EWF Guideline for
International AM Metal Designer Technician

PERSONNEL WITH QUALIFICATION FOR METAL ADDITIVE MANUFACTURING

# Minimum Requirements for the Qualification and Examination

IAMQS

IAMQS-QUAL-014-25

MINIMUM REQUIREMENTS FOR
QUALIFICATION AND EXAMINATION

# International Additive Manufacturing Metal Designer Technician (I AM M DT)

## Guideline - General information for the public and organizations that implement this qualification

For more information regarding the Qualifications System, the Management Team or the IAMQS ANB should be contacted
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## Preface

The present document consists in International AM Metal Designer Technician Guideline, developed by EWF.

This guideline for the European education, training, examination and qualification of additive manufacturing personnel has been prepared, evaluated and formulated by the EWF International Additive Manufacturing Qualification Council (IAMQC). Contains general information for the public and organizations that implement this qualification.

Copies of this document can be downloded from EWF website: www.ewf.be, requested to IAMQS Authorized Nominated Bodies for Metal Additive Manufacturing (IAMQS ANBs) or Management Team.

# MINIMUM REQUIREMENTS FOR THE EDUCATION, TRAINING, EXAMINATION AND QUALIFICATION OF PERSONNEL

## Introduction

This guideline covers the minimum requirements for education and training, which have been agreed upon by all IAMQS ANBs, in terms of Learning Outcomes (Knowledge and Skills) and the recommended contact (teaching) hours to be devoted to achieving them. It will be revised periodically by EWF IAMQC to take into account changes to reflect the "state of the art".

Students successfully completing examinations will be expected to be capable of applying the achieved learning outcomes at a level consistent with the qualification diploma level.

The modular course contents are given in the following structure (overview):

| COMPETENCE UNITS | I AM M DT | |
|---|---|---|
| | Recommended Contact Hours* | Expected Workload** |
| CU 00: Additive manufacturing Process Overview | 3,5 | 7 |
| CU 74: Designing Metal AM Parts | 18 | 36 |
| CU 58: Design Metal AM parts for Directed Energy Deposition (DED) Processes | 7 | 14 |
| CU 60: Design Metal AM parts for Powder Bed Fusion (PBF) Processes | 7 | 14 |
| **TOTAL** | **35,5** | **71** |

* Contact Hours are the minimum recommended teaching hours for the Standard Routes. A contact hour shall contain at least 50 minutes of direct teaching time.

** Workload is calculated in hours, corresponds to an estimation of the time students typically need to complete all learning activities required to achieve the defined learning outcomes in formal learning environments plus the necessary time for individual study.

Within EWF´s qualifications, there are two types of Competence Units:

Cross-cutting Competence Unit - A competence unit whose learning outcomes are not directly linked with one job function since the knowledge and skills achieved will be mobilized in several job functions and activities.

Functional Competence Unit - A competence unit whose learning outcomes are directly linked with at least one job function and in which the knowledge and skills achieved will be mobilized in specific job functions and related activities.

The expected learning outcomes are described in two ways: generic outcome descriptors organized in knowledge, skills, autonomy and responsibility; and in detail for each competence unit, organized in job functions and related activities, knowledge and skills corresponding to a specific proficiency level within EWF´s Systems Framework levels (see Appendix III).

On each Competence Unit, objectives and scope are defined for a specific depth of knowledge and skills.

Recommended contact hours are distributed between theoretical (A), assigned projects/exercises (B), practical workshop training(C), as showed in the following example:

| ***Qualification:* Example 1** | |
|---|---|
| **CONTACT HOURS** | **X= (SUM A:C)** |
| **Subject Contents** | A + B + C |

**Professional Profile**

Metal AM Designer Technicians are professionals with the knowledge, skills, autonomy, and responsibility to design additive manufacturing (AM) solutions for the main metal AM processes.
Their main tasks are to:

- Create new or redesign existing models using CAD tools based on the instructions provided by a Metal AM Designer;
- Create part design solutions for metal AM processes, ensuring that:
  - The design considers AM benefits.
  - The part can be manufactured in a cost-effective and efficient way.
  - Post-processing can be applied.
- Close metal design proposals by validating designs with the Metal AM Designer and deriving production drawings, corresponding parts lists, and their structure;
- Contribute to projects in cooperation with the AM Team and customers.

# 1 Routes to Qualification

Two distinct routes to gaining the qualifications described in this document have been agreed.

1. The Standard Route
2. Blended Learning Route

## 1.1 The Standard Route

The Standard Route requires successful completion of EWF approved courses which are designed to meet all the requirements in this Guideline. This is the route recommended by EWF as offering the fastest, most comprehensive manner in which the detailed knowledge may be covered.

## 1.2 Blended Learning Route

The Blended Learning Route will depend on the type of Competence Units (Cross-cutting or Functional). The Cross-Cutting Competence Units (theoretical knowledge and skills) may be taught using Distance Learning Programs under the control of the AM ANB and all the Functional Competence Units (practical knowledge and skills) must be taught at the Authorized Training Bodies for Metal Additive Manufacturing (AM ATB) facilities.

## 2. General Access Conditions

The defined access conditions approved by IAMQC are given in detail for all countries participating in the EWF system.
The access conditions to the International AM Metal Designer Technician Qualification admission are the following:

- National compulsory school diploma
- Basic knowledge and skills related with computer-assisted design tools
- At least 1 year of experience in part design in manufacturing activities is recommended

## 3 Special Requirements

### 3.1 Standard Route

Applicants shall satisfy the access conditions, to be accepted for the attendance of a training course conducted by an IAMQS ATB.

There will be written, oral and practical examinations (where applicable) for the award of the applicable EWF Diploma.

It is not obligatory to follow exactly the order of the Competence Units given in this guideline and choice in the arrangement of the detailed knowledge is permitted, with the exception that **the first Competence Unit to be provided must be CU 00: Additive manufacturing Process Overview.**

The rules for the conduct of the examinations by the IAMQS ANB are prescribed under Examination and Qualification in each Competence Unit guideline.

Complementary to the Competence Units that are required for the purpose of the International AM Designer for Polymers Diploma issuing, a set of optional Competence Units that can also be of added value for the student and can be implemented by the IAMQS ATB as a supporting training and education offer.

For these optional Competence Units, separate Records of Achievement will be issued after examination approval. Whenever these optional Competence Units are considered mandatory for a certain EWF Qualification, they can be recognized for the purpose of such Qualification Diploma.

The examination of any Competence Unit for the purpose of being validated individually, not included in a Qualification course, shall be completed within a period of 1 year from the starting day of the Competence Unit.

If the Competence Unit “A” is done as a part of a qualification course, the examination shall be completed within a period of 6 years from the date of the completion of the first Competence Unit from the qualification where Competence Unit “A” is integrated in. Failure in the examination shall require re-examination.

Each Competence Unit has a period of validity of 4 years. When applying for a Qualification course, the period of validity of the completed CUs are at discretion of the IAMQS ANB.

### 3.2 Section I: Theoretical and Practical Education – Qualification Descriptors and Learning Outcomes

## I.1. Qualification Outcome Descriptors

| QUALIFICATION | EWF LEVEL | KNOWLEDGE | SKILLS | AUTONOMY AND RESPONSIBILITY |
|---|---|---|---|---|
| **International AM Designer Technician** | **INDEPENDENT** | Broad factual and theoretical knowledge of metal AM processes, including DED and PBF technologies, design principles, CAD tools, and post-processing techniques. | Ability to apply design thinking and AM-specific design principles to create or adapt parts for metal AM processes using CAD tools. Capable of evaluating process constraints and selecting appropriate design strategies. | Operates with limited supervision in predictable and structured contexts. Takes responsibility for completing design tasks and collaborating with AM designers to validate and finalize part designs. |

## I.2. Mandatory Competence Units Learning Outcomes

### Competence Unit 00: Additive Manufacturing Processes Overview

| CU 00: Additive Manufacturing Processes Overview | CONTACT HOURS |
|---|---|
| **SUBJECT TITLE** | |
| Directed energy deposition | 0,5 |
| Powder bed fusion | 0,5 |
| Vat photopolymerization | 0,5 |
| Material jetting | 0,5 |
| Binder jetting | 0,5 |
| Material extrusion | 0,5 |
| Sheet lamination | 0,5 |
| **Total** | 3,5 |
| **WORKLOAD** | **7** |

| Learning Outcomes – CU00: Additive Manufacturing Processes Overview | |
|---|---|
| **KNOWLEDGE** | Basic factual knowledge of:<br>– Directed energy deposition<br>– Powder bed fusion<br>– Vat photopolymerization<br>– Material jetting<br>– Binder jetting<br>– Material extrusion<br>– Sheet lamination |
| **SKILLS** | Distinguish parts produced by different AM processes<br>List the advantages and limitations of AM processes from a manufacturing process chain point of view<br>Name the applicability of different AM processes, according to the characteristics of each process |

## Competence Unit 74: Designing Metal AM Parts

| CU 65: Overview on polymer materials and properties | CONTACT HOURS |
|---|---|
| **SUBJECT TITLE** | |
| Metal AM materials overview | 1 |
| Think Additively | 4 |
| Design principles for AM | 7 |
| CAD files | 1 |
| Post processing Overview | 2 |
| Case study | 3 |
| **Total** | **18** |
| **WORKLOAD** | **36** |

| Learning Outcomes – CU 74: Designing Metal AM Parts | |
|---|---|
| **KNOWLEDGE** | Factual and broad knowledge of theory, principles and applicability of:<br>– Metal AM Materials<br>– AM design thinking<br>– Design principles for AM<br>– Post processing |
| **SKILLS** | Identify types of metal materials commonly used in AM<br>Apply design principles when developing and modelling a CAD part<br>Associate design considerations to design thinking<br>Relate AM potentials and limitations to metal parts design |

## Competence Unit 58: Design Metal AM parts for DED Processes

| CU 58: Design Metal AM parts for DED Processes | RECOMENDED CONTACT HOURS | |
|---|---|---|
| LEVEL | INDEPENDENT (I) | ADVANCED (A) |
| Overview of Machines, Process Capabilities and Limitations | 2 | 0 |
| Process related materials | 1 | 0 |
| Specific Design considerations | 4 | 0 |
| Parts requirements | 0 | 3 |
| CAD Software & Software | 0 | 12 |
| Part optimisation | 0 | 4 |
| Designing parts | 0 | 4 |
| Design to cost | 0 | 4 |
| Data preparation for production | 0 | 1 |
| Case studies for “Design Thinking & Development | 3 | 7 |
| **Subtotal Per Level** | **7** | **35** |
| **Cumulated Subtotal** | **7** | **49** |
| | | **WORKLOAD** |
| **PER LEVEL** | 14 | 70 |
| **CUMULATED** | **14** | **84** |

| CU | EQF/ EWF LEVEL | JOB FUNCTIONS | JOB REQUIRED ACTIVITIES | CONTACT HOURS | WORKLOAD |
|---|---|---|---|---|---|
| **Design Metal AM parts for DED Pro-cesses** | **4 INDEPENDENT** | Design of parts for DED metal process | Interpret process requirements | **7** | **14** |
| | | | Apply basic DED design principles | | |
| | | | Use CAD tools for part modeling | | |
| | | | Determine tolerances and constraints | | |
| | **5 ADVANCED** | | Analyse part requirements and constraints | **49** | **98** |
| | | | Optimize design for cost and performance | | |
| | | | Use advanced CAD and simulation tools | | |
| | | | Prepare data for production | | |
| | | | Conduct reengineering and redesign | | |
| | | | Collaborate with technical teams | | |

| LEARNING OUTCOMES – CU 58: Design Metal AM parts for DED Processes | | |
|---|---|---|
| **LEVEL** | **INDEPENDENT** | **ADVANCED** |
| **KNOWLEDGE** | Factual and broad knowledge of theory, principles and applicability of:<br>– DED machines: Features and performance data.<br>– Capabilities and limitations of DED metal processes influence in design<br>– Design considerations required for DED metal parts design<br>– Specific materials for DED: achievable properties and sustainability | Advanced knowledge and critical understanding of:<br>– Influence of parts requirements in design;<br>– Design optimisation. |
| **SKILLS** | – Explore the degrees of freedom of a DED machine to the possibilities in terms of design<br>– Relate the capabilities and limitations of DED to design considerations<br>– Determine dimensional constraints and geometric tolerances required for DED parts design | – Verify and analyse requirements for production providing initial propositions and constraints<br>– Analyse relevant costs considering the requirements, materials, machine hour rate and manual preparations to ensure the most efficient design<br>– Test additively manufactured parts to assess the need for redesign (for example, when the part design is completed, and its performance needs to be tested. If it fails, some redesign may be needed.)<br>– Carry out reengineering design using metal AM to design parts previously produced by conventional processes/methods<br>– Ensure liaison with other technical areas (process, production, etc.)<br>– Sign off (ESO) drawings (STL/AMF files included) |

## Competence Unit 60: Design Metal AM parts for PBF Processes

| CU 60: Design Metal AM parts for PBF Processes | RECOMENDED CONTACT HOURS | |
|---|---|---|
| LEVEL | INDEPENDENT (I) | ADVANCED (A) |
| Overview of Machines, Process Capabilities and Limitations | 1 | 0 |
| Process related materials | 1 | 0 |
| Specific Design considerations | 4 | 0 |
| Parts requirements | 0 | 4 |
| CAD Software & Software | 0 | 4 |
| Part optimisation | 0 | 4 |
| Designing parts | 0 | 4 |
| Design to cost | 0 | 4 |
| Data preparation for production | 0 | 1 |
| Case studies | 1 | 7 |
| **Subtotal Per Level** | **7** | **28** |
| **Cumulated Subtotal** | **7** | **35** |
| | | **WORKLOAD** |
| **PER LEVEL** | 14 | 56 |
| **CUMULATED** | **14** | **70** |

| CU | EQF/ EWF LEVEL | JOB FUNCTIONS | JOB REQUIRED ACTIVITIES | CONTACT HOURS | WORKLOAD |
|---|---|---|---|---|---|
| **Design Metal AM parts for PBF Processes** | **4 INDEPENDENT** | Design of parts for PBF metal process | Interpret process requirements | **7** | **14** |
| | | | Apply basic PBF design principles | | |
| | | | Use CAD tools for part modeling | | |
| | | | Determine tolerances and constraints | | |
| | **5 ADVANCED** | | Analyse part requirements and constraints | **35** | **70** |
| | | | Optimize design for cost and performance | | |
| | | | Use advanced CAD and simulation tools | | |
| | | | Prepare data for production | | |
| | | | Reengineer conventional parts for AM | | |
| | | | Collaborate with technical teams | | |

| LEARNING OUTCOMES – CU 60: Design Metal AM parts for PBF Processes | | |
|---|---|---|
| **LEVEL** | **INDEPENDENT** | **ADVANCED** |
| **KNOWLEDGE** | Factual and broad knowledge of theory, principles and applicability of:<br>– PBF machines: Features and performance data.<br>– Capabilities and limitations of PBF metal processes influence in design<br>– Design considerations required for PBF metal parts design<br>– Specific materials for PBF: achievable properties and sustainability | Advanced knowledge and critical understanding of:<br>– Influence of Parts requirements in design;<br>– Orientation and positioning of parts in the build chamber;<br>– Design optimisation. |
| **SKILLS** | – Explore the degrees of freedom of a PBF machine to the possibilities in terms of design<br>– Relate the capabilities and limitations of PBF to design considerations<br>– Determine dimensional constraints and geometric tolerances required for PBF parts design | – Verify and analyse requirements for production providing initial propositions and constraints<br>– Analyse relevant costs considering the requirements, materials, machine hour rate and manual preparations to ensure the most efficient design<br>– Test additively manufactured parts to assess the need for redesign (for example, when the part design is completed, and its performance needs to be tested. If it fails, some redesign may be needed.)<br>– Carry out reengineering design using metal AM to design parts previously produced by conventional processes/methods<br>– Ensure liaison with other technical areas (process, production, etc.)<br>– Sign off (ESO) drawings (STL/AMF files included) |

## Appendix I: EWF Systems Framework

| FIELD OF ACTIVITIY | | EQF LEVELS | EWF PROFICIENCY LEVEL | KNOWLEDGE | SKILLS | AUTONOMY AND RESPONSIBILITY |
|---|---|---|---|---|---|---|
| COORDINATORS/MANAGERS | WELDERS & OPERATORS | 7 | EXPERT | Highly specialised and forefront knowledge including original thinking, research and critical assessment of theory, principles and applicability of metal additive manufacturing or welding related technologies. | Highly specialised problem- solving skills including critical and original evaluation, allowing to define or develop the best technical and economical solutions, when applying metal additive manufacturing or welding related technologies, in complex and unpredictable conditions | Manage and transform the metal additive manufacturing or welding and related technologies processes in a highly complex context.<br>Fully responsible for the definition and revision of personnel's tasks. |
| | | 6 | ADVANCED | Advanced knowledge and critical understanding of the theory, principles and applicability of metal additive manufacturing or welding and related technologies. | Advanced problem-solving skills including critical evaluation, allowing to choose the proper technical and economical solutions, when applying metal additive manufacturing or welding and related technologies, in complex and unpredictable conditions | Manage the applications of metal additive manufacturing or welding and related technologies in a highly complex context.<br>Act autonomously in decision making and definition in the definition of the metal additive manufacturing or welding and related personnel's tasks. |
| | | 5 | SPECIALIZED | Specialised, factual and theoretical of theory, principles and applicability of metal additive manufacturing or welding and related technologies | Specialised range of cognitive and practical skills, allowing to develop solutions or choose the appropriate methods, when applying metal additive manufacturing or welding and related technologies, in common/regular problems. | Manage and supervise common or standard metal additive manufacturing or welding applications and related technologies, in an unpredictable context.<br>Take responsibility in standard work and supervise the metal additive manufacturing or welding and related personnel's tasks. |
| | | 4 | INDEPENDENT | Factual and broad concepts in the field of metal additive manufacturing or welding technology | Fundamental cognitive and practical skills required to develop proper solutions and application of procedures and tools on simple and specific metal additive manufacturing or welding problems. | Self-manage of professional activities and simple standard applications of metal additive manufacturing or welding and related technologies in predictable contexts but subject to change.<br>Supervise routine tasks and similar function workers, as well as take responsibility for decision making in basic work. |
| | | 3 | BASIC | Basic facts, principles, processes and general concepts of welding, joining and related technologies | Be able to check and follow the information on the welding procedure specification, to produce butt and fillet welds in plates and or tubes, and or profiles in a variety of geometries and positions to the required quality and of specified dimensional accuracy | Work under supervision, taking personal responsibility for own actions and for the quality and accuracy of the work produced. |
| | | 2 | ELEMENTARY | Elementary principles of welding, joining and related technologies | Able to check and follow the information on the welding procedure or adhesive bounding specification, and to produce weld/joints in a variety of geometries and positions to the required quality and of specified dimensional accuracy | Work under supervision. |

**General reference descriptors transversal to all qualifications. Each Qualification has its own specific descriptors in terms of Knowledge, skills, autonomy and responsibility.**