

# SLOVENSKI STANDARD

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Additive Fertigung - Grundsätze der Qualifizierung - Teil 1: Qualifizierung von Maschinenbedienern (ISO/ASTM DIS 52926-1:2022)

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## Additive Manufacturing of metals — Qualification principles —

### Part 1: General qualification of operators

ICS: 25.030; 03.100.30

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ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11

Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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ASTM International  
100 Barr Harbor Drive, PO Box C700  
West Conshohocken, PA 19428-2959, USA  
Phone: +610 832 9634  
Fax: +610 832 9635  
Email: [khooper@astm.org](mailto:khooper@astm.org)  
Website: [www.astm.org](http://www.astm.org)

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## ISO/ASTM DIS 52926-1:2022(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 261, *Additive manufacturing*, Joint Group JG 74, *Personnel Qualifications* in cooperation with ASTM Committee F42, *Additive Manufacturing Technologies*, on the basis of a partnership agreement between ISO and ASTM International with the aim to create a common set of ISO/ASTM standards on Additive Manufacturing.

ISO/ASTM 52926 consists on the following parts, under the general title *Additive manufacturing – Qualification principles*:

- *Part 1: General qualification of operators*
- *Part 2: Qualification of operators for PBF-LB*
- *Part 3: Qualification of operators for PBF-EB*
- *Part 4: Qualification of operators for DED-LB*
- *Part 5: Qualification of operators for DED-Arc*

A list of all parts of the ISO/ASTM 52926 group standard can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

For many companies, additive manufacturing represents an alternative to established manufacturing processes. The trend towards complex components, decentralised production and customer specific products allows an economically feasible use for more and more areas. This also applies to many series applications, which comprise completely different demands on the efficiency of the processes. In particular, components used in industry (automotive industry, mechanical engineering, railway sector, aerospace, process and industrial plants, medical technology, etc.) are subject to high demands in terms of quality and safety. The current lack of norms and standards means that processes for the production of components have to be defined from the scratch for each individual case, which causes a great effort and allows little transparency and thus little trust of other stakeholders in the processes.

If industrially used components are manufactured using additive manufacturing processes, it should be proven that these meet the requirements. To this end, the production chain and environment should be designed in such a way that the process quality and the resulting product quality are always consistent and reproducible. To assure the before mentioned consistency and reproducibility, is of utmost importance to assure that the involved workforce is adequately qualified for the several production stages.

Since this document is designed not to be cross-technology, the different processes are indicated in the relevant four parts of the standard.

This document offers a common approach for the qualification of professionals in AM. If the requirements of ISO/ASTM 52926 series are fulfilled, the scope of an audit can be greatly reduced.

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# Additive Manufacturing of metals — Qualification principles —

## Part 1: General qualification of operators

### 1 Scope

This document describes the activities and responsibilities of the operators on the field of the Additive Manufacturing technologies dealing with metallic parts production.

This document is intended to provide guidance for qualification of machine operators in general industrial applications. Where industry-specific requirements exist for the qualification of operators, such as ISO/ASTM 52942 for aerospace applications, those industry-specific standards shall be used instead of this document.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/ASTM 52900, *Additive manufacturing — General principles — Fundamentals and vocabulary*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/ASTM 52900 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1 operator

person who operates systems and equipment for additive manufacturing, following defined procedures and instructions for the AM process and associated requirements, for example preparation of the equipment and health and safety

Note 1 to entry: to entry: this definition only applies to operators whose activities can direct influence the process quality or part quality.

#### 3.2 examiner

person with knowledge and experience relevant to the qualification, and acceptable to the customer or examining body or engineering authority.

Note 1 to entry: In certain cases, an external independent examining body can be required [ISO/IEC 17024].

## ISO/ASTM DIS 52926-1:2022(E)

### 4 Operator qualification

#### 4.1 General

The qualification test for operators shall follow a suitable documented procedure. Examples of such procedures are contained in process specific ISO/ASTM 52926 parts. .

Qualifications of operators shall include the assessment principles.

#### 4.2 Essential variables and the range of qualification

##### 4.2.1 General

The qualification of machine operators for additive manufacturing is based on essential variables. For each essential variable, a range of qualification is defined. If the operator shall work outside the range of qualification, a new qualification test is required. The essential variables are:

- a) AM process for metals (see [4.2.2](#))
- b) Feedstock material group. (see [4.2.3](#))
- c) AM machine (see [4.2.4](#)).

##### 4.2.2 AM processes for metal

There are several additive manufacturing (AM) processes for building parts in metallic materials. A general overview and illustrations of different AM process categories and materials is available in ISO 17296-2, definitions for the different process categories are published in ISO/ASTM 52900, a guideline for identification of the individual processes is available in [Annex A](#), and general description of fundamental process principles is available in Annex B of the same document.

In this document specific DED and PBF processes for metal are addressed and the qualification depends on the process, so the operator has different qualifications for several processes. A new process requires a new qualification test.

The process-specific requirements are defined within the other parts of this document, as listed below.

- Part 2 Qualification of operators for PBF-LB.
- Part 3 Qualification of operators for PBF-EB.
- Part 4 Qualification of operators for DED-LB.
- Part 5 Qualification of operators for DED-Arc.

##### 4.2.3 Material groups for metallic feedstocks

The assessment in the framework of the qualification scope shall be adapted according to the material group in use for production.

Material group A: Unalloyed steel, low-alloyed steels, high-alloyed ferritic steels.

Material group B: Austenitic, martensitic and precipitation hardening steels.

Material group C: Titanium and titanium alloys, niobium, zirconium, and other reactive metals.

Material group D: Aluminium and magnesium alloys.

Material group E: Materials that do not conform to other material groups (e.g. molybdenum, tungsten, copper alloys, titanium aluminide).