



www.destineproject.eu

Rules for conducting **National** and **European** Skills League



Co-funded by the
Erasmus+ Programme
of the European Union



PARTNERS



Additive Manufacturing (AM) is seen as a Key Enabler Technology for the EU that secures a strong industrial base. Market forecasts predict that between 2031 and 2038, AM is expected to reach 50% of the market potential. It is evolving at a much faster pace than the development of the workers' skills is being tackled. AM suffers from a "capability challenge" characterized by a skills gap and a difficulty in finding a well-trained workforce capable of applying AM to real world production.

Metal AM Profiles skilled in design are of outmost importance for companies, but the current shortage of talent is requiring new educational initiatives to deliver qualified professionals. In this context, making Vocational Education and Training (VET) a first choice is critical to guarantee a smoother transition of students /youngsters into employment and maintain the workforce skills according to sectoral and national needs, thus avoiding shortage of people with VET qualifications in the future.



INDEX

Introduction.....Page 3

Performance Evaluation Guideline.....Page 7

Global Structure of Test.....Page 9

Materials and Conditions.....Page 10

Competition Layout Type.....Page 12

Certificates.....Page 13

Useful Links.....Page 14



INTRODUCTION

Rules for conducting **National and European Skills League** is part of DESTINE, a co-financed project by the Erasmus+ program, with the aim to promote VET excellence in **Additive Manufacturing** sector by creating a European Metal Additive Manufacturing Design Technician (EMAM-DT) Qualification Standard (EQF level 4) and introducing Additive Manufacturing technologies in skills competitions.

This booklet **summarises** a guidance to the implementation of **European Metal AM Design Technician Leagues** into skills competitions.

I.1 - CONTEXT

PROFESSIONAL PROFILE: European Metal AM Design Technician

Competition nature: Individual

Application:

1. Preparation and organization of evaluation tests for professional development;
2. As a reference to other events associated to the preparation and organization of professional development tests, such as the ones occurring in the scope of learning activities.

Participation conditions in the leagues:

1. Age: $17 \leq 25$ years old
2. Experience: Skills in using 3D CAD tools and EQF level 2
 - I. Or VET diploma in technical areas
 - II. Or Comparable professional experience of at least 2 years





INTRODUCTION

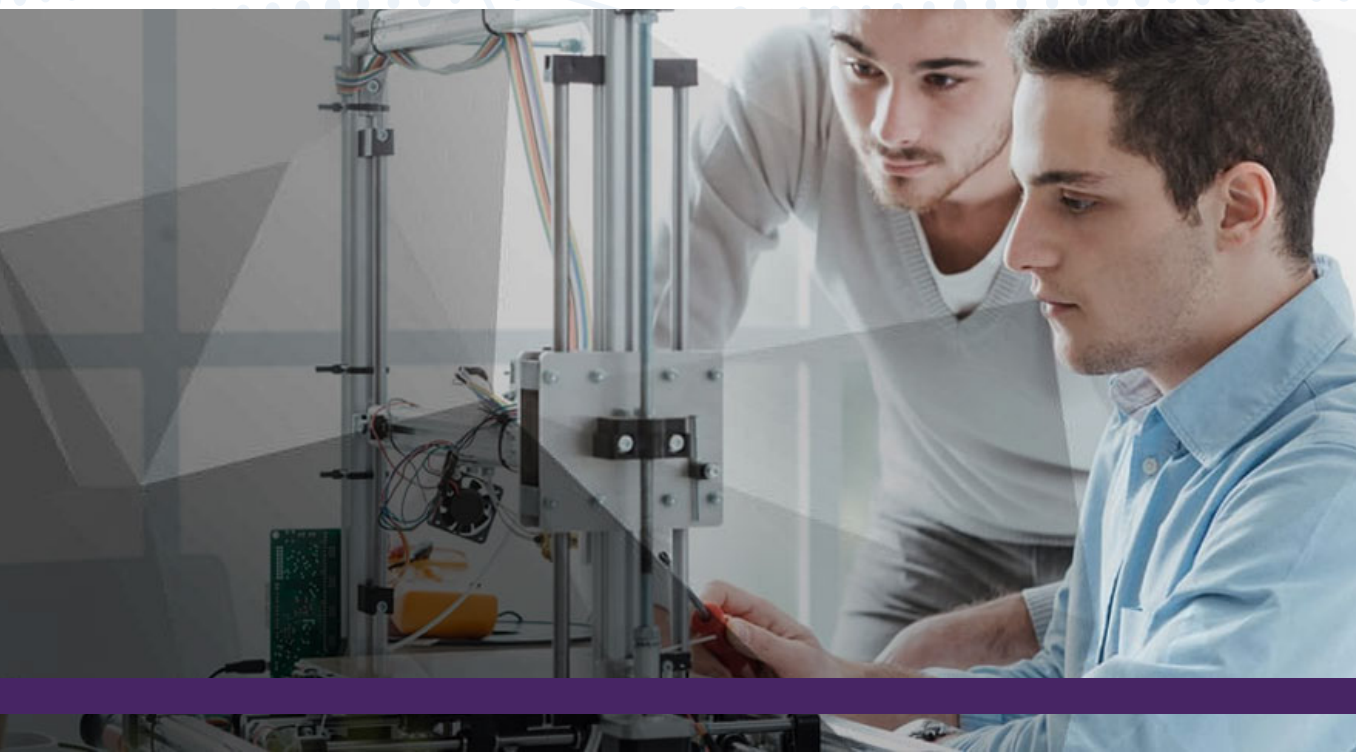
1.2. - RELEVANCE OF THE ADDITIVE MANUFACTURING LEAGUES RULES (LR)

The actual AM LR is the harmonization instrument of technical conditions for the development of National and European Leagues for the **European Metal AM Design Technician** Professional Profile. It is a guide for trainees and trainers to enroll in the leagues, from the elaboration and organization of tests and the quality itself of the Leagues and vocational education and training.

1.3 - NATIONAL AND EUROPEAN AM SKILLS LEAGUES

The competition is composed of, at least, two levels: The first level comprises a competition with a larger group of competitors: **The National AM Skills League**. In this round only the three participants with more punctuation will pass to the second level of competition: The Final Competition – **European Skills League**.

This **League Rules** is an instrument that focuses on National AM Skills Leagues which are one-day long and on European AM Skills Leagues which are four-day long. The contest is based on a case study that is provided to participants, serving as a kick-off for individual performance evaluated according to criteria, knowledge and skills suitable for the qualification of the EMAM-DT.





INTRODUCTION

COMPETENCE AREAS

1. CU: Additive Manufacturing Processes Overview

Knowledge:

- Basic factual knowledge of: Directed energy deposition, Powder bed fusion, Vat photopolymerization, Material Jetting, Binder Jetting, Material Extrusion, Sheet Lamination

Skills:

- Skills on AM Processes: Distinguish parts produced by different AM processes. List the advantages and limitations of AM processes from a manufacturing process chain point of view. Name the applicability of different AM processes, according to the characteristics of each process.

- CU00 of the International AM Qualification System



CLICK HERE



2. CU: Designing Metal AM Parts

Knowledge:

- Factual and broad knowledge of theory, principles and applicability of: Metal AM Materials, AM design thinking, Design principles for AM, Post processing.

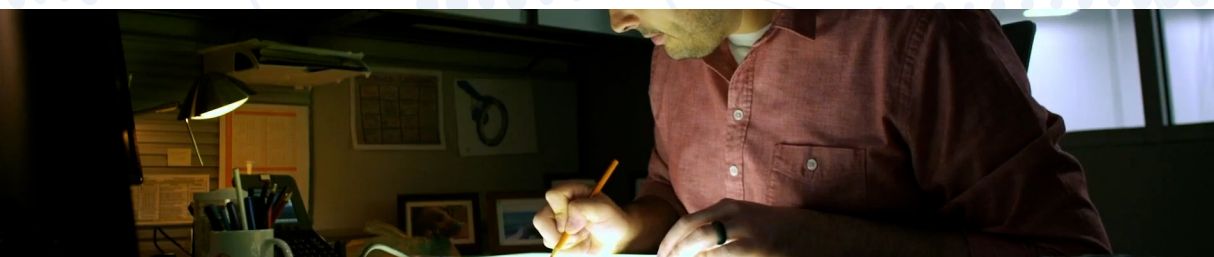
Skills:

- Skills on designing Metal AM parts: Identify types of metal materials commonly used in AM. Apply designing concept for AM. Apply design principles when developing and modelling a CAD part. Associate design considerations to design thinking. Relate AM potentials and limitations to metal parts design .

- CU: Developed for EMAM-DT profile, not yet part of the IAMQS



CLICK HERE





INTRODUCTION

COMPETENCE AREAS


3. CU: Design for PBF processes

Knowledge:

• Factual and broad knowledge of theory, principles and applicability of PBF machines: Features and performance data. Capabilities and limitations of PBF metal processes influence in design. Design considerations required for PBF metal parts design. Specific materials for PBF: achievable properties and sustainability.

Skills:

• Skills on design for PBF processes: Associate the degrees of freedom of a PBF machine to the possibilities in terms of design. Relate the capabilities and limitations of PBF to design considerations. Determine dimensional constraints and geometric tolerances required for PBF parts design.

• CU: Developed for EMAM-DT profile, not yet part of the IAMQS  [CLICK HERE](#)

**In DESTINE project and in the national and European skills leagues only the CU Design for PBF processes was considered as complete CU to finish before the league.*


4. CU: Design for DED processes

Knowledge:

• Factual and broad knowledge of theory, principles and applicability of DED machines: Features and performance data. Capabilities and limitations of DED metal processes influence in design. Design considerations required for PBF metal parts design. Specific materials for DED: achievable properties and sustainability.

Skills:

• Skills on design for DED processes: Associate the degrees of freedom of a DED machine to the possibilities in terms of design. Relate the capabilities and limitations of DED to design considerations. Determine dimensional constraints and geometric tolerances required for DED parts design.

• CU: Developed for EMAM-DT profile, not yet part of the IAMQS  [CLICK HERE](#)



Performance Evaluation Guideline

2.1 - EVALUATION CRITERIA

According to the **EMAM-DT** job profile analysis, considering the importance of the **several competence areas**, the evaluation criteria to consider to the test elaboration are the following:




Descriptions:

- A)** Function - 10%
- B)** Compliance with the specified project - 30%
- C)** Feasibility with AM processes - 30%
- D)** Material efficiency - 10%
- E)** Drawing - 20%

EVALUATION CRITERIA

Sub-criteria	A	B	C	D	E
Tightness					
Completeness					
Dimensions / angles					
Supports					
Geometry / innovation					
Structures					
Thickness					
Conformity					
Connections					

The reference duration of each **type of league** is the following:

 TYPE OF LEAGUE	 MODEL / CASE STUDY	 TIME OF EACH LEAGUE
National Skills League	Metal AM Processes	4 Hours
European Skills League		7 Hours

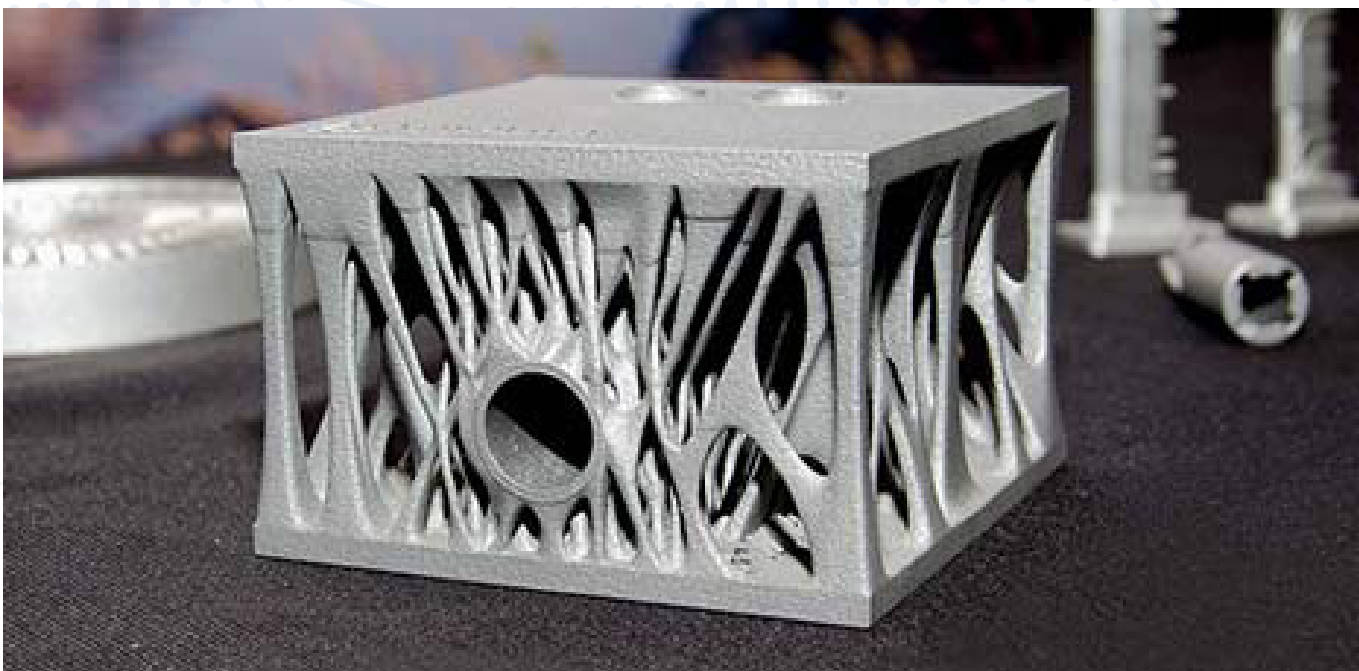


Performance Evaluation Guideline

2.2 - SPECIFIC EVALUATION PROCEDURES

In what the **profession** is concerned it is **determined** the following evaluation limitations:

1. It cannot be given punctuation to the aspects that the competitor is not able to complete due to the lack of tool/equipment in his/her toolbox (applicable in the situations that the tool/equipment is responsibility of the competitor or his/her entity);
2. If any competitor is not able to complete operations/tasks of the test due to fails that are not his/her own, the punctuation referring to these operations/tasks must be given to competitors that tried/began the execution of it/them. The following are considered for this:
 - a. Workplace fails;
 - b. Equipment malfunctions not applicable to competitor bad usage;
 - c. Energy fails.
3. In all situations the juries must evaluate, fully, all aspects of the evaluation sheet for each competitor;
4. The punctuation given to aspects to evaluate may vary according to the defined grading for each competition. Yet, it should show the degree of complexity/difficulty acceptable by the reality of the sector;
5. In the constitution of the evaluation jury groups, it should be considered the expertise in Leagues and also professional experience.





Global Structure Of Test

The aim of the test is to give **evidence conditions** of the competences required as far as the profession is concerned, and also provide complete, balanced, and fair evaluation conditions, according to the technical demands of the profession. The relation between the test, the guideline and evaluation criteria is a key indicator to guarantee the quality of the League.

The test concerns the **individual evaluation** of the different competences necessary to an exemplar professional performance. It consists in being given a case study / tasks where AM design is required and the participant has to design the part considering AM (design) rules.

3.1 - GENERAL

The test is designed to be executed in the **number of hours** corresponding to the League (refer to 3.1) and concerns one module, where the participants will be given:

1. Case Study statement both in English and mother tongue;
2. CAD Files.

**It is not permitted to participants to talk to anyone, after the time given for questions, during competition.*

3.2 - STRUCTURE

The **participants** will have to:

- Be able to read technical drawings;
- Execute 3D models according to specifications;
- Know PBF metal additive manufacturing;
- Solve given problem(s).





Materials and Conditions

4.1 - GENERAL

General **Security Regulations** - Ethics, Health and Safety:



4.2 - TECHNICAL INFRASTRUCTURES

It is possible to draw up an infrastructure list that details all **equipment, materials** and **facilities** provided by the Competition Organizer. Specifically, technical infrastructures should comprise:

1. Room with adequate light (natural or artificial);
2. Internet connection;
3. Computers (desktops or notebooks as appropriate);
4. Mouse and keyboard;
5. Electrical extensions.

As appropriate, computers (MOUSE and keyboards, too) could be made available to competitors by organization body or competitors could be asked to use their personal computer.

4.3 - GENERIC EQUIPMENT

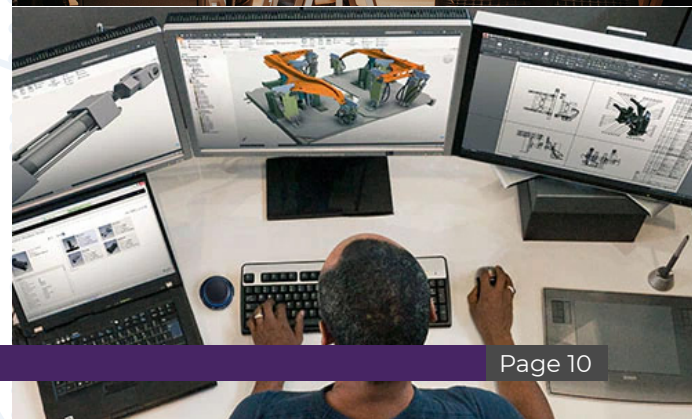
Generic equipment should be placed on the **workplace** and refers to:

1. Desks;
2. (Adjustable) chairs;
3. Pencils and pens;
4. Sheets of paper.

4.4 - TECHNICAL EQUIPMENT

Technical **equipment** includes:

1. Technical drawings and CAD file;
2. CAD software - TinkerCAD;
3. Standards (if any).





Materials and Conditions

4.5 - EQUIPMENT AND MATERIALS ON PARTICIPANT RESPONSABILITY

Competitors may bring the following **equipment** and **materials** to the competition:

1. Personal computer (as appropriate, see 5.2);
2. Technical manuals;
3. Instruments for freehand sketching (ruler, set square, etc...);
4. Measuring instruments;
5. "Space mouse" (3D mouse) is allowed;
6. Calculator.

4.6 - EQUIPMENT AND MATERIALS FORBIDEN

All materials and equipment brought by **Competitors** have to be presented to the Experts.

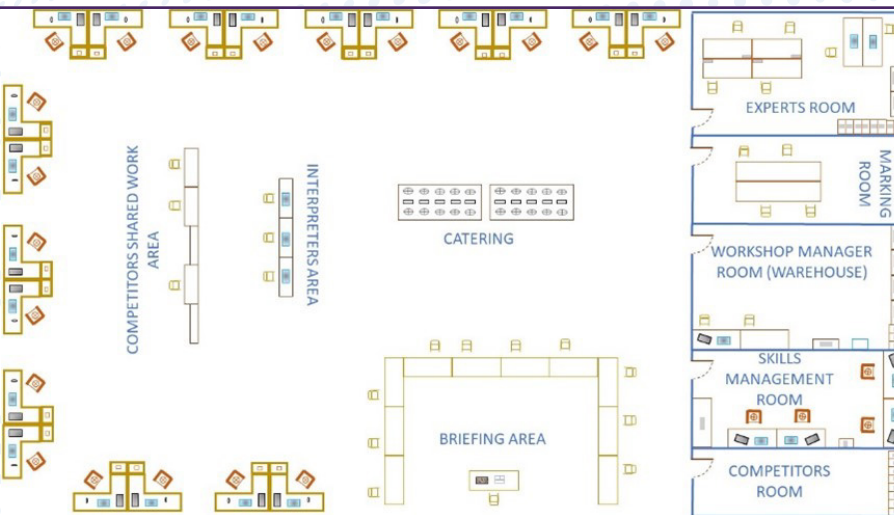
The **Experts** shall rule out any items brought to the Competition that are not considered normal Engineering Drawing and CAD related tools and equipment, that will give any Competitor an unfair advantage.





Competition Layout Type

5.1 - GENERIC LAYOUT OF COMPETITION SPACE



Layout Sections Names:

1. Experts Room
2. Marking Room;
3. Workshop Manager Room
4. Skills Management Room
5. Competitors Room
6. Briefing Area
7. Catering
8. Interpreters Area
9. Competitors Shared Work Area

5.2 - LAYOUT TYPE OF WORKSTATION

Equipment & Materials:

1. Personal computer;
2. Technical manuals;
3. Instruments for freehand;
4. Measuring instruments;
5. "Space mouse";
6. Calculator.



WORKPLACE



CERTIFICATES

6.1 - GENERAL

There are **two certificates** that will be given to the participants:

- Winner certificates (1st, 2nd, 3rd places)
- Certificates of attendance (the rest of participants are awarded with 4th places)





USEFUL LINKS

DESTINE Project webpage

<https://www.destineproject.eu/>

DESTINE Project Video

<https://www.youtube.com/watch?v=Da9iPEILsyM>

DESTINE Skills League - Testimonies video

<https://youtu.be/56mVhwn6sNc>

IAMQS - International Additive Manufacturing Qualification System

<https://www.ewf.be/qualification/iamqs.aspx>

WorldSkills

<https://worldskills.org/>



www.destineproject.eu



Co-funded by the
Erasmus+ Programme
of the European Union



The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein. **Project: 2020-1-ES01-KA202-082337**

 **PROJECT DURATION:** nov. 2020 – oct. 2022

 **CONTACT US:** destine@idonial.com