



Guidelines for Performance & Competences Assessment of eu-WELD target audience

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1. INTRODUCTION

This project has been developed with the aim to help welders all around the EU to gain quick and easy recognition of their skills and qualifications.

Through this project, a special platform will be built to allow welders from across the EU to approach the same basic training and then certification.

The training was divided into theoretical and practical sections. Theoretical part will be carried out with the help of learning materials prepared in the form of presentations, animations and films. The practical section will include training in manual skills by using simulated objects, i.e. 3D Augmented Reality - AR.

The main advantage lies in the fact that the candidate for welder acquires the basic knowledge by distance learning without any materials costs. In this way, it avoids long-lasting classical exercises in workshop, which are usually the biggest obstacle to rapid progress during training. This way of learning is very attractive and interesting for younger generations because they are very familiar with smart phones, tablets and 3D video games.

In this way it is possible to replace 100% of theoretical lectures in the classroom and up to 50% of the classical practical training in the workshop on welding machines.

An integrated training program is important so that welders throughout the EU have the same entry conditions to qualification exams for certification.

Upon completion of the training, applicants for welders will receive a certificate, which is an entry requirement for qualification exams and certification. The system for welder's certification will be standardized and will include the following steps:

- Application for certification;
- Confirmation of application by Certification body;
- Training;
- Qualification examination;
- Certification;

The preparation of the above mentioned methodologies was the subject of the eu-WELD

project.

The methodologies produced by the eu-WELD partners to reach project's objectives are the main outputs of the eu-WELD project, which are the following:

- **Training needs and competences** for European Welding Expert
- Possible national welding experts **qualifications** linked to **ECVET** guidelines
- **eu-WELD curriculum** consists of Basic welding technologies(Part I) and Basic s of fusion welding processes(Part II)
- **Courseware and e-learning courseware**
- **Methodologies and guidelines for validation, assessment and certification**
- **Augmented Reality case studies**

The eu-WELD project addresses the following **target groups**:

- Companies engaging in welding industry;
- Different Schools for welding personnel;
- Persons seeking employment in the field of welding;
- Welders of all ages who want to acquire new knowledge or refresh the existing knowledge;
- Welders who want to obtain a certificate recognized throughout the EU;
- Other stakeholders: VET providers, regional development agencies, political decision makers, chambers of commerce and industry, industrial associations etc.



2. STRATEGY AIMS

This Assessment Strategy has been produced to ensure the course has credibility in industry throughout Europe. It outlines the principles and requirements to be applied to the assessment of knowledge, understanding and performance for this qualification and its associated units.

The following sections outline specific principles in regard to:

- Qualification Units
- Rules of combination
- Assessment of knowledge and understanding methodology
- Quality control of assessment
- Participant eligibility criteria
- Occupational expertise for those involved in the training and assessment process



3. UNITS

Part I (Technology): Basics of welding technology	
1	<i>General welding aspects (Mandatory)</i>
2	<i>Materials used in fusion welding</i>
3	<i>Materials weldability and heat treatment</i>
4	<i>Quality assurance and qualification in welding</i>
5	<i>Technical drawing used in welding field</i>
6	<i>Specific norms of health and safety for welding processes (Mandatory)</i>

Part II (Processes): Basics of fusion welding processes	
1	<i>Oxy-gas welding (Skills)</i>
2	<i>Manual metal arc welding process (Skills)</i>
3	<i>TIG welding (Skills)</i>
4	<i>MIG/MAG/FCAW welding (Skills)</i>
5	<i>Submerged-Arc Welding (Skills)</i>
6	<i>Laser welding; Electron Beam welding; Plasma welding (Skills)</i>



4. UNIT DETAILS – PART 1 (TECHNOLOGY): BASICS OF WELDING TECHNOLOGY

General welding aspects

Objectives:

- Understanding the main principles regarding the fusion welding processes
- Getting familiar with the specific terms, standards and abbreviations in the field
- Acquiring knowledge on how to prepare the joint for welding
- Differences in the main characteristics of the power sources used in fusion welding processes

Sample Assessment




1. Which abbreviation is correct for TIG welding according to EN ISO 4063?

- a) 136
- b) 111
- c) 141**

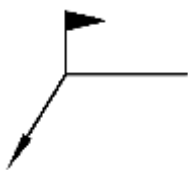
2. Which abbreviation is correct for pipe position for orbital welding according to EN ISO 6947?

- a) PH
- b) PG
- c) PK**

3. Which picture represents Square butt weld according to EN ISO 2553?

- a) 
- b)  (correct answer)**
- c) 

4. What does this designation mean according to EN ISO 2553?



- a) weld all around

- b) **field weld**
c) manual weld
5. **What is Rectifier?**
- a) is an electrical device which converts an alternating current into a direct current. Current flows through it in both directions.
b) **is an electrical device which converts an alternating current into a direct current. Current flows through it in one direction only.**
c) changes electric voltage and current from primary side to secondary side.

Materials used in fusion welding

Objectives:

- Knowing the properties of the materials used in fusion welding processes
- Identification of the base materials used in fusion welding processes

Sample Assessment

1. **Duplex stainless steels contain:**
- a) austenite + martensite
b) martensite + ferrite
c) **austenite + ferrite**
2. **Which steel can not be grouped in Group 1 according ISO/TR 15608:2017 standard?**
- a) carbon content = 0.15%
b) **$R_{eH} = 710$ MPa**
c) $R_{eH} = 300$ MPa
3. **Which steel can be classified in Group 1 according ISO/TR 15608:2017 standard?**
- a) **carbon content = 0.15%**
b) carbon content = 0.35%
c) carbon content = 0.15% Cr content = 10%
4. **What is the multiplication factor for carbon in the steel names with chemical composition?**
- a) 10
b) **100**
c) 1000
5. **Which steel contains more than 10wt.% alloying elements?**
- a) C45
b) 51CrV6 10
c) **X6CrNiMo 20-10-2**

Materials weldability and heat treatment

Objectives:

- Knowing different theoretical and practical aspects concerning the materials weldability.
- Knowing the main heat treatments applied for the materials used for welded structures
- Explain fully the origin, influencing factors and magnitude of residual stress and distortion in welded fabrication.
- Detailed procedures on how to minimize distortion and stress

Sample Assessment

1. The three factors that govern weldability are:

- d) Material, design, production
- e) Appearance, weight, density
- f) Machinability, formability, tensile properties

2. The carbon equivalent (CE) is related to:

- a) Hot cracking
- b) Hydrogen induced cracking
- c) Lamellar tearing

3. The purpose of tempering is

- a) to increase hardness
- b) to decrease toughness
- c) to increase toughness

4. Transverse stresses after welding are

- a) Higher than longitudinal stresses
- b) Lower than longitudinal stresses
- c) Equal to longitudinal stresses

5. Distortion can be reduced

- a) Increasing the number of welds
- b) Decreasing the number of welds
- c) With higher heat input

Quality assurance and qualification in welding

Objectives:

- Knowing the main differences between quality assurance, quality control and

inspection systems and their use in welded fabrication.

- Knowing the influencing factors of the quality that are related to equipment and personnel in welded fabrication.
- Knowledge on weld imperfections, the cause of their appearance, avoidance and detection methods.
- Outline the operation modes of the principal destructive and NDT methods, their advantages and disadvantages in welded fabrications

Sample Assessment

1. A weld imperfection is:
 - a) any deviation from the ideal weld;
 - b) a welding crack;
 - c) any deviation from welding parameters.
2. The tensile test is:
 - a) a way of evaluating a weld's strength and ability to withstand loading;
 - b) a way of evaluating the final welded product;
 - c) is not a method of assessing the quality of welded joints.
3. Penetrant testing can be applied to detect:
 - a) Surface imperfections or surface related imperfections;
 - b) Imperfections inside the materials;
 - c) All kinds of imperfections.
4. The welding procedure qualification:
 - a) demonstrates that the joining process proposed for construction is capable of producing joints having the required mechanical properties for the intended application;
 - b) doesn't apply to repair welding and build-up welding;
 - c) demonstrates that the manufacturer is capable of producing joints having the required mechanical properties for the intended application.
5. In case of welders' qualification:
 - a) the qualification of welders is based on essential variables;
 - b) the certificate needs to be confirmed every 1 year;
 - c) the validity period of the certificate is 5 years.

Technical drawing used in welding field

Objectives:

- Knowledge of the importance of the technical drawing in welding applications
- Knowledge on how to elaborate and present a technical drawing

Sample Assessment

1. How can engineering drawings be used in the welding activity?

Correct Answer: Engineering drawings provide the detailed technical information and representation of the part and weld.

Other Answers:

- Engineering drawings provide information about the welding set.
- Engineering drawings provide information about the welder.

2. What is the difference between conceptual and detailed drawings?

Correct Answer: Conceptual drawings are used for idea generation, whereas detailed drawings contain more details and are accurate.

Other Answers:

- Conceptual drawings contain more details and are more accurate, whereas detailed drawings are used for idea generation.
- Conceptual drawings are used as a guide for welding, detailed drawings are only used by management for documentation.

3. Why do we need multiple projections in a drawing?

Correct Answer: To represent the component from different viewing directions.

Other Answers:

- To make the drawing look professional and nice.
- To make the drawing difficult to understand.

4. Why are assembly drawings used?

Correct Answer: To show how multiple components are assembled and/or welded to each other.

Other Answers:

- To make the drawing more complex.
- To illustrate details of a component.

5. Why is CAD helpful?

Correct Answer: CAD uses the power of computers to efficiently generate the detailed drawings required to manufacture a component.

Other Answers:

- CAD is helpful to make nice drawings.
- CAD is helpful to provide information about the welder.

Specific norms of health and safety for welding processes

Objectives:

- Knowledge of the electricity, gases, fumes, fire, radiation and noise risk factors associated with welding.
- Correct interpretation of the Health and Safety regulations with respect to the above hazards

Sample Assessment

1. Which type of documents generally defines health and safety rules at work ?

- g) European directives and guidelines
- h) EN(european) and ISO (international) standards
- i) All of the above

2. What can be reason for electric shock during welding

- a) Replacing the welding electrode with bare hands without switching off the welding transformer.
- b) Inappropriate welding helmet
- c) Inappropriate shielding gas

3. What of mentioned is not effect of radiation during welding?

- a) Skin burns
- b) Permanent hearing loss
- c) Eye damage

4. **The sparks and expulsion of molten metal produced by welding can travel up to:**
- a) 5 meters
 - b) 8 meters
 - c) **10 meters**
5. **Which shielding gases displace oxygen in the air and can lead to suffocation, particularly when welding in confined or enclosed spaces?**
- a) Argon, helium
 - b) Carbon dioxide
 - c) **All of the above**

5. UNIT DETAILS – PART 2 (PROCESSES): BASICS OF FUSION WELDING PROCESSES

Oxy-gas welding

Objectives:

- Oxy-gas welding principles description.
- Knowledge of the three flame types characteristics and applications for each type
- Identification of the potential hazards and methods of safe handling, storage and working practices
- Identification of the limitations and the range of process application and recognize how to overcome the potential problems associated with this process

Sample Assessment

1. **In which part of a multipass weld is the lowest the dilution ratio?**
- j) In the root pass
 - k) In the fill pass
 - l) **In the cover pass**
2. **Which valve of the gas welding torch should be open at first for lighting the torch?**
- a) The oxygene valve
 - b) **The acetylene valve**
 - c) Both valve together
3. **Which valve of the gas welding torch should be close at first for shutting off the torch?**
- a) **The acetylene valve**
 - b) The oxygene valve
 - c) Both valve together

4. Which flame type is required for welding of carbon steels?
- Oxidizing flame
 - Carburizing flame
 - Neutral flame**
5. Which neck colour is required for an acetylene gas cylinder?
- Maroon**
 - Dark yellow
 - Brown

Manual metal arc welding process

Objectives:

- Knowledge of the MMA welding principles
- Knowledge on how to select the appropriate type of current, polarity and electrode according to application
- Identification of the application range, appropriate joint preparations and how to overcome potential problems

Sample Assessment

1. What is the function of the metal core of the welding electrode?
- Produces a gaseous shield
 - Isolates the electrical supply
 - Conducts the electrical supply**
 - Produces a solidified slag
2. Which electrode coating produces low hydrogen welds?
- Basic**
 - Rutile
 - Cellulosic
 - Iron Powder
3. What does the 3 signify in this EN ISO 2560 Electrode classification?
- Yield strength
 - Current type**
 - Polarity
 - Hydrogen control
4. What is the suggested amperage for a 3.2mm diameter electrode?
- 40 – 50
 - 60 – 80
 - 100 – 150**
 - 140 – 180



5. What is the function of the coating of the welding electrode

- a) Conduct electricity
- b) Insulates the welding electrode
- c) Cleans the metal surface
- d) Speeds up the cooling of the weld

TIG welding

Objectives:

- Knowledge of the TIG welding, arc ignition methods and their most common applications
- Knowledge of the most important applications and selection of the appropriate values for welding parameters
- Use of and care for the equipment and accessories demonstration

Sample Assessment**1. Which arc initiation systems does not need the electrode to touch the metal surface?**

- a) Lift Start
- b) Scratch Start
- c) High Frequency Start
- d) Push Start

2. When would water cooled TIG torches be used?

- a) High amperage welding
- b) Underwater welding
- c) Overhead welding
- d) Tack welding

3. What would be the effect of an incorrectly ground tungsten electrode?

- a) Porosity
- b) Arc wander
- c) Electric shock
- d) Tungsten inclusions

4. Which electrode type is identified by a red tip?

- a) Ceriated
- b) Zirconiated
- c) Thoriated
- d) Lanthanated

5. Which shielding gas requires an increased flow rate?

- a) Pure Argon
- b) Carbon Dioxide
- c) Helium
- d) Hydrogen

Gas metal arc welding (GMAW)

Objectives:

- MIG/MAG welding principles description, including metal transfer modes and their applications
- Identification of the most common applications for each type of current, polarity and electrode
- Identification of the application range, appropriate joint preparations and potential problems to be overcome

Sample Assessment**1. Which current is generally suitable for MAG welding electrode?**

- a) AC
- b) DC+
- c) DC-

2. What is one of the most important and simplest way to create strong welds.

- a) **Maintainance of equipment**
- b) Health and safety of welder
- c) High speed welding

3. What is typical gas flow rate for MAG welding?

- a) 3-5 litres / minute
- b) **8 - 20 litres / minute**
- c) 2 - 5 litres / minute

4. Which are the most common mixtures for welding of unalloyed structural steels to EN ISO 14175 designation?

- a) EN ISO 14175: M22
- b) **EN ISO 14175: M21**
- c) EN ISO 14175: C1

5. Which are typical causes for spatter on weld?

- a) **wrong welding angle, incorrect wire feed speed, long/short welding arc**
- b) insufficient welding gas flow (missing gas)
- c) too low welding speed

Submerged arc welding

Objectives:

- SAW principles description
- Identification of the application range and joint edge preparation
- Knowledge of the selection criteria of flux-wire combinations

Sample Assessment

1. Saw welding process notation according EN ISO 4063 is:
 - a. 114
 - b. 136
 - c. 12
2. The abbreviation of welding process SAW means:
 - a. Solid Welding
 - b. System Automatic Welding
 - c. Submerged Arc Welding
3. How many types of fluxes are used in SAW process:
 - a. 1 type Bonded Fluxes
 - b. 1 type Fused Fluxes
 - c. 2 types Fused and Bonded
4. Which procedures of welding process bellow induce less heat in 25mm plate welding
 - a. MMA 1 side /multi pass
 - b. TIG 1 side /multi pass
 - c. SAW 1 side/ 1 pass

Laser welding; Electron beam welding; Plasma welding

Objectives:

- Principles description of the mentioned welding processes and their application
- Identification of potential hazards and methods of safe handling and working

Sample Assessment

1. Wich are the advantages of the plasma welding
 - a. Less quality welding
 - b. High heat input
 - c. Low distortions



2. Plasma welding electrode used is
 - a. Celulosic electrode
 - b. Rutile electrode
 - c. **Tungsten electrode**
3. Welding process acc EN ISO 4063 is false
 - a. Electron beam welding 51
 - b. Laser welding 52
 - c. **Plasma welding 12**
4. Plasma welding is a process
 - a. **Cheap**
 - b. With rapid cooling rate
 - c. With high costs with mentenance

6. RULES OF COMBINATION - QUALIFICATION STRUCTURE

To ensure a flexibility that meets the needs of individual participants and industry a minimum requirement to achieve the eu-Weld qualification is prescribed. This is to consist of the 2 mandatory units and a minimum of 2 skills units. Additional units can be added as endorsements to the minimum achieved certification level.

7. ASSESSMENT METHODOLOGY

Mandatory units:

These units are to be assessed by a short answer written examination. Minimum pass mark for achievement is 70%

Skills Units:

These units are to be assessed by a short answer written examination and a practical task. Minimum pass mark for achievement of the written examination will be 60%.

Practical Skills:

The assessment of practical skills are not an element of this project, although delivering organisations can progress suitable candidates for welder qualification to ISO 9606-1 Qualification Testing of Welders – Fusion Welding. More details of this standard are available in appendix A.

Endorsement Units:

Part 1: Technology units

These units are to be assessed by a short answer written examination. Minimum pass mark for achievement is 50%.

Part 2: Processes units

These units are to be assessed by a short answer written examination. Minimum pass mark for achievement of the written examination will be 50%.

8. OCCUPATIONAL EXPERTISE

Staff must have sufficient operational experience within the welding sector that is current and relevant to the unit(s) being delivered and assessed. Decisions on the suitability of staff for the delivery and assessment of this qualification is the responsibility of the respective organisation.

9. PARTICIPANT ELIGIBILITY

No formal qualifications are a prerequisite of attending the eu-Weld course

The eu-WELD project target the following groups:

- professional welders with extensive experience that require formal certification at EU level
- persons working in the field with some experience as welders that need to be trained and get a formal certification
- workers in the welding field, with extensive experience as welders, that have their skills gathered through years of experience at their place of work that need formal certification.



10. QUALITY CONTROL

Internal quality control of the qualification will be the responsibility of the delivering organisation and be incorporated in any existing systems. As a minimum, organisations should:

- Have a system to standardize assessment decisions
- Devise assessment criteria for the judgment of practical tasks to a minimum standard.

11. ECVET

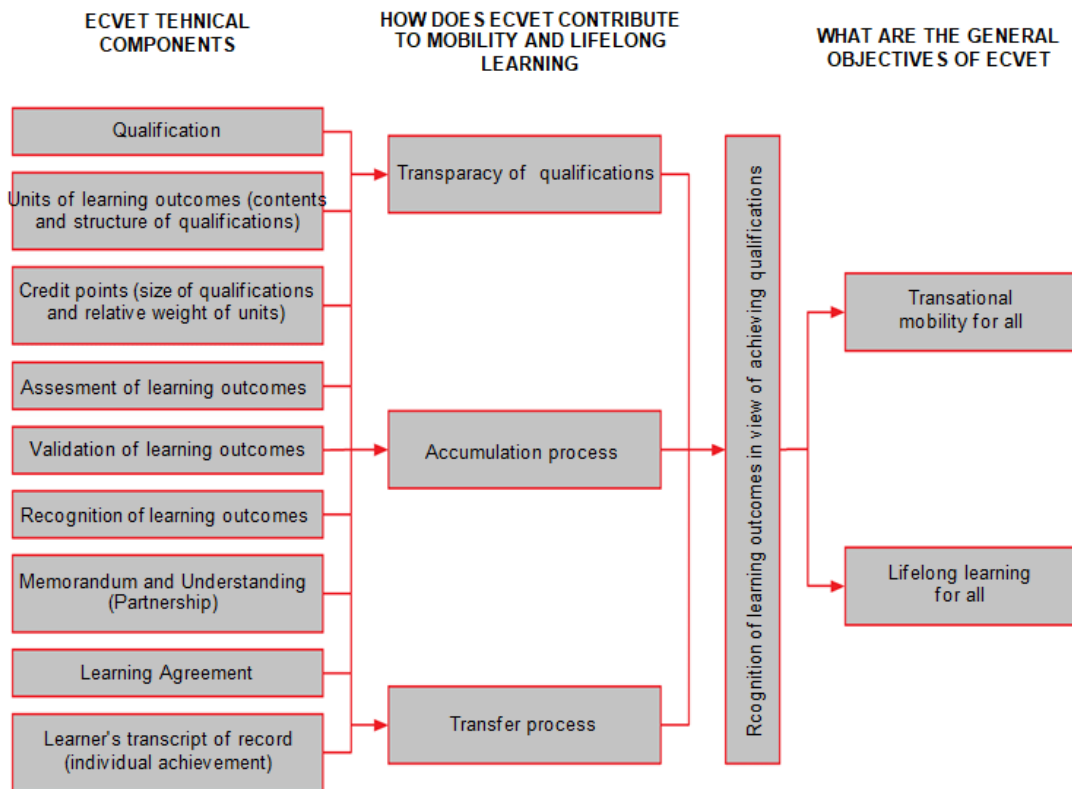
To facilitate the recognition and the transfer of the learning results achieved in vocational education and training, formal, informal and non-formal learning, the European Credit System for Vocational Education and Training (ECVET) has been set up by the European Commission.

The key concepts and processes of ECVET are:

- **Learning outcomes**, which are statements of knowledge, skills and competence that can be achieved in a variety of learning contexts.
- **Units** of learning outcomes, which are components of qualifications. Units can be assessed, validated and recognized.
- **ECVET points**, which provide additional information about units and qualifications in a numerical form.
- **Credit** that is given for assessed and documented learning outcomes of a learner. Credit can be transferred to other contexts and accumulated to achieve a qualification on the basis of the qualifications standards and regulations existing in the participating countries.

In ECVET, learning outcomes are used as a basis for credit transfer and accumulation. The different learning outcomes are grouped to create Units. Assessed learning outcomes constitute credit. Credit is the basis for enabling the transfer between learning contexts and for the accumulation of learning outcomes.

The following image illustrates the ECVET System starting from its main objectives that are to facilitate and encourage the mobility of students/learners/workers through EU Member States and to make lifelong learning a tangible reality.



The consistent way to use credit transfer processes is an effective mechanism for increasing trust and transparency in the recognition and assessment of diverse learning contexts existing in different European Countries.

Regarding eu-WELD project, the following scheme represents how the eu-WELD partners has translated the ECVET process into the eu-WELD training course. This is an example for one unit. For the entire course, please refer to the project output entitled “eu_WELD_ECVET_3”.

Description of Training Units N° 6: Specific norms of health and safety for welding processes

EQF Level	3	
ECVET Points - 3	Allocation of ECVET points to a qualification is based on using a convention according to which 60 points are allocated to the learning outcomes expected to be achieved in a year of formal full time FET. More info: http://www.ecvet-secretariat.eu/de/system/files/documents/14questions-answers-about-ecvet-21/04/2010.pdf http://www.smgc.de/fo-to-us/ecvet_qna_web_2.pdf	
Hours	e-learning – 2h Self Study – 4h	
Learning outcomes	He/she is able to identify and apply the specific norms of health and safety for welding processes.	
KNOWLEDGE <i>(has knowledge and understanding of...)</i>	SKILLS <i>(is able to apply their knowledge to practical applications as...)</i>	COMPETENCES <i>(has professional competences based on responsibility and autonomy)</i>
He/she is able to:	He/she is able to:	He/she is able to:
<ul style="list-style-type: none"> Identify and use the norms of health and safety for welding processes. 	<ul style="list-style-type: none"> Apply and respect the health and safety norms for welding processes. 	<ul style="list-style-type: none"> Select the necessary protective equipment for performing welding operations.

12.APPENDIX A: ISO 9606 - QUALIFICATION TESTING OF WELDERS – FUSION WELDING

Purpose:

Ensure the ability of a welder to follow written instructions and verify the welder's skill. These are important factors in ensuring the quality of a welded product.

Principle:

The welder can be assessed for the same and all other conditions, which are considered easier to weld.

Standards for qualification testing of welders

- EN ISO 9606-1 – Steels (substitutes SS-EN 287-1)
- EN ISO 9606-2 – Aluminium and aluminium alloys
- EN ISO 9606-3 – Copper and copper alloys
- EN ISO 9606-4 – Nickel and nickel alloys
- EN ISO 9606-5 – Titanium and titanium alloys, zirconium alloys

Welding Processes

- 111 manual metal arc welding
- 114 self-shielded tubular cored arc welding
- 121 submerged arc welding with solid wire electrode (partly mechanized)
- 125 submerged arc welding with tubular cored electrode (partly mechanized)
- 131 MIG welding with solid wire electrode
- 135 MAG welding with solid wire electrode
- 136 MAG welding with flux cored electrode
- 138 MAG welding with metal cored electrode
- 141 TIG welding with solid filler material (wire/rod)
- 142 autogenous TIG welding
- 143 TIG welding with tubular cored filler material (wire/rod)
- 145 TIG welding using reducing gas and solid filler material (wire/rod)
- 311 oxyacetylene welding

Essential Parameters

- welding process(es) and transfer mode
- product type (plate or pipe)
- type of weld (butt or fillet)
- filler material group
- filler material type
- dimension (material thickness and outside pipe diameter)
- welding position
- weld detail(s) (material backing, gas backing, flux backing, consumable insert, single

side welding, both side welding, single layer, multi-layer, leftward welding, rightward welding).

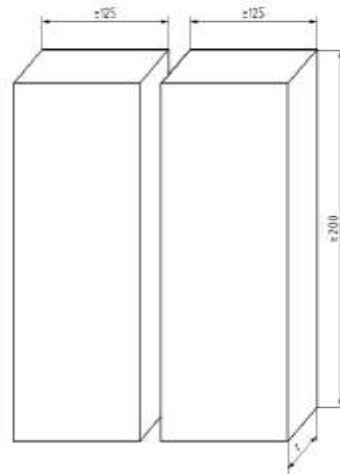
Type of Weld

- Test pieces welded as butt weld (BW) qualifies any type of butt welds (BW) except for branch joints with an angle $\leq 60^\circ$.
- Butt welds (BW) do not qualify fillet welds (FW) or vice versa.
- To qualify a BW and a FW in the same certificate a supplementary fillet weld (FW) test can be welded. The test piece shall be at least 10 mm thick or the thickness of the butt weld. Welded as a single layer in PB position. This qualifies the range of qualification for FW based upon the BW essential parameters.

Test Pieces

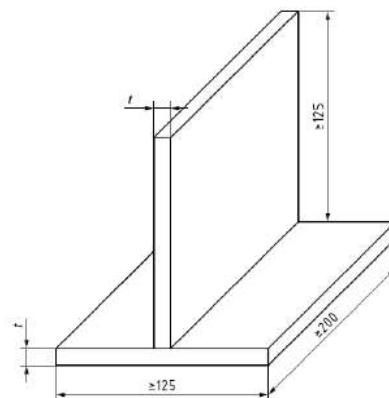
Dimension of test piece for a butt weld in plate.

- t =material thickness of test piece.
- Dimensions in mm.



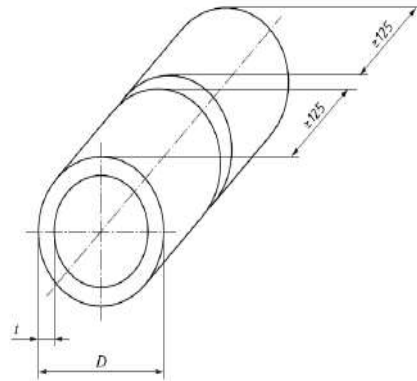
Dimension of test piece for a fillet weld on plate.

- t =material thickness of test piece.
- t can be of different thickness.
- Throat thickness is specified by pWPS or WPS.
- Dimensions in mm.



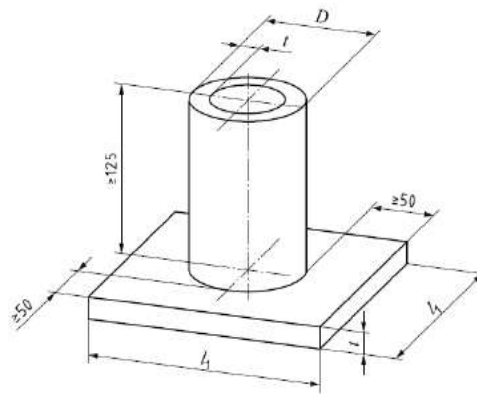
Dimension of test piece for a butt weld in pipe.

- Less than 150 mm in circumferences requires additional test pieces, but maximum three test pieces.
- t =material thickness of test piece.
- D =outside pipe diameter.
- Dimensions in mm.



Dimension of test piece for a fillet weld on pipe

- t =material thickness of test piece.
- D =outside pipe diameter.
- l_1 =length of test piece.
- t can be of different thickness.
- Dimensions in mm.

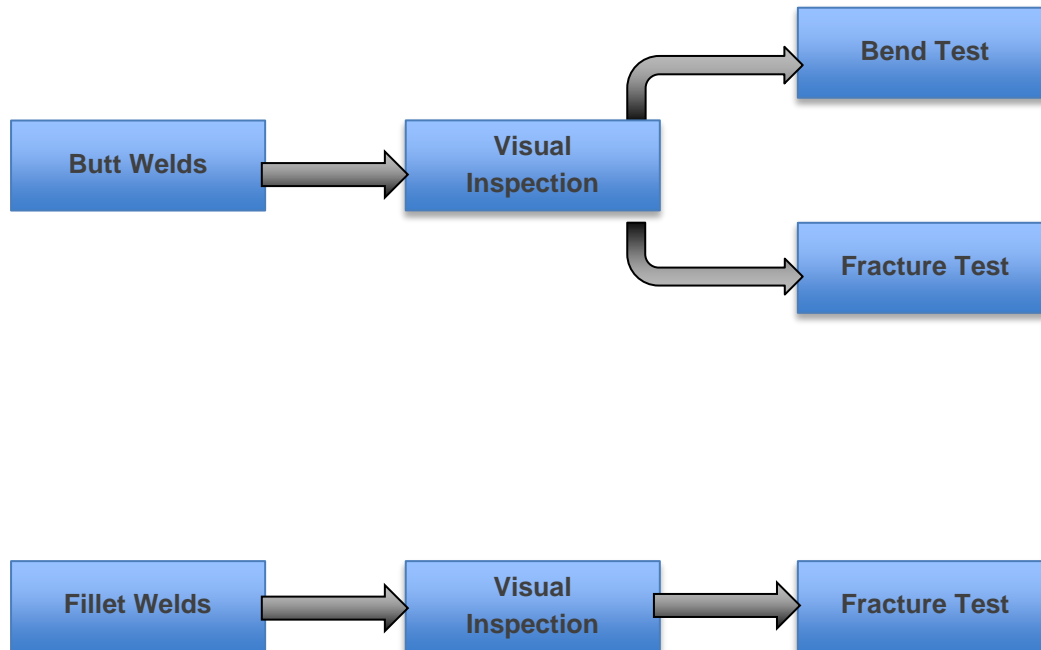


Welding Conditions

- The welder shall follow a WPS according to ISO 15609-1 or ISO 15609-2.
- Test piece shall have at least one stop and restart in the root and capping run.
- For a multi-process, this is a requirement for both weld method.
- Stop and restart shall be marked.
- For root and filler runs, minor imperfections are allowed to be removed after permission from the examiner.
- In capping run only stop and restart may be grinded.
- Any post-weld heat treatment required in the WPS may be omitted.
- The examiner can cancel the qualification at any time (E.g. the welder doesn't follow WPS, lack of skills of the welder, major repairs)

Test Methods

Visual inspection methods only are required as a minimum for this qualification. Further tests are required to fully meet the requirements of ISO 9606-1



Acceptance Requirements for Test Pieces

The finished test pieces shall be examined to determine whether it meets the requirements. Except for 25 mm on each end of the test piece (plate).

The test piece shall be evaluated according to ISO 5817, quality level **B**.

The visual testing shall be according to ISO 17637.

- Prior to any testing, the following shall be checked:
- All slag and spatter removed.
- No grinding on the root and the face side of the weld (according to 6.3).
- Stop and restart in the root run and in the capping run are identified.
- Profile and dimensions