describe how to get the required parameters.			

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Fusion welding processes • Revision of the MMA, MIG, MAG, TIG welding • Principles of Self Shielding Metal Arc (114) welding • Principles of gas welding (311) • Principles of plasma welding (151) • Principles of submerged-arc welding (121)	1. Describe different welding processes: 111, 114, 121, 13, 141, 151, 311.			

***Competence Unit –M2-* WELDABILITY OF FERRITIC STEELS**

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Introduction to steels • Making of steel • Nature of non-alloy steels • Effects of welding on steel • Adding elements to create alloys • Basis of ISO (TR) 15608	1. Outline the processes when: making steel, using continuous casting and hot working. 2. Explain the influence of welding on steel. 3. Compare non alloy, stainless steels and other alloy steels. 4. Recognize the influence of alloying elements on the properties of steel. 5. Classify materials according to ISO (TR) 15608.	**6**	**12**	**0,5**
Weldability of steels • The concept of weldability • Effects of composition, thickness and temperature (preheat and interpass) • Heat input	1. Name the influence of alloying elements on the properties of weldable steel. 2. Describe the effect of plate thickness on the properties of weldable steel. 3. Explain the influence of carbon equivalent. 4. Interpret the heat input concept and its use.			
Materials other than non-alloy steels (introduction) • Stainless steels and other alloy steels • Aluminum alloys • Copper alloys • Nickel alloys • Titanium and other special materials • Typical problems when welding the above materials	1. Identify different kinds of materials such as stainless steels, other alloy steels and aluminum alloys.			

Competence Unit –M3- **WELDABILITY OF AUSTENITIC STAINLESS STEELS**

KNOWLEDGE He/she will have factual knowledge about	**SKILLS** He/she will be able to	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Stainless steels • Definition of stainless steel • Identification of stainless steel • Protective oxide film • Welding processes • Characteristics of stainless steel compared to unalloyed steel and aluminum alloys • Grades of stainless steel and their characteristics: austenitic, ferritic, martensitic, duplex (austenitic ferritic) • Health aspects during welding of stainless steel, alloys in stainless steel and their effect on the health • Methods for preventing health risks related to welding of stainless steel, breathing zone, welder's mask with fresh-air filters, hygiene • Safety precautions for cutting	2. Define the characteristics of stainless steel and explain the concept of protective oxide film formation 3. Explain the difference between welding stainless steel and unalloyed carbon steel 4. Outline the grades of stainless steel and their characteristics: austenitic, ferritic, martensitic, duplex (austenitic-ferritic) 5. Identify common welding processes for stainless steel 6. Explain health risks related to welding of stainless steel and how to prevent them	**8**	**16**	**0,5**
Weldability of stainless steels • Welded joints for stainless steel • Methods for joint preparation in stainless steel • Weldability of stainless steel, heat input, interpass temperature • Effects of composition, temperature, heat input. • Welding of dissimilar metals and clad metal (stainless steel-unalloyed steel) and control of dilution • Distortion caused by welding stainless steel and the difference when compared to unalloyed steel • Handling of stainless steel in the workshop and the use of tools for stainless steel	1. Outline the commonly used welding joints and the methods of joint preparation regarding stainless steel 2. Explain the importance of controlling heat input and interpass temperature 3. Name the influence of alloying elements on weld properties. 4. Explain the effect of heat input on stainless steel. 5. Outline typical problems when welding stainless steels			

KNOWLEDGE He/she will have factual knowledge about	**SKILLS** He/she will be able to	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Welding consumables for stainless steels • Welding consumables (filler metals and shielding gases) adequate for stainless steels, standards • Measurements (ppm) of oxygen on backing gas, requirements for different grades of stainless steels • Determination of required backing gas, density of gases compared to density of air • Equipment for backing gas	1. Recognize the main types and classification of welding consumables for stainless steel 2. Determine and measure required backing gas 3. Identify equipment and tools for backing gas			
Corrosion, post weld treatment • Use of protective means, • Corrosion types in stainless steel (pitting, intergranular, crevice corrosion), • The influence on corrosion in stainless steel caused by welding and environment • Post weld treatment: pickling, blasting, brushing and grinding • Post weld heat treatment: austenitic, ferritic, martensitic, austenitic-ferritic (duplex)	1. Outline methods to avoid corrosion in stainless steel 2. Identify the influence of welding in corrosion of stainless steel 3. Describe post weld treatment: pickling, blasting and brushing, grinding			

***Competence Unit –M4* - WELDABILITY OF ALUMINUM AND ITS ALLOYS**

KNOWLEDGE He/she will have factual knowledge about	**SKILLS** He/she will be able to	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Basics of aluminum alloys • Grades of aluminum and aluminum alloys, their characteristics and classification. • Characteristics of aluminum compared to mild steel and stainless steel. • Protective oxide film positive for welding? • Welding processes for aluminum and aluminum alloys. • Health aspects during welding of aluminum and its alloys. • Methods for preventing health risks during welding and joint preparation of aluminum, breathing zone, welder's masks with fresh-air filters, hygiene.	1. Define the characteristics of aluminum and aluminum alloys and explain the concept of protective oxide film formation 2. Outline the grades of aluminum and aluminum alloys, their characteristics and classification. 3. Explain the difference between welding aluminum alloys and unalloyed carbon steel. 4. Identify common welding processes for aluminum alloys. *5.* Explain health risks related to welding and joint preparation of aluminum alloys and how to prevent them.	**8**	**16**	**0.5**
Weldability and welding techniques • Weldability of aluminum heat input, preheating • Post weld treatment • Welding processes, TIG and MIG • Handling of aluminum in the workshop • Survey of specific imperfections and their cause (porosity, hot cracking, lack of fusion).	1. Outline the essentials of weldability of aluminum alloys, heat input, preheating, post weld treatment 2. Compare welding processes TIG and MIG 3. Describe the correct handling of aluminum alloy material in workshop 4. Identify the imperfections characteristic to aluminum and explain how to avoid them. 5. Outline typical problems when welding aluminum alloys.			

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Welding consumables for aluminum alloys • Filler metals for aluminum, standards, consumable manufacturers recommendations • Shielding gases for aluminum welding, standard, consumable manufacturers recommendations • Handling of welding consumables • Consumables selection based on required properties of the weld (strength, weldability, corrosion properties and anodizing properties.)	1. Identify the main types and classification of welding consumables regarding aluminum alloys 2. Compare the two types of welding consumables – Al-Si and Al-Mg.			
Welding joints and distortion in aluminum alloys • Welding joints for aluminum alloys • Methods of joint preparation in aluminum alloys • Cleaning before welding • Distortion caused by welding aluminum alloys compared to steel	1. Outline the commonly used welding joints and the methods of joint preparation regarding aluminum alloys 2. List methods to avoid distortion of aluminum alloys caused by welding			

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Welders´ qualification: ISO 9606-2 • Welders´ qualification	1. Explain different types of test pieces and welding conditions 2. Interpret the qualification certificate: essential variables and range of qualification 3. Explain confirmation of the validity and prolongation of qualification 4. Interpret the WPS			

Competence Unit – M5 WELDING APPLICATION AND QUALITY

KNOWLEDGE He/she will have factual knowledge about	**SKILLS** He/she will be able to	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
QUALIFICATION OF WELDERS: ISO 9606-1 • Objectives of qualification tests • Interpretation of WPSs • Welders qualification standard (ISO 9606) • Essential variables; range of qualification; validity; test pieces and assessment of the welder.	1. Explain different types of test pieces and welding conditions 2. Interpret the qualification certificate: essential variables and range of qualification 3. Explain confirmation of the validity and prolongation of qualification 4. Interpret the WPS	**15**	**30**	**1**
SHRINKAGE, RESIDUAL STRESS, DISTORTION • The thermal cycle in welding • Development of residual stresses due to solidification, cooling and shrinkage • Effects of restraint on residual stress • Significance of residual stress • Preheating, post heating • Relationship between heat input and shrinkage, residual stress and distortion. • Development of distortion; effect of heat input, weld size, penetration, and number of runs single and double-sided fillet welded joints and in plate welds. • Corrective measures, procedure, welding technique, sequence, joint preparation, pre-setting • Correction of distortion after welding	1. Describe the thermal cycle during welding. 2. Describe distortion resulting from shrinkage. 3. Describe residual stresses. 4. Name measures to minimize distortion. 5. Describe the main causes for weld shrinkage. 6. Outline the main effects on a weld due to residual stresses.			

<table>
<tr><th>KNOWLEDGE
He/she will have factual knowledge about</th><th>SKILLS
He/she will be able to</th><th>CONTACT HOURS (teaching hours)</th><th>WORKLOAD (including study)</th><th>ECVET POINTS</th></tr>
<tr><td>WELD IMPERFECTIONS
• Origin of imperfections: parent metal; welding process; welder; joint preparation
• Survey of specific weld imperfections and their cause
• Influence of weld imperfections on product performance
• Influence of the weld geometry on the fatigue life of the product</td><td>1. Identify different types of weld imperfections in ISO 6520-1.
2. Describe the cause of the most common weld imperfections such as cracks, gas inclusions, solid inclusions, incomplete penetration and lack of fusion, geometrical imperfections and other imperfections.</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>INSPECTION AND TESTING
• Review of weld imperfections (ISO 6520-1)
• Review of quality levels (ISO 5817)
• Checking dimensions, surface and distortion
• Surface inspection of cracks and other surface imperfections by visual testing (VT), penetrant testing (PT) and magnetic particle testing (MT)
• Detectability of internal imperfections of welds by radiographic testing (RT) and ultrasonic testing (UT)
• Destructive tests to measure mechanical properties of weld</td><td>1. Perform simple visual inspection of welds according to ISO 17637 and subsequently evaluate to ISO 5817 (for aluminum ISO 10042).
2. Explain the following destructive and non-destructive methods: bend tests, hardness tests, tensile tests and impact tests, VT, MT, PT, RT and UT.</td></tr>
</table>

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
QUALITY ASSURANCE IN WELDING • Role of inspection and Quality control • Key role of welders in assuring weld Quality • Key role of inspection and NDT in identifying potentially dangerous weld defects • Introduction of ISO 3834: Quality Requirements for Welding • Introduction of ISO 14731: Welding Co-ordination and relationship to IIW qualifications	1. Explain the concept of quality assurance (ISO 3834). 2. Explain the connection of ISO 3834 with the standards for welding personnel and welding procedures.			
REVIEW AND CONSEQUENCES OF FAILURE • Revision of safety requirements of welded products • Review of product failures due to bad performance of welding • Implication of failure; product liability	1. Exemplify failures and their consequences. 2. Define the key role of the welder in avoiding failures			

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
INTERNATIONAL WELDING STANDARDS • Role and operation of CEN and ISO; relationship with National Standards Organizations • Standards for welding equipment and welding consumables • Standards for welding practice • Product Standards which contain welding requirements • Standards for Quality and Co-ordination in welding	1. Name the most important International and national standards for welding.			
WELDING PRACTICE 2 • Introduction to weld imperfections, ISO 5817. • The control of welding parameters. • The effect of welding parameters on weld geometry. • The effect of magnetic arc blow • Visual inspection.	1. Describe the influence of the welding parameters on the weld geometry. 2. Describe the effect of incorrect welding parameters. 3. Perform visual inspection on a fillet weld and subsequently evaluate to ISO 5817. 4. Explain the principle of magnetic arc blow. 5. Describe methods how to avoid magnetic arc blow.			

Competence Unit – M6 – Health and Safety

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
HEALTH AND SAFETY • Electric shock • UV- and heat radiation • Eye hazards • Burns and fires, fire prevention, fire fighting • Welding fumes • Respiratory hazards • Personal protective equipment and clothing • Noise hazards • Specific rules and regulations	1. Identify dangerous situations in relation to electricity, humidity, DC and AC. 2. Identify the health risks of welding fumes. 3. Recognize the signals for escape routes. 4. Name adequate means of personal protection. 5. List measures to be taken to prevent fire. 6. List measures to prevent noise hazards. 7. Summarize the specific rules and regulations for health and safety.	**6**	**12**	**0,5**
SAFE WORKING IN THE FABRICATION WORKSHOP: • dust • heavy and hot material, • electrical cables • Ventilation • Fumes disposal • Escape procedures • Welding in confined spaces • Build-up of pollutants • Risk of explosion • Enrichment of gases • Handling gas cylinders	1. Identify the general hazards in a fabrication shop. 2. Explain the need for ventilation. 3. Identify the risk of explosions. 4. Explain safe handling of gas cylinders.			

KNOWLEDGE He/she will have factual knowledge about	**SKILLS** He/she will be able to	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
ON SITE WORKING: • Gantry systems • Fixed staging • Grounding conditions • Weather condition • Earthing conditions	1. Identify the hazards for welding when working on site. 2. Name basic precautions to be taken.			

Competence Unit - M7 PREPARATION FOR WELDING

KNOWLEDGE He/she will have factual knowledge about	**SKILLS** He/she will be able to	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Methods of preparation for welding Suitable cutting processes for different types of steel to achieve a suitable cutting surface. Flame cutting: principles and parameters, cutting blow pipes, cutting machines; quality of cut surfaces (e.g. ISO 9013). Arc gouging and gas gouging principles Other cutting processes as: plasma, laser, mechanical cutting	1. Outline methods used for joint preparation and their specific application. 2. Explain essential parameters and results of thermal cutting (plasma and flame cutting). 3. Select suitable cutting and gouging processes for the main types of steel.			
Welded joints in plates Types of welds: plate and fillet Types of joints: plate, "T", lap and corner (EN 12345, ISO 17659) Characteristics of fillet welds; leg length, throat thickness, penetration, number of runs, surface finish Characteristics of plate welds; types of joint preparation; single and multi-run welds; excess weld metal; weld profile, penetration, surface finish, permanent and temporary backing Examples	1. Identify different types of welds and joints (plate weld, fillet weld, plate joint, T-joint, lap joint and corner joint). 2. Identify characteristics of welds such as throat thickness, leg length, penetration, and number of runs. 3. Identify single- and multi-run welds, excess weld metal, weld profile. 4. Name different types of joint preparations and their main dimensions.	**15**	**30**	**1**
Welded joints in pipes Plate welds in pipes; in-line and at an angle; the importance of gas backing Tube to plate welds Branch connections (set-on, set-in and set-through) Adaptation of joint preparation methods for pipes	1. Identify the following joint preparations: I-, V-, X-, and U-preparations. 2. Identify and draft tube to plate welds, branch connections. 3. Describe the different methods for joint preparation of pipes.			

7.1 to 7.3					
KNOWLEDGE He/she will have factual knowledge about	**SKILLS** He/she will be able to	**Specific Process**	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Preparation for welding Safety at work in the production plant. Working environment for a safe and quality work using a welding process. Choosing the tools, equipment, base, filler and auxiliary metals for welding based on demands from technical and technological documentation. Choosing the corresponding protective and work equipment and means for working in a safe manner. Identification of demands from technical and technological documentation for a welding process, especially the WPS. Weld preparation and cleaning of the welding surface. Preparation of equipment for pre-heating if necessary. Setting the defined welding parameters on the welding machine.	1. Prepare the work place 2. Prepare the operative work for welding	***M7.1 – MMA Welding***	**8**	**16**	**0,5**
		M7.2 - MIG / MAG Welding	**8**	**16**	**0,5**
		M7.3 - TIG Welding	**8**	**16**	**0,5**

Competence Unit M8 – MMA Welding for Ferritic steels: Carbon and Low Alloy steel

KNOWLEDGE He/she will have factual knowledge about	**Transversal SKILLS** He/she will be able to	**Specific SKIILS**	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Covered knowledge is addressed in modules M1 to M7.1	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)	Specified in table M 8.1	**90**	**180**	**7**
		Specified in table M 8.2	**50**	**100**	**4**
		Specified in table M 8.3	**75**	**150**	**6**
		Specified in table M 8.4	**75**	**150**	**6**

Competence Unit M9 – MMA Welding for Stainless Steels

KNOWLEDGE He/she will have factual knowledge about	**Transversal SKILLS** He/she will be able to	**Specific SKIILS**	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Covered knowledge is addressed in modules M1 to M7.1	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.)	Specified in table M 9.1	**90**	**180**	**7**
	3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control	Specified in table M 9.2	**50**	**100**	**4**
	5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding.	Specified in table M 9.3	**75**	**150**	**6**
	7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (electrode holder, cables, etc...)	Specified in table M 9.4	**75**	**150**	**6**

Competence Unit M10 – MAG Welding for Ferritic steels: Carbon and Low Alloy steel

KNOWLEDGE He/she will have factual knowledge about	**Transversal SKILLS** He/she will be able to	**Specific SKIILS**	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Covered knowledge is addressed in modules M1 to M7.1	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)	Specified in table M 10.1	**90**	**180**	**7**
		Specified in table M 10.2	**90**	**180**	**7**
		Specified in table M 10.3	**75**	**150**	**6**
		Specified in table M 10.4	**75**	**150**	**6**

Competence Unit M11 – MAG Welding for Stainless steels:

KNOWLEDGE He/she will have factual knowledge about	Transversal SKILLS He/she will be able to	Specific SKIILS	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Covered knowledge is addressed in modules M1 to M7.2	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)	**Specified in table M 11.1**	**90**	**180**	**7**
		Specified in table M 11.2	**90**	**180**	**7**
		Specified in table M 11.3	**75**	**150**	**6**
		Specified in table M 11.4	**75**	**150**	**6**

Competence Unit M13 – FCAW for Ferritic steels: Carbon and low alloy steel

KNOWLEDGE He/she will have factual knowledge about	**Transversal SKILLS** He/she will be able to	**Specific SKIILS**	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Covered knowledge is addressed in modules M1 to M7+M7.2	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)	**Specified in table M 13.1**	**90**	**180**	**7**
		Specified in table M 13.2	**90**	**180**	**7**
		Specified in table M 13.3	**75**	**150**	**6**
		Specified in table M 13.4	**75**	**150**	**6**

Competence Unit M14 – FCAW for Stainless steel

KNOWLEDGE He/she will have factual knowledge about	**Transversal SKILLS** He/she will be able to	**Specific SKILLS**	**CONTACT HOURS (teaching hours)**	**WORKLOAD (including study)**	**ECVET POINTS**
Covered knowledge is addressed in modules M1 to M7+M7.2	1. Adjust the welding parameters according to the WPS. 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make plate welds in different types of joints in single and multi-run technique. (according to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform root face and gap preparation with grinding tools 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)	**Specified in table M 14.1**	**90**	**180**	**7**
		Specified in table M 14.2	**90**	**180**	**7**
		Specified in table M 14.3	**75**	**150**	**6**
		Specified in table M 14.4	**75**	**150**	**6**

***Competence Unit M15* – TIG Welding for Ferritic steels: Carbon and Low Alloy steel**

KNOWLEDGE He/she will have factual knowledge about	Transversal SKILLS He/she will be able to	Specific SKIILS	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Covered knowledge is addressed in modules M1 to M7 + M7.3	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)	**Specified in table M 15.1**	**50**	**100**	**7**
		Specified in table M 15.2	**50**	**100**	**7**
		Specified in table M 15.3	**50**	**100**	**6**
		Specified in table M 15.4	**50**	**100**	**6**

***Competence Unit M16* – TIG Welding for Stainless steels**

KNOWLEDGE He/she will have factual knowledge about	Transversal SKILLS He/she will be able to	Specific SKIILS	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Covered knowledge is addressed in modules M1 to M7 + M7.3	1. Adjust the welding parameters according to the WPS 2. Apply instructions from WPS (joint preparation, welding sequence, pre-heating, etc.) 3. Make welds in different types of joints in single and multi-run technique. (According to the table below) 4. Visually inspect his/her own work and take appropriate action resulting from that inspection and deal with problems within his/her control 5. Perform preparation with grinding tools. 6. Analyze mistakes done during welding. 7. Correct the mistakes (welding technique or imperfection). 8. Maintain the welding equipment (welding torch, cables, etc...)	**Specified in table M 16.1**	**50**	**100**	**4**
		Specified in table M 16.2	**50**	**100**	**4**
		Specified in table M 16.3	**50**	**100**	**4**
		Specified in table M 16.4	**50**	**100**	**4**

Competence Unit M18– Aerobic training

KNOWLEDGE He/she will have factual knowledge about	SKILLS He/she will be able to	CONTACT HOURS (teaching hours)	WORKLOAD (including study)	ECVET POINTS
Physical training	1. Differentiate between and apply the basics in techniques for different motor activities 2. Demonstrate complex structure of the chosen motor activity 3. Apply elements of technique in complex structures of the chosen motor activity 4. Differentiate between specific (kinesio therapeutic) exercises that are carried out 5. Adjust the exercises to the health condition and according to the endangered state of the movement system in order to prevent occupational injury *6.* Repeat the assigned dynamic and rhythmic movements	**25**	**50**	**2**
My body and I	1. Identify the level of physical fitness and takes responsibility for its improvement 2. Exercise regularly in order to improve the level of fitness 3. 3. Perform the chosen exercise complexes 4. Question the impacts of carried out exercise complexes on work ability 5. Adjust the manner of exercising to cognitions	**12**	**24**	**1**
Healthy living	1. Recognize the influence of eating habits on health 2. Plan and carry out physical training for health preservation purposes 3. Carry out physical training outside/in nature 4. Coordinate physical training with work obligations *5.* Carry out different types of recreational motor activities	**12**	**24**	**1**

5. Document references

5.1. Reference numbers

2016-1-HR01-KA202-022187 – OSAW3

5.2. Members of work groups who participated in creation of Occupational standard

Heliana Gaspar Bibas, Goran Burazer, Aránzazu Casero Perpiñá, Pietro Connsoni, Dominik Gjuretek, Daniela Grüter, Jorge J. Huete Chugunowa, Željko Habek, Anja König, Marlena Lakić, Mario Lovrić, Edita Margeta, Giuseppe Mastrangelo, Dinis Garcia Nunes, Juan Vicente Rosell González, Mariano Santoro, Mirta Szügyi, Robert Vidas.

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