BET Project

D3.1 EN1090 Course Syllabus with Work-Based Learning

EQF 5-6

Version 0.9

The “High-FivE” EN1090 Course Syllabus

This syllabus describes and provides an overview of the work-based learning cycles and breaks them down into five work-based instruction phases or domains:

Engage, Explore, Explain, Elaborate and Evaluate (FivE)

These **FivE** pedagogical model domains are key elements of a complete model for industry engaged delivery of work-based learning within Vocational Education and Training (VET) programs, to be provided to mechanical fabrication industry in Europe.

In some lessons, teachers and instructors will naturally apply and switch between several domains in response to industry fabrication companies and their staff’s needs, as well as the learning program requirements. In other training activities, they will move through all five domains.

The proposed integration of repeated work-based learning cycles respects this kind of flexibility. They are not designed to become templates for linear or prescriptive lessons plans in a classroom. The new training model with subsequent learning activities, brings flexible training paths into VET by integrating work-based learning activities that are successfully merging theory with practice.

It creates a **“High-FivE”** line of sight between traditional classroom VET practices, and the new, flexible VET training paths delivered on a “pick and mix” basis.

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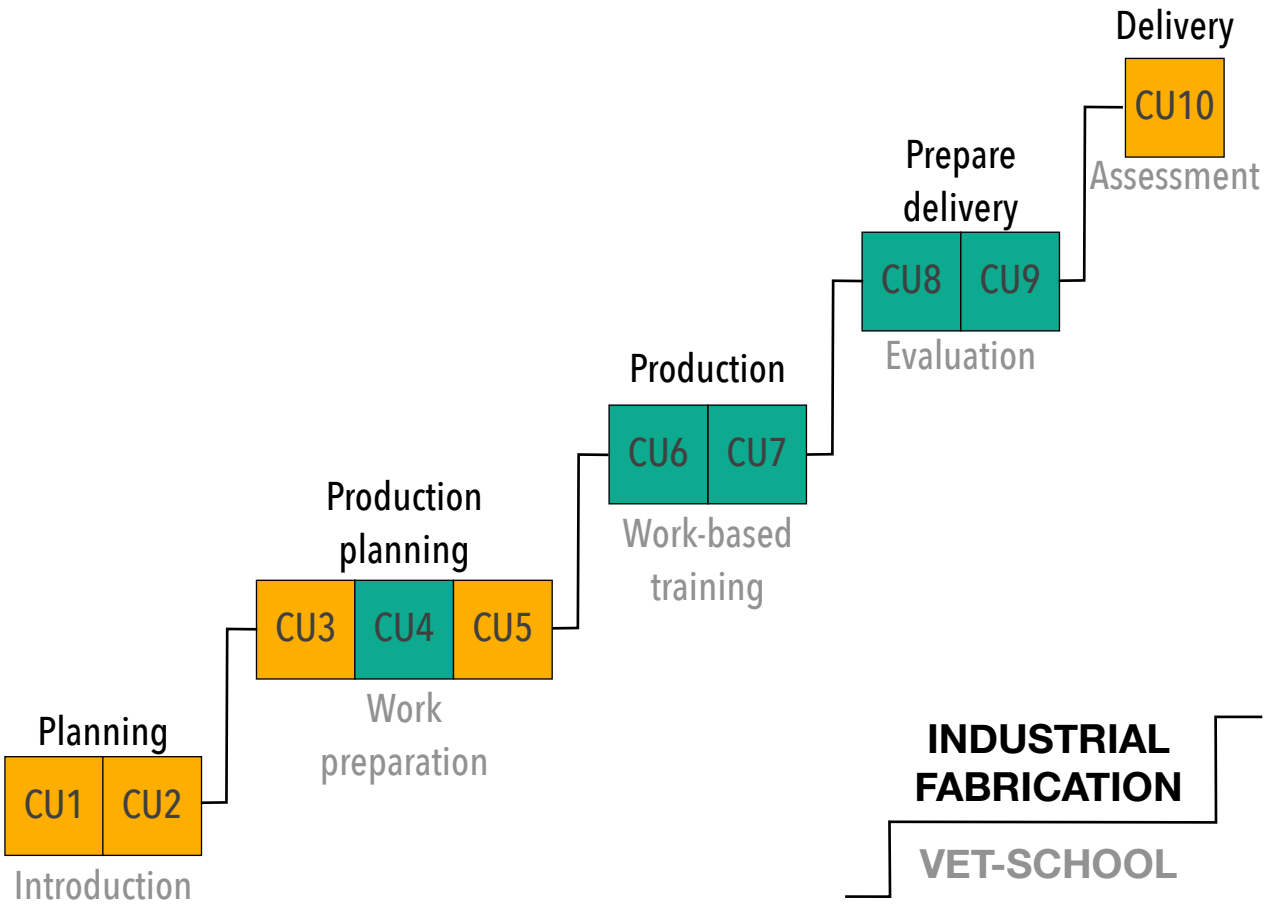


The EN1090 Course is structured in 10 **Competence Units** (CUs). 5 of the CUs (blue boxes) apply work-based learning where the training follows the fabrication process of a product. Each CU targets various stages in the fabrication process.

The descriptions of this frameworks (front page) should be done at ***course level*** and at the ***competence unit levels***. This innovative and flexible training solution methodology demonstrates how VET schools may apply standards to set up, establish and deliver blended learning solutions that better respond to industry demands. The CUs should be structured and delivered according to the industry needs, whereby the CUs follows the fabrication industry requirements for specific methods, processes and materials.

- CU1 - Introduction and ICT
- CU2 - Evaluating an Inquiry
- CU3 - Design Review
- CU4 - Documentation and Production Plan
- CU5 - Greener Economics in Welding and Cutting Inspection
- CU6 - Non Destructive Testing (NDT) Inspection
- CU7 - Mechanical Fastening and Erection of the Structure
- CU8 - Surface Protection and Dimensional Control
- CU9 - Dimensional Control and Delivery Documentation
- CU10 - Summary and Examination

EN1090 Inspector Course Level

Course Content

The course clarifies the inspector's role during manufacturing. It begins well before the welding processes starts, continues during the welding operation, involves action after welding is completed, and is finalized when the results have been properly reported.

The course applies work-based training and follows the manufacturing process from the order is received until the welded product is ready for delivery. The inspector is responsible for producing the documentation that secures traceability of the components and related manufacturing actions during this process.

General Learning Outcomes

- Be able to explain the role and responsibilities of welding inspector's job function in manufacturing of welded components.
- Identify the main aspects regarding the inspector's attitude and code of ethics.
- Understand the basic project planning techniques and how they are applied to inspection activities.
- Understand and describe the main differences between quality assurance, quality control and systems for inspection.
- Be capable of applying, follow up and supervise the implementation of quality control procedures.
- Know the key factors related to personnel and equipment and their influence on the quality of a welded construction.
- Ability to recognize and evaluate WPS/WPQR for welded components and their relations.
- Understand the purpose of visual inspection and the usage and limitations of visual inspection tools.
- To develop a traceability scheme for a welded product.
- Identify the role of the Production Coordinator and the responsibilities of the coordinator
- To develop a SPC (Statistical Production Control) system for the company.
- Identify the role of the Production Coordinator and the responsibility of the coordinator.

Specific Learning Outcomes

- Manage to create inspection procedures, including reviewing and assessing inspections reports.
- Learn how to develop inspection plans for a welded product.
- Develop a traceability plan for all relevant inspection documents.
- Carry out inspection before, during and after welding.
- Estimate inspections costs and the other requirements for resource during the producing a welded product.
- Understand and interpret the international and European standards and directives, for fabrication of welded products.
- Learn how to define none-conformances and corrective actions
- Create skills update plans for inspection personnel.

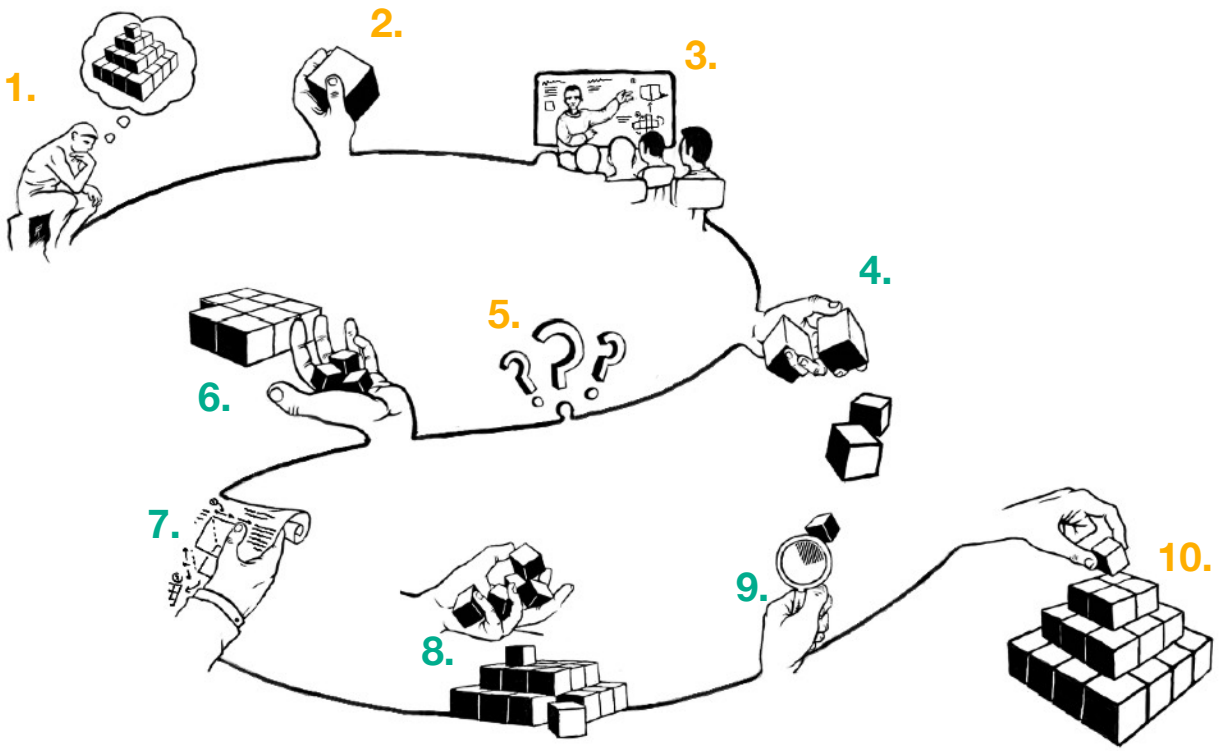
General Competence

After completing the course, the student will get an advanced *knowledge and competence* of welding and inspection theory, and how to implement inspection processes at the practical levels.

This will enable the skilled worker to carry out the following tasks:

- Develop, comment and review Quality Control Plans and Inspection and Testing Plans based up on product standards, codes, specifications, drawings and regulatory requirements.
- Verify the compliance of WPQRs and WPSs, including welder qualifications and approvals against the applied standards, codes and specifications for conventional manufacturing applications
- Take decisions related to acceptance of quality documents related to manufacturing of welded products.
- Take decisions based on quality documents according to the requirements defined for the product.
- Verify product documentation according to company and requirements in the contract.
- Establish non-conformance documentation and specify corrective actions.

Product ORIENTED Learning
for inspection **Methodology**



A customer specifies a product and delivers it to the class as an order when the course begins. The product must be produced, inspected and delivered to the customer within the deadline in the order, with documented quality. The students inspect the quality of the various components according to the specifications in the order. The customer checks if the quality is according to the specifications in the order, before they receive it.

The training follows the industrial production process. Theoretical knowledge is immediately transferred into work-based learning. The students must actively evaluate and figure out how to inspect and check the various components, before they are joined together into a final product. This includes learning new theory. The training method combines cases, modern teaching tools and interactive learning services that highlight, demonstrate and initiate discussions among the students.

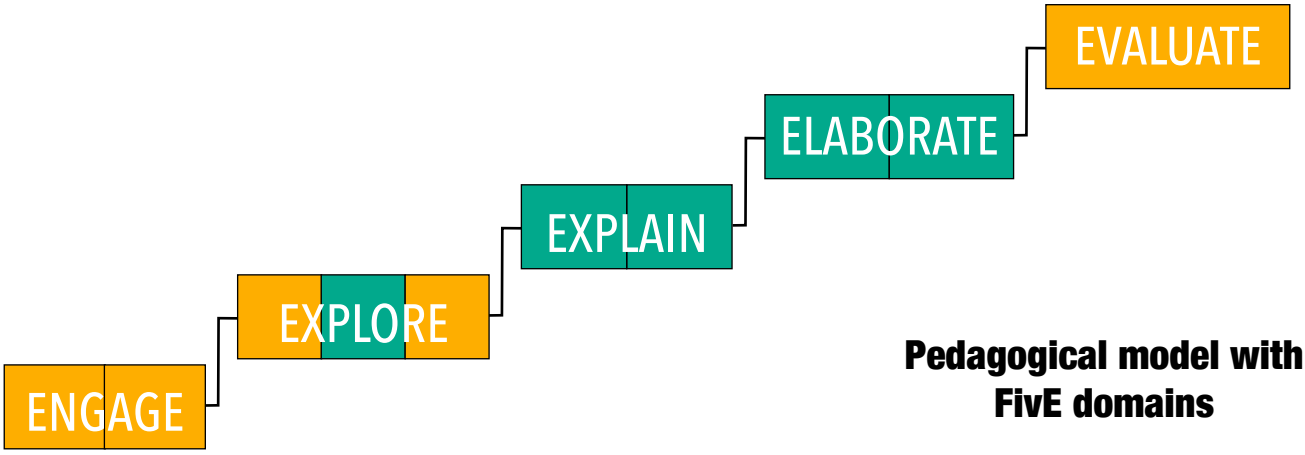
THE COURSE

The EN1090 Inspector course aims to boost provision of new skills and address skills mismatches by designing new curricula that is applying an innovative design. The proposed syllabus may be applied in classroom-based training with e-learning support, or in e-learning based training or in a blended learning framework mixing classroom-based training together with student active learning. The training and learning methods include applying for instance recognition of students prior learning, e-learning systems and video tools for effective collaboration and communication across distances.

The students' digital skills, which are increasingly important in all job profiles across the entire labor market, are going to be developed and enhanced by applying modern ICT tools and services. This includes Learning Management Systems (LMS) for planning, collaboration and communication, mobile devices for documentation and reporting purposes, and subject specific software tools. Europe's transition to a greener economy will be supported and underpinned through the changes in the qualifications and the new training curricula, addressing professional needs for developing new green skills and new manufacturing processes that improve and enhance sustainable production.

The 2030 Agenda for Sustainable development, adopted by all United Nation Member States, contains 17 sustainable development goals, that are urgent calls for action by all countries in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth, all while tackling climate changes and working to preserve our oceans and forests. The EN1090 Inspector course targets quality education (goal 4) and industry, innovation and infrastructure (goal 11). Applying process-oriented training, will achieve this by focusing on increasing the capacity and competence of the students' skills related to stimulation of a greener profile for the industrial product development.

Prior to the course(s) the vocational education and training (VET) school establishes a school-industry partnership together with the company. This includes developing a plan for the industry practical training needs. The training is delivered as problem-based learning, where an external customer delivers a set of drawings to the class and asks them whether they can deliver a product based on the specifications.



Pedagogical model with FivE domains

ENGAGE

CU 1 Introduction and ICT

Introducing an innovative, participatory approach for provision of an attractive EN1090 inspector specialists attractive VET program that apply a range of new digital tools, services, methodologies and processes for recognition of prior learning. A modern, dynamic, committed, and professional learning environment where the training follows the industrial production process by letting a customer specify a product and deliver it to the class when the course start up. The students must at start-up actively engage, propose and figure out how to inspect and check the various sub-production processes and components before they later are going to be joined together into a final product, thus integrating good inspection practices and new methods, including digital capabilities leading to new digital skills, into their daily activities. Students from different organizations will together in groups engage, investigate, and propose solutions to the external order, thus opening for capturing new synergies together with organizations active in different fields or in other socio-economic sectors. This participatory approach help securing strategic planning of professional development for staff in line with individual needs and organizational objectives.

The new digital skills include how to use, apply, communicate, and collaborate by applying a professional Learning Management System. This includes for instance how to apply the calendar function, how to use the digital library and use their own mobile phones for documentation of results. Thus, the ambition is to let this unit foster new, innovative, and multidisciplinary approaches to teaching and learning, including linking this to the European as well as UN goals for more sustainable production within industry.

CU 2 Evaluating an Inquiry

An inquiry has arrived from a possible customer. The company must investigate various aspects of the inquiry, especially if it represents a new type of product. A group of people from the company is engaged to explore and investigate the manufacturing tasks that must be done and the consequences of submitting a bid to get a new order. This group investigates if the inquiry contains a complete documentation, if any information is missing and which parts of the EN1090 and the CPR directive that must be applied.

The company cannot at this stage in the process, however, invest too many resources since they haven't received a formal order with a contract. They would ask some general questions like:

- What type of personnel are needed?
- Will a possible order require that the company hire new personnel, and will it affect the gender equality?
- What responsibilities will they have if the inquiry ends up in an order?
- How will a preliminary quality plan for such an order look like?
- Which types and amounts of resources will it require?

EXPLORE

CU 3 Design Review

The order has been granted and the contract is signed. An in-depth design review is carried out to explore and explain to the various categories of staff in the production chain the requirements and consequences of the order. It is at this stage important to receive internal feedback and comments from the fabrication staff that is related to the design of the product and the specifications in the order. This combined explanation and internal feedback process may end up in a possible design review report and a request for change in the order due to for instance technical issues, saving of manufacturing costs, make the production process greener, etc.

It is important before the manufacturing process starts, to explain and clarify for the fabrication staff the main differences between quality control, quality assurance and inspection. This helps securing a smooth fabrication process. The relevant parts of the EN1090 and the CPR directive with the associated standards, must be clearly explained for the fabrication staff such they can deliver their tasks with sufficient quality during the following production process.

CU 4 Documentation and Production Plan

A manufactured product that is produced according to the requirements in the EN1090 and the CPR directive with associated standards, must include documentation that proves that it satisfies the EU regulations and requirements. However, this need for developing and delivering detailed, up to date documentation must be explored and explained to all the fabrication staff in the production chain. They must accept why and how this must be organized and done. The documentation must be gathered and delivered «on-the-fly» when they have the production data accessible. A comprehensive documentation plan for *Production, Inspection and Testing* must be developed and delivered together with the detailed report templates.

This CU explains how important it is to apply a planned and structured approach for gathering and assembling this documentation in parallel with the production process. Lack of correct documentation often led to serious economic consequences, e.g. repair costs, if disagreements with the customer occur at a later stage.

CU 5 Greener Economics in Welding and Cutting Inspection

Many companies will follow their traditions and accumulated experience when they start the fabrication process. However, the competition in the market is fierce, whereby the profit at the economic bottom line of an order may be small.

A greener production may today give a manufacturing company competitive benefit in the EU market. Thus, the external demands and requirements from the society and EU related to a greener industry and improved sustainable production, must be explained to the fabrication staff that take part in the manufacturing process. Possible alternatives for the production process must be evaluated to reduce energy costs, reduce the CO2 footprint, reduce pollution, etc. These factors must be explored, evaluated, and explained to the fabrication staff to fully raise their awareness for these topics. The life cycle costs must be evaluated and the consequences and costs for each production series with its associated inspection process, must be discussed.

EXPLAIN

CU 6 Non Destructive Testing (NDT) Inspection

Production failures or defects could always randomly occur at any step during a manufacturing process. The inspection process must be designed and organized to reduce the effects of these failures and defects during the industrial production process. To better understand and explain why and how this happens is crucial. The inspection process must

- Enable the fabrication staff to carry out corrective actions before the produced components enter the next stage of the manufacturing process
- Analyze what can be done to avoid a similar failure.

The later a manufacturing defect is detected, the more expensive it will be to correct it. It is important to apply various types of inspection methods in the workshop, both those that are theoretical and those that are practical. A production failure or defect may indeed be corrected by training or re-training of the fabrication staff. Hand-on training processes are recommended to get the most appropriate or correct understanding of the applied manufacturing methods. Their advantages and disadvantages must be understood and explained, including where, when, and how to use the various types of inspection methods. If welding is an important activity during a fabrication process, the ISO 6520 standard and its definition of failures and defects, will be an important reference standard.

CU 7 Mechanical Fastening and Erection of the Structure

Erection of the structure requires both mechanical fastenings and welding of components. Misalignments often occur and it is important to understand the the consequences of those, and how to avoid or correct them. Destructive testing procedures are carried out to investigate when a component breaks down. Destructive testing methods will often be carried out by an accredited third-party independent inspection company. Destructive testing requirements includes applying fracture- and mechanical testing, as well as aggressive environmental or corrosion testing.

It is important to explain and know when and where to carry out these tests, to better understand their impact for the fabrication- and manufacturing processes. Fabrication staff should know the principles for each testing method, understanding their usage, advantages, and disadvantages.

ELABORATE

CU 8 Surface Protection and Dimensional Control

Surface protection and treatment covers a wide range of technologies which must be explained to and elaborated by the fabrication staff. Surface protection could be used a temporary protection or as a final protection of individual components of a final assembled product. Unfortunately, the surface protection often causes problems for a fabrication process. For instance, the thickness of the zinc coating on plates that is cut and welded together must be elaborated by the fabrication staff. Other types of surface protection material may give serious consequences for the environment and for the fabrication staff in the factory.

Dimensional control is always important in fabrication of assembled metal products. The drawings which is part of the order, will contain information for dimensional control and the required tolerances for the final product. The fabrication staff must use this information to elaborate various control methods, knowing their advantages and disadvantages as well as their environmental effects and requirements.

CU 9 Dimensional Control and Delivery Documentation

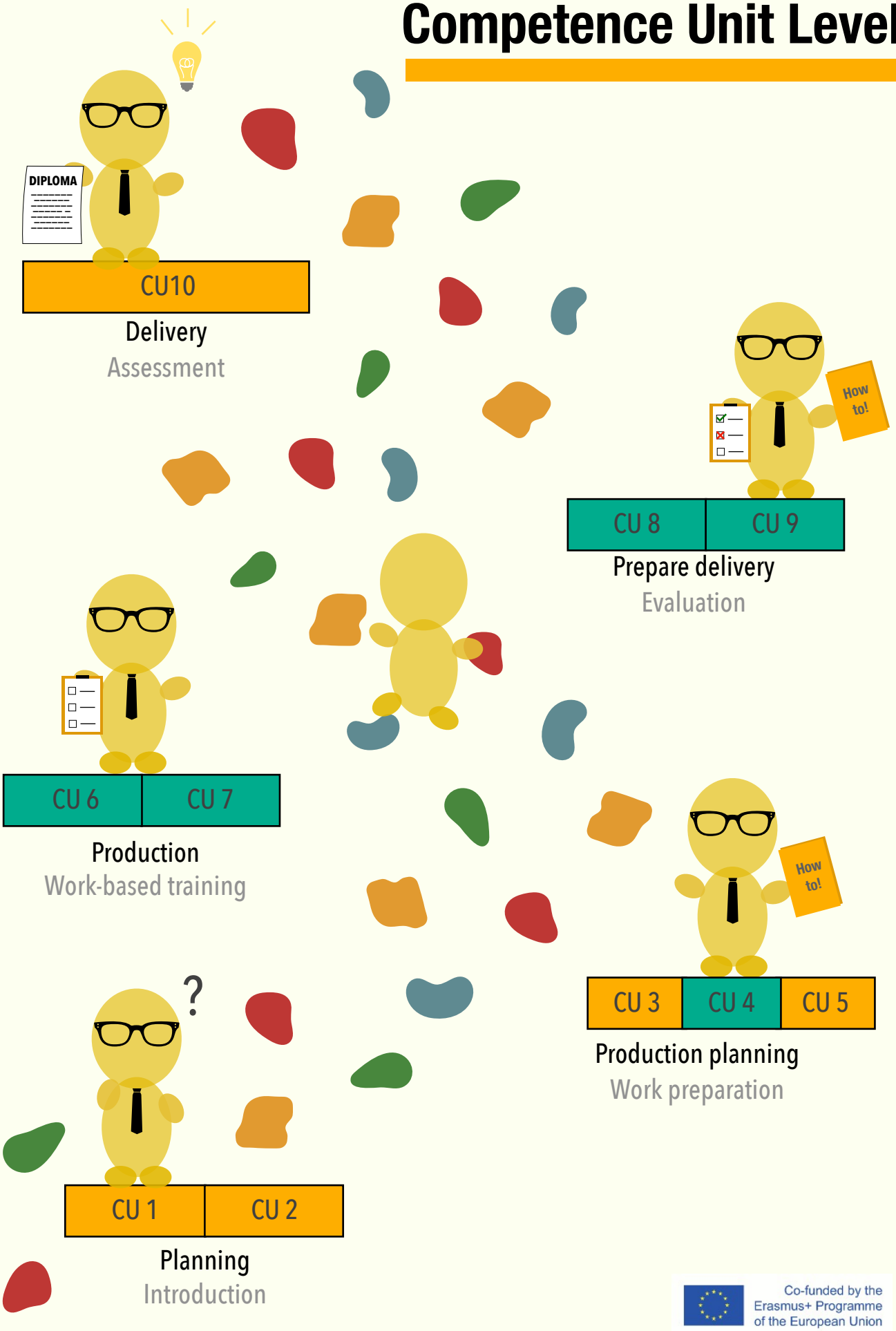
Before a product is delivered to a customer, the fabricator must elaborate and document that all the specifications and tolerances are met and the requirements for quality are fulfilled. However, this can be done in various ways. The inspection may be done before delivery or through a thorough elaboration of the Product Documentation Record Book, which is containing all the quality related documents. It may also be a combination of both. The Pre Delivery Inspection summarizes the findings in a Pre Delivery Inspection (PDI) checklist, which has been developed at an earlier stage during the production. This PDI could in addition act as a product delivery acceptance list. If any errors, defects or failures occur later, these documents will be essential for solving disputes. The data set may be generated through a Statistical Production System (SPS) that is implemented in the company.

EVALUATE

CU 10 Summary and Examination

The evaluation of the product and the product documentation has been completed. The product is ready for delivery. Signing a PDI, or signing an acceptance document or acceptance test, defines the acceptance of the product by the customer and transfer of the final payment. If any non-conformances occur, a report should be developed, and the customer and the producer must agree up on corrective actions. The consequences of a possible recall of the product will be evaluated to highlight the importance of doing the fabrication process correctly. This CU covers the summary and wrap up of the course itself. By delivering an accepted product to the customer, the students have obtained the necessary competence to work as an Inspector.

Competence Unit Levels



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CU 1 - Introduction and ICT

General Content

To learn how to use a Learning Management System (LMS) and a videoconferencing tool. Integration of these tools into work-based learning.

This CU will be part of Step 1 (Planning) in the fabrication cycle for work-based learning in the company.

General Learning Outcomes

- Pressure equipment directive (PED), Simple Pressure Vessels Directive (SPVD) and other directives specified in the list of learning materials.
- Learn how to navigate through the available welding standards and select the correct standard for a task.
- Get an overview of European harmonized product standards, typical structures, requirements and usage that comply with the directives.
- Learn how to evaluate risks associated with accepting new product orders in a company.
- Compliance to the European directives applying both non-harmonized and harmonized standards.

Specific Learning Outcomes

- Know the structure of European directives with regards to essential safety requirements, and their relation to welding fabrication.
- Identify classes of requirements within welding product fabrication.
- Identify and specify the role and tasks of the welding inspector.
- Develop procedures required for compliance with the European directives.
- Apply governing standard requirements to the fabrication of welded products.
- Interpret the harmonized standard requirements to comply with European directives.
- Identify the role of the Production Coordinator.

General Competence

The student will know how to apply data tools needed in e-learning sessions and use a LMS in their theoretical- as well as work-based VET. This includes submitting their replies and answers to tasks, exercises and solving multiple choice questions. They shall know how to collaborate together in groups supported by usage of modern data tools that are applied during the course. This includes communicating with the instructor and the other students by using modern video communication systems.

CU 2 - Evaluating an Inquiry

General Content

An inquiry has arrived from the company and an offer is being developed. This inquiry is documented through the drawings and specification as a part of the learning material. The students will now be in the position to follow this inquiry through its steps through the company as it materializes into a product to be delivered. The key topic is Management of Inspection and an evaluation of your resources and, if needed, how to update your resources. Additionally, a verification of the drawings and its content must be used in order to verify if they are correct.

This CU will be part of Step 1 (Planning) in the production cycle for work-based learning in the company. The company's own drawings can be applied here. A student may apply the company's own drawings during the work-based training.

General Learning Outcomes

- To understand the responsibilities associated with inspection activities as they relate to staff, company/organization and record generation, retention and archiving.
- To understand the responsibilities and requirements in the company based on EN1090 and CPR.
- To be able to understand and to develop a quality plan for the inquiry given in CU 1.
- To recognize the importance of accurate records and monitoring of activities with respect to the inspection process.
- To be able to develop a client feedback loop/routines for communication with client.

Specific Learning Outcomes

- Design an inspection plan for the product that was defined in CU 1 product that covers the manufacturing processes in all fabrication steps.
- Review the Welding-symbols-and-drawings.
- Know the differences in welding symbols between ISO and ASME.
- Define the execution classes according EN1090.
- Design feedback procedures to the client.

General Competence

The student will be able to:

- Evaluate product drawings and drawing symbols.
- Evaluate the inspection requirements.
- Be able to evaluate the resources needed for the job.
- Be able to evaluate execution classes for the job.
- Be able to define an inspection plan and inspection resources.

CU 3 - Design Review

General Content

The students carry out a design review process and develop a quality plan for the order and product. They learn how to develop procedures for the inspection activities and to verify the design from an inspection point of view.

The students learn the key quality assurance principles to be applied when receiving an order. They learn how to create a deviation report for the findings during the design review process.

This CU will be part of Step 2 (Production planning) in the production cycle for work-based learning in the company.

General Learning Outcomes

- To describe the main differences between quality assurance, quality control and inspection systems and their usage for welded manufacturing.
- Be capable to apply, follow, supervise the quality control procedures and their implementation.
- Be capable to interpret and select appropriate part in EN 1090 and the referred standards, and to understand and explain the CPR regulation.
- Know the basic factors related to personnel and equipment, which influence the quality of a welded fabrication.
- Be capable of interpreting and defining the inspector's role during manufacturing activities, and to check if the correct standard, Eurocodes and local requirements are met.
- Verify if a competent person has checked the designated drawings and specifications, and if any NDT and other testing where appropriate specified.
- To be able to develop a client feedback loop/routines for communication with client.

Specific Learning Outcomes

- To be able to ensure that all the steps in the inspection plan can be covered with the correct procedures and actions.
- Define a follow up plan for corrective actions and ensure that these are followed up, and to be able to create a detailed inspection plan for the product.
- Define execution classes, and design feedback procedures to the client.
- Develop a Design Review report.

General Competence

The student will be able to:

- Verify if the requested design can be fabricated in the factory.
- Verify if the design should be altered to meet the current fabrication facilities.
- Create a design review report with or without non-conformities.
- Define the inspectors' tasks for a the current product design.
- Define Design Review reports with request for change order.

CU 4 - Documentation and Production Plan

General Content

The students learn how to develop control documents for Quality Control in welding, and procedures for Quality Control that shall be used during the Quality Control and Inspection process. Practical examples from industry will be discussed.

This CU will be part of Step 2 (Production planning) in the fabrication cycle for work-based learning where the documentation requirements are defined.

General Learning Outcomes

- Outline the typical structure of an IT (Production, Inspection and Test Plan), how to implement, and to develop the necessary tasks.
- Be able to develop a weld joint traceability scheme for the welded product.
- Identify the procedures necessary to review and validate the typical inspections records and reports.
- Be able to define positive reporting techniques and techniques for negative reporting.
- Develop a develop a full Production, Inspection and Test Plan.
- Be able to develop a traceability plan, materials, cutting, welding, mechanical fastening, anti corrosion protection, dimensional control.
- Be able to develop a production sequence, erection plan, temporary attachments, tack welding.

Specific Learning Outcomes

- Develop a traceability scheme for the product with the relevant documents.
- Create the report documents needed for an order
- Develop procedures and instructions for the inspection activities
- Definition and implementation of reporting techniques

General Competence

The student will know how to:

- Define the documentation needs for the selected designs and to how to create these documents.
- Define various inspection plans and create procedures for selected designs.
- Establish routines for documentation and reporting through the manufacturing process
- Obtain experience in developing and completing written procedures

CU 5 - Greener Economics in Welding and Cutting Inspection

General Content

The students learn how the cost of inspecting a product, will influence on both the product costs itself and the repair costs, including the relations between these costs. The costs will cover the overall costs as well as the lifetime costs associated with inspection.

This CU will be part of Step 2 (Production planning) in the fabrication cycle for work-based learning where costs are planned.

General Learning Outcomes

- To understand the influence of inspection methods to costs compared to the overall costs for the complete welding fabrication process.
- Learn to describe the factors affecting welding inspection cost.
- Develop a budget for the total cost of the inspection activities for a selected product.
- Better understanding the life cycle costs of a given design.
- Discuss the cost influence of the repair rate.
- Understand the quality and safety relations and influence on the costs.

Specific Learning Outcomes

- Develop a budget for the inspection activities for a selected product.
- Develop a budget for welding activities.
- Calculate the repair rates at different production stages.

General Competence

The student will know how to:

- Create costs calculations for alternative fabrication scenarios.
- Create repair cost profiles for a selected design.
- Evaluate the costs associated with different inspection methods.

CU 6 - Non Destructive Testing (NDT) Inspection

General Content

This CU addresses visual Inspection and NDT testing. Visual Inspection includes the inspection of materials and components, as well as inspection before, during and after a welding operation. Inspection of surface preparation and coating is included.

CU 6 will be part of Step 3 (Production) in the production cycle for work-based learning where the production is carried out.

General Learning Outcomes

- Describe the purpose of visual inspection at all stages of welding.
- Understand the purpose and limitations of tools used in visual inspection.
- Describe limitations of tools used in NDT inspection.
- Perform visual inspection and report in detail the defects identified during the inspection processes.
- Read and understand the implications of NDT reports.
- Create a non-conformance report and develop a repair request.
- To understand the standard ISO 6520.
- Define and differentiate between acceptable and not-acceptable defects and deviations.
- To recommend and communicate with external NDT providers.

Specific Learning Outcomes

- Verify the film quality for RT (Radiographic test).
- Interpretation of films for RT.
- Tools for Visual inspection.
- Identify welding defects according to ISO 6520.
- Differentiate between acceptable defects and non-acceptable defects.
- Understand the basic structure of NDT standards.

General Competence

The student will know how to:

- Select alternative NDT methods for a selected product.
- Define Visual Inspection requirements.
- Develop an inspection education program.
- Document the various inspection methods relevant for the product.
- Document defect types according to ISO 6520.

CU 7 - Destructive Testing

General Content

This CU targets destructive testing (DT). In welding fabrication most of the destructive testing are related to the development of welding procedures. This will be testing and creating WPQR`s, or to test the materials them self.

CU 7 will be part of Step 3 (Production) in the production cycle for work-based learning where the production is carried out

General Learning Outcomes

- Explain the purpose and added value of DT in relation to the development of welding procedures.
- Understand the objectives of a welding procedure and the welder qualification tests.
- Understand test reports, including the information and results from DT.
- Select the appropriate test that is requested by the code/standard.
- Carry out witness performance tests for welding procedures.
- Evaluate DT as a service or as an in-house activity.

Specific Learning Outcomes

- Destructive testing methods and their application.
- Documentation of testing methods.
- Procedures for destructive testing.
- Maintenance and calibration of testing equipment.

General Competence

The student will know how to

- Create a Destructive Testing schedule.
- To plan, execute and document destructive testing operations.
- Create documentation for WPS/WPQR.
- To establish a document register (archive) and traceability for welding procedures.
- To create a document register for DT documents and procedures.

CU 8 - Surface Protection and Dimensional Control

General Content

This CU gives the students key knowledge and competence related to surface protection of welded products. Additionally, it contains information and examples for dimensional control.

CU 8 will be part of Step 4 (Prepare delivery) in the production cycle for work-based learning where the delivery of the product is prepared.

General Learning Outcomes

- Explain the purpose of surface protection of steel and aluminum structures.
- Describe the different surface protection methods and techniques for steel and aluminum materials.
- Prepare the materials for surface protection.
- Create procedures and documentation for surface protection.
- Handling of tools and measuring devices.
- Describe the tools and methods for dimensional control of steel structures.
- Define procedures and documentation for dimensional control.
- Be able to witness pressure tests and to perform dimensional control.
- Develop and check working procedures for surface protection.

Specific Learning Outcomes

- Witness and understand the principles of pressure, leakage tests and dimensional control.
- Apply the tools used for surface protection tests as well as dimensional control.
- Recommend the correct surface protection technology and its prerequisites.
- Prepare for surface protection and/or for dimensional control, including creating test reports.

General Competence

The student will know how to

- Define the requirements for surface protection and surface protection procedures.
- Planning, execution and follow up surface protection work.
- Define requirements for pressure tests and dimensional control.
- Verify the company resources for surface protection and dimensional control.
- Explain the influence of the surface protection on welding conditions.
- Develop a set of tests for documentation of the inspection.

CU 9 - Dimensional Control and Delivery Documentation

General Content

The students will be able to create a Product Documentation Record Book, which is the fabrication documentation to be delivered together with the product to the client.

CU 9 will be part of Step 4 (Prepare delivery) in the product cycle for work-based learning where the delivery of the product is prepared.

General Learning Outcomes

- Describe how to carry out a pre-delivery inspection (PDI).
- Understand why PDI and tests are important.
- Understand the consequences of improper or missing PDI.
- Develop a Product Documentation Record Book, for the fabricator and the client.
- Understand the consequences of a product recall or reclamation.
- Develop a feedback loop back to the design containing data based up on experiences.

Specific Learning Outcomes

- Define and create a PDI checklist.
- Identify and list all critical components in the product delivery.
- Develop a Product Documentation Record Book.
- Develop a feedback document highlighting production experience of this product.

General Competence

The student will be able to:

- Develop product documentation for the fabricator and the client.
- Develop «as-buildt» documentation for the product.
- Submit a product record book with the product containing all relevant documentation.
- Develop a feedback routine and format that allow production experience to be submitted to design.

CU 10 - Summary and Examination

General Content

This CU targets the product delivery phase with acceptance, by focusing on the delivery of the product to the customer. It addresses how to create delivery acceptance reports and eventually, non-conformance notice and corrective actions. A summary of the course and the preparation of final assessment of the course is included.

CU 10 will be part of Step 5 (Delivery) in the production cycle for work-based learning where the delivery of the product take place.

General Learning Outcomes

- Describe how to carry out the delivery of the product.
- Prepare for the delivery acceptance.
- Understand the consequences of missing acceptance tests.
- Learn how to create a non-conformance report.
- Understand the consequences of a product recall or reclamation.
- Understand the knowledge and competence requirements for the final assessment.

Specific Learning Outcomes

- Define and create a delivery acceptance report.
- Identify and list all critical components, for the design, in the product delivery which may be redefined in a subsequent follow up delivery.
- Create a Product Documentation Report highlighting request for design alterations.
- Provide a summary the subjects and the course before the final assessment. This includes both the theoretical- and practical tests.

General Competence

The student will know how to

- Develop a product acceptance test for the fabricator and the customer.
- Develop a «non-conformance» report for the delivery of the product.
- Develop a summary of important topics for the assessment.