



European Design Technicians League
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European Design Technicians League

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Leagues Rules – National and European Leagues

Metal AM Design Technician

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TITLE

DESTINE – Leagues Rules of the Competition in European Metal Additive Manufacturing – Design Technician (EMAM-DT)

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CLUSTER/ACTIVITY AREA: Manufacturing and Engineering Technology

The Leagues Rules show the development conditions of the competition according to a specific profession.



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PREFACE

This League Rules (LR) document has been developed in the framework of the European project “European Design Technicians League –DESTINE”, co-financed by the Erasmus+ program. DESTINE project aims at promoting VET excellence in the AM sector by creating a European Metal Additive Manufacturing Design Technician (EMAM-DT) Qualification Standard (EQF level 4) and introducing AM technologies in skills competitions as they are a way to set benchmarks, so promoting excellence in Vocational Education and Training (VET).

Accordingly, project partners have been implementing National and European competitions which follow the rules in this document. The target group of the leagues are VET students, aged between 17 and 25 years old to motivate youngsters to a new field area which the labour market greatly needs. The competitions aim to infer, showcase and assess the ability of its participants in the specific area as well as promoting networking as it involves people from five countries, Portugal, Spain, Italy, Germany and Belgium.

This guideline has been developed by all partners involved in the project (IDONIAL, CESOL EWF, Istituto Italiano della Saldatura, ISQ, IEFP and LZH Laser Akademie) aligned with other skills competitions already in place. The document has been updated considering the results of the first rounds of both National and European competitions developed in the framework of the project and validated by external experts from WorldSkills Portugal.

The current document aims to provide guidance on the implementation of EMAM-DT leagues in what National Leagues are concerned, as well as to serve as reference for the introduction of other qualifications into the skills competitions. It contains information about the professional profile, competition programme, evaluation procedure and health & safety issues.



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1. INTRODUCTION

1.1. CONTEXT

PROFESSION: European <i>Metal AM Design Technician</i>	
Competition nature:	<ul style="list-style-type: none">• Individual
Application:	<ol style="list-style-type: none">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:	<ol style="list-style-type: none">4. 17 ≤ 25 years old (on 31st December 2022).5. Experience: Skills in using 3D CAD tools and EQF level 2 Or VET diploma in technical areas Or Comparable professional experience of at least 2 years

1.2. RELEVANCE AND MEANING OF THE LEAGUES RULES (LR)

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

1.3. NATIONAL AND EUROPEAN LEAGUES

This LR is an instrument that focuses on National Leagues which are one-day long and on European Leagues which are four-day long.



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2. PROFESSION GUIDELINES

2.1. DESIGNATION AND DESCRIPTION

Activity designation

European Metal AM Design Technician

General description

The Metal Additive Manufacturing (AM) Design Technician is the professional with the specific knowledge, skills, autonomy and responsibility to design metal additive manufacturing parts to be manufactured by METAL AM processes.

2.2. OPERATIONAL ACTIVITIES

In the scope of the professional activity, the Metal AM Technician develops the following operational activities:

1. Design Metal AM parts for DED and/or PBF Processes according to instructions provided by the DED/PBF Designer.
2. Develop solutions on basic and specific problems related with the design of DED and/or PBF parts.
3. Contribute to projects in a teaming environment.

2.3. COMPETENCE UNITS (CU)

The European Metal Additive Manufacturing Design Technician (EMAM-DT) guideline encompasses four competence units. The CUs on “Additive Manufacturing Processes Overview” with 3.5 recommended contact hours and the CU “Designing Metal AM parts” with 18 recommended contact hours are mandatory. In addition, to complete the professional profile of the EMAM-DT, the trainee can choose between the CU “Design for DED processes” with 14 recommended contact hours and the CU “Design for PBF processes” with 7 recommended contact hours. He or she can also do both. For the skills league on the EMAM-DT, the participants shall have completed the whole profile or should be about to finish it.



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In the testing phase of DESTINE project, project partners agreed to focus on the CU “Design for PBF processes” and the PBF-LB-M process in the National and European skills leagues. Every participant of the leagues had to visit a preparation course before the competition, where the content of this CU was taught combined with essential aspects and contents on the PBF-LB process from the CU “Additive Manufacturing Processes Overview” and the CU “Designing Metal AM Parts”. By this procedure, a similar procedure was manageable in all European partner countries to pilot National and European leagues.



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COMPETENCE AREAS

1. CU00 Additive Manufacturing Processes Overview

The participants must know and comprehend:

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

The participants achieve:

- 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.

COMPETENCE UNITS:

- CU00 of the International AM Qualification System ([IAMQS](#))

2. CU: Designing Metal AM Parts

The participants must know and comprehend:

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

The participants achieve:

- 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

COMPETENCE UNITS:

- CU: Designing Metal AM Parts (developed for EMAM-DT profile, not yet part of the IAMQS)



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3. CU: Design for PBF processes

The participants must know and comprehend:

- 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

The participants achieve:

- 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

COMPETENCE UNITS:

- CU: Design for PBF processes (developed for EMAM-DT profile, not yet part of the IAMQS)

*In DESTINE project and in the national and European skills leagues only the CU Design for PBF processes will be considered as complete CU to finish before the league. The other aspects will be taught partly in the preparation courses

4. CU: Design for DED processes

The participants must know and comprehend:

- 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

The participants achieve:

- 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
-



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COMPETENCE UNITS:

- CU: Design for DED processes (developed for EMAM-DT profile, not yet part of the IAMQS)
-



3. PERFORMANCE EVALUATION GUIDELINE

3.1. EVALUATION CRITERIA

According to the job profile analysis, considering the importance of the several competence areas, the evaluation criteria to consider to the test elaboration are as follow:

Evaluation Criteria		Percentage (%)
A	Function	10
B	Compliance with the specified project	30
C	Feasibility with AM processes	30
D	Material efficiency	10
E	Drawing	20
Total		100

We have as reference the following distribution:

Competition	Module/Case study	Time
National League	Metal AM processes	4h
European League		7h



		Evaluation Criteria				
		A 10%	B 30%	C 30%	D 10%	E 20%
Sub-criteria	Function	X				
	Compliance with the specified project		X			
	Feasibility with AM processes			X		
	Material efficiency				X	
	Drawing					X
	Tightness	X				
	Completeness	X				
	Dimensions / angles		X			
	Supports			X		
	Geometry / innovation			X		
Structures				X		
Thickness				X		
Conformity					X	
Connections					X	



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3.2. 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.



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4. 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.

4.1. 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.

4.2. 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)



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5. MATERIALS AND CONDITIONS

5.1. GENERAL

There are general Security Regulations in a separate booklet (Ethics, Health and Safety).

5.2. 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.

5.3. 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.

5.4. TECHNICAL EQUIPMENT

Technical equipment includes:

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



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5.5. 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.

5.6. 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.



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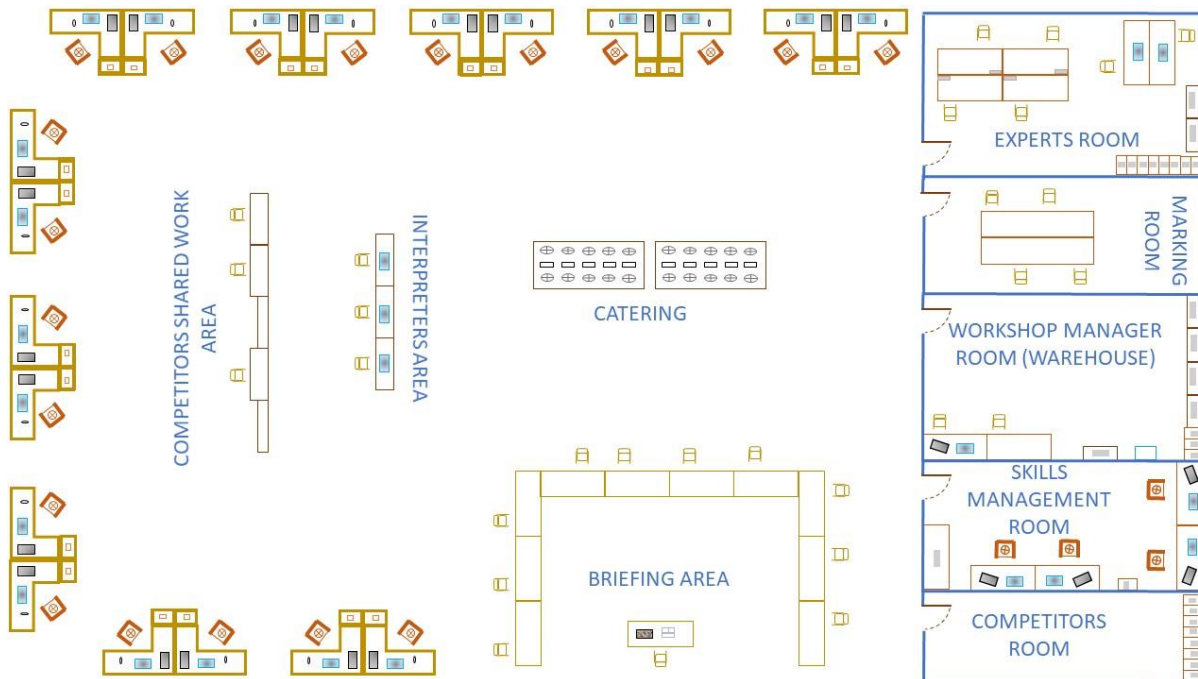
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6. BEST PRACTICES

- External visitors, if applicable;
- Networking between the participants and external experts and/or visitors if/when possible;
- External trainer in classroom (with no AM knowledge);
- Breaks – some food available;
- No talking between anyone after the time given for questions;
- Combine VET students with university students in the competition - no difference in knowledge between VET and university students in 3D design using TinkerCAD;
- Social networking between VET schools and DESTINE project;
- VET teachers;
- VET students from different classes;
- Students with limited AM knowledge so all wanted to learn and all starting from scratch.

7. COMPETITION LAYOUT TYPE

7.1. GENERIC LAYOUT OF COMPETITION SPACE



7.2. LAYOUT TYPE OF WORKSTATION

WORKPLACE

